

SCIENTIFIC AMERICAN

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THE GORILLA.

The gorilla is the largest of the anthropoid apes; and since his discovery in 1847, by Dr. T. S. Savage, he has attracted much attention from naturalists. The writings of Du Chaillu have done much to familiarize us with this remarkable animal; and its strength, ferocity, and cunning have made it remarkable, even in these days of natural wonders. The gorilla is chiefly found on the west coast of Africa, both north and south of the equator. It is generally seen in troops of four females and one male; and these never associate with other animals. The muscular power of the gorilla is prodigious. He marches steadily towards his enemy, beating his breast with both hands and roaring terribly; when near enough, he springs upon him, and destroys him by tearing him to pieces. One of Du Chaillu's men was eviscerated by a single blow from the paw of a gorilla.

In the dense forests of the African continent, man can only advance with difficulty; and the miasma that pervades them is sooner or later fatal to mankind. But here the gorilla takes up his abode, and his long arms and prehensile toes enable him to swing himself over long distances between the trees, and thus to wander over large tracts of country, passing each night in a rudely constructed nest made for the purpose.

Some of the antics of the gorilla are amusing, and resemble certain human characteristics to a remarkable degree. Mr. A. R. Wallace had one in Borneo; and when he gave it a piece of food to its liking, it licked its lips, drew in its cheeks, and turned up its eyes with an expression of supreme satisfaction. If it disliked a morsel, it would roll it round on its tongue, and then push it out between its lips. If it could not get the food it desired, it would scream like a baby in a passion.

The specimen shown in our engraving, in his sagacious watchfulness against strangers, is at once on the alert on the approach of a strange footstep; and the intruder who will face such a sentinel must be either very ignorant or very incautious. The picture is so vivid and life-like that it seems almost like a portrait taken on the spot; it is the work of Mr. Joseph Wolf, the eminent naturalist and artist, whose book, "The Life and Habits of Wild Animals," we have heretofore had occasion to notice.

A New Wall Paper.

It is now proposed in Germany to make wall paper which will adapt itself to the degree of illumination of the room, becoming darker as the room is more lit up, and *vice versa*. The *Papier Zeitung* suggests to this end paper printed or coated with oxalate of copper, which acts in the manner above described. It is believed that very curious and novel effects of color and shade may in this way be produced on wall papers, and possibly on other materials.

Manganese.

Messrs. Hobbs, Pope & Co., of Boston, Mass., state that the rumored discovery of a mine of pure manganese in Georgia is probably erroneous. They say: It is well known that nearly every State in the Union produces manganese to a greater or less extent, as well as all the provinces of the Dominion of Canada. The mines of England, Saxony, Spain, and Turkey mainly supply the European markets with ore. Manganese of high test and superior quality is obtainable only in limited quantities; while the medium and lower grades of ore, which are obtainable in almost any desired

Late Theories on the Earth's State.

Is the inside of the earth fluid or solid? Even in such an apparently simple question as this we are still in some degree of doubt. You may think this is strange, because we find volcanoes throwing out lava, which is liquid rock, and because we find much other geological evidence to show that solid rocks, such as basalt and trap, have been protruded as molten masses within recent geological epochs; but it has recently been shown by Mr. Mallet that the fact of volcanoes throwing out liquid rock may not be inconsistent with the view that the earth as a whole is solid. Mr. Mallet's investigations go

to prove that this liquefaction of the rocks which we observed may be produced at no very great depth from the earth's surface by the shifting and rubbing together of the rocks, owing to cracking due to the alteration of the temperature, just as boys at school rub a button on the bench until it is hot, when they often place it on to their neighbor's cheek. Applying the laws of the mechanical theory of heat to this problem, Mr. Mallet believes that the friction of the rocks, caused by the secular cooling of the earth and the consequent shrinkage, is a sufficient and a satisfactory explanation of the occurrence of the high temperature of volcanic action.

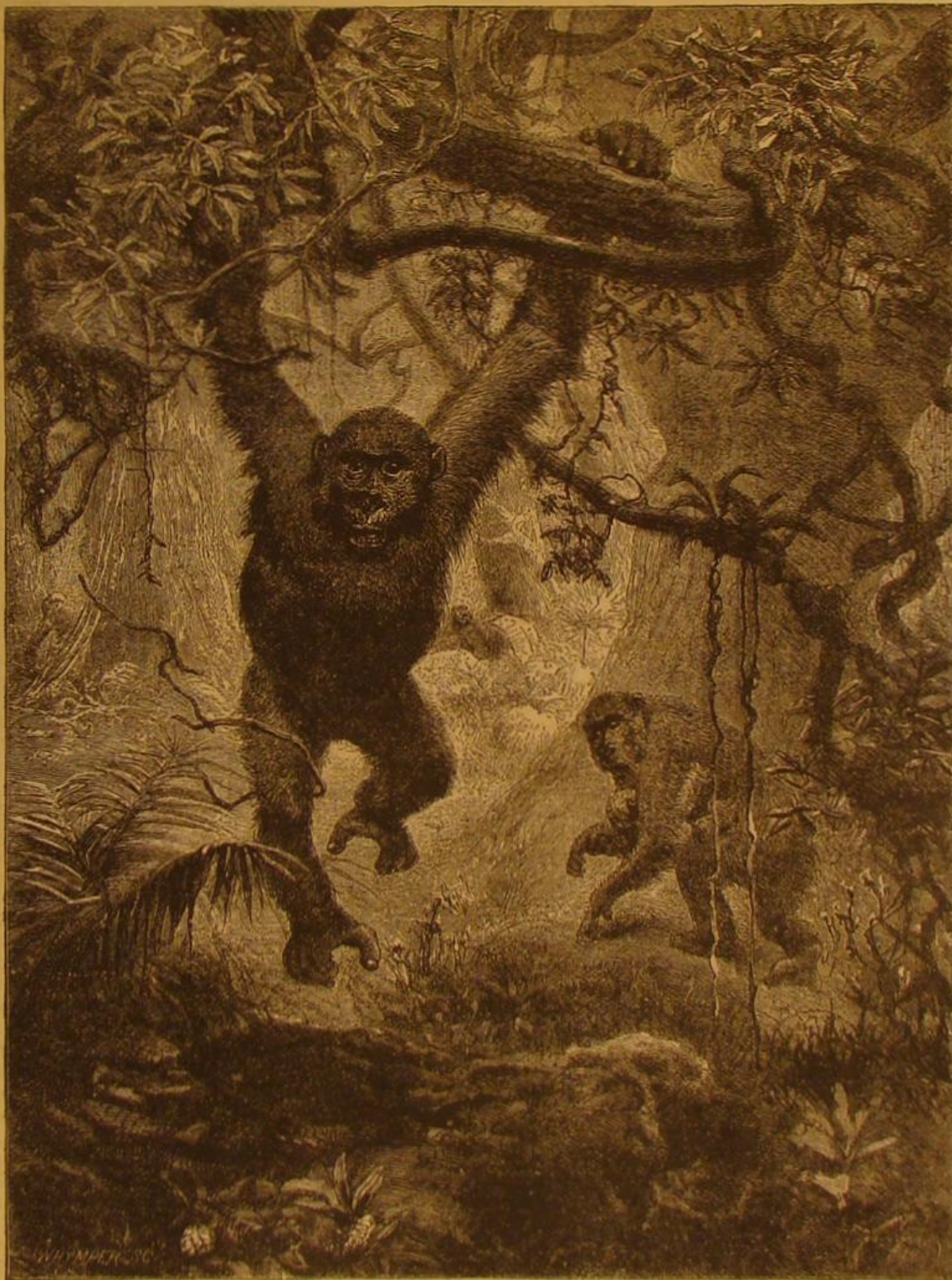
Sir Wm. Thomson, also, than whom no one is more capable of expressing an opinion, decides in favor of the earth's solidity. He tells us in his address to the Physical Section at Glasgow, that the conclusion concerning the solidity of the earth originally arrived at by Hopkins is borne out by a more rigorous mathematical treatment than this physicist was able to apply; so that the idea of geologists, who were in the habit of explaining underground heat, ancient upheavals, or modern volcanoes by the existence of a comparatively thin solid shell resting on an interior liquid mass, must now be given up as untenable.—*Professor Roscoe.*

A New Ornamental Panel.

Mr. William Bleiss, of New York city, has patented through the Scientific Patent Agency, December 5, 1875, a very tasteful frame or tile for decorative purposes, which he prepares from a glass plate having a roughened or crystallized surface, on

the back of which the design is traced in suitable colors to represent the seams between the pieces composing a mosaic. Transparent colors are then laid over portions of the work, and gold leaf is laid over the entire surface of the glass, and a backing added, which is composed of any material that will protect the surface and form a durable coating. The effect is very handsome; and as the paint will not crack or blister, the panel may be used in place of encaustic or other tiles for the exterior ornamentation of buildings.

The head of a bolt is usually about twice the diameter of the spindle, and of a thickness which is generally greater than five eighths of that diameter.—*Rankine.*



WHO COMES HERE?

quantity, will often not pay to ship. It is found in inexhaustible beds, like coal; but its deposits are very unreliable, it being almost always found in pockets, or in veins or seams, which can never be relied upon as carrying ore for any specified distance; it is, in fact, next to impossible to estimate the yield of a manganese mine for a specified time.

NOVEL CAVALRY EQUIPMENT.—It is intended to supply slabs of gun cotton as part of the cavalry equipment, to be carried in a sort of waist belt, and used, if necessary, for the destruction of railways, stockades, etc., for which purposes gun cotton has proved the most powerful of all explosive agencies, while it is the safest and most convenient to carry.

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SOME SUGGESTIONS FOR FUTURE POLAR EXPEDITIONS

Of the numerous suggestions for reaching the north pole, which the failure of the recent English expedition to attain that goal has elicited, there are two which, apparently more than any of the others, have attracted public attention. The first is that, to cross the paleocrystic sea, which, by reason of its very irregular surface, Captain Nares pronounces impassable by any known means of sledge or like conveyance, balloons may possibly be utilized. The second contemplates the establishment of an arctic station, at as high a latitude as may be practicable, which shall serve as a basis of operations by a party who shall there take up a permanent residence until the object of the enterprise is accomplished. It is expected that, by this last plan, men can be acclimated, so to speak, to the intense cold, the absence of light for long periods, the deprivation of vegetable food, and other hardships of the polar regions; and they may be thus rendered less likely to be baffled by obstacles which have determined the failure of most previous expeditions. A project substantially similar to this is, we understand, already before Congress; and an appropriation of \$50,000, and the ordering of government officers and vessels to the duty is proposed.

The objections urged against the balloon project are, first, that the natural phenomena of cold, etc., would probably act upon the gas, or the envelope material of the air ship, and determine conditions unfavorable to its continued buoyancy; and secondly that, as balloons cannot be steered, the voyagers might find themselves carried anywhere but in the right direction; and that, in case of the balloon failing and compelling their descent far away from their base of supplies, their perishing would be a certainty. We allude to this plan simply because it is open to modification in a manner which we shall point out further on. We have first to suggest a possible improvement on the fixed station scheme.

We do not see the necessity of educating a band of men to dwell under adverse conditions as proposed, when the most that will be required, of all but the leaders, is physical work and endurance; and most especially when the people already fitted by nature for arctic life are at hand on the spot. In other words, we think that it would be much more practicable to engage a number of Esquimaux, bring them South, and educate them up to a point equal to that of the working white men, who would be otherwise employed as pioneers, hunters, sledge haulers, etc. We would teach them the object of the enterprise, and place them under the officers—of course white men—who would furnish the brains, and under whose government the work would be conducted.

It may be argued that the Esquimaux cannot be taught properly to serve the interests of such an expedition. Experience shows to the contrary. They are an intelligent people, and there is not an arctic explorer but can testify to the material aid which they have rendered. Hall and others who have dwelt among them state that they are quick to learn; and as an instance, Hall mentions that he found no difficulty in teaching them the intricate game of chess. They are the only people that can live in the land of no wood. Peschel, in his new work on "The Races of Man," says: "They have found out how to build huts of snow as quickly as tropical natives build them of branches and leaves; nay, they have constructed arched vaults of stone, which had not occurred to any of the civilized people of Mexico." The same authority, summing up their achievements, tells how they warm their huts with train oil lamps, how they invented sledges, and utilized the dog as a draught animal: "while in America, the most advanced stage of such art was to be found only among the Incas of Peru, who used llamas as beasts of burden, though not as draught animals." "Like assistants in the darkness," adds Peschel, "appear beings of our species whose cheerfulness is unaffected by cold and obscurity, and who contentedly wander and range over regions in which Nature seems armed with all the horrors of one of the circles in Dante's hell." We need not recall the invaluable services of Esquimaux Joe in sustaining the sailors of the *Polaris* on their voyage on the ice floe, or the many instances in which the narratives of arctic explorers quote the value of his people as guides, as proofs of the fidelity of the race.

The expense of maintenance of a party of Esquimaux, with white men as leaders, would clearly be less than that of a party of white men alone. It will further be evident that to dispatch Esquimaux in balloons would be a different matter from sending other people, because, no matter where the balloons might come down, unless in the open sea, the travelers, being used to shift for themselves, would be as much at home as anywhere else. And they would thus be able to support themselves, and also the single white man who might go with them in command. But—supposing of course it be possible to make the gas and the envelope of the balloon withstand the climate—it does not seem to us that high-flying, wind-driven balloons are the proper means to be employed. While any balloon system is open to objections, the low-flying balloon, just capable of lifting one man off his feet so that he can propel himself over the surface with a pole, and by the same means cause his balloon to jump over high obstacles, appears to be the most promising means of locomotion for traversing the paleocrystic sea. A party starting would, therefore, go in as many balloons as there were individuals; and the chances of failure of all the air ships would be materially less than if the expedition travelled in a single large balloon; while there would be the additional advantages of strength of fabric, easy handling, and possibility of stopping during adverse winds by merely mooring the air ships without discharging gas.

MIND READING AND CONJURORS.

We have recently witnessed two exhibitions of the alleged abnormal power of second sight, or, what amounts to the same thing, mind reading. One was the performance of Mr. J. R. Brown, who has acquired considerable reputation as a mind reader. His exhibition consisted in experiments intended to prove the existence of a genuine phenomenal faculty whereby he reads the thoughts of other people. The second was the exhibition of Mr. Robert Heller, the well known conjuror, and his assistant, Miss Heller, wherein the lady, blindfolded, ostensibly saw and described articles not visible to her, but known to the conjuror and his audience. The reader will observe the distinction. Brown seeks to prove a supernatural power by curious experiments. Heller, likewise, performs equally curious experiments, but candidly avows them to be part of his programme of illusions—in short, neatly executed tricks.

Mr. Brown's so-called manifestations have an advantage over those of spiritualistic and other wonder-working mediums, in that they are reared on a small basis of actual fact. And it is just this modicum of reality which has commended them to college professors and others seeking the solution of many perplexing biological problems. At the same time, the phenomenal nature of the mind reader's apparent power has secured for him a host of adherents from the ranks of those whose peculiarly framed intellects are always ready to believe anything which rises above the level of their comprehensions to be superhuman. Mr. Brown's ability seems to consist in an exceedingly delicate sense of feeling, doubtless cultivated by long practice; he is also endowed with quick perceptive powers, likewise trained, and possesses a sensitive nervous organization. By the aid of these not at all phenomenal powers, he is enabled to detect the involuntary changes either of the pulse, or the breathing, or in the muscles in the person with whom he is in contact. It is an old and well proved fact that a person who has performed any secretive action, which is on the verge of discovery by another, will infallibly and involuntarily indicate the fact by some such bodily motion as above noted. This mental peculiarity is constantly taken advantage of in the cross examination of witnesses in courts, and by detectives in seeking to fix proof of guilt on criminals. Guilty individuals will usually betray themselves by their physical behavior; thus their actions are carefully scrutinized. Nothing is better understood than that the mind strongly affects the body: witness the actions of blushing, becoming pale, trembling, weeping, and laughing, all of which are involuntary, betraying even to the dullest observer the sentiments of the person affected. Deaf mutes can catch the meaning of persons conversing with them by the merest shades of change in countenance; and nothing shows more clearly how the perceptive powers may in this respect be developed than the fact that the deaf mute has long since ceased the constant spelling of words with his fingers, and has substituted, in an immense number of cases, slight symbolical signs with the hands, movements of the body, and facial expressions, which fully convey the ideas. We might multiply instances, all showing that Mr. Brown's mind-reading faculty consists in a keen perceptive faculty rather than in any supernatural mental qualification. Examples of this ability exist in deaf, dumb, and blind persons, who communicate with each other by touch of fingers. But sufficient has been suggested to account for Mr. Brown's ability to find hidden articles while grasping the hand of the concealer.

As the foregoing negatives the idea of any superhuman power, it will be seen that the mind reader and the conjuror practice their arts by similar means; and on comparing them we do not hesitate to say that Mr. Heller's tricks are immeasurably more mysterious than Mr. Brown's. Eliminating the idea of jugglery altogether, it is evident that, for Mr. Heller's lady assistant to name articles touched by him at random, requires on her part a wonderful exercise of the memory, to return the exact answer called for by the peculiar form of question; and on the other hand an equally marvelous celerity of thought is necessary on the part of the conjuror to frame exactly the proper question to convey the information to his blindfolded assistant without a moment's hesitation. Robert Houdin, in his "Memoirs," explains the immense labor involved in two persons thus learning what amounts to a new language, the intricacy of which is shown from the fact that the conjuror repeatedly asks questions which convey to his assistant the ideas of phonetic syllables, which the latter links together to form the names of persons designated.

THE COST OF THE EAST RIVER BRIDGE.

It is a curious fact that, in the construction of great public works in this State, the original estimates of the architects or engineers are uniformly exceeded. The two largest structures now in progress, the State capitol at Albany and the East river bridge, are both instances of the truth of the above. The capitol is, on paper, an imposing palace, covered with ornamentation of the most elaborate and expensive description. Its original estimated cost (some \$4,000,000) has already been far exceeded, and yet the building is not half finished. Indeed, so great, it is now said, will be the additional expense that it is seriously proposed to abandon the work rather than tax the people for the necessary outlay. Regarding the East river bridge, the cost first estimated by Colonel Roebling, in 1868, was \$7,000,000, exclusive of the land. After this engineer's death, his son, Mr. W. A. Roebling, succeeded to the supervision; and he, in 1872, three years after the work was begun, revised his father's estimate

and added about \$1,000,000 more. He stated, however, at the time that the probable total cost would be about \$9,500,000, an increase of size of the work having raised the expense some 8 per cent. That even this estimate was too low was proved in 1875, when the directors sought and obtained an appropriation, raising the sum to \$13,000,000. Up to the present time, \$6,000,000 has been expended, for which we have to show two anchorages, two completed towers, and the connecting wires across the river. There are yet the wire and superstructures, additional stone and masonry, land and labor, to be paid for, the total outlay for which, according to estimates obtained by the *New York Sun*, will swell the entire cost to \$17,569,000.

It will be interesting to compare this with the cost of tunnelling. The clear span of the bridge across the river measures 1,595 feet; so that for the actual means of transit, the cost is about \$11,015 per foot. Even measuring from anchorage to anchorage, a distance of 3,475 feet, the cost reaches \$5,056 per foot. Let us contrast these figures first with those shown in the results of submarine tunnelling. The first Chicago waterworks tunnel, 5 feet in diameter and two miles in length, cost \$457,844, or some \$43 per foot; the second bore, 7 feet in diameter and of the same length, about \$39 per foot. These are of course too small for traffic purposes, but may be quoted to aid us in reaching an idea of relative cost. The Thames tunnel can hardly be used for comparative purposes, since it was the forerunner of submarine excavation, and was worked upon over a period of some 36 years. Its total cost was \$2,000 per foot. Lately a very heavy tunnel belonging to the London Underground Railway has been finished under the London Docks. The work was exceedingly difficult, and the quantity of water to be pumped out enormous. The final cost was £390,000 per mile, or about \$369 per foot. Lastly, we have the estimates of the English channel tunnel, 31 miles in length, which amount to \$20,000,000, or about \$122 per foot.

Now we may glance at land tunnels. The Mont Cenis tunnel cost about \$300 per lineal foot, inclusive of equipment of road, etc.; the Kilsby (England) double track railroad tunnel, in the construction of which great difficulties in the form of quicksands were encountered, \$262.50; the Hoosac tunnel, \$300; Underground Railway, Fourth avenue, New York city, \$285; Bletchingly (England) double track tunnel, \$120; the very difficult Hauenstein tunnel between Basle and Berne, Switzerland, \$133; the contract price of the St. Gothard tunnel now in progress is £1,896,945, or about \$189 per foot. Many more examples might be given, but the above will suffice to show that in all probability \$350 per lineal foot would be a large estimate for a tunnel under the East river. Supposing for the sake of comparison that the total length of excavation be equal to the total length of the bridge, 3,475 feet (it obviously would be much less), its cost would be, at the above figures, some \$1,200,000. Consequently, for the sum now estimated as the probable cost of the bridge, New York might have at least fourteen tunnels crossing the river at as many principal streets.

Meanwhile the success of the bridge as an engineering work is by no means assured; nor is it certain that the estimate of \$17,569,000 will not still further be exceeded. The distance from the pier to the City Hall terminus on the New York side is 2,381 feet; on the Brooklyn side the distance from tower to terminus is 1,881 feet. The whole aggregates 660,000 square feet, or some 200 city lots, largely covered with buildings, to which title must be acquired. The estimate given fixes \$25,000 each for the lots; but in cities where real estate fluctuates so greatly as in New York and Brooklyn, it must be clear that any such calculation is merely an approximation.

Again—and we cannot gainsay the wisdom of the conclusion—the Board of Directors of the bridge are strongly opposed to take any risk of inferior material on account of an apparent economy in its cost. It has been a question for some time past whether the cables shall be made of Bessemer and open hearth steel, or crucible cast steel only. There appeared from the engineer's report a saving of some \$250,000 to be effected by the use of the former. Thus the Roeblings offered crucible steel at 9 cents per lb. gold, or for \$612,000, and Bessemer steel at 6½ cents, or \$459,000 in all. The strain withstood by each, per square inch of section, was respectively 179,019 lbs. and 178,163 lbs.

Mr. Abram S. Hewitt, in a letter to the Board referring to Bessemer steel, said: "The peculiarity of that material is that it is apt to have weak spots of which there is no external indication. This is probably due to the enclosure of bubbles of air in the mass, or possibly to the oxidation of minute particles of the material while the air is being driven into it under high pressure. No amount of visual inspection can determine in what part of the ingot, the rod, or strand of wire, such defects will occur, and I have seen Bessemer rods break under apparently very inadequate strain." Finally, the Board, after carefully considering the question, concluded not to use Bessemer steel—and this even after proposals for the same had been invited—and awarded the contract to supply crucible cast steel wire to Mr. J. Lloyd Haigh (he being the lowest bidder), at the price of 8½ cents gold per pound.

We said, nearly five years ago, that the probable cost of the East river bridge would be \$20,000,000. At present the indications are that our prediction will be realized; and judging by the rate of increase in previous years during the progress of the work, even the large sum we named may be insufficient to cover the actual cost of constructing the bridge.

THE MIGRATIONS AND DISPERSAL OF ANIMALS.

One of the most important considerations in studying the past history of the earth, as shown by the distribution of animals, is that which leads us to examine, first, what means animals of every class have for dispersal, and second, what barriers Nature interposes to prevent the same. It is a necessary part of the great struggle for existence, which pervades all life, that the creature shall encounter not merely active enemies but passive ones: not merely those which directly threaten its existence, but those which prevent its self-maintenance by cutting off its access to the necessary means of so doing: and against these last the organism is often compelled by force of necessity to oppose itself. Animals, even those which breed most slowly, increase with a rapidity out of all proportion to the available food in any specified district which they may inhabit; and therefore all are obliged to struggle against the obstacles which prevent them wandering in search of fresh hunting grounds or pastures.

Whether a certain natural phenomenon is or is not a barrier to further dispersion depends very greatly upon the class of animals inhabiting the region which it limits. Thus the elephant will climb the loftiest peaks and mountains, traverse rivers, and range the densest forests; the tiger can endure the widest extremes of heat and cold, and can swim moderate distances; but on the other hand, the monkeys, for example, must remain within the limits of forest vegetation, while the antelopes and zebras cannot exist otherwise than on the deserts.

Mr. Alfred Wallace, in his "Geographical Distribution of Animals," the underlying theory of which work we recently reviewed, devotes some very interesting pages to the above topic, considering in some detail the various obstacles to animal emigration. Climate seems to be a potent boundary to the travels of mammals, as there are such animals as the polar bear and walrus, which cannot live, in a state of nature, far beyond the polar ocean. But it is believed that it is not so much the climate itself as the change of vegetation consequent on climate which renders it effective as a barrier. It appears that valleys and rivers are often insurmountable obstacles, as animals which naturally exist on hills would be checked by the difference of vegetation and of insect life, and also by the unhealthy atmosphere often found in valleys. An arm of the sea over twenty miles wide cannot be traversed by land animals, by swimming; but on the other hand, long voyages are often made by mammals that are involuntary passengers on uprooted trees and ice floes. Bats and the cetacea have exceptional means of dispersal. The latter, however, find themselves opposed by temperature, as the polar species cannot cross the equator, nor can those indigenous to the tropics venture into the cold polar waters.

It would seem that no barrier could limit the range of birds, and that consequently they must be the most ubiquitous of living things; but this is far from being the case. The petrels and gulls are the greatest wanderers over the ocean, and the sandpipers and plovers roam over immense extents of coasts; but there are many species which are wholly checked by natural obstacles. The ocean presents an almost absolute barrier to prevent the birds of one continent passing over to another. Large numbers of birds cannot exist outside the forest countries; others cannot soar above the mountain ranges which bound their inhabited region. Again, the prevalence of their enemies is a potent barrier to birds dwelling in or crossing any region; and where nest-hunting quadrupeds, such as monkeys, abound, they are comparatively scarce.

We now reach that very interesting phenomenon known as migration; and here must be drawn a distinction between the true migrations of fishes and birds and the periodical movements of certain mammalia. Thus, in summer, monkeys ascend the Himalayas to heights of 10,000 and 12,000 feet; in dry seasons antelopes move southward toward the Cape of Good Hope. These differ from the great movements of fishes and birds, since such take place in large bodies and often to considerable distances. Migration may be looked upon as an exaggeration of a habit, common to all locomotive animals, of moving about in search of food; and in birds, it is especially exaggerated by their powers of flight and the necessity of providing soft insect food for their unfledged young. In North America, every grade of migration is found, from that peculiar to species which merely shift the limits of their range a few hundred miles (so that in the central parts of the area the species is a permanent resident), to others which move completely over 1,000 miles of latitude. So that, in all the intervening districts, such species are only known as birds of passage. There are many curious facts peculiar to migration, notably that of birds returning, year after year, to build nests in the same spot: a local attachment which prevents their wandering into localities unsuitable for them. Also that the old birds migrate first, the young following at random. This indicates the absence of imperative instinct in the habit, and it also accounts for the diminution in numbers of the young that return. On the succeeding year, however, the young profit by their experience, and fly when the old birds do. Another curious fact, however, in favor of instinct, is that "agitation" of caged birds at the time when their wild companions are migrating. This, however, Mr. Wallace considers to be due to a social excitement, due to the anxious cries of the migrating birds, and to be ascribable to some strong social emotion, gradually developed in the race by the circumstance that all who, for want of such emotion, did not join their fellows inevitably perished. The long flights of some birds, without apparently stopping on the way, is thought to be inexplicable, as well as their

finding their nesting place of the previous year from a distance of many hundreds or even a thousand miles. But the observant powers of animals are very great; and birds flying in the air may be guided by the physical features of the country, spread out beneath them, in a way that would be impracticable to purely terrestrial animals.

Reptiles are scarcely more fitted for traversing seas than mammals; but lizards evidently possess some unknown means, probably while they are in the egg state, of passing the ocean, since they are found to inhabit many islands where there are neither mammals nor snakes. Fishes are not without means of dispersal over land. Some are carried through the air by hurricanes; those living in subterranean waters have been thrown up by volcanoes. Geese and ducks often eat fish eggs without impairing the vitality of the same, carrying them meanwhile over long distances. Molluscs often attach themselves to animals or to fragments of wood and stone, and so are transported.

Winged insects possess more varied means of dispersal than any other highly organized animals. Many fly to immense distances; others are carried off by storms; and the floating trees which serve as rafts for mammals are the homes of myriads. Immense numbers of tropical insects are brought to the London docks in foreign woods; and they have often emerged from furniture, after lying dormant for many years. They will survive wonderfully hard usage. Many species can withstand hours of submersion in strong spirit; others can go for months without food.

But on the other hand, wide as is the distribution of insects, the barriers opposed to the same are equally great. Hundreds of species of *lepidoptera* can subsist, in the larval state, only on one species of plant; so that, on perfect insects being carried to a new country, the existence of the race would depend on the presence of the same or of some closely allied plant. Again, some require succulent vegetable food all the year round, and hence are confined to the tropics; some are dependent on water plants, some on mountain vegetation. Many are parasites of other insects; all have enemies in every stage of their existence; and the abundance of any one of these may render their survival impossible in a country otherwise well suited to them.

We have thus briefly reviewed the means which animals have for their dispersal about the globe, and the barriers which Nature has interposed to limit their wanderings. What effect these obstacles have exerted in determining the present distribution of animals, we shall consider in a future article drawn from the same source.

THE CAUSE OF THE DELAY IN ISSUING THE PATENTS.

We are in receipt of numerous letters from inventors, inquiring the cause of the delay on the part of the Patent Office in forwarding their patents, and also calling our attention to the fact that notices of their inventions have not appeared in these columns. In reply to all, we would state that, for the last two months, the Patent Office has encountered considerable difficulty in having the photo-lithographic copies of the drawings prepared. The acting commissioner has issued a circular, which is forwarded to individual patentees, in which each is informed "that, on account of the imperfection of the photo-lithographic copy of the drawing which was to accompany the patent, the Office was compelled to return the drawing to the photo-lithographic company for reprint. As soon as a perfect drawing can be procured, the patent will be forwarded to your address."

As fast as we receive copies of the delayed patents, we shall prepare and publish the usual notices. The difficulty has now existed since October 31; and while a few patents of subsequent dates have reached us, the large majority have yet to come.

A Prepared Codfish Patent Litigation.

The patent of Mr. Elisha Crowell, under which he claims a royalty on all cod and other fish deprived of skin and bones and packed in boxes, etc., for transportation, is to be contested by the wholesale fish dealers of this city. Mr. Crowell has heretofore issued stamps, which the trade purchased and affixed to the boxes of fish, at the rate of ¼ cent per pound. The dealers now claim that this tax inflicts injury on their business, and that Mr. Crowell has no legal right to exact it. As a large number of merchants are associated in these legal proceedings, and as it is reported that other fish dealers throughout the country will co-operate with them, it is probable that Mr. Crowell's claims will be vigorously fought in the courts.

Six Tons of Gold.

Three million dollars in double-eagles recently arrived in this city on a Baltimore and Ohio railway car. The treasure, which weighed six tons, was brought overland from San Francisco, to be deposited in the New York Sub-Treasury. It filled fourteen iron safes, and was guarded by a squad of soldiers, and was in charge of eight Treasury Department clerks.

In our description of the Tomlinson axle box, on page 54, present volume of the *SCIENTIFIC AMERICAN*, the address of Mr. Tomlinson should have been: "Care of G. L. Kelly, 80 and 82 White street," instead of "C. L. Kelly," which was the name and address given in part of the edition.

Persons desiring further information may address Mr. Tomlinson as above, or Mr. James E. Crane, 76 Park Place, N. Y., or Wm. Knifton, Black Hawk, Gilpin county, Col.

IMPROVED COMPOUND ENGINE.

The object of this improvement is to facilitate the working of both engines by low pressure steam, when such working becomes necessary, as, for example, when war steamers are brought into action. This improvement is the design of Mr. Charles Sells.

Fig. 1 represents a section through the low pressure valve chest of a compound engine, in which the high and low pressure cylinders are on the same axis, showing an arrangement of steam and exhaust valves for operating according to the invention. A is the high pressure cylinder, and B the low pressure cylinder, having the slide facing C; D is the exhaust pipe from the high pressure, and E the exhaust pipe from the low pressure, cylinder; F is a branch from the main steam pipe; G is a duplex valve which can seat, either as shown in Fig. 1, in which case the exhaust from the high pressure cylinder flows into the valve chest of the low pressure cylinder, or which can be seated on the seating, g, in which case the exhaust from the high pressure cylinder flows by the pipe, E, to the condenser; H is a shut-off valve, which, when seated as shown in Fig. 1, prevents the supply of steam from the main steam pipe to the low pressure cylinder, but which can be opened so as to supply steam thereto when the valve, G, is seated on g.

Fig. 2 is a sectional plan of the cylinders, A and B, of a compound engine, placed side by side, showing an arrangement of valves for effecting the same purpose; C is the low pressure slide jacket; D is the discharge from the high pressure; E is the exhaust pipe leading to the condenser, and F is the steam pipe from the boiler; G is a duplex valve, whereby the exhaust from the high pressure cylinder can be permitted to flow into the reservoir supplying the low pressure cylinder, or can be made to pass to the condenser when the valve, G, is seated on g; H is a shut off valve which either cuts off or admits steam from the steam pipe to the low pressure reservoir.

It will be seen that the invention consists in arranging in connection with the cylinder valves by means of which the passage between the induction of the high pressure cylinder and the low pressure slide jacket can be closed, and a communication can be opened between the low pressure slide jacket and the main steam pipe; so that, when it is desired to work with a considerably reduced pressure of steam in the boilers, both the high and low pressure cylinders are supplied with steam at the same pressure, and the induction from both is led into the condenser, the engines being thus worked as ordinary coupled engines, and the combined areas of all the cylinders being thus utilized. We are happy to add that the Admiralty have been so impressed with the value of Mr. Sells' invention that the engines of the new fast unarmored ship Iris, 7,000 horse power, now being built by Messrs. Maudslay, Sons, & Field, will be constructed on this principle.—*The Engineer*.

A Valuable Antique Inscription.

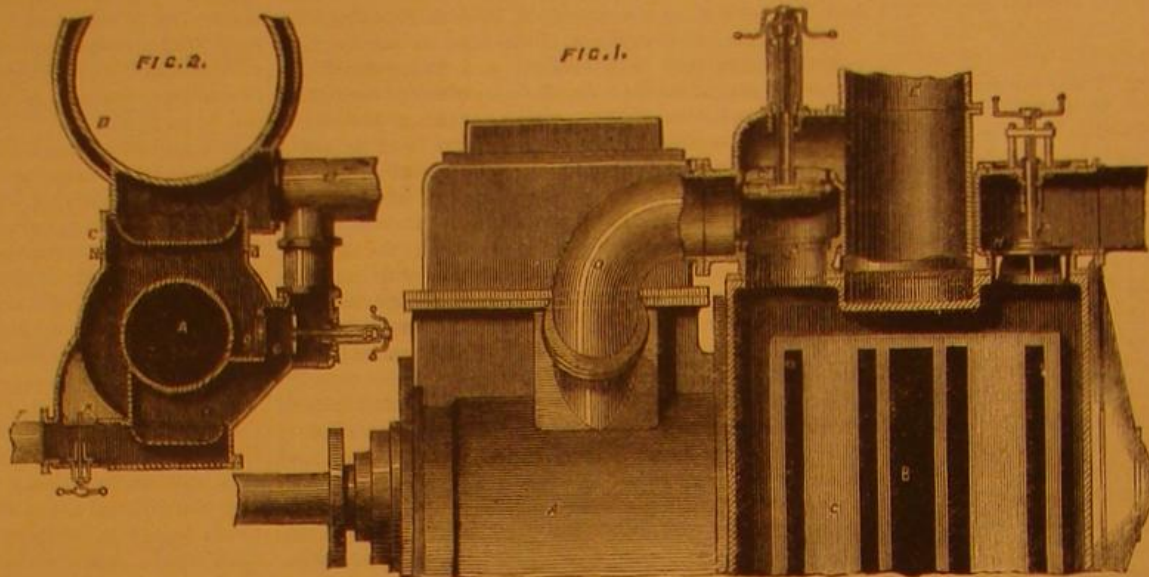
In the Hippodrome at Constantinople may still be seen the remains of a venerable trophy of the Persian war, the bronze serpent which, with the gold tripod it supported, was dedicated to the Delphian Apollo by the allied Greeks after the victory of Plataea, as a tenth of the Persian spoil. On the bronze serpent, which served as a base for the tripod, the Lacedaemonians inscribed the names of the various Hellenic States which took part in repelling the barbaric invader. The golden tripod perished long ago in the sacrilegious plunder of Delphi by the Phocians, but the bronze serpent remained in its original position till it was removed by Constantine the Great to decorate, with other spoils of Hellas, his new seat of empire at Byzantium. Here it has remained in the Hippodrome till our own time, not unscathed, for the last of the three heads of the serpent has long since disappeared; but the list of Greek States inscribed on the intertwined folds of the body remains perfectly legible to this day, having been fortunately preserved from injury by the accumulation of soil in the Hippodrome. This earth concealed about two thirds of the serpent till the excavation made in the Hippodrome in 1855, when the inscription was first brought to light. As the date of the battle of Plataea was B. C. 478, it may be assumed that the setting up of the tripod took place shortly afterward. Thus the inscription would not be later than B. C. 476. Of hardly inferior interest is the bronze helmet found at Olympia early in this century, which, as its inscription tells us, was part of a trophy dedicated by Hiero I., of Syracuse, after his great naval victory over the Tyrrhenians, B. C. 474. If the German excavations now going on at Olympia continue to yield results as promising as the discoveries which have distinguished the first months of this enterprise, we may hope that many similar records of Hellenic triumphs may be found in the rich soil of the Altis.—*Contemporary Review*.

A NEW TUBE EXPANDER.

Mr. Alanson Work, of Providence, R. I., has patented through the Scientific American Patent Agency, October 10, 1876, a new tool for expanding hose couplings and applying them to the ends of sections of hose.

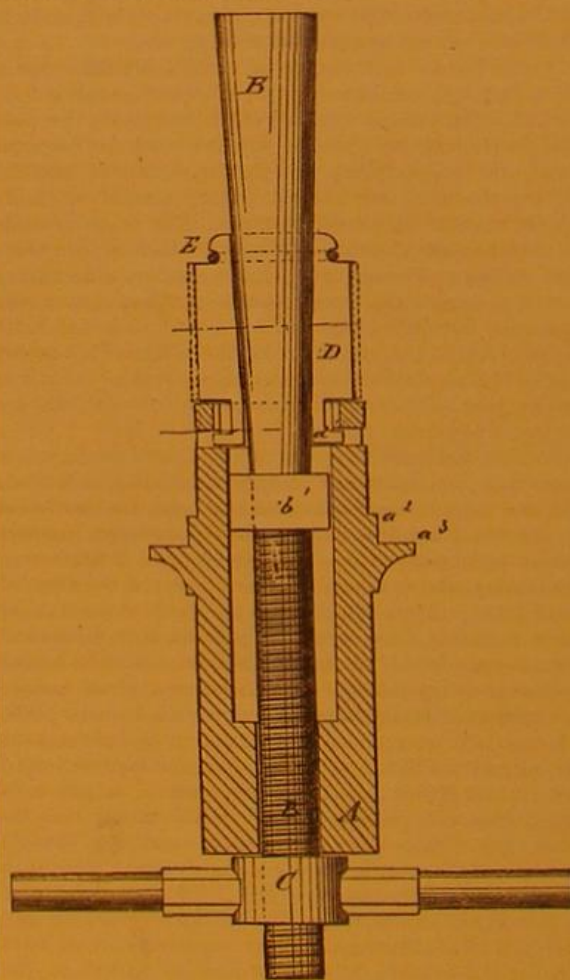
A represents the body of the tool, which receives the spindle, B. A square collar, C, formed upon the middle part of said spindle, keeps it from turning in the body.

The forward part of the spindle, B, has a screw thread to receive the lever nut, C, by which it is drawn forward. The rear part of the spindle is made conical, as shown. At D are sixteen, more or less, segments, which are arranged



SELLS' COMPOUND MARINE ENGINE.

radially around and correspond with the incline of the rear part of the said spindle. The forward ends of the segments, D, have hooks, d', formed upon them to hook into radial mortises, a', formed in the rear end of the body, A, to keep the said segments always equally distant from each other, and thus prevent them from huddling or getting closer together in one place than in another. A rubber ring, E, holds the segments against the spindle, as the said spindle is withdrawn after expanding the tube.



The copper tube to be expanded is placed upon the segments, D, with its forward end resting against the end of the body, A. Upon the rear part of the body, A, at the proper distance from its end, is formed a shoulder, a', for the end of the male part of the coupling to rest against, and a second shoulder, a'', for the end of the female part of the coupling to rest against.

Wash for Trees.

Pour ten parts of boiling water on one of gas tar; and when cold, sprinkle peach, plum, and other trees, gooseberry bushes, and even standard roses before any bud appears; the same will be free from insects all the summer. You may safely paint the stems of trees, and the stems of young larch and forest trees, and it will entirely keep away hares and rabbits. Sheep or horses will not touch the stems of apple trees.—*Land and Water*.

Dr. Schliemann finds an Ancient Greek.

Dr. Schliemann's excavations at Mycenae are yielding results which are of immense value, not merely archaeologically, but intrinsically, for he is exhuming gold in remarkable quantities. To print even the mere catalogue of the articles in precious metal which he has brought to light would occupy a large portion of this journal. Golden drinking cups curiously wrought, golden buttons, breastplates, diadems, figures of animals, leaves, personal ornaments (all in the most perfect condition), are daily found, and the coffers of the Hellenic Bank in Athens (where the treasure is deposited until it can be placed in a museum) are overflowing with wealth.

The most interesting part of the explorer's work is just now in progress, as he has at last reached human remains in a preserved state. Most of the bodies had been incinerated in the places where they lay; and it was evident that many had been robbed already. The signs of a shaft sunk into the tomb were noticeable, and the intruder had hastily collected the more valuable ornaments, and decamped. It is doubtful if the robber will be apprehended, as he accomplished his wickedness some time before the capture of Mycenae by the Argives in 468 B. C.—a fact shown by the absence of Greek pottery in the tomb, as such would have been there had the inhabitants of the Greek city, subsequently built over it, known of its existence.

In one tomb there were three bodies of gigantic proportions, which had been squeezed into the small space of six feet between the walls. Two were fragmentary, but the third had its face perfectly preserved under its ponderous golden mask. There was no vestige of hair, but both eyes were visible, also the mouth, which, by the enormous weight pressing upon it, had been forced wide open, showing thirty-two beautiful teeth. The nose had entirely gone, and the head had been pressed in such a way on the breast that the upper part of the shoulders was nearly in a line with the vertex of the head. From the top of the skull to the loins, the body, in its squeezed and mutilated state, measured two feet four and a half inches; and the entire remains had been pressed to a thickness of about an inch. Still the immense thigh bones left no doubt but that the man, when alive, was of very large stature; while the appearance of the teeth indicated that he died—or doubtless was killed, as he was a warrior—when he was about 35 years of age.

In color, the corpse resembled an Egyptian mummy. A broad golden shoulder belt lay across the loins; and from this was suspended a small bronze sword, on which was soldered a beautifully polished, perforated object of rock crystal, in the form of a jar with two silver handles. To the right and left of the body lay long bronze swords; and beside one of the swords, a bronze knife. These weapons had evidently been suspended from a belt, now gone. All the sheaths had been gilded, and were adorned with round buttons of gold, beautifully chased. The handles of the swords were gold plated, and exquisitely engraved. The massive golden mask which covered the head is 12½ inches in length and breadth, and is so thick that the enormous weight, which forages has been pressing on it, has made no impression. "It shows a round face, with large eyes and a large mouth much resembling the features of the body." Dr. Schliemann, in fact, is convinced that all the masks which he has found represent the features of the persons whose heads they covered. "A single glance," he says, "on these splendidly made masks must convince every one that they are real portraits and not ideal types."

When the news spread that the explorer had found a tolerably well preserved body, people flocked to Mycenae by thousands, from all parts of Greece, to view it. The corpse, however, threatened disintegration at any moment, and Dr. Schliemann in despair of keeping it sent for a portrait painter to prepare a picture of it. Luckily it lasted two days; and before that period had elapsed, a smart druggist, from a town in the vicinity, suggested soaking the remains in spirit in which gum sandarac had been dissolved. This was done; and Dr. Schliemann now thinks that, as the body can be lifted wholly on an iron plate which is beneath it, it can be removed to Athens unimpaired.

Wants to be an Editor.

A young man writes to the *Graphic* that he wants to be an editor, to which the *Graphic* editor replies: Canst thou draw up Leviathan with a hook thou lovest down? Canst thou hook up great ideas from the depths of thine intellect, and clean, scale, and fry them at five minutes' notice? Canst thou write editorials to measure? Canst thou write an editorial to fit in a three quarter column of the paper, which shall be in length just twenty-two inches, having three inches of fine sentiment four inches from the beginning, and nine inches of humor in the middle, and an outburst of maxim and precept, nine and three quarter inches long, at the close?

A NEW FOOD STEAMER.

Mr. Thomas B. H. Andrews, of Mansfield, Ohio, has patented through the Scientific American Patent Agency, November 28, 1876, an improved apparatus for steaming food of all kinds, boiling sugar, canning fruit, and for other purposes, which we illustrate herewith.

A represents the furnace, and B the steam chest, which is placed upon the same, and supplied with water for generating steam from a reservoir. The food-steaming box, C, is supported on an extension chamber, A', of the furnace, which may be made in one piece therewith, of cast or sheet iron, and separated therefrom by a hinged damper, C', so that the gases of combustion may be drawn through the same, or not. The furnace has two additional dampers—namely, a front damper, a, and a side damper, b—the hinged damper, C', and side damper, b, being closed when the apparatus is used, as shown in Fig. 1, for the purpose of steaming food. The smoke, etc., is then drawn through a pipe, d, at the rear of the furnace, and transferred to a short elbow, e, commonly closed by a cap, e'. When the apparatus is used for boiling sugar or other purposes, the hinged damper is opened to draw the fire through the entire extension chamber for the heating of the evaporating pan, D, placed on the furnace.

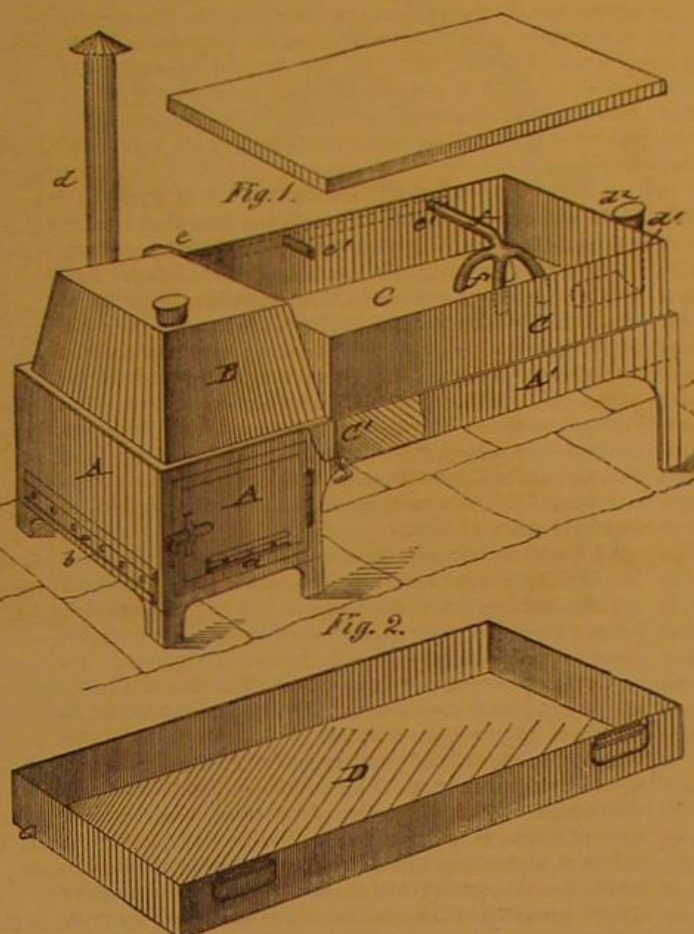
The steam chest, B, is connected by a steam pipe, e, and branch pipes, e', with the food box, detachable pipes, f, with branching arms, f', that open near the bottom of the food box, being applied to the branch pipes, e'. The steam issues near the bottom of the food box, and is thereby distributed throughout the food, a cover being placed on the same to retain the heat. The food is thereby steamed in a quick and effective manner, while, by taking off the steam chest and food box, the furnace may be employed for other purposes.

NATURAL HYGROSCOPES.

A very simple and quite accurate little apparatus, for determining the degree of dampness in air or any other medium, may be made from the screw-shaped appendage of the seed of the *pelargonium*. To the species and varieties of this botanical genus the name geranium is popularly given though the *pelargonium* differs from the true geranium in several characteristics, the most obvious of which are the half shrubby character of the stems and the somewhat irregular flowers. The mode of constructing the hygroscope is shown in Fig. 1. E is the support of the *pelargonium* spiral, F, inserted in a block of wood. G S is a light wooden needle or piece of straw fixed by collodion to the spiral extremity. The end, S, turns over a dial, C D, divided as shown. On this circle, zero corresponds to the greatest humidity, and 100° to the greatest dryness. Between these extremes are traced five spiral turns, as the helix does not usually unwind on itself more than four times. Each turn marked is considered as beginning on the diameter, 0 to 100. Thus, for example, if the helix makes two twists and a half, the indicated degree is read on the

fine construction. The accordance of the indications in it is quite remarkable.

There are two other hygrosopes noted by *La Nature*, which are even more simple than the foregoing. The first, Fig. 3, is a cork, B, in which a needle is inserted as a pointer, suspended from a nail by a catgut cord. The catgut cord contains more or less twist in proportion to the quantity of moisture in the air. The needle, therefore, as the cord turns, swings in one or the other direction; and by a little experimenting, a dial can easily be made from which



ANDREWS' APPARATUS FOR STEAMING FOOD

its indications may be interpreted. The simplest hygroscope of all is a ginger snap or spice cake, placed on a ledge, as shown in Fig. 4. This kind of cake is very sensitive to variations of humidity in the air; and when dampness is present, it bends, as indicated by the dotted lines, from C B to C B'. During dry weather, it returns to its horizontal position. A straw may be fastened to it as an index, and a dial, as above noted, be constructed by experiment.

NEW YORK ACADEMY OF SCIENCES.

The regular monthly meeting of the chemical section was held at the Mott Memorial rooms, Monday evening, January 15, 1877. Professor J. S. Newberry, President, in the chair. Notwithstanding the inclemency of the weather, the attendance was unusually large. Mr. Geo. F. Kurz exhibited

A NEW MINERAL

from Mexico, which contained sulphur, selenium, mercury, zinc, cadmium, and iron, in fact a sort of cinnabar, remarkable for the large percentage of selenium, about 1.8 per cent. It has been named *guadalupazite*, from the locality where it was found. It is said to be sufficiently abundant there to be employed as an ore of mercury, thus furnishing a means of developing the silver deposits. Mr. Kurz also exhibited a specimen of *jeffersonite*. The first paper of the evening was by Dr. Peter T. Austin, on the

CONSTITUTION OF THE ADDITION COMPOUNDS OF PICRIC ACID WITH HYDROCARBONS.

The author first called attention to the fact that picric acid combines directly with hydrocarbons, like benzol, and that this property is often taken advantage of in preparing perfectly pure hydrocarbons, as some of these picric acid compounds are very finely crystallized, and may therefore be readily purified. Dr. Austin objected to the use of the term physical compounds as applied to these substances, claiming that there is but one class of compounds—namely, molecular compounds. After illustrating, by means of graphic symbols, the probable constitution of these molecules, and offering some facts in substantiation of his theory, he closed by stating that certain substances, like paradinitro-benzol, are more easily prepared from these picric acid compounds than from any other source.

LABORATORY NOTES FROM THE UNIVERSITY OF CINCINNATI, was the title of a paper by Professor F. W. Clarke, read by the chairman of the section, Professor Leeds. In the analysis of certain minerals, where it is customary to fuse them with bisulphate and fluoride of sodium, Professor Clarke finds that chloride of sodium may be substituted for the more expensive fluoride with but slight inconvenience. The mixture employed by him contains 3 parts chloride of sodium and 12 parts bisulphate of sodium to 1 part of the mineral. He recommends it particularly for refractory iron ores and for chromite.

Professor Clarke has succeeded in preparing a fluoride of nickel containing three molecules of water, $\text{NiF}_3 \cdot 3\text{H}_2\text{O}$. It has a specific gravity of 2.15 at 19°, and retains the water at 130°. He also prepared a fluoride of zinc with four molecules of water. He was unsuccessful in making the fluorides of gold and of platinum.

Professor Clarke is perseveringly at work on the subject of molecular volumes. (See *SCIENTIFIC AMERICAN*, June 3, 1876.) He gave a list of 17 haloid salts, with their actual densities (determined by experiment), their molecular volumes, and the theoretical density calculated from their molecular volumes, which agreed in a remarkable manner. In all these cases, the volume was 5.5, 11, 16.5 or 22, all multiples of 5.5 the volume of hydrogen.

NEW METHOD OF DETERMINING FERROUS OXIDE IN SILICATES.

was the subject of a brief paper by Professor A. R. Leeds. It consists in the method of preparing and using hydrofluoric acid. The ore is pulverized and placed in a platinum dish which is supported on a platinum triangle within a platinum retort or still. The still is charged with fluorspar and sulphuric acid, and filled with dry carbonic acid. On heating the retort, dry hydrofluoric acid gas is evolved, which dissolves the ore and removes all the silicon. The carbonic acid is again passed through the retort until cold, when the ore may be removed, dissolved, and titrated with permanganate of potassium. This furnishes the best means of determining the amount of protoxide of iron in an ore or mineral. The objection to the use of the liquid acid imported in gutta percha bottles is that it is not strong enough, and contains enough organic matter to render it totally unfit for use in determining protoxide in the presence of the peroxide of iron. Photographs of the apparatus employed were exhibited. It is to be hoped that some less expensive apparatus may be devised for this process, when it will, no doubt, meet with popular favor.

At the conclusion of Professor Leeds' paper, Professor Charles Seeley made some interesting remarks on

HYDROFLUORIC ACID.

This acid is now very largely employed in this city in making the ornamental glass signs, usually supposed to be made by the sand blast. This involves its preparation on a large scale, as some establishments consume 100 lbs. per month. Iron retorts are employed, and are found to be better than lead, and last much longer than the leaden pipes which are attached to the retorts for condensing the acid. In regard to the physiological effects of the acid, Professor Seeley thinks the text books exaggerate its dangers. On dipping the hand into hydrofluoric acid, no immediate effect is produced; but if not washed off at once, in the course of half an hour the fingers begin to ache worse than the teeth with toothache; they swell up, and in a day or two the true skin begins to separate and crack open. These sores do not heal for two or three weeks. If, however, the hand is washed immediately in water or dilute alkali, no more inconvenience is suffered than from sulphuric acid. Lead bottles are used to transport it; and although gutta percha will last three times as long, its cost is much greater in proportion. Hydrofluoric acid can be made very cheaply, and sells in quantities at 18 cents per lb. Professor Seeley believed that it could be furnished here sufficiently pure to answer the objections raised by Professor Leeds.

HIPPOPOTAMUS DENTISTRY.

The hippopotamus now at the New York aquarium recently underwent that most disagreeable experience to all



juveniles, the extraction of a tooth. "Baby," as the unwieldy young female is named, is now some twenty months old; and her second set of teeth or tusks are pushing out the rootless milk teeth. This is attended with considerable suffering, and the animal has been very uneasy, constantly rubbing her snout along the floor or against the bars of the

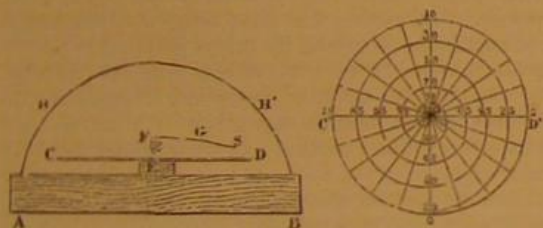


Fig. 1.

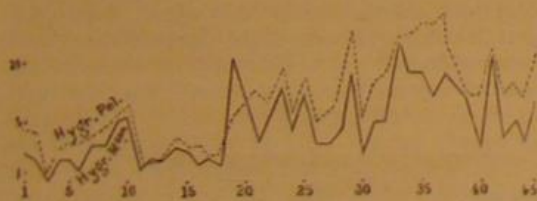


Fig. 2.

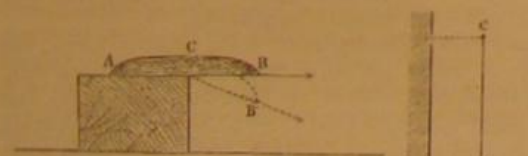


Fig. 3.



Fig. 4.

third turn of the spiral marked on the dial where the needle points to 50°. As the helix is quite fragile, a few copper wires may be arched over it, as at H H', to protect it from chance injury. Fig. 2 shows the indications of the pelargonium hygroscope, as compared with a Mason hygrometer of

cage, and instinctively endeavoring in many ways to rid herself of the pain.

To remove a tusk from a grown hippopotamus would be rather a difficult and possibly a perilous proceeding; but Baby, who is but little larger than a good sized hog, is very gentle, and, when it was decided to resort to the forceps, she submitted to being rolled over on her side and only kicked and grunted moderately when, after two or three attempts, a strong pull and a stout twist wrenched forth the offending tusk. Dr. Kohn, the keeper of the hippopotamus, performed the operation, the main object of which was not only to relieve the animal, but also to prevent her swallowing the tooth. It is a curious fact that brutes in a wild state almost always swallow their milk teeth; and it frequently happens that they thus commit involuntary suicide. In members of the cat tribe, the teeth are quite large and sharp when they are shed, and it may easily be imagined that the keen points may produce serious wounds in the internal organs. This is a cause of mortality which we have not seen considered in natural histories, and which might exercise a potent effect in reducing the number of wild animals.

Dr. Kohn calls our attention to a curious phenomenon in relation to the hippopotamus, regarding which naturalists are not wholly in accord. It is known that, after the animal has remained out of water for a brief period, a handkerchief passed over the skin becomes colored with a reddish liquid. This is commonly believed to be an oily secretion, something analogous in quality to the oleaginous material which occurs in feathers of aquatic birds. If, however, the period of the animal's absence from water be extended, the skin becomes mottled with spots which, on close examination, prove to be true scabs. Microscopic examination of these, as well as of the red liquid, Dr. Kohn informs us, distinctly shows the presence of blood globules, similar in all respects to those found in the blood of the hippopotamus; so that it is hardly possible to conclude otherwise than that the animal actually undergoes a sweat of blood. The pores of the skin are unusually large and widely spaced apart; and at the orifice of each, a scab is formed.

Communications.

The First Steamboat on the Mississippi.

To the Editor of the Scientific American:

In the communication under the above heading, published in your issue of January 3, F. L. I. says that the *Navigators*, published in 1814, contains no information except that relating to the Orleans. Having been upon the river in 1831, I have preserved documents and papers relating to the history of steamboating in the West, in which I find the following facts: All statements in regard to the Orleans agree with those given by your correspondent, except the tonnage. The boats were, in custom house measurement: 1. Orleans, of Pittsburgh, 200 tons, in the year 1811; 2. Comet, of Pittsburgh, 25 tons, 1813; 3. Vesuvius, of Pittsburgh, 90 tons, 1814; 4. Enterprise, of Brownsville, 75 tons, 1814; 5. *Etna*, of Pittsburgh, 361 tons, 1814; 6. Despatch, of Brownsville, 75 tons, 1816; 7. Buffalo, of Pittsburgh, 250 tons, 1816; 8. James Monroe, of Pittsburgh, 150 tons, 1816; 9. Washington, of Wheeling, Va., 212 tons, 1816. Of the above I propose at this time to give the history of two only, and this because they were both commended by Henry M. Shreve, to whom undoubtedly the honor belongs of having successfully established steam navigation on the Mississippi. The *Enterprise*, 75 tons, was built at Brownsville, Pa., on the Monongahela, by Daniel French under his patent, and was owned by a company at that place. She made two voyages to Louisville in the summer of 1814, under the command of Captain I. Gregg. On December 1, she took on board a cargo of ordnance stores at Pittsburgh, and sailed for New Orleans, commanded by Captain Henry M. Shreve, and arrived at New Orleans on the 14th of the same month. She was then dispatched up the river in search of two keel boats laden with small arms for General Jackson's army, which had been delayed on the way. She returned to New Orleans with the cargoes of the keel boats, after an absence of six days and a half, in which time she ran 624 miles. For some time after she was actively engaged in transporting troops. She made one voyage to the Gulf of Mexico, one to the rapids of Red River with troops, and nine trips to Natchez. She departed for Pittsburgh on May 6, 1816, and arrived at Louisville on the 30th, twenty-five days out, being the first steamboat that ever arrived at that port from New Orleans. The citizens of Louisville gave a public dinner to Captain Shreve for having accomplished in 25 days that which, up to that time, had never been accomplished by the barges and keel boats in less than three months. The *Enterprise* proceeded to Pittsburgh. The command was then given to Captain D. Worley, who lost her in Rock Harbor, Shippingport, Ky. Captain Shreve, on surrendering the command of the *Enterprise*, proceeded to fit out the *Washington*, of 312 tons, the hull of which was being built at Wheeling, Va., and the engines at Brownsville, Pa. Shreve's experience on the *Enterprise* had suggested some radical changes, which he proceeded to make in the *Washington*. It had been the practice on the boats previously built to carry the boilers in the hold, in the after part of which the cabin for passengers was also located. They were removed and placed upon the main deck, and a hurricane deck built on them. He rejected the upright cylinders of Fulton and the vibrating cylinders of French's patent; and he placed the cylinders in the *Washington* in a horizontal position, and connected them to the

water wheels with pitmans working on cranks at right angles. Fulton and French used single low pressure engines. Shreve discarded these, and used high pressure. But his greatest improvements were the cam cut-off and the use of flue instead of cylinder boilers; and by using these, one half of the fuel was saved.

On September 24, 1816, the *Washington* passed Louisville on her first trip to New Orleans, and returned to Louisville in November. While in New Orleans, Captain Shreve had an interview with Edward Livingston, who informed him that they (Fulton and Livingston) would commence suit against him for infringement on their patents. The severity of the winter compelled the *Washington* to remain at Louisville until March 12, 1817. On that day, she departed on her second trip to New Orleans, and performed this voyage by returning to the falls of the Ohio in forty-one days. The run from New Orleans to Louisville was made in twenty-four days.

It being now practically demonstrated that steamboats could ascend the river in one fourth less time than was required for barges and keel boats, the general public were satisfied that steam navigation was an established fact. At a public dinner given to Captain Shreve, on the completion of this trip to Louisville, he predicted that the time would come when the trip from New Orleans to Louisville would be made in ten days. This statement was regarded in the same light that Stephenson's was when he predicted that locomotives would be run at 20 miles an hour. Both predictions were a long way within the facts. The trip from New Orleans to Louisville, that required twenty-five days to perform in 1817, was made by the A. L. Shotwell in 1853 in four days and ten hours.

All doubts in reference to steam navigation having been dispelled by Shreve's success, shipyards were established, and the building of steamboats was actively commenced. Among those who were watching with intense interest the progress made by Shreve was Edward Livingston. He claimed that, under patents owned by Fulton and Livingston, they held the exclusive right of steam navigation on all the rivers of the United States. Upon the arrival of the *Washington* in 1817 in New Orleans, Livingston commenced suit in the United States District Court. The *Washington* was seized by the marshal, and the case went to trial. Shreve fought it out, and had the pleasure of hearing the claims of Fulton and Livingston declared to be unconstitutional; and the right of free navigation of the rivers of the United States by steam was secured to the people for ever. Geneva, Ill. EDWARD H. BEEBE.

Railroad Bridges.

To the Editor of the Scientific American:

Have engineers considered the plan of two or four strong wire cables to be braced and drawn tight under every span of all high dangerous bridges? It is the last feather that breaks the camel's back; and it is just a little too great a load, coupled with the motion of the train, that breaks the bridge. A plan that would supply this additional strength would seem to be what is needed. Would not wire cables, which never break suddenly, and are not much affected by the frost, be just the thing? Has a wire suspension bridge of so short a span ever broken? This plan would combine the truss and the suspension. It would seem as if it would be cheap and effectual in preventing the many such disasters as the one on the Lake Shore road. Certainly, with such disasters, the science of bridge building cannot be complete. There is much yet to learn. Ought not the State Legislatures or Congress to take hold of the matter? The cost of this plan on all dangerous bridges, even on a long line of road, would not equal the loss by the recent calamity, to which should be added the more important saving of hundreds of lives, and the loss of reputation of the line. And if all of the bridges on any of the great through lines were known to the traveling public to be thus secured, would it not greatly increase the patronage of such line? A. WATSON. Washington, D. C.

Boiler Explosions.

To the Editor of the Scientific American:

I consider the explanation of explosions in boilers in the communication of E. G. A., of Monticello, Pa., to be entirely wrong. For if the boiler was merely hot enough to convert the water into steam, there would be no danger of explosion; the sudden cooling of the iron, and consequent unequal contraction of its parts, would merely strain the boiler and cause it to leak. According to my experience, the boiler has to be hot enough to prevent evaporating, which generates a gas causing the boiler to rend; and to effect this does not require "a large amount of water to be introduced." Again, the very fact that employers repose confidence in their engineers is conclusive proof that they are worthy of that confidence. And when the employer has been besieged by pedlars of patent appliances of every description, until he is bored to death, he, in order to get rid of them, sends them to the engineer, who, as a general thing, has enough to attend to beside arguing the merits of whatever article the agent may have to sell. His answer is usually short and decisive.

Now, as to low water reporters or alarms, there are a number of points in regard to their working, which E. G. A. should remember. In localities where there is any amount of vegetable matter in the water, it causes a sediment to be precipitated in the boiler; this sediment, entering the water end of the reporter, becomes, from constant disuse and from the fact that there is very little circulation in the pipe, solidi-

fied. This prevents the water falling in the pipe, so as to allow the steam to enter and blow the whistle, which is done by the hot steam expanding a brass tube which acts upon a valve connected with the whistle.

There is a rule, adopted pretty generally by insurance companies, to the effect that they will not insure a building containing a steam boiler, unless the said boiler has a safety plug. This plug is hollow, the hole being larger upon the inside than upon the outside. The hole is filled with a patent composition composed of tin and lead, and it is all right, so long as it is covered with water; but as soon as the water level falls below the plug, the more intense heat of the steam and iron melts the composition and blows it out. I think all engineers who desire safety would prefer the plug to any low water reporter, as, in case of low water with a reporter, a single cup of cold water dashed upon the brass tube contracts it, and stops the whistle; while, with the plug, the steam has to be allowed to run down before a new one can be inserted. This causes delay and the unavoidable disgrace of the engineer in charge, if the circumstance be due to his carelessness. AN ENGINEER.

Cambridgeport, Mass.

[We shall be glad to hear from engineers in response to E. G. A.'s strictures; but we would caution our correspondents that vituperation is not argument, nor is it likely to assist our readers in appreciating the merits of either opposing views. For this reason, we omit publication of some replies already received.—Eds.]

Ideation in Utero.

To the Editor of the Scientific American:

Two objections, which seem to me quite serious, suggest themselves against the "Ideation in Utero" theory, which you quote from the *English Lancet*. These are:

1. If the unformed brain of the embryo is capable of receiving any impression, and retaining the same during the long period which must elapse before a child's brain can develop sufficiently to enable the child to express its idea in speech, why is not the more perfect brain of the child after birth impressed by external occurrences (especially if of a phenomenal nature) sufficiently to produce memories afterward of events happening during the first few months of existence? In other words, is it reasonable to assert that the embryonic brain is capable of receiving ideas of locality, etc., when we know that the brain of the very young infant is not? Certainly no living person can recall any experience of the first year of his babyhood.

2. But, it may be urged, this impression is due in some mysterious manner to the close linking of the embryo and the mother's body. The circulating blood, therefore, must be the medium, since the nervous connection in the umbilical cord is but slight. Why, then, did not one Siamese twin influence the ideas of the other, when between them there was both a blood and a nerve connection, far more highly organized than any connection between child and mother, and on the integrity of which the actual lives of the brothers depended? It is well known that the mental and intellectual existences of the pair were totally distinct. B.

The Recent Railway Accident.

To the Editor of the Scientific American:

The accident that recently occurred at Ashtabula, Ohio, whereby about 100 persons lost their lives, of course brings forth many theories as to why the bridge gave way.

The bridge was a Howe truss, of one span 157 feet long, built at Cleveland, by the Lake Shore and Michigan Southern Railway; it had been in use about 11 years, and had stood the test of 6 heavy engines, and was considered safe by the chief engineer of the road, who stood on it but a few days before the accident while an engine was passing over, and could see no sign of weakness.

The engineer of the leading engine felt something give way when about two car lengths from the end, and pulled the throttle open wide, breaking the drawhead between the tender and train, and thus saving his engine. Some good engineers think that a portion of the train must have been off the track and struck and broken one of the chords, as the bridge fell one way and the cars the other. The chief engineer and others, including your correspondent, could not see the least signs of the cars being off when they went on the bridge; and if a single truck had been off, it would have left marks on the ties. Others think that the frost and the heavy storm raging at the time caused it to give way. My opinion is that the bridge had been greatly weakened by the vibration and concussion of passing trains. These and the cold weather, combined, caused it to give way.

For two years, I ran a printing press, printing forms just as large as would go on, so that the clamps came solid against the chases. When the bolts were made of the best iron I could get, they would break without any seeming cause, the iron looking crystallized and brittle. The strain could never exceed 30 lbs. on each bolt, the latter being 1 1/2 inches in diameter. One broke in 66 days, having run about 286,000 impressions; the other broke three days after. I then had two pairs made of Swedish iron: the first pairs used ran for about three months. I then put in the others, putting a piece of wood 1 inch thick between clamp and chases, when they ran 105 days, and broke about the same time. They always broke in the same place.

Is it not probable that the same principle is at work on our iron bridges, and that the strongest will give way from this cause, if it be not renewed in time? J. H. S. Erie, Pa.

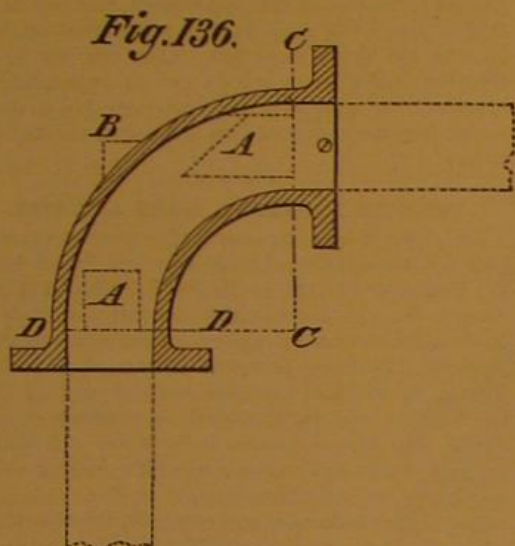
PRACTICAL MECHANISM.

BY JOSHUA ROSE.

SECOND SERIES.—Number XIX.

PATTERN MAKING.

Our next example will be a pipe bend, such as is shown in section in Fig. 136. It will be seen upon examination that the bend proper is included in that portion contained within the dotted lines, C C and D D, which meet at the center from which the arcs forming the bend are struck. Those parts exterior to the dotted lines are made separately from the bend proper, and are subjects in plain turning, similar to those already treated upon. It will be noted, however, that in this kind of pattern the core is not so well supported as in our previous examples; and it has, therefore, a tendency to sag or droop towards the center of the arc, and also to rise above its proper level when the metal is poured into the mould. To obviate this, we must make the core, and hence the core prints, extra long, as shown by the dotted lines in Fig. 136. It is usual also to make a provision for fastening these external pieces to the bend proper as follows: The flange is one piece, the bend proper another, and the core print yet another. The core print fits into the flange, and



has a projecting piece extending into a recess or hole, provided in the bend proper to receive it, as shown, and thus is the pattern strengthened. If the core prints are made so short that the core overbalances itself when placed in the mould, the moulder inserts, into the mould, stays or supports to keep the print in position; and these supports are called chaplets. They consist of pieces of thin sheet iron bent to about the curvature of the core and riveted to a piece of wire, the device being pressed like a flat-headed nail into the sand. The piece of sheet iron represents the nail head upon which the core rests, and it is inserted into the cope and nowel so that they project the proper distance. They act to prevent the core from either sagging or lifting by floating upon the molten metal. Then, when the casting is taken from the mould, the projecting wires are chipped off, and that remaining in the casting is riveted. This trouble can be, in many cases, saved by simply making the core prints a few inches longer; besides, wherever there is a chaplet, there is an excrescence left upon the casting. In the case of large work, however, the matter is different, on account of the expense of making very long prints and their awkwardness in being handled.

The bend part of our pattern may be either turned in the lathe or pared by hand; and sometimes it is a difficult matter to decide which of the two will best answer the purpose. To turn up a bend, it is necessary to turn up a ring semicircular in section, as shown in Fig. 137, and of a radius corresponding to that of the required bend. This ring is then cut up into portions of the length of arc required, and about one half is in most cases left over. The advantage of this

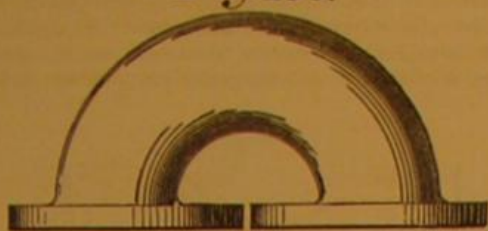


method is the direct and ready manner in which the required form is obtained; whereas in paring and shaping, the bending by hand, though the operation be ever so skillfully performed, will not be so true as if turned. And when we consider that castings only three thirty-seconds of an inch in thickness are sometimes required, we perceive that the slightest error or deviation from the true shape will be perceptible, and will often result in the loss of a large proportion of the castings. For all small work, then, the turning is of decided advantage; but since such is not always the case with large work, and since the line must be drawn somewhere, a correct decision will always be largely influenced by the facilities afforded by the tools, etc., in the shop. In the example shown in Fig. 138, which is what is called a return bend, the whole of a ring, turned as above described, would be appropriated; therefore, there being no loss of material, the method by turning will in this instance always be preferable.

In fixing the half flanges for work of this kind, not exceeding six or seven inches in size, one screw passing through the center of the pattern into the flange will be sufficient.

Care must, however, be taken to hold the flange firmly in its exact position while boring for and during the insertion of the screw. It should not be forgotten to add the small projecting piece, B, shown in Fig. 136, which lies in the center line of each arm of the bend, which is provided to enable the casting to be conveniently swung in the lathe.

Fig. 138.

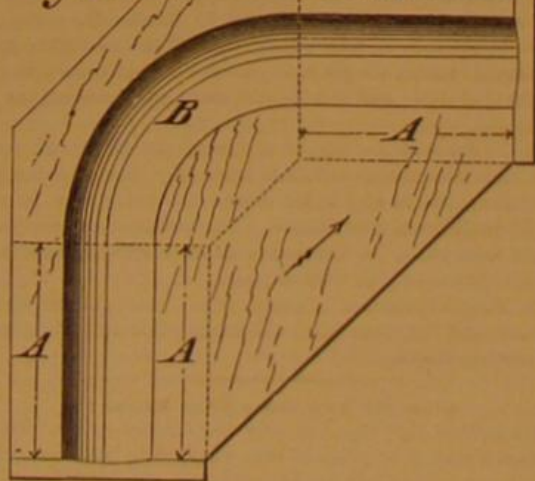


Before quitting examples of this kind, it will be well to once more direct the reader's attention to the core boxes, so as to impress upon him the important fact that, where equal thickness of metal is required, the core box should be as the pattern is. A round pattern demands a round core box; the one is of equal importance with the other. For example, in the designing of a bend, the required thickness is determined by the amount of internal strain to which the casting will be subjected. If, then, we give a round bend and an oval core box, we either make the bend too weak or we cause the manufacturer to pay for so many pounds of metal which he does not require. In the case of castings so thin as to require care to make the metal flow throughout the mould, an unduly thin place or spot will prevent the flow (at that part) of the metal, and thus spoil a large proportion of the castings.

A half core box for either a bend or a T may be made by preparing a block sufficiently large to cut out the whole recess, as shown by the full lines in Fig. 139. In this case, after the block has been surfaced truly on one side and edge, the grain of the wood being in the direction denoted by the arrow, the center lines are marked upon it, and also upon the pattern. We then lay one half of the pattern upon the block, and make the center lines upon them come exactly fair and even; and then we mark upon the face of the block the outline of the pattern, core prints and all. The core prints will of course be the right size of the core; but the outline marks thus produced form a guide to work by, and the distance between these outline marks and the edge of the core will represent the thickness of metal in the finished casting. A margin of stuff in the block is required outside of the outline marks, so as to give the core box sufficient strength. We next trace out a plan of the core, and then, upon the ends or sides of the block, we describe semicircles representing the exits of the recess to be cut out, the block being left so deep as to leave stuff enough below the depth of the recess to afford ample strength. We may now proceed to cut out the core by our hand tools, finishing it with the plane, shown in Fig. 14, and smoothing it with sand paper wrapped around a piece of wood of a sweep or curve a little less in radius than that of the core box recess.

Another method of getting out a core box for a bend is shown by the dotted lines in Fig. 139; and in this instance we make the core box in three pieces, the object being to turn up the end pieces, A A, in the lathe, the manner of pro-

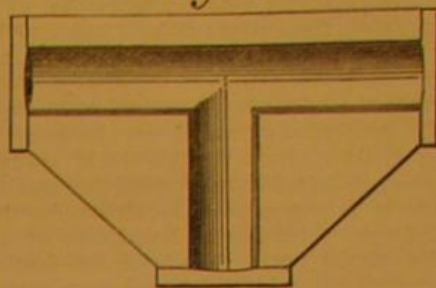
Fig. 139.



cedure being as follows: We get out the two pieces marked A A, and square up the faces truly, and chuck them, with the planed faces placed together in the chuck shown in Figs. 56 and 57, taking care that they are chucked so that, when the hole is bored in them, it will be half in each piece, or, in other words, chucking them truly, with the joint being between the two. We then pare out the curved part in the middle section, and then glue on the end pieces, A A, A A, and strengthen the whole by placing battens on the bottom and sides.

Fig. 140 represents a half core box for a T. In half core boxes, it is necessary to close the openings in the ends or sides by bradding on pieces of light board, taking care to give draught by paring them slightly concave at the top, and thus making the ends of the core similar to the slightly rounded ends of the pattern. When these pieces are omitted, the core maker has to extemporize them. When a full core box is required, as in the case of the oblique T, it is sufficient to mark the shape of the core upon one half only of

Fig. 140.



the box; and when this is cut out, we may place the two half boxes together, and trace the second half from the finished one, using a long bent scriber for the purpose of marking.

Cattle Food.

Experience teaches us that cattle thrive best on a mixed diet; all hay or all grain will produce less beef than hay and grain. The animal structure of the ox also demands bulk in food as well as richness: the feeding of concentrated food being only profitable so far as the animal assimilates it, beyond that simply increasing the manure heap at a cost far beyond its value. The ox has approximately eleven lbs. of stomach with only two and one half lbs. of intestines to each one hundred lbs. of live weight; the sheep has less stomach and more intestines, giving a smaller percentage of digestive apparatus; while the pig, for every hundred lbs. of his live weight, has only one and a third lbs. of stomach to six lbs. of intestines.

A steer would thrive well on a bulk of straw, with a little oil meal, that would shrink a sheep and starve a pig. Pork can be produced from clear corn meal, while mutton requires greater variety of food, and beef cattle would become cloyed and diseased with its exclusive use. A thoughtful attention to these broad facts will change much injudicious feeding into cheaper meat production.

One element in the economy of cattle feeding, the use of straw as fodder, has not received the attention its importance demands. On no one point is the average farmer so incredulous as regarding the value of straw to feed, and on many farms the wasteful practice still exists of turning all the straw into the manure heap. If properly made and reasonably well cared for, a large portion of the straw, especially of the oat crop, should be used as cattle food. Early-cut straw is worth for feed two thirds as much as hay, and is three times as valuable in feeding cattle as in the manure heap. Pea haulm and bean straw, especially if in the latter the pods are attached, are of still greater value. The best heat-producing foods are wheat, corn, oats, hay, and bran. Oat straw will develop as large a percentage of heat as oil cake; bean straw even more; and, in this respect, one hundred parts of oat straw are equal to eighty parts of hay. Straw is deficient in flesh-forming material, it requiring one hundred parts of straw to equal sixteen parts good hay in this particular; yet, fed with cotton seed or linseed cake, it supplies what they lack in heat-giving and respiratory elements.

For the purposes of feeding out oat straw, our oat crop is allowed to over ripen, a large amount of its nutriment being lost without any corresponding benefit to the grain, which never improves after the upper portion of the stem has commenced turning yellow. Oats cut when just turning from the green state, yield more grain as well as greater feeding value in straw. The narrow margins of profit in cattle feeding in this section of the country demand the closest economies in the food supply, and the most thorough investigations and experiments with an article of so little present market value, and one of such abundance with most farmers, as oat straw.—*American Cultivator.*

Uses of Glycerin.

According to Klever, one hundred parts of glycerin will dissolve:

Parts.	Parts.
Acid arsenious..... 20.00	Mercury bichloride..... 7.50
" arsenic..... 20.00	" bichloride..... 27.00
" benzoic..... 10 to 20.00	" arsenate..... 20.00
" boracic..... 10.00	Potassa chlorate..... 3.50
" oxalic..... 15.00	" and iron tartrate..... 8.00
" tannic..... 50.00	Potassium bromide..... 25.00
Alum..... 40.00	" cyanide..... 22.00
Ammonia carbonate..... 20.00	" iodide..... 40.00
" muriate..... 20.00	Morphia..... 0.45
Antimony tartrate..... 5.50	" acetate..... 20.00
Atropia..... 3.00	" muriate..... 20.00
" sulphate..... 35.00	Soda arsenate..... 50.00
Barium chloride..... 10.00	" bicarbonate..... 8.00
Borax..... 60.00	" carbonate..... 28.00
Bruce..... 2.25	Phosphorus..... 0.20
Cinchona..... 0.50	Sulphur..... 0.10
" sulphate..... 6.70	Strychnia..... 4.00
Copper acetate..... 10.00	" nitrate..... 0.25
" sulphate..... 20.00	" sulphate..... 22.40
Iron lactate..... 16.00	Veratrin..... 1.00
" sulphate..... 25.00	Zinc chloride..... 20.00
Iodine..... 1.50	" iodide..... 20.00
Lead acetate..... 20.00	" sulphate..... 35.00

Glycerin is particularly valuable as a solvent for gum arabic, as also in paste. Glue, by continued digestion, is soluble in glycerin, gelatinizing on cooling. Glycerin dissolves aniline violet, alizarin, and alcoholic madder extract. A solution of aniline color in glycerin is often used for stamping with rubber hand stamps. Glycerin is employed to extract the perfume from flowers, and the aromatic principle of red peppers. Sulphate of quinine dissolves in ten parts of glycerin when hot, but when cold separates in clots, which, when triturated with the supernatant liquid, gives it the consistency of a cerate, very useful for frictions and embrocations. Fifty parts of warm glycerin will hold in solution when cold one part of salicylic acid. Three hundred parts of water may be added without causing precipitation.

THE RESPIRATION OF ROOTS.

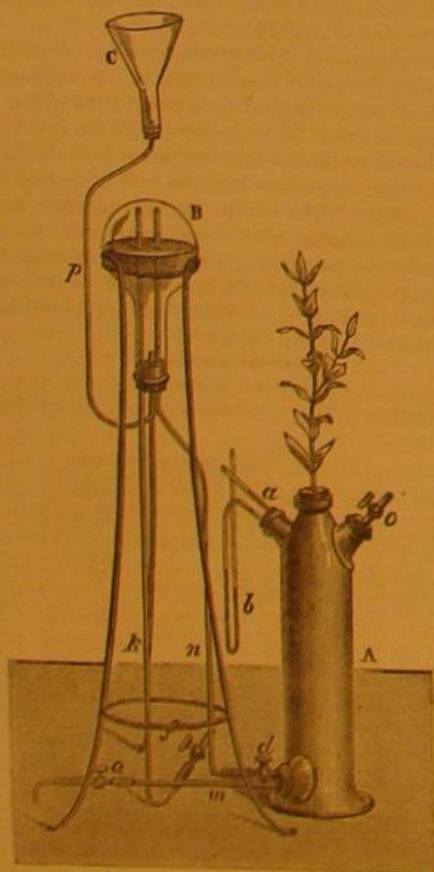
There are two functions peculiar to vegetables, which are often confounded: Respiration and assimilation. With air-breathing animals such a confusion is impossible, as their alimentation takes place only by the introduction into the digestive organs of solid and liquid matters, while respiration requires the penetration of oxygen into the lungs. With vegetables, on the contrary, the function of nutrition involves not only the introduction, through the roots, of substances soluble in water, such as nitrates, ammoniacal salts, and phosphates, but also the introduction of carbonic acid gas through the leaves. The latter also take oxygen from the atmosphere; and if the plant ceases to grow when it no longer finds carbonic acid gas in the air about it, and if this privation produces death through inanition, so also the plant perishes when deprived of oxygen, dying in such case through suffocation.

The leaves thus play the double part of organs of assimilation and organs of respiration; but the two gases which penetrate into the tissues act very differently. Under the influence of solar rays, the leaves decompose carbonic acid and emit oxygen. The carbon remains in the plant, when it is found united with water, forming those compounds—such as cellulose, starch, sugar, etc.—as are commonly called hydrocarbons. The penetration of carbonic acid into the leaves and the decomposition by light which it there undergoes are necessary to the growth of the plant, and thus constitute a phenomenon of assimilation.

Oxygen also enters the leaves, but its action is not well understood. Why a plant perishes when deprived of the gas is not definitely known; but it is certain that oxygen is not only necessary to the air-breathing organs of vegetables—the leaves, flowers, and branches—but equally so to the roots.

In order to determine the effect exercised by plant roots on the atmosphere of the soil in which they are buried, M. Vesque has recently undertaken a series of experiments, the description of which, with the annexed illustrations, we find in *La Nature*. To examine whether roots consume oxygen as do other vegetable organs, plants of various kinds were set out in vases filled with pulverized pumicestone. A soil absolutely free from vegetable matters was necessary in order to render it certain that such changes as might occur in the atmosphere about the roots were due to those organs, and not to the oxidation of carbonaceous matters which exist in arable earth. The arrangement of apparatus is shown in Fig. 1. The vessel, A, has three mouths, in one of which the plant is sustained by a stopper of rubber; the second, c, has a stopper and cock, and the third, a, has a thermometer and a mercury manometer, b. Water for watering the plant is admitted at d, the water coming from the funnel, C. In order to prevent bubbling and the consequent modification of the atmosphere in

Fig. 1.



the vase, A, the water from the funnel is led into the reversed flask, B, where the air contained in the water is caught. The water then passes off to the plant vase through the tube, a, and rises in said vase until it escapes at the cock, c. The cock, d, is then closed, and that at c opened, when the water runs off to a vessel under the table, the pumicestone in the vase being left sufficiently moistened to answer all needs of the plant.

When it is desired to remove a certain quantity of air from the vase, A, for analysis, the apparatus represented in Fig. 2 is used. The vessel, D, is attached to a musket barrel and filled with mercury, in which is plunged a pipette, E, having a glass cock. A vacuum is thus produced in the pipette, and

it is connected with the cock, c, of the vase, A, Fig. 1. In Fig. 2, the connection is established with a bell glass covering the leaves. The cocks, c, Fig. 1, and i, Fig. 2, are then opened, and the air from A rushes into the pipette. This air is then drawn off into a suitable vessel and analyzed. It is always poor in oxygen, but it contains a small quantity of carbonic acid. The quantity of the latter being a small fraction of that of the oxygen consumed, there is a diminution of the volume of air contained in the vessel enclosing the roots—a fact also shown by the manometer. Thus, like the leaves, branches, and flowers, the roots respire, and the oxygen consumed is not integrally replaced by carbonic acid.

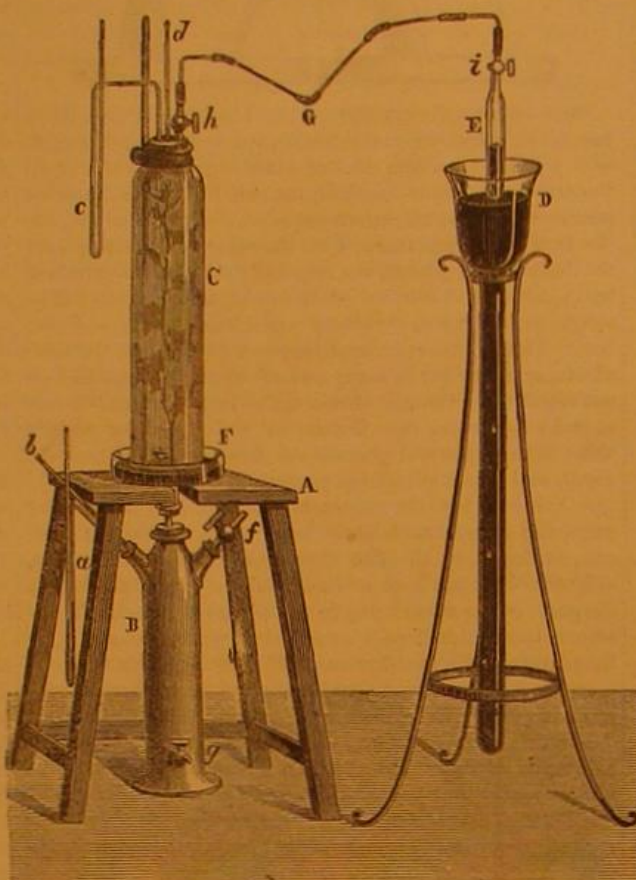


Fig. 2.—MM. DEHERAIN AND VESQUE'S APPARATUS FOR STUDYING PLANT RESPIRATION.

It is easy, by means of the apparatus shown in Fig. 1, to replace ordinary air with pure oxygen. The absorption of that gas by the roots is considerable, and the manometer indicates that a partial vacuum is formed in the containing vessel, and that carbonic acid is emitted. The plant lives very well when its roots are thus plunged in oxygen; but when nitrogen or carbonic acid is substituted for the latter, it dies.

It will be seen, therefore, that the respiratory function of the plant is not localized in any one organ, and that all its parts must be in contact with oxygen. This shows the great advantage of draining land. Water in marshy soil hinders access of the air, and the roots therefore keep near the surface where they can best obtain oxygen. When, however, the soil is thoroughly penetrated by drains, the roots go down to the subsoil, where they still find the necessary gas. Hence this allows the plant to gain sustenance from a larger amount of soil, and the development of these organs is promoted.

While the roots are organs of absorption of soluble matters, they also absorb carbonic acid. By means of the apparatus shown in Fig. 2, the leaves and roots may be enclosed in different atmospheres. The carbonic acid supplied to the roots passes to the leaves, is decomposed, and thus charges the vessel, C, with oxygen.

M. Vesque proposes to carry these investigations much further, and doubtless will reach many other important and interesting results.

How Do You Keep Your Books?

We believe, says the *American Cabinet Maker*, that there is a considerable proportion of men engaged in business—men who know how to buy goods, and can make a good sale of the same—who do not understand the details of keeping accounts. These men go on, year after year, without this knowledge, content if they find enough money in their drawer or at their bank to meet their bills. But, when you talk to them about a balance sheet, they immediately show a lamentable ignorance of the rules by which it should be made. Such ignorance may be very well when trade is flush and the skies are bright; but when the screw of hard times is applied, they are like the captain of a rudderless ship, who does not know when or how the rudder was lost. Partners go on drawing out money for personal expenses exceeding in amount the profits of the business, but they fail to see that this excess diminishes the capital of the concern. A and B form a partnership, and put in \$15,000 each. If each draws out \$2,500 for living expenses during the year, there must be a profit of \$5,000 made by the business in order to keep the capital at its original figures. If the profits fall below the amounts drawn out, the capital is diminished by whatever that difference may be. This is simplicity itself, and it requires no special education to understand it.

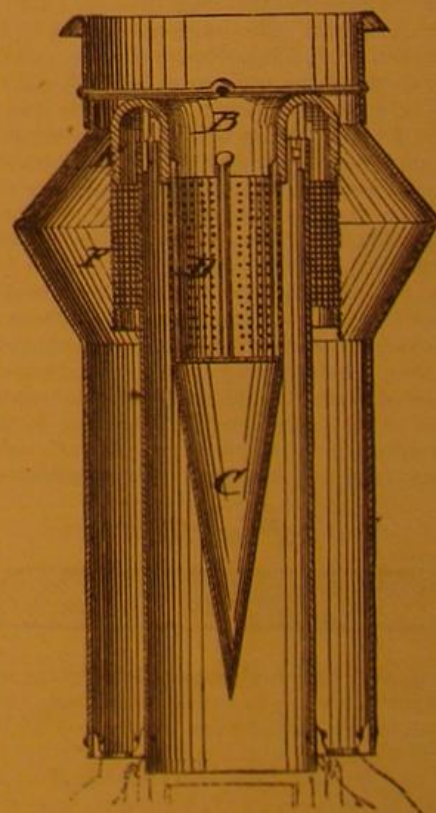
Therefore, if a business man understands how such a sheet should be made, he has no excuse for not knowing just how he stands.

Buy Small Trees.

Nurserymen usually describe trees on their catalogues as "second class," "medium," "first class," and "extra." The difference in these classes is principally, if not wholly, in the size and height of the trees; and as most farmers desire the best, they suppose that the large "extra" trees merit that description, and hence order them. The fact is, however, that a small tree will grow faster and (if a fruit tree) come into bearing condition sooner than a large one; and, as the *New England Homestead* states, in half a dozen years the tree that was small when planted will be larger and finer than the other. The larger the tree, the larger the roots which it has, and the larger the roots the less fibers there will be upon them. A tree that has plenty of fibrous roots will grow readily if proper care is used in transportation; but no amount of skill can coax a tree to live and flourish which is destitute of these little fibers. The roots of large trees are always more or less mutilated in the process of taking up, while small trees sustain little injury from this source. Dealers in trees assert that experienced men buy small, thrifty trees, while those who are just starting are anxious for the largest to be had. Those who are to set trees the coming season will do well to learn from the experience of those who, at considerable loss to themselves, have demonstrated that small trees are the ones to buy.

IMPROVED LOCOMOTIVE SPARK ARRESTER.

An improved spark arrester for locomotives has been patented through the Scientific American Patent Agency, November 14, 1876, by Mr. Simon Smith, of Mauch Chunk, Pa. As shown in the illustration, there is an inside and outside stack, and an annular space between the same. To the top part of the inner stack is attached a cone, B, which is extended partly downward into the interior, and partly around the outside of said stack. The cone terminates at the lower end with a tapering deflector, C, against which the exhaust steam and sparks strike in their upward motion. Above is arranged a cylindrical wire netting, D, through which the steam escapes to the outside, while the sparks are passed up to the annular top part, E, of the cone, which forms a conducting channel for them. Below the top part is again arranged a cylindrical wire netting, F, through which any steam carried around to the outside may escape, while the sparks drop down in the space between the inside and outside stacks to pipes communicating with the dirt box, from which they can be let out at the will of the engineer. The tapering deflector, C, that extends down through the inner stack, divides the steam and sparks gradually while passing up through the stacks, and avoids thereby the difficulty arising from the reaction



of steam and sparks by the direct impact of the steam on the horizontal bottom of the steam escape. A free escape of the exhaust steam and a free draught for the fire is thus secured.

Metropolitan (Underground) Railway, London.

The *Pall Mall Gazette* states that the Metropolitan Railway, with a traffic almost exclusively in passengers, is the most economically worked railway in England. During the last year it earned £100 for every £39 which is expended, being 32 per cent better in this respect than the average of English lines. At the same time its revenue per mile was between nine and ten times that of the average, exceeding \$200,000 per mile.

THE PRICKLY COMFREY.

Our illustrations represent a plant now much recommended, by the French scientific journals, to farmers, as yielding large quantities of excellent forage. It is known as the prickly comfrey, its botanical name being *symphytum asper-rimum*. With regard to the rapidity of growth and amount of herbage yielded by it, the *Journal de l'Agriculture de la France*, of October 7 last, says: "Two sets put late into the ground in the month of May, in a fairly deep soil but of poor quality, gave on September 29, the one 7,150 lbs. forage, and the second 3,850 lbs. The height of each plant was 15 inches, diameter 32 inches. The appearance was that of the small engraving, Fig. 2, which was drawn from nature at the Botanical Gardens, Kew, in England. Two cows, to which we offered the leaves freshly cut, ate them at once, in spite of their roughness. The quantity of water is 88 per cent, and the proportion of nitrogen 0.4 per cent in the green state, or about the same as in green Indian corn. The total of nitrogenous substances is about one third, a remarkable richness, justifying the high opinion cultivators who have tried it have formed of the plant. The sets we experimented on were sent us by M. A. E. Ragou."

The *Journal d'Agriculture Progressive* says: "We persist in recommending this plant, chiefly for small and middle farming; those who farm on a large scale will probably adopt it all in good time. The price of the plant is high; but we must not forget that a thousand plants will yield from fifteen to twenty thousand the year following, and that the planting of these sets, the original price deducted, does not cost more than pricking out cabbages, and less than does planting potatoes."

The following letter, dated October 30, from Culloor, in Malabar, Madras Presidency of British India, was received by *Land and Water*, from the pages of which we select the engraving:

"Thus far I am glad to be able to report most favorably on the progress of the comfrey roots I brought out with me here for the Tambracherry Coffee Estates Company. I have had them planted on a low, marshy soil, in ridges three feet apart, taking care previously to have the soil broken up two feet deep, and at subsoil of the ridges making a good coating of cattle manure mixed with jungle soil. By this cultivation the roots will not only have considerable depth of soil to grow in; but in the event of having a dry season, the manure, being placed at a fair depth under the top soil, will tend to make it moist for a very considerable time. I was greatly surprised at the quick germinating qualities of these roots, which, in several instances, had not been planted more than forty-eight hours at about three to four inches below the surface, and had appeared in that time one inch above the surface. I also found, after a voyage of six weeks from England, on opening the case, that the roots had germinated a little. The comfrey has now been planted about ten days, and promises well. I only hope our cattle will take to it here, as, being so quick in growth, it will be invaluable, in my opinion, here on coffee estates as a standard food for cattle: grasses being often difficult to obtain



during some seasons of the year. I shall advocate its trial to my agricultural friends in England. I am surprised it is not more generally grown. To a dairy farmer it would be an acquisition. I confidently expect to get here a crop every two months, if not more frequently."

Sand and Water.

An important point in the selection of materials is to procure a pure silicious sand for mixing with cement or lime to

form mortar. The sand used should be free from all nitrogenous, and some saline matters, such as alkaline chlorides; if not, these matters are liable to undergo a chemical change, after being mixed with the lime and cement, and so cause a rupture of the work even after it has set. For cementing purposes, for mixing with cement, a sharp sand is undoubtedly the best. It would be a saving of cementing material to select sands of various degrees of fineness so as to reduce the interstitial space as much as possible. Pure silicious sand forms, in combination with the limes, a silicate of lime which augments the strength, especially in those parts excluded from the air, as the interior of thick walls. Sand acts as



SYMPHYTUM ASPERRIMUM.

a dilutant for cement, so that its approximate strength, within certain limits, may be arrived at by knowing the proportions of sand used.

With regard to the selection of water, either fresh or sea water may be used for mixing with Portland cement. It has been shown by Mr. J. Grant, C. E., that the use of sea water augments the strength of Portland cement. This may be due to certain combinations taken place between some of the salts in sea water and the cement; on the other hand, the excess of certain salts will undoubtedly injure the cement. Sewage water, for example, should on no account be used in compounding mortar. The author has seen cases in which the best materials, both as regards cement and sand, have been used; but when mixed with sewage water the cement has never properly set, while the same cement, in the same work, compounded with pure water, has set rapidly and well. Care should also be taken in the mixing of cement that too great a proportion of water is not used. The smaller the quantity of water used in the compounding of cement, the better it will be found to be. The volume of water to be used, therefore, should only be sufficient to bring the mortar into a thick paste. Where more water is requisite, it is a sign that the bricks or other materials which are used in the construction of the works have not been sufficiently soaked, and that the mortar is robbed of its moisture, by reason of the inattention paid to this important point.—*Engineering News*.

A Sinking Island.

The Island of Heligoland is reported to be gradually disappearing. It is now, says *Iron*, less than a mile in superficial extent; but in 1649 it was four miles in circumference, in 1,300 forty-five miles, and, in 800, a hundred and twenty miles. The encroachment of the sea is effected almost entirely from the northeast, owing to the set of the currents and the direction of the prevailing winds.

In painting woodwork, a priming coat followed by a dark coat, such as chocolate or purple brown, and finished off with a coat of common varnish, is cheaper than, and as durable as, four coats of common color; it looks better, is more rapidly executed, and stands washing well.

A MIXTURE of 96 parts salt, 20 parts caustic soda, 1 part extract of oak bark, and 4 parts potash, is recommended as a preventive of incrustation in boilers.

A Few Modest Hints.

Although the depression in the iron trade, says the *American Manufacturer*, is very great, and almost universal, the manufacturers of agricultural implements and hardware, as well as certain other lines of goods, are doing a good business. Especially is this the case in the West. The activity in the farming implement branch is doubtless due to the fact that the tillers of the soil have enjoyed a succession of years of prosperity, and that existing in the hardware branch of manufacture is attributable, no doubt, to the fact that this business is not overdone, as is the case with many other branches, and to the further fact that American hardware is crowding the foreign into narrower limits, not only in this country but in many foreign markets. There is in this a lesson that manufacturers would do well to heed. It shows that if the demand for some manufactures is less than the productive capacity of the works, for other productions it is not. Indeed, the import figures furnished by the Bureau of Statistics show that for many kinds of goods which could be produced with advantage in this country the production is either nil or totally inadequate to the demand. So long as this is the case capitalists ought not to complain that there is no use for their money.

What is needed is diversity. There should be a branching out into the manufacture of the finer grades of goods. When one looks over the long list of imports and notes how many might be profitably produced at home, he is struck with amazement. The production of iron rails, of many forms of merchant iron, of certain kinds of glass goods, etc., has outgrown the demand; but is this a good reason for allowing the works at which these are made to stand idle or go to decay? Why not use the buildings, the power, as much of the machinery and as many of the employees as possible in producing articles for which there is a paying demand? Let the owners of such works look over the list of our imports and see if there are not many things which they could produce without making any costly changes in their plan; and let capitalists ascertain in the same way if there is not room for the profitable employment of their money in erecting and operating new works for the production of goods not now made in this country. This would be more enterprising at least, and we hope more profitable, than waiting, Micawber-like, for something to turn up. Our English cousins set us a good example in this respect. When one branch of business becomes overgrown, they adapt their works for the production of something for which there is a better demand. Is the iron rail business overdone? then they make the necessary changes for the production of steel rails. Is the pig iron of the vicinity unsuited to this? then they put their experts to work to see if an iron rail cannot be made that will compete strongly with steel rails. Their boldness and energy in opening foreign markets are also worthy of emulation.

CHEMICAL MAGIC.

A subscriber to *La Nature* communicates to that journal a simple trick, which is as deceptive as many of those per-



formed by professional "magicians." It is proposed to place the fumes of a cigarette, smoked by the operator at some distance, in a closed goblet, as shown in our engraving. The goblet is to all appearance empty, and the phenomenon of the white smoke wreaths inexplicable. But the vapors are formed by the admixture of muriatic acid and aqua am-

monia, two or three drops of the former being put in the goblet, and the covering saucer being wet underneath with the latter. The quantity of the liquids is so small as to pass unperceived; but as soon as the saucer is placed on the goblet, white vapors of muriate of ammonia are formed, which closely resemble tobacco smoke.

The Analysis of the Diamond.

The great French chemist Lavoisier undertook the examination of the diamond, and it is worth while noticing how carefully he went to work, how he proceeded slowly from one step to another in logical sequence, until he arrived at the true solution of the question he had undertaken to investigate: that is, until he was able to tell us exactly what happens when the diamond evaporates in the free fire, and why it did not do so when surrounded by charcoal. In the first place, he evaporated the diamond by means of the burning glass, and he observed that no visible vapor or smoke was given off, but that the diamond disappeared. He thought that perhaps the solid diamond had in some way been dissolved by the water, and that by evaporating the water, which was in the lower part of the bell jar in which he burnt his diamond, he might obtain the constituents of the diamond in a solid form; but he found that no solid residue was left on evaporation, and thus no trace of the diamond could be found. His next experiment was that of placing a diamond in the focus of a less powerful lens than the one he had formerly used, so that the diamond was not heated to so high a temperature as before, again placing it, however, in a bell jar over water. He then found that the diamond, when not heated quite so strongly, lost only about one quarter of its weight; it did not disappear altogether, but the remarkable fact was noticed that it became covered with a black substance which Lavoisier describes as being exactly like lampblack or soot, so that it dirtied the fingers when touched, and made a black mark upon paper. Hence Lavoisier concluded that the diamond is susceptible of being brought under certain circumstances into the condition of charcoal, so that it really belongs to the class of combustible bodies. He was, however, yet far from having proved this point, and he went on experimenting. He next measured the volume of air in which he was going to burn the diamond, and found it to be eight cubic inches. Then he burned the diamond in this volume of air by means of a lens, and found that the air had diminished to a volume of six cubic inches: thus showing that the air had undergone some change by the combustion of the diamond, and that two out of the eight volumes of air had disappeared. The next experiment he made was to examine the condition of the air in which the diamond had been evaporated. What changes had gone on in the air in consequence of the evaporation of the diamond? After allowing the glass in which he had burned the diamond to stand for four days, he poured clear lime water into the jar in which the diamond had been evaporated, and he says this lime water was at once precipitated in the same manner as if it had been brought into contact with the gas evolved in effervescence and fermentation, or that given off in cases of metallic reduction. Here, then, he had got on the track of what he wanted. Hitherto the diamond had apparently disappeared, and nothing was found to account for its disappearance; but now he had found that there was something contained in the air in which the diamond was burned which was not contained in that air before.

The next step he took was to examine the white precipitate or powder which was formed, and he found that the substance thus precipitated from lime water, by the air in which the diamond had been evaporated, effervesced on treatment with acid, and evolved what was then known as fixed air, but which we now know as carbonic acid gas. Here, then, in his last experiment he completes his proof, showing that exactly the same effects are observed when charcoal is experimented upon instead of diamond. Lavoisier had now run his quarry to earth; he had determined exactly what it is that is formed when a diamond is burned. He has shown that a diamond when burned produces exactly the same substance that is produced when common charcoal is burned, and he, therefore, legitimately concludes that diamond is only another form of the element carbon. The reason that the diamond did not burn in the furnace when surrounded by a mass of charcoal was that the air, or rather the oxygen of the air, could not get to the diamond, because it was kept off by the charcoal, which burned instead of the diamond.—*Professor Roscoe.*

The Avoidance of Colds.

This is the season when coughs and colds are most frequent, and when by lack of proper care slight attacks often increase to serious ailments. The following sound suggestions by Dr. Dobell, in his excellent work on "Coughs, Consumption, and Diet in Disease" are therefore of timely importance:

"But 72 per cent," says the writer, "of the cases of winter cough, which I have analyzed, might probably have been prevented by attention to commonplace things. Let us then give a few minutes to their consideration. 1. Sudden changes of temperature.

"This is the most difficult to avoid of any on the list. The occupations and amusements of all classes involve such changes, and we cannot stop these occupations and amusements, even were it desirable to do so. But very much could be done to prevent the body from feeling these changes. The first and most important is the complete envelopment of the body and limbs in wool next the skin, thus interposing a bad conductor of heat between the surface of the body and

the outer air. It is surprising that even in the present day this simple and common sense protection is neglected by so large a number of persons, both of the educated and of the uneducated classes. It is not sufficient for the purpose in view that a little body vest should be worn, just big enough to cover the thorax and abdomen, leaving all the extremities unprotected. It should be insisted upon by medical men that the arms and legs require to be protected from the sudden transitions of temperature, as well as the trunk.

"The main source of protection, then, against sudden changes of temperature to the surface of the body, is to be found in a complete covering of wool next the skin. But, besides this, a much greater attention than is common should be paid to putting on and taking off complete and efficient overclothing, on going from hot to cold and from cold to hot temperatures. This is particularly neglected by the working classes, and by girls and boys at schools.

"What I have said with regard to sudden changes of temperature will apply equally to two other causes of fresh colds, namely, draughts of cold air, and cold winds. Both are to be deprived of their sting by proper clothing of the skin and mucous orifices.

"Getting wet, and wet feet, occupy a very serious place in our list; and there is no doubt that damp and cold applied to the general surface is the most efficient means of producing chill and vital depression, with congestion of the internal organs. It is necessary that cold be combined with moisture to produce this effect. Even if all the clothes on the body are wet, no harm will come so long as they are kept warm; and this suggests the very great value, to all persons liable to exposure to wet, of light waterproof overalls. They may either be put on to keep the under clothing dry; or if the under clothing has become wet, either by weather or by perspiration, they may be put on to prevent too rapid evaporation and consequent reduction of temperature, especially when the person is about to remain still after getting warm with exercise. In this variable climate, therefore, schoolgirls, governesses, shop and factory girls, and all women whose occupations call upon them to brave the weather, ought to carry with them complete waterproof mantles, made as light as possible, but extending from the neck to the ankles, which can be put on or not as required; and boys and men, similarly exposed, should carry waterproof overalls.

"But if wet and cold to the surface of the body is a fruitful source of catarrh, wet feet—which means wet and cold feet—is a still more prolific source. There is no external influence which so surely produces congestion of the naso-pulmonary mucous membrane as wet and cold to the soles of the feet. There is nothing so universally neglected, and yet there is nothing more easy to avoid. Warm socks, horsehair soles, goloshes, provide efficient protection against wet and cold feet. It does not seem to be half enough understood that, although a shoe or boot may not be wet through, if the sole is damp it will by evaporation most effectually conduct away the heat from the sole of the foot, and therefore ought never to be worn after exercise is over.

"We have still one item left on our list—namely, fogs and damp air. I have particularly remarked, that although the smoke and other irritating matters constituting fog are unquestionably very injurious, it is the moisture and cold of the fog which are the qualities most potent for mischief to the naso-pulmonary mucous tract. There is but one means of depriving a fog or mist of its injurious properties, and that is a respirator; and the same may be said of the changes of temperature, of which I spoke just now; a respirator is the only means of protecting the respiratory passages from the effects of transitions of temperature. It would be difficult to over-estimate the value of efficient respirators, as a means of protection against naso-pulmonary catarrhs, if persons disposed to these affections would only carry respirators about with them in their pockets, ready to put on if required at a moment's notice.

"Although it is quite proper to cover the neck lightly, I am decidedly of opinion that warm wrappers round the neck are objectionable; they produce congestion of the nasal and faucial mucous membrane, and thus dispose to the very complaints they are supposed to prevent. On what possible grounds people justify the sudden transition from a hot sitting room to a wretchedly cold bed room, which may not have had a fire in it for weeks or months, it is impossible to say; but it is quite certain that the absurd neglect of proper warming in bed rooms is a fruitful source of all forms of catarrh. We cannot too much impress this upon our patients. It may often be almost necessary for a delicate person to put on a respirator on going up to bed as when going out of doors, unless proper precautions are taken to assimilate the temperature of the sleeping room with that of the sitting room.

"Such, then, are the principal means by which I would attempt to defeat the fickleness of climate. They all assume that the patient suffering from winter cough is to lead an active and an out-of-door life—not to be confined to his bed room, or his sitting room, or even to his house."

American Beef in England.

A correspondent of one of the English journals writes as follows in regard to the American beef recently received in London and other cities:

"A novel feature at this year's market was the introduction of American cattle, and the American breeders are to be congratulated on the result of their initial effort. Their consignments were none the worse for their long journey, and

we doubt not the experiment will be followed up in future years to a far larger extent, and with even greater success.

"* * * There is a sudden rage for American beef. A little while ago, when the weather was bad, American beef was selling at two cents a pound at Smithfield, and from ten cents to fourteen cents a pound at Birmingham. To-day I hear it has risen to the same price as English beef, and a well known West End butcher, whose customers are almost exclusively aristocratic, has purchased no beef but American. This looks as if Brother Jonathan were going to beat Brother John out of the field. If it has the effect of lowering the price of English beef I shall not grumble; but if fashion is going to run it up to the price of a luxury, I don't know that we shall be much better off after all."

[For the Scientific American.]

CHEMICAL PROGRESS IN 1876.

ORGANIC CHEMISTRY.

The immense field which organic chemistry opens for investigation is being assiduously tilled by a small army of chemists. It is, indeed, a tempting one, for the possibilities are great; in fact, nothing in it seems impossible of accomplishment. The number of possible compounds is infinite, and centuries will not exhaust the field of experiment. Synthetic chemistry is, perhaps, the most fascinating. The strides that it has taken since Wohler first prepared urea, and broke down that imaginary barrier, the idea that life was essential to the production of organic bodies, almost surpasses belief. At the Centennial Exhibition were exhibited many substances only recently obtained by synthesis and yet articles of commerce. About two years ago we heard with some distrust that the flavoring matter of the vanilla bean had been made from the sap of the pine tree; now it is a commercial article, cheaper if not better than the natural. Recently, other methods of preparing it have been devised, totally unlike that first discovered, and from different material. We refer to its preparation by Reimer from wood tar creosote, and from eugenol or eugenic acid (found in oil of cloves) by Erlenmeyer. Tiemann, the original discoverer of artificial vanillin, has made important contributions to our knowledge of the subject, having devised methods for the estimation of vanillin, determined the other constituents of vanilla beans, and made ethyl-vanillin, vanillic alcohol, coniferyl alcohol, and other compounds.

Another interesting case of synthesis is that of bitter almond oil, made from toluol by first subjecting it to the action of chlorine, when benzyl-chloride is produced, and then acting upon that with dilute nitric acid or nitrate of lead. Lippmann and Hawliczek, of Vienna, have recently subjected this artificial oil of bitter almonds to a series of careful tests, both chemical and physical, and proved its perfect identity in every particular, even in vapor density, with the genuine oil.

Phenol or carbolic acid continues to be the subject of numerous experiments; and Reimer and Tiemann have found that it may be converted into salicylic acid by heating its alkaline solution with tetrachloride of carbon. Para-oxybenzoic acid is produced at the same time. Kupferberg has succeeded in converting the last named acid into salicylic acid.

New methods of preparing alcohols and vegetable acids have been devised, and are curious from a theoretical point of view. Many attempts have been made to prepare the costly alkaloids, but as yet unsuccessfully, although in some cases these efforts have led to other discoveries of great importance.

The synthesis of indigo blue has been equally unsuccessful; the only method of its artificial production produces but a trace of it when the utmost care is expended upon it. The number of new dyestuffs is legion, and is daily increasing, so that none but a dye chemist may hope to keep up with the latest improvements in this direction. Coal tar products are the chief source of these dyes; but new dyes are occasionally produced from other materials, such as the sulphuretted organic dyes of Croissant and Bretonnière; and even ultramarine has come in for a fair share of attention. Eosine, one of the latest and most beautiful of the coal tar colors, has been the source of repeated experiments. R. Wagner has devised a method of detecting it on dyed fabrics by means of collodion; Waterhouse has investigated its photographic action, by mixing it with collodion, as Vogel had done with some other dyes. He found such collodion very sensitive to yellow and green; but on exposing it in the camera, the time of exposure was increased threefold. Binschedler and Busch state that Egli's method of making eosine by forming benzene-disulphonic acid, and then hydroxylating the compound, works well in practice. In all literature published on this subject, unfortunately, the most interesting details are carefully concealed, probably as trade secrets. The first step in the operation, says Durand, is to conduct benzol vapors into hot and concentrated sulphuric acid. The benzene-disulphonic acid formed is next converted into a lime salt, then into a soda salt, which is converted into resorcin by fusion with caustic soda. The resorcin is purified, and then fused with phthalic acid, which produces the fluorescene. To convert this into dibrom-fluorescene is the most difficult part of the operation; and it is on this point that we are left in the dark.

Aurantia is the name given to a new artificial dyestuff, which readily imparts to silk and wool a beautiful shade of orange. According to R. Gnehm, this dye is the ammonia salt of an acid discovered and named by him hexa-nitrophenylamin. It possesses the remarkable and unfortunate property of irritating the skin of persons using it, causing an

eruption like that made by croton oil. Although some persons are not affected by it, it is not suited to general use.

A new series of dyestuffs, formed by the action of glycerin on phenol (carbolic acid) in the presence of sulphuric acid, has very recently been discovered by Reichl, of Prague, who is still at work on it. Both red and purple have been obtained in this way. He has also obtained dyestuffs by the action of glycerin on pyrogallol and on thymol, and purposes to study its action on cresol and other phenols. This opens a new field for study, and promises to prove the most important discovery of the year.

W. H. Perkin, the discoverer of the first aniline dye, is still finding new things in the color line. Among his recent papers is one on anthrapurpurin. Lauth has succeeded in preparing a new class of dyes by the introduction of sulphur into aromatic diamines, and then oxidizing the sulphur compound. It forms a beautiful purple. (See SCIENTIFIC AMERICAN, October 21, 1876.)

A natural dyestuff capable of forming lakes has been obtained by Mederstadt from the *musa fehi*, a plant of the banana family. Aniline black has attracted more attention than any other aniline color. Most of the experiments relate to the use of vanadium, which has almost entirely superseded copper, notwithstanding its price. One part only of vanadium salt is required for 50,000 parts of aniline oil.

In regard to the alkaloids, the principal work has been done by Drs. Wright and Beckett. Cahnberg gives some new reactions for codeine and atropine; Flueckiger, a new test for brucine; and De Vrij, a new reagent for quinine. Much has been done to aid the analyst in determining various alkaloids quantitatively too. The glucosides, the bitter principles, and the active constituents and essential oils of many plants have been sought and studied. Among the plants subjected to chemical investigation we have, first, the *eucalyptus globulus*, then *dulcamara solanum*, *vicia sativa*, and many others. Ergot has also been analyzed.

The subjects of food and drink have not been neglected, especially wine and milk. The adulterations of wine and the addition of artificial coloring matter is becoming so common abroad, where adulterations are not so tamely submitted to as here, that chemists are exhausting all their ingenuity to detect the falsifications, and with only partial success. Aniline colors are most easily detected by the power of dyeing silk or wool; but fruit and vegetable coloring matter is the most difficult of detection. The best paper on this subject is that of Gautier, who has constructed a series of tables of the reactions with various reagents. Dr. H. Vogel applies the spectroscope to them. Mellias has also written on the detection of colored red wines, and Bretet described a new method of detecting plastered wines.

The subject of the adulteration of milk is so often before the courts that the public are kept informed of all the latest investigations in that department; and it seems as if perfection had almost been attained in milk analysis. Not so with butter, however. The subject of artificial butter still agitates the public as well as the scientific mind. A pharmaceutical society in Leipzig offers a prize of 300 marks (about \$75) for a certain and practical method of testing cows' butter for adulteration with foreign fats. Competitors are required to send in their papers to B. Kohlmann, Leipzig-Rendnitz, before September 30, 1877. Water analysis is in an equally uncertain state, no satisfactory test for wholesome water having yet been devised; and the fight between Wanklyn and Frankland, about the albuminoid ammonia test, is still in progress.

DISINFECTANTS.

About disinfectants, a very great deal has been said and written. Carbon disulphide is one of the latest competitors in the field. Zöllner seems to have been the first to observe that mould never appeared in vessels containing a trace of carbon disulphide vapors. The poisonous nature of these vapors would lead us to expect that it would destroy germs of all sorts, and such seems to be the fact. Zöllner kept beef and veal for 32 days, at a temperature of 60° to 85° Fah., in an atmosphere containing this vapor. Hugo Schiff confirms these observations. Little that is new has been learned about salicylic acid, and doubts are entertained of its fulfilling the great expectations formed of it. Attention has been directed anew to borax and boracic acid as antiseptics. Thymol as an antiseptic has been described by Husemann.

ANALYSIS.

Analytical chemistry has not fallen behind in either the organic or inorganic branch. Gas analysis and volumetric analysis, or titration, have been subjects of thorough investigation. Many new substances have been introduced as indicators by acidimetry, in place of litmus, such as salicylate of iron, logwood, fluoresceine, eosine, and carmine. Grete proposes to use of xanthogenate of potassium for the quantitative determination of carbon disulphide, copper salts, and caustic alkalies in the presence of alkaline carbonates. Kopfer recommends the use of platinum for the ultimate analysis of organic substances. Other new methods of analysis, equally interesting to the analyst, are to be found in journals devoted to that branch of the science.

The above imperfect sketch of the doings of chemists in our Centennial year sustains the assertion with which we set out, that there is something new under the sun.

E. J. H.

Cast iron should be painted directly after leaving the mould, in order to preserve the hard skin which is formed upon the surface of the metal by the fusing of the sand in which it is cast.

[For the Scientific American.]

CEDEMA GLOTTIDIS.

When a great or good man dies of an obscure disease, new incentives are added to the study of its nature and rational treatment. Previous to the year 1799, the clinical history of *cedema glottidis* had been loosely described by Morgagni and by Bichat; but of the pathological condition, giving rise so suddenly and insidiously to fatal results, but little if anything was known.

General Washington, with the exception of a slight cold for the day or two last past, was in the enjoyment of an ordinary degree of health. Suddenly, and without warning, he was seized with difficulty in breathing; and ere the danger was fully realized, the narrow slot in the respiratory track was closed up, and the nation was startled by the announcement: "Washington is dead!" An autopsy was had, which revealed an oedematous condition of the larynx and complete closure of the little space between the vocal chords; and since the 14th of December, 1799, the medical profession of the whole world has been more familiar with the pathology and rational treatment of *cedema glottidis*.

The immediate cause of death is suffocation from closure of the slit or space between the vocal chords (the *rima glottidis*); and the remote cause is oedematous thickening or enlargement of the parts nearly adjacent to this narrow passage. It will therefore be observed that the thickening may be in the mucous covering of the vocal chords, or in the ventricular bands or false vocal chords; it may be in the covering of the arytenoid cartilage or commissure; it may be in the lip, cushion or body of the *epiglottis*; or it may extend to all of these simultaneously. Strictly speaking, however, oedematous thickening can take place only in tissues like the ary-epiglottidean folds, where areolar tissue is interposed between the mucous membrane and the fibrous or cartilaginous structures beneath: the thickening of mucous membrane, or of the arytenoid muscle, when found, being more dependent upon an inflammatory process. Practically, this distinction is not made, the term being applied to thickening of all laryngeal structures which, in the main, partake of an oedematous character. And within the confines of a narrow and unyielding cartilaginous box like the larynx, an amount of swelling, which in other parts of the body would be of the most trivial consequence, is productive of grave and fatal results. In some instances the whole larynx is involved, but generally the condition is limited to one or more parts of it. The disease may be idiopathic, as in the illustration given, or it may occur as a sequence of other diseases, springing, as it were, from ambush upon a patient well advanced in convalescence from an attack of laryngitis, whooping cough, measles, scarlatina, small pox, erysipelas, pulmonary catarrh, Bright's disease, or any other disease of which dropsies are among the *sequela*. It may be also traumatic, from mechanical injuries to the larynx, or from an attempt to swallow corrosive liquids.

The rational signs consist of difficulty in swallowing and of articulation, with hoarseness and ineffectual cough, a sense of constriction as from the presence of a foreign body within the larynx, difficulty in breathing, with a whistling or stridulous sound, and finally death from suffocation. The physical signs are: More or less enlargement at and above the thyroid prominence, and tenderness upon pressure in proportion to the extent of inflammatory complication. The uvula and tonsils are generally more or less enlarged, and the mucous membrane of the pharynx more or less infiltrated, and of a dusky red color in proportion as the disease is high in the larynx. Generally, by wiping the tongue so as to grasp it with a napkin to draw it well out, or by pressing the base of it well down, the enlarged epiglottis may be seen rising above its natural position, often depressed in the middle by a crease from before backward, and having a semi-translucent appearance. If the enlarged parts are too low to be seen in this way, and there is no laryngoscope at hand, the finger may be passed well down into the larynx, when the condition may be made out with considerable accuracy by the touch. This, however, is a hazardous proceeding, as the irritation may result in spasm and complete closure of the glottis.

The rational differential diagnosis of *cedema glottidis* is comparatively easy. There is more regularity in the increase or decline of symptoms than in spasm of the glottis, less pain and enlargement than in acute laryngitis, and more rapid development of symptoms than from the presence of an intralaryngeal tumor or abscess. The laryngoscope reveals to ocular inspection the true condition; and physical differential diagnosis is clear and decisive.

The demand for relief is generally too urgent to justify the delay required for the operation of topical applications. Besides the irritability of the muscles of the larynx, and the liability of local applications to provoke spasm, is a serious obstacle to their use. Among the remedies that have been used as such may be mentioned a solution of nitrate of silver, a solution of alum, and also of tannin. Dilutions of carbolic acid and of the *liquor persul. ferri* have been recommended. But when it is remembered that danger results from mechanical occlusion, consequent upon a sero-plastic effusion beneath the mucous membrane, the insufficiency of mere local applications is apparent. If the oedematous enlargement can be reached, as is generally the case, the parts should be freely scarified or incised with a long curved bistoury or hernia knife, as recommended by Dr. Buck, who devised an instrument especially for such use. Relief follows almost instantaneously upon the evacuation of the effusion. Professor Strohmeyer advises the forcible rupture of the distended

membrane with the end of the finger, when it can be done without too great risk of strangulation. When Dr. Buck's plan, which is generally employed, cannot be satisfactorily performed, the last resort is either to produce an artificial larynx through the creco-thyroid membrane, or tracheotomy; and the prompt relief which almost invariably follows is among the most satisfactory rewards of the surgeon, patients frequently falling asleep after the first few inspirations through the artificial opening. The opening of the trachea, however, is not curative, but affords refuge from the immediate danger of suffocation, while the disease is being controlled by such measures as remove dropsics in other parts of the body. They should be in the main constitutional; and the fact that these cases often occur in those with impaired or broken down constitutions should never be lost sight of in their treatment.

A. G. F.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

The computations and some of the observations in the following notes are from students in the astronomical department. The times of risings and settings of planets are approximate, but sufficiently accurate to enable an ordinary observer to find the object mentioned.

M. M.

Positions of Planets for February, 1877.

Mercury.

Mercury, which was so beautiful in the evening twilight of January, has now moved on to a position west of the sun, and should be looked for in the morning.

On February 1, Mercury rises at 6h. 22m. A. M., and sets at 4h. 19m. P. M. On the 28th, Mercury rises at 5h. 41m. A. M., and sets at 3h. 30m. P. M.

Mercury will be best seen on the 20th, when it attains its greatest elongation from the sun.

Venus.

Venus, although approaching the sun in position, is still very brilliant in the morning, and can be well seen during the first half of February.

On February 1, Venus rises at 6h. 1m. A. M., and sets at 3h. 12m. P. M. On the 28th, Venus rises at 6h. 3m. A. M., and sets at 4h. 14m. P. M.

Mars.

On February 1, Mars rises at 3h. 18m. A. M., and sets at 0h. 30m. P. M. On February 28, Mars rises at 2h. 54m. A. M., and sets at 11h. 52m. A. M.

Mars can easily be recognized on the 28th by its nearness to Jupiter. Both planets are in the constellation *Sagittarius*, Mars being a little south of Jupiter.

Jupiter.

Jupiter is conspicuous now in the morning, but is so far south and rises so late as to give scarcely any time for observations before daylight.

On the 1st, Jupiter rises at 4h. 21m. A. M., and sets at 1h. 24m. P. M. On the 28th, Jupiter rises at 2h. 55m. A. M., and sets at 11h. 56m. A. M.

Saturn.

Saturn rises so late in the morning and sets so early in the evening that it can be seen for only a very short time after sunset.

On February 1, Saturn rises at 8h. 28m. A. M., and sets at 7h. 13m. P. M. On February 28, Saturn rises at 6h. 49m. A. M., and sets at 5h. 44m. P. M.

Uranus.

Uranus is better situated for observations, during February, than any other planet. It is in good northern declination. It rises about 6 P. M. on the 1st, comes to the meridian a few minutes before 1 A. M. of the next morning, and sets at 7h. 46m. A. M.; it can, therefore, be seen for more than 12 hours. On the 28th, Uranus rises at 4h. 7m. P. M., comes to meridian at 11 P. M., and sets at 5h. 57m. the next morning. Uranus rises before the bright star Regulus, and, when on the meridian, is 2° above it. A small telescope will show its disc, looking like a very small full moon.

Neptune.

Neptune rises February 1 at 10h. 36m. A. M., and sets at 11h. 54m. P. M. On the 28th, Neptune rises at 8h. 51m. A. M., and sets at 10h. 11m. P. M. But Neptune can be seen only with the aid of good telescopes. It is among the stars of *Cetus*.

Sun Spots.

The report is from December 18 to January 15 inclusive. The large spot mentioned in the last report was observed until December 23, moving regularly across the disc on account of the sun's motion on its axis. Owing to cloudy weather, it was not seen after that date. On January 4, a very faint spot was discovered, already considerably advanced on the eastern limb. On January 9, when the next observation was made, a pair of very faint spots was visible on the eastern limb, while this faint spot, first noticed on January 4, was now on the western limb. On January 12, neither the single spot nor the pair could be found. The picture of January 12 shows a large spot on the eastern limb, followed by two very small ones. On January 13, another large spot appeared, irregular in shape and surrounded by faculae. The photograph of January 14 shows a regular motion of these large spots; but one of the small ones, which were observed accompanying the spot first noticed on January 12, had disappeared.

These two remarkably large spots are still visible (January 17), and the one first seen on January 13 will remain on the disc for at least a week longer. It seems probable, from position and peculiarity of shape, that this is the same spot first seen on December 17.

Milk Testing in Holland.

At the last meeting of the American Association for the Advancement of Science, held in Buffalo, Professor Von Baumhoer, delegate to the Centennial for Holland, gave an account of the milk adulteration question in the city of Amsterdam, where the lactometer is not relied upon; but a simple and quick method of chemical analysis, introduced by the Professor, is employed, and has been adopted by the city authorities. The method of Dr. Von Baumhoer consists in an improvement on that first proposed by Brunner. The trouble commonly found in evaporating milk, in order to find the amount of solid ingredients in it, consists chiefly in the continual formation of a skin on its surface, which swells up from the vapors beneath, and the milk boils over. This is avoided by mixing a sample of the milk with pure, clean sand, placing the mixture on filtering paper, and heating the whole on a slab of porous stone. All that evaporates is water, and the quantity is shown by the loss in weight.

In good cows' milk, the solid ingredients amount on the average to 13 per cent; but as they may vary, 11½ per cent has been allowed as a minimum, corresponding to a loss by evaporation of water of 88½ per cent. If the loss in weight is more, the milk may be set down as watered or skimmed, or both, no matter what the lactometer test indicates. In order to find the amount of butter, the filtering paper and its contents are placed in a funnel, and ether poured on and allowed to percolate through; this removes all the butter, and the amount of the latter is found by allowing the ether to evaporate. As the amount of butter in cows' milk varies between 3½ and 5 per cent, 3½ per cent may be adopted as a minimum; and milk having less butter than 3½ per cent, the inventor claims, may be set down as skimmed or watered, or both.

As the determination of the amount of water and butter in milk is simply sufficient to determine its value in a commercial and sanitary point of view, the tests for casein and milk sugar may be dispensed with. In the above explanation, we have only given the main points of the analyses without entering into the minute practical details, which it is necessary to understand in order to obtain fully reliable results. Professor Von Baumhoer stated that the milk inspectors, after being properly instructed, can in this simple way make 20 or more analyses simultaneously and in a very short time. In Holland, it is customary to test only such samples as arouse suspicion by their transparent, watery appearance; and many kinds of milk thus examined are proved to be largely adulterated, notwithstanding that they stand the lactometer test.

NEW BOOKS AND PUBLICATIONS.

NOTES ON ASSAYING AND ASSAY SCHEMES. By P. de P. Ricketts, E. M., Ph. D., Instructor in the School of Mines, Columbia College, New York city. Price in cloth \$2.50, in paper \$2.00. New York city: Published by the Author, School of Mines, 50th street and Fourth avenue.

This book is especially designed to meet the wants of the practical miner and assayer, as well as to lay down a system for the guidance of the student and the professional analyst. The rules and directions are the result of long experience, many of them having been tested in the laboratory of Columbia College. Several processes and details, originated in the mines of the Great West, have been embodied in the work, and complete lists of apparatus and reagents are added.

THE ELECTRIC BATH, ITS MEDICAL USES, EFFECTS, AND APPLIANCES. By George M. Schweig, M. D., etc. Price \$1.00. New York city: G. P. Putnam's Sons, 183 Fifth avenue.

The writer of this little work treats the subject and his readers with great candor, admitting that his "failures" in treating patients "have been illustrative of the fact that the electric bath is no more a panacea for all ills than any other remedial agent. Applicable as it is to a great variety of pathological conditions, it meets with many where it is destined to have negative or at best imperfect results." He claims, however, that the book is the result of his own experience, and that it owes nothing to the labors of other practitioners. We commend it to sufferers who desire to try such remedies.

That very useful manual of reference, the *Public Ledger Almanac*, George W. Childs, publisher, Philadelphia, has appeared for the year 1877, and is presented gratis to every subscriber to the *Philadelphia Public Ledger*. It contains a carefully prepared calendar, a valuable article on the progress of Philadelphia during the past century, another on the Centennial Exposition, a chronology of notable events of the past year, and lists of the officials of the National and State governments, Supreme Court, Diplomatic Corps, etc. The page of proverbs contains a world of homely wisdom and good counsel epigrammatically expressed.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED CARTRIDGE CRIMPER.

Mordecai B. Massey, Huntington, Pa.—This little instrument is intended to answer a want which has not, the inventor says, been heretofore supplied satisfactorily. The device consists of a pair of pliers with jaws formed to fit the shell, and a cylindrical tongue between them, over which tongue the shell is placed for crimping. This tongue has a slight depression in it, into which the jaws compress the shell; and the end of this tongue, on withdrawing the shell, serves as a gauge to show when it is sufficiently crimped. A shell which has been used with a heavy charge of powder is so much expanded that it will not hold the bullet, when reloaded, unless the mouth of the shell be somewhat reduced in size; and the shell must be reduced or crimped in such manner that it will hold the bullet with its center line from base to point exactly coinciding with the center line of the bore of the barrel. The bullet then starts straight and true. The inventor above named claims that his crimper answers the want exactly.

IMPROVED SAW SET.

George S. Grier, Milford, Del.—The object of this invention is to furnish a device for setting the teeth of saws of different sizes, which is capable of being so adjusted as to give much or little set to them, as may be desired. It consists of two hinged jaws provided with die plates having teeth to engage alternately with the teeth of the saw, between the lower portion of which jaws, beneath the hinge, a double cam is placed, for closing or opening them, the said cam being operated by a lever.

IMPROVED MEANS OF LESSENING DRAUGHT OF VESSELS.

Edward Ellison, San Francisco, Cal.—This invention consists in certain means for lessening the draught of vessels in moving through the water, and it consists in either constructing the vessel with inclined surfaces upon its bottom, or in applying to the bottom or the sides of it inclined plates which will tend to lift the vessel in the water as it moves through it, thereby lessening the draught.

IMPROVED COMBINATION LOCK.

George Winter, Jacksonville, Va.—The present invention is an improvement upon that for which the same party received letters patent No. 181,756, dated August 29, 1875. The object of the invention is to produce a cheaper, more simple, compact, and secure lock.

IMPROVED VALVE GEAR.

Wilberforce Johnson, Camden, N. J.—The object of this invention is to provide a simple, effective, and valuable valve gear, which shall be regulated at will alike for the admission of steam to the cylinders, the stopping and reversing of the engine, and which shall have separate devices for controlling the "lead" for greater or less speed. To this end the devices are located upon a drive shaft, which may be either a part of the running mechanism of a stationary or marine engine, or the axle of the car wheels when applied to a locomotive. These devices consist in the main of a central loose sleeve encompassing the shaft and connected by diametrical pivots to a transverse encompassing collar. This collar is geared to the shaft and made to revolve through the devices for controlling the "lead," and is oscillated by a pitman arranged longitudinally with a drive shaft and geared with it rigidly at one end, and to a sliding collar at the other. This oscillation is imparted to a rim which slides upon the periphery of the collar and imparts the proper motion to the valves through connecting rods.

IMPROVED RAILWAY CAR.

Samuel R. Wallace and Oliver V. Wallace, San Francisco, Cal.—The object of this invention is to obviate the sudden jolt and jar incident to railway cars in stopping and starting. In attaining the end of the invention the body of the car is located upon swinging supports which have spring seated bearings in the car frame, whereby the longitudinal jolt of the car is converted into a swinging upward movement of the body of the car and its contents, instead of having the effect of the impact and start imparted directly to the said car and contents.

IMPROVED FEATHERING PADDLE WHEEL.

Francis J. Leisen, Woodbridge, N. J.—This consists of a contrivance of stationary cams in a hollow hub, in which the bucket arms are fitted in boxes so as to revolve a quarter of a revolution forward and backward to present the buckets sidewise or edgewise. The essential feature of the invention is the contrivance of the hub.

IMPROVED ELEVATOR.

Stillman E. Chubbuck, Boston, Mass.—The invention relates—First, to the automatic mechanism employed for throwing the hoisting apparatus proper out of gear or arresting its operation when the ascending platform is overweighted, or when any object or material placed thereon comes in contact with the floors or timbers of a hatchway, so that the hoisting rope will not continue to be wound up, and so that no injury can result to persons on the elevator or the building in which it is located. Second, to the automatic mechanism employed for throwing the hoisting apparatus proper out of gear or arresting its operation whenever the said hoisting rope parts, or the platform is arrested in its descent, thereby preventing the rope continuing to unwind. Third, to the belt shifting mechanism proper and the arrangement of the driving worm shaft with two drums for winding and unwinding the hoisting rope.

IMPROVED FENCE.

Frederick Sulter, De Witt, Iowa.—Instead of wooden fences, which are costly and not durable, this inventor suggests an iron fence of very simple construction, which is at the same time strong and capable of being cheaply erected. A semicircular post that tapers upward and downward from a base plate at the point where it emerges from the ground. It is strengthened by a center rib or ridge. The fence wires are connected by staples, slots, and fastenings, and also intermediately between the posts to a stub post. The posts of the end panels are stiffened by a tubular diagonal brace, that is fitted by collars to the posts.

IMPROVED SNOW PLOW.

William Cooke, Morrisville, Vt., assignor to himself and Henry A. Buzzell, of same place.—This timely invention may be commended to the notice of railway companies, inasmuch as it aims to substitute for the large heavy snow plows now in use a much lighter and more manageable apparatus which will effectually keep tracks clear. It consists of a car with snow plows, hung in an adjustable manner to both ends, and operated by a suitable lever device. The plows are fitted with tips extending below the top of the rail. The track is cleared of ice by means of spring-acted concave cutters or knives, that are applied to a suitable frame, and raised or lowered by a lever. The plows swing readily on the eyebolts, and are so adjusted that when they come in contact with any frozen dirt or ice they will lift and run over it without breaking.

NEW AGRICULTURAL INVENTIONS.

IMPROVED DITCHING MACHINE.

Daniel Hess, Greenville, Miss.—This invention is an improvement in the class of ditchers, having an endless belt or apron by which the earth is elevated and deposited upon a cross-belt or carrier. The improvement relates particularly to the construction and arrangement of devices for causing the machine to advance, to the form of the cutters, and also the mode of attaching them to the elevator belt or apron.

IMPROVED CHURN.

James S. Smith, Beebe Station, Ark.—This invention is an improvement in the class of churns having a vertical rotating dasher. The improvement relates first to the construction and arrangement of parts whereby the dasher shaft and its operating gear are adapted for convenient removal from their bearings. The invention also relates to the construction of the top or cover of the tub or churn-body, in two like-sized parts, which are connected by a hinge and elastic strap, to adapt the cover for convenient application to and removal from the tub.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED ARTIFICIAL LEECH.

Floyd F. McDonald, Blacksburg, Va.—This invention relates to that class of medical instruments intended to subserve the purpose of the natural leech and extract blood from some portion of the human body. It consists in an artificial leech produced by combining an elastic bulb open at the upper end, a T tube open at its three ends, a small tube open at one end only, and a suitably constructed knife. The bulb is first compressed and the open end held firmly against the body; the bulb is then allowed to expand and form a vacuum which draws the skin upward; the knife then makes a puncture in the skin, and the blood flows until the requisite quantity has been drawn.

IMPROVED MEDICAL COMPOUND.

Miss Judie D. Lipscomb, Andrews, Va.—This compound, known as the "chill master," is a specific for fever and ague, consisting of an infusion of tulip tree bark (*Liriodendron*), willow bark (*salix*), flux root (*gentiana Catechua*), with cherry bark (*prunus Virginiana*), dogwood bark (*cornus Florida*), sassafras (*sassafras*), flowering almond (*prunus amygdalus*), sulphate of quinia, Fowler's solution of arsenic, and whiskey in the proportions specified; and it is said to be very efficacious for the purpose.

IMPROVED INDEXER.

John Suter, New York city.—This device is made of one piece of sheet metal, and consists mainly of a strip or plate designed to be inserted between the leaves of a book to indicate where an extract is to be made, or reading resumed, etc. The broad end of this strip or plate is bent in such manner as to form a clamp for holding slips containing memoranda, notes, etc., against the back of the book.

IMPROVED FIRE EXTINGUISHER FOR VESSELS, ETC.

Almon M. Granger, New Orleans, La.—This invention relates to certain improvements in chemical fire extinguishers, designed more particularly for harbor fire protection boats and sea-going vessels, but applicable also in most of its features to general use. The general principle of the improvement rests in the direct use of the dry gaseous carbonic acid in smothering volume, in contradistinction to the common use of a limited quantity of the same dissolved in water under pressure. The means for carrying out the invention consist generally in the combination of a set of capacious generators for containing bicarbonate of soda, a set of superposed acid vessels, a subjacent acid reservoir, and an air pump, or equivalent forcing apparatus for charging the acid vessels from the reservoir, the whole being combined, by means of communicating pipes controlled by valves or cocks, so that the acid may be forced from the reservoir in the hold of the boat only when the effective power of the gas is required, and whereby accidental admixture of the chemicals is from the motion of the vessels, or from other causes, completely avoided. This apparatus embodies many novel details of construction, and from practical experiments upon a large scale conducted on board the New Orleans Harbor Protection Boat, promises to supply a want which the loss of life and property on the sea has made long felt.

IMPROVED PAPER BAG.

James H. Percy, Cumberland, Md.—This is a paper bag provided with strings permanently attached to its sides in such positions as to come together when the mouth of the bag is turned or folded down.

IMPROVED LETTER BOX.

Joseph Katz, New York city.—This letter box indicates automatically the time at which the mail is to be collected; and the invention consists of a swinging door or drop, which must be opened to collect the contents of the box that is hinged, and provided with teeth at the free end, that engage similar teeth of a roller that operates, by a pawl and ratchet device, the time-indicating disk.

IMPROVED PANTALOONS CONFORMATOR.

John G. W. Feldmann, New York city.—Pantaloons cutting is by some tailors adopted as a specialty—and they charge, as a rule, large prices for their neatly fitting garments. Mr. Feldmann here presents an invention which will enable any one, he says, to cut trousers to a perfect fit, the apparatus being analogous to the conformators used by hatters in measuring the head. The device consists of a frame of the size and general shape of the leg, with a number of spring-acted adjustable set pieces that bear on the leg, and mark, by pins passing through recesses of the main frame, the exact shape of the leg on a pattern paper applied to a detachable marking frame. The latter is supported by a foot part and forced against the marking pins, releasing a suitable spring mechanism. A center waist rule and tape line at the top part serve to take other measures.

IMPROVED UMBRELLA SUPPORT AND ROBE HOLDER.

William Rounds, Chester, Vt.—Knowing how difficult it is to hold up a lap robe or boot, an umbrella beside, and to manage the reins at the same time, this inventor proposes an ingenious device for relieving the driver of the care of the two articles first mentioned. To sustain both robe and umbrella, he attaches to the carriage seat a plate, which is provided with dovetail grooves for supporting a standard, to which a holding device is secured, in which an umbrella stock may be clamped and adjusted to any desired angle on a horizontal or vertical plane. The said standard is clamped in the grooves in the plate by an eccentric, and is bent into a U-shaped loop, the open end of which is inclined downward toward the front of the carriage for receiving the lap robe or boot, which is retained by a suitable clamping device.

IMPROVED BRICK KILN.

Holland B. Evans, St. Charles, Mo.—This inventor has devised a useful improvement in the construction of the brick kiln, patented, jointly, to himself and Ernest G. Kemper, November 9, 1875. A number of permanent corner and side flues are arranged to run from the bottom and arches to the top of the main part of the kiln, and then under the different compartments to the uppermost compartment, and out at the highest point of the same. A series of shorter flues at the top of the main part and compartments of the kiln are closed in suitable manner, as required to adjust the heat in the kiln. The permanent flues secure thus a constant supply of heat at the top part of the kiln while the short temporary flues, distributed over the top of the kiln and compartments, serve to regulate the heat and give complete control over the kiln during the process of burning the bricks.

NEW HOUSEHOLD INVENTIONS.

IMPROVED MEAT CHOPPER.

Hugh P. Rankin, Allegheny, Pa.—This invention relates to certain improvements in that class of meat choppers in which a series of cutters are successively lifted by a shaft provided with cams, and allowed to chop the meat upon a rotating table from the tension of separate springs which force the cutters downwardly when the cams leave the lift bars carrying the cutters. The improvement consists principally in the means for regulating the downward stroke of the knives to prevent them from rapidly chopping up and wearing out the wooden table.

IMPROVED PORTABLE FIREPLACE.

Theodore C. Nativel, San Francisco, Cal.—This invention relates to a novel construction of portable fireplace designed to be used with an improved form of chimney stack which requires no earth foundation, for which letters patent were granted the same inventor, October 5, 1875. The portable fireplace is so constructed as to fit in the corner, or any other portion of the room, and is constructed preferably of fire clay with arrangements for ventilation, and for preventing the burning of the woodwork of the building.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED COMBINED SLED AND TRUCK.

Sylvanus F. Brooks, Cambridgeport, Mass.—This consists of a truck body having runners, with semi-circular recesses on one side, and wheels that extend into the recesses of the runners and above the body at the other side. Projecting side strips support a detachable frame on the body, whether the same is used on runners or wheels. The device may be used as a toy vehicle for the amusement of children, being quickly changed to a sled or truck, as desired.

IMPROVED MACHINE FOR SHAPING PLOW HANDLES.

Edmund A. Conner, Metropolis, Ill.—This is an apparatus for guiding plow handles and other articles while being shaped; and it consists of a frame attached to the side of a shaping machine, which is capable of being moved vertically by a suitable lever, and which is provided with pins, upon which moves a guide having cam slots of the form desired in the article to be shaped, the article being clamped to the guide, and moved up to the cutters by a lever connected with the guide.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion. If the Notice exceeds four lines, One Dollar and a Half per line will be charged.

Agricultural Implements and Industrial Machinery for export and domestic use. R. H. Allen & Co., N. Y.

Skinner Portable Engine Improved, 2 1/2 to 10 H. P. Skinner & Wood, Erie, Pa.

For Sale—Half Interest in Foundry and Machine Shop. Machinist preferred. A. W. Maxwell, Knightstown, Ind.

Yacht and Stationary Engines, 2 to 20 H. P. The best for the price. N. W. Twiss, New Haven, Conn.

Wanted—A complete set of Patent Office Reports. Address, with price, P. O. Box 3,700, New York city.

Pattern Makers can get Metallic Pattern Letters, to letter patterns, of H. W. Knight, Seneca Falls, N. Y.

Scientific American, 34 vols. (2 to 35) for sale cheap. J. D. Rice, 923 Race St., Philadelphia.

Wanted—Good second hand Back Geared Screw Cutting Foot or Bench Lathe. P. O. Box 303, Amsterdam, N. Y.

Lightning Screw Plates. A perfect thread at one cut adjustable for wear. Frasse & Co., 62 Chatham St., N. Y.

More than Ten Thousand Crank Shafts made by Chester Steel Castings Co., now running; 8 years' constant use prove them stronger and more durable than wrought iron. See advertisement, page 73.

Metallic Letters and Figures to put on patterns of castings, all sizes. H. W. Knight, Seneca Falls, N. Y.

Split-Pulleys and Split-Collars of same price, strength and appearance as Whole-Pulleys and Whole-Collars. Yocom & Son, Drinker st., below 147 North Second st., Philadelphia, Pa.

Emery Grinders, Emery Wheels, Best and Cheapest. Awarded Medal and Diploma by Centennial Commission. Address American Twist Drill Co., Woonsocket, R. I.

Patent Scroll and Band Saws, best and cheapest in use. Cordesman, Egan & Co., Cincinnati, Ohio.

To Clean Boiler Tubes—Use National Steel Tube Cleaner, tempered and strong. Chalmers Spence Co., N. Y.

D. Frisbie & Co. manufacture the Friction Pulley—Captain—best in the World. New Haven, Conn.

Wire Needle Pointer, W. Crabb, Newark, N. J.

Send for circular of Brass Hydraulic Engine for blowing organs. Hilbourne L. Roosevelt, Church Organs, New York.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

Magic Lanterns and Stereopticons for Parlor Entertainments and Public Exhibitions. Pays well on small capital. 74 page catalogue free. Centennial Medal and Diploma awarded. McAllister, 49 Nassau St., N. Y.

Superior Lace Leather, all sizes, cheap. Hooks and Couplings for flat and round Belts. Send for catalogue. C. W. Army, 148 North 3d St., Philadelphia, Pa.

F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines, have removed to 533 Water St., N. Y.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N. Y.

Water, Gas, and Steam Pipe, Wrought Iron. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

Diamond Tools—J. Dickinson, 64 Nassau St., N. Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon, 470 Grand St., N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, New York.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

M. Shaw, Manufacturer of Insulated Wire for galvanic and telegraph purposes, &c., 230 W. 27th St., N. Y.

Shingle, Heading, and Stave Machine. See advertisement of Trevor & Co., Lockport, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Articles in Light Metal Work, Fine Castings in Brass, Malleable Iron, &c., Japanning, Tinning, Galvanizing. Welles Specialty Works, Chicago, Ill.

Boosey's Cheap Music and Music Books. Full Catalogues free by mail. Boosey & Co., 32 East 14th St., New York.

For Sale—Two sets Hydraulic Presses, 10 inch cylinder, 2 foot lift, 100 tons pressure, 5 inch one set, 4 inch other. In good order. P. O. Box 3356, Boston, Mass.

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vol. 30, directions for nickel plating.—T. R. S. will find a recipe for a washing fluid on p. 27, vol. 34.—B. B. C. will find a good recipe for shoe blacking on p. 27, vol. 34.—C. A. M. will find directions for making an electric machine on p. 266, vol. 34.—T. J. M. will find directions for making a barometer on p. 394, vol. 33.—J. S. will find directions for making paper stick on tin on p. 302, vol. 36.—C. A. H. will find a description of toughened glass on p. 402, vol. 32.—B. S. will find a recipe for varnish for patterns on p. 409, vol. 33.—W. A. H. will find directions for making rubber stamps on p. 155, vol. 31.—R. T. W. will find something on hardening copper on p. 123, vol. 32.—E. J. will find directions for hardening rubber on p. 303, vol. 35.—C. I. H. will find full descriptions of air brakes on p. 289, vol. 34.—H. W. will find a recipe for white ink on p. 208, vol. 33.—R. C. will find directions for tempering steel on p. 123, vol. 30.—T. F. M. will find directions for making root beer on p. 170, vol. 27.—J. L. P. will find rules for calculating the proportions of gear wheels on screw-cutting lathes on p. 107, vol. 34.—C. D. will find directions for repairing sheet rubber goods on p. 155, vol. 26.—W. F. P. will find directions for moulding rubber on p. 283, vol. 29.—J. B. C. will find directions for making parlor matches on p. 75, vol. 29.—J. C. M. will find a recipe for a black walnut stain on p. 90, vol. 32.

(1) A. I. says: I have been told by a great many men who pretended to know, that a gun would recoil or kick much more violently if the shot or ball is not close down to the powder. I experimented with a gun barrel some time since, leaving 1 1/4 inches or more space between shot and powder, and found the recoil to be very much less than when the shot was rammed solid down. I laid the barrel on a plank and measured the distance of the recoil at each fire. I used only a barrel of a gun and fired it by a slow match, so it was free to move. A. Your experience is contrary to that of many a sportsman, who is sometimes forcibly reminded that he did not ram the charge home by getting a "kick" from the gun on his shoulder.

(2) J. S., of Brussels, Belgium, asks: 1. Can the ratio of expansion be changed in any high pressure engine that has not a variable expansion cut-off? A. It cannot be changed without making some alteration in the valve gear. Your engine should have the valve set to cut off the steam at about 3/4 of the stroke. 2. What is the formula for the quantity of water in cubic feet to be evaporated for an engine? A. Allow from 40 to 45 lbs. per horse power. 3. Would the crushing force between rollers be the same under two different speeds of the engine, not per hour, but at a given moment? A. Yes. 4. Is there any rule or formula to calculate the intensity of the crushing force between the rollers? A. It can be calculated approximately by the relative distances travelled by piston and roller respectively in a given time, making deductions for friction of the parts. 5. What will be the best ratio of expansion if the engine runs at 25 revolutions per minute? A. The same as before, supposing that you refer to getting the most power out of the engine.

(3) M. H. P. asks: 1. What percentage of nourishment does butter, beef, and beans respectively contain? A. The ratio of nitrogenous or flesh-producing material in each is approximately as follows: Beef 25, beans 9, butter (pure) none. 2. Why is it that the tables, showing percentage of nourishment in food, by different authorities, differ so greatly? A. That differences do occur in tables of this kind, and principally in the figures given for animal food, is because of the non-homogeneity of such material, and the arbitrary methods of selecting the materials for determinations. The best results are, therefore, only approximate.

(4) A. P. B. says: I have a vulcanized rubber bath tub, which I have used till the rubber has become soft, and is now quite gummy and cracked. Is there any remedy for it? A. We do not know of a practical remedy for this. The interior surface may be somewhat improved by coating with a varnish made by dissolving equal parts of caoutchouc and gutta percha in hot naphtha or bisulphide of carbon; such varnish is sold in the market.

(5) A. J. and others ask: How can we make a good varnish for patterns? A. Use shellac varnish with just enough fine lampblack to color it. Do not apply the varnish too thick. It is not hygroscopic. Tap the pattern gently at different points before attempting to remove it from the sand. If your sand does not work well, dust the pattern over with fine blacklead, as it lies in the flask, preparatory to packing the sand.

(6) L. S. W. says, in reply to J. B. C., who asks for a demonstration of the following theorem: If tangents be drawn to 3 circles of unequal diameters, the points of intersection of the tangents are in a straight line. The best demonstration and the most rapid one is based on analytical geometry. If I can prove that (1), (2), (3) are in a straight line, the theorem is demonstrated: Let r, r', r'' be the radii of the 3 circles. The co-ordinates of (1) and (2) are:

$$(1) \begin{cases} x = \frac{r(r' - r'')}{r' - r''} \\ y = \frac{r(r' - r'')}{r' - r''} \end{cases} \quad (2) \begin{cases} x = \frac{r(r' - r'')}{r' - r''} \\ y = \frac{r(r' - r'')}{r' - r''} \end{cases}$$

Equation of the straight line passing at (1) and (2) is:

$$\frac{r(r' - r'')}{r' - r''} (y - r'') = \frac{r(r' - r'')}{r' - r''} (x - r')$$

The latter has for co-ordinates:

$$\begin{cases} x = \frac{r(r' - r'')}{r' - r''} \\ y = \frac{r(r' - r'')}{r' - r''} \end{cases}$$

Remarks: The points (1), (2), (3) are called "centers of similitude." The line, D E, is the axis of similitude.

(7) J. P. M. asks: 1. If I have a glass tube 1/4 of an inch in diameter, with a bulb on its end 2 inches in diameter, and an airtight piston working in the tube, what force would it exert by heating from 60° to 104° Fah.? A. If air is employed, as the original pressure or volume is multiplied in a definite ratio by a given change of temperature, if it is greatly compressed, the change when it is heated will be proportionately large.

2. Would it be any more if filled with mercury or with compressed air? A. The tension of mercury vapor under this change of temperature would be very slight, and much less than in the case of compressed air.

(8) C. S. asks: What is oil of bay rum made from? A. Bay rum is obtained by distilling rum with the leaves of *myrcia acris*, sometimes called the bayberry. The tree is a native of Jamaica and other West India islands.

(9) O. A. S. asks: How is hop extract made? A. Tincture of hops is made by taking 5 troy ozs. hops in powder, and a sufficient quantity of diluted alcohol. Moisten the powder with 2 ozs. of the alcohol, pack in a cylindrical percolator, and pour diluted alcohol on till 2 pints tincture are obtained.

(10) J. C. D. asks: What is the best varnish for varnishing a drawing made in India ink with heavy lines and parts, which have been tinted with various colors? A. Put a drop or two of acetic acid in the ink; and when the drawing is dry, varnish with mastic varnish.

(11) C. V. P. asks: How can I stain the grain side of a calf skin a permanent black? This leather contains oil, and the stain must have something alkaline, alcoholic, or acid to make it bite in. A. First rub well with a strong aqueous solution of proto-sulphate of iron, and then with a concentrated solution of extract of logwood.

(12) H. B. B. asks: How can I make a dark blue ink with gunpowder? A. Make a strong solution of the gunpowder in warm water containing gum arabic, and add a sufficient quantity of sulphate of indigo (in dilute solution) to produce the desired tint.

(13) B. F. B. asks: How can I cure chilblains? A. The following treatment has given general satisfaction: Melt together in a suitable vessel 3 ozs. beeswax, 3 ozs. Venice turpentine, 8 ozs. lard, and 1 pint sweet oil. Stir these well together and raise the temperature till the mixture simmers; then allow to cool. This should be applied to the feet on a piece of cloth when going to bed. A sure protection against this irritating ailment is found in good, dry, woollen clothing for the feet.

(14) J. C. C. asks: 1. Is there any electric current or power in the so-called electric belts and bands? A. Yes. 2. Is there any power in a belt made of alternate discs of zinc and silver, wetted in vinegar once a day, to be worn around the body to create an electrical current for the cure of pain, etc.? A. Yes, but such currents are very weak.

(15) G. W. S. says: I am using an oxyhydrogen gas machine for burning sheet lead together. I make the hydrogen by using commercial sulphuric acid 1 part, water 7 parts, and granulated zinc. It melts the lead well enough on flat seams; but on upright work the lead seems to tarnish and will not unite together. I use chemically pure muriatic acid as a flux. A. Use a saturated solution (in water) of sal ammoniac (chloride of ammonium) instead of the acid, and the inner cone of the flame—not the extreme tip—which oxidizes the metals rapidly. The operation should be performed as rapidly as possible. Your jet, being fed with air, which contains only about 1 part oxygen, is not an oxyhydrogen jet, but a blast lamp. The general arrangement of your hydrogen generator is correct.

(16) J. E. asks: How is solder applied in the manufacture of tinware, so as to make it adhere, and lay evenly on the surface of the tin? A. Use, in conjunction with the solder, hydrochloric acid in which has been dissolved all the pure zinc it will take.

(17) F. L. asks: Is there any mixture with which I can color an alloy of block tin and lead to a copper color? A. A lacquer composed of thin shellac varnish colored with turmeric and dragon's blood is sometimes used for this purpose. A thin electrolytic deposit of copper gives much more satisfactory results.

(18) H. P. S. says: In reply to A. A. A., who asks what wood is best for the top of a violin: The tops of all good violins are of spruce, with fine, straight grain. Backs are curled maple, the grain in short, fine waves, not wild, as it is termed. Shellac varnish is worthless, and worse, on a violin. Two kinds of varnish may be used, namely: 1. Best coach oil varnish (a light coat, with long time to dry). 2. The old Cremona varnish, the basis of which is the rare gum amber. If this varnish is used, no other coloring will be necessary, as the varnish gives a beautiful amber color, though deeper stains may be used if desirable. The varnish is not in the market; but if A. A. A. will address the initials as above, at Syracuse, N. Y., I will give him particulars regarding it.

(19) H. T. D. asks: 1. How can I get a good deposit of iron from K_2SO_4 , or any solution that may be preferable? I have succeeded in getting only a black powder from a sulphate solution. I think I can utilize a good deposit of iron. A. Use a very strong solution of the proto-sulphate in an aqueous solution of chloride of ammonia. The anode should be moderately large and of good wrought iron. Use one large Since cell (carbon zinc, 1 quantity). The current should be strong and constant, but in no case strong enough to decompose water. The bath must be as nearly neutral as possible, and the surface of the cathode perfectly clean; this is the greatest source of the difficulty. The connections should all be made before the cathode is placed in the bath. 2. In Napier's "Electro-Metallurgy" there are some remarks upon depositing alloys. Would the carbonate of ammonia and cyanide of potassium solution, spoken of, answer for an alloy of equal part of tin and copper? A. Yes.

(20) A. H. W. says: I send you a bottle containing a worm which troubles our well water. It is never seen in summer, and then the water is pure and quite cold. As soon as cold weather comes the worms come also; and then the water has a smell and seems warmer than in summer. Can you inform me of something, not injurious to health, that can be put in to clear the worms out? A. Test a small sample of the water by just tinting it with an aqueous solution of permanganate of potassa. If, after standing for a few hours, the tint

disappears, the water is unfit for drinking purposes. It is not advisable to add any chemical to the water; the best that can be done under the circumstances is to add a few frogs or tadpoles which feed upon the insects and worms, and purify the water. This method is an old one.

(21) R. L. asks: 1. To what degree of heat should coal be exposed to make illuminating gas in the most economical manner? A. About 2,300° Fah. 2. Would it be necessary to have the gas purified for heating purposes, and what would be the disadvantages of non-purified gas? A. The purpose of purification is principally to remove the carbonic acid gas, which greatly impairs both the heating and light, producing qualities of the gas, by obstructing its proper combustion. The gas will burn readily, however, without purification. 3. Have there ever been any successful attempts to generate coal gas with a small heating apparatus of about the capacity of an ordinary stove? A. With an iron retort and good fire, coal gas may be obtained in small quantities in the way you mention. The pipe leading from the retort should be of ample dimensions to prevent clogging, and the hot gas, as it comes over, should be thoroughly washed with cold water in order to remove the tar, coal oils, ammonia salts, etc., which come over with it. 4. Would the gas and coke burnt separately give out a smaller or larger amount of heat, than the quantity of coal wherefrom they are produced? A. The total amount expressed in foot-pounds would be the same in either case.

(22) W. J. T. says: I saw on each side of the sun a perpendicular rainbow-colored streak, about 15° in length, with the orange side toward the sun, and about 10° away. Thermometer +19, atmosphere hazy. What was the cause? A. This class of phenomena is caused by the refraction and decomposition of light by crystals of ice floating in the atmosphere, on the same principle as the prism produces the different colors.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the result stated:

A. M.—It is galena (sulphide of lead) containing in 100 parts, 88.6 lead, 13.4 sulphur. It is the principal ore of lead worked.—R. & P.—It is a piece of amorphous quartz rock, somewhat discolored by sesquioxide of iron. There is a remote possibility that it may contain a small percentage of gold. This would necessitate a qualitative analysis.—A. H. K.—It contains sulphide of antimony, sulphur, nitrate of strontium, nitrate of potash, and gunpowder.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Boiler Explosions. By B. F. C., and by J. M. L.
On Public Buildings. By J. B.
On Balloons. By J. F. B.
On Migratory Spiders. By J. S. D.
On Thomas Edward, Naturalist. By —.
On the Suez Canal. By —.
On the Ball Puzzle. By J. T. H.
On Mathematics. By T. F.

Also inquiries and answers from the following:
J. O.—J. L. L.—E. C. S.—W. T.—C. C.—S.—J. R.—H. H. D.—A. G. F.—H. F.—A. B. F. G.—T. W. S.—R. M.—E. H.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who makes water motors? Who sells pressure-regulating gas burners? Whose is the best water wheel? Who sells batteries for plating? What is the price of peroxide of manganese in the New York market?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were

Granted in the week ending

December 12, 1876.

AND EACH BEARING THAT DATE.

[Those marked (r) are renewed patents.]

A complete copy of any patent in the annexed list including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

[This list should have been published before the two in our last week's issue, but the copy did not arrive in time.]

Air valve for blast cylinders, J. Hemphill..... 183,321
Bake pan hanging, J. Gravenstone..... 183,226
Bale band stretcher, C. M. Pearre..... 183,347
Bale tie, J. C. Du Bois..... 183,304
Bale tie, G. S. France..... 183,310
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E. L. C. can fasten cloth to brass by following the directions given on p. 101, vol. 34.—C. H. E. will find directions for making manifold paper, for writing in duplicate or triplicate, on p. 154, vol. 30. It is a well known device.—A. C. will find directions for drilling glass on p. 218, vol. 31. As to soldering silver, see p. 251, vol. 28.—C. is informed that peroxide of manganese is sold in the market, packed in barrels containing about 800 lbs. each.—J. B. will find directions for separating platinum from gold on p. 409, vol. 35.—F. S. C. will find directions for French polishing on p. 11, vol. 32.—G. O. will find directions for preparing skeletons of animals on p. 75, vol. 28.—D. W. will find the desired information as to the transit of Venus on p. 180, vol. 32.—B. B. T. should state what method he employs, and what ore of nickel.—J. G. S. will find directions for bluing steel on p. 123, vol. 31. For polishing shirt bosoms, etc., see p. 213, vol. 34.—W. L. L. will find directions for silvering mirrors on p. 267, vol. 31.—J. N. will find something on the use of petroleum in boilers on p. 164, vol. 30.—C. V. L. will find a recipe for an aquarium cement on p. 292, vol. 28.—W. M. B. will find a description of the photo-engraving process, which is probably the one he enquires about, on p. 272, vol. 32.—E. D. L. will find the dimensions of the Birmingham wire gauge on p. 230, vol. 28.—J. J. should use rubber varnish on his cotton cloth. See p. 11, vol. 32.—J. M. will find on p. 151,

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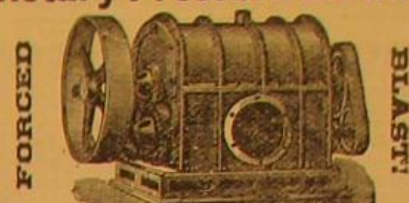
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A new mode of traveling has lately been invented, which the inventors claim to be applicable to any mining country where flumes exist, or which may be used wherever a stream of water of sufficient velocity of current can be inclosed for suitable distance. The device involves a carriage driven entirely by outside power; and paradoxical as it may appear, it is caused to travel either in the same direction as the force, or diametrically opposite thereto, while the direction of application of the power remains unchanged. In short, it is a carriage which travels up stream, impelled by no other force than that of the current. The invention is claimed to be practicable; it has already been used in California for transportation on a small scale; and judging from experiments, the inventors state that a car for the transportation of passengers, as shown in our engraving, may thus be driven at considerable speed, depending of course upon the head of water.

The carriage rests on ordinary flanged wheels which traverse rails laid on the edges of the flume. On the axles are attached paddle wheels, which correspond in shape to the section of the flume, and are acted upon by the current therein. It is clear that the current turning the paddles will so rotate the wheels of the vehicle, which will consequently move in a direction opposite to that of the current. When it is desired to move in the same direction as the current, the paddles are stayed stationary, and the water impels the car down stream.

A test trial with a working model, we learn, has demonstrated the capacity of the carriage to carry about 8 lbs. of load (exclusive of its own weight) for every inch (miner's measure) of water in the flume. A flume of 600 inches of water will therefore furnish power to transport a load of about 5,000 lbs. up stream, on any grade from 4 to 20 inches to the rod, at a speed of from 4 to 8 miles per hour; a less grade causes a slower run. The strength of flume and car is the only measure of capacity of the device in going down stream, and the velocity may extend to any speed desired, being governed only by the grade and the speed of the flow of water. The rate of travel is regulated by brakes; and the paddle wheels are attached to the shafts with clutch gear, to be unshipped at pleasure.

The frame is built in two sections, and the platform rests on anti-friction balls, for the purpose of turning curves with but little friction. By double gearing, the speed may be greatly increased for passenger transportation, of course at the expense of power.

This invention was patented through the Scientific American Patent Agency, November 7, 1876, by Messrs. C. A. Leaman and John A. Heckart, of Pentz Ranch, Cal.

In some localities, damp-proof courses in walls are formed of slates set in cement: these are liable to crack, and thin impervious stones are better. Sheet lead has been used for the same purpose, and is most efficacious; but it is expensive.

A New Method of Making Glass Signs.

Mr. Henry A. Goetz, of New Albany, Ind., has patented through the Scientific American Patent Agency (January 2, 1877) a new method of making gilt signs, etc., on glass. The usual mode of procedure consists in roughly painting the letters on one side of the glass; then on the opposite side the letters are carefully painted in gold size. On this the gold leaf is laid, and when the whole is dry the superfluous gilding is removed. The letters are then shaded by hand. Mr. Goetz' process is much more simple and expeditious. He begins by covering the glass where it is to be lettered with gold or silver leaf, having previously applied a coating of isinglass size. Then a yellow, hard-drying ink is applied to the gilded surface with elastic type, in such places as are to retain the leaf. When this ink becomes thoroughly hard and dry, the surplus leaf is removed with whiting, applied with a damp

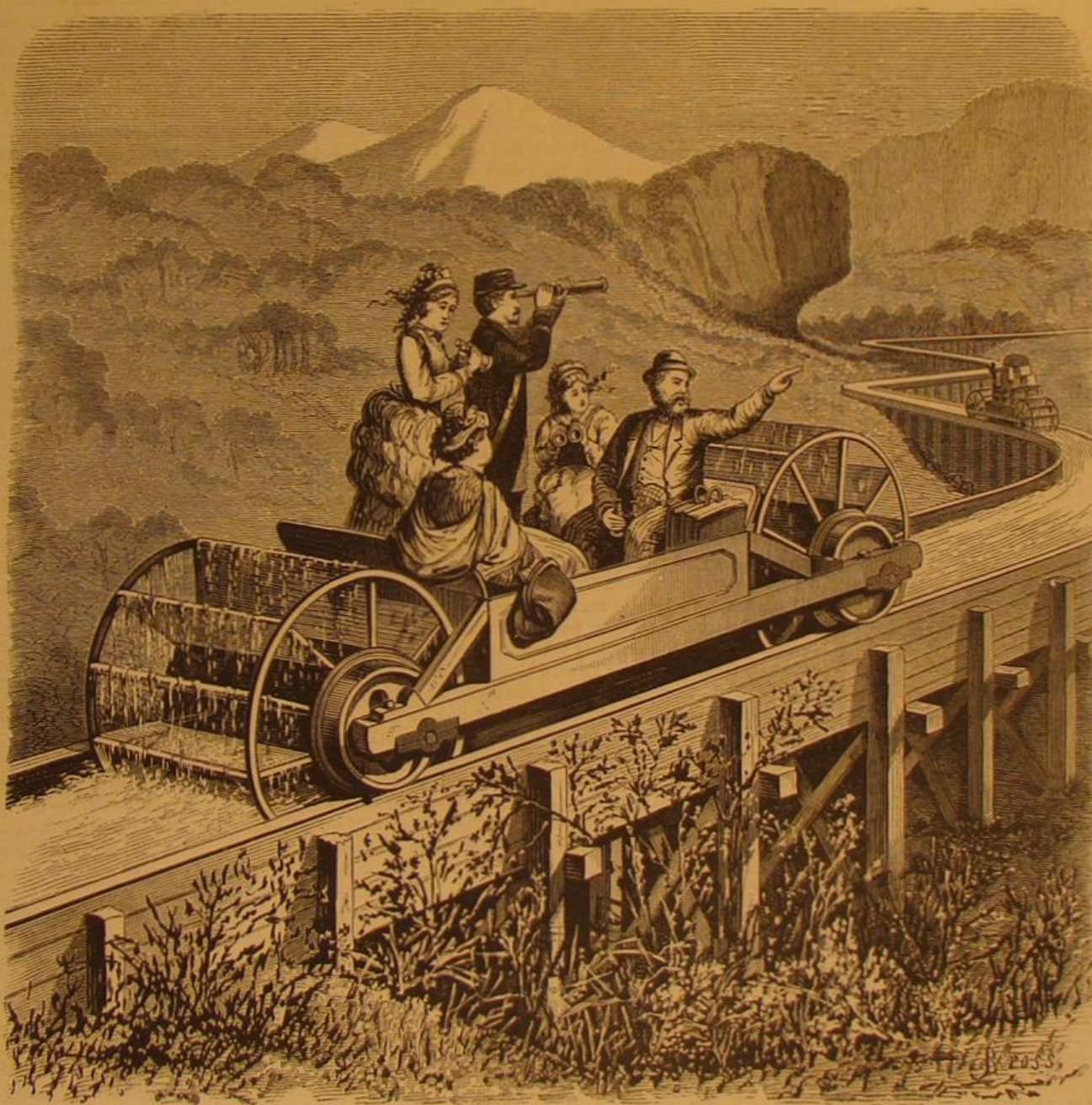
Treating Lubricating Oils.

Heretofore it has been necessary to mix hydrocarbon, or mineral lubricating oil with a considerable proportion of fatty oils, to give it the necessary body or viscosity, but these fatty oils (both animal and vegetable) are all more or less oxidizable in the air, producing gummy matter becoming very acid; and if left in warm places on cotton, wool, clothes, sawdust, or similar material, are exceedingly liable to spontaneous combustion. For lubricating the pistons of high pressure compound surface-condensing engines, both marine and stationary, the fatty oils are particularly objectionable, for, in addition to the before mentioned faults, the high pressure steam decomposes them into fatty acids and glycerin, which are, of course, carried into the boilers, where the fatty acids corrode most powerfully, and with the glycerin make a kind of soapsuds, producing excessive priming.

But Mr. Humphrey, of Chester, England, claims that he is able to produce mineral or hydrocarbon lubricating oil of such a body that no mixture of fatty oils whatever is required, the viscosity being equal to the best olive, and considerably superior to sperm; while being perfectly neutral, it cannot act on or corrode the condensers nor boilers, nor form concretions in the cavities of the pistons and steam passages; nor does it act on the india rubber valves of the air pumps to any injurious extent when used for internal lubricating of steam engines. For ordinary lubricating it is perfect, as it forms no gum or acid, and it is absolutely safe from spontaneous combustion, with a lubricating power equal to sperm. The oil treated by his invention is also specially suited for lubricating fast running machinery, and for all kinds of fast running mechanism. He first submits the oil to careful fractional distillation, and collects the heavy portion of the product. In the refining or chemical treatment, instead of agitating the chemicals with the oil by means of paddles, screws, or other mechanical means as have heretofore been used, he forces a large stream of compressed air through a pipe at or near the bottom of

the vessel, by which very important advantages are obtained. As well as a most thorough and complete agitation, a considerable effect is produced, powerfully aiding the action of the chemicals used; at the same time, the great volume of air passing through carries off all traces of oils of low gravity and boiling points, the result being lubricating oil possessing more body and higher specific gravity and flash point than any mineral lubricating oils heretofore produced, making it specially adapted for lubricating the pistons, slide valves, and other parts of the marine, locomotive, and other steam engines, steam hammers, and other apparatus. The oil may be produced from coal, shale, peat, bitumen, asphaltum, petroleum, and other oil producers as is found most economical and convenient.

The bark of slippery elm has been recommended as a preventive of boiler incrustation.



NOVEL HYDRAULIC RAILWAY LOCOMOTIVE.

pledget of cotton, while the lettering or ornamentation is retained by the ink. The shading, or the outline of the shading, is now printed on the glass with elastic type in any required color. When this becomes dry, hand work may be added, if desired, and the whole backed up in the usual way.

Number One, 1877.

We would remind those of our Western subscribers who have failed to receive our first of the present year that the mails, carrying that number of the SCIENTIFIC AMERICAN, were burned at the recent destruction of the Ashtabula, O., railway bridge. We will supply the missing number gratis, to those subscribers who have not received it, on receipt of postal card request.

At Pomeroy, O., at a depth of 104 feet, a petroleum well, supplying nine or ten barrels of oil a day, has lately been opened.

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FORCE ANALYZED.

We have repeatedly taken occasion to point out the exceedingly loose apprehension which prevails regarding the meaning of the word "force." We doubt if there be another word in the language which is more constantly wrongly used, or which is dragged in to express a greater variety of more wholly different and entirely indefensible significations. We are told of "accelerating force," "moving force," "centrifugal force," "living force," "projectile force," "centripetal force," in mechanics; imaginative biologists wander into such expressions as "psychic force," "odile force," and "vital force." We say a force "may be generated," and that a moving body has such a "force," and in brief so generally used is the word, anywhere and everywhere, that we carry its wrong meaning into idioms and colloquialisms, and talk of the "force of habit," "force of circumstances," etc.

It will be observed that all these erroneous notions of the term are based on the conception that force is a thing, something tangible and existent; whereas it is nothing of the sort, as a brief consideration will show. The various arguments on this topic are admirably summed up in Professor Tait's latest addition to his excellent work on "Recent Advances in Physical Science," and we can do no better than to follow the same course of reasoning and adopt the very clear and concise definition of the term "force," to which his views of the subject lead him.

At the outset, we may recall the fact that absolutely nothing can be learned as to the physical world save by observation or experiment, or by mathematical deductions from data so obtained. The exercise of reason is an unavoidable necessity, for it shows us that our senses are merely subjective, that what we call a sensation of color is but an influence upon the eye due to the extent, form, and rapidity of the vibrations of the luminiferous medium; that our classification of sounds, as to loudness, pitch, and quality, is merely the subjective correlative of what in the air particles is objectively the amount of compression, the rapidity of its alternation, and the greater or less complexity of the alternating motion. And thus we may know that light and sound no more exist outside ourselves than does the pain, which a swiftly moving stick is capable of producing on our bodies, reside in the stick itself. Heat, though not material, has objective existence in as complete a sense as matter has. It is merely a form of energy, which, in all its constant mutations, satisfies the test which we adopt as conclusive of the reality of matter, that we cannot in the slightest degree alter its quantity. This test fails altogether when applied to force.

In his endeavor to reach an idea of the meaning of force, Professor Tait first brings forward Newton's laws of motion. Of these the first is: Every body continues in its state of rest or of uniform motion in a straight line, except in so far as it is compelled by forces to change that state. That is, any change whatever in the direction or the rate of motion of a body is attributed to force. This carries with it the upsetting of the old notion that, in bodies moving in a circle, a centripetal force was necessary to balance a so-called centrifugal force, it being imagined that a body moving in a circle had a tendency to fly outward from the center. "If," says our author, "a body is to be made to move in a curved line instead of its natural straight path, you must apply force to compel it to do so; certainly not to prevent it from flying outwards from the center about which it is for the moment revolving. In fact, just as you must apply force in the direction of motion to change the rate of motion, so must you apply force perpendicular to the direction of motion to change that direction."

Newton's second law is: Change of motion is proportional to the moving force and takes place in the direction of the straight line in which the force acts. Motion is here used as a technical scientific term for what we now call momentum, the product of the moving mass into the velocity with which it moves. "Change of motion," therefore, is change of momentum, or the product of the mass of the moving body into its change of velocity. "Of course," says Professor Tait, "the longer a given force acts, the greater will be the change of momentum which it produces; so that, to compare forces, which is the essence of the process of measuring them, we must give them equal times to act, or we must measure a force by the rate at which it produces change of momentum."

Thus the measure of a force is the product of the mass of the body moved into the acceleration which the force produces on it. Unit force is, therefore, that force which, whatever be its source, produces unit momentum in unit of time. The earth's attraction for a body in our latitudes produces in that body, if let fall, in one second a velocity of about 32.2 feet per second. Hence, if we take 1 lb. as the standard of mass, the weight of a pound of matter is rather more than 32.2 units of force, so that the unit of force is rather less than half an ounce.

Unit momentum is that of 1 lb. of matter moving with a velocity of 1 foot per second. Unit force is that force which, acting for one second, produces in unit of mass a velocity of 1 foot per second. Momentum, then, is obviously not force. We may substitute ton for pound, or mile for foot, and the relative values will remain unaltered; but if we take minute instead of second, then the time unit increases sixty fold the nominal value of the momentum considered; while that representing the force is increased three thousand six hundred fold. Hence the two cannot possibly be equated. Now as we have shown that there is no such thing as centrifugal force, and as from the above it follows that the so-called

accelerating force is not a physical idea at all, we have yet to deal with the term "living force."

And here we pass to Newton's third law, namely: To every action, there is always an equal and contrary reaction; or, the mutual actions of any two bodies are always equal and oppositely directed. And Newton proceeds further to point out—and here is that grand stumbling block of the perpetual motionist, no matter what form his mania may assume—that if the action of an agent be measured by the product of its force into its velocity, and if, similarly, the reaction of the resistance be measured by the velocities of its several parts into their several forces, whether these arise from friction, cohesion, weight, or acceleration, action and reaction, in all combinations of machines, will be equal and opposite. But actions and reactions here dealt with are no longer simple forces, but the products of forces into velocities; they are rates of work, the time rate of increase, or the increase per second, of a very tangible and real something, for the measurement of which Watt devised the practical unit of a "horse power." Now with a moderate exertion a man may raise a hundredweight, which in its descent might be employed to do work, but he is by any exertion unable to lift a ton; and after all his labor to do so, the weight will not do any work by descending again. Hence it appears that force is a mere name, and that the product of a force into the displacement of its point of application has an objective existence. And a simple mathematical operation shows us that it is precisely the same thing to say: the horse power or amount of work done by an agent in each second is the product of the force into the average velocity of the agent, and to say: force is the rate at which an agent does work per unit of length.

THE ENCOURAGEMENT OF INSANITY.

A good many honest but misguided people have expressed the belief that the SCIENTIFIC AMERICAN has been too severe in its remarks about spiritualistic frauds, delusions, and the like. Particularly disagreeable to such people has been our characterization of spiritualism as a mixture of self-deception, knavery, and craze. We are pleased therefore to find our diagnosis sustained by so excellent a medical authority as the London *Lancet*, which goes even further than we have presumed to, and raises a warning voice against those who are in any way party to such spurious manifestations of the psychological instinct. The *Lancet* does not hesitate to say that the practice of gathering neurotic people, at what are politely called *séances*, for the purpose of holding converse with denizens of the spirit world, is so debilitating to the mind and so debauching to the moral sense that it needs to be stigmatized in terms at once trenchant and decisive. "To speak plainly, while strong-brained beings may indulge in this form of dissipation without more serious consequences than perhaps a trifling weakness of memory, minds of less robust mould may suffer severely. Anything more perilous than the custom of permitting young persons of either sex to participate in this abuse of mind power it would be difficult to conceive."

Particularly blamable, the *Lancet* thinks, is the President of the "Psychological Society" and other patrons and leaders of "the last new craze." They ought to know better than to give their countenance and support to a pursuit in which weaker heads are in danger of being turned, to their permanent injury. Already mischief, perhaps irreparable mischief, has been wrought. "Minds that have hitherto done wonderfully well in the world are showing signs of weakness. The worry of trying to be quite sure whether there is a force outside the material world, which will bridge over the gulf between the present and the past—those who now tread the earth, and those who have passed out of normal sight and hearing—is beginning to tell on the mental strength of some who have been lured into the toils of a psychology, which is no longer a science, because it has cast adrift the principles of Nature and elects to run riot in vain imaginings and idle conceits."

These are hard words, but they certainly are neither unjust nor unnecessary. As symptoms of mental degradation, the recent actions and utterances of several once straightforward and sensible English scholars are surely painful enough to warrant any protest, however forcible, against the encouragement of such unsanitary pursuits and speculations.

MEDICAL PROGRESS OF THE PAST YEAR.

In accordance with its custom, the *Lancet* begins the new year with an extended review of the notable events of the past twelvemonth in the world of medicine and its allied sciences. From the thirty-six columns devoted to this valuable summary of progress, the following items are especially worthy of remembrance.

In the department of anatomy and physiology, several important advances may be noted. M. Malasses has continued his researches in connection with the blood, and has introduced the new term *blood-corpuscle capacity*, to designate the quotient obtained on dividing the number of blood corpuscles in an animal by the weight of the animal in grammes. Thus a rabbit, weighing 2,450 grammes and having 919,450 millions of blood corpuscles, has a blood corpuscle capacity of 375 millions. It is worthy of notice that the blood corpuscle capacity of carnivora, in consonance with their more active metamorphosis of tissue and manifestations of life, is much greater than that of herbivora. Heretofore the pressure of the blood has always been estimated by manometers introduced into the larger blood vessels. Dr. Kries has ingeniously shown that the pressure in the capillaries may

be determined by applying pressure with a small plate of glass to the fingers, ears, or other accessible parts till pallor is produced. In this way he finds that the pressure in the capillaries of the fingers is ordinarily from 37 to 38 millimeters of mercury; if the veins of the arms be compressed, the pressure in the capillaries is increased three or four fold. Röhrig finds that the secretory activity of the mammary gland varies directly with the blood pressure.

Taking advantage of a fistulous orifice communicating with the larger intestine, Markwald has studied the digestive powers of that organ, and finds that it possesses no power of converting starch into sugar, while fibrin appears to undergo for the most part putrefactive decomposition, only a small part being probably absorbed. The practical lesson to be drawn from these observations is that, in cases where it is necessary to introduce nourishment *per anum*, pancreas triturated with meat is the best material to use.

Perhaps the most important event in therapeutics is the discovery of the power of salicin and salicylic acid over the course of rheumatic fever. Salicylic acid is preferred by some, salicylate of soda by others. They all have the power of wonderfully reducing temperature, and appear to bring the process of rheumatic fever to an end in as many days as it formerly took weeks. These remedies also give the profession new hopes of controlling others of the large class of diseases characterized by high temperatures. Of great importance too, are the notes of Cattaglia of Rome, on the cure of diphtheria by the local use of chloral and glycerin, with the internal administration of chlorate of potash. The local use of carbolic acid and glycerin, in the proportion of one part of the former by weight to six of the latter, has also been highly commended in the treatment of this fearful disease.

Much careful and laborious work has been done in the domains of surgery and pathology, but no important discoveries have been announced in either. The subject of lunacy has received much attention, and in connection with it the *Lancet* makes the pertinent remark that each year it becomes more strikingly evident that what has been misnamed "mental disease," and erected into a specialty, is in fact an essentially component part of general medicine. Mind symptoms cannot successfully or safely be studied apart from the phenomena of physical disease, organic and functional; and if the terrible onslaught of insanity is to be resisted, the battle must be fought at close quarters by general practitioners while cases are still recent and curable.

The International Medical Congress at Philadelphia was one of the important events of the Centennial year. It was attended by many respected representatives of foreign medicine and surgery. The impression made on the British visitors by the members of the profession whom they met here was, the *Lancet* has reason to know, of a very satisfactory kind; and that critical representative of British medicine is glad to believe that the condition of medical education in this country is more advanced than might be supposed from the chaotic state of medical legislation, and from the great number of medical schools purporting to grant qualifications.

WHOLESALE HEATING.

According to the Lockport papers, Mr. Holly's plan of heating cities by steam is soon to be put to the test of practical trial in that place. The scheme involves the division of the city into districts, and the establishment of a separate system of boilers in each district, with mains leading to the houses to be heated. That done, the citizens of Lockport will be enabled to dispense with stoves and fireplaces, as they already have with private wells and candlesticks, and regulate the temperature of their homes by the simple process of turning a faucet.

The plan is undoubtedly feasible, and, if properly carried out, cannot fail to effect an enormous saving in trouble and fuel. It is open to the serious objection, however, that the general introduction of steam for household purposes will necessitate the abandonment of almost all the appliances for heating and cooking now in use. Besides, the number of local boilers and attendants required to supply a town of any considerable size with the necessary steam must make the system altogether too complex and costly. Obviously a cheaper and more economical system of wholesale heating could be established by means of gaseous fuel. Gas is already supplied to most houses in towns of any size; and but few and comparatively inexpensive changes would be required to carry this self-propelling fuel to existing fireplaces, stoves, and cooking ranges, and burn it there. Now that gas can be manufactured for less than twenty cents a thousand cubic feet, the economy of its use for domestic heating is beyond question. No other fuel can be burned so completely or to so good an advantage, while nothing can be simpler than the means required for its distribution. Once introduced, the gas required for heating our houses and cooking our food need not exceed what is now paid simply for the cartage and handling of the coals we burn, after they have been laid down at the door.

Among the minor advantages of gas over steam for household uses, not the least are the facility with which the amount taken by each consumer can be determined, and the ease with which the supply can be adjusted to the demand, without waste. Gas will keep indefinitely without loss of heating power; steam will not; and it is not easy to see how provision could be economically made with it for any sudden increase or diminution of the amount of heat which consumers individually or collectively might require. Besides, with gaseous fuel, it would be possible to retain and increase the

number of our cheerful and sanitary open fires, compared with which steam radiators present few attractions. Every charm of a hickory fire—the bright blaze and the radiant embers—can be had from a grate burning gas, with none of the evils and inconveniences of a wood fire; while with the use of the same ever ready and perfectly controllable fuel in the kitchen, all the uncertainties and no small part of the common mishaps in cooking might be entirely obviated.

It is surprising that Lockport, which has the credit of taking the lead in the matter of public lighting with gas, should not have given it the preference for public heating. Are there no more natural wells in that neighborhood to draw upon? It would be a good plan for some of the towns near flowing gas wells to immortalize themselves and lessen their expenses by utilizing in this way the precious products of Nature's laboratory, now going to waste. A large iron manufacturing company in Western Pennsylvania write us that all their smelting is done with gas brought from a natural well nineteen miles away, through pipes laid down by themselves. Any enterprising town, in the neighborhood of one of those splendid natural reservoirs of fuel, might do likewise, tapping a gas well for a public fuel, supply, just as other towns tap a lake or a river for a public supply of water. The example, once set, would be sure to be followed elsewhere, with public gas works where no natural source is to be found. It is one of those inevitable advances in public economy which it is safe to predict; and men now living may see it carried out in all well regulated towns.

PROPELLING VESSELS.

It is probable that many who have recently joined the noble army of subscribers to the *SCIENTIFIC AMERICAN* have no knowledge that there are many other methods of propelling vessels besides the use of the oar or paddle, the sail, the screw, the paddle wheel, and animal towage; and that many who have been our readers for years have no idea of the variety of styles of propellers devised by the ingenuity of the many inventors who have labored in this field. We therefore think that a brief description of some of the most prominent varieties may be acceptable to our readers and prevent the re-invention of many old and exploded notions.

Leaving out of further consideration the ordinary use of the means mentioned above, as too well known to require description, we would state that many patents have been obtained for different forms of and arrangements of the buckets in paddle wheels, some having them adjustable on the arms to give them the proper amount of dip, others having them set at an angle diagonal to the shaft, others showing pointed paddles; others have the paddles set obliquely to the central line of the spokes or arms of the wheel, and still others show the paddle wheels made in the form of drums to assist in floating the vessel; but the favorite change from the ordinary style is that known as the feathering paddle wheel, which consists in such an arrangement of the paddles as will allow them to enter and leave the water perpendicularly, so as not to beat it when entering or lift it when leaving, as do the fixed paddles. This is accomplished generally by journaling the paddles to the arms of the wheel, and providing them with guides of various descriptions that compel them to retain a vertical position on entering and leaving the water. A few of such wheels have been and are still used, but have met with comparatively small favor from practical men, as the loss from the beating and lifting of the water is not near so much as is generally supposed. Some of these feathering paddle wheels are submerged and run on vertical shafts, in which case the paddles are set vertically during that portion of their revolution when they act on the water and lay horizontally during the remainder of their motion.

One of the favorite ideas of would-be improvers on the paddle wheel is to convert it into an endless chain of paddles passing over two drums at a considerable distance apart so as to have more action on the water than the ordinary wheel. In some cases, the chain is very long and is supported between the drums by friction pulleys; and in other cases the chain is made so short or is so constructed as not to require the pulleys. In some forms of this device for propelling, there is a single chain of paddles, passing over the center of the vessel and underneath its center in a channel between two keels.

Several attempts have been made to displace the paddle wheel by substituting disk wheels, or solid wheels without paddles, acting only by friction as they revolve in the water. These wheels have sometimes been made with single plain disks, others have been provided with corrugated or undulating surfaces; in other cases, two or more disks, set at varying distances apart, have been employed; and in some instances these wheels have been formed of one or more disks, set in an inclined position on the shaft.

Vibrating and sliding paddles have also received much attention from inventors, some of whom so arrange their devices, that, like oars, the paddles descend into and pass through the water, and then rise clear of it before returning to the starting point; others, usually called duck's foot propellers, have their motions all the time in the water, but open out when travelling in one direction, and close up when going in the other, in the manner of a duck's foot; and still others are made of flexible material and work like the tail of a fish. In connection with vibrating propellers, we may state that several patents have been granted for devices for operating oars arranged in such a manner as will allow the oarsman to face the bow of the boat that he may the more readily see in which direction he is travelling.

Screw propellers have been made in almost every imagina-

ble shape and arranged in almost every conceivable way and place. Many patents have been granted for using the screw as a means of steering as well as propelling, which is usually accomplished by connecting the screw to the shaft by a universal joint, and providing it with appropriate guiding mechanism so that it may be turned at any desired angle to the keel of the vessel.

Hydraulic propellers have also had their full share of attraction for inventors, and especially for those who wished to pocket the \$100,000 canal boat prize. These propellers are made in many different forms, but consist essentially in the use of a tube through the boat provided with some means (usually a screw) of drawing in water at the bow and expelling it at the stern. Sometimes the tube forks at the stem and stern, so that the water may be expelled at either side for steering purposes. By reversing the water-forcing apparatus, and in some cases by changing valves in the tube, the course of the water is reversed, for backing the vessel. Something on the same principle as the above is the use of a wheel or screw in a channel beneath the boat between two keels, many different styles of which have been patented.

Several patents have also been granted for pneumatic propellers, in which air pumps are employed to draw in air and force it out against the water at the stern. In some cases steam from a boiler, or the force of gases generated by the firing of some explosive substance, is substituted for air and air pumps.

In addition to the above there are various styles of propelling devices adapted to shallow or small bodies of water, as rivers and canals, among which may be classed rope or rail traction, in which a rope is laid from one end of the route to the other, and is acted on by a wheel or drum on board the boat around which the rope is usually passed. The rope generally lies on the bottom of the canal or stream and either passes over the bow of the boat to the driving power and drops into the water at the stern, or over a wheel at the side of the boat. Sometimes the rope is suspended above the water, and then is usually clamped between two driving wheels, or between a driving wheel and an idler; and in other cases a chain or a fixed rail (either over the canal, or on its bank, or the canal bottom) is substituted for the rope. In some cases the rail takes the form of a rack, on which runs a pinion driven by power on the boat. As somewhat analogous to this, we may mention that some inventors have proposed to lay rails on the tow path on which a light locomotive, driven by a boiler on board the boat, shall run and tow the boat by means of the flexible steam tube connecting the boiler with the locomotive.

Ground traction propellers of various styles have also been tried, some of which show driving wheels running in self-adjusting frames, so that they will always bear on the bottom of the canal or stream; others have poles driven by cranks or eccentrics; and still others have legs with shoes pivoted at the bottom; but the two last styles are essentially the same in principle.

Air propellers, or screws which act in the air instead of the water, have also been tried and patented, the object being to avoid the washing of the banks in steam propulsion on canals.

Windmill propellers, or rather the use of windmills to drive screws or paddle wheels, have also received some attention; and one of the patentees of such an arrangement has provided an endless chain horse power as an auxiliary force.

Several patents have been granted for wave power propellers, in which the waves, in rocking the vessels, are supposed to drive the screw or paddle wheel. The force of a running stream has been availed of to drive a boat across it with considerable success. In one case, there is a rope stretched across the river, on which run two pulleys connected with the bow and stern of the boat. The pulley at the bow is connected by a very short cord and the one at the stern by a longer one, thus holding the boat obliquely to the rope and the current, so that the force of the latter acting on the side of the boat will propel it across the stream. Another plan that has been suggested consists in attaching one end of a rope to a boat and the other end to an anchor located in the middle of the stream, at some distance above the place where the boat is to cross, in which case the boat travels in an arc, of which the rope forms the radius.

A method of making a boat travel against the stream by the power of the stream itself has been proposed, and it consists in a fixed cable lying in the bed of the river, which cable is acted on by a wheel or drum driven by a paddle wheel or screw impelled by the current. The cable may either have one end coiled up on board the boat, or have both ends anchored, as in rope traction before referred to.

The above gives but an incomplete sketch of the various means devised by the ingenuity of man to propel vessels through the water, as a description, be it ever so brief, of the different modifications of the various plans for propulsion would fill a good sized volume, there being probably upwards of eight hundred United States patents for propelling devices, to say nothing of the many foreign inventions for the same purpose.

MR. R. HITCHCOCK, of Watertown, N. Y., states he was the inventor of the clock propelled by a wind wheel, described in our issue of January 20 as the patent of C. B. Hoard. The patent was granted to Mr. Hitchcock after the decision of an interference suit.

An excellent blacking for fine harness can be made by dissolving five or six sticks of black sealing wax in a pint of alcohol.

GUARDIOLA'S SUGAR AND COFFEE MACHINERY.

It is well understood, by those familiar with the manufacture of

SUGAR

according to the best and most correct scientific principles, that it is of great importance that all the operations be carried on with the utmost rapidity, otherwise the juice is liable to ferment, entailing considerable loss. In slow evaporating pans, the juice is exposed to another danger, termed "inversion," through which it loses its power of crystallization. In brief, the longer the evaporation lasts, the larger is the quantity of molasses obtained; and consequently the amount of crystallizable sugar is diminished in the same proportion. All open evaporating pans, wherein these liquids are boiled in large quantities at once, produce these evil effects. Pans evaporating *in vacuo* are free, to a certain extent, from these inconveniences; but a vacuum apparatus is very expensive, and requires skillful labor, besides the use of animal charcoal filters and their revivifying kilns, etc. The helix evaporator, illustrated in Fig. 1, although it works under the full pressure of the atmosphere, is claimed to have an evaporating power superior to that of any other open pan, and equal to that of any pan working *in vacuo*. It presents also other advantages, which no vacuum pan can have, namely, the separating of the impurities, by the same apparatus, during the ebullition of the juice. This is obtained through a very ingenious strainer that follows the whole length of the channel; not a drop of liquid is lost, and a beautiful, clear stream of syrup runs out of the evaporator, leaving little work for the filters. The impurities arrested

the water is stopped, and the defecated juice run along the helix, never allowing the channel to be bare. One after another, the compartments of the double pan are emptied, in order to receive the syrups supplied by the helix. In a few minutes the whole train is in good working order, and everything goes on smoothly. When work is stopped, a small stream of water is run in right behind the juice; this water protects the metal from burning, and at the same time cleans



FIG. 1.—GUARDIOLA'S HELIX SUGAR EVAPORATOR.

the apparatus. When the defecated juice begins to run and boil, the impurities coagulate and rise with the froth, spreading over the continuous strainer, and there they are deposited, allowing the clear juice to pass through the small holes and falling into the channel below. In this manner, the impurities are set aside and removed without causing the loss of a drop of liquid; in fact, this helix evaporator suppresses entirely the "scums." The syrup that comes out of this evaporator, in a continuous jet, is so pure and so rich in crystallizable sugar that it leaves very little for the filters to do. The quantity of the juice and the fire will regulate the density of the syrup, which has to receive its last concentration in a separate pan. The fire must be kept, as much as possible, under the helix evaporator, which receives the full

this important industry, for the accomplishment of which the appliances have hitherto been of the most primitive character; and his inventions are the result of the extended practical experience. His object has been the saving of time and labor, and the improvement of the quality of the product. It is hardly necessary, therefore, to add that the inventions herein described are worthy the consideration of persons engaged in the above-named industries. Mr. Guardiola has

given his inventions a thorough trial, on a large scale, before bringing them before the public. The engravings which we present herewith represent machines for washing, drying, hulling, and polishing coffee, and also one for grinding corn when boiled for the purpose of making tortillas.

The washing machine, Fig. 3, is employed to get rid of a mucilaginous substance that adheres to the husk or inner cover of the coffee

berry, after the pulp or outer cover has been removed. If the coffee is left in a heap for some hours, after having been pulped, this gummy substance is decomposed and is then easily washed off. The coffee, as it is gradually introduced into the machine, is simultaneously acted upon by a small jet of water. In a few seconds, the coffee emerges at the other end of the cylinder thoroughly washed, and passes to a sieve, when the water drains off and the berries are then ready for the process of drying. This washer is made of several sizes, to prepare any quantity of coffee desired.

The drying apparatus, Fig. 4, performs one of the most tedious and expensive operations in the preparation of coffee for the market. It has hitherto been the practice, in drying coffee, corn, cocoa, etc., simply to spread the grains and expose them to the air and heat of the sun. This process would seem to be the most economical; but in cloudy or rainy weather, the drying completely stops, and often the planter sustains heavy losses through the delays and deterioration of his crop. The great number of people required in the sun-drying process and the length of time consumed are objections that every planter has experienced, and is desirous of avoiding. Every grain of coffee, etc., in this apparatus is kept constantly in motion by the rota-

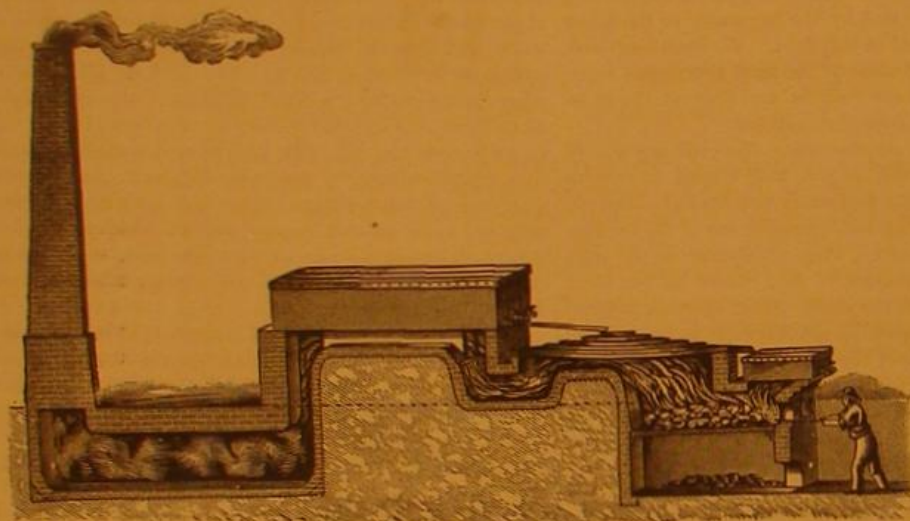


FIG. 2.—GUARDIOLA'S TRAIN OF SUGAR-MAKING APPARATUS.

and left on the strainer are readily removed by hand; boys or women can be employed for this purpose.

The *modus operandi* is easily understood. The saccharine juice, after having been defecated, is directed, in a determined quantity, on to the top channel, and in its passage down to the end of the gutter it loses the greatest part of its water by evaporation, leaving on the strainer nearly all the impurities. The apparatus is calculated to produce, in about five minutes, defecated juice from, say, 8° to 25° Baumé, in a continuous stream, the amount being determined by the length of the channel. The economy of fuel claimed amounts to about 40 per cent; and as all the operations go on with greater rapidity, there is also a saving of time and labor. Of course, a constant degree of heat must be maintained in the furnace in order to obtain a constant density in the syrup; otherwise this can always be obtained by the use of a double pan, set on the same flue.

The train of sugar-making apparatus shown in our Fig. 2 is composed of three defecating pans set on the same level and on separate flues, a helix evaporator and a double flat pan, the latter being used to regulate with greater nicety the density of the syrup. This battery is so disposed that one pan discharges into the next below. The defecators keep the evaporator supplied with juice; while one is being emptied, another is filling up, and the third is in course of defecation. After filling up the defecators, a little water is run in the channel of the helix and into the double pan, and the fires are lighted. As soon as one defecator is ready,

benefit of it. When the syrup has reached the desired degree of density in the double pan, it may be directed, while hot, either into bag or bone-black filters. From the filters, the syrup is put into an open striker pan or into a vacuum pan for that purpose. A copper tilting pan, for direct fire, with a rolling damper (also the invention of Mr. Guardiola), which cuts off the fire instantaneously from under the pan, can be used to prevent the charring of the sugar.

The saving of fuel, time, and labor, by using this helix evaporator, is so great, says the inventor, that the attention of all persons interested in sugar making should be called to it. The apparatus will be made of any size desired, oval or round.

The helix evaporators, like the many other inventions made

ting movement of the machine; while an even temperature pervades the whole mass. The vapors arising from the grain are instantly blown off by a current of hot air. A heater and fan accompany this apparatus, and the temperature is easily controlled. By this machine, Mr. Guardiola states, a planter can have his coffees ready for market 24 hours after he puts them in his drying machine.

MALT

has also been dried lately in the same apparatus in the city of Philadelphia, at a heat varying from 90° to 123° Fah., afterwards raised towards 160°, in much less time than is usually employed in the old brick kilns, with excellent results. The machine occupies very little space and requires but little attention. It is especially adapted for brewers' use, inasmuch as it separates all the radicles during the drying process, thus delivering the malt perfectly screened and clean. Mr. Guardiola assures us that he has dried corn and kept it for two years without its being injured by weevils, and this in localities where the grain usually became spoiled within three months. The corn was subsequently planted,

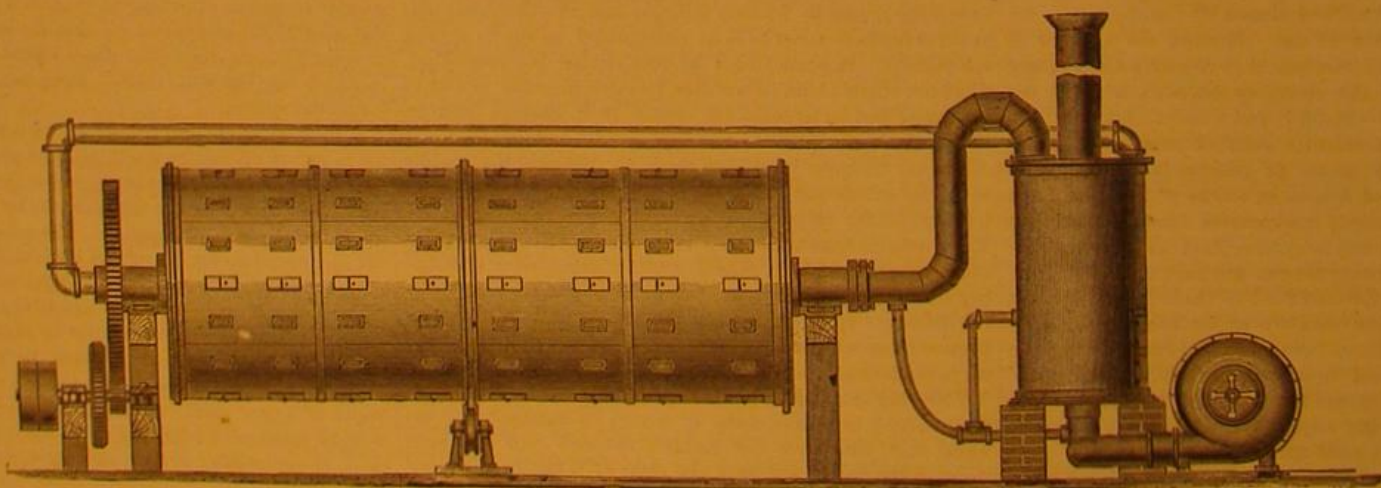


FIG. 4.—GUARDIOLA'S COFFEE-DRYING APPARATUS.

by Mr. Guardiola, are the direct result of practical experimenting to meet his own needs on his large estate, Chocollá, Guatemala, where they are in successful use. In addition to the sugar evaporators, Mr. Guardiola, who is already well known to our readers as the inventor of a variety of novel and useful apparatus relating to the preparation of

COFFEE

for the market, has invented several machines for processes in

and it germinated, thus showing that its vitality was unimpaired. One of these machines, as shown in our engraving, 16 feet long by 6 feet in diameter, is claimed to be capable of drying 10,000 lbs. of coffee or corn, or 300 bushels of malt, etc., per day, requiring less than 4 horse power to drive it. For smaller quantities, machines are made to be operated by hand.

It has been a common objection made to former appliances

for drying malt or grain that the principal aim has been too great a heat, thus rendering the grain liable to injury. Mr. Guardioli has avoided this danger, by using a low degree of heat throughout, particularly when the moisture in the grain is at its greatest. Fig. 5 is an end view of Fig. 4.

The coffee hulling and polishing machine, represented in Fig. 6, is remarkable for its simplicity. A mortar and pestle are its principal parts; and the construction is such that the coffee is cleaned and polished by the friction of one grain against another, moving in the broken chaff. The pestle is a cone, having on its surface oblique projecting ribs, set at proper distances from each other so as to form channels. The interior of the mortar is also provided with ribs and channels. The pestles drop simultaneously into the mortars, and the coffee is forced to move up and down the channels. The husk is thus broken and finally pulverized, leaving the coffee thoroughly clean. By opening a valve at the bottom, the contents of the mortar are discharged. No coffee grains

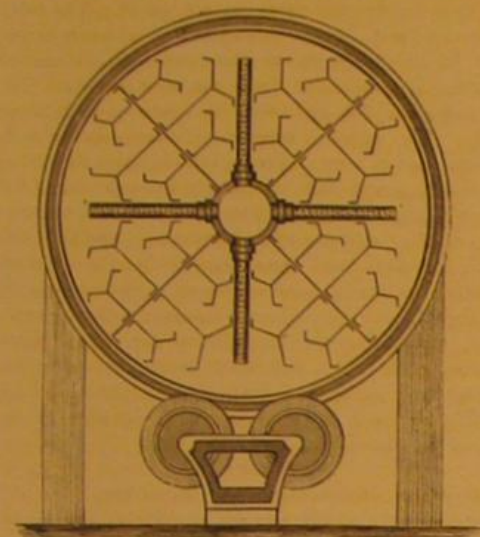


FIG. 5.—COFFEE DRYER, TRANSVERSE SECTION.

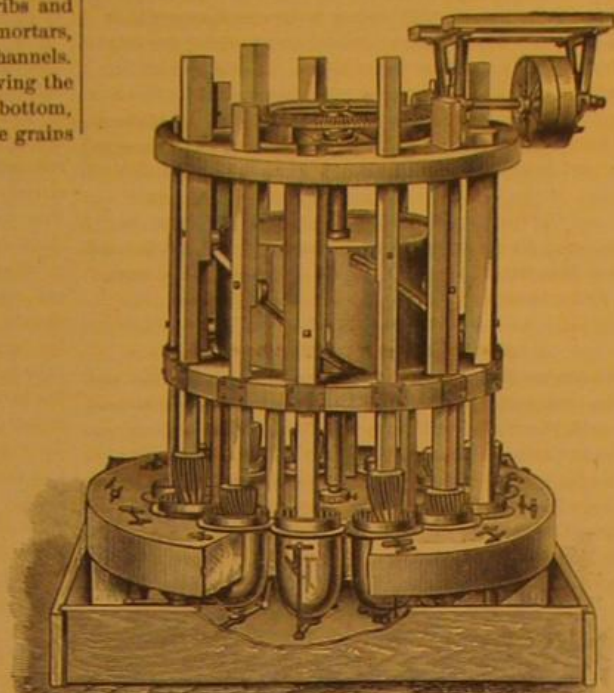


FIG. 6.—GUARDIOLI'S COFFEE HULLING AND POLISHING MACHINE.

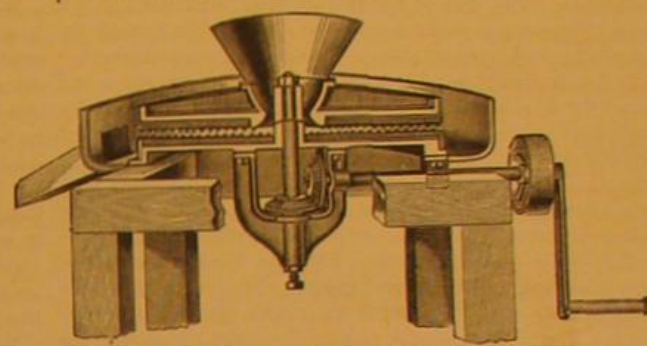


FIG. 7.—GUARDIOLI'S COFFEE HULLER FOR HAND POWER.

are broken. Each mortar will clean about 150 to 200 lbs. coffee per hour. The battery shown in our engraving has 13 pots; the number, however, may be increased or decreased as desired.

Fig. 7 represents a new coffee huller, useful where steam or water power cannot be had. The principal and most important feature of this machine is the elasticity of the rubbing surfaces. If the parts that come in contact with the coffee do not yield instantaneously, the coffee is injured and the loss is sometimes very great. But this machine has an elastic material acting like a very sensitive spring on the rubbing plates, so that the latter yield to the slightest pressure, while they are sufficiently rough and rigid to break apart the husk of the coffee.

Fig. 8 is a

CORN GRINDER,

an apparatus which is used principally in Mexico and Central America, where corn is boiled and then crushed and reduced to a fine pulp, for the purpose of making *tortillas*, or flat, round cakes, which, when toasted, form the principal



FIG. 8.—GUARDIOLI'S GRINDER FOR CORN, CHOCOLATE, ETC. food of the people. The machine is equally well adapted for grinding chocolate, seeds, paint, etc., as may be required.

Messrs. Morris, Tasker & Co., of Philadelphia, Pa., have recently made a new set of Mr. Guardioli's machines; and they may be addressed as to either the sugar or coffee machinery. Mr. Guardioli's address is Chocolá, Guatemala, Central America.

Wanted a Postage Stamp Canceller.

The Government suffers yearly the loss of many thousands of dollars through the cleansing and re-use of postage stamps, after the same have once passed through the mails. About one thousand million stamps of all kinds are annually cancelled. Those printed on postal cards and envelopes, numbering, it is estimated, one third of the above total, cannot of course be used a second time. To prevent the remainder entering again into circulation, we rely on their being indelibly marked; but this important result no one has yet succeeded in attaining in a sufficiently simple and effective manner.

We still adhere to the old printers' ink besmeared pad and wooden hand stamp. In small post offices, where the clerk can take his time to the work, the above simple device answers all purposes, or at least is better than anything yet offered as a substitute; but in the offices of large cities, where the clerks are obliged to acquire marvellous celerity in handling the letters, it is almost a necessary consequence

that some stamps are so lightly marked that the greasy ink is readily removable.

The question now is whether a mode can be invented which will both rapidly and effectually produce the requisite cancellation. The prospects in this regard are certainly not promising, if we may accept the experience of the Post Office Department, which, after two years of experimenting on all sorts of inventions for the purpose, has recently brought its tests to a close, and is actually no nearer a solution of the problem than at the outset. A *World* correspondent says that, in one corner of the Post Office building in Washington, there is a room containing some five hundred

ones. There is an excellent opportunity here for some inventor not only to confer a great benefit upon the community, but to secure for himself splendid rewards; for a thoroughly successful invention of this kind would be welcomed by every government in the world.

A Visit to a Slate Quarry.

At Festiniog are situated some of the largest slate quarries in North Wales. We find in the *Building News* the following graphic description of a visit to the locality:

Passing over an iron bridge we were soon in the midst of the busy scene. All around extended the workings, the sides of the mountains being strewn with slate, which to an outsider seems to be wasted in a very prodigal manner.

Down the precipitous sides, every now and again, a huge mass of slate is hurled by the quarrymen above, and as it jumps and tumbles down, the crackling and crashing of the waste slate adds not a little to the prevailing noise. In the distance we hear the boom of blasting, and in all directions trucks hurry along, some in strings laden with waste, while single ones rush up and down very steep inclines. These last are worked in couples with an endless chain and drum, the ringing, rattling noise they make being most startling to the visitor. Not infrequently these chains break, when, it may be imagined, the position of the unloading gang at the bottom is somewhat awkward.

At a certain point our guides stretched themselves prone

upon the ground—we following their example—and crept to the edge of a cliff. Peering over, a sight met our view which was interesting to a degree; four hundred feet below lay the busiest and most remarkable portion of the workings. Almost immediately beneath us was a huge gray colored chasm, its entrance all misty with the smoke and dust of the blasting which was going on somewhere deep down in the bowels of the mountain. Around this opening for some distance was a cleared space alive with pigmy men, who were busy loading and unloading the various trucks which kept arriving from all directions, some appearing every now and again out of the chasm, others working by the tank system in stages, while the majority came pelting down the mountain side, held by a thin bright thread which glistened in the sun; this was the chain system spoken of. From the clearing around the chasm, lines of tramway led away to the railway, along which strings of trucks drawn by horses toiled continually. Leaving our birdseye view, we walked along until we reached the workshops. In a large building the different processes of bringing the slate into shape were going on in full swing; wheels spinning overhead, with driving bands in all directions, sawing, planing, and lopping the slate into sizes. Everything apparently was done by machinery, with but the one exception, as far as we saw, of rending or splitting the slate into the thin slabs technically known as 'slates;' this appears to be entirely done by hand. The process is very simple but very interesting. The render sitting upon a block, with a pad on his legs, is supplied by boys with slabs about an inch and a half in thickness. Taking one between his knees, after having selected the truest end, he taps it with a broad blunt chisel and mallet, prising it open; then, with a turn of the wrist, rends the slab in twain. Often when he appears to have come to the last slate which can be got out of the slab, he will again rend it, apparently as easy as the first time. We watched one man for perhaps ten minutes, while he did over a hundred slates, and did not see one mistake. After this process they are taken to a revolving hollow drum with stout iron blades, and are held by a man on a fixed bed or frame, with a gauge attached to it, and squared up into the different sized slates.

Leaving the shops we went on until we came to some sheds, where was a shaft descending to the lower workings, passing on our way an old man sitting in a slate hut, who, assisted by a boy only, was busy rending, lopping, and slacking small sized slates, looking as though he adhered tenaciously to the old style, and scorned the idea of the new-fangled machinery. At one of the sheds we procured candles and then waited for the tank, or skip, to come up, which it presently did with a laden truck; this being pulled off on to the tramway, we stepped on to the tank in its place. The water was then turned on, and the tank filling, the weight of the water soon counterbalanced the loaded (empty) tank at the bottom. The water being turned off, we began to move, and down we went, until, after about a minute's journey, a gentle bump told us we were at the bottom. A rumbling noise and a shout warned us of the approach of some trollies drawn by a pony. We just managed to evade them, but not without some of the party getting very wet. The train we returned by carried about 800 quarrymen, who dropped off the trucks at the nearest point to their destination. These men work in gangs and earn very considerable wages.

Now we shall not for an instant credit the idea that our inventors are content to remain baffled by this problem, for we are convinced that there is a solution of it, and a practicable one. Let the inventors therefore understand the main points of the requirement: The mode of cancellation must admit of rapid use; must in nowise affect the contents of the envelope; must be applicable without special machinery or any special process; must be so simple as to require no more skill to use it than is now required to manipulate the hand stamp; must legibly inscribe the postmark and cancel the postage stamp, both simultaneously; must be cheap; if an ink, it must be chemically ineradicable, and yet not necessitate rare or costly chemicals for its manufacture; and if a self-destroying stamp, it must be as portable as the present

Communications.

Cotton Picking by Machinery.

To the Editor of the Scientific American:

Will you allow me space to answer a large number of communications received since the publication of my letter in your number of December 16 last?

Cotton is grown in rows or drills which are varied in the distance apart by the quality of soil. For instance, a rich soil produces large plants, and *vice versa*. Perhaps an average of distance would be 3½ feet. The drills are but little raised above the general surface when picking time arrives. If it were necessary for the successful working of a cotton picker, the plants could be grown in double rows, with a wider distance, especially in the poorer soils. The height of the plants varies from 12 or 15 inches upon poor soil to 6 or 7 feet upon the rich bottoms. The variation in a single field would be much less considerable. In general, the height may be stated as from 2½ to 3½ feet. The plant is pyramidal in form, grows upright, and with a width proportioned to the height. It is rather woody, more so than elder, less so than the whortleberry. There is a central stem, which is perpendicular, and sends down deeply into the earth a tap root; from this, as a center, the roots below and the branches above radiate with some degree of regularity. The stalk would not be easily injured, as it is well protected by its branches. The size of the boll or pod, when fully grown and unopened, is about that of the black walnut, some being larger and some smaller. This pod bursts at maturity; the lint gradually unfolds itself and hangs down more and more for days and weeks, until at last it would drop out by agitation of the wind, if not gathered. The number of bolls to the stalk varies from ten or twelve to several hundreds. This varies with the size of the plant, and also with the selection of seed for prolific varieties. The bolls are situated upon foot stalks 2 or 4 inches in length, which make off from the main branches. They are borne upon all of the branches, both below and above. The bottom bolls are first to mature, and afterwards the others, upward in succession. The fruit is borne chiefly upon the exterior of the plant; but, as in the apple tree, some of it is to be found towards the center of the head.

The force required to extract the lint from the well opened pod is very slight. It might be represented by a weight of perhaps 1 oz. as the maximum, and from this down to nothing, when the lint falls of its own weight. The picking season in this latitude extends from September 1 to the close of December. The last of the crop is usually fully opened and ready for picking by or before the middle of November, and is constantly liable to damage until it can be picked out. The later pickings are usually more or less damaged by this delay, and command a lower price.

It would be difficult to state the average number of acres in cotton upon each farm and plantation; perhaps it might be put at 50 acres in this region, and further south 100 acres would be nearer the mark. The extremes could not be more definitely fixed than by stating them at from one acre up to two or three thousands. The yield of merchantable cotton per acre differs widely with soil and culture, as does corn, wheat, or any other crop. A fair average for this region would be probably 200 lbs. of lint, the extremes being from 30 to 1,000 lbs. One bag of 500 lbs. is a very successful crop upon the best lands without special fertilization.

Can the cotton be blown out of the boll? Yes, when it is very mature; but it is not likely that this could be a successful method of gathering. A draft of air might be useful to agitate the long locks of lint that card teeth might the more easily seize them. Would a team be likely to injure the plants? No, not if properly driven.

Personally I have no interest whatever in the growth or sale of cotton. I do not desire in any way to engage in the invention or sale of a cotton-picking machine. I am a physician, and do not desire to become anything else. My business carries me through the cotton plantations; I see a great and manifest agricultural want which I cannot supply. I have asked the use of your columns to bring this want before those whose business and whose interest it is to supply it. I have given my own thought upon the subject freely to the public; I cannot do more than this. In the invention of a successful cotton picker, I think I see in the near future an immense revolution in all the cotton industries of this country, the influence of which will be sensibly felt throughout our vast domain from Maine to Texas, from Oregon to Florida.

ROBERT BATTEY, M. D.

Rome, Ga.

Boiler Explosions.

To the Editor of the Scientific American:

In No. 2 of the present volume of the SCIENTIFIC AMERICAN, there is a letter from E. G. A., headed as above. In this letter he says "that it is very generally conceded by scientific and practical men that the most common, if not the sole, cause of boiler explosions is low water." He also says: "If an explosion occur, and you ask the engineer his opinion of the cause, he has no theory; but one thing he is certain of, and that is that the boiler was full of water a few minutes before the catastrophe occurred; and here he is at variance with all scientific men and the public generally." I think that whenever the pressure in a boiler becomes greater than the boiler is able to bear, it will give away, and a new boiler is sometimes made in such a bad manner that it will not bear anything like the pressure that it is expected to

E. G. A. goes on to suggest the use "of automatic water regulators and low water alarms to prevent these explosions;" but he says, "when you go to the proprietor for permission to put one on his boiler, he goes to the engineer, who, on account of ignorance, objects to it." Now any man who will give this one moment's thought will see that it is unreasonable to lay this blame on the engineer, who would not object to anything that would lessen his duties or take any responsibility off his shoulders. To think that he would object to anything that would give warning in time to save an explosion, and thereby save his own life, would be at variance with the laws of human nature, especially when it does not cost him anything. But the trouble lays in the expense to the owner. I will relate a circumstance which I heard the other day. I have a friend an agent for the sale of a water regulator and low water alarm. I said to him that I thought he could sell one to my neighbor. He said he could not, and that he went to the engineer with the instrument, who, after examining it, said that he thought it was a good thing, and would like that I should go to the owner and sell him one. "So," said my friend, "I went to the owner and explained the matter to him as well as I could. Said he, 'I pay my man for looking after that boiler; I will not buy this and pay him too.'"

D. KARN.

St. Petersburg, Pa.

A Hint for a New Pomade.

Notwithstanding that we owe much to the Baconian philosophy, many discoveries have been the result of pure accident, and the "rule of thumb" has been the predominant feature in their development. When one reads of a Yankee specific for the growth of hair, which when spilt in the neighborhood of a doorstep over night resulted in a handsome door mat the next morning, one feels at liberty to exercise the fashionable faculty of scepticism. But when a British Consul tells a "plain unvarnished tale," we presume it must be received with becoming gravity. Still we cannot help remarking that the news conveyed by Mr. Consul Stevens in his last report to the Government on the trade of Nicolaieff would be indeed a blessing to bald heads, if true.

Mr. Consul Stevens states that a former servant of his, prematurely bald, whose duty it was to trim his lamps, had a habit of wiping his petroleum-besmeared hands in the scanty locks which remained to him; and after three months of lamp trimming experience and practice of his dirty habit, he found he had a much finer head of black, glossy hair than he ever possessed before.

Consul Stevens, therefore, tried the remedy on two retriever spaniels that had become suddenly bald, with wonderful success. During the summer of 1875 his attention was called to several cases of sudden baldness of bullocks, cows, oxen, and the loss of tails and manes among horses. His previous experience induced him to suggest the use of petroleum to the owners, and it was found that, while it stayed the spread of the disease among animals in the same sheds and stables, it effected a quick and radical cure on the animals attacked.

Consul Stevens says that the petroleum should be of the "most refined American qualities," and should be rubbed in vigorously and quickly with the palm of the hand. It should be applied six or seven times in all, at intervals of three days, except in the case of horses' tails and manes, when more applications may be requisite.—*Pharmaceutical Journal*.

Coal Miners' Relief Fund.

The Wilkesbarre Coal Company, after the occurrence of the Avondale catastrophe in 1869, established a benefit relief fund at the mines. The company gave the yield of the mines for one day, and the miners each gave a day's work, the amount raised being \$6,000. Since that time this fund has been constantly and rapidly accumulating, every new miner giving the first day's work to the fund. The fund is deposited with the coal company, who pay 6 per cent. interest on the money. The trustees are selected by the miners. Since the establishment of the fund it has been changed, in order to include all the mines owned by the Philadelphia and Reading Coal and Iron Company, and more liberal provision has been made for families whose heads have been crippled or killed in the mines. It is provided that, "should any person, after having been in the employ of the company for upwards of one month, meet with a fatal accident in the discharge of his duty as a workman, his family shall be entitled for one year from date of death to the following benefits, provided that no person entitled to said benefits shall directly or indirectly engage during said time in the sale of intoxicating liquors: 1. \$30 to be paid for funeral expenses. 2. \$3 per week to be paid for maintenance of widow. 3. \$1 per week to be paid for the maintenance of each orphan under 12 years of age." The total contributions to the fund, including interest, in the seven years have amounted to \$93,217. Of this \$66,881 has been distributed in benefits, and \$26,335 remains in the treasury.

The Great Ice Gorges.

An immense loss of property has resulted from the late great ice gorge on the Monongahela river. The flood, occasioned by the damming of the stream, on breaking its frozen barrier, swept the great ice masses before it, and these in turn destroyed everything in their path. Whole fleets of coal-laden barges were borne along like chips, to be crushed and sunk on striking a bridge pier or other obstruction strong enough to resist the terrible impetus. When the gorge reached Pittsburgh, seven large steamboats, besides a number of loaded coal packets and upwards of 300 barges, were swept away.

Nearly all were filled with coal, of which it is estimated some 15,000,000 bushels were lost. The tipples used for dumping coal, built on the river bank, were destroyed for a distance of sixteen miles, and their wrecks, with those of the vessels, lie strewn over the shores in inextricable confusion. The loss in the vicinity of Pittsburgh is placed at \$2,000,000, to which must be added the cost of clearing the channel of the debris which now impedes navigation.

At Cincinnati, the break-up of ice in the Ohio resulted in destruction almost as extensive, and 75 full and 200 empty coal barges, and several steamers, were sunk. It is estimated by coal shippers that the total damage caused between Pittsburgh and Cairo will not fall short of \$12,000,000.

A Town Built on Ice.

A correspondent of the *Detroit Free Press* states that the fishermen on Saginaw Bay have erected a good-sized town of shanties far out on the ice. The dwellings are of thin wood, lined with thick building paper, and are attached to runners so as to be movable from place to place. The town already boasts a hotel. From this structure, which is larger than any of the dwellings, the view is truly astonishing, the shanties dotting the surface of the bay in all directions. The number is now about 300, and about 30 are arriving and being put up daily. The average number of occupants in each shanty is three men or men and boys, thus making, including the larger buildings and their occupants, not less than 1,000 persons already living on the ice. There probably will be twice the number on the ice by the first of February, and they can remain there in safety until the middle of March. Teams are constantly engaged in gathering together and hauling the fish thus caught by the men, who fish through holes in the ice to Bay City, whence they are shipped to all parts of the State. That all these people find it sufficiently profitable, to induce them to brave the perils and hardships attending this adventurous life, is proof that the aggregate revenue of the business must be quite large.

Heating Street Cars not Feasible.

Several newspapers of this city are advocating the warming of the street cars, a proposal which, in view of the manner in which those conveyances are used in New York, betrays a very decided lack of common sense. We suppose that there are few more disagreeable places on this mundane sphere than the interior of a Third Avenue car in this season of the year, when packed with the average crowd which travels on that line. The floor is usually covered with slush and wet straw; and ventilation is conspicuous by its absence. Now to add to the reeking atmosphere of these cars the emanations of a hot stove would be simply to render the place unbearable to persons who fear aerial poison, and dangerous to health by the repeated sudden changes in temperature, due to the constant opening and shutting of doors. On some lines of cars which are crowded and which travel long distances, stoves may be, and we believe are already, used; but to place them on vehicles which are always thronged, and at certain hours literally packed, is certainly impracticable.

What is needed is good ventilation, a clean floor, and proper illumination at night. These can all be easily provided, and would do much toward rendering street car travel more comfortable.

Poisonous Fireworks.

Miss Helen Locke, a beautiful young lady living at Bristol, N. H., died recently from the effects of inhaling gas from "red fire," burned during a young ladies' tableaux entertainment, in which she took a part, given about six weeks before.

The above pyrotechnic mixture, "red fire," is quite a favorite at private tableaux exhibitions, but should be utterly banished from the parlor and the lecture room. Its fumes are highly poisonous. It is composed of nitrate of strontia, black sulphide of antimony, sulphur, and chlorate of potash. The crimson color is due to the strontia. The latter is a salt of the metal strontium, which is of light yellow color, nearly as hard as gold, and very ductile.

"Red fire" was formerly in common use in our theatres; but its poisonous character and danger as a combustible have caused its general abandonment. The same may be said of other firework mixtures. The lime light lanterns and lenses of different colors have been substituted, by which even greater brilliancy and variety of effects are obtained.

Fluids of the Mouth.

Dr. Hodson wisely calls attention in the *Medical Record* to the fact that, in any illness involving a febrile condition, the fluids of the mouth are constantly as intensely acid as respects the teeth as in any medicine administered by the physician, and, moreover, from the high temperature of the buccal cavity at such times, the power of these acids for evil is greatly augmented. Further, a direct consequence of these conditions is the especially rapid fermentation and decomposition of all food lodged between and around the teeth, and the consequent elimination of other deleterious acids. Dr. Hodson recommends rinsing the mouth with *liquor calcis* (lime water), diluted according to the sensitiveness of the mucous membrane, and flavored with a few drops of wintergreen or peppermint to make it agreeable.

The relative strength of different forms of riveted joint, as compared with that of the solid plate, is as follows: The strength of the solid plate being 100, that of the single riveted joint is 50, double riveted 70, chain riveted 85.

Thomas Edward, Naturalist.

The name of Thomas Edward, of Banff, Scotland, appears as reference or authority on the pages of many standard British works on natural history; and he has the honor of giving his name to several new species of crustacea, discovered and classified by him. Birds, fishes, insects, zoophytes, and crustacea have been in his principal lines of investigation. A working shoemaker, his researches have been conducted in the hours of daylight, after work hours and before; and the hours of the night have been employed for such hunts as could then be followed. He ambushed, or slept when he could no longer keep awake, in badgers' holes or other uninviting shelters, and he was on such terms with the inmates that they would let him alone. Weather, fair or foul, made no difference to him, except as it indicated what particular investigation he should follow. Of course, though little known abroad except among naturalists, he was a local celebrity. He was elected, in 1866, one of the thirty Fellows of the Linnean Society, and afterward a member of the Aberdeen Natural History Society; and he received the diploma of the Glasgow Society. Neither of these appointments yielded any income, but his neighbors of Banff made him curator of their museum, with the not very munificent salary of four pounds four shillings, about \$21, per annum. This was something tangible for a prophet in his own country; but his townsmen regarded him as "daft," nevertheless. The local magistracy gave him a special certificate, warning gamekeepers and policemen that he was not a poacher or vagrant, but a sober, respectable working man, engaged in natural history investigations. Nobody, however, could give him a certificate against the rheumatism, or against poverty; and now, at the age of sixty-three, he is spoken of as a "ragged, weather-beaten, rheumatic old man."

It is pleasant to add that better times have dawned on Thomas Edward. During the recent holidays, he received a letter of which the following is a copy:

"WHITEHALL GARDENS, CHRISTMAS DAY, 1876.

"SIR:—The Queen has been much interested in reading your biography, by Mr. Smiles, and is touched by your pursuit of natural science, under all the cares and trouble of daily toil. Her Majesty has been graciously pleased to confer on you a pension of fifty pounds a year.

"I am,

"Yours faithfully,

"BEACONSFIELD."

Now this was to the old man, who need be ragged no more, a most acceptable Christmas present. It exceeds what were his average earnings; when, in health, by full work he could earn a pound a week at mending shoes. The date, on an unofficial day, adds grace to the gift.

Mr. Samuel Smiles, author of "Self Help," "Character," "Thrift," and other books of an eminently practical character, mentions Thomas Edward in the book first named, published eighteen years ago. And he has just written an extended biography of the naturalist, which will doubtless be republished in this country and read with interest. In one thing Edward is not a model. He hated school, and played truant when he could; and when he attended, it was with pockets full of worse than rocks: bugs and reptiles to wit, which made him no eligible bench-fellow. Consequently, when he reached adult age, he was forced to learn as best he might how to read and write. His last appearance in any school was when a pet crow, concealed in his trousers, made responses during prayers, which were neither well timed nor edifying.

Steel Ship Building.

One noticeable feature in connection with the construction of the six steel corvettes now being built for the Admiralty by Messrs. John Elder & Co., of the Clyde, is the rapidity with which the work is being done. One instance of this may be discovered in the fact that the stem of each vessel is being cast in gun metal, a process which completes this portion of the work in a fortnight for each; whereas the old method of forging in wrought iron is said to require some four or five months' work. Messrs. Finlay & Davidson, of Port Eglinton, by means of their reverberatory or air furnace, which is capable of melting some thirty-five tons of pig iron, undertook the casting of the stems, each of which when finished is of the estimated value of \$7,500. In outline each of these stems bears some resemblance to the prow of the war galleys of the ancients. Continuous at one end with the keel of the vessel, of which it is to form a prominent feature, the stem bends forwards and upwards, becoming about 15 inches thick along the anterior border, and attaining to about 4 feet as its greatest breadth. It then curves backwards and upwards, gradually becoming smaller towards the upper end, where it merges into the bulwarks of the ship; indeed, it may be said to consist of two curved arms meeting in the broadest part at a somewhat obtuse angle, and there becoming a sort of ram. Speaking roughly, each stem may be said to be about 45 feet long; and as it is all cast in one piece, it is not surprising to learn that in its finished state the casting weighs about 10 tons, and that its production necessitates the employment of a charge of 14 or 15 tons of metal.

Considerable care has, of course, to be exercised during the process of casting, which takes place much in the usual way, by the aid of loam and dry sand, and a wooden pattern. The essential ingredients of the metal are copper and tin, and in the casting of No. 4 stem the other day the charge consisted chiefly of old brass or bronze guns from Woolwich. At half past four in the morning the charging began, and by eight o'clock, there being a remnant from a former casting

in the furnace, some 7½ tons were melted down. Gradually adding some 5 tons of metal up to one o'clock, 10½ cwt. of tin were admitted, and by two o'clock all was ready. Just immediately before tapping, a number of slabs of zinc or spelter, weighing about 1½ cwt., were cautiously slipped into the molten mass, and the whole well rabbled. It was so arranged that the finished metal in the furnace should have something like the following composition: Copper, 16 ozs.; tin, 1½ ozs.; zinc, ½ oz., the resulting alloy being guaranteed to stand a tensile strain of 15 tons per square inch. In all about 4 tons weight of old guns were used in the production of the charge of fully 15 tons. The furnace used in melting this mass of metal is formed of two portions, at right angles to each other—that most distant from the fire terminates in the chimney stalk, and in it the tapping hole is situated. Its total length is about 20 feet, by 3 feet 6 inches in breadth, but prior to its use for these castings its internal capacity was considerably reduced by a layer of firebricks being built. The running of No. 4 stem proved as successful as the others, and among the many features which appeared strange to the ordinary ironmoulder was the reception of some 8 tons of the metal into a kind of reservoir from which it passed through a shutter, raised at will by a lever, and on through no less than thirty runner gates. The extreme liquidity of the metal and its easy flow afforded ample opportunity for manipulation outside of the furnace; and with the great care taken that every attention be paid to the various details of the work, Messrs. Elder & Co. are enabled to turn out what is considered a triumph in the shipbuilding world.—*Iron.*

Planting, and What to Plant.

The selection of trees suitable for various soils and situations should be carefully considered. On light, poor, hilly lands, and moderately exposed, the larch is the most profitable tree to plant for a main crop; when the altitude or exposure is too great for the larch, a shelter screen should be planted with Austrian, Corsican, and Scotch pines, planting the Austrians on the outside or exposed sites, as they are of a more bushy habit than the others, and the best pines grown for shelter. The Scotch and Corsican pines thrive well and make excellent timber on exposed, poor plains, where the larch has been found to be a failure. On the other hand, the larch generally is more vigorous and less liable to disease when grown on the declivities of hills with a southwest, west, or northwest aspect, than in other situations, the reason being that the sun's rays do not reach these aspects so early in the day, and thus the trees do not suffer from late spring frosts so much as when planted on east or southeast aspects. Firs should be planted in judiciously chosen positions to give the most pleasing and natural effects without stiffness and formality. The Douglas and Menzies spruce, Nordman's silver fir, and the Wellingtonia, which are now more plentiful than they have been, and may be bought at moderate prices, might also be introduced in smaller groups in the lower sites, where the soil is tolerably deep and the situation somewhat sheltered; they are all hardy, fast growing, and beautiful conifers, being very effective when planted in groups amongst deciduous trees.

Where hardwoods are planted to form the permanent crop on thin, poor soils, the beech, sycamore, and sweet chestnut are the best sorts to select. When the soil is of a loamy nature and resting on clay, the oak and ash should be planted; the latter, particularly, will prove a profitable tree to plant extensively where the land is suitable to its healthy growth, as the supply of copse or maiden ash timber is at the present time not equal to the demand, and likely to be still more scarce in the market. We would, therefore, say plant ash in preference to any other hardwood when forming new plantations, or filling up copses, wherever it is found to thrive. In copses on poor, hilly ground, sweet chestnut and hazel should be planted where blanks occur; in wet bottom land, alder, willow, and poplar are the most suitable sorts to plant; on chalky lands the hazel alone is sure to succeed best; it is a most accommodating plant, will thrive in almost every kind of soil, and is very profitable as underwood, always commanding a good price and ready sale where there is a demand for grate and hurdle wood.

Whenever the weather is favorable for planting operations, push forward without delay any forest tree planting that may be in progress, or the formation of any new plantations which may be contemplated during the present season; also drainage by means of open ditches and trenches, where naturally wet, or where there is not sufficient natural fall for surface water, likewise the enclosure of the ground by the erection of substantial fences to protect the young trees from damage by the inroads of cattle; and the cutting, clearing, and burning of furze, brambles, heath, or any other strong growing material of that kind that is likely to impede the work of planting or interfere with the healthy growth of the plants. These are all necessary preliminaries to forest tree planting that should have been finished ere this, in order that the work of digging the holes and planting the trees may progress speedily during seasonable weather, and when the ground is in a good condition to put in the plants. As soon as the latter are received from the nurseries, they should be taken without delay to the ground where the planters are at work, and heeled in thinly in a trench, their roots being securely covered over to prevent them from getting dry, and to protect them from frost.

[A correspondent of the *London Garden* gives the above information on the selection of trees adapted to various soils. We would add that the present is the season for removing and transplanting large trees; but it is necessary that

provision should previously be made for taking them up with a large ball of frozen earth.—*Eds.*]

Selecting Timber.

There are certain appearances characteristic of good wood, to what class soever it belongs. In the same species of wood, that specimen will in general be the strongest and the most durable which has grown the slowest, as shown by the narrowness of the annual rings. The cellular tissue, as seen in the medullary rays (when visible), should be hard and compact. The vascular or fibrous tissue should adhere firmly together, and should show no wooliness at a freshly cut surface; nor should it clog the teeth of the saw with loose fibers. If the wood is colored, darkness of color is in general a sign of strength and durability. The freshly cut surface of the wood should be firm and shining, and should have somewhat of a translucent appearance. A dull chalky appearance is a sign of bad timber. In wood of a given species, the heavier specimens are in general the stronger and the more lasting. Among resinous woods, those which have the least resin in their pores, and, among non-resinous woods, those which have least sap or gum in them, are in general the strongest and most lasting. Timber should be free from such blemishes as "clefts," or cracks radiating from the center; "cup shakes," or cracks which partially separate one annual layer from another; "upsets," where the fibers have been crippled by compression; "rind galls," or wounds in a layer of the wood, which have been covered and concealed by the growth of subsequent layers over them; and hollows or spongy places, in the center or elsewhere, indicating the commencement of decay.—*Rankine.*

Whitewashing.

Samuel Smith claims, in the *English Mechanic*, that the following is a correct scientific and practical rule: Well wash the ceiling by wetting in twice with water, laying on as much as can well be floated on, then rub the old color up with a stumpy brush and wipe off with a large sponge. When this is done, stop all the cracks with whiting and plaster of Paris. When dry, claircole with size and a little of the whitewash. If very much stained, when this is dry, paint those parts with turps, color, and, if necessary, claircole again. To make the whitewash, take a dozen lbs. of whiting (in large balls), break them up in a pail, and cover with water to soak. During this time melt over a slow fire 4 lbs. common size, and at the same time, with a palette knife or small trowel, rub up fine about a dessertspoonful of blue-black with water to a fine paste; then pour the water off the top of the whiting, and with a stick stir in the black; when well mixed, stir in the melted size and strain. When cold, it is fit for use. If the jelly is too stiff for use, beat it well up and add a little cold water. Commence whitewashing over the window, and so work from the light; lay off the work into that done, and no: all in one direction, as in painting. Distemper color of any tint may be made by using any other color instead of the blue-black—as ochre, chrome, Dutch pink, raw sienna for yellows and buff; Venetian red, burnt sienna, Indian red, or purple brown for reds; celestial blue, ultramarine, indigo for blues; red and blue for purple, gray, or lavender; red lead and chrome for orange; Brunswick green for greens.

The Nautigon.—A New Scientific Instrument.

An instrument for the use of navigators, patented in Europe through the *SCIENTIFIC AMERICAN*, has recently been invented by the Rev. Dr. Thomas Hill, late President of Harvard College, which is called by the manufacturer (C. H. Farley, of Portland, Me.) the Nautigon. It solves instantly, by mere inspection, without the use of tables, any problem in spherical trigonometry, with sufficient accuracy for the principal problems of practical navigation. It requires no more time and no more mathematics to work out an observation by this instrument than to take the sun with a sextant. Thus, with a sextant, chronometer, and nautigon, the navigator needs no logarithmic tables. An observation of altitude gives instantly, by inspection of the nautigon, the ship's time and the azimuth of the sun or star, enabling the observer at once to get his longitude and the deviation of compass. The time of rising or setting of any heavenly body and its azimuth is determined with the same ease. The course for great circle sailing is also visible from inspection of the instrument. If the chronometer is out of order, the nautigon gives the altitude of moon and star, making it only necessary to observe the distance with a sextant. The correction of the lunar distance is the only problem too delicate for the nautigon, which gives angles to the nearest minute of arc; it would be too expensive for ordinary use, if it were made for the nice adjustment of seconds of arc. Even here, however, the corrected distance can be found, to the nearest minute, by the nautigon, giving a valuable check on the computation, easily applied.

A NEW SUN.—M. A. Cornu, in a note to the Paris Academy of Sciences, gives an account of his spectroscopic observations of the new star, 4th to 5th magnitude, lately discovered in *Cygnus*. The light of the star, he says, appears to possess exactly the same composition as the envelope or chromosphere of our sun.

DWELLING HOUSES IN LONDON.—In a quarter of a century, from 1849 to 1874, more than 270,000 houses are declared to have been added to London, making an average of 10,813 houses per annum; and in one particular year of commercial activity, at least 18,000 were built.

IMPROVED UPRIGHT MOULDING MACHINE.

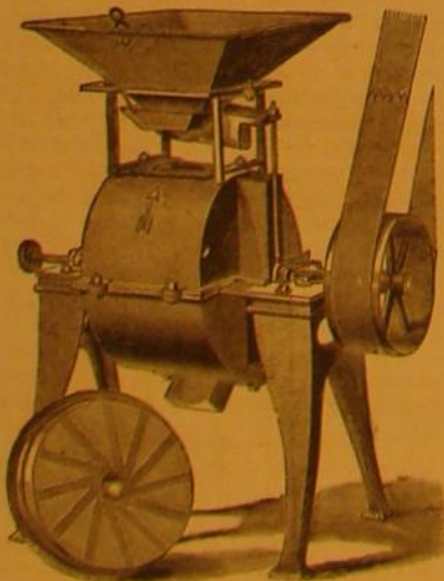
In the improved upright moulder shown in the accompanying illustration, there are several excellent features. The table is lowered or raised by turning the hand wheel, while the socket of the table, being a plain and truly bored hole, fitting to a neat working fit over the thread upon the standard, is always kept true and is not liable to get out of true, as it would be were it threaded itself. Furthermore, the table, being fastened with a set screw, will stand true even though the table socket had worn so as to become loose upon the screw or thread. Upon the thread on the standard, a groove is cut down to the bottom of the thread or a little below it; and into this groove the end of the set screw projects. Thus the table is prevented from turning, while the set screw is prevented from damaging the thread upon the standard. The tables upon all large machines are made square, as shown in our engraving; while those for small machines are made round, as shown in the engraving in our advertising columns.

The spindle or shaft, it will be seen, is provided with cone bearings, running in composition brass boxes, at top and bottom, the lower one being of smallest diameter, so that it will pass through the upper one when putting the shaft into its place. Beneath the lower bearing is placed the set screw shown in the sectional view; by means of which screw a perfect adjustment of the bearings may be made. In both the upper and the lower boxes are enclosed cavities for the introduction of cotton waste or other similar material and oil, so that perfect lubrication is ensured while the bearing is at the same time kept clean. To further ensure this latter object, the oil holes are provided with plugs, easily removable when the bearings require a new supply of oil. The spindle is made of the best cast steel; and from the design of its bearing and the proximity and rigidity of the bearings, it runs at the highest of speeds with quietness and without undue wear. The cutter carrier, or cutter spindle, is coned similarly to a lathe center, and is furthermore held to its place by a nut; so that, while it is certain to run true, it is at the same time capable of carrying any required amount of cut; and it also enables the cutter spindles to be changed from $\frac{3}{4}$ to $\frac{1}{2}$ and 1 inch, to suit light or heavy work. The loose pulley is made self-oiling by a very simple device; and it is a noteworthy fact that there is not a bolt and nut about the whole machine. The cutters are reversible, and danger of accident is removed by the use of the guard shown. The machine is of good material, and it received the highest awards at the American Institute Exhibition of 1875 and at the Centennial Exhibition.

For further particulars, address the patentee and manufacturer, J. H. Blaisdell, 20 North 4th street, Philadelphia, Pa.

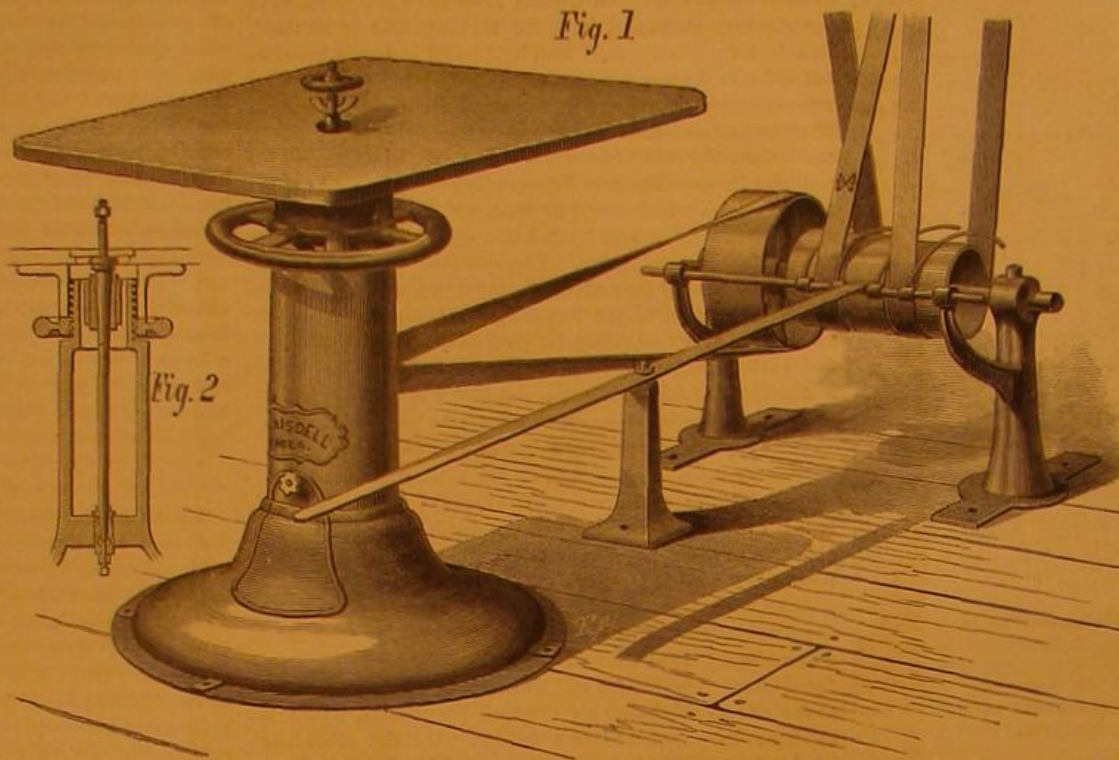
THE SCIENTIFIC GRAIN MILL.

We illustrate herewith a new mill for grinding grain, middlings, minerals, or paint. Among the advantages claimed are that it requires no costly counter shafts and large pulleys



in order that a high speed may be obtained. It is a French burr mill and corn cob breaker combined; it will remain true in line while shaving both sides of tender bran between the millstones; it has journal boxes with caps to take up wear; it is simple in design; and finally, the millstones may be easily removed and dressed.

The bedplate is cast solid in a single piece. It has the stone case in the middle, with large dirt spaces at each end, so that the dirt falls to the floor without passing into the journal boxes. The space around the stones measures $2\frac{1}{2}$ inches, and there is a bottom discharge to prevent clogging. The bedstone is secured in an iron ring, bolted against the end of the stone case, forming a dust-tight joint. It is trammed to the runner with three set screws. The journal boxes, which, as already stated, have caps to take up wear, are lined with Babbitt metal, and are seven inches in length. The screw conveyor, corn cob breaker, eccentric, and pulley are all fast to the spindle, the latter being cast to the running

**BLAISDELL'S UPRIGHT MOULDING MACHINE.**

stone with zinc. The temper screw at one end of the bedplate rests against a hard plate, and the latter against the spindle. The pulley has a hub on one side, and the journal box passes half way through on the other side, to remove the strain of the belt from the spindle. This allows the belt to approach from any angle, and to be removed without unsewing. The mill is raised on legs as shown, so that a bottom discharge is allowed, while the expense of a foundation is avoided. The hood rests upon the bedplate, there being a heavy twine packing between the two; and a large feed trunk at its end extends down to the cob breaker. The feed shoe is dammed in front by the eccentric on the spindle, and the hopper has a valve in the bottom to control its discharge.

The manufacturers state that either the 12, 20, or 30 inch mill will make first quality of wheat or rye flour after having been ground into face, turning out fine large bran, discharging the flour round, live, and cool, making as good a yield as any four foot stone, and all this without keeping the flour between the stones, rubbing, heating, and killing it long after it is fine and should be discharged. This mill is especially adapted for regrinding middlings, and requires one horse power for every 300 lbs. per hour. When grinding paint in oil, two scrapers are added, one L-shaped, bolted against the hind side of the running stone. This scrapes the case clean outside of both stones. The other scraper is bolted to the bedstone, passes inside the L scraper at its free end, and scrapes the running stone clean. An open space around both stones is thus kept.

For further information, address the manufacturers, Messrs. A. W. Straub & Co., 1357, 1359, and 1361 Ridge avenue, Philadelphia, Pa.

Simultaneous Weather Observations.

Every day, at precisely 7:35 o'clock, A. M., Washington mean time, simultaneous weather observations are taken from 106 stations in the United States, from the deck of every United States naval vessel, no matter in what part of the world she may be, from 8 stations in the West Indies, 28 in Canada, 58 in Great Britain, 6 in Algeria, 13 in Austria, 1 in Belgium, 6 in Denmark, 48 in France, 23 in Germany, 1 in Greece, 30 in Italy, 1 in Japan, 4 in the Netherlands, 4 in Norway, 4 in Portugal, 27 in Russia, 2 in Spain, 6 in Sweden, 2 in Switzerland, and 6 in Turkey. There is now needed only the organized aid of the mercantile marine, which can be given without loss of time, to place the entire northern hemisphere under a system of daily observations.

A Snake Rain.

The Kentucky meat shower, which attracted so much attention recently, has now been supplemented by a rain of live snakes in Memphis, Tenn. Thousands of little reptiles, ranging from a foot to eighteen inches in length, were distributed all over the southern part of the city. They probably were carried aloft by a hurricane and wafted through the atmosphere for a long distance; but in what locality snakes exist in such abundance is yet a mystery.

What Came in a Potato.

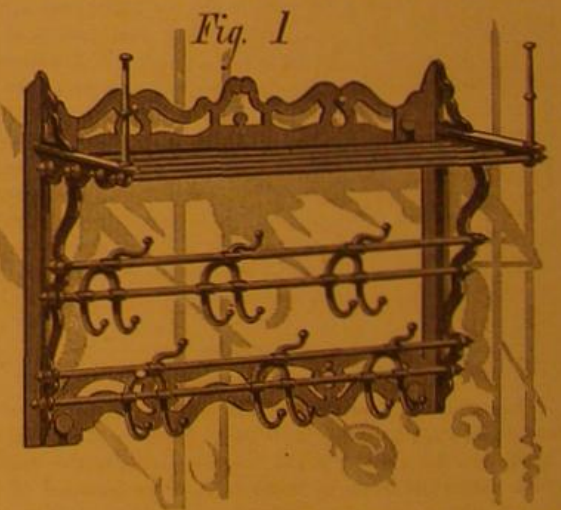
A friend of ours received a day or two ago through the post office, from Olympia, Washington Territory, a roundish, irregular package, which on examination proved to contain a large potato. Further investigation showed that the potato had been cut in two and the inside scooped out, and in the cavity were found flowers and leaves, which, as he learned by a note previously received, had been picked in a garden in the open air on the 26th day of December. The flowers, pansies, geraniums, and others, were as fresh and bright as if they had been gathered within an hour, though their journey across the continent had occupied 15 days. Olympia is in about the latitude of Quebec, though its winter climate is not more severe than that of Memphis.—*Worcester Spy.*

Training Camellias.

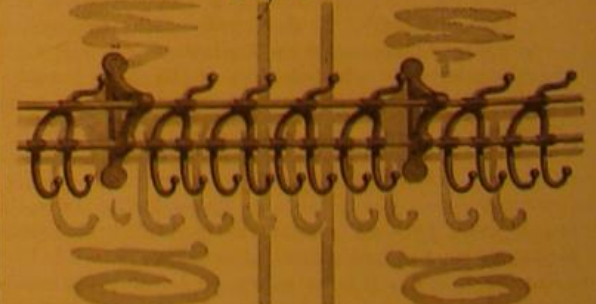
It is seldom that one sees camellias trained, says the *London Garden*; still it is perhaps as good an arrangement as can be effected with old spindly plants. If the branches be tied in as closely as possible, they will soon break freely from the old wood and make well furnished plants, which they will rarely do if left to themselves. Plants of this description are excellent for planting at the foot of pillars or iron supports in a conservatory. They furnish the lower part with green foliage where ordinary creepers would not succeed; and when other large growing creepers are trained up these pillars to the roof, the camellias serve to hide the ugly, bare stems; and when in a healthy condition and full of flower, they are exceedingly attractive.

IMPROVED HAT AND COAT RACK.

A large number of the portable hooks for the suspension of garments, hats, etc., are pivoted or otherwise arranged in wooden frames, so that their construction is not very strong. At the same time, the relative position of the hooks is fixed,



and there is no convenient way of adjusting them to afford space between for voluminous garments. In the present invention, the hooks are very strongly supported, and may be moved either close together or far apart as desired. To this end, the hooks (which, in common with the entire contrivance, are of metal) slide on parallel rods, which pass through suitable apertures in them. The rods are secured in neat brackets, and may be continued along indefinitely or placed as shown in Fig. 1, which is a hat and coat rack, the shelf of rods above serving to receive the hats. Fig. 2 represents the single line of hooks and rods as adapted for a wardrobe.

Fig. 2

The hooks, it is claimed, cannot break off or pull out, while they may be disconnected from the rods and the latter from the brackets at pleasure.

For further particulars regarding agencies, sale of rights, etc., address the inventor, Mr. Russell R. Dorr, 206 Third street, Burlington, Iowa.

THE LARGEST FLOWER IN THE WORLD.

The wonderful flower represented in our engraving is that of the *Rafflesia Arnoldi*, a plant discovered by Dr. Arnold in the Island of Sumatra some sixty years ago. The various species now known are all parasitic, not, however, to the branches of other plants, but to the roots. Entirely destitute of leaves and green in color, these singular vegetables are provided with scales or bracts which conceal and envelope the flower previous to opening. A swelling beneath the bark of some huge surface-appearing root of a large tree announces the coming of a flower. Soon the bark splits, and the bud, resembling the head of a young cabbage, bursts, showing five great lobes which open and roll back slightly on the edges. Then a circular ring appears surrounding a deep cup, in the center of which is the ovary. Below the edges is a kind of gallery wherein are numerous stamens in which is located the pollen, the fecundating action of which it is impossible to comprehend unless it be assumed that insects intervene for its transportation.

The remarkable feature of the flower is its colossal size, the largest species, here represented, being 39 inches in diameter. The central cup holds six quarts of liquid, and the total weight of the flower is over 15 lbs.

The *Rafflesia patina* of Java is somewhat smaller in size. The brick red color of the perianthus, as well as the lighter spots with which it is sprinkled, give to the flower a curious flesh-like appearance. The cup and the central plateau carrying the stamens are of a dark red, while the odor of the plant is almost meat-like. In Java, the natives regard the flower as sacred, and the priests prepare from the tannin which it contains an astringent mixture useful in cases of hemorrhage.

Bronzing Composition.

A composition of about 6 parts sulphate of potassium or similar sulphate, 6 parts of salt of lead, 12 of ammonia or similar salts, 3 parts acetic acid, 3 of hydrochloric or similar acids, when in combination, form a mixture with which Mr. L. J. Roucou, of Birmingham, England, gives to articles manufactured of copper, brass, zinc, or other metals, the color of bronze, as desired, by bath or application. By altering the proportions, and adding or taking away from any of the above described substances, he obtains a different mixture, which, when applied to the surface of works or articles made of gold, silver, and other metals, whether by brushes or otherwise, will preserve to the said works and articles their original color, and prevent their oxidization.

The Andes and the Amazon.

In a review of this new work by Professor James Orton, of Vassar College, the editor of *Nature* says: "We know of no single work containing a fuller, more brilliantly written, and at the same time more trustworthy general account of the basin of the Amazon and its many wonders. We are sure that all into whose hands the work may fall will agree that few more attractive and at the same time more instructive works of travel have been written." We may add that a considerable portion of the valuable information given in this work was originally presented to the public in the *SCIENTIFIC AMERICAN*, in the series of letters written to us from Brazil and Peru by Professor Orton during his original explorations. He is now again in South America making further investigations of the same region; and if his time permits our readers will have some additional contributions from his pen.

ASPARAGUS IN WINTER.

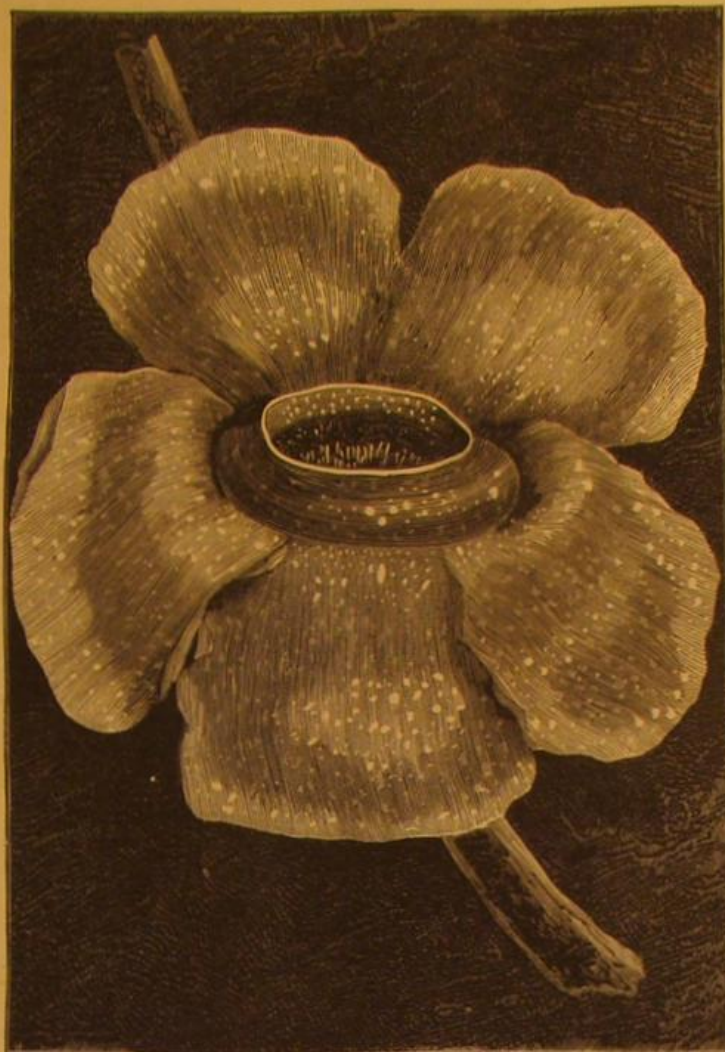
There is probably no vegetable that repays the trouble of artificial cultivation better than asparagus. It grows rapid-

Fig. 1.



ly and attains great size when properly cared for; and it may be made a source of great profit, large quantities of it being grown under glass in France, and sold in winter at high prices. M. Jacquissou, of Chalons, France, a well known horticulturist, has introduced a plan of forcing asparagus, so simple that our engraving (Fig. 1) is sufficient to explain it. He uses an ordinary wine bottle with the bottom cut off. These bottomless bottles, when well corked, are placed over the asparagus head just as it is beginning to rise above the ground. The asparagus being thus protected not only grows

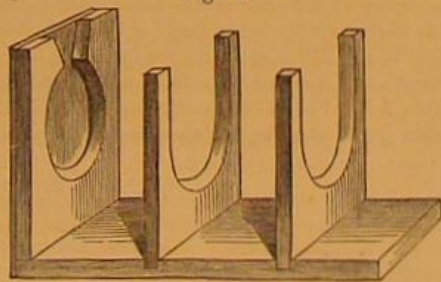
fast, but is so tender that the whole of it may be eaten. The air being kept from it, the development of the woody fiber of the plant is retarded, while that of the cellular tissue is accelerated. Cultivated in this way, asparagus is as expeditiously cut as when grown in the ordinary manner, sufficient light passing through the bottle to show when the heads are ready for gathering. In addition to this, the small amount of light which passes through the bottle gives the asparagus a rosy tinge which greatly improves its appearance.



THE RAFFLESIA.

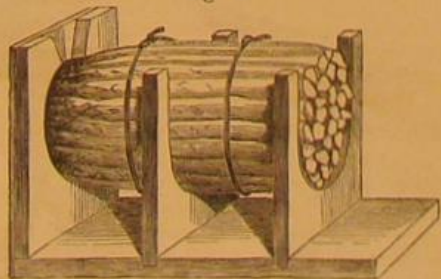
Numerous simple devices for holding the heads of asparagus while they are being tied in bunches are in use; and they are useful to the gardener, as carefully put up bunches are far more salable than irregular bundles of unevenly arranged heads. Fig. 2 shows an implement of this kind,

Fig. 2.



called the Sartrouville buncher. When filled, the tips of the heads are brought close together, the diameter of the space for the tips being less than that of the other openings in the

Fig. 3.



upright boards. When the frame is nearly full, the shoots are passed in through the wedge-shaped opening shown. Fig. 3 shows the same buncher when filled.

A New Solvent for Silk.

Schlossberger first suggested the use of an ammoniacal solution of protoxide of nickel for dissolving silk. Persoz proposed to use chloride of zinc, and Spiller used concentrated hydrochloric acid. J. Loewe recently described a new solvent, the cold alkaline solution of copper with glycerin, which is not inferior to the above, and with great dilution surpasses them. In very weak solutions, the silk is acted upon slowly; if moderately concentrated, the silk swells up on moistening it a short time; and with a larger quantity it soon dissolves to a thick liquid, which can be filtered, although it filters slowly. By adding hydrochloric acid to the

filtrate, the dissolved silk separates in the form of a white jelly; frequently this separation is very slow, and the filtrate appears like a cold solution of gelatin. Wool, cotton, and linen, after being in contact with this solution for hours, is neither attacked by it nor taken up by it. It appears as if the solvent power of the alkaline glycerin and copper solution only extends to the silk. In mixed fabrics, the silk may be readily detected, and even quantitatively determined.

Silk which has been dyed black with iron salts dissolves with more difficulty and less completely, for the reason that the fibers are surrounded and protected by the insoluble oxide of iron. Such silk should be soaked for some time in sulphide of potassium or ammonium, and washed, and the sulphide of iron thus formed dissolved out with dilute hydrochloric acid. It then dissolves more readily, because of the partial removal of the iron. By treating the sample with dilute hydrochloric acid and metallic zinc, in special cases, this end may be accomplished. Silks dyed with other colors do not exhibit this difference in solubility, which depends upon the protecting action of the iron salts. In black mixed fabrics this treatment must precede the test for the other fibers. White wool acquires a blue-black color in the copper solution, but this is easily removed by an acid bath.

The alkaline copper solution is prepared as follows: Dissolve 16 parts of pure sulphate of copper in 144 to 160 parts of distilled water, and add 8 to 10 parts of pure glycerin, specific gravity 1.24, and mix thoroughly by shaking. Into this, while cold, drop slowly a solution of caustic soda until the light blue precipitate of hydrated oxide of copper at first formed is completely dissolved to a dark blue liquid, which is preserved without filtering in a closely corked bottle. If the ingredients are pure, it will keep for an indefinite length of time without the slightest change. It should not be kept in glass stoppered bottles unless the stoppers are waxed.

This solution may also be used hot to detect the presence of grape sugar or glucose, in the usual manner.

THE PINKS.

A French contemporary remarks with much reason that the constant production of novelties in floriculture has caused many beautiful flowers to disappear from our gardens. Rare and new varieties engage so much attention that the simple originals, from which so many costly specimens are directly derived, are almost forgotten.

The pelargonium is now sought for, not the geranium; the tea rose and the yellow rose are more frequently seen in hot houses than the hundred-leaved and the moss roses with which we used to be familiar; and the carnation has caused the humble pink to be slightly passed by. But the last named flower is one of singular beauty, and is known in great variety of colors and delicate gradations of tint; and its blossoms, which are grouped together at the top of firm stalks, are particularly well adapted to bouquets. It is hardy, and will readily accommodate itself to change of soil and climate. It is readily multiplied by slips or cuttings, although it may be grown from seed; and a mass of the plants two or three feet in diameter will form when in full blossom an ornament on which any garden may fairly boast itself. Three distinct



shades of color are shown in our engraving; but the number of tints of this pink family is very large, and all the varieties yield a powerful and agreeable fragrance.

A TRANSPARENT mucilage of great tenacity may be made by mixing rice flour with cold water, and letting it gently simmer over the fire.

SPOKE-MAKING MACHINERY.

Our extracts this week from Knight's "Mechanical Dictionary" relate to lathes, planers, and other machines for making spokes. This apparatus, owing to the irregular forms of spokes, is specially constructed for their manufacture, and embodies mechanical devices of exceeding ingenuity. In Fig. 1 is illustrated a

SPOKE LATHE, based on Thomas Blanchard's lathe for irregular forms. The spoke is placed between centers in a lathe head, and is approached to or drawn away from a cutter, in accordance with the shape of a pattern which governs the proximity of the tool to the work. The pattern spoke is in the upper part of the machine, and the guide pieces on each side govern the position of the revolving cutter, which acts upon the material placed between the lower centers.

The lathe shown in Fig. 2 is adapted for turning handles for axes and other implements, as well as spokes. The work, *a*, and pattern, *b*, are fixed between centers and revolved upon a carriage, which is automatically traversed in a longitudinal direction, and at the same time swung by the upright guide, bearing against the pattern, so as to present the work to the action of a set of cutters fixed in the rotary head, *d*; the amount of this swing and consequent penetration of the cutters is dependent upon the shape of the pattern, of which the work is thus caused to present an exact copy. Adjustments are provided for forming several sizes of work from the same pattern.

Fig. 3.

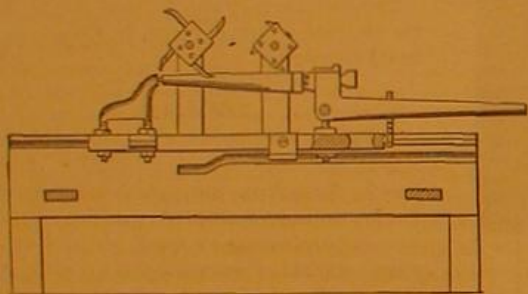
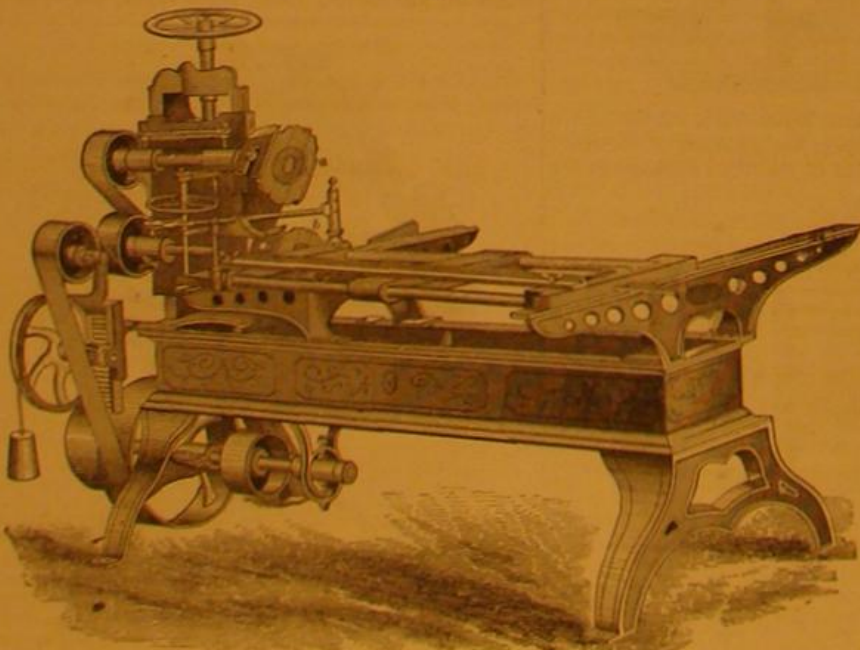


Fig. 3 is a machine for dressing a spoke lengthwise of the stuff, the spoke or the cutter being so moved, the one relatively to the other, that the required shape is produced. In the example, the piece is clamped between the dog in the bent lever and the opposite center; the clamp lever is held in position by a support placed under it and upon the bench. The carriage is reciprocated on the ways, beneath the roughing and the finishing cutter, a guide bar determining the presentation to the cutter, so as to confer the proper shape.

Fig. 4 is a machine for centering a hub, so that it may be bored truly for the spoke mortises. The standard forms a support for the adjustable portions of the apparatus. The

Fig. 7.

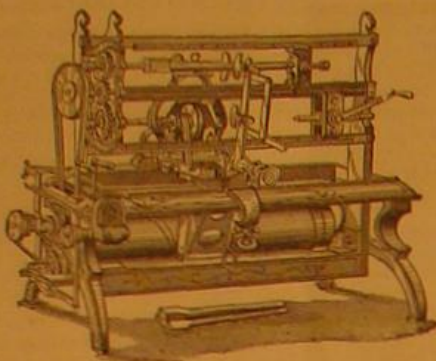


point of the hub rests on a block keyed up by wedges. The butt of the hub rests on a pivoted bar whose carriage is vertically adjustable on the standard by a lever and rod in the rear. The mandrel bolt clamps the pivoted hub rest to a bar on the back of the standard.

Fig. 5 represents a machine for planing the sides of spokes and bringing them to a uniform shape; the edge of the tenon may be tapered at the same operation if desired. The spoke

is placed upon the table, *c*, where it is held against a stop, adjustable to different sized spokes; the table is pushed forward to an amount determined by the previous adjustment of a collar on the stop, bringing the side on the spoke in contact with the cutters on the rapidly rotating cutter head, *b*, which at once dress that side of the spoke and tenon; it is

Fig. 1.



then turned over, and the other side similarly dressed. On drawing the spoke forward and releasing it from the stop, the desired bevel is given to the edge of the tenon by means of the cutters, the particular inclination being determined by an adjustable angle gauge.

SPOKE-TENONING MACHINES

are used for forming the tenons on the outer ends of spokes. In Fig. 6 the hub, having the spokes inserted, is placed on a circular iron plate upon the workbench, and is held fast by

Fig. 4.

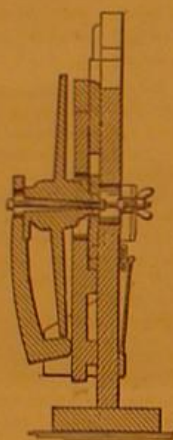


Fig. 5.

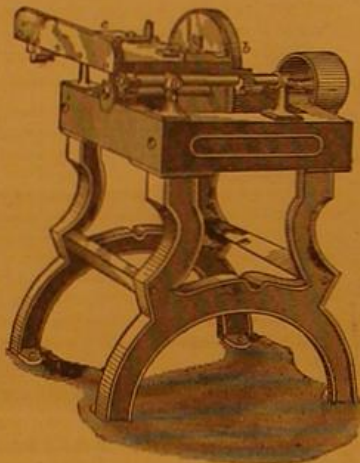
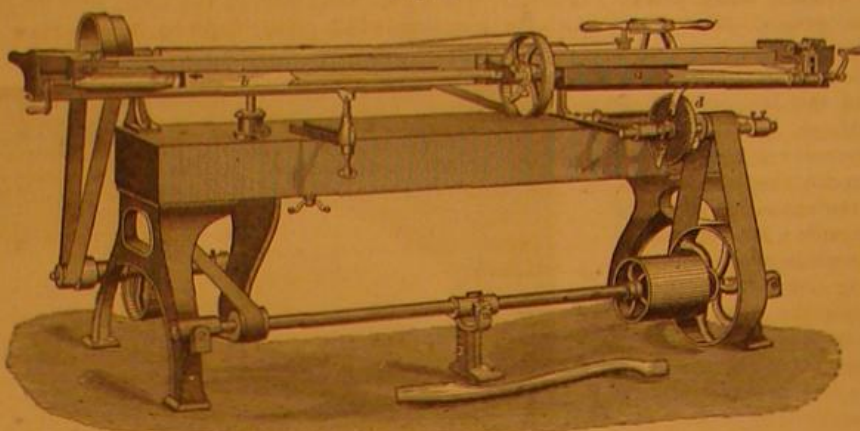


Fig. 2.

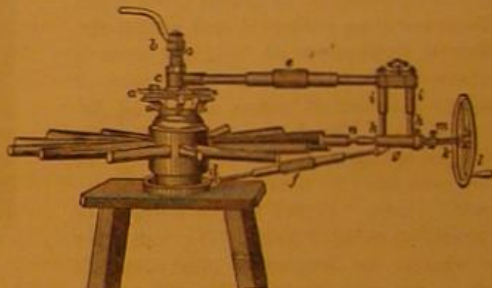


The machine is intended for shaping and smoothing the throats or necks of spokes, preparatory to insertion in the hubs. It has an iron frame. The cutter head revolves on a steel shaft, running in self-oiling boxes, and can be so constructed as to make the throat of any desired shape. The frame upon which the spoke to be throated rests is hinged on a slide bar which passes back and forth over a guide, which, in connection with the knives on the cutter head, regulates the shape of the throat. The spoke is placed under a lever, and held firmly while passing back and forth; ordinary spokes can be throated on both sides by simply changing the guard, which is accomplished by the hand lever on the end of the machine. A

SPOKING MACHINE

is represented in Fig. 9, and is used for setting spokes in the hub with a uniform dish. It has a fixed standard, A, and

Fig. 6.



a movable standard, C, carrying pillow blocks adjustable as to height by means of screws, and a head, N, which may, to vary its elevation, be hinged in either one of a series of notches, P. The hub is laid with its ends resting in the pillow blocks, and clamped by the rod, J, which works into a nut; and the spoke is adjusted to the required dish, and firmly held, while being driven, by means of a gage block, Q, operated by a cranked screw, R; while a hook and chain, U, attached to a bevel-edged lever engaging one of the notches in the rack T, hold it to the gage, and prevents its moving too far in the opposite direction. Each spoke is successively driven and the wheel removed, the head, N being turned on its hinge.

Damp Walls.

The walls of a building are liable to be charged with moisture, 1, by wet rising in them from the damp earth; 2, by

Fig. 8.

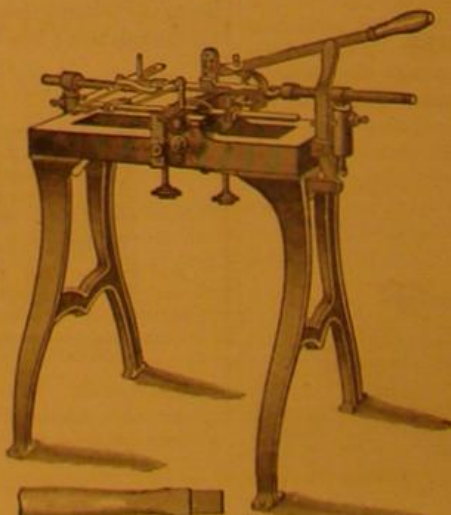
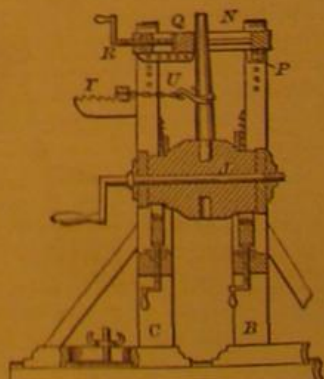


Fig. 9.



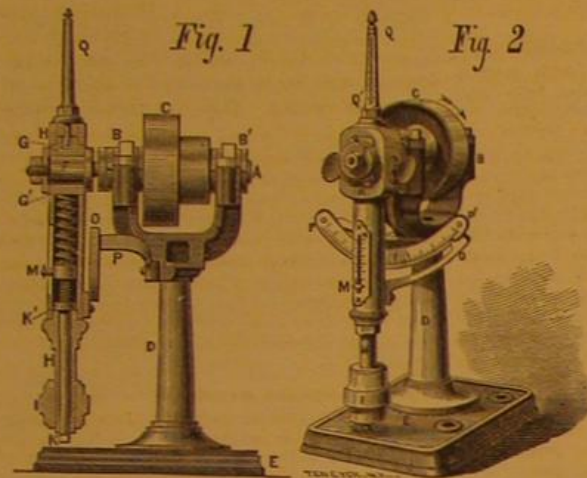
side, and turns freely in the guide unless held by a set screw; when this is made fast, the screw shaft, *k*, feeds in either direction, according as the hand wheel, *l*, is turned to the right or left. The depth of tenon is gaged by a collar, *m*, adjustable at any point on this shaft. The tenons are formed by a hollow auger held by the brace, *n*, the apparatus being rotated around the fixed hub as a center.

The machine shown in Fig. 7 is adapted for tenoning cabinet work as well as spokes. The two cutter heads, *a* and *b*, are

rain falling upon the exterior of the walls; 3, by water from the roofs or leaking gutters soaking into the tops of the walls. Of these evils, the first may be prevented by the construction of dry areas or air drains, and by the introduction of damp-proof courses; the second, by impervious outer coatings or by the use of hollow walls; and the third, by the use of projecting eaves with proper gutters, or, where parapet walls are used, by an upper damp course.—Notes on Building Construction

IMPROVED LUBRICANT-TESTING APPARATUS.

We illustrate herewith Professor R. H. Thurston's machine for testing lubricants, the construction of which is clearly shown in the sectional view, Fig. 2. At F is the journal on which the lubricating material is to be placed for test. This journal is on the overhung extremity of a shaft, A, which is carried in bearings, B B', on a standard, D D', mounted on a base plate, E E'. The shaft is driven by a pulley, C, at any desired speed. Where desirable, a counter may be placed at the rear end of the shaft to indicate the number of revolutions. Usually, the shaft is driven at a fixed speed, corresponding to the velocity of rubbing surfaces approximating that of journals on which it is proposed to use the oil. In the inventor's practice, a standard speed of 750 feet per minute is adopted. The test journal, F, is grasped by bearings of bronze, G G', and with a pressure which is adjusted by the compression of a helical spring, J. This spring is carefully regulated, and the total pressure on the journal and the pressure per square inch are both shown on the index plate, N N', by a pointer, M. Above the journal is a thermometer, Q Q', of which the bulb enters a cavity in the top brass, and which indicates the rise in temperature as wear progresses.



The brasses, thermometer, and spring are carried in a pendulum, H, to which the ball, I, is fitted; and weights are nicely adjusted in such a manner that the maximum friction of a dry but smooth bearing shall just swing it out into the horizontal line. The stem, K K', of the screw, which compresses the spring, projects from the lower end of the pendulum and can be turned by a wrench. A pointer, O, traverses an arc, P P', and indicates the angle assumed by the pendulum at any moment. This angle is very large with great friction, and very small with good lubricating materials. This arc is carefully laid off in such divisions that dividing the reading, by the pressure shown on the index, N N', gives the corresponding co-efficient of friction. The machine can also be arranged to give the friction directly.

In practical use, a standard quantity of oil is placed on the journal. The bearings are slipped on and set up to the proposed pressure; the machine is started at the speed determined upon, and the observer notes the time, speed, pressure, and temperature. These observations are repeated and recorded at regular intervals, and cease when a rapid rise of temperature to an objectionable or dangerous extent indicates that the lubricant has become destroyed.

The machine is made by the mechanical laboratory of the Stevens Institute of Technology, Hoboken, N. J., and by Messrs. Bailey & Co., of Salford, near Manchester, England. It is adapted to the uses of makers of and dealers in lubricating materials, and all classes of consumers of the same. It was patented through the Scientific American Patent Agency.

The American Railway System.

The total length of the railways in operation in the United States on the 1st day of January, 1877, was seventy-six thousand six hundred and forty miles, being an average of one mile of railway for every six hundred inhabitants. The railways are as follows:

Miles.	Miles.	Miles.
Alabama..... 1,722	Kentucky..... 1,464	Ohio..... 4,680
Alaska..... 0	Louisiana..... 589	Oregon..... 251
Arizona..... 0	Maine..... 967	Pennsylvania..... 5,866
Arkansas..... 787	Maryland..... 1,092	Rhode Island..... 182
California..... 1,854	Massachusetts..... 1,825	South Carolina..... 1,352
Colorado..... 950	Michigan..... 3,437	Tennessee..... 1,638
Connecticut..... 925	Minnesota..... 2,024	Texas..... 2,072
Dakota..... 290	Mississippi..... 1,028	Utah..... 486
Delaware..... 285	Missouri..... 3,016	Vermont..... 810
Florida..... 484	Montana..... 0	Virginia..... 1,648
Georgia..... 2,308	Nebraska..... 1,181	Washington..... 110
Idaho..... 0	Nevada..... 714	West Virginia..... 576
Illinois..... 6,090	New Hampshire..... 942	Wisconsin..... 2,575
Indiana..... 4,072	New Jersey..... 1,594	Wyoming..... 459
Indian Territory..... 281	New Mexico..... 0	
Iowa..... 3,957	New York..... 5,520	Total..... 70,640
Kansas..... 3,226	North Carolina..... 1,371	

A New Fire Detecting and Extinguishing Apparatus for Ships.

Mr. Daniel W. Howes, of East Dennis, Mass., has patented through the Scientific American Patent Agency, November 14, 1876, a novel means both for detecting and extinguishing fires on shipboard, one and the same apparatus serving both purposes. A system of perforated pipes is led through the hold or other portions of the vessel to be protected and connected with a fan blower. The latter communicates with a receptacle for carbonic acid gas. In order to remove hot air or dangerous gases produced in the process of spontaneous combustion, connection between fan and gas recep-

tacle is shut, so that the former acts as an exhaust. If any fire be present in the hold, the smell of smoke in the air withdrawn, will announce the fact. If such is found to be the case, communication with the carbonic acid gas reservoir is opened and the air discharge of the blower closed, so that the latter then forces the gas through the pipes, whence it escapes at the perforations and so extinguishes the fire.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED DUMPING DEVICE.

William Willes, Salt Lake City, Utah Terr., assignor to himself and Wm. H. Rowe, of same place.—This invention was illustrated under the name of the "Lightning Dumper" on page 4 current volume. It is an excellent and strongly constructed device for loading and unloading vessels and vehicles with substances that may be dumped without injury; for dumping mortar and rubble in building concrete walls, and for other similar uses.

IMPROVED RETORT FURNACE FOR STEAM BOILERS.

George K. Stevenson, Valparaiso, Chili.—This inventor proposes a new furnace for burning coal dust, which is made in the shape of a retort, of firebrick, open at both ends, and provided with radial or inclined discharge channels at the upper parts. This is placed in position on the supporting walls, and is partly charged with a quantity of wood and coal, and lighted. The apparatus by which the powdered fuel is introduced is then placed in position and the fuel fed to the furnace, after the coarse fuel is thoroughly ignited by the blast from a blower used in connection therewith. The powdered fuel is then continually introduced, care being taken to remove the ashes from beyond the mouth or inner end of the retort, which can be done in a few minutes. The apparatus may be detached and replaced, and the operation proceeded with, without a great decrease of temperature, as the firebrick retort retains some of the heat from previous firing. The fuel is said to be completely consumed by the addition of air injected with the same into the retort, and thereby a high and uniform degree of temperature be kept up, while the fire may be instantly interrupted without the loss of large quantities of fuel, and also be started again with great rapidity, so as to facilitate the getting up of steam in boilers.

IMPROVED FORCE PUMP.

Chas. Houston McKeehan, Texarkana, Ark.—The pump consists of four vertically-acting plungers, operated in pairs, alternately, by slotted reversely-vibrated levers. The plungers force the water out of a valved receiving or suction chamber into another, whence it passes into the exit pipe.

IMPROVED ORE-ROASTING FURNACE.

William K. Aldersley, Colusa, assignor to Abbott Quicksilver Mining Company, Colusa, Cal.—A useful invention for the reduction of quicksilver ore, devised by an inventor well acquainted with the practical necessities of the industry. The forming of adobes of fine dirt is dispensed with, and the ore reduced by the application of heat, both to the top and bottom of the ore, during its gradual passage through the furnace. The latter is provided with double fireplaces, and a double inclined roasting sole, along which the ore is fed from a feed hopper, with adjustable check, to the slag pit. A longitudinal partition divides the furnace into two sections, through which the fire is drawn, passing over the top of the ore, while a heating chamber below the furnace floor heats up the ore from below. We are informed that the furnace has in practical use proved economical both in time and in fuel.

IMPROVED BOAT-LAUNCHING APPARATUS.

James Strachan, Goderich, Ontario, Canada.—In this device the boat davits are attached not directly to the ship out to horizontal portions which by rollers and guides traverse thwartship ways. They are connected and secured laterally by diagonal braces. They may be moved bodily inboard, so that passengers can easily step into the boat from the deck. The davits are moved outboard and the boat is lowered in the usual way.

IMPROVED TALLOW CUP.

Devore Farmer, Fort Madison, Iowa, assignor to Hugh McConn, of same place.—An excellent invention which will doubtless prove of great convenience to millers. The cup in which the tallow is placed also receives the spindle. When the latter becomes heated the tallow of course melts and runs down into the bush. Friction is thus relieved, the spindle cools and the melting ceases, and this operation is repeated as often as the heating occurs. The action is therefore entirely automatic. The cup is applicable to vertical shafts of various descriptions, and is effective in preventing heating and the accumulation of dust.

IMPROVED WINDMILL.

Charles B. Post, New London, O.—This embodies a new and simple construction of the governing mechanism which renders the windmill self-regulating under any wind pressure. There is an ingenious combination of regulated levers which as the wheel revolves with increased velocity turn the vanes so as to expose less surface to the wind. The vanes have a twisted or winding surface. This seems to be a device well calculated to add to the efficiency of perhaps the cheapest motor a farmer can use.

NEW HOUSEHOLD INVENTIONS.

IMPROVED SAD IRON.

Salathiel C. Fancher and William W. Judson, Kansas City, Mo.—In this improved reversible and self-heating sad iron there are novel means whereby the flow of alcohol from the lamp to the burner is regulated, and a new and valuable feature is supplied in a tube that extends from a point near the top of the lamp to the interior of the sad iron, running along the wick tube to the burner, where the gas generated in the lamp by the heat of the iron is consumed as fast as generated.

IMPROVED LAMP EXTINGUISHER.

Martin P. Flanders, An Sable Forks, N. Y.—A useful safety appliance for lamps so constructed that the leverage exerted by a sliding weight and wire frame on a cap swings the same over the wick tube, and extinguishes thereby the flame without being obstructed by sticky coal and oil particles, as is frequently the case with the common sliding extinguishing tubes in use.

IMPROVED FLY FANS.

Samuel W. Mills, Kingsville, Mo.—This is an ingenious arrangement of fans secured to a vertical shaft which rises from the center, say of a dining-table. By means of a very simple treadle and pulley mechanism some one sitting at the table can cause the shaft and fans to rotate and so drive flies from the dishes.

IMPROVED DOUGH KNEADER.

Ezra Staples, Rochester, N. H.—It is well known that nothing is so essential to the production of good light bread as thorough kneading. When large batches of dough are to be worked, this becomes an exceedingly arduous operation; and even in the small quantities necessary for family use the work is by no means light. The present inventor therefore merits the thanks of bakers and housekeepers for an ingenious machine for kneading the dough in a thorough manner. By turning a roller in one direction, and then in an opposite direction, a moulding board is carried forward and back simultaneously beneath it, while a top roller with eccentric cams serves to regulate the pressure of the kneading roller on the dough.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED ORGAN ACTION.

Archibald N. Hanna, Murray, Ind.—This invention consists of the arrangement of several sets of reeds that are operated with or without stops, by different pressure on the keys, a light pressure operating only the first set of reeds, a heavier pressure the first and second sets, by actuating a shorter series of pitman or push pins, and a still heavier pressure, a still shorter series of pins of the third set of reeds. In this way a change of the music from a soft tone to medium or very loud tone, and, vice versa, from a loud tone to medium and a very soft tone, may be accomplished without moving the hands from the key board.

IMPROVED BALE TIE.

Ball Hempstead, Little Rock, Ark.—This improvement consists in constructing an open rectangular frame with a hook upon one of its bars, which hook is extended laterally to the bale band, and formed of one and the same piece of metal with the frame. One end of the band is passed through the open rectangular frame and bent around, while the other is slotted to receive the hook.

IMPROVED SLATE PENCIL SHARPENER.

William H. S. Hennaman, Philadelphia, Pa.—There are few sounds more annoying to sensitive nerves than that produced by the sharpening of a slate pencil with a knife. In schools, where such pencils are constantly required to be sharpened, the operation, besides making constant noise, often involves cut fingers of young children, or else is the cause of perpetual requests to the teacher for its performance. The present invention suggests a simple little device which may easily be attached to every child's desk. It consists in a V-shaped file or rasp, made convex in the direction of its length, and provided with graduated teeth, coarser at the upper and outer edge of the V, where the greater portion of the cutting is done, and finer in the angle of the V, where the point of the pencil is formed. The file is conveniently mounted in a block of wood.

NEW AGRICULTURAL INVENTIONS.

IMPROVED FENCE.

Orlando Cleaveland, Middlesex, N. Y.—The movable panels are supported between short stakes which stand in pairs, those of each pair being inclined toward each other at a right angle or thereabout. The heads of the stakes are bound together by wires, and the projecting ends of the lengthwise boards of the panels lap past each other and rest on the binding wires between the stake heads; a wire brace is also applied for holding the fence panels vertical and rigidly in place.

IMPROVED COMBINED WHEELBARROW AND CULTIVATOR.

John D. O'Callaghan, Chattanooga, Tenn.—The tray and legs of the wheelbarrow are so constructed and connected together that they may be readily detached from the truck or wheeled frame, whenever it is desired to use a cultivating attachment, thus saving the cost of a frame for the latter.

IMPROVED CORN-HUSKING MACHINE.

John Lund, East Oxford, Ontario, assignor to David N. Moore and John Henry, Beachville, Canada.—This is a very ingenious invention that will doubtless interest farmers, as it husks corn very rapidly, whether on or off the stalk. The mechanism consists of a vertically-reciprocating knife, operated by treadle, that cuts off the ear from the stalk, while an ejector, passing down with the knife, releases, by a lever and pawl arrangement, a spiral governing spring, and throws out the ear. The release of the treadle carries the knife up, and draws the ejector back in position to allow its locking pawl to drop into place until the knife descends again for cutting.

IMPROVED CHURN.

Friend Murdock, Centreton, O.—The new feature in this churn lies in the shaft of its rotary dasher which, provided with flanged sleeve in combination with a latch for retaining the crank in place. The general construction embodies many other useful improvements, notably a spout through which hot or cold water may be introduced for tempering the cream. Provision is also made for a thermometer by which the temperature of the contents can always be observed.

IMPROVED AUTOMATIC GATE.

William Nairn, Monterey, Ill.—This is an ingeniously constructed gate, which can be opened and closed by the occupant of a carriage without requiring his moving from his seat. A weight on the side to which the passerby comes is raised by a cord, then the latch is lifted by a cord, when the weight on the opposite side of the gate swings it open. After passing through, the weight which opened the gate is raised, which allows the other weight to close it.

IMPROVED HARVESTER.

James D. Winans and Gilbert Vandusen, Sycamore, Ill.—An endless chain of cutters work in a recess in a cutter bar, and in the forward part of the platform, and the latter is so pivoted in arms that when raised and lowered the necessary gear wheels always remain engaged. New devices are provided to catch the grain and rake it from the platform. The invention as a whole embodies many valuable novelties in construction which commend it to the examination of all agriculturists.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED WAGON GEARING.

Levi W. Frederick, Hall, Ind.—The new features in this invention are, first, a brace that passes along the top of the reach, and its rear end is slotted to receive the rear king-bolt. The brake bar attached to the brace rests upon a plate secured to the forward part of the rear hounds, and has hooks fastened to it, which hook upon the ends of the said plate. The brace plate and hooks keep the brake bar always parallel with the rear axle, and thus in position to apply the brake shoes to the wheels. To the rear side of the brake bar is pivoted a rod which controls the brake mechanism. The invention has for its object to render the gearing stronger, freer in movement, and more fully under the control of the team.

IMPROVED SEWER TRAP.

Frederick B. Wells, Montreal, Quebec, Canada.—This invention suggests a simple and ingenious device for preventing the escape of sewer gas without obstructing the flow of surface water. It consists of a conical or funnel shaped tube, that is supported on a top ring, and provided at the lower end with a cup shaped and weighted trap. The latter extends by an annular flange around the lower end of the cone, to seal the same until it is forced open by the weight of the collecting water. The whole apparatus is easily removable to afford access to the sewer; and the conical shape of the tube prevents its rupture in case of the freezing of the contents.

IMPROVED LEVER PAWL AND RATCHET FOR WAGON BRAKES, ETC.

James R. Robinson, Shawnee Mound, Mo.—This is an ingenious device so constructed that when pressure is applied to force the lever forward the pawl slides over the teeth of the ratchet bar and engages another tooth. Thus the brake is applied with a degree of force corresponding to the pressure on the handle; but the pawl is released from such engagement when the handle is pressed backward.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion. If the Notice exceeds four lines, One Dollar and a Half per line will be charged.

Patent right for sale of a new and useful Shoe Soling Machine. Address W. Manley, Rochester, N. Y. Set of Mechanical Curves, as illustrated in Sci. Am. Supplement, No. 35, mailed on receipt of \$5.25, by Keuffel & Esser, New York.

Pat. Repts. & Sci. Am., cheap. Box 133, Ipswich, Mass. How to lay out the teeth of Gear Wheels, price 50 cts. Address E. Lyman, C. E., New Haven, Conn.

Hyatt & Co.'s Varnishes and Japans, as to price, color, purity, and durability, are cheap by comparison than any others extant. 246 Grand st., N. Y. Factory, Newark, N. J. Send for circular and descriptive price list.

Will purchase or introduce, on a reasonable royalty, some good, useful article. Address, with description and full particulars, A. E. Lowison, Boston, Mass.

Yacht and Stationary Engines, 2 to 30 H. P. The best for the price. N. W. Twiss, New Haven, Conn.

Lightning Screw Plates. A perfect thread at one cut adjustable for wear. Frasse & Co., 43 Chatham St., N. Y.

Wire Needle Pointer, W. Crabb, Newark, N. J.

Send for circular of Brass Hydraulic Engine for blowing organs. Hilbourne L. Roosevelt, Church Organs, New York.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J. Superior Lace Leather, all sizes, cheap. Hooks and Couplings for flat and round Belts. Send for catalogue. C. W. Army, 148 North 3d St., Philadelphia, Pa.

F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines, have removed to 530 Water St., N. Y.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N. Y.

Water, Gas, and Steam Pipe, Wrought Iron. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

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Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, New York.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

M. Shaw, Manufacturer of Insulated Wire for galvanic and telegraph purposes, &c., 230 W. 27th St., N. Y.

Shingle, Heading, and Stave Machine. See advertisement of Trevor & Co., Lockport, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Articles in Light Metal Work, Fine Castings in Brass, Malleable Iron, &c., Japanning, Tinning, Galvanizing. See Specialty Works, Chicago, Ill.

See Boud's Paneling, Moulding, and Dovetailing Machine at Centennial, B. 8-43. Send for pamphlet and sample of work. B. C. Mach'y Co., Battle Creek, Mich.

Wanted—Novel and practical invention, by a reliable house, for manufacturing. Address Post Office, Box 25, Chillicothe, Ohio.

Chester Steel Castings Co. make castings twice as strong as malleable iron castings, at about the same price. See their advertisement on page 93.

Notes & Queries

P. M. S. will find an article on windmills on p. 241, vol. 22.—G. M. F. will find a description of a Rhamkoff coil on p. 219, vol. 22.—J. G. A. will find directions for binding rifle barrels on p. 123, vol. 31.—C. A. M. will find on p. 296, vol. 34, directions for making an electric machine.—C. B. P. will find on p. 218, vol. 31, directions for drilling glass.—O. O. O. will find something on violins on p. 75, vol. 36.—H. E. W.'s query as to lightning rods was answered on p. 44, vol. 36.—H. N. T. & Co. will find a recipe for tinning brass by the boiling process on p. 10, vol. 28.—A. C. G. will find an answer to his query as to electro-magnets on p. 44, vol. 36.—G. S. will find directions for nickel plating on p. 235, vol. 33.—J. B. D. will find directions for making copying ink on p. 123, vol. 32. For copying without a press, see the description of the manifold process, on p. 154, vol. 30.—C. M. will find directions for making soft soap on p. 379, vol. 31.—P. M. will find a description of the calorific engine on p. 66, vol. 34.—H. P. will find directions for building an icehouse on p. 251, vol. 31.—C. T. H. will find an article on working in compressed air on p. 408, vol. 30.—C. S. can waterproof his leather boots by following the directions on p. 155, vol. 26.—C. A. B. will find a formula for the proportions of a safety valve on p. 363, vol. 29.—B. T. will find directions for galvanizing iron on p. 346, vol. 31.—J. T. M. will find a method of calculating the power of a wind wheel on p. 241, vol. 32.—J. F. will find an elaborate article on the power of small steam engines on p. 33, vol. 33.—D. H. L. will find a recipe for French polish on p. 11, vol. 32.—E. M. E. will find a description of the gyroscope on p. 91, vol. 31.—W. W. will find directions for making rubber hand stamps on p. 155, vol. 31. To construct with copper, see p. 90, vol. 31.—R. & A. will find on p. 43, vol. 32, a recipe for marine glue that will answer the purpose of a waterproof cement for labels.—W. S. can fireproof his shingles by following the directions on p. 290, vol. 28.—J. C. R. will find a recipe for a depilatory on p. 196, vol. 34.—A. E. H. will find something valuable on the nature of electricity on pp. 195, 228, vol. 32.—D. D. V. will find a recipe for a shoe polish on p. 78, vol. 26.—J. M. T., U. M., R. H., J. A. M. J., W. F. C., E. S. R., C. H. S., L. A. S., B. H. C., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) H. L. W. asks: What is the size of the smallest engine that is capable of driving a pair of mil-

stones 4 feet 4 inches in diameter and a belt reel 18 feet long? A. If you wish to work the mill up to full capacity, you will need an engine of from 40 to 50 indicated horse power; but you can do fair work with an engine only half as powerful.

(2) B. H. asks: What pressure will my boiler stand? It is 1 1/2 inch thick in the body, and 3/4 in the ends; it is of cast iron, 4 feet long by 11 1/2 inches internal diameter. A. Working pressure, about 100 lbs. per square inch.

(3) J. P. L. asks: How can I calculate the power required to punch sheet metal? A. Professor Rankine's expression for calculating the work in foot pounds per stroke is: 12,500 x circumference of hole x thickness of plate.³

(4) E. J. D. asks: How many lbs. weight, dropping 25 feet, will work three lift and force pumps, the pumps making 40 strokes per minute each, and raising water 60 feet, being each 3 inches diameter of barrel with 5 feet stroke? How long would it take the weight to descend? A. The question is rather indefinite; but if you will specify your meaning more plainly, we will endeavor to answer you. It might be well to send a sketch of your device.

(5) E. J. W. asks: 1. How can I find the height and diameter of a smoke stack for a horizontal boiler? A. Make it with cross section equal to about 1/2 of the grate surface. 2. Should a boiler set in brick have a larger smoke stack than one not set in brick? A. It is not necessary, other things being equal.

(6) C. H. asks: Please tell me if it is advisable to use a cross pipe on a double-acting water ram, from the ram to the head? A. We would be glad to receive a sketch and description of the present or proposed arrangement; and if you send one, we shall be better able to advise you.

(7) S. S. asks: In the case of pulleys with curved arms, is the strength of the arms at all affected by the direction in which the pulley is made to revolve? A. We do not think the difference is of much importance.

(8) C. B. H. asks: With a pipe 2 1/2 inches in diameter, with 5 feet head, on a 9 foot overshot water wheel, what amount of power will I get? A. With a well constructed wheel, you might obtain 1/2 of a horse power.

(9) R. P. D. asks: Is there any difference in the obstruction of the flow of the water, between the same rock in the same race (the depth of water being the same in both cases) being placed at right angles, or at an angle of say 45°, with the bottom of the race? A. As we understand the question, we think there would be no difference.

(10) J. H. asks: How large a volume of water can a 10 horse engine raise to the height of 150 feet? How large a continuous round stream would that volume make if not subjected to pressure? A. It will depend upon the size of the pipe, which can be large or small, and the columns of water will still be solid; but the volume discharged in a given time will vary because different amounts of power will be expended in overcoming the friction of the pipe.

(11) T. T. E. asks: Who was the maker of the first steam locomotive in the United States? What was the man's name who ran it, and where did the trial trip take place? A. The first locomotive that ran in this country was built at Stourbridge, England, by Mr. Horatio Allen, and was imported for the Delaware and Hudson Railroad. This was in the year 1829.

(12) W. W. B. asks: Is there anything that I can do to the glass in my show windows to prevent dampness freezing thereon? A. The remedy is to keep the air inside the store dry, so that there shall be no moisture to form ice crystals on the windows.

(13) J. A. W. asks: What is the proper number of the wire used for winding the magnet for the engine described in the SCIENTIFIC AMERICAN SUPPLEMENT of May 6, 1876? What is the proper size for the magnet? A. Engines of this kind can be made of various sizes; a small one with cores about an inch and a half long, and wound with about 300 feet of copper wire, will work well with one or two cells of battery of low resistance.

(14) E. A. S. says: A friend and I want to put up a short telegraph line. Will it work without a relay instrument? If so, how many 1/2 gallon cells of the Callaud battery will it take at each end? To work without the relay, how many feet of No. 22 insulated copper wire will it need around each core of the electro-magnets of the sander? Will it work with ground circuit, or would it be best to use double wire? If we use the ground circuit, how large an iron plate shall we bury? Will silver do, instead of platinum, for tips on the sending key? A. It is difficult to answer your questions definitely, as they are in themselves indefinite. From six to ten cells in all will work a line of about a mile length without a relay, the sander having 250 or 300 feet of No. 22 copper wire each. The ground circuit should not be used for very short lines. Silver is not a good substitute for platinum contacts.

(15) A. S.—Use a little litharge in your ink. The burnishers used in finishing plated goods are of various forms; some of them are used in the lathe. They are usually made of hard, polished steel or bloodstone.

(16) P. F. asks: 1. How can I dissolve bones with acid? A. Digest the bones for some time in warm, strong hydrochloric acid. 2. Is sulphuric acid best for this purpose? A. No. Hydrochloric acid is best. 3. What sort of vats are used? A. Large vessels of stone-ware or porcelain-lined iron are best. 4. How much acid is required to dissolve a ton weight of bones? A. The amount of mineral salts contained in bones varies to some extent with the age of the animal from which they were obtained, the younger bones contain the smaller proportion. The average amount of inorganic constituents of the bones of cattle is from 40 to 70 per cent, the principal part of which consists of tribasic phosphate of lime. In practice, it will be found that a weight of acid equal to that of the bones is needed.

(17) J. B. asks: What is a good preparation for preparing canvas duck or cotton cloth to prevent mildew? A. Soak it in a strong alum solution and then in a bath of ammonia water. Wash it well afterward with plenty of water.

(18) J. V. B. asks: What oil is the best to soften lithographic rollers? A. Cover the rollers with glycerin, not oil.

Would a coating of liquid glass adhere to polished steel? A. Yes.

(19) A. F. asks: How are hairpins varnished? A. The varnish consists of gum copal or anime with fine ivory black, turpentine, and a little boiled oil. The coating is applied by dipping the smooth pins in a very thin solution of the above, and drying at as high a temperature as the varnish will bear without injury. This treatment is repeated.

(20) M. G. P. asks: Are not meerschaum pipes, after they have been used a time, subjected to some process to bring out the color? A. No; but they are sometimes artificially colored with annatto and tobacco oil.

(21) W. M. says: I have discovered a new or partly new method of case hardening: Heat the cast metal to a white heat, then feed the part to be hardened with prussiate of potash, pulverized, until the metal comes to a low red; then dip the metal in muriatic acid. This is a quick and reliable process.

(22) J. L. I. asks: 1. Is it practicable to increase the steaming capacity of a small portable engine by a smaller upright tubular boiler suspended in the smoke chamber in such manner that the heated gases shall surround a part of the auxiliary boiler and also pass up through its tubes, the feed water to be supplied by the pump at the cross-head first to the auxiliary boiler, and thence pass by a pipe inserted in its shell at the height of its proper water line, to the main boiler? Steam is to be also taken by a pipe from the top of the auxiliary boiler to the steam dome of the main boiler. A. This arrangement may answer, if the products of combustion leave the boiler at a very high temperature. 2. How can I burn coal dust in a small portable engine? A. The general idea is to increase the draft, and prevent the coal dust from forming into large masses so as to choke up the air spaces.

(23) G. T. asks: 1. What power can be obtained from a small engine, the cylinder of which is 2x6 inches stroke, with steam at 60 or 70 lbs. pressure, running at 150 revolutions per minute? A. About 1-horse power. 2. What size boiler, horizontal and set in brick, would it require? A. Make one 18 to 20 inches in diameter, and 3 feet high.

(24) T. K. says: In a work on engineering, this rule is laid down for finding the working pressure of steam boilers: 34,000 lbs. per square inch is the tensile strength of boiler iron; the rule for 1/2 inch plates is to divide 4,250 by the diameter of the boiler in inches. The quotient is the working pressure, being one sixth of the bursting pressure. And it says that the rule for 1/2 inch plate is to divide 5666 2/3 by the diameter of the boiler in inches, and the quotient is the working pressure. I find that the figures in the first rule are got by dividing the tensile strength by 8, and the figures in the latter rule by dividing the tensile strength by 6. What I want to know is, by what rule are these divisors, 8 and 6, obtained? A. These numbers are assumed, it being considered advisable to allow a large margin on the safe side in proportioning boilers.

(25) A. W. S. asks: Where can I find the method for working out the transit of Mercury of 1878? A. In the Nautical Almanac, published by the Bureau of Navigation, Washington, D. C., the figures are published three years in advance for the purpose of ships which are taking long voyages.

(26) G. H. W. asks: Can egg or blood albumen be preserved for several months? A. Yes. Dry it perfectly by allowing to stand in a close vessel over pumice-stone moistened with oil of vitriol.

(27) J. R. asks: Where can I get silica for making infusible brick? A. The dried sand from the sea shore, or calcined and ground quartz rock (which is pure silicic acid) will answer.

(28) M. D. K. says: I have a safe with two vaults inside, and a combination lock on each. One of them is now locked, and the combination lost. I wish to get it open, but see no way but to drill a hole on a line opposite to the holes that are in the tumbler wheels, so that a wire can be inserted to change the combination. The place where I want to drill is 2 1/2 inches thick and of chrome steel, so hard that no steel drill will have any effect on it. Can I use a diamond drill? A. The best forms of diamond drills are patented, and you will probably find it cheaper and more satisfactory to obtain one, with full directions for use, from a manufacturer. It is quite likely, however, that you can soften the metal sufficiently, by the aid of a blow-pipe, to penetrate it with an ordinary drill. It may be remarked, in addition, that combination locks can frequently be picked without great trouble by experts; and, if you can have the safe opened in this manner, it will probably be more satisfactory than either of the others.

(29) J. E. F. says: In answer to G. W. R., you say: "Use 10 to 15 lbs. sulphuric acid to 100 lbs. tallow, to separate the stearin from the olein? Is the olein, thus separated, used for butter purposes? If not, what is the proportion of acid to 100 lbs. tallow? A. This method is not employed in the manufacture of butter from suet. See p. 337, vol. 35.

(30) J. R. C. asks: Please publish a recipe for printers' red ink? A. Boil linseed oil till smoke arises, then apply a lighted paper stuck in a cleft stick; and then remove the pot from the fire, allowing the oil to burn till it can be drawn out into strings half an inch long. Add 1 lb. rosin for each quart of oil, and 1/2 lb. dry brown soap cut into slices; put the latter in cautiously, as the water in the soap causes a violent commotion. Then grind up the oil with sufficient pigment. Vermilion, red lead, carmine, Indian red, Venetian red, and the lakes are all suitable for printing ink. Grind on a stone with a muller.

(31) C. P. B. asks: If a ball be fired from a gun resting on the ground in a perpendicular position, will that ball have acquired the same velocity and momentum in its descent when it reaches a point 10 feet from the muzzle of the gun that it had in its ascent when it was at the same point? And will it penetrate as far into a piece of wood in its descent, say 10 feet from the muzzle of the gun, as it would have penetrated in its ascent had the ball struck the wood at the same distance from the muzzle of the gun? A. No; but in a vacuum it would.

(32) M. L. F. says: I have a water tank 18 inches in diameter and 3 feet high. How many lbs. weight will it require to force the water 30 feet high through a 3/4 inch pipe? A. It will depend upon the velocity. It will take a weight of about 3,300 lbs. to just sustain the column of water in the pipe; and by increasing the weight, the water will be forced out.

(33) J. K. asks: How much power (rated as horse power in a steam engine) can be got from a suspended weight weighing 5 tons and falling 5 feet per hour? A. Your figures give 0.0282 of a horse power, nearly 1/35.

(34) J. H., Jr., asks: What is a safe working steam pressure per square inch for an upright boiler 30 inches in diameter, by 6 feet high, with twenty 3 inch flues, 4 feet long, made of 3-16 inch iron? A. From 50 to 60 lbs.

(35) E. J. B. asks: What is the chemical symbol for attar of roses? A. It consists of two compounds, one of which has but little odor. It is polymeric with olefiant gas, but its composition is not accurately known. Miller gives it as (C₁₂H₁₈)_x, x being the unknown constituent.

(36) H. H. B., Jr., says: I have made several small models of sheet brass and cast brass; and in finishing I use a dipping bath of nitric acid, which leaves a beautiful finish on sheet brass and brass wire, but the castings turn a dirty, coppery black color. How can I remedy this? A. The rolled brass usually contains a larger percentage of zinc (yellow brass); besides its surface is denser and more uniform than that of cast brass. Use more dilute acid, and touch it up a little subsequently with rouge or tripoli powder.

(37) W. E. C. asks: I wish to use second-hand tomato cans, and a good many of them are very rusty. What solution can I steep them in to take off the rust, so that they can be used again? A. Try a pickle of dilute oil of vitriol. We do not think it advisable to attempt using the cans again for fruits or vegetables without first having retinned them, which is not impracticable.

(38) C. M. M. Co. says: We tried acetic acid with glue for covering silver on mirrors, but it did not work to our satisfaction. Please let us know some other methods? A. Use genuine asphalt (free from coal tar) and spirits of wine. After the addition of the latter allow to stand some time before using. Make of a suitable strength for using, and give as many coats as requisite for your purpose.

(39) G. H. B. asks: What is the best disinfecting agent to use in a room where persons sleep at night, and are also employed during the daytime? On building a fire, a close heavy smell fills the room. Carbolic acid and water sprinkled on the floor seems inadequate and evaporates rapidly. Can you suggest any harmless agent that will kill the close smell? A. The first thing to be done in a case of this kind where carbolic acid, which is one of the most powerful disinfectants known has been tried, and found, as you say, inadequate, is to investigate the room and its surroundings, and discover the cause. It must be remembered that disinfectants at the best but palliatives of the evil; and if the source remains, the smell and perhaps miasm may be generated faster than its capacity for injury is destroyed by any disinfectant, however powerful. A room without such positive source of noxious gases, should not become positively offensive, even when occupied by a number of persons day and night. Instead of being regarded as a substance easily volatile, carbolic acid is one of the most persistent disinfectants, and the objection to it is not the thoroughness with which it does the work, but that its odor is so penetrating as to be to many unendurable. Use chloride of lime exposed in shallow vessels, if not too disagreeable to you. This does the work of disinfection very thoroughly. Or you can use a more elegant, though somewhat more expensive disinfectant, in the shape of permanganate of potash; and a solution of this salt in water containing persulphate of iron (Condy's fluid) is excellent.

(40) U. S. A. asks: How can I make a liquid for shampooing the hair? A. Take carbonate of ammonia 1/2 oz., carbonate of potash 1 oz., water 1 pint. Dissolve these, and add tincture of cantharides 5 fluid ozs., rectified spirit 1 pint, good rum 3 quarts. Moisten the hair with the mixture, rub till a lather is formed, then wash with cold water.

(41) H. J. asks: 1. How high above the water line on a return flue boiler can I, with safety or without danger of burning the iron, risk running the fire? A. The fire should not strike any part of the boiler above the water line. The products of combustion, after passing through the flues and having been cooled down, are sometimes returned along the sides and over the top of the boiler. 2. How can I tell the horse power of a boiler and of an engine? A. We do not know what is meant by the horse power of a boiler. As for your engine, the power will depend upon the pressure of steam, the point of cut-off, and the piston speed. See p. 33, vol. 33.

(42) L. W. S. asks: Will a two flue boiler, 28 feet long and 48 inches in diameter, supply with steam an engine 16 x 36 inches, running at 75 revolutions per minute, if I double the length of the grate bars, making them 7 or 8 feet long, using dry pine slabs for fuel? A. The boiler will be large enough for average work if the engine is well designed, but probably will not supply sufficient steam to run the engine up to full power, with steam following for 3-3 or 7-8 of the stroke.

(43) C. C. B. asks: What kind of lamp is most efficient for heating the boiler for a small steam engine? What oil is the best? A. Good alcohol is the

best fluid for use in any lamp where luminosity is not requisite, and smoke is objectionable. For this purpose crude methylic alcohol (methylic spirit wood naphtha) is nearly, if not quite, as useful, and is very much cheaper. Any of the heavier oils, such as lard, sperm, mineral sperm, and many of the heavier distillates of petroleum, may be used for this purpose with very good results, provided a suitable tubular boiler and a tall chimney is employed. Under these conditions complete combustion is obtained and there is no soot deposited.

(44) A. B. Y. says: 1. I have been making clay moulds from type, and I have taken a beautiful impression every time; but it always cracked in the drying. Is there anything that would prevent its cracking? A. Add a little plaster of Paris and salt; dry at a very moderate temperature at first, and the mould will not crack. 2. What could be put into the clay that would make it very hard after it was dried? A. Try a strong solution of water glass and aluminate of soda.

(45) J. L. A. says: Is there any known acid that will cut or eat glass? If so, what is it kept in, and what use is made of it? A. Hydrofluoric acid is used for this purpose. The acid is usually kept in vessels of gutta percha or lead. It is obtained by gently heating together fluorospar and strong oil of vitriol in a suitable retort, and dissolving the evolved gases (fluoride of hydrogen) in distilled water.

(46) F. E. K. says: 1. Our boilers are 22 feet long, and 44 inches in diameter, thickness of shell is 3/8 inch, of heads 1/4 inch, with two 16 inch flues. The heads are stayed with 5 stay rods, and 20 stay bolts. There is one 4 inch safety valve for the two boilers. I once asked you what is the greatest pressure they will safely bear. You replied: From 50 to 60 lbs. Do you consider them low pressure boilers? A. The term "low pressure" is rather indefinite. Thus, 50 or 60 lbs. per square inch might be considered high pressure for marine boilers, and low pressure for small stationary boilers. In the case of your boilers, the pressure is not much below the average that is maintained in boilers of about the same size. 2. What is the safest and best mode of testing boilers? A. Fill the boiler with water, load the safety valve to the desired pressure, and heat the water gradually.

(47) P. W. S. says: I have a tank or cistern holding about 90 barrels coal tar. What is the best manner to get it out, as the cold weather prevents dipping it out? A. If it becomes too thick to be taken out with a dipper, it is scarcely probable that an ordinary pump can be used. You might employ some form of steam ejector in which the steam would first soften the tar, and then force it out; or a steam pipe might be introduced into the tank, and when the tar was softened it could be dipped out.

(48) J. J. S., and others: The specific heat of water is found to be higher than that of any other substance, and for this reason is taken as unity. If we take 1 oz. water at 174° Fah., and 1 oz. ice at 32° Fah., and put them together, we shall have, when the ice has melted, 2 ozs. of water at 32°. The ounce of water has therefore parted with 142° of its heat in melting the ice, which heat is said to have become latent. Water, at the normal atmospheric pressure, boils at 212° Fah., which is its maximum of temperature. Here again this apparently anomalous phenomenon occurs. When the temperature of the water reaches 212°, it becomes stationary; and further addition of heat is absorbed in converting the water into steam, which has the exact temperature of the water which produced it. Here also has heat been rendered latent, with an accompanying change in form of the water. As from ice to water, likewise from water to steam: or from solid to liquid, from liquid to gaseous. On condensation of the steam and recondensation of the water, the exact amount of heat absorbed or rendered latent is given out. A certain weight of steam condensed at 212° gives out 950 of latent heat. In its descent from 212° to 32°, it gives out 180° sensible heat, and again in its recondensation it restores 142° of latent heat, amounting together to 1,272°. Pressure influences the boiling point of water, and for that reason water may, by the application of adequate pressure, be heated so as to melt lead. Likewise, as the pressure decreases, the boiling point is lowered. At the hospital of St. Bernard, in the Swiss Alps, which is 8,400 feet above the sea, water boils at 184° Fah.

(49) J. M. L. says: Please tell me the best method of clarifying cotton seed oil? A. The best method is to treat with sulphuric acid, and afterwards with steam, as follows: The agitator is constructed of wood, lined with lead. After introducing, say 500 gallons oil, the agitator is set in motion, and 26 lbs. oil of vitriol are added by means of a perforated leaden trough, so as to spread it as a shower over the whole surface of the oil. The time employed in the addition of the acid should not be less than 30 minutes, and the agitation should be continued for 8 hours. It is then allowed to stand for 10 hours, the acid drawn off, and the oil pumped into a steaming tank of iron. It should then be steamed for 8 hours with 1/4 inch steam pipe, at 20 lbs. pressure. Allow to stand for 30 hours, draw off water, and pumped into receiving tanks (of wood lined with lead). A competent carpenter should be able to construct the apparatus. The lead lining should of course be burned, not soldered.

(50) S. E. E. asks: Please find enclosed some powder called porous silica, for polishing metals, etc. Can this be made artificially? A. A similar article may be prepared by treating a strong solution of water glass (silicate of soda) with a small quantity of strong oil of vitriol. If the solution has been sufficiently strong, after standing a few hours in a warm place it will completely gelatinize. Wash this well with cold water, decant or filter off the washwater from the gelatinous silica (hydrated silicic acid), place the latter in a suitable vessel, and dry over a good fire. See also articles on pp. 20 and 240, vol. 35.

(51) J. McI. asks: 1. What is the most simple process of converting chloride of calcium into chloride of lime (bleaching powder)? A. This is not feasible. Hypochlorite of lime (chloride of lime, bleaching powder) is commercially prepared by exposing slightly moist slaked lime to an atmosphere of chlorine gas, which absorbs it largely. 2. Is not muriates of lime the same substance as chloride of calcium? A. They are different

names for the same substance. The latter is the proper appellation. 3. Can dry silicate of soda be dissolved by water alone, hot or cold? A. It is quite soluble in boiling water. Cold water does not dissolve it very rapidly.

(52) M. B. asks: How can I remove the pitch stains from an engraving? The stains were from the colored gum exuding from the retaining board of the frame. A. Soak the print for some time in hot water, and then in a solution (strong) of chloride of lime. This will remove the stain without injuring the engraving.

(53) A. J. D. says: 1. I wish to make some of the glue by the recipe given in your reference book, but do not know what kind of ether to use? A. Use good petroleum naphtha instead of the ether. It is maintained by many that this gives much better results. The naphtha should be warm. 2. Will vulcanized rubber answer? A. Vulcanized rubber will not answer. Use crude caoutchouc. The ether referred to in the recipe was what is commonly known as sulphuric ether or common ether.

(54) E. J. B. says: One work on chemistry mentions oil of rose as an essential oil containing oxygen, and another says it contains no oxygen. Can you tell me its composition? A. The essential oil of rose is destitute of oxygen; it is a carbon-hydrogen compound. The proper formula is $C_{15}H_{26}$.

(55) T. H. K. asks: What can be done with copal varnish when it gets thick and candied? Can it be thinned, so that it can be used? A. It will be necessary to melt the candied varnish, and, while fused, to add a sufficient quantity of oil of turpentine. Great caution should be exercised in order to avoid accidental ignition of the violently boiling turpentine. The vessel should be covered and removed from the source of heat immediately after the turpentine is added. In many cases, it is advisable to add a little raw oil to the fused varnish before introducing the turpentine.

(56) D. P. W. says: In SUPPLEMENT No. 19 is given a description of a small electric locomotive. Can one be made to run with Leclanché battery of 4 small cells? If so, please give about the size to make the different parts of the locomotive. A. The Leclanché battery is not suitable for such work. See answer to G. U. S. on this page.

(57) G. U. S. says: I wish to construct an electric locomotive the same as described in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 19. Of what size should the magnets and cores be, and with what size and quantity of wire should they be wrapped to give the largest possible powers with a six cell Grove battery? A. Use about 230 feet of No. 18 copper wire for the four helices and make the cores about 1 1/4 inches long.

(58) A. B. L. asks: 1. How many and what size cells will be necessary to produce an electric light sufficiently powerful for the electric light microscope? A. Fifty half gallon cells will answer well. 2. What form of battery will be the best? A. Grove or Bunsen. 3. What will be the approximate cost for running the same, per hour? A. Probably about 50 or 60 cents. 4. What should be the diameter, shape, and focus of the lenses composing the condenser? A. Double convex and three or four inches in diameter; they are supplied with the lamps. 5. Can the effects of the heat on the object and objective be obviated by interposing a glass cell filled with ammonia-sulphate of copper, alum, or some analogous solution between the condenser and object slide? Would it have the same effect if the cell were interposed between the light and the condenser? A. Yes; but, as a general thing, it is scarcely necessary. 6. Will the electric light give off enough heat to necessitate the use of iron for the camera, or would old mahogany well clamped inside do as well? A. The lamp should be of sheet iron. 7. Should the condenser be fixed permanently as regards the object stage, or should there be means of varying the distance between stage and condenser? A. Better make it adjustable. 8. Where, if anywhere, can I find detailed description of electric light or oxyhydrogen gas microscope? A. See remarks on solar microscope in almost any work on physics.

(59) F. J. S. asks: 1. I want a solvent for vulcanized rubber or old rubber shoes, etc., to make a cheap solution, which, on cooling, will leave a coating of rubber. A. Place the material, cut in small shreds in a strong (boiler iron) air-tight vessel, provided with a good safety valve, and introduce into it 4 or 5 parts of bisulphide of carbon for each part (by weight) of rubber. Close all the openings, and place the vessel over a suitable water bath, or, what is better, have a small steam coil inserted within the boiler. Heat for an hour at the boiling point of water. This will insure the complete solution of the rubber. The vapor of the bisulphide is very inflammable; and when mixed with air, it is explosive when ignited. For these reasons, as well as because of the offensive odor of the solvent, the operation is best conducted in the open air, and with steam heat only.

How can I recover the sulphuric acid from the waste, after the washing of nitro-glycerin? A. In the manufacture of sulphuric acid from pyrites, the pyrites are subjected to a roasting process with a plentiful supply of air, and the resulting sulphurous acid gas, together with nitric acid vapor and steam, is conducted into a series of large, lead-lined chambers, the floors of which are covered with a layer of water, which dissolves and condenses the sulphuric acid as fast as formed. Sulphuric acid cannot be manufactured economically on a small scale by any of the methods now in use. The necessary plant is very expensive.

(60) F. S. asks: 1. Can you give me a recipe for making good, clean gunpowder? A. Rifle powder consists of sulphur, 10 parts, finest charcoal, 15 parts, nitre, 75 parts. Each of the several ingredients is first dried and reduced to an impalpable powder; then they are mixed thoroughly, and moistened with water. The paste is then ground together between stones to insure a close and uniform admixture, after which it is removed, pressed into blocks and dried. When dry, these blocks are brought against a revolving toothed wheel, which granulates the powder. The granular powder is then passed through sieves which remove all the coarser granules, and prepared for market. It is difficult to

manufacture good gunpowder on a small scale, and its manufacture is attended with some danger.

1. Is it safe to use cocculus indicus for catching fish, and are the fish so caught poisonous? I have seen boys use it (bruising the berries and mixing them with flour paste); and after gutting the fish they sold them to the Chinese. A. The berries do contain poisonous fluids, and should not be used for any such purpose. 2. Is it lawful? A. We are not aware that there is any law to this effect.

(61) F. H. asks: About how strong a solution of bichromate of potash would you use in mixing Indian ink for drawing purposes, by the method given on page 26, vol. 36? A. Reduce a small quantity of the bichromate to powder and dissolve in a limited quantity of boiling water. There should be an excess of the salt beyond what is taken up by the water. When the solution has cooled, pour it off from the residue, and bottle. When required for use, dilute the solution with about one third its volume of water, and it is ready for use.

(62) W. K. D. says: In reply to A. L. C., who asks how to protect lead pipe laid in the ground, from frost: Do not under any circumstances use sawdust to fill in around the pipe if you can dig a ditch only 2 feet deep. Unless you can get this pipe below the frost, sawdust will be utterly useless. If you can dig 3 feet deep, and fill in hard with dry coal culm, you will find your object attained. If you can get but 2 feet below the surface, the only sure way would be to make a box, say 1 foot square, the whole length of the pipe, and fill in with dry culm, laying the pipe in the center. Make three sides of the box first, fill half with culm, lay the pipe, then fill full with culm, and nail top board on. If you have plenty of culm, fill a few inches over the box before throwing in the dirt.

(63) W. N. asks: How can I refine petroleum to convert it into kerosene oil? A. Crude petroleum is first washed by agitation with water, then with sulphuric acid (oil of vitriol), and the last traces of acid removed by washing again with water. It is then run into capacious stills fitted with suitable condensers and a gentle heat applied, when the lighter products, naphtha, benzene, etc., immediately begin to distill over and are condensed and collected separately. As the temperature is raised from time to time oils of greater specific gravity come over. Kerosene oil is one of these distillates. See p. 308 of the SCIENTIFIC AMERICAN SUPPLEMENT for full particulars.

(64) C. C. says: I have a Brussels carpet which has been damaged by rain; and the green dye from a wool mat has run into it. What will take that color out and restore the carpet as before? A. Before we can give you any definite advice we must see a sample of the material, or know what constitutes the green dye. Try alcohol and water, or methylated spirit.

(65) S. W. D. E. asks: 1. What are the component parts of firebrick, and how are they proportioned and mixed? A. They consist principally of an impure variety of fireclay (silicate of alumina) containing a very small quantity of organic matter. The clay is freed as far as possible from any gravel which it may contain, moistened thoroughly with water, moulded into the requisite form by suitable machinery, and dried in the air. When sufficiently hard to bear handling, they are subjected to a moderate heat in a kiln, and afterward heated strongly. This treatment removes the last trace of moisture, and consolidates the brick. 2. How much pressure to the square inch will firebrick stand? A. This depends a great deal upon the quality of the brick and the way in which the strain is applied. The limit of tensile strength in the average fire brick is, perhaps, about 100 lbs.

(66) W. B. H. says: Will you give me a recipe for making paraffin paint? A. Mix together good asphalt and paraffin in equal parts, melt, and stir well together. Add to this a small quantity of finely ground caustic lime with constant stirring, and apply to the surfaces of the tank with a large brush. When this has cooled, put on another coating of pure molten paraffin, applied quickly and evenly.

(67) W. J. P. asks: I have an emery wheel of 2 inches face and 6 inches depth for grinding skates, etc. I broke it while driving the spindle in. The fracture has the appearance of good cast iron. It broke into nearly equal halves. How can I unite them? A. The stone may be cemented by means of a paste of oxychloride of zinc (used largely by dentists). Cover the fracture surfaces with a thin coating of the paste, place the pieces accurately together, and press strongly in a vise. To insure a strong joint, it should be left undisturbed in a warm place for a week or two.

(68) F. H. asks: Is it easier for an engine to drive a certain amount of machinery when placed close to it than at the end of long shafts, line as well as intermediate? A. Yes.

Is there a saving of fuel in having a large boiler and a large engine; I mean large for the amount of work to be done? A. In general, it is more economical to have the boiler large enough to furnish all the steam that is required with very slow combustion, or, in other words, to have a boiler that is considerably larger than is absolutely necessary. The engine, however, will generally be most economical when working up to the full power at which it was designed to run.

(69) J. C. M. asks: Which are more easily drawn, high wheels or low ones, provided they are loaded alike? A. We presume you intend a comparison between wheels of large and small diameter. A load on the large wheels can be drawn more easily than when on small wheels, on account of the greater leverage afforded by the former. If there were no resistance to motion other than the inertia of the body to be moved, the large wheels would have no advantage over the small ones.

(70) McC. Bros. ask: 1. Will injectors lift water as well as discharge it, or do they require a head of water? A. They are made both lifting and non-lifting. 2. Will they work water as hot as 150° or 200° Fah.? A. It is best not to heat the water more than 120°. 3. Will muddy water wear them out very rapidly? A. They will probably not work satisfactorily unless the water is passed through a strainer or filter. 4. What are the comparative merits of injectors and good steam pumps? A. There is not very much difference,

(71) A. D. asks: 1. An upright tubular boiler is 9 feet high and 40 inches in diameter, with 190 tubes, 2 inches in diameter and 6 feet long, with 3 feet heating surface in grate and firebox. Firebox is 32 inches in diameter. How many cubic feet of water would a boiler of this size evaporate in one hour, pressure being 100 lbs. to inch? A. Between 7 and 8, with a strong draught and good coal. The evaporation of a boiler depends largely, of course, on the rate of combustion, and the above figures are for a high rate. 2. One cubic inch of water, under pressure of 100 lbs. to the inch, is converted to steam. Would it expand to 1,600 times its volume, pressure remaining the same, or would it be less or more? A. One cubic inch of water would make about 230 cubic inches of steam of 100 lbs. pressure.

(72) W. S. asks: If a cylinder, filled with compressed air, be brought to a red heat, would there be danger from a sudden ignition of the oxygen within, or would the expansion of air be gradual up to that temperature? A. There would be no danger. Oxygen is not combustible.

What is electricity as produced by friction? Can it be a substance eliminated from the air, or produced by a finer division of its particles as the air is ground up in its passage between the cushion and cylinder. A. Probably no one can tell you exactly what electricity is; but your definition would be generally regarded as a statement of what it is not.

(73) J. C. D. asks: What is the best material for covering a cylinder of an engine, to prevent radiation? The cylinder is steam-jacketed with steam from boiler at 70 lbs. pressure. The outside of cylinder is covered with wooden lagging with space left for the non-conducting filling. A. Use felt for the filling, and lag with wood as you suggest.

(74) H. M. says: In a recent issue, you give an answer on the subject of crocus. I wish to say that crocus is made as follows: Calcine sulphate of iron, then roast it with a strong fire until acid vapors cease to rise; cool, wash with water until the latter ceases to affect litmus, and then dry.

(75) E. C. asks: We are at work out of doors, and our tools on cold mornings are all right; but if held to the fire, the frost comes out, although it was not seen before. I claim that the frost is in the steel, all through it, because they break much more easily. Another claims that the frost does not go into the steel. A. The appearance is caused by the condensation of the moisture in the atmosphere, due to the sudden variation of temperature. The same effect is caused by ice water in a glass.

(76) F. H. T. asks: I am building a small engine, 1 1/4 x 3 inches, and I hardly know how to proceed. Is it necessary to have packing rings on piston, or will it do to just turn the piston so that it will fit in the cylinder nicely? A. A solid piston nicely fitted and say 1/16 inch thick would do; but a ring would improve it.

(77) R. D. H. says: 1. By diminishing the speed of the governor, can I increase the speed of the engine? A. Yes. 2. What will be the safe working pressure in pounds of steam of a boiler 26 inches in diameter and 48 inches long, of 1/4 inch thick iron, single riveted with several 3 inch flues? A. About 50 lbs.

(78) H. Isenbeck, St. Petersburg, Russia: For grain elevators, address Gill & Mansfield, New York Central Railway, 60th street, New York city, or George Milson, Buffalo, N. Y.

(79) T. H. S. asks: 1. How many quart cells of the gravity battery will be necessary to work a telegraph in my house, and should they be connected for quantity or intensity? A. Three or four cells should be sufficient, connect in series. 2. How can I arrange a gong for a burglar alarm so that it will keep striking for 2 or 3 minutes after the current is connected? A. Join one end of the magnet wire to the armature lever, use a spring for the back contact, and connect this to the rest of the circuit as the magnet wire would be if the instrument was used in closed circuit.

(80) C. S. asks: Would a die made of an alloy of copper and tin in equal parts do to stamp on copper, or would it be too brittle? A. We know of no alloy that would answer this purpose.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the result stated:

H. H. T.—We should be happy to see the specimen of the tin ore mentioned. The specimen you send is a piece of cast iron containing much carbon. The matrix is slag from a blast furnace. You did not pay sufficient postage on your letter; 12 cents due.—H. V. H.—No. 1 is arsenide of nickel. No. 2 is apophyllite (carbonate of lime). No. 3 is magnesite. No. 4 contains chlorite, undefined crystals of carbonate of lime, and garnet. No. 5 appears to be slag from an iron furnace. No. 6 is clay containing a small percentage of sulphur and crystals of carbonate of lime.—No. 7 is colamine.—G. O. P.—We did not find gold in the sample sent us.—W. R.—No. 1 contains zinc and lead. No. 2 consists principally of zinc.—G. S. Y.—It is what is known as spiegeleisen, a carburet of iron usually containing a small percentage of manganese. It is not a natural formation. It is used in the manufacture of Bessemer steel.—S. M. W.—Your oil will make a very good lubricant, if freed from the bituminous matter which it contains. It contains a considerable percentage of paraffin oil. Send us a larger sample of it.—A. V. S.—Your stone has been pronounced by dealers to be very good, as far as may be judged from so small a fragment, for polishing purposes and hones. If it can be quarried in large pieces, sufficiently homogeneous and without flaws, it may prove marketable. We have seen similar stones from Arkansas.—G. S. R.—It is goeconite, a double sulphide of antimony and lead.

E. D. L. asks: Can any one give me the dimensions of the old English standard and the American wire gauges? Does Stubs' steel wire gauge correspond to either of the above?—L. W. F. asks: What is the method pursued by hub cutters for transferring a new design upon steel in the manufacture of jewelry and

colt—S. D. says: There is a certain species of wood used in England for boring tin plates. Some say it is a yarrow pine imported from Belgium, others that it is a species of ash. Does any one know what it is?—V. C. asks: How is inland woodwork done, and how are the colors for dyeing the wood made?—F. P. says: There is a species of hawk, called in Vermont blue hawk, whose true name I would like to ascertain. Its back is very dark; it is bluish in color, with the breast rather of a brick color. It is nearly as large as the hen hawk. It has crooked wings like the wings of an eagle, it flies very rapidly, and it makes great havoc among young chickens, etc., which it seizes without stopping, making a rapid swoop upon them. It is hardly ever seen except in the neighborhood of its nest, which is always made on the bare rock, on lofty cliffs. The eggs are of a very dark red, a little mottled with white. It is very noisy, and screams when any one goes near the nest. What is its proper name?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On a Bread Toaster. By T. C. H.
On Boiler Explosions. By J. R. R. M., and by H. P. G. C.

On the Climate of Oregon. By M. W. W.

On Aerolites. By J. S. D.

Also inquiries and answers from the following:

G. K.—H. M. S.—J. A. H.—C. H. P.—J. G. G.—T. S.—J. A. G.—O. J. S.—C. R. S.—S. L. M.—O. B. S.—S.—F. E. J.—G. W. S.—R. H. M.—W. H. R.—P. A. B.—J. B. J.—M. V.—E. M.—W. G. R.—C. F. E.—E. R. C.—B. S. G.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells paper bag machines? Who sells refrigerators? Who sells steel springs for use in small motors? Who sells parlor skates? Who is the best nautical telescope? Who sells a freckle preparation, porous enough to admit the passage of gas, as in a wire gauze burner?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is especially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were
Granted in the week Ending

January 9, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are renewed patents.]

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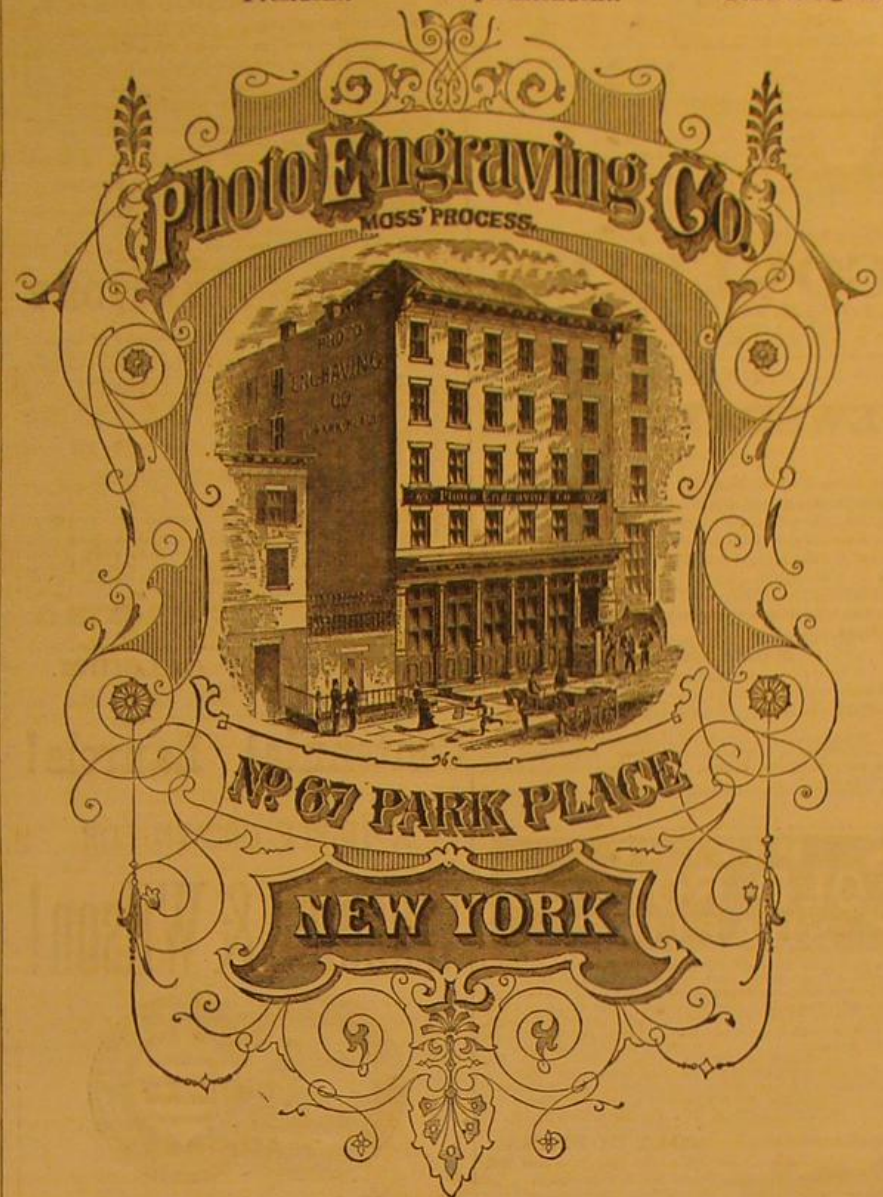
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THE ECLIPSE AGRICULTURAL ENGINE.

We illustrate herewith the well known "Eclipse" engine, mounted on wheels to adapt it for farmers' uses. The machine as thus arranged, the manufacturers inform us, vanquished all competitors at the Cincinnati Industrial Exhibition of 1874, and also during the field trials held under the auspices of the Centennial Commission, giving in both cases the most power with the least consumption of coal and water. From testimonials from parties using the engine, submitted to us, we learn that, with an 8 horse machine, 1,600 bushels of wheat were threshed with three fourths of a ton of coal and only five hogsheads of water. Another writer states that, with a 10 horse power engine, he is able to saw 3,000 feet of 1 inch oak timber per day, using a 48 inch saw. We have been obliged to obtain our information regarding the construction and advantages of this engine mostly from a pamphlet issued by the manufacturers; but from what we learn from other sources, we believe the Eclipse engine possesses all the qualifications herein stated.

The engine is of the horizontal style, the cylinder and steam chest being made in one cast ing. All of the exposed parts are felted and covered with iron. The frame or bed which comprises the cylinder head, the guides for the crosshead, and the two bearings for the crank shafts are also cast solid; so that it is impossible for the important working parts to get out of line. In shape, the bed is the half of a horizontal hollow cylinder, excepting a small portion of one extremity, which is an entire cylinder, which has a flange to which the cylinder and steam chest casting is bolted. The form of the bed enables all waste oil to be caught and afterwards led away by a suitable tube. The cylinder, being secured to the bed at one end only, is free to expand; and as the cylinder, steam chest, slide valve, and piston rod lengthen in the same direction, the engine will have the same lead and clearance when working as when cold. The pillow blocks are lined with anti-friction metal, and are provided with means for taking up lost motion. The crank shaft is double, made of forged iron, and is counterbalanced so that its motion is smooth and equable, even when at high speed. The piston has a metallic packing ring, and is self-adjusting; the piston rods are of steel. The pump is driven direct from the crosshead, its valves may be readily removed without disturbing the connections, and the water supply is easily regulated. A heater consisting of a large cast iron pipe, bolted near its end to the steam cylinder and supported by a bed bracket, receives the exhaust steam on its way to the smoke stack. The steam warms the feed water, the conduits of which pass two or three times through the entire length of the heater. All necessary fittings in the way of air cocks, self-feeding oil cups, governor, etc., are added; and the various parts are manufactured by special machinery so that they can be accurately duplicated.

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lap-welded, and a cold water pressure of 200 lbs. to the square inch is guaranteed to be withstood.

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sides was quite a humorist, and delighted to use his peculiar talents for purposes of harmless fun. It is related that a favorite amusement of his was to visit the markets, and there enjoy the astonishment of the old fruit women when he gravely extracted gold dollars from their oranges, and of the egg dealers, when their eggs hatched canaries under his marvellous touch.

Personally, Signor Blitz was a refined and pleasant gentleman and lavishly charitable to the poor. The best anecdote that is related of him describes how one sour-faced ascetic came and remonstrated with him, and taxed him with inculcating in the popular mind a proneness to deception. The Signor politely heard him through, and did not excuse himself in the slightest particular; but instead, he quietly extracted a pack of playing cards from his visitor's coat pocket and then a dice box and dice from the crown of his clerical hat. The giver of good advice departed in dumb astonishment.

Boiler Explosions.

In reference to this subject, a correspondent, H. P.

G. C., writes to us to say that in his district, the oil regions of Pennsylvania, boilers are frequently too small for the work they have to perform, and that the men in charge of the boilers have frequently to quit this work to visit the wells which may be 60 or 600 yards away. Thus the boilers are left to mind themselves for hours at a time; and therefore, he claims, automatic safety appliances, such as fusible plugs, low water alarms, etc., would never be objected to by the engineers employed in the oil industry.

"An Engineer" points out the danger arising from scale in the boiler, which threatens destruction when the boiler has plenty of water as well as when the supply is short. Boiler plates get burnt by the excessive heat necessary to overcome the resistance of the scale; the scale may crack, the water come in contact

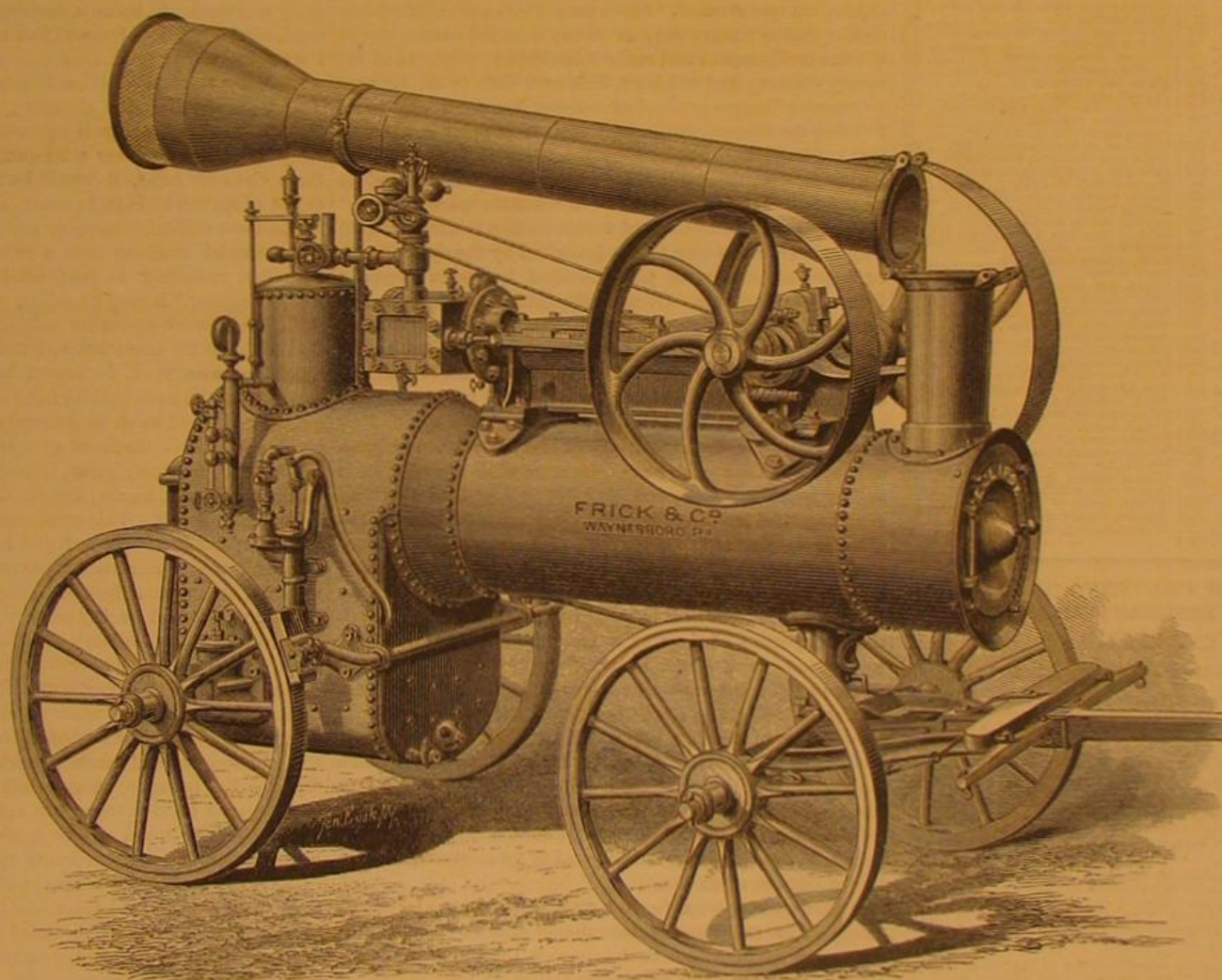
with red hot iron, steam in prodigious quantities will be formed, and the boiler be unable to resist the sudden strain. He recommends the examination and certification of men in charge of stationary engines, and points out many well known advantages of the fusible plug.

Compressed Air for Power.

In using compressed air as a means of transmitting power, a velocity of about 40 feet per second for the air in its compressed state has been found to answer in practice. When the diameter of the pipe is so adjusted as to secure this velocity, the pressure expended in overcoming friction may be estimated at one per cent of the total or absolute pressure of the air, for every five hundred diameters of the pipe in length.—Rankine.

Fine Workmanship.

We recently received a small lathe chuck from the Morse Twist Drill Company, of New Bedford, Mass., sent as a sample of milling machine work. It is a superior specimen of a branch of machine shop manipulation of which we have reason, as a nation, to be justly proud.



FRICK & CO'S ECLIPSE AGRICULTURAL ENGINE.

fire. The ash pan also has a close-fitting door, to prevent danger from that source.

For further information, address the manufacturers, Messrs. Frick & Co., Waynesboro', Franklin county, Pa.

Aniline Water Colors.

Aniline water colors are extensively used for tinting photographs, and are also being introduced for painting water color drawings. But as nearly all of these colors are altered by light, fade, and change, no honest artist will make use of them, unless he informs the purchaser by stamping some such notice as the following on the margin of the picture: "These colors, although pretty to look at, are good for nothing. They will soon fade."

Death of Signor Blitz.

Antonio Blitz, better known as Signor Blitz, the famous ventriloquist and conjuror, died recently in Philadelphia, in the sixty-seventh year of his age. Mr. Blitz came to this country from England in 1834, and at once became famous for his remarkable dexterity in the art of legerdemain. He was a very ingenious inventor, and many of the most startling tricks of later magicians originated with him. He be-

Another element of consideration is that, while it is very easy to cast or forge small work uniform in size and shape (and it does not matter if an occasional piece is lost from a defect in its casting or forging), a defect or variation is much more liable to appear in a large casting; and as the loss would be a serious matter, it may, by a slight and often inconsiderable variation, be made to serve. We have also to remember that the greater part of the fitting of work depends for its truth upon the file, for machine tools do not as a rule cut the work sufficiently true. In lathe work, special tools are confined to appliances, chucks, standard reamers, gauges, etc.; and in work of a medium size, the use of these aids tends to make the operator more expert, and a more skillful workman. It is indeed to be remembered that in small and moderate sized lathe work, the duty performed by

the tools is so great that it requires constant skill and attention to keep them in order; and the tools in use are in such continual motion as to render their employment one requiring skillful manipulation.

The interchangeability of parts is an excellent and valuable assistant in producing new machinery, but its usefulness is far from being universal, as it is commonly supposed to be; because in making repairs the new parts generally require to be larger than their original size, in order to compensate for the wear which has taken place in other parts, and hence it is that, as a rule, repairs are made by the users and not by the original manufacturers of machines. Repair shops for this reason are in general demand, and in view of this necessity, which calls for the highest manipulative skill, they generally contain the best of workmen and pay them the highest rates of wages.

STATE PATENT LAWS.

A bill now before the New York State Legislature, introduced by Mr. Lang and known as the patent right bill, is intended to protect the people of the interior of the State against the wiles of the swarms of patent right vendors who perambulate the country, selling rights and taking promissory notes for bogus patents. It provides that the words "given for a patent right" shall be written or printed across the face of the note, and any person who shall take or sell a note without the above placed upon it shall be deemed guilty of a misdemeanor. The bill has been ordered to a third reading.

We suggest a slight amendment to this proposed law, to wit, strike out the words "patent right;" otherwise the law, if passed, would be void because in conflict with the Constitution of the United States.

The United States courts have more than once decided that no State has a right to legislate upon the subject of patents, nor to regulate, nor attempt to regulate, their sale. That power belongs alone to Congress.

In the case of M. J. Robinson, arrested by the local authorities of Indiana, 1870, for violation of the State law concerning the sale of patents, it was held by Judge Davis, of the United States Circuit Court, as follows:

"This is an attempt on the part of the Legislature to direct the manner in which patent rights shall be sold in the State, to prohibit their sale altogether, if these directions are not complied with, and to throw burdens on the owners of this species of property which Congress has not seen fit to impose upon them. I have not time to elaborate the subject, nor even to cite the authorities bearing on the question, and shall therefore content myself with stating the conclusion which I have reached.

It is clear that this kind of legislation is unauthorized. To Congress is given by the Constitution the power "to promote the progress of science and the useful arts by securing for limited times to authors and inventors the exclusive rights to their respective writings and discoveries." This power has been exercised by Congress, who have directed the manner in which patents shall be obtained, how they shall be assigned and sold.

The property in inventions exists by virtue of the laws of Congress, and no State has a right to interfere with its enjoyment, or annex conditions to the grant. If the patentee complies with the laws of Congress on the subject, he has a right to go into the open market anywhere within the United States, and sell his property. If this were not so, it is easy to see that a State could impose terms, which would result in a prohibition of the sale of this species of property within its borders, and in this way nullify the laws of Congress which regulate its transfer, and destroy the power conferred upon Congress by the Constitution. The law in question attempts to punish by fine and imprisonment a patentee for doing with his property what the National Legislature has authorized him to do, and is therefore void."

In the case of Anthony vs. Carroll, where a State law of Massachusetts was cited as a bar to a patent right suit, Judge Shepley held, 1875, as follows:

"The policy of the Government to provide a uniform system of rights and remedies throughout the United States upon the whole subject matter of patents for new and useful inventions and discoveries, by placing it under the control of Congress and the federal courts, would be frustrated if such State legislation could directly or indirectly limit, restrict, or take away the remedy."

RECENT STUDIES OF LUMINOUS FLAMES.

For a long time Sir Humphrey Davy's explanation of the luminosity of flames—that it was due to the presence of highly heated solid particles—sufficed for all observed phenomena. A serious blow to its sufficiency was given, however, when Frankland discovered that certain flames were luminous under conditions which left no reason for supposing that solid matter could be present. For instance, hydrogen and carbon monoxide, burned in oxygen under a pressure of ten to twenty atmospheres, yield a luminous flame giving a continuous spectrum. So likewise the non-luminous flame of alcohol becomes bright when the pressure is increased to eighteen or twenty atmospheres. Frankland inferred from experiments like these that the luminosity of flames was due rather to the presence of the vapors of heavy hydrocarbons, which radiate white light, than to incandescent solid matter.

Still further doubt of the prevalent theory was raised by the experiments of Knapp, which proved that the diminished luminosity of a flame on the admission of air could not be due, as had been supposed, to an oxidation of the carbon suspended in the luminous gas, since the same effect was produced when nitrogen or carbon-dioxide, or other indifferent gas, was used as a diluent.

Stein and Blochmann attributed this effect to the direct influence of the diluting gases in separating the particles of carbon, so that the oxygen of the air might unite with them more quickly than under the ordinary circumstances of combustion.

Wibel held, on the contrary, that the diminished luminosity was due entirely to the absorption of heat by the diluting gas, and supported his view by some very ingenious experiments. The correctness of this conclusion has been, in turn, controverted by the later experiments of Stein and Heumann, particularly the latter, which seem to show that the diminished luminosity consequent upon dilution is due not solely to dilution nor wholly to the cooling action of the added gases, but to both these causes acting together and frequently supplemented by a third cause—namely, the energetic destruction of the luminous material by oxidation. Heumann's experiments, which have been particularly ingenious and careful, lead to the following results: That hydrocarbon flames, which have lost their luminosity by the withdrawal of heat, become luminous again by the addition of heat; that flames rendered non-luminous, by dilution with air or indifferent gases, become luminous again on raising their temperature; that flames rendered non-luminous by excess of oxygen, which brings about energetic oxidation of the carbon, are rendered luminous again by diluting the oxygen with indifferent gases. In most cases of diminished luminosity two or all of these causes are at work.

Another unsettled question with regard to flames has been the cause of the non-luminous space between the opening of a gas burner and the flame, or between the wick of a candle and the luminous envelope. Blochmann attributed it to the inability of the surrounding air to mix at once with the stream of gas so as to make it combustible. Benevise, on the other hand, thought the dark space due to the mechanical action of the issuing gas, whereby the air is driven to a distance from the orifice of the burner—greater or less, according to the pressure on the gas, leaving a space wherein the gas is deprived of the requisite amount of oxygen and consequently remains unburned. Both these explanations are shown to be insufficient by the single circumstance that a flame never directly touches any cold body held within it. In all such cases Heumann finds an explanation of observed conditions in the cooling effect of its surroundings—burner, wick, cold iron, or what not—upon the gas. For a certain space around the cooling body the gas remains at a temperature too low for ignition.

Where the gas issues under high pressure, or is greatly diluted, the distance of the flame is attributed partly to this same cooling action of its surroundings, but more especially to the fact that the velocity of the stream of gas in the neighborhood of the burner is greater than the velocity of the propagation of ignition within the gas.

THE FLOWER TRADE OF NEW YORK.

On Broadway, Fifth and Sixth avenues, and the cross streets near them between Third street and Forty-seventh, there are thirty large florist concerns, each of which pays a rent from \$1,000 to \$4,500 a year, and does a yearly business of from six to forty thousand dollars. There are besides perhaps fifty smaller shops for the sale of flowers in different parts of the city. Many of the larger gardens and hot-houses were established during the flush times between 1860 and 1870, when large sums were lavished on floral decorations. At the wedding of Tweed's daughter, for instance, the floral designs, bouquets, and parlor decorations are said to have cost nearly \$4,000. Since 1871 there has been no notable increase in the number of flower producers in this vicinity. The number of retail dealers, however, has increased, and with the greater competition and smaller demand the prices and profits have been materially lowered. Indeed, says a *Times* reporter, to whom we are indebted for a three-column review of the trade, it is only at holiday seasons that prices can be regarded as handsomely remunerative. For example, a shipment of roses and violets sent to Boston just before New Year's brought \$15 a hundred for the roses and \$1.50 for the violets; but by the 10th the same sorts of flowers were respectively worth only \$4, and half a dollar a hundred.

At this midwinter season the assortment of flowers in the New York market embraces ten choice varieties of roses, four varieties of camellias, several varieties of carnations, violets in abundance, heliotropes, mignonettes, pansies, primroses, azaleas, forget-me-nots, the sweet alyssum, etc. The lilies of the valley seem to gain in popularity constantly; and notwithstanding the great number grown about New York, so high are they in favor that the price is always good. Roehrs, of Union Hill, N. J., grows 150,000 sprays of them annually. One day last year he sent to the city by one man 10,000 sprays, for which he received fifteen cents each, or \$1,500 for a single back-load. Carl Jurgens, of Newport, Rhode Island, grows this winter 800,000 sprays of these little beauties. Roman hyacinths, which rival the lilies of the valley in popularity, are worth just now from seven to ten cents a spray, or from one and a half to two dollars a dozen. Orchids are always hard to get and very costly; sometimes as much as five dollars has been paid for a single flower. The finest collection of orchids grown for the trade in this country is believed to be that of George Such, of South Amboy, N. J.

Among foliage plants, ferns and smilax are most commonly used, and are justly prized for their effect in lighting up all floral decorations. Ordinary branches of ferns cost but three dollars a hundred, but some of the rarer kinds command as much as fifty cents each. The amount of smilax used here is enormous, experienced florists estimating that from 1,000,000 to 1,500,000 feet of this beautiful vine are made up annually in this city. Formerly it used to be imported entirely from Boston, at a cost of a dollar a yard for

single strings; now that the local florists are growing it largely, the price is greatly reduced. This winter not more than three thousand dollars' worth of all kinds of flowers and foliage have been imported from Boston, while considerably more than that amount has been sent there, besides large shipments to Philadelphia, Baltimore, Albany, and other cities.

The best informed of our large flower-growers estimate that not less than \$10,000,000 are invested in the wholesale florist's business, in land, greenhouses, and stock in this vicinity. The hot-houses cover over forty-five acres. At Union Hill, N. J., there are perhaps twenty acres under glass for the cultivation of flowers for the New York market. The general average of prices at the present time is, for loose roses, \$1 a dozen, except for choice specimens, which command fifty cents, or even a dollar apiece; calla lilies, 25 cents each; smilax, 30 cents a yard; heliotropes, carnations, bouvardia and other small flowers, about 50 cents a dozen; hand bouquets from \$5 to \$25, according to size and composition; table designs from \$5 to \$100; funeral designs from \$3 to \$150.

For permanent house decorations, grasses, *immortelles* and pressed leaves are in great favor; the most beautiful grasses being the magnificent "pampas grass" plumes from California, which sell from 50 to 75 cents each, or \$1 a pair for handsome specimens. *Immortelles*, of natural color and dyed, are brought from France, but not in large quantities.

PUTTING IN COAL.

We are in receipt of a letter from a correspondent in this city regarding the annoyances to which householders are subjected in putting in coal during the winter season. When a heavy snowfall blocks the streets, and coal carts cannot back up to the coal shoots, the drivers often carelessly dump their loads on the snow heaps, and quantities of coal are thus lost by becoming imbedded in the snow.

The remedy which will at once suggest itself to many is the adoption of the English system of delivering coal in sacks, each containing a given amount, say 200 lbs. This, in London, is obligatory; and in order to protect the purchaser against short weight, wherein, by the way, he is often woefully cheated by the system of delivery in vogue here, every cart in which the sacks are carried is provided with scales, so that the sacks may be weighed singly if the buyer makes the demand. In England, however, this is regulated by laws, and any similar statutes we do not possess. Hence there is no way of compelling coal dealers to deliver their coal in sacks; and besides there yet remains the trouble of emptying the bags into the cellar shoot. For this work, the extortion would undoubtedly be as great as for shovelling the coal by hand. Besides, the coal sacks must in some way interfere with the profits of the business, judging from a sign (now posted on a prominent thoroughfare in this city, before the office of a dealer in the commodity) to the effect that "coal will be delivered in 100 lbs. bags at 50 cents per sack." That is \$10 per ton, or about double ruling prices based on bulk delivery.

The best way, we think, to introduce a reform is to make it profitable in a legitimate way to the persons on whom it is to act. To this end, we suggest making the bags themselves an article for sale; and instead of using hemp or other cloth in their manufacture, use paper. There is no question but that coarse brown paper can be made strong enough to hold 100 lbs. of coal during its transit from yard to cellar. Let this paper be well soaked in resinous material and it will constitute a first-rate kindling, possibly as good as the "fire lighters" of similar composition now sold. It will only be necessary then to lift the filled bags from the cart and toss them bodily down the shoot. Of course, it is immaterial if they break while sliding into the cellar. Coal thus transported would be protected from the weather, and would obviate the necessity of moistening to prevent dust while it was being deposited in the cellar; and even if abandoned by the cart driver on a snow bank, the coal would hardly suffer the fate of our correspondent's fuel. We live in an era of reform. It remains to be seen what enterprising coal dealer will adopt our suggestions.

Slate Roofs.

A very economical system of slating buildings with large slates is as follows: The rafters are placed at a clear distance apart about 14 inch less than the width of the slates. Down the center of each rafter is nailed a fillet, thus forming a rebate on each side, in which the edges of the slates rest, being secured by black putty, or—as this looks smeary and uneven—by a second fillet 2 inches wider than the first, nailed over it so as to cover the edges of the slates and hold them down. Each slate laps about 3 inches over the one below it. Only half the number is required in this as compared with the ordinary method of slating, and no boarding or battens are necessary.—*Notes on Building Construction.*

In our description of Mr. Guardiola's sugar evaporator, on page 82 of our last issue, we stated that the apparatus is calculated to produce defecated juice from, say, 8° to 25° Baumé. It should read: "The apparatus is calculated to produce, in about five minutes, syrup of about 25° Baumé in a continuous stream, from defecated juice of 8°," etc.

A LAWSUIT has been commenced by one firm of pianoforte makers against another, for damage caused by the latter's misrepresenting the nature of the Centennial awards, and claiming to have received a premium higher than that given to any other maker.

SOLAR PHOTOGRAPHS.

Photography has proved an invaluable aid in the study of solar physics. By its help astronomers now obtain pictures of sun spots accurate in all their details, of the different phases of eclipses, and of phenomena of too short duration for the eye fully to appreciate. At the observatory of the Roman College, Rome, Italy, Father Secchi photographs the sun daily by means of the instrument represented in Fig. 1; and having carried on this operation for several years, he is now possessed of a record of occurrences on the solar surface which has served as the basis of many important conclusions regarding our luminary. By comparing these pictures, the periodicity of the spots has been determined; and from data thus obtained, astronomers have reached the belief that the sun acts not merely as a center of attraction and luminous source, but that it exercises a potent effect on magnetic phenomena.

The engravings herewith given were reproduced from Father Secchi's photographs, in order to show that astronomer's new work on the sun. Figs. 2, 3 and 4 show very perfectly the wavy, unequal, and granulated surface of the sun, as exhibited by a telescope of high power. Fig. 2 represents the normal condition of the surface projected (much magnified) on a white screen. Fig. 3 exhibits the granulations with their interstices, observed directly. Fig. 4 is a facula on the surface thrown upon the screen. Fig. 5 is a photograph of a sun spot, showing its rounded form at the moment of complete development; and in Fig. 6 are several such spots, grouped together.

The depth of the immense cavities forming the spots is usually about one third the earth's diameter, and never exceeds 4,000 miles. The cavities are by no means empty, as the resistance which they offer to the passage of luminous currents shows that they are filled with more or less transparent vapors. They are produced in the luminous exterior envelope of the sun—the photosphere—and are craters therein, filled with dark vapors which cut off the light from the lower strata. They are the result of violent crises in the interior of the solar globe, which sometimes take place over large areas with great rapidity; at other times they occur quite slowly, last for a considerable period, and are seemingly intermittent in their violence. The material which composes the pe-

Fig. 2.

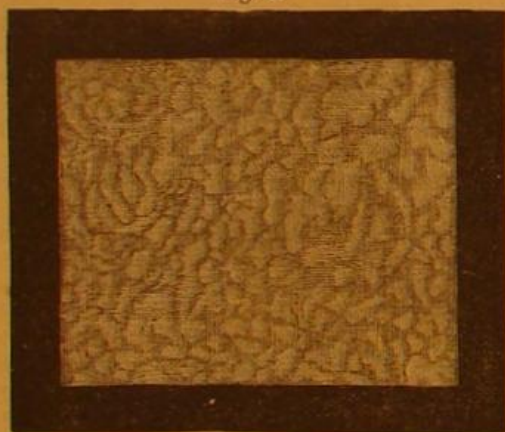


Fig. 3.

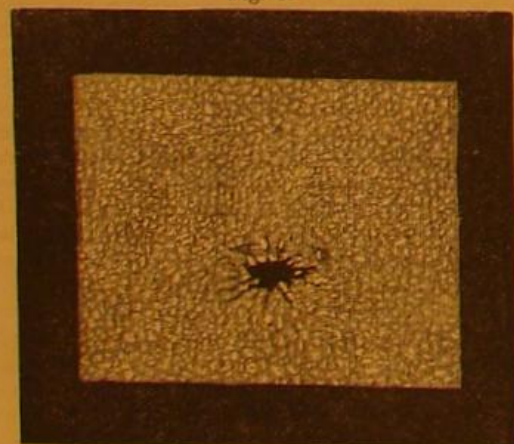


Fig. 4.



numbra of the spots, and the cloudy bridges which cross or float over the dark portion are masses of photospheric mat-

ter. These masses are the result of violent action taking place occasionally in the interior of the sun. Sometimes these actions are sudden; at others they take place slowly, and sometimes their action is renewed from time to time; and the interior trouble, of which they are but the manifestation, perseveres for a long period after their first appearances. In fact, in a great number of instances, there is a movement constantly going on, from the interior to the ex-

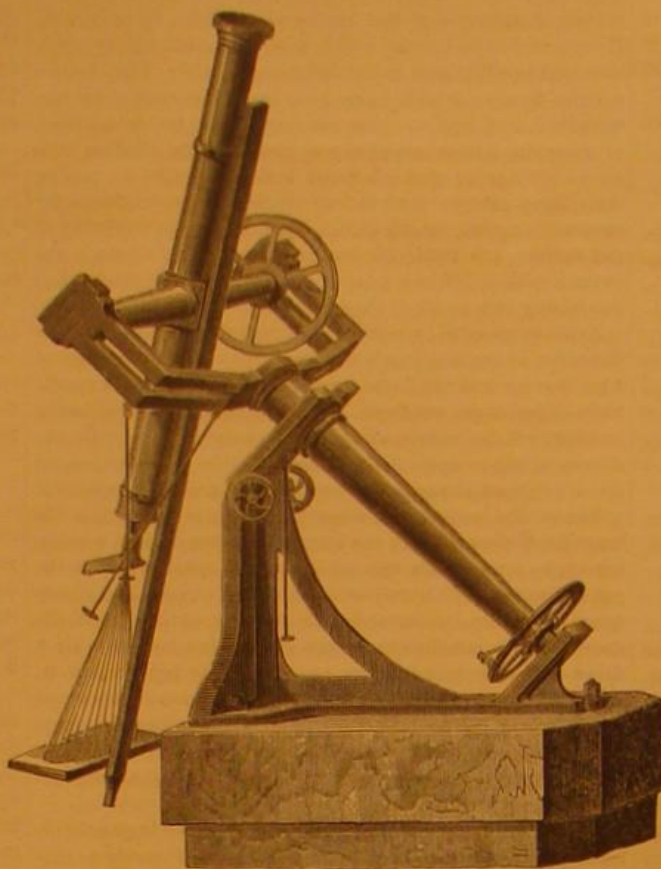


Fig. 1.—SECCHI'S SOLAR PHOTOGRAPHIC INSTRUMENT.

terior of the sun; and this movement is shown to us by the upheaval and the projection of the luminous matter, the latter becoming visible under the form known to us as *facula*. But generally, if we study the luminous masses which are seen as spots, we find that they are comparable to vaporous clouds suspended in a transparent medium. The currents and the

Fig. 5.



particles of the photosphere are driven towards the center of the spots, where they dissolve and cease to be luminous. They are often seen suspended at different heights in the solar atmosphere; and frequently the higher ones hide the lower from our view.

Solar spots are principally seen on two zones parallel to the sun's equator, one on each side of it, between 10° and

Fig. 6.



30° of latitude. The rotation of the sun was discovered by the displacement of these spots; but it is remarkable that this rotation is not similar on all points of the sun's surface. The angular speed is greatest at the equator, and diminishes as the degrees of latitude augment in number. The sun does not revolve according to the laws which we suppose to gov-

ern the movements of a solid body, whence it follows that we should regard it as a mass of fluids. The sun's rotation is accomplished in a mean period of 25 1/3 days; and we cannot as yet explain whether this rotation affects the solar atmosphere as well as the globe itself, for the interior regions are entirely hidden from us; but we can cite an indirect proof which has some importance, although it appears at first to be a little singular.

Herr Hornstein, discussing the magnetic phenomena observed at Prague, found in the movement of the magnetic needle a variation of which the period was 26.33 days. On comparing it with certain data, he attributed the phenomenon to the magnetic influence of the sun; and if we admit that the magnetic period above referred to is the same as that of the solar rotation, we find that the sun turns on its axis in 24.55 days. Magnetic phenomena thus give us a new idea of the period of solar rotation, which differs from that which we derived from study of the whole solar surface, but which is similar to that formed on a study of the sun's equatorial region.

Inventions.

Among the general public it is thought that great inventions are the result of what is called "lucky hits," and that chance has more to do with them than brain work. It is undoubtedly true that the most wonderful inventions are the simplest, and that the truths on which they are founded appear obvious. However commonplace some inventions may seem when they have become familiar to everybody's understanding, it must not be overlooked that for centuries their truths had lain concealed from the busy brain of man. If the real nature of great discoveries is fairly considered, as well as the intellectual processes which they involve, none can seriously hold the opinion that such inventions have been the effect of mere accident; but, on the other hand, it must be apparent that such *soi-disant* accidental discoveries never happen to ordinary men. We believe that inventions dawn gradually on the contemplating mind; a certain fixed idea becomes, step by step, developed, by patiently weighing the *pros* and *cons*, until at last a sort of electric spark convulses the brain, momentarily sending a glow of joyful spasm to the heart, and true genius is born to the world.—*British Mail*.

ORNITHOLOGICAL DEFORMITIES.

Mr. W. B. Tegetmeier, a naturalist whose writings on ornithology are widely studied in Europe, asserts that the struggle for life finds one of its best examples in the malformations which are occasionally found in animals of different species. A whale has been known to hurt its lower jaw so that it could not close its mouth; yet it lived and thrived, and when killed it was in excellent condition. He also states that he has in his possession the head of a salmon which weighed 12 lbs., of which the upper jaw had been entirely torn off. Yet it lived, and attained a fair average development. In birds, too, such deformities are not uncommon; and our engraving shows two remarkable instances.



The first specimen is the head of a hen pheasant, of which the upper mandible is so curved that it has cleft the lower mandible in half, and grown down so as to cause the bird to die of starvation. The second instance is that of a starling, of which the lower mandible grew to an inordinate length. The reason of this prolongation cannot be found in any necessity for it; for the bird uses its beak simply to dig for worms in soft earth, and the prolongment was formed entirely of a species of horn. In caged birds, such formations can be accounted for, as the captives do not employ their bills as they do in their native state. Sometimes the protuberance has been clipped off, but it rapidly grows again.

A TRACTILE POWER ECONOMIZER.

It is well known that any effort of traction applied to a rigid non-flexible object is much more arduous than if applied to an elastic body. Thus a carriage hung on springs is easier to draw than one not so suspended, yet of like weight. Herr Schermann, a German engineer, has lately invented an apparatus which he applies, to the collar of a horse, for example, on each side and attaches to it the traces. It consists of an iron cylinder filled with disks of rubber alternating with disks of sheet iron. Through the whole passes a rod having a hook at each extremity of the apparatus. When strain is brought on either end of the rod, the rubber is compressed, and hence the device serves as an elastic medium to pull against. The inventor has made experiments which are said to show an economy in fatigue and tractile power of 17 per cent during travel and of 20 per cent in starting the load.

[The foregoing, translated from *Les Mondes*, offers another instance of an American invention advertised abroad as the production of some foreign scientist. The same device was patented here, January 18, 1876, by Mr. August J. Peters. Its construction will be clear from the annexed engraving, in which C is the elongated end of the trace hook, entering the cylinder which contains alternate disks of rubber and metal, as already described. B is the link whereby the device is connected to the trace chain. If the invention is so economical of power as above intimated, it is worth examination by street car owners and others using horses for severe work.—Eps.]

IMPROVED SAFETY VALVES.

We annex engravings of a safety valve designed and patented by Mr. J. W. Melling, of Birkett Bank, Wigan, England, the special feature of this valve being the arrangement adopted to secure a large discharge area. This increase of discharge area as compared with ordinary valves is due partly to the increase of lift and partly to there being two openings through which the escape of steam can take place. The increased rise is obtained by providing a larger area for the steam to act on when the valve is blowing off than when it is closed. This will be seen on reference to the sections Figs. 1 and 2. When blowing off, the steam that passes the inner face, B, acts with effect on the additional surface provided by the part, C, on the valve. The width of the space left between this part, C, and the top of the boss on the seat determines what amount of increase in pressure the valve will allow before rising to its full height; for instance, if a valve was loaded to commence blowing at 60 lbs., it would act something like an ordinary valve until the pressure reached, say 62 lbs., when it would rise at once to its full height; but if the escape was made wide it would allow the pressure to rise to 63 lbs. or 64 lbs. before going to its full height, which is, when loaded by dead weight, about equal to the width of the orifice in the seat, so that the area given for discharge is as much as is required by that orifice. In addition to the outer discharge, there is the inner one that is equal to from 30 to 40 per cent of the outer one, and the combined areas amount to six or eight times as much as would be given by the ordinary kind of valve of the same outer diameter, when working with pressures over 50 lbs. per square inch.

It will be seen that the discharge from the outer face is uninterrupted, whilst the inner discharge gives these valves an additional advantage when used as reducing valves, where the difference required in the pressures is small. Mr. Melling's valves also overcome the objection to spring loading, as the increasing resistance of the spring is compensated for by the additional area that is provided for the steam to act upon. These valves also differ from the ordinary safety valves, as the lift is as great with high as with low pressures of steam.

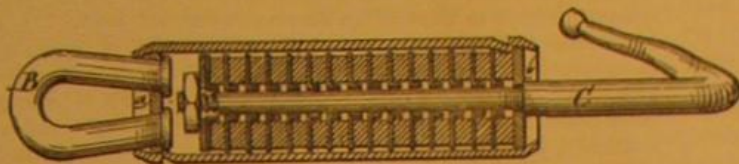
The lift of the valve shown in Fig. 1, when loaded by dead weight, is self-regulating, as the steam lifting the valve has first to pass through the orifice in the seat, but with Fig. 2 the lift has to be limited. These valves may be so proportioned as to give a large discharging area with a smaller loaded or lifting area, which makes them specially valuable when used as combined low water and high pressure valves.

Fig. 3 shows the simplest and most direct mode of loading for stationary boilers, the weights being carried by the crossbar or stirrup, the socket of which fits loosely on the end of the valve spindle.

Fig. 4 is a representation of a spring-loaded valve in which the spring fits round the body of the seat, and at the top is held at each side by the hooked ends of the crossbar or stirrup, which rests on the valve; at the bottom it is held by the projections on the collars that fit round the screw studs by which the tension is regulated. The easing lever bears against

two shoulders on the stirrup, and is so mounted that it cannot prevent the valve from rising.

For marine purposes Mr. Melling adopts an arrangement in which a pair of valves are mounted on the same branch seating. The valves are loaded by means of the two springs, one at each end of the crossbar, and the tension of the springs is regulated by means of nuts on the screw studs at the bottom, or in place of the springs two ordinary spring balances are used; in either case the springs are out of the direct current of the escaping steam. The valves when locked up are eased from their faces by the double lever and double cam. We are informed that a number of these valves are now in

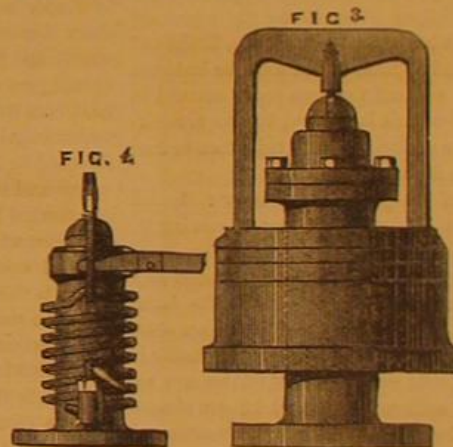
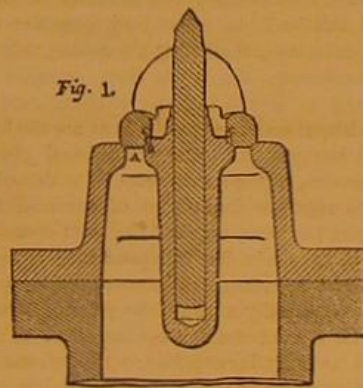
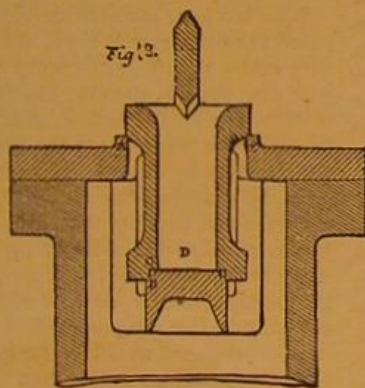


PETERS' POWER ECONOMIZER.

use, and several very favorable reports of their performances have been received. The need of such appliances is large, and is daily increasing.—*Engineering*.

The Latest Advertising Dodge.

This time it is a thoughtful financier in Vienna, who has invented an ingenious method of attracting people's attention to his lottery scheme. He watches the English newspapers, in which it is customary to print "births" with the usual notices of "deaths" and "marriages," and carefully registers the address of each happy mother. In due time the parent receives a letter (photo-lithographed) worded thus: "Dear Madam: Having read in the ——— the happy event which lately took place in your family, I beg (although a perfect stranger to you) to congratulate you with all my heart, and to add my wishes that the little offspring may become a source of great pleasure and comfort to the parents. * * It has been for many years the custom on the Continent to endow the little helpless child who enters this world with a fair chance of life in a pecuniary sense of the word. It is almost the universal practice to lay aside for the baby an interest-bearing first-rate Government bond, which also stands the chance of obtaining a large premium prize of thousands



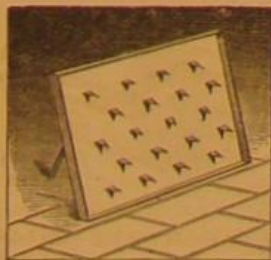
MELLING'S IMPROVEMENTS IN SAFETY VALVES.

of pounds." Then the financier encloses prospectus of the — loan of the year 1870, descants on the opportunity of the young one's winning £10,000, and thoughtfully adds a blank application for the mother to fill out, which last she is requested to please "return together with the needful cash."

A somewhat similar advantage of family increase was once taken by an enterprising porter brewer of London, who advertised porter for nursing women. New mothers invariably received circulars and full information concerning the beverage.

A Woman's Invention.

All lovers of good toast will be interested in the following useful bread toaster, the invention of Mrs. A. C. Harris, of Granville county, N. C. It is not patented, and can be made by all who wish to use it. It is made by taking a piece of sheet iron or heavy tin, about 18 inches square, and turning



up the edges so as to form a shallow tray, to give sufficient stiffness to the sheet. A number of V-shaped openings are now made in regular order across the bottom; and the tongues of the V's are turned up at right angles to the sheet. These sharp points are to hold slices of bread pressed upon them. A short piece of stout wire hinged to the back serves as a prop to hold it at any angle to the fire. After placing the slices of bread in position, by pressing them on the points, the toaster is set up on the hearth before an open fire, where the bread soon assumes a rich brown color, and then the slices should be reversed. If the lower part should brown before the upper, the toaster can be turned upside down, and so bring the underdone bread nearest the fire.

This useful invention costs only a few cents; and when once used, it becomes a household necessity.

Persian Petroleum.

Mr. Churchill, an English consul, states that for hundreds of years naphtha has been extracted by the natives from the pits at Baku, Persia, and the quantity underground appears to be unlimited. At the present moment a well eighty-one feet deep is shown that was dug by the Persians when they were masters of the country 200 years ago. In summer, when gases are generated in the bowels of the earth, the naphtha is thrown up in jets, some reaching 100 feet in

height above the soil; it then runs to waste, as no means have as yet been devised to collect such large quantities of this oil. While at Baku Mr. Churchill visited the wells situated on the plateau of Balakhana. Strings of high-wheeled carts were met going to and coming from the wells, conveying in raw skins naphtha to the town. The first well we visited, says the writer, was an artesian well 126 feet deep. It was bored three years ago, and last year rendered from 16,000 to 20,000 poods of naphtha a day. At present, the demand having decreased, it only gives about 5,000 poods (a pood is 36 lbs. in weight). A horse was employed in raising the oil by means of a pump. Each time this pump was set to work a jet of naphtha seven or eight feet high and one foot in diameter came gushing out, and kept on coming for some time. We next visited the well that was sunk by the Persians 200 years ago. With a looking glass to throw a sunbeam down it, the naphtha is seen working away at the bottom, some eighty feet below the surface, like a troubled sea.

In the close neighborhood of these two wells has been formed a lake of pure naphtha, fully a quarter of a mile in circumference and twelve feet deep. It is calculated to hold millions of poods of naphtha that has run to waste, and has now become worthless. In the year 1874 upwards of 180 manufactories were at work in the outskirts of Baku; but owing to the enormous competition of American petroleum, many of the smaller manufactories have been compelled to shut up.

The two largest manufactories are those of Mr. Mirzayoff and Messrs. Kokoroff & Co., at Surakh Khana, a spot situated five miles from Balakhana, and eight miles and a half from the town. This spot was chosen on account of the

economy of fuel, as gas issuing out of the surface is used in lieu of coal or naphtha. There is at Surakh Khana the wonderful sight of green fields with waving corn, in the midst of which the removal of a foot or two of earth will reveal a jet of gas that will raise an enormous blaze if set on fire. It is here that the Hindu monastery of fire worshippers is established, where a tongue of flame is perpetually kept up. But if these establishments have the

advantage of cheap fuel, the position of Surakh Khana, away from the naphtha wells and at a distance from the town, increases the cost of transport, and consequently adds to the cost of the article produced. The buildings, moreover, erected by Mr. Mirzayoff are too palatial for practical purposes. There may be said to be four distinct operations in the development of this trade: 1st, the extraction of the naphtha from the earth; 2d, its conveyance to the refining manufactories; 3d, its refining processes; and 4th, its transport and its disposal in the markets of Russia.

The quantity of naphtha extracted at the wells is regulated by the demand, as there seems to be an unlimited supply of the raw material. Forty wells produced in 1874 upwards of 4,000,000 poods, besides the quantity that ran to waste. The means employed in the extraction are in some cases most primitive and clumsy, and it is only within the last three or four years that the process of boring has been resorted to, and wells are even now dug in the ordinary fashion at great expense. Then, again, while fuel exists in abundance on the spot, few steam engines are used, and those which are employed are not of the best. A recent visitor did not see a single centrifugal pump in use. After that the carting of the naphtha is both clumsy and expensive. The carts are not calculated to carry more than twenty-five or thirty poods each, and they require a horse and a conductor for every one separately. There is a vast field for economy in this, if in nothing else, and various plans have been suggested for the transport of the raw material to the manufactories; some are for the establishment of a tramway, others of a railway with suitable tanks to hold the oil, while a third party insists upon the laying down of an iron pipe through which the naphtha would, by gravitation, find its own way to the lower level of the town. These two last methods are used successfully in Pennsylvania for much longer distances, and it is only by the use of such plans that the Baku petroleum can possibly compete with the petroleum of the United States.

Communications.

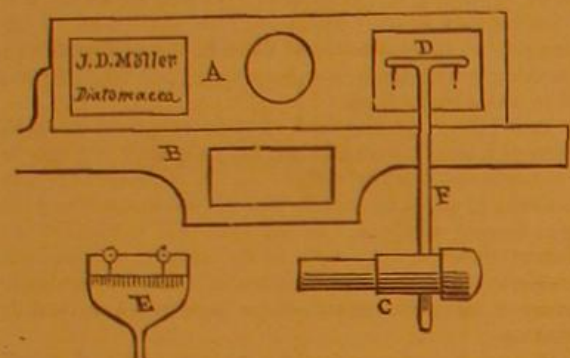
A New Object-Finder for Microscopes.

To the Editor of the Scientific American:

Enclosed I send you a sketch and short description of a finder for minute microscopic objects, a little device of my own, which has worked so well that I thought it might be useful to others.

A represents a microscopic slide *in situ* against the stop, B, of the stage, supposed to contain a diatom, perhaps several. C is a brass pin with the rake, F D, firmly fastened thereto. This pin is to be inserted into a little post fixed on the back part of the stage; or where the bar of the microscope always sustains the same relation to the stage, this pin, with a little modification of the stem, F, of the rake, can be inserted into a hole in the bar, thus avoiding the post. The collar on the pin, at C, always brings the finder to the same position, laterally, and, being fixed to the rake, F D, always has the same position longitudinally.

Having found the object on the slide and brought it into the center of the field, ink the points of the finder and press them on the label. This registers the position of the object at once; and in case the slide contains several objects, this simple process can be repeated for each. Afterward, when wishing to find the same objects, put the finder in place in the post or bar, and, adjusting the rake close to the paper, bring the dots under the points. The object can then be



seen in the microscope. At E is another form for the rake, D. A piece of brass, beveled to a thin edge, containing two semicircular openings, is substituted for the D part of the rake. To register an object, put a pencil in the openings and make the dots. With a high power objective, if the object should be out of the field at first, it can soon be brought into it by moving the stage so that the dots move around in the little circle, one half of which is formed by the semicircular openings. It will take no longer to do this than to find the numbers each time on a Maltwood finder.

The following are some of the points in its favor: 1. All the objects on the slide can be found without removing it, thus avoiding the continuous changing, as with the Maltwood finder. 2. It costs only about one fifth as much as a Maltwood. 3. With decent usage, it is practically indestructible, whereas a slight accident or a careless move shatters the glass finder; and in such a case a new glass finder is entirely useless until the whole collection of slides are re-registered, which in large collections would be no simple task. In case my finder is lost, a new one can be constructed from one registered slide, which would be correct for all. 4. With $\frac{1}{4}$ or $\frac{1}{2}$ objective, it works well. F. L. BARDEEN.

Stevens Institute of Technology, Hoboken, N. J.

A Word About Railroad Disasters.

To the Editor of the Scientific American:

In reading the accounts of the too frequent railroad disasters, I cannot avoid thinking that many of them might in part be prevented. In cases of a locomotive being thrown off the track by a broken rail, axle, or wheel, or of an obstruction on the track, an open bridge draw, or a broken bridge, the whole train is dragged to destruction because there is no mode of uncoupling quickly enough to ensure safety. This evil should be remedied, and directly. The connection between tender and cars should couple automatically, and be readily uncoupled under all ordinary conditions; and in cases of the engine or other portion of the train being thrown from the track by any of the common or uncommon causes, it should disengage automatically, thereby preventing much damage and loss of life.

In cases of collisions of cars being thrown from the track, it frequently occurs that an auxiliary in the shape of fire is on hand to join in and complete the general misery and destruction. Why not avoid this horror by making the cars of steel or iron, using as little as possible of combustible material in building and fitting up, both inside and out? I have no doubt if the ingenuity of inventors should be encouraged by railroad companies, and strongly endorsed by the traveling public, and more especially by the press, plans and models would be brought out, which, if followed up and tried, would solve the problem, and save much property from destruction and many valuable lives.

Stratford, Conn.

TRUMAN HOTCHKISS.

Success in Life.

To the Editor of the Scientific American:

I never could understand why a workman should be precluded from making what is known as a success in life. Our young men are constantly told that success lies in appli-

cation, study, energy, etc., to be used as levers whereby to lift themselves as far as possible and as quickly as possible from the position of the workman. Now since success is thus pointed out as consisting in not making skill in a handicraft the objective point: and since a large majority of those who learn a trade must of necessity remain workmen, the advice, *per se*, is valueless to the greater part of those to whom it is tendered, and is therefore, upon general principles, bad. What young man starting out with the determination to achieve that which he is taught is success in life, and bending every energy to that end, can help feeling, when after a number of years of toil he finds himself still working with his tools, that his life has been a failure? And how many of us pause to think of the disappointment and indifference that such a feeling must produce in the mind of a thoughtful man? Now where is the justice, not to say the philosophy, of a doctrine which thus compels, by force of circumstances, most of those to whom it is addressed to make a failure in life?

The striving of workmen to rise out of the ranks undoubtedly raises the general standard of excellence, and the best qualified to rise are almost sure to do so. Both these premises may be allowed; but should not the many of those who have raised that standard be entitled to some consideration and to be accredited with a measure of success? If in the race to govern others, a workman is outstripped, should he not be able to turn to his tools and feel that he can earn with them a degree of success that his fellows will regard to be as meritorious as that achieved in managing a shop or bartering the products of his skill? It may be advanced that such an idea of success would tend to destroy the ambition to rise; such, however, is not the case, because the incentive of personal comfort and even the personal cleanliness incidental to superior positions may always be relied upon to render such positions desirable.

If we examine into the circumstances of the ninety and nine, as the operative workmen may aptly be termed, we shall find that success, that is to say, the financial success to which men bow, is to them utterly unattainable through any existing avenue except it be through piecework. The system of piecework is not, however, so largely introduced in this country as it is in England; and its benefits, both to employer and employed, are not so well understood. Once let the workman see that it is to his advantage to work by the piece, and the love of gain will make him independent of the arbitrary rules laid down by trades' unions, which have done so much to hinder men from rising in the social scale and to make them dependent on the class to which they belong. The ninety and nine, if once convinced of the difficulty of individual progress, will fall back on what they consider the next best thing, the protection afforded by the unions, which, under existing circumstances, are, while their energies are directed to maintaining or increasing the existing rate of wages and other not illegal ends, as justifiable as are the laws and usages by which lawyers and other professional gentlemen protect their interests, or the agreements by which commercial combinations regulate the prices of commodities. There is this difference, however, between the two: commercial men may achieve success in life independently of such combinations, and the extra measure of success, attained by a combined effort to unnaturally advance the price of a commodity, is therefore far less excusable than the effort to improve a career which, as everyday experience proves, cannot end in what men as a rule regard as a success in life, and such a career that of the workman must be conceded to be.

New York city.

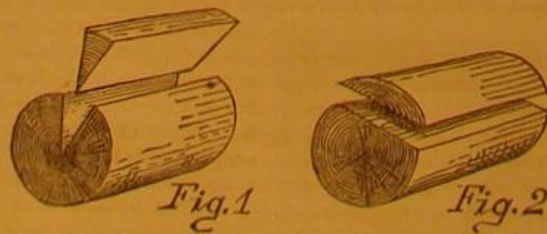
J. R.

Something on Violins.

To the Editor of the Scientific American:

I notice that some of your correspondents ask as to what purpose the twofold division of the back and belly of a violin serves. Some makers are inclined to the belief that it gives the instrument a better tone, but this I do not think is the reason that it is done, for some of the finest violins which Joseph Guarnerius ever made had whole backs. My opinion is that it is because the wood can be used to better advantage this way than it could if the back and belly were made whole. To give you a clearer idea, I will illustrate the two modes of cutting the log:

Fig. 1 represents the mode of cutting the log to get the back in two pieces, the piece which is separated from the log being afterwards divided. Fig. 2 shows the method of obtaining the whole back or belly. It will thus be seen that,



by dividing the log as in Fig. 2, we could get but four backs at the most, therefore most of it would be wasted; while by the method adopted in Fig. 1 the whole can be used, which is a great advantage where one has a fine log to cut. The two pieces are glued together with the edges that were next to the bark inwards; the under side is planed flat, and the upper or outside is planed down somewhat like the roof of a house, that is the highest in the center and sloping gradually towards the edges. The form is then scooped or worked out to the taste of the artist, in doing which a pair of double

caliper compasses are used in order to maintain a due thickness in the respective parts. In Germany and France, where the manufacture of cheap violins is carried on to a large extent, the backs and bellies are formed by steaming and then compressing them in hot iron moulds. This is done only for very cheap and toy violins, it being impossible for an instrument with the back and belly so formed to produce a good tone.

Rockland, Mass.

E. P. WHEELER.

Ideation in Utero.

To the Editor of the Scientific American:

In answer to B.'s objections, I would say:

(1) Upon thinking a moment, it will readily appear to any one that, the greater our experience in a certain branch or subject, the more readily do we comprehend anything in reference to it; and the better we comprehend it, the better and easier is it impressed upon our memory. For instance, a child might read a few pages in a book, say of chemistry, and lay it aside without remembering a word of it, simply because its experience on this subject is not sufficient to enable it to comprehend what it reads. But if the book contained stories, or some other such reading, which the child's experience allowed it to understand, it might remember the several pages for a long time afterwards. Hence experience lays the foundation for comprehension, and comprehension is the great and deep impresser of our memories.

Now if the mind of the mother has connection with and influence over that of the embryo (as it no doubt has), anything which should strongly affect her mind might implant an impression upon its mind which would be deeper and hence more lasting than any conveyed there during the first few months after birth, when its experience, and therefore comprehension, is small and insignificant. This may seem incongruous; but if such strange cases of recognition of localities as you mention in the SCIENTIFIC AMERICAN for January 27th, 1877, do occur, this, it seems to me, is the only way to account for them.

(2) B. must remember that we are all twins in one sense—that is, we have two brains (lobes), arms, legs, etc.; but all, however, supplied with one set of vital organs. Hence they bear a closer relation to each other than did the Siamese twins, but yet they are capable of acting independent of each other. In both cases, though, neither was born of the other.

Philadelphia, Pa.

H. M. S.

Dangerous Bridges.

To the Editor of the Scientific American:

Your last issue contains an article suggesting, as a safeguard for dangerous bridges, the bracing of two or four wire cables tightly drawn under each span. The idea is a good one; but it is often the case that the truss bridge, which is the form generally to be so aided, is above navigation, and the deflection necessary to the strength of the cables could not therefore be allowed. Even if this difficulty were overcome, by attaching the cables to the tops of the end posts of the truss and limiting their deflection to its height, the objection remains that a faulty proportion of strains is communicated through the truss from the supports of the cables. If, therefore, cables are to be added, they must be supplemented by additional posts and chord. The expense attending this safeguard would be far greater than that necessary to render the bridge safe at first.

I would suggest that the merits and choice of a bridge should be in all cases determined by the chief engineer, and not limited by a board of directors, who may be ignorant of the principles of bridge construction and who have no real responsibility, although the engineer may declare the structure to be unsafe.

H. V. HINCKLEY.

Marston's Mills, Mass.

The New President of Dartmouth College.

In consequence of declining health, the venerable Asa D. Smith, D.D., LL.D., has resigned the presidency of Dartmouth College after fourteen years' active and faithful service. The trustees of the college have passed resolutions very complimentary to the retiring president, and this is simple justice; for no officer of any educational institution ever worked more assiduously or accomplished greater results in raising its standard, or was more successful in obtaining funds for carrying on its work, than the wise and good Dr. Smith, who labored so long and so earnestly for Dartmouth College.

While we join the trustees in regretting the necessity of Dr. Smith's retirement, we congratulate them on their wise selection of a successor in the person of Rev. Samuel C. Bartlett, D.D., who was elected president of Dartmouth College a few days ago. Mr. Bartlett graduated in the class of 1836, and was once tutor in the college, afterward pastor of the Congregationalist church at Monson, Mass., and was for six years since Professor of Intellectual Philosophy and Rhetoric at the Western Reserve College in Ohio. He is now Professor of Sacred Theology at the Chicago Theological Seminary, where he has been for eighteen years. Professor Bartlett is one of the ablest men in the West, and his influence has been felt all over the country. His published addresses are numerous, and he is a vigorous contributor to several leading journals.

We have known both the retiring and incoming presidents for a quarter of a century, and the citizens of New Hampshire can rely upon the success of their college as long as they have such men as either at its head.

PRACTICAL MECHANISM.

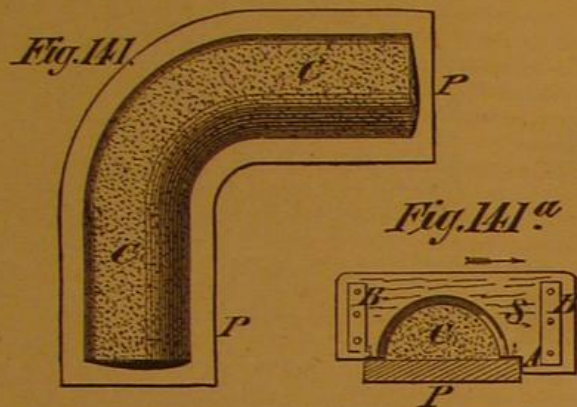
BY JOSHUA ROSE.

NEW SERIES—No. XX.

PATTERN MAKING.

Economy in timber and in the cutting must be studied as much in the core box as in the pattern; hence, when the pattern is of such a size as to render it economical to build it in pieces, it will be equally desirable to build the core box in like manner. For the bend itself, however, it is scarcely necessary to speak, for the core can be made with a simple contrivance; whereas the building of a half box, though not offering any elements of difficulty, demands so much labor in the cutting out, compared with the extra labor devolving upon the core maker employing the contrivance referred to, that such boxes are for large work seldom or ever constructed. We proceed, therefore, to describe the contrivance with which the core maker is usually supplied. It is applicable to all sizes where loam cores are used; but the core box is preferable when its construction involves no great outlay.

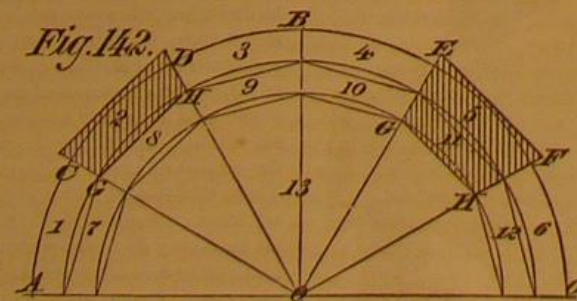
Having determined upon the size of the core from end to end of the prints, we proceed to make a pattern from which one or two iron plates may be cast. Upon these plates the core, in separate halves, is made and dried. The plates are generally about $\frac{3}{8}$ inch thick, and of such a width as to leave a small margin around the core to support what is called the strike. In Fig. 141, P represents the plate, C the core, and



S the strike: this latter is cut from a piece of board from $\frac{3}{4}$ to 1 inch thick, the semicircular hole cut in it being the size of the required core. The grain of the wood may run in the direction of the arrow. It is strengthened, if necessary, by the two battens shown in Fig. 141 a, at B B. The edges of the semicircle are beveled off, which causes the strike to work more smoothly and correctly over the composition forming the core.

A few flat-headed tacks should be driven into the surfaces of the strike that come into contact with the iron plate, so as to prevent the wood from wearing rapidly away, and thus altering the shape of the core and causing it to be oval. The core maker places upon the iron plate enough material to make the core, and, taking the strike, places it so that the edge or shoulder, A in Fig. 141 a, contacts with the edge of the plate. He then sweeps the strike over the material; the semicircle leaves the core upon the plate, and sweeps off the surplus material, the sweeping process being completed until the perfect half core is formed. In Fig. 141 a, P represents the plate, S the sweep, and O the material or core, the figure being an end view, and the tacks referred to being shown so as to mark their location.

We have hitherto treated of building patterns of such size that they could be made out of the solid; it often happens, however, that the pattern maker is required to build up a pattern by what is called staving or lagging. As an example of this kind of work, let it be required to stave up a pipe, 18 inches diameter inside, with 1 inch thickness of metal. We proceed by taking a clean board and drawing on it the line, A O, in Fig. 142; and then we describe upon it the semi-

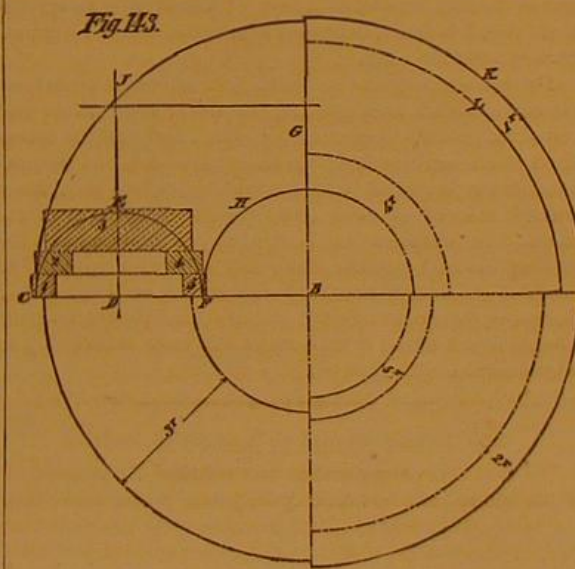


circle, A B O (for we will suppose the pattern to be made in halves), of the required finished size of the pattern, the shrinkage being allowed for. This semicircle we divide off into as many equal parts as it is intended to have staves; and we next draw radii from the points of division to the center of the semicircle. We then take any one of these divisions, of which there are six shown in Fig. 142, and draw the line, E F, parallel to an imaginary line joining the points of division, C D. The distance of the line, E F, from the arc is the amount allowed for the lathe turning, say, in this case, $\frac{1}{8}$ inch. We next draw the line, G H, parallel to E F, and the figure, E F G H, is the exact size and form required for each stave. From the center, Q, we then describe a semicircle passing through the points, G H, and cutting each of the radii, and by joining all these points, we form the half poly-

gon shown by the whole figure. This shows the exact size and shape of the disk to which the staves are to be fixed. In Fig. 142, this whole process is drawn twice, showing thick staves and thin ones, from 1 to 6 representing the thick, and from 7 to 12 the thin, staves; while 13 represents the disk of wood. The thin staves are to form the body of the pipe; but when it is desired to have the points solid with the body, we must use the thick staves. The first procedure is to prepare the requisite number of disks, making them of the form shown; and some pattern makers do this by turning the disks and then flattening them off to form the sides of the polygon. But when a hand saw is accessible, the turning is unnecessary; and we may simply draw them out and saw almost to the line, allowing, say, $\frac{1}{8}$ inch for finishing. Each half disk should be pegged to its mate, and a template, like the figure, E F G H, is useful in preparing the staves and verifying their sizes. To prepare the staves, we cut out with the rip saw the required number of pieces, a little wider than E F in Fig. 142; or if there is a circular saw at hand, we use it in preference, and it will save time to resaw the pieces to give them the required bevel, which may be done by canting the saw table. In the absence of any provision for canting, we may fix a packing piece to the table so as to elevate one edge of the stave. After sawing, we plane the bevel edges to correspond to the template, leaving just a shade of stuff to allow for jointing the staves at a close fit together.

Having prepared the staves, we set up the pattern as follows: On a planed board, the requisite number of half disks are placed, perfectly in line with each other; and the outer ones must be at such a distance apart as to allow for turning up the ends of the staves. The intermediate disks, if any (and they should occur about every 2 or 2½ feet), are to be distributed at equal distances in the space that intervenes. These disks we then fix temporarily to the board, paper being laid at the ends of the disks to catch the surplus glue.

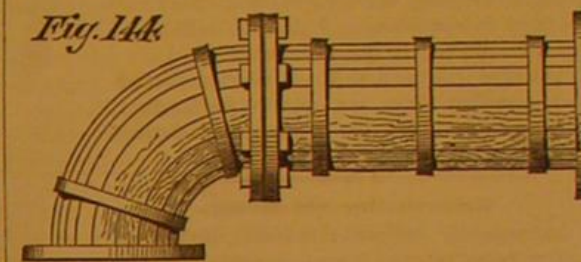
The staves are glued and each screwed with one screw to the disk. The boring of the stave to receive the screw should be performed before applying the glue, and the head of the screw should be well sunk beneath the surface, so as to admit of a wood plug being glued in on top of it. First a hole is bored in the stave, a little larger in size than the head of the screw, and nearly as deep as the screw head is to be sunk; for in tightening the screw, the head will be sure to be driven $\frac{1}{8}$ or $\frac{1}{4}$ inch deeper than the hole is bored—that is, providing the material is a soft wood, as is usually the case. The stave is now to be completely pierced with a hole just fitting the plain part of the screw. If it is larger, the head of the screw will sink deeper; while, if it is smaller, a thread will be cut in it by the screw, and it may prevent the stave from being



drawn to its place. The glue should be applied, and the screw inserted while the glue is hot. It is best to joint on a stave back and front; that is, at each end first, and to then put in the middle or connecting stave, thus completing one length of the staves, the top one being, preferably, the first erected. In putting on the succeeding staves, each one should be properly jointed to its fixed neighbor; a little chalk being rubbed on the fixed stave will show if its fellow bears or joints properly. When one half of the pattern is finished, we may dispense with the board, using the finished half in its stead, and taking care to insert paper between the two to prevent the glue from sticking them together.

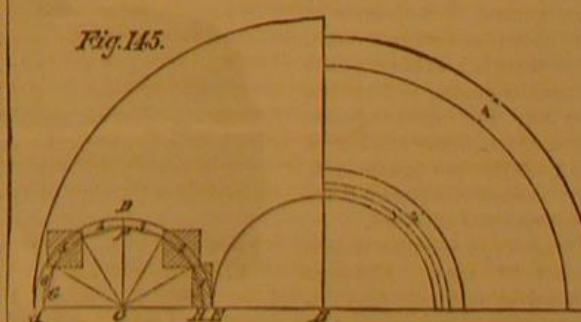
In lagging up a branch for a T, the disk at one end should be set back sufficiently far to allow for the part to be cut away in fitting the branch to the body of the T, as explained when treating that subject. This method of staving is that regularly employed for cylinders, pipes, rollers, and similar jobs; and though sufficiently simple for straight pieces, it becomes very complicated when applied to a bend. It is not, therefore, usual to stave up a bend, but to build it in the manner illustrated in Fig. 143. The operation is to first draw the bend in plan, of the full size, upon a board. Let B, in Fig. 143, represent the center from which it is struck, the plan in this case being a quarter circle bend denoted in Fig. 143 by the line, C D E, the line, G, and the sections of a circle, H and J. We have decided to build up our pattern with five pieces, an end view of the half pattern being denoted by the circle, C E F, and the five pieces or layers being denoted by dotted lines, so that by adopting this method we show the plan and end view of the bend in one drawing. It would be well now to cut out forms, in card or in very thin wood, as

templates, one for each of the pieces, marked from 1 to 5 respectively. To obtain these templates, we draw the line, C B; and from the center, D, we describe the semicircle, C E F, representing the diameter of the half bend. We then lay off the tiers from 1 to 5, as shown by the dotted lines; and to find the bend necessary for each respective piece, we proceed as follows: Setting our compasses at a distance equal to that between the center, from which our bend is struck (B in Fig. 143), and the extreme outside of the piece marked 1, we draw the quarter circle denoted by the dotted line, K. Then setting our compasses from D to the inside of piece 1, we draw from the center, D, the quarter circle denoted by the dotted line, L. The space included between those quarter circles, and denoted by I T, is the sweep for the piece 1; and we may cut it out for use as a template wherefrom to mark out piece 1. By setting the compasses in like manner for each respective piece, 2, 3, 4, and 5, we obtain the templates, 2 T to 5 T, respectively, for use in marking out the pieces upon the board from which they are to be sawn. In building the pieces up, we lay those forming the lower tier on the plan previously drawn out on the piece of board, putting them a little outside the lines to allow for finishing. We then temporarily fix them in that position, the faces being of course planed up. We now glue on the next tier. It is well, however, to have a semicircle made of a piece of thin wood and of the size of that shown in Fig. 143, by C E F, which we may place upright against the ends of the first tier as a guide in adjusting the position of the second and succeeding tiers. The num-



ber of tiers is discretionary; but it is well to have the top piece comparatively thick, so that it shall not be liable to curl, as it would be apt to do if the turning left it thin. If the joints of the tiers are well surfaced and well glued, neither nails nor screws will be needed. It is not compulsory to make each layer a continuous piece, and it will save stuff to make every alternate layer of two pieces; but the bottom and top layers are better if each be made in one piece.

It will be observed that this staving up a bend is both laborious and wasteful; yet there are cases in which it becomes imperatively necessary to make it in this manner. A very common job of this kind is lagging up a steam pipe, such as is shown in Fig. 144. The pipe is usually covered with felt or some other non-conducting material, and covered round with mahogany or walnut. Now it would be very unsightly to have the joints in the bend out of line with those on the straight part of the pipes. A hollow bend of wood has therefore to be constructed, having in it the same number of staves as there are for the straight pipe. To get out the pieces for such a bend, we proceed as illustrated in Fig. 145, in which there are shown 6 sections or staves, the semicircle, G H, representing the required inside diameter of the bend; while the semicircle, A E, represents the required outer diameter. We then divide off one of the semicircles into the required number of divisions; and we draw radii and then form rectangles around each division or space representing a stave, as shown by dotted lines in Fig. 145 at 2, 3, and 5. The method pursued in getting out these staves is precisely similar to that pursued in building up in our last example. In this case, however, as each stave is fitted to its fellow, it should be held to its place by dowels—that is, small pins of wire placed at frequent intervals, which will serve instead of glue, which would not answer by reason of the heat from the steam pipe. The disks upon which the bend is built, and of which there should be at least three, are merely temporary; and therefore the staves are not to be



fastened to them except for convenience, so as to keep them in position. For this purpose, a piece of paper with a little hot glue on each side should be placed between the stave and the disk; it will make a fastening sufficiently strong, if a little pressure be applied during the drying. Neither nails, screws, nor staples are admissible on this kind of job, as they would mar the appearance of the work when finished and polished. The two halves of the bend being completed, they are made to go together with loose pegs—that is to say, pegs that do not fit the holes tightly, as the dowels do. The halves should be held together by polished brass or plated bands; and the neatness of the finished appearance will amply repay the cost and trouble, for the polished wood forms a pleasing contrast to the contents of an engine room, where almost everything the eye can rest on is iron.

IMPROVED COW MILKER.

We illustrate herewith a new cow-milking machine, which, the inventor says, will do all that can be done in milking by hand, faster and easier. It is a useful device, especially where cows have sore teats or are hard milkers. It prevents any loss of the milk through spilling, it renders milk or straining pails unnecessary, and prevents entrance of dirt. Finally, it can be easily manipulated by anybody.

The apparatus consists of a glass globe, A, sufficiently large to contain the average yield of a cow at a milking. To the top is cemented a metal cover, which is secured by a pivoted bar and thumbscrew, B, so that all the pressure is brought on the thumbscrew and not on the globe flange. Connected with the globe by a flexible tube is the air pump, C. Also rising from the cover are small pipes which terminate in metal tips, which, as shown in the illustration, are inserted in the teats. A hard rubber holder or cut-off is made to fit over the end of each tip after the flexible tube is adjusted so as to form an air-tight joint.

The mode of operation consists simply in forming a partial vacuum in the globe by the air pump. The vessel is then suspended under the animal by straps, or is placed upon the ground, and the tips are inserted in the teats. The suction is then turned on, and the milk is drawn from the bag into the chamber. By having several of these globes, while the attendant is emptying, exhausting, and applying one, others may be kept in operation, and thus the milking of several cows may be quickly accomplished.

Patented October 3, 1876. For further particulars, regarding rights, etc., address the inventor, Mr. Edward M. Knollin, Sandy Creek, Oswego county, N. Y.

Rejuvenating Old Butter.

It frequently happens that butter dealers and butter manufacturers have a quantity of butter which becomes rancid and unfit for sale, either through improper handling or carelessness in its manufacture. Such butter can be worked over and be made to appear fresh by the following method, communicated to the *Ohio Farmer* by a Mrs. B. Smith: "In a perfectly clean water barrel, filled with water, put half a pound of alum and allow it to stand until the impurities in the water have all settled to the bottom of the barrel. Fill a large boiler half full with the alum water; heat as warm as the hand can bear—but not boiling—and then add what butter the boiler will hold conveniently. Stir it thoroughly for fifteen or twenty minutes and put the butter into a churn, adding one gallon of new milk for each ten pounds of butter. Add butter coloring enough to give a rich, yellow color and churn the whole. When the butter is gathered in the churn add salt; wash and work it well, and it will have the taste, smell, and appearance of fresh butter. It is hardly necessary to add that when butter has been worked over in this way the sooner it is sold the better."

[The last assertion of the writer renders the value of the recipe, which is otherwise reasonable, rather suspicious.—Eds.]

HYDRAULIC PUNCHING MACHINE.

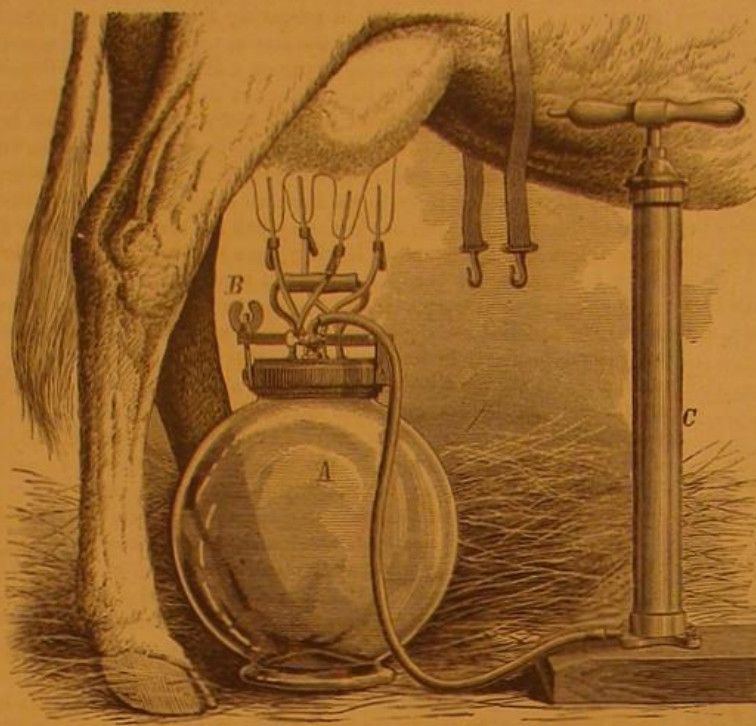
The powerful hydraulic punching and shearing machine we illustrate this week forms part of an entire plant of hydraulic machine tools on Mr. Tweddell's well known system at the French Government dockyards, at Toulon. M. Berrier Fontaine, of the engineering staff at Toulon, having gone into the whole question of economical working very closely, furnished the patentee with his requirements and the general arrangement of the shops; and when we state that there is a 50 horse power pumping engine to force water into two accumulators, each 20 feet stroke and loaded to 1,500 lbs. per square inch, the extensive nature of the application is apparent.

The whole machine weighs about 28 tons. Although shown as one combined machine, there are really two entirely separate tools, and no breakdown in the one affects the other; or, if desired, they can at any one time be placed apart if required for the better working of the shop, or, as is often done, to have a third cylinder inserted for angle bar shears. The machine will punch $1\frac{1}{4}$ inch holes in $1\frac{1}{4}$ inch plate at a distance of 5 feet from the edge, and it shears $1\frac{1}{4}$ inch plates 5 feet from the edge, taking at each cut a length of 18 inches;

this long cut is a great advantage in straight work, and reduces the number of strokes to cut the same length of plate fully one third as compared with the ordinary geared machines; the knives also can be turned round, so as to cut at right angles to center line of machine at an angle of 45° either way, or in a line with center line, thus enabling bars of any length to be cut to the length required.

The drawback motion is self-acting; and by means of tapped rods and nuts, as shown on the punching end in the engraving, the length of stroke, and consequently the consumption of water, can be regulated so as to be proportionate to the thickness of plate punched or sheared.

The levers admitting the pressure and opening to exhaust can either be worked by the man in front of the plate being



KNOLLIN'S COW MILKER.

operated upon or from behind by the chain as shown. It may be added that no stop motion is required in these machines, as the machine becomes stationary at any point of stroke the moment the man working it releases the handle; and as the first impulse of a man on discovering an error is to do this, it is found to answer admirably, and to insure extremely accurate work.

The machine requires no foundation; and as the pipes from the main are all underground, the whole space above and round the machine is clear of belts, etc., and thus the cranes fixed on the machine itself can travel all round; and the traveling crane overhead, which works the whole shop, has a traverse clear of all belts, and over the whole area of the shop. The workmanship is of a very high order, and the castings are an especially clean and well finished job. The machine was manufactured by the Hydraulic Engineering Company (Limited), Chester, England, and the results of its preliminary working in their shops was most satisfactory to all concerned.—*Engineering*.

The Young Should be Taught to Think.

We have often suggested in our columns the importance of parents and teachers drilling the young people under their

charge to think. The greatest difficulty which the teacher has to contend with is not in accustoming the pupil to repeat the rules in grammar, arithmetic, and other studies, but to induce him to reflect on the reason why the rules are laid down, and why following the rule produces a correct result: in other words, to teach the pupil to think. A correspondent, Mr. R. K. Slosson, reflects in the *Western Rural* our thoughts on this subject in a somewhat lengthy article, from which we make the following extracts:

The world is indebted for nine tenths of its valuable knowledge, its improvements and progress generally, to men and women who have trained themselves to think in a systematic and consecutive manner. No man has ever become eminent in science, art, literature, or farming, who was not a profound thinker—who did not well examine and compare all the items pertaining to the subject—to know whether, in their various relations, they sustain the principle which public opinion upholds as being true. It is not a very uncommon thing that a principle has been enunciated by men who have pet theories to support, and where it is plain to a thinking, unbiased mind, that some of the important items of the theory are in direct antagonism to the principle, and therefore false; or otherwise, the principle itself has no foundation in truth.

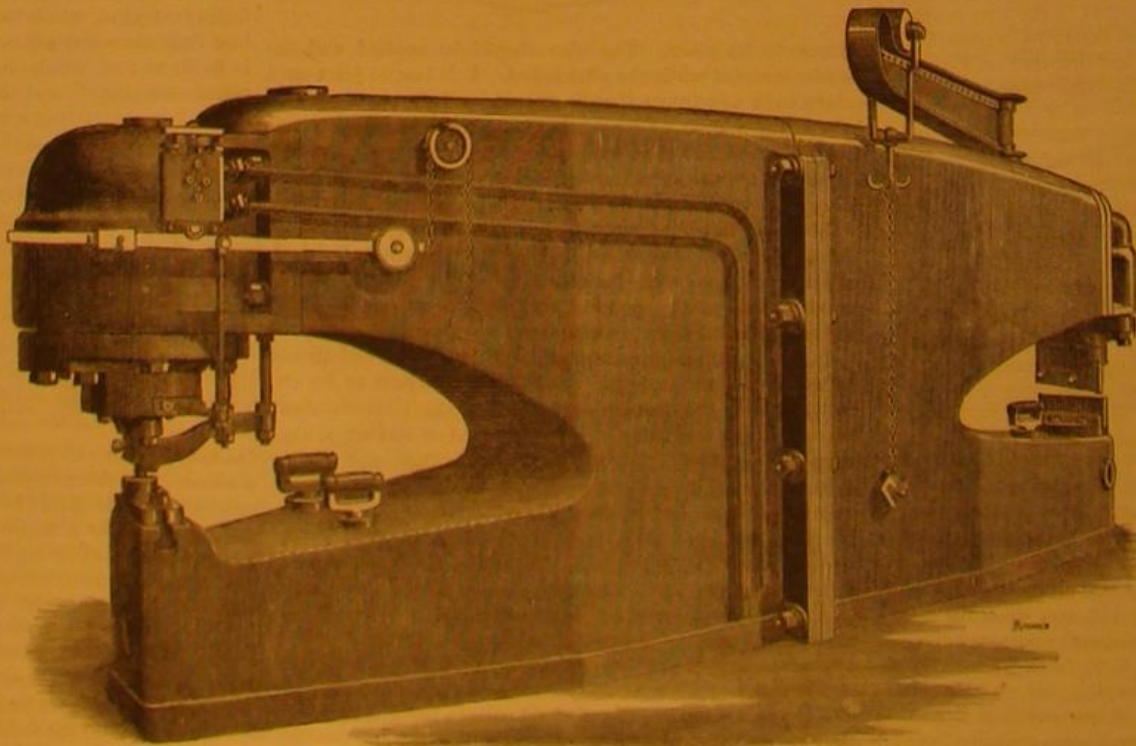
The earlier, consistent with health, that youth learn to think, the more massive and powerful will be the brain in maturity—the better prepared will be the mind to shed a glow of interest and happiness on all around, and fill itself with an intense sense of enjoyment unknown to the undisciplined mind. This process of thinking should be systematized, so that the mind can bend its energies in full force on one point at a time, and after having examined in this manner the whole ground, the facts elicited can be classified, managed, and put in a position to be easily understood and appreciated, because they are forcibly and logically brought to bear. If you once acquire the ability to concentrate the mind, so as not to be diverted from the main question or object in view, you have made a long stride in the right direction, and the vigorous use of individuality, comparison and causality will be pre-tive ones.

To assist yourselves very materially you need specially to cultivate memory; and we believe this can best be done by the association of things and ideas. If you wish to retain an idea, you have only to specify in your mind a familiar idea, analogous in some particular to the one you wish to remember; so all you have to do is to recall the familiar idea and the new one immediately pops into your mind. A little practice in this way will convince you of its utility, and remember the longer you practise a thorough analysis of the subjects submitted to your investigation, the more speedy, perfect and satisfactory will be your work. We believe, therefore, that all high schools should have a professor whose business shall be to teach pupils to think, and even our common school law should require elementary instruction in the science of thinking.

Carbonic Acid Exhaled by Animals.

A German chemist has made a long series of careful experiments to ascertain the quantity of carbonic acid given off in respiration and perspiration by different animals. From among his most important conclusions printed in the

Journal of the Chemical Society, we select a few which appear worth wider notice. In proportion to their weight, the largest quantity of carbonic acid is given off by birds—mammals come next—and worms, amphibia, fishes, and snails form another group in which the excretion of carbonic acid is much smaller; of these, worms give off the most, and snails the least. Those that live in water give off more carbonic acid to the air than they do to the water; and young animals more than old ones. Experiments with colored light show that under the green and yellow more carbonic acid is excreted than in ordinary daylight; and on comparing light and darkness, it was found that much less carbonic acid is given off during the night than during the day. Among the rays of differently colored light, the milk-white and blue rays come next to the green and yellow in activity; and the red and violet are the least active of all the hues of the spectrum.



HYDRAULIC PUNCHING MACHINE.

FAIENCE WARE.

The term *faience* is properly applied to pottery which is decorated on the surface by an enameling process after the object is made and partly baked. The name is derived from Faenza, in Italy, where decorated pottery was made in the sixteenth century; and although for a long time it was given, in France, to porcelain and china, such use must be considered erroneous. M. F. de Lasteyrie, in writing on the subject, states that forty years ago hardly any one in France was acquainted with this beautiful ware. Porcelain, which alone was used on the tables of the wealthy, enjoyed all the popularity; and *faience* was hardly reckoned in the same category as its more refined relative, and was found, chiefly in cheap wine shops, etc., in the form of plates and dishes of white color coarsely ornamented with military and other subjects printed on the ware by a kind of lithographic process. However, as taste developed and specimens of old pottery were studied, it was found that the art of Palissy and Lucca della Robbia was not without its uses, and that those great men did not give their lives to the perfection of processes merely for the enrichment of the collections of curiosity seekers. Now *faience* ware occupies the attention of the best manufacturers of ceramic art objects; and in France, where the revival of taste is most marked, the enameled pottery processes are being used in the production of the finest works of art. But the details of the old processes were not known; and the potters had chiefly to depend on the study of objects in museums for the means of carrying out their ideas. Soon, however, the art made great strides, and *faience* ware became common in the better class of houses and was accessible to men of moderate means.

Among the manufacturers and artists who brought about this result were Count Adalbert de Beaumont, a gentleman whose taste had been formed by study of the art in the East, and M. Collinot, a potter who spent many years in the study of enamels and in attempting to rival the works of the old masters. Our engravings, selected from the pages of *La Nature*, show two specimens from the atelier of M. Collinot; and it may be interesting to know how such superb vases, 8 or 10 feet in height, are produced, the enameled decorations being in inalterable colors.

The clay suited to the potter's art has one of two origins: it is either deposited by a decantation process or is a volcanic formation. The first is either marl or fuller's earth; and when baked, it possesses a rough surface to which the enamel adheres. If the ware is polished a little too much, the enamel sooner or later chips off. The clays of igneous origin, however, formed from felspar, quartz, sand, etc., take the enamel by the fusibility of their surface and form with it a homogeneous whole; but, unfortunately, they are very difficult to work and to bake, and the homogeneity will vary in different parts of the same vase or other article. These difficulties have to be overcome by mixing the clay so that the enameled surface shall be uniform all over when the ware is withdrawn from the oven; a rather difficult problem, as it will be acknowledged when it is remembered that the conditions are never alike in two instances. But when the proportions of the ingredients are once settled, and the vase is formed, it is coated with a preliminary glaze of salt and sand, or frit, as it is termed in the trade; and a first baking yields a true biscuit ware, with a surface having an affinity for the enameling materials with which it is to be treated. But in mixing the clay, it must be borne in mind that all oxides of iron must be excluded, as their presence is fatal to the brilliancy and purity of nearly all the enameling colors. The forming of the vases is done by the potter's wheel and by moulding, two methods which are almost as old as the human race.

The enamels in relief are sometimes apt, when subjected to the intense heat of the furnace, to melt and spread over the adjacent parts of the surface, making the design appear smeary and devoid of sharpness. The Egyptians and Chinese avoided this by using a kind of *cloisonnage* process, the term signifying "partitioned work." It is extremely expensive, but gives great durability and permanence to the ornamentation, especially when employed, as it frequently is, on metal. Messrs. de Beaumont and Collinot used a simple and rapid method of doing this work, which is one of the most curious discoveries of the modern ceramic art. The design is outlined on the object with a brush dipped in a mixture of copper and iron in fine powder. In the baking, the metallic mixture oxidises, and forms hard lines which prevent the overflow of the enameling material when it begins to melt under the heat. A second and a third baking give the finish to the ware, and produce the glaze, which is then uniform all over the object.

Of the two beautiful specimens illustrated, the first was exhibited at Vienna in 1873; and the Chinese Imperial Commissioner remarked: "I thought that exhibitors were allowed to show only their own productions; but here is a Frenchman who does not hesitate to place among his own

wares a Satsuma vase." To deceive an educated Chinaman with a vase of European manufacture was a real triumph for M. Collinot.

Freight Charges to the French Exposition.

A special order of the French Minister of Public Works



SATSUMA VASE IN FAIENCE WARE.

has lately been published, in which it is stated that all objects for the Exposition of 1878 (except objects of art and valuables), will be transported by all French railway companies for half the regular rates. The price, however, is in no case to be reduced below the basis of $\frac{1}{2}$ of a cent per ton



ASSYRIAN VASE IN FAIENCE WARE.

per kilometer (0.6 mile). Objects of art, valuables, very large articles, such as locomotives, cars, etc., if they cannot travel on French tracks, are subject to special rates, to be agreed upon.

A pink efflorescence has been removed from a stone wall where the Rosendale cement was used. It contained manganese, magnesia, alumina, iron, soda, and sulphuric, carbonic, and silicic acids.

Whales on the California Coast.

Last week, says a recent number of the *Monterey Californian*, our Portuguese fishermen killed a large female whale of the California gray species (*rhachianectes glaucus*) about sixty feet in length, being some twenty-two feet larger than has ever been killed here before—the average of females killed being about forty-two feet. After cutting off the blubber, they found inside a nearly full-grown male calf, which measured eighteen feet from the end of its nose to the tip of its tail, or fluke, as the whalers call it; the circumference of the body at its center, nine feet; the head about four feet in length; pectoral fins, three feet; breadth of tail, three and a half feet; and it had two ridges on the lower jaw. When brought on shore it still had three feet of the umbilical cord attached to it. The whalebone on its upper jaw was soft and white; the tongue, large and soft; the eyes, nearly full size, about as large as a cow's; and the skin was of a dark brown, mottled white. It had no dorsal fin. The females, when with young, generally keep off shore when on their way down south, to bring them forth in the warm waters of the bays of Lower California, where they remain all winter and go north in the spring. The females, when with calf, are dangerous, as they often attack the boats of the whalers. The writer once saw a boat cut completely in two by the flukes of one of these whales, and it looked as if it had been chopped in two by a dull axe; and several of the men were wounded. The term of gestation is about one year. Formerly these marine monsters were so numerous in Monterey Bay that whalers would fill up lying at anchor. Oftentimes they would be seen playing in the surf and rolling the barnacles off of their sides and backs on the sand beach—an odd way of scratching themselves.

Health Improvements.

On this subject Dr. Richardson, F.R.S., has recently delivered a lecture at the London Institution, in which he gave further illustration of the high views he entertains in regard to house sanitation. He considered that for purposes of health the houses in Great Britain require to be rebuilt, or remodeled, from Land's End to the Hebrides. Dr. Richardson entered into the history of ventilation, from the time of Stephen Hales, in 1733, to the present day, and explained the different discoveries that had been made in the various branches of science bearing on the health of towns, showing that, till these were understood and appreciated, all modes of construction were of necessity imperfect. He called attention to the influence of water, dampness, light and darkness, etc. The effects of light deserve special notice. Having got from India some poison of the cobra, on ivory points, he discovered that, on some of those which had been exposed to the light in a glass bottle, the poison had become inert; while on others that had been wrapped in paper, in the same bottle, the poison retained all its deadly activity. He hence argued that, if sunlight exercised such power on the poison of the cobra, it might by analogy destroy the poison of smallpox, scarlet fever, and typhoid. He considered that pure air and water, freedom from damp, pure daylight, and equal temperature were essential. He then entered into a variety of details of the required modifications of our present house architecture, foundations, closets, and other offices, which may possibly be excellent if practicable. From the amount of expense that would be incurred in erecting such model houses, we imagine that the worthy doctor would justly entitle himself to the thanks of every architect and builder, if not of the owners of such houses.

An Intelligent Watch.

Mark Twain has been examining a curious watch at a jeweler's in New Haven, Conn., which he describes as follows:

"I have examined the wonderful watch made by M. Matile, and it comes nearer to being a human being than any piece of mechanism I ever saw before. It knows considerable more than the average voter. It knows the movements of the moon and tells the day of the week, the month, and will do this perpetually; it tells the hour of the day, the minute, and the second, and splits the seconds into the fifths and marks the division by stop hands; having two stop hands, it can take care of two racehorses that start one after the other; it is a repeater, wherein the voter is suggested again; musically chimes the hour, the quarter, the half, the three quarter hour, and also the minutes that have passed of an uncompleted quarter hour—so that a blind man can tell the time of day by it to the exact minute.

"Such is this extraordinary watch. It ciphers to admiration; I should think one could add another wheel and make it read and write; still another and make it talk; and I think one might take out several of the wheels that are already in it, and it would still be a more intelligent citizen than some that help to govern the country. On the whole, I think it is entitled to vote—that is, if its sex is the right kind."

THE NEW SUN AND ITS DISAPPEARANCE.

The phenomenon of the appearance of a new star in the heavens is rare enough to arouse the greatest interest among astronomers and other scientific persons. It is not merely an occurrence appalling in its mystery and immensity; but even in the minds of those accustomed to contemplate the majesty of other worlds, it tends to arouse questions of the gravest importance relative to the physical and chemical constitutions of the stars, and to the comparison of our own sun with other far distant ones.

On November 24 last, M. Schmidt, Director of the Observatory at Athens, Greece, at 5h. 41m. in the evening, saw a star of the third magnitude in the constellation *Cygnus*. No record of the existence of any such star was in existence. No such star was visible on November 20; but whether it appeared on one of the intervening days between that date and the 24th, M. Schmidt cannot say, as cloudy weather had then prevailed in Athens. The news was at once telegraphed throughout the world, and the astronomers watched the new star gradually wane until, on December 8, it was scarcely of the sixth magnitude. The position of the star is shown in Fig. 2, which we take from *La Nature*.

By comparing the observations of the discoverer, M. Schmidt, with those of M. Prosper Henry, we find two important facts: First, that within eight days the star diminished from the third to the fifth magnitude; and secondly, that the color changed from a marked yellow to a bluish green. On December 2, spectroscopic observations at different observatories were made; and the general conclusion was that the spectrum, being formed in large part of brilliant lines, was that of an incandescent vapor or gas. On December 4, M. Cornu obtained a very satisfactory observation, which enabled him to identify three lines as the lines C, F, and 434 of hydrogen. A fourth appeared to him to correspond to the line D, of sodium, and another with the characteristic line, δ , of magnesium. Finally, two lines, of which the wave lengths are 531 and 451, appeared to coincide, one with the famous line 1474 (Kirchhoff's scale), observed in the solar corona during eclipses; the other with a line of the chromosphere. M. Cornu's own account of his investigation is as follows:

"The spectrum of the star is composed of a certain number of brilliant lines on a luminous background, completely interrupted between the green and the indigo, so that at first sight the spectrum seems to be in several detached parts (see Fig. 1). . . . The brilliant lines, arranged in the order of their brilliancy, are eight in number, with the following wave lengths in millionths of millimeters: α , 661 (hydrogen, C, is 655), δ , 589 (between sodium D, 589, and chromosphere band, 587), γ , 531 (corona band, 532), β , 517 (identical with δ , 517, of magnesium), ζ , 500 (no correspondence), η , 483 (hydrogen, F, 486), θ , 451 (chromosphere band, 447), and ϵ , 435 (hydrogen, 434)."

It thus appears that the light of this new star is exactly the same in composition as that of the solar chromosphere; and thus we are told that the new comer is a sun, doubtless in general respects like our own, which has met with some great catastrophe whose cause we cannot at present determine, but whose real nature is unmistakable. "Our sun," says Professor Proctor, commenting on the phenomenon, "is one among hundreds of millions, each of which is probably, like it, the center of a scheme of circling worlds. Each sun is rushing along through space, with its train of worlds, each bearing perhaps, like our earth, its living freight, or more probably each, at some time or other of its existence, becoming habitable for a longer or shorter period. Thus the suns may be compared to engines, each drawing along its well freighted train. Accidents among these celestial engines seem fortunately to be rare. A few among the suns appear suddenly (that is in the course of a few hundred years, which in celestial chronometry amounts to a mere instant) to have lost a large part of their energy, as though the supply of fuel had somehow run short. Mishaps of that kind have not attracted much attention, though manifestly it would be a serious matter if our own sun were suddenly to lose three fourths of his heat, as has happened with the middle star of the Plow, or ninety-nine hundredths, as has happened with the once blazing, but now scarcely visible, orb called η , in the keel of the star ship *Argo*. But when we hear of an accident of the contrary kind—a sun suddenly blazing out with more than a hundred times its usual splendor—a celestial engine whose energies have been overwrought, so that a sudden explosion has taken place, and the fires, meant to work steadily for the train, have blazed forth to its destruction—we are impressed with the thought that this may possibly happen with our own sun. The circumstances are very curious, and though they do not show clearly whether we are or are not exposed to the same kind of danger which has overtaken the worlds circling around those remote suns, they are sufficiently suggestive.

"Now, a point to which I would call special attention, is that all the elements of the catastrophe, if one may so speak, which has befallen the remote sun in the Swan exists in our own sun. At times of marked disturbance parts of our sun's surface show the lines of hydrogen bright instead of dark, which means that the flames of hydrogen over those parts of the sun are hotter than the glowing surface of the sun there. We

have all heard, again, how Tacchini and Secchi, in Italy, attributed some exceptionally hot weather we had a few years ago to outbursts of glowing magnesium. And, lastly, our sun is well supplied with that element, whatever it is, which gives the bright line of its corona during eclipses; for we now know that the whole of the streaked and radiated corona occupying a region twenty times greater than the globe of the sun (which itself exceeds our earth one million two hundred and fifty thousand times in volume) belongs to the sun. Again, though the sun has shone steadily for thousands of years, yet, so far as can be judged, the stars which, like this one in the Swan, have burst out suddenly, blossoming into flames of hydrogen, within which the star's heart core glows with many hundred times its former heat, have also been for ages shining steadily amid the star depths. We know that the one which blazed out ten years ago in the Northern Crown was one of Argelander's list, a star of the tenth mag-



Fig. 1.—SPECTRUM OF THE NEW STAR IN THE CONSTELLATION CYGNUS.

nitude, and that, after glowing with eight hundred times its former brightness for a few days, it has resumed that feeble luster. We have every reason which analogy can furnish for believing that the new star, which was not in Argelander's list, simply escaped record by him on account of its faintness. It is now fast losing its suddenly acquired luster, and is already invisible to the naked eye. It appears, therefore, that there is nothing in the long-continued steadfastness of our sun as a source of light to assure us that he, too, may not suddenly blaze forth with many hundred times his usual luster (the conflagration being originated, perchance, by some comet unfortunately traveling too directly towards him). Though he would probably cool down again to his present condition in the course of a few weeks, no terrestrial observers would be alive at any rate to note the fact, though the whole series of events might afford subject of interesting speculation to the inhabitants of worlds circling round Sirius or Arcturus. Fortunately we may legitimately reason that the risk is small, seeing that among the millions of suns which surround ours, within easy telescope distance, such catastrophes occur only ten or twelve times per century."

A New Method of Fireproof Construction.

We have repeatedly pointed out, says the *London Building News*, the futility of relying on iron as a fireproof material, when used in construction in the form of girders or columns, unless duly protected. Of course the most perfectly fireproof structure would be one built entirely of bricks, but the impracticability of employing these materials in sufficient

joists they place on the walls in the ordinary way, only, instead of placing them, as is usual in constructing an ordinary floor of wood joists and boards, with a space between the joists, they are placed together without any intervening space. The ends of the joists are allowed to bear on the walls in the usual way (only no plate is required), and the last joist at each end of a series of joists is also allowed to bear upon the walls. The sides of the joists are brought into intimate contact by being bolted up close at intervals with screw bolts, or spiked together with strong spikes, or screwed with ordinary screws, or any other similar method; and the result is a solid slab or floor of timber of the size of the room, bearing on the walls on all four sides, of enormous strength, and capable of bearing almost any weight that may be put on it, and yet exerting no outward thrust upon the walls. After the floor has been thus constructed, the inventors drive, at close intervals, into the under surface of the floor forming the ceiling of the room below, a number of flat-headed nails; this forms a key for the plaster, and the ceiling is then plastered in the ordinary way, with a good thick coat of common plaster, care being taken to use a rough plaster that will not shrink and crack, rather than a hard and brittle one. This coat of plaster would resist an immense heat, until it became calcined and red hot itself, but

even then the under surface of the wood becomes only charred with the heat of the plaster, and its strength remains unimpaired for a very long period. In addition to its other advantages, it is noiseless in use, and in any room or building where it is applied as a floor the sound of feet is scarcely heard, whilst in the rooms below the sounds made above are unheard, the floor being practically sound-proof.

Under ordinary circumstances, it is only necessary to plane off the top surface of the joists, no flooring boards or other covering being required; but if the floor above is intended for the storage of highly inflammable goods, such as oils, spirits, varnishes, paraffin, etc., the patentees recommend that the upper surface of the floor should be floated with cement, or covered with stone or tiles, or some other similar material; before the cement is laid, it is advisable to cover the top surface of the joists with a thin layer of loam and sand, or fine concrete, to receive the cement. This will prevent any cracking in the surface of the cement caused by shrinkage, which might occur in the timber. As an additional precaution against any shrinkage in the timber, causing an open joint, a wood tongue may be introduced between the joists; but this, it is asserted, is not absolutely necessary, as, should any shrinkage occur at any time, and show a gaping joint in the floor above, a little fine plaster or cement run between the joists would effectually stop all draught, and answer the same purpose as the tongue, and with very much less cost; but of course, when the upper surface is covered with cement or paving, neither precaution would be required.

Rapid Transit in Paris.

The Paris Municipal Council has before it a scheme prepared by the engineers of the city, after an inspection of the London Metropolitan and District Railways, for the construction of underground railways in Paris. It is proposed by this scheme that there shall be two main lines running east and west. The first, starting from the Vincennes Station, will pass under the Lyons station, the Château d'Eau, the Halles, the Palais Royal, the Bourse, the St. Lazare terminus of the Western Railway, and terminate at Les Batignolles. The second, starting from the Orleans terminus, will follow the left bank of the Seine, and run beneath the whole length of the Boulevard St. Germain. This line will also have a junction with the first by means of a railway passing under the Seine and the Louvre, and terminating at the Palais Royal. The first line will also have a branch from the Halles to the Northern and Eastern railway stations. The central station of the whole system, that of the Palais Royal, will be 23 feet below the level of the pavement, and the approach to it will be from the Galerie d'Orleans, the buildings upon the north side of which will be utilized as booking offices and waiting rooms. The total cost is estimated at \$31,800,000 for 17 miles, which gives an average of \$1,870,585 per mile.

Illumination by Reflection.

In our issue of June 10, 1876, we described and illustrated a system of illumination introduced in Italy by Signor Balestrieri, of Naples, and stated that it was identical with that used in the locomotive head-light patented to Messrs. Lee & Baldwin, of Troy, N. Y., on July 18, 1871. We are now in receipt of a long communication from Signor Balestrieri, stating that his invention was exhibited at the Maritime Exposition held at Naples in the beginning of 1870, and citing evidence in support of his claim to the origination of the idea.

MR. M. W. WALKER, of Warm Springs, Oregon, writes to us to say that the mean daily temperature at that place ranged between 23° and 48° Fah. during the month of December, 1876. On 25 days of the month, it was between 30° and 40°. This is remarkably mild weather for winter; and it would seem from this that Oregon is a good locality for invalids.

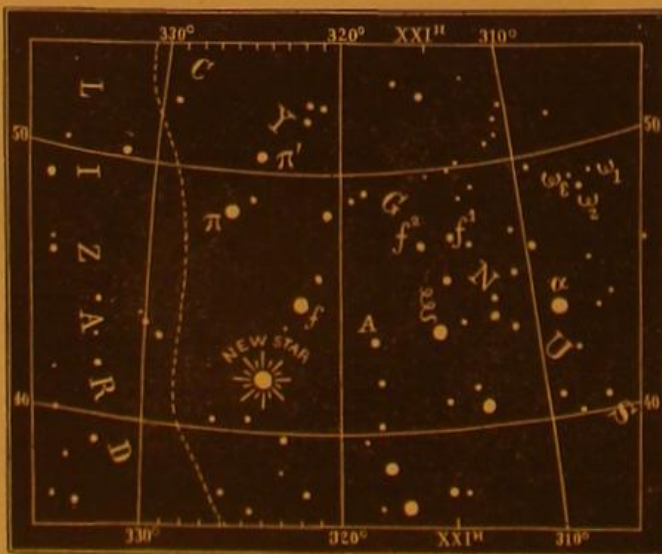


Fig. 2.—THE NEW STAR IN THE CONSTELLATION CYGNUS.

masses to resist the immense thrust exercised by brick arches of any span, if required to carry any weight, has been universally admitted. Messrs. Evans and Swain, the patentees of a new system of fireproof construction, prefer to rely on wood and plaster, and there is little doubt but that by the judicious application of these two materials a large amount of resistance to the action of fire may be obtained. Captain Shaw some time ago conducted a series of experiments on the fire-resisting qualities of a stout wooden post, which set many people thinking whether, after all, we had done well to abandon the use of timber in favor of cast iron; while common plaster, as we have more than once had opportunities of witnessing in great conflagrations, is unequalled as a protecting material, remaining intact when wrought iron melts and stone shivers into fragments. In the construction of their new fireproof floor, Messrs. Evans and Swain take ordinary timber joists of any uniform depth, generally 9 inches or 11 inches for ordinary floors and spans up to 25 feet, but deeper where greater span or strength is required, and of any thickness (the thinner the better, as there is less chance of shrinkage and an open joint forming). These

THE RESOURCES OF THE PACIFIC COAST.

The Pacific Coast States and Territories—namely, California, Oregon, Nevada, Colorado, Utah, New Mexico, Washington, Montana, Idaho, Arizona, and Wyoming—have an aggregate area of 1,218,385 square miles, amounting to about one third the total area of the United States, and equal to that of China proper. While China, however, contains over four hundred million inhabitants, the total population of the above States is but little over a million and a half. Hence they are practically undeveloped, and their magnificent resources lie comparatively idle, inviting the industry and the enterprise of the emigrant from the overcrowded East. On the southern borders of this great region, which extends for 1,500 miles along the shores of the Pacific, are found the olive, the vine, the lemon, the mulberry, the cotton plant, and the sugar cane; further north, wheat and other cereals, with all the fruits of the temperate zone, flourish; and still further northward, the wheat and flax indigenous to cold latitudes are encountered. From an industrial point of view, the area may be divided into two sections, the mineral and the agricultural. The purely pastoral districts are scattered over the whole of it, from the Colorado to the Fraser river, and from the borders of Nebraska to the Pacific. The agricultural districts are mainly found between the base of the Sierra Nevada chain and the ocean. In Nevada, Utah, Colorado, New Mexico, and Arizona, there are great tracts capable of being rendered fertile by irrigation. The mineral section is the largest of all, embracing three fourths of the territory under consideration, and stretching eastward from the western foot hills of Dakota, Nebraska, Kansas, Indian Territory, and Texas. We have before us an annual review of commercial and industrial progress in the Pacific States, prepared by the San Francisco *Journal of Commerce*. From this splendid piece of journalistic work, which covers eight huge newspaper pages, we extract the facts on which this article is based.

Taking first the agricultural products, it appears that there are at least one hundred million acres of land suitable for the culture of

WHEAT.

It is estimated that this territory is capable of producing, when scientifically cultivated, yearly some 2,500,000,000 bushels of wheat, worth, at 50 cents per bushel, \$1,250,000,000. The actual value of the wheat yield for 1876 was but \$33,000,000. The wheat lands of the coast are extensive enough to supply a million farmers and their families each with a 100 acre farm. Reckoning in workmen and their families, the wheat lands can give employment in their cultivation to a population of 15,000,000; while, taking into account tradesmen, merchants, manufacturers, etc., they can support fully 35,000,000 people, or a population equal to that of France.

COTTON

culture is greatly neglected. The production during the past year was very small, and the cotton sold at the low rate of 14 cents per lb. There are some 8,000,000 acres of good cotton land in the territory under consideration, capable of producing a crop worth \$200,000,000 annually. In this connection planters skilled in cotton cultivation are required, as the plant, it is said, grows better in California and Arizona than on the Atlantic coast.

There are few regions in the world better adapted to

THE VINE.

Some 30,000,000 of acres are peculiarly suited to the culture, and these are capable of a yield worth \$6,000,000,000 a year. Vine growing offers the strongest inducements for immigration of the skilled laborers from the vineyards of France, Germany, Switzerland, Italy, Portugal, and Spain. The country needs their experience and intelligence; and, in return, it offers them homes and the means of fortune. The total area available for fruit culture is 50,000,000 acres, all capable of being planted with orchards and orange, lemon, and banana groves. At the same time all the fruits of the temperate zone are cultivated with wonderful results; the aggregate possible value of the fruit yield is \$2,500,000,000 yearly.

There are favorable localities for the cultivation of the sugar cane and rice in quantities sufficient to supply the population of the region and their immediate neighbors. Coffee can be profitably grown in the southern part of Arizona. Jute, hemp, and ramie may also be cultivated.

Turning now to the pastoral capacities of the territory, it appears that over one third the whole area, or 250,000,000 acres, are suited in a high degree to

WOOL GROWING.

Even the Angora goat has been successfully raised; and it is thought that the alpaca and the Thibet and cashmere goats can also be acclimated. It is estimated that 250,000,000 of sheep can yearly be raised on the coast, producing wool worth at its very lowest \$180,000,000 annually.

One of the greatest sources of wealth of the Pacific coast in the future will be its magnificent array of woodlands, which are probably the finest in the world. The quantity of

LUMBER

contained is estimated at 4,000,000,000,000 of feet, worth at the present mill price of lumber \$40,000,000,000. There is no species of lumber that may be required for any useful purpose that may not be found somewhere on the coast or islands; while ornamental woods of the finest kinds abound.

Lastly we have the mineral resources. The principal

GOLD DEPOSITS

are and have been found in the valleys of the rivers flowing

from the high mountain ranges; hence California, Colorado, Idaho, and Montana, and the sides of the valleys in them, adjacent to the great ranges, have become the chief sources of gold. The western side of the Sacramento and San Joaquin valleys have yielded little, if any, of the precious metal. Most of the known superficial deposits have been worked out; but there are still vast beds, that are treated by the hydraulic process, that will last for a score of years. Besides these, there are the ancient river beds, one of which, the Blue Lead, has been traced for hundreds of miles. The present production of gold is about \$53,000,000 on the Pacific Slope, of which California produces some \$23,000,000. The production of

SILVER

is principally confined to the States of Nevada and Colorado and the territories of Utah and New Mexico. The deposits are practically inexhaustible, and their extent has never been determined. The yield of the metal for 1876 was about \$50,000,000.

The quicksilver mines of California and Arizona have produced in 1876 between 60,000 and 70,000 flasks. They are capable of yielding 120,000 flasks yearly, worth at the lowest \$3,600,000. Lead is found united with silver and in immense quantities. The amount supplied to the United States from the Pacific coast is about 8,000 tons yearly. Copper is mined in small quantities now; but is present in large amounts, and eventually will become an article of export.

COAL

is found in great abundance. That on the Pacific slope is nearly all lignite. The great Rocky Mountain coal field covers some 300,000 square miles; and there are other immense deposits in or near the coast ranges. Iron exists in large amounts in Oregon, the deposits having been traced for a distance of 25 miles; the mines are yet to be developed. The California and Nevada borax deposits are the most extensive in the world; and although they are of comparatively recent discovery, they have already greatly affected the price of the product. In Nevada, there are a mountain of rock salt and illimitable soda deposits. There is also a fine deposit of tin, and extensive beds of antimony and manganese in Nevada and Utah. The petroleum wells of southern California are capable of yielding 20,000 barrels of oil per day, or nearly as much as the present Pennsylvanian product. Sulphur is also found in Nevada in large amounts, and is shipped to San Francisco.

The Scarlet Fever Epidemic.

Scarlet fever is reported as being epidemic at present over a large portion of the country, especially in the Western States. In Chicago, the prevalence of the disease has excited considerable alarm, and several meetings of the medical faculty of the city have been held for the discussion of the best modes for its prevention and cure. In Boston, also, the disease is being closely watched by the health authorities of the city, and they have issued very admirable instructions for its avoidance and treatment, which will be found quoted below.

Scarlet fever is highly contagious, and at the same time exceedingly fatal; so that there should be no halfway measures taken to prevent its spread. Wherever the disease has manifested itself, the utmost vigilance is imperative to prevent clothing or other infected articles communicating the malady to other persons. There is even danger of disseminating the poison by funerals, the *Medical Record* tells us; and the same authority counsels the greatest care on the part of physicians lest they themselves, coming from the bedside of patients, carry the disease to non-infected houses. The protection of school children will also require great care; and our contemporary strongly recommends that a thorough system of medical inspection be organized in our now crowded public schools.

As a recent meeting in Chicago, the physicians discussed at considerable length the value of belladonna as a specific for the malady. The daily use of this drug as a prophylactic against scarlatina is "emphatically recommended;" "but," continues the resolution passed, "only in doses so attenuated as not to produce visible effects upon the organism, and always under the advice of the family physician." The other resolutions agreed upon are "that isolation is the next only means that we know of to prevent the spread of the disease, but we deprecate arbitrary interference with the rights of families;" and "that we have every reason to believe that such a course would reduce the frequency, the severity, and the mortality of this disease, but will not wholly eradicate it, nor do we know of any means that will."

The following is the Boston Board of Health's circular: "Scarlet fever is like smallpox in its power to spread readily from person to person. It is highly contagious. The disease shows its first signs in about one week after exposure, as a general rule, and persons who escape the illness during a fortnight after exposure may feel themselves safe from attack. Scarlet fever, scarlatina, canker, rash, and rash fever are names of one and the same dangerous disease. When a case of scarlet fever occurs in any family, the sick person should be placed in a room apart from the other inmates of the house, and should be nursed as far as possible by one person only. The sick chamber should be well warmed, exposed to sunlight, and well aired. Its furniture should be such as will permit of cleansing without injury, and all extra articles, such as window drapery and woolen carpets, should be removed from the room during the sickness. The family should not mingle with other people,

Visitors to an infected house should be warned of the presence of a dangerous disease therein, and children, especially, should not be admitted. On recovery, the sick person should not mingle with the well until the roughness of the skin, due to the disease, shall have disappeared. A month is considered an average period during which isolation is needed. The clothing, before being worn or used by the patient or the nurse, should be cleansed by boiling for at least one hour, or, if that cannot be done, by free and prolonged exposure to out-door air and sunlight. The walls of the room should be dry-rubbed, and the cloths used for the purpose should be burned without previous shaking. The ceiling should be scraped and whitened; the floor should be washed with soap and water, and carbolic acid may be added to the water—one pint to three or four gallons. The infected clothing should be cleansed by itself, and not sent to the laundry. In case of death from scarlet fever, the funeral services should be strictly private, and the corpse should not be exposed to view. Because children are especially liable to take and spread scarlet fever, and because schools afford a free opportunity for this, the Board of Health has excluded from school every child from any family in which a case of the disease has occurred, and has decreed that the absence shall continue four weeks from the beginning of the attack, except in cases subject to the discretion of the Board, and that the scholar, to be re-admitted to his schoolroom, must have the certificate of a physician that the required time has passed."

As regards this last provision, in localities where authorities do not promulgate similar instructions, parents will do well to take the precautions noted; and after the disease has shown itself in the family, the attendance of any of the household at school, until the period stated has elapsed, should be prevented.

Chloroform and Dentistry.

We have repeatedly noted accidents produced by the use of chloroform in minor dental operations. A very sad case recently occurred in Rahway, N. J., in which, by the improper administration of the anæsthetic, a robust, healthy boy lost his life. The *New York Medical Record*, commenting on the casualty, offers the following valuable suggestions:

In regard to the use of chloroform in dentistry there is but one opinion, namely, that it is always dangerous. As a general rule, it should never be administered at all for purposes of tooth extraction. In the present state of professional opinion upon the subject, the dentist who chooses to administer it, even in a special case, assumes a responsibility of which he should not be ignorant. So great is the prejudice against this anæsthetic among leading dentists that many will not allow it to be administered in their offices, even when the direct professional responsibility is assumed by an experienced physician.

Although the fact cannot be very well explained, chloroform has taken more victims from the dentist's chair than from any other place. Indeed, it has gained its reputation as a dangerous article more in connection with simple tooth drawing than with any other operation, however grave or formidable. A very good reason for the liability to accidents is the erect position of the body of the patient while in the operating chair. Taking this into account, authorities are unanimous in advising that chloroform should never be given except the patient is recumbent.

No surgeon cares to assume the responsibility of giving chloroform unless he knows that the stomach of the patient is empty, that the circulatory apparatus is in good condition, and the lungs free from disease. A previous inquiry into these conditions is as much a part of the administration of any anæsthetic as in the placing of the napkin to the nose. It appears in the Rahway case that all these preliminaries were neglected. The patient came into the office immediately after having eaten a hearty meal, and, without any questions being asked, was at once placed in the operating chair. There was no loosening of waistband or shirt collar, no examination of the chest—in fact, nothing was done except to order the little fellow to take long and deep inspirations, while the napkin was held closely against the nose. The result could easily have been foreseen. The overwhelming effects of rapid anæsthesia and the crowding impediment of a full stomach, in the most unfavorable of all positions of the body, did not invite death in vain.

The examination of the bodies of patients dying from the effects of chloroform have not thus far given us any satisfactory pathological explanation. The lesions have varied with each individual case, and have given rise to as many different theories. The careful and thorough examination of the body of the victim of the Rahway tragedy still leaves the question an open one. It may be, however, that both asphyxia and asthenia operated together in producing the effects observed; but the precedence which should be given to either involves the discussion of some questions, for which, in the present state of pathology regarding deaths from chloroform, we are not yet prepared.

Death of the White Whale.

The white whale at the New York Aquarium recently died. He was captured with much difficulty off the coast of Labrador, and has seemingly enjoyed good health during his five months' sojourn in the aquarium tank. Lately, however, the experiment of giving him fresh instead of salt water was tried, and the change disagreed with him, producing his death.

NEW BOOKS AND PUBLICATIONS.

AERIAL NAVIGATION. By the late Charles Blachford Mansfield M. A. Edited by his brother, R. B. Mansfield. Price \$5.00. New York city, Macmillan & Co., 21 Astor Place.

This is a curious book. It is probably the most elaborate treatise on its subject extant; yet it is written by one who never made a balloon ascension in his life, never saw more than half a dozen balloons, never made any long study of the question, and so on through a series of negatives which would imply utter ignorance of the whole subject attempted to be considered. The work is, therefore, due to a kind of inspiration, an inventive frenzy it would appear, and the author says he writes it "simply to deliver my brain of a burden which came upon it uninvited." The volume is divided into two parts; the first is devoted to the statement of the problem of aerial navigation, the second to suggestions for solving that problem. Some of the author's opinions we reserve for more extended review. As a whole, the book is dissatisfying. Its writer died before completing it. Hence the most important concluding part is but in fragmentary state, while the text is written with a diffuseness and redundancy of language which shows the absence of the final condensing and pruning which it would doubtless have received at his hands. Mr. Mansfield moreover died twenty-five years ago, and the volume takes no account of recent progress in aeronautics. The work, however, contains much that may be read with profit, especially those parts relating to form and propulsion of balloons, while its appendices include much valuable information relative to weight of materials, buoyancy of gases, etc.

THE APPLICATIONS OF THE PHYSICAL FORCES. By Amédée Guillemin. Translated from the French by Mrs. Norman Lockyer. Edited, with Notes, etc., by J. Norman Lockyer, F.R.S. Illustrated. Price \$12.50. New York city: Macmillan & Co., 21 Astor Place.

This work is devoted to the popular exposition of the practical applications of the laws of physics; and the publishers have left nothing undone, in the way of exquisite engravings (some beautifully colored), elegant paper, binding, and printing, to make the volume thoroughly attractive. The translator's work is excellently done; the editor's, with the exception of a few oversights such as "Nero's" fountain for "Hero's," with judgment and care. The volume is divided into five books, respectively relating to phenomena and laws of weight, acoustics, light, heat, and magnetism and electricity, the information given being brought up to very recent dates. To readers who, not having had the advantages of a scientific education, desire a good general idea of practical physics, we can cordially recommend this work. It has few technicalities, goes over an immense field, and neglects nothing that is important; and it is plainly and pleasantly written. It is especially well adapted to meet the needs of young students of Science.

RECENT ADVANCES IN PHYSICAL SCIENCE. By Professor P. G. Tait. Second Edition, revised. Price \$2.50. New York city: Macmillan & Co., 21 Astor Place.

The lectures of which this volume is composed were delivered by Professor Tait before a number of professional men of Edinburgh, who wished to obtain a notion of the chief advances made in natural philosophy since their student days. The present is the second edition of the work, and has been subjected to careful revision. The volume is chiefly to be recommended on account of its containing a thoroughly admirable disquisition on the nature of energy, from the time of Newton up to the very latest modern researches; the whole being explained and elucidated in a masterly manner. The chapters on transformation of energy and transformation of heat into work are exceptionally good; and we commend them to the careful perusal of all engineers who would be well grounded in the theoretical part of their profession. The new chapter on force, added to this edition, we have already reviewed in detail.

Messrs. Slocum, Woodman & Co., 119 and 121 William street, New York city, are the publishers of Mark Twain's new "adhesive scrapbook." The erudite author, explaining his production, says: "I have invented and patented a new scrap book, not to make money out of it, but to economize the profanity of this country. You know that when the average man wants to put something in his scrap book he can't find his paste—then he swears; or if he finds it, it is dried so hard that it is only fit to eat—then he swears; if he uses mangle, it mangles with the ink, and next year he can't read his scrap—the result is barrels and barrels of profanity. This can all be saved and devoted to other irritating things, where it will do more real and lasting good, simply by substituting my self-pasting scrap book for the old-fashioned one." This is very true so long as the purchaser does not meditate over the title of the work; but if he does, and misled by the same tries to make the book adhere, he will miserably fail. The pages are exceedingly sticky and the postage stamp paste is excellently put on. The work will hold scraps with intense tenacity, and generally is commendable in all respects; but still there is that subtle confusion in the title which might lead the unwary to try to cause the volume to adhere to a wall or desk, and, on failing, to make the cursory remarks which Mr. Twain hates to see misapplied. Price from \$1.25 to \$3.50, according to binding.

Inventions Patented in England by Americans.

From December 22, 1876, to January 15, 1877, inclusive.

BOILER.—C. V. Lloyd, Decorah, Iowa.
BOILER FURNACE.—A. F. Upton, Boston, Mass.
BOOT, ETC.—L. B. Blake, Boston, Mass.
BREECH-LOADING GUN.—C. H. Pond (of Bridgeport, Conn.), London, Eng.
BUTTON HOLE SEWER.—E. Remington & Sons, Ilion, N. Y.
CAR TRUCK.—E. H. Horsey, Chicago, Ill.
COMPRESSING INGOTS.—D. McCandless, Pittsburgh, Pa.
DRYING BOX-BLACK.—L. Colwell, New York city.
ENGRAVING MACHINE.—A. H. Watkins et al., Boston, Mass.
FASTENING BOOT SOLES, ETC.—G. V. Sheffield, Brooklyn, N. Y.
HORSESHOE NAIL, ETC.—J. M. Laughlin, Boston, Mass.
KNITTING NEEDLE.—W. Corey, Manchester, N. H.
MAKING BUTTONS.—C. Radcliffe, Newark, N. J.
MAKING FARINA, ETC.—C. Morfit (of Baltimore, Md.), London, England.
MAKING HOSE.—J. V. D. Reed, New York city.
MALT SYRUP, ETC.—O. F. Boomer et al., Brooklyn, N. Y.
MULTIPLY TELEGRAPH.—G. B. Prescott, New York city.
OXYGEN FOR COMBUSTION.—C. Hornbostel, New York city.
FLOW HANDLE, ETC.—W. S. Babcock, Windham, Conn.
PRINTING PRESS.—I. L. G. Rice et al., Cambridge, Mass.
PULLEY.—A. Montgomery, New York city.
REDUCING ORES, ETC.—T. S. Blair, Pittsburgh, Pa.
REMOVING BOILER SEDIMENT.—T. F. Strong, Brooklyn, N. Y.
ROCK DRILL.—W. Weaver, Phoenixville, Pa.
SAFETY LATCH.—G. C. Setchell, Greenville, Conn.
SCHOOL DESK.—W. Rose, New York city.
SEWING MACHINE.—S. W. Johnson, New York city.
SHUTTLE.—W. E. Whitehead et al., Lowell, Mass.
SKIRT ADJUSTER.—A. S. Gear, Boston, Mass.
SPRING MOTOR.—I. Solomon, Solomon's Island, Md.
STEAM HEATER.—J. Wilcox, New Haven, Conn.
STONE DRESSING TOOL.—J. Hartnell, N. H.
STRAIGHTENING BARS, ETC.—D. McCandless, Pittsburgh, Pa.
TABLE CUTLERY.—W. Eccleston, New York city.
WASH BASIN, ETC.—A. G. Myers, New York city.
WATCH CASE SPRING.—J. Britton, San Francisco, Cal.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED BAILE TIE.

Peter Harden, New York city.—The free end of the band is coiled upon itself by means of a turning key or other suitable device, and the coil being on the under side of the slotted buckle, it serves to hold (by friction) the other end of the band which is looped around the buckle, but not riveted. Thus, both ends of the band are locked by the coil. The band can be drawn very tight, and all slack taken up, so that the bale is held compressed in place of being allowed to expand so soon as released from the press, as usual heretofore.

IMPROVED SPIKE PULLER.

Joseph Douglass, McConnellstown, Pa.—This invention relates to an improved device for extracting railroad spikes. It consists in a sliding fulcrum arranged to rest upon the surface of the rail, provided with legs to prevent it from turning, and having upon its upper surface graduated steps of increasing elevations arranged part upon one side and part upon the other of the plate, and in connection with which a lever carrying a pivoted grapple is adapted to operate; the grapple being arranged to clutch the heads of the spike, while the lever is operated upon the different steps of the sliding fulcrum, beginning with the lowest near the spike and working toward the highest until the spike is extracted.

IMPROVED SOLDERING MACHINE.

Peter Dillon and John Cleary, Sherbrooke, P. Q.—The two plates comprising the body of the can are bent into suitable shape by a divided die. The solder is discharged through the hollow soldering tool as its valve opens when the bath of molten solder moves forward and the soldering tool passes over the side seam of the can. The bottom of the can is soldered by a hollow tool when the can is raised and rotated in suitable manner.

IMPROVED PEG FLOAT.

Tilghman F. Lippengood, St. Louis, Mo.—The cutter proper is reciprocated by a vibrating lever operated by a crank. The cutter is reversible on its bearing to adapt it to rasp and remove the ends of the pegs both at the heel and toe of a boot or shoe. It is secured in either position by means of a spring catch or locking device.

IMPROVED PUMP VALVE.

Garret D. Hopper and William H. Laufkotter, Sacramento, Cal.—The invention consists in the valve stem, made rectangular in its lower part and round in its upper part. Across the lower part of the valve box passes a crossbar, through which is formed a rectangular hole which receives the valve stem. Across the upper part of the box is formed another crossbar, so placed that the shoulder of the stem may strike it, and the upward movement of the valve be thus limited. Upon the stem is formed a second shoulder, against which the valve is clamped by a nut. By means of a bail the valve can be lowered into, and raised from, its place by a hooked rod.

IMPROVED NUT LOCK.

Fredrick Swingly, Bucyrus, O.—An ingenious device for preventing the bolts from working loose in railroad joints, and in other places where they will be subjected to an intermittent or continuous jarring. It consists in the combination of two or more nuts with each other, in such a way that the backward movement of either will tend to move the other forward, causing them to mutually lock each other. This is one of the simplest inventions for the purpose that have come under our notice.

IMPROVED CAR COUPLING.

Hermann Wittmann, Manitowoc, Wis.—Accidents to brakemen while coupling cars are among the most common on railroads. The present invention aims to prevent these in great measure by improving the common draw-heads so that the link may be readily and conveniently guided to the opposite draw-head by the brakeman without danger of injury to the hand. The invention consists of a draw-head with a swing bar, pivoted to screw pins at both sides, near the lower part of the same. The swing bar is bent of one piece of rod iron, with side extensions. The pendent position of the swing bar, when the cars are coupled, prevents any damage to the same, as it is entirely out of the way.

IMPROVED MACHINE FOR FORMING SHEET METAL TUBES.

Abner C. Goodell, Salem, Mass., assignor to Mortimer M. Camp and John E. Searles, Jr., New Haven, Conn.—This consists of an endless belt of suitable strength, that is revolved by a driving roller mounted in a sliding carriage, and applied to a detachable tube-forming mandrel by top and bottom stretching rolls. The sheet metal blank is fed to the mandrel by being introduced between it and the belt, and formed by lapping around the same. The tubes are thus formed of any required length and thickness, as rapidly as the blanks may be fed and the tubes removed.

IMPROVED PRESS FOR TOBACCO AND OTHER ARTICLES.

William H. Malone, Farmington, Ky.—This is a strong yet simple and inexpensive press, constructed substantially as follows: A lever is pivoted in one of the upright ends of the frame, and moves in a slot in the opposite end of the frame. The said slot has ratchet racks, which are engaged by pawls attached to the end of the lever. There is also a lever which is fulcrumed in the said frame, and carries a ratchet bar that engages with, and moves, the first mentioned lever; and there is a device for raising the main lever after the bale has been pressed.

IMPROVED BOILER.

Robert Excell, Chicago, Ill.—This is a tubular saddle boiler for heating greenhouses and for other purposes. It consists of a semicircular boiler with longitudinal flues arranged therein, in connection with a lateral fire-back at the bottom, and a lateral circulator at the top part of the boiler, between which the fire passes from the fireplace back to the flues. The boiler communicates by top-flue tubes above the circulator and return tubes at diagonal ends with the heating tubes. The heat of the fire is first exerted on the front section of the boiler, next on the circulator and generator, then on the rear part of the boiler, and finally by the passage through the flues, utilizing thereby quite fully the heating capacity of the fire.

IMPROVED SEWING MACHINE.

Lyman Robinson, Matteawan, N. Y.—The object here is to adapt a sewing machine for sewing on the binding of the brims of stiff hats, which, up to this time, have been sewed by hand. The needle and the presser-foot project outward from the head in which the bar works, to allow room for turning the crown of the hat over toward the head. In this way the needle and presser-foot can work on the upper side of the brim along the sides, which are curved up toward the crown.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED VEHICLE SPRING.

William W. Sayers, Harrodsburgh, Ky.—The object of this invention is to provide for buggies, top carriages, or other light vehicles, a spring which shall be superior in point of elasticity, lightness, strength, and durability, and also adapted to prevent rocking motion of the body of the vehicle. The invention relates chiefly to the use of end cross-springs, which are connected with the brackets or scroll springs that support the side springs of the body.

IMPROVED COMBINED POLE AND SHAFT.

William H. Hiteshew, Peru, Ind.—This is a contrivance of the shafts and their connecting devices whereby they may be readily shifted into suitable position for forming a pole for two horses. The shafts are pivoted to braces, so that they may be swung around to the center for use as a pole, or to the side. The shafts are connected at the outer ends, when used as a pole, by a metal point which has a kind of double clamp socket that slips on the ends, and fastens by an eccentric ring, or other device. The shafts are also connected together in this position by a plate.

IMPROVED METHOD OF VENTILATING BUILDINGS.

John F. Cameron, South Brooklyn, assignor to Elizabeth W. M. Cameron, Brooklyn, N. Y.—The impure air that rises to the top of the room passes through plates and spouts into a space between true and false ceilings, and thence into the cavities of the cornices and out through the pipes, the spouts preventing its return into the room. A number of new

devices are embodied which may be recommended to the notice of architects and sanitary engineers.

IMPROVED VENTILATOR.

John Sandall, Jr., St. John, N. B.—This is a simple ventilator for railway cars which works efficiently without regard to the direction in which the car may be moving. It consists, essentially, of a case projecting laterally from the side of the car, with an opening on two sides, into a passage which curves from the side to the outer end. The two passages unite with each other a short distance from the outlet, where there is also the outlet of an exit passage from the car. In this passage draft is established by the air rushing through one of the side passages, and making a vacuum in the middle passage from the car. At the junction of the passage is a valve, which is opened automatically to the advancing side, and closed to the other side, by the wind.

IMPROVED PROCESS FOR MAKING WOODEN SCOOPS.

Robert Richardi, Belleville, Ill.—An ingenious mode of turning scoops out of a single piece of wood. The block is first turned in the form of a goblet and then hollowed out at the scoop part. The inclined handle is cut and turned from the smaller rear portion, and finally the edges of the scoop are finished off.

NEW HOUSEHOLD INVENTIONS.

IMPROVED EASY CHAIR.

Henry Parker, Osawatimie, Kan., assignor to himself, Ammi A. Brown, and Frank A. Lauter, of same place.—This improvement consists in pivoting the back of the chair to a supporting frame, and pivoting the back, bottom, and foot pieces together, so that the back and foot pieces may be placed at any angle between a horizontal and vertical position. The parts are attached in such a manner that the back and foot piece are always parallel to the same line. The chair will doubtless prove useful for dentists and barbers, and also as an easy or invalid chair.

IMPROVED LAMP EXTINGUISHER.

Leonard H. Pilger, Philadelphia, Pa.—This consists of a fulcrumed lever and slide rod at the under side of the burner. The lever extends below the collar of the bowl, to form contact with the same on detaching the same, and to raise thereby the slide rod and a weighted extinguisher tube sliding on wick tube. A guard piece opposite the lever assists the working and re-inserting of the lever into the bowl. An automatically operating attachment is thus provided, which extinguishes the light even in case the person filling the lamp neglects to extinguish the flame before unscrewing the burner. It thus forms a good preventive against accident.

IMPROVED WEATHER STRIP.

David O. Hink, Maryville, Mo.—This is a new weather strip for outside doors that adjusts itself in automatic manner on the sill, so as to give protection against the entrance of moisture in stormy weather. A drop with a raised round knuckle is attached to a bed piece, and applied at suitable distance from the bottom edge of the door. The bed piece has a concave groove and is so constructed as to form a projecting lip, in which the knuckles of the drop swing, being held in position by means of hinges embedded in the knuckle-joint, thus forming a continuous knuckle hinge.

IMPROVED GAS LIGHTER.

Eddy T. Thomas, Boston, Mass.—This is an exceedingly ingenious device which automatically turns on, ignites, and extinguishes the gas at any desired hours. It consists of a clockwork train arranged in connection with a dial, the latter spaced off for 24 hours. By this dial the mechanism may be adjusted in accordance with the hours when it is desired to light and extinguish the gas. The apparatus when set in motion, at the regulated time turns on the gas, and removing a match from a receptacle, lights it, and ignites the gas. Subsequently, at the hour desired, it turns the gas off. The device may be moved and set once a week to the required time.

IMPROVED WASHING MACHINE.

Joseph O. Beauperland, Fall River, Mass.—The novel feature in this device is a metallic cylinder, having longitudinal corrugations, in the internal concavities of which octagonal rollers are sustained, being journaled in the cylinder heads. Clothes and a quantity of hot or cold water are introduced through the doors in the covering and in the cylinder, and secured therein by closing and fastening the doors. The cylinder is then rotated, and the by constantly falling toward the lower portion of the cylinder over clothes, the roller, soon become cleansed.

IMPROVED WEATHER STRIP.

Jesse Chandler, Warsaw, Ill.—A timely invention intended as a means for excluding cold and rain from windows and doors. It consists of a strip of metal or wood, which is movably attached to the door by the staples, and is of such length as to fit loosely between the jambs of the door. It is placed in a rabbet at the lower edge of the door, and is of sufficient width to drop into the rabbet in the threshold when the door is closed. On opening the door the strip strikes the block, which throws it upward until it engages the catch, by which it is retained until the door closes, when it is allowed to fall into the rabbet in the door sill.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CHURN DASHER.

Chapman J. Syme, Petersburg, Va.—The invention relates to certain improvements in churn dashers, designed to churn the butter more rapidly by producing a larger degree of agitation in the cream. It consists in the particular construction and arrangement of a conical or funnel-shaped dasher, having a socket to receive the handle and provided with a perforated plate near its apex upon the outside, and a second perforated plate attached to a rod upon the inside.

IMPROVED CORN SHELLER.

Zadok T. Blackwell, Carrington, Mo.—A useful invention for farmers, by which the corn is rapidly separated from the cob and the cob expelled. It consists of a toothed revolving cylinder of slightly tapering shape, to which the ears of corn are fed from a hopper by a reciprocating slide with step-shaped surface. The ears drop on spring acted pressing pieces, that carry the same along the clearing teeth, and, finally, by means of a roller of the spring piece, through an exit aperture of the sheller frame, to the outside. A small outside hopper, with opening near the lower end, conducts any corn that may pass out with the cob back into the sheller. The especial feature of the invention is that the cylinder enlarges as the cob in its progress becomes stripped of its corn.

IMPROVED PLOW.

Samuel Huber, Danville, Pa.—In order to fasten the share or point of the plow without bolts, this inventor attaches the share to the plow by means of a projecting finger or dowel that fits into a corresponding aperture in the mold board, and locks the share by means of a dovetail in the beam and land side. The advantages of this method are that, as no bolts are required, the surface of the share may be smooth and entire. The usual danger of breaking the share by tightening the bolts is thus obviated, and it is not liable to become accidentally loosened.

IMPROVED CULTIVATOR.

Philip Studer, Mechanicsville, Iowa.—This is an improved machine for cultivating corn and other crops planted in hills and drills. It is so constructed that the plows may be readily adjusted toward or from the plants, and raised from the ground for passing from place to place. The new features relate mainly to improved construction of frame and braces.

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Skinner Portable Engine Improved, 2 1/2 to 10 H. P. Skinner & Wood, Erie, Pa.



J. M. will find on p. 17, vol. 30, an article on the examination of engineers.—J. M. P.'s theory of the chord of an arc, to decide the area of a circle, is correct. Can he find the angle or number of degrees in the arc?—M. N. will find directions for fastening sheet rubber to metal on p. 101, vol. 34. He should use marine glue if he wants a waterproof cement. See p. 43, vol. 32.—T. will find directions for polishing wood in the lathe on p. 139, vol. 35.—G. B. will find directions for preserving natural flowers on p. 234, vol. 28.—T. W. will find directions for putting a polish on starched goods on p. 213, vol. 34.—P. L. L. will find on p. 91, vol. 36, an answer to his question as to marine glue.—W. H. P. will find directions for nickel-plating iron on p. 235, vol. 33. For galvanizing iron, see p. 346, vol. 31.—D. H. will find a description of a pantograph on p. 179, vol. 28.—O. J. S. will find a recipe for a black walnut stain on p. 90, vol. 32. For polishing boxwood, see p. 315, vol. 30.—S. L. M. will find on p. 330, vol. 26, directions for making an oil-harp.—E. will find on p. 344, vol. 34, a description of the fastest train on railways.—J. J. will find on p. 106,

vol. 32, a good recipe for vinegar.—McC. Bros. queries as to injectors were answered on p. 91, vol. 36.—A. B. will find directions for removing inkstains from paper on p. 154, vol. 30.—G. L. W. will find an excellent recipe for dried yeast on p. 204, vol. 30.—J. T. B. will find on p. 203, vol. 30, a recipe for cement for fastening leather to rubber.—P. T. will find something on making superphosphate of lime from bones on p. 90, vol. 36.—F. B. M. will find an article on lubricants for drilling iron, brass, etc., on p. 43, vol. 35.—W. A. H. will find directions for making rubber hand stamps on p. 206, vol. 35.—L. M. C. should repair his rubber boots with rubber cement made according to the recipe on p. 203, vol. 30.—W. R. R. should apply to the Massachusetts Institute of Technology, Boylston street, Boston.—S. L. M. should abstain from using hair dyes; but a comparatively harmless one is described on p. 138, vol. 27.—A. F. G. is informed that we know nothing of the toughened glass of which he speaks.—T. W. W. will find directions for making cheap telescopes on p. 186, vol. 30.—S. R. S. can blue watch springs or other steel goods by following the instructions on p. 123, vol. 31.—R. D. H. should thin his shoe polish by adding more ink.—J. M. & Co. should read our article on p. 241, vol. 35, and they will find that no decision as to the respective merits of exhibits was made by the Centennial Judges.—A. B. W. will find directions for soldering all metals on p. 251, vol. 28. We cannot answer his question as to brick, as we do not know the nature of the clay.—H. A. L. will find directions for galvanizing iron castings on p. 346, vol. 31.—S. will find a recipe for waterproofing paper on p. 17, vol. 33.—J. L. T. will find on p. 324, vol. 32, directions for making salicylic acid.—E. E. K. can make his lightning rod of either iron or copper. See p. 277, vol. 35. Copper is a better conductor than iron.—O. A. H. will find directions for vulcanizing rubber on p. 378, vol. 28.—D. H. C. cannot calculate horse power of an engine unless he knows the mean steam pressure in the cylinder and the piston speed, as well as the dimensions of the cylinder. See p. 43, vol. 35.—J. H. B. will find a recipe for a silver-plating fluid, for use without a battery, on p. 408, vol. 32. To bleach beeswax, see p. 259, vol. 31. For a varnish for polished brass, see p. 310, vol. 35.—P. P. H. will find directions for straightening wire on p. 299, vol. 34.—V. A. S. will find directions for making a cheap battery on p. 43, vol. 35.—T. P. H. will find an answer to his question as to molding rubber on p. 203, vol. 35.—W. W. should study the lessons on mechanical drawing published in the SCIENTIFIC AMERICAN SUPPLEMENT.—E. J. B. will find directions for painting transparencies for magic lanterns on p. 330, vol. 35.—A. H. B., C. F. P., T. W., C. E. R., C. H. S., C. M. W., F. B., A. L., R. L., S. M. H. N., F. H., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) W. E. L. asks: 1. Which is the most economical to heat a dry house with, hot air or steam? Our boiler has capacity to supply steam for a fifteen horse engine, but our engine is but two horse power. A. If you have the appliances, steam will be best for you to use. Enclose a low coil of pipe in the drying room, and admit cold air below it; have registers in the floor for the air to escape, and conduct it to a fine built against or around your chimney; this will insure a circulation. 2. How large a dry house can we heat with steam from this boiler, without robbing the engine? A. This you had better prove by experiment, as so much depends upon conditions.

(2) C. M. F. asks: What shall I use in filling the grooves in a ceiling so as to make it smooth enough for wall paper? A. The usual course is to paste narrow strips of thin cloth over the joints.

(3) S. K. S. asks: How can I easily ascertain which of several sugars contains most saccharine matter? A. The amount of saccharine matter in a given quantity of raw sugar is determined now, almost exclusively, by means of an instrument called a saccharimeter. If a beam of polarized light be caused to traverse a solution of the sugar, and is examined by a thin plate of the mineral selenite, the solution will be found to have caused a rotation of the beam towards the right. A sugar solution of 6-1 cubic inches (3-4 fluid oz.), containing 231-5 grains of sugar, turns the ray of polarized light, of 7-8 inches length, 20° to the right; with twice the amount of sugar, 40°, etc. The scale is generally graduated to read percentages directly. One of the best chemical tests is the following: Dissolve 617-33 grains of sulphate of copper in 2-469 grains of distilled water and add 5-14 ounces of neutral tartrate of potash in a little water, and 1-14 pints of caustic soda ley of specific gravity 4-12. The solution should then be diluted (with distilled water) to 2-438 pints at 60° Fah.; and 3-1555 oz. of this solution corresponds to 77-17 grains of dextrose or 73-31 dry sugar. The sugar solution (of known strength) is added to a sufficient quantity of the reagent and boiled for a few minutes in a glass flask. The sugar reduces the copper to protoxide, which is removed from the solution by filtration, and weighed.

(4) H. N. R. says: I have set up a loom for rag carpet weaving, and have on hand a quantity of unbleached cotton warping which I wish to dye red or green. Will you oblige by giving some rough, ready, and cheap way of dyeing with the above colors? A. The aniline colors are the brightest and least troublesome to handle. With these, for the most part, wool requires no mordant. Cotton goods require to be mordanted with tannic acid in alcohol or by animalizing the fibers with albumen. You can purchase these dyes, together with the proper mordants already prepared, with instructions for use from any druggist.

(5) E. J. F. asks: 1. What is the best preparation for promoting the vigor of human hair, and what will prevent its turning gray prematurely? A. See p. 50, vol. 36. 2. What is the best method of restoring the color to faded switches of human hair without resorting to the use of hair dyes which contain poisonous ingredients? A. The natural color cannot be restored in such hair except by the use of dyes. Wash the hair thoroughly with soap and water, and dye with the aniline colors, which may be purchased already prepared, and accompanied with instructions, from any druggist. Do not use these dyes except on loose hair. In general, we cannot recommend the use of hair dyes under any conditions.

(6) J. N. A. asks: Is there any instrument or contrivance to register the changes of temperature? A. In the United States signal service observatories, advantage is taken of the expansion and contraction of very long wires of brass, zinc, and iron; and of the unequal expansion of thin bands of brass and steel, which causes a compound bar of these metals to curve by a slight change of temperature. Some of these latter are in the form of large springs. Besides these, the old photometric method is still in use at some stations. In this, the light is caused to pass into a dark box, over the top of the column of mercury in an ordinary thermometer, where it leaves a record on a moving slip of photographic paper. None of these instruments are in the market.

Is steam used as a motor at as low temperature as 213° Fah.? A. No.

(7) A. W. asks: Is it possible that an ice boat can travel faster than the wind? A. Yes. On smooth ice, the wind blowing with a velocity of fifteen miles an hour, a first-class ice boat may be sailed sixty miles an hour, or three times faster than the wind.

(8) J. L. asks: I am in charge of two boilers, 16 feet x 50 feet, with 55 tubes of 3 1/4 inches diameter. The boilers are suspended at each end by a column. They have been two years in use, using one at a time. The boilers leak on top of the fire; we had a boiler maker caulk them, but in a short time they were leaking. A friend proposes to have belts turned to fit and take the place of the rivets (some of the leaks take in 15 rivets). I say the nuts coming in contact with the same will burn, and be dangerous. Which is the better plan? A. The bolts and nuts would answer and would not burn; but to ram out the rivet holes and put in new rivets would probably be the best plan.

(9) M. P. asks: Where can I have failed in my efforts to produce the first-class waterproof blacking, directions for making which are given in your number of September 9, 1876? I have followed the instructions as carefully as possible—both by the aid of heat and without it—I have also varied the proportions of the ingredients given, and all without success; and as I am most anxious to attain my object, I shall be thankful for any help you will kindly afford me. A. The following are the materials and method employed in the manufacture of an excellent blacking, and one which we can vouch. Dissolve 18 ozs. caoutchouc in 9 lbs. hot rapeseed oil by constant stirring. Add to this 60 lbs. finest ivory black and 40 lbs. molasses, with 1 lb. finely ground gum arabic previously dissolved in 20 gallons vinegar, No. 24; the whole to be triturated in a paint mill until smooth. Then add, in small successive quantities, 12 lbs. commercial oil of vitriol with constant stirring for half an hour. Repeat this half hour daily stirring for 2 weeks, add 3 lbs. gum arabic in very fine powder, and continue the daily stirring, as before, for 2 weeks longer. It is then ready for use. Care should be taken to avoid loss of the solvent by evaporation. For blacking in paste, use only 12 gallons vinegar. A good blacking is also made by mixing 3 ozs. ivory black, 2 ozs. molasses, a tablespoonful sweet oil, 1 oz. oil of vitriol, 1 oz. gum arabic dissolved in water, and 1 pint vinegar.

Will you give me directions for preparing a first-class oil for watches? It should be free from gummy matter, and should neither freeze nor act upon metals, and yet have lubricating power. A. For delicate machinery pure olive oil is in general use. For this purpose glycerin has also lately been employed, and mixtures of glycerin with sperm and olive oils. One of the best watch oils now in use is prepared from finest sperm oil. We are not, however, in possession of sufficient information concerning the precise method pursued in its production to warrant us in formulating a recipe for its preparation.

(10) M. J. says: We have built a tank house about 40 feet high and 15 feet square at the base, and 12 feet square under the eaves. The tank is in the top story of a building; it is 10 x 10 x 8 feet, and it leaks. We made the tank out of 1 1/4 inch matched flooring 6 inches wide; the joints were well tarred, but it was no good. So we laid another layer of common flooring inside of the 1 1/4 inch layer or outside body of the tank, and used white lead on the joints throughout, and had the floor coated with tar; but it still leaks, and a new difficulty has presented itself in that the water which comes from the tank tastes very strongly of tar. How can I stop the leaking of this square tank without using any poisonous substance, as all the water used for culinary purposes and drinking comes through this tank? A. You would have done better to have made a circular tank secured with iron hoops, the tank increasing in size towards the bottom. Your surest remedy now is to line your present tank with sheet lead, properly put in by a plumber.

(11) G. M. G. says: I wish to make a circular saw arrangement to run by treadle or foot power. If I put a fly wheel on large enough, can it not be made to run all right? The saw is 8 inches in diameter; what must be the size of the fly wheel? A. Use a 3 inch pulley and a 3 foot driving wheel with a heavy rim. If you intend using the saw for sawing short stuff or for cross cutting, a balance wheel on the saw mandrel will assist, as the power stored up in the balance wheel will carry the saw through a short cut.—J. E. E., of Pa.

(12) J. J. G. says: 1. If I pump 130 lbs. of air into a boiler 30 inches in diameter and 30 feet long, in the evening, will I have the same pressure in the morning? A. If the temperature of the air is unchanged, the pressure will remain constant. In this case, if the air becomes heated, the pressure will increase; if cooled, the pressure will fall. 2. Is 130 lbs. of air equal to 130 lbs. of steam, and is expansion of air less than that of steam? A. There is not much difference between the expansion of air and steam, for constant temperature; but where there is no gain or loss of heat, the difference is considerable. 3. Has any one invented an air locomotive? A. There have been quite a number of compressed air engines invented. If your device is an improvement over others, it may be worth your while to bring it to the notice of the public.

(13) H. L. H. says: I have 6 oscillating engines 10 inches stroke by 3 inches diameter. I wish to run them 500 revolutions per minute, with 25 lbs. pressure.

ure. How large a tubular boiler will I need? How much water will be evaporated per hour at that speed and pressure? A. It would be best to make some experiments with one of the engines before building the boiler. But if this cannot consistently be done, it may be well to design a boiler capable of evaporating 24 cubic feet of water per hour. You may allow from 30 to 35 square feet of heating for each cubic foot of water to be evaporated per hour.

(14) S. W. asks: Can you give me a method of rendering soap fat, so as to get the grease free from water? A. The fat is heated, not boiled, in a vat (see article on p. 22, vol. 36) with dilute oil of vitriol for some hours, which treatment separates the fat completely from the soap, and it being lighter than the pickle, rises to the surface, where it is allowed to stand for a short time, molten, until the water is eliminated by its superior gravity. By this method the water may be completely separated without difficulty.

(15) J. E. W. says: I have a piece of land of 100 acres, and I cannot get water by digging wells. I have a spring of very best water at the base of a hill which affords 12 or more gallons a minute. I want to force the water 100 feet high into a large tank 1,000 feet from spring, and let half the water into this tank and the other half 50 feet higher to the top of hill, to another tank 500 feet from first tank, making in all 1,500 feet from spring. Which would be the best, windmills or steam power, to pump the water? A. We judge from your remarks that a windmill would answer your purpose very well; and we advise you to adopt it in preference to the steam pump.

(16) R. B. G. says: In the SCIENTIFIC AMERICAN of September 30, 1876, I notice a problem given by C. D. S. to find the radius of a circle, the chord and versed sine being given. The formula given is erroneous. When using the square of 1 and dividing by 1, you do not materially change the result. But take any other number than 1 for the versed sine, and you will readily perceive the catch in your formula. If C. D. S. will use the following old formula he will be always right. Thus: Chord = 6 inches, versed sine 2".

Then: $2 \text{ rad.} = \left(\frac{C}{V.S.}\right)^2 + \text{versed sine}$; this gives the radius 22-6". Your formula gives:

$\left(\frac{C}{2}\right)^2 + V.S.^2 = \text{rad.}^2$. Now the proof is as you stated. $\text{Rad.} = \sqrt{\text{rad.}^2} = \sqrt{\text{semi-chord}^2 + V.S.^2}$, which shows your formula erroneous, giving the versed sine 0-198 instead of 0-2. A. The two expressions are alike, and will give the same value for the radius, if the proper substitutions are made. By a slight reduction, either formula can be changed into the other.

(17) G. C. R. says, in relation to the subject of testing milk: A solution of subsulphate of iron does the work admirably. I took two wide mouthed bottles of the capacity of nearly 2 ozs. each. In No. 1, I put 1 oz. milk, added 5 drops of the iron solution, and mixed them by shaking, merely closing the mouth of the bottle with my hand. The milk was at once divided into water, containing the excess of the solution of iron, and coagulum. On bottle No. 2, I fixed a small piece of wire gauze in a box, so as to have a border around the sieve. On pouring the contents of bottle No. 1 on the sieve, the water ran through, leaving nothing but the wet coagulum.

(18) B. asks: In preparing books for sewing, will a set of saws 8 inches in diameter, each saw having 8 teeth, cut the paper to 1/4 inch depth as well as a set of the same size having more teeth? A. The more numerous the teeth the better, unless they are so small that the paper clogs them.

(19) H. & F. say: During the recent frosty weather, an upright tubular boiler was caught well filled with water, which froze so hard that the boiler sprung the bolt heads and seams; so that when fire was again started and steam up, it leaked, and let steam escape from many places. After caulking up these places, however, the leaks seemed to be stopped, and she now carries her usual head of steam; but the boiler is very plainly sprung outward, and our anxiety is to know whether she has received any permanent injury from this strain, or been weakened in any manner? A. We have known of several cases resembling yours. It would be impossible for us to say certainly, without a personal examination, whether or not your boiler has been permanently injured; but, as far as we can judge from your account, it seems probable that no serious damage has been done.

(20) T. & H. ask: We wish to put up a steam saw and planing mill run by a 40 horse power engine with governor. At a distance of 150 or 200 feet therefrom is a large building for ginning cotton, requiring, say 10 or 12 horse power, to drive successfully. Which would be the best way to run said cotton gins, by a line of shafting from saw mill to gin house (the land being level), or to put a 12 horse power engine in the gin house, to take her steam from the boilers 150 or 200 feet distant through 1 1/4 inch steam pipe laid on a level with the ground? A. Use the steam pipe, but jacket it thoroughly to prevent radiation.

(21) W. S. H., Jr., says, in reply to a correspondent who asked for a soldering fluid that will not corrode tools: For the past three years, I have used a fluid the fumes of which do not rust tools (I cannot say what actual contact might do, as I do not spatter my fluid about). It consists of muriate or iodide of zinc in crystals 1 oz., best alcohol 2 1/4 to 3 fluid ozs. It keeps best in a glass-stoppered phial. I have found the above to work full as well as the old kind, and much prefer it to anything I have ever used for the purpose.

(22) W. T. asks: 1. Why will not common charcoal do for the carbons for a bichromate battery? It does work for a short time. A. It will do, but its porous nature and brittleness are great objections to its use. 2. Is it as easy to magnetize a rod of soft iron, 12 inches long, as it is to magnetize one 2 inches long, provided the same number of layers are used? A. Yes, but greater current is required to produce the same degree of magnetization. 3. Will No. 30 wire magnetize satisfactorily

a core $\frac{1}{2}$ inch in diameter and 8 inches long? I have put 4 layers on to a core of that size, intending to put on about 30, but the result, so far, does not encourage me to proceed. My object was to run a good sized core, with a very small quantity of battery. A. Two to four layers of No. 16 or 18 copper-covered wire will answer your purpose better. No. 30 is used only when the resistance of the circuit, exclusive of the magnet coils, is comparatively great. 4. Why is platinum used for vibrating tongues? I have some of brass and copper that work very well. A. Because it is less oxidizable than most other metals. 5. How is sheet brass toughened? A. By rolling or hammering. 6. How is iron softened for electro-magnets? A. By heating it red hot and then allowing it to cool very slowly.

(33) J. M. M. asks: What metal will expand and contract the most by heated air? How much would a bar of metal 10 feet long and $\frac{1}{2}$ inch square expand for each degree of heat? A. Lead, zinc, and tin are among the most expandable solids, their coefficients of linear expansion per Fah. degree being about as follows: Lead 0.000016, zinc 0.000017, tin 0.000015.

(34) E. S. says: In answer to your correspondent P. J. S., who having read "that the seed of sunflower is the most healthy feed that can be given to horses in winter and spring, half a pint a day keeps them in health and spirits, with sleek coats, and more animated than any other feed. It prevents heaves and some other disease," and he inquires if there is any truth in it. I have a large number of horses under my care, and had the above feed recommended to me. I gave it a trial, and found it to do good, it bringing horses into a good condition in a short time. The seed contains an oil which the horse seems to relish, when the seed is mixed with other food; and given in half pint doses, it aids digestion and acts as a mild laxative, and as such may prevent some cutaneous diseases and other disorders arising through constipation. I have never used it as a preventive of heaves, but know it to give relief to horses afflicted with them. I have also used it with good results on a horse whose lungs had been left impaired by a severe attack of pneumonia, and whose respiration was difficult and laborious, and it afforded considerable relief. The following is also a very good food for horses, and may be used for the same purposes as the above: It is composed of 2 quarts oats, 1 bran, and $\frac{1}{2}$ pint flaxseed. The oats are first placed in the stable bucket, over which is placed the flaxseed. Add boiling water, then the bran (do not mix), covering the mixture with an old rug, and allowing it to thus rest for 5 hours, when it is mixed and ready for use. The bran absorbs while retaining the vapor, and the flaxseed binds the oats and bran together. A greater quantity of flaxseed would make the preparation too oily and less relished. One feed per day is sufficient; it is easily digestible and is especially adapted for young animals. It also tends to fatten.

(35) H. F. B. asks: Can I return the condensed water of a coil of pipe into the boiler without the use of a pump? A. With properly designed heaters, you may possibly be able to return the water; but it will be better to use a trap specially constructed for the purpose.

(36) O. O. M. says: I have a model side-wheel boat 45 feet long by 12 feet beam; it draws 14 inches of water. I want to put two direct connecting engines in it. What size will I need? What size single engine will I need? What size wheel should I use? A. Diameter of wheels, 8 to 10 feet. For engines, 7 to 8 inches diameter, 1 to 18 inches stroke, or a single engine with same cross section of cylinder.

(27) D. B. T. says: In the open air, water boils at 212°. In a boiler having an air pressure of six atmospheres, it will not boil at less than 230°. What would occur in a steam boiler having a pressure of six atmospheres of steam, if we turn air of seven atmospheres pressure into it, without allowing the temperature to rise? Would all the steam be condensed or would the air be diffused through the steam according to Dalton's law of the diffusion of gases? If so, why? A. If the temperature of the air was not raised, none of the steam would be condensed, and the mixture would follow Dalton and Gay Lussac's laws. This follows from the definition of a perfect gas. You will find a good discussion of this subject in Rankine's "Treatise on the Steam Engine."

(28) T. S. S. says: I wish to build a governor, the arms of which, from the centers of motion, shall measure 6 inches, the balls to be 2 lbs. weight each. How many revolutions per minute will be required to raise the arms to a horizontal position? A. You cannot raise the arms to a horizontal position, at any rate of speed, but you may approximate the position quite closely. A full explanation is given on p. 229, vol. 31.

(29) H. H. H. asks: I have a horizontal bar suspended from two wire ropes and guyed to the floor with four more; it however turns with the hands. How should the suspension rope and guys be fixed to the bar so that it will not turn, and will be perfectly stationary? A. The manner in which the bar is set up by professional gymnasts is probably as good as any. The bar is secured to two uprights, so that it cannot turn. These uprights rest on the floor, and the guys are attached to them.

(30) J. B. asks: Why is it that the low pressure cylinder of a compound engine is made larger in diameter than the high pressure? Would not the effect be the same if the terminal pressure in the high pressure cylinder acted upon a piston of the same size, instead of a reduced pressure (due to larger space occupied) acting upon a larger piston? A. One of the objects of the compound engine is to obtain a high grade of expansion; another is to employ a comparatively low temperature in the cylinder which is exposed to the cooling action of the condenser; and it is also desirable, generally, to have the equivalent mean pressure the same in each cylinder. We think these are the principal reasons for making one cylinder larger than the other, when only two cylinders are used.

(31) C. J. A. says: I have two low pressure boilers, 15 feet long and 40 inches in diameter, with

two flues each. They have a two foot brick wall between them and are not connected together. I heat 135 large rooms with them, that do not have regular heaters in and only have a large quantity of piping hung on the walls in a zigzag form. The steam passes directly through about 280 or 300 feet of piping before reaching my return pipe in every room. Those that are close to the boilers get the most steam and return steam or foam into my boilers; while those at a distance retain the water so that the lower part of the pipes have water in them all the time. I have no pump, and have to depend on my condensed steam for supply of water. Is it safe to set boilers without having a pump, injector, or other reliable way of supplying them, or can I safely depend on condensation for supply? A. Without knowing the size of rooms and character of building, we could not form a very definite opinion as to the economy. We think it would be well for you to attach a trap of the kind that is made for returning the condensed water from heating coils. 2. In starting steam in the morning, there is a continual cracking and thumping noise until I have a complete circulation. I have about 35 drip cocks to assist in letting the air out, besides two main air cocks. A. To get rid of the cracking and thumping noise, it will be necessary to re-arrange your heating apparatus, so as to secure better circulation.

(32) J. J. says: 1. A reservoir $\frac{1}{2}$ mile square in surface, 20 feet deep, 2 miles from town, and 200 feet above the level of town, has 2 pipes, of the same size and length. One is inserted at foot of reservoir, the other is inserted 19 feet above the first, or as near the surface as practicable without admitting air. Both pipes are brought to the same level in town. Would there be any difference in the pressure or amount of water discharged? If so, why? A. As long as the proper level was maintained in the reservoir, there would not necessarily be any difference in the action of the two pipes beyond what would be due to their difference in length and shape. 2. What would be the effect if the last mentioned pipe was fed from a box three feet square, the water being kept at the same height as the reservoir? A. The box, under the conditions named, would answer just as well as the reservoir for the connection.

(33) H. S. P. says: 1. I have a small copper boiler 12 inches high and 8 inches in diameter; it has a funnel inside, 8 inches in diameter at the bottom and 1 1/4 inches at the top. The copper is $\frac{1}{8}$ of an inch thick. How much pressure will it stand? A. You can carry a pressure of 20 lbs. per square inch. 2. How large an engine will it run? A. Make one 1 x 1 1/2 inches.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the result stated:

H. A. S.—Your precipitate consists principally of organic matter and sulphur, together with a small quantity of silicic acid.—J. D. R.—It is galena, sulphide of lead, and contains, in 100 parts, lead 87, sulphur 13 parts (by weight).—M. T. D.—No. 1 is a silicate of alumina and lime, together with carbonate and sulphate of lime, blende, and sulphide of lead. No. 2 is jamesonite (3 Pb S + 2 Pb S₂), and contains in 100 parts, lead 43.6, sulphur, 56.4 parts.—G. S. M.—Nos. 1, 2, 3, and 4 are impure clays (silicate of alumina) containing considerable quantities of lime and sesquioxide of iron. They might be employed as material for the manufacture of bricks. No. 4 might be called a low grade of potter's clay. No. 5 is clay slate, of no particular value. No. 6 is clay, containing a large quantity of carbonaceous matter, etc. No. 9 is red hematite (sesquioxide of iron). If in large quantities, it is valuable as an ore of iron.—W. H. J.—The substance consists of carbonate of lime, a little magnesia and iron, some fine sand, and a considerable quantity of alumina and silicate of alumina, or clay. The greater part of the alumina, clay, and sand may be removed from the water by slow filtration through gravel, and the iron and bicarbonate of lime by the addition of the proper quantity of clear lime water. The quantity of lime water requisite may be determined by experiment with known volumes of the water and reagent.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:
On Transporting Ships Overland. By E. R.
On Brushing the Teeth, etc. By S. M. A.
On Nature and Life. By E. S. N.
On the Coast of France. By P. G.
On a Cave in Pennsylvania. By P. M.
On the Geographical Distribution of Animals, etc. By G. D.
On the Flight of Birds. By F. B.
On the Diagonal and the Side of a Square. By T. F.
Also inquiries and answers from the following:
G. W. E.—J. B.—J. W.—P. T. C.—M. M.—J. G. G.—G. M. W.—J. J.—E. F. Y.—H. A. J.—E. M. E.—G. K.—L. A. S.—C. F. P.—M. M. C.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "What will a suit of sails for a schooner cost? Who sells lithographic stone, and what is the price per lb.? Who sells barometers? Who sells screw propellers, suitable for small boats? Who sells a machine for making fishing nets?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

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DATES AND THE DATE PALM.

Even those whose knowledge of the customs of the Orient extends no further than a recollection of the contents of that time-honored story book, the "Arabian Nights," are doubtless aware that, since time immemorial, the date has been the chief food staple of the desert-dwellers of the East. The "handful of dates and gourd of water" form the typical meal and daily sustenance of millions of human beings both in Arabia and in North Africa, and to this meager diet ethnologists have ascribed many of the peculiar characteristics of the people who live upon it. Buckle, who finds in the constant consumption of rice among the Hindoos a reason for the inclination to the prodigious and grotesque, the depression of spirits, and the weariness of life manifest in that nation, likewise considers that the morbid temperament of the Arab is a sequence of vegetarianism. He points out that rice contains an unusual amount of starch, namely, between 83 and 85 per cent; and that dates possess precisely the same nutritious substances as rice does, with the single difference that the starch is already converted into sugar. To live, therefore, on such food is not to satisfy hunger; and hunger, like all other cravings, even if partially satisfied, exercises control over the imagination. "This biological fact," says Peschel, "was and still is the origin of the rigid fastings prescribed by religions so widely different, which are made use of by Shamans in every quarter of the world when they wish to enter into communication with invisible powers." Peschel and Buckle, however, are at variance as to the influence of the date diet as affecting a race; and the former remarks that, "while no one will deny that the nature of the food reacts upon the mental powers of man, the temperament evoked by different sorts is different;" yet "we are still far from having ascertained anything

in regard to the permanent effects of daily food, especially as the human stomach has, to a great degree, the power of accommodating itself to various food substances, so that with use even narcotics lose much of their effect." The same author also adds that the date "trains up independent and warlike desert tribes, which have not the most remote mental relationship to the rice-eating Hindoos."

It remains for the reader to reconcile this disagreement of learned doctors according to his own judgment. The evidence of those who subsist on the date is certainly overwhelming in its favor. The Assyrians, tradition says, asserted that it was such a great gift to them that its worth could not be too extravagantly told; for they had found, for the leaves, the fruit, the juices, and the wood of the tree, three hundred and sixty different uses. The Mohammedans adopt the date palm into their religion as an emblem of uprightness, and say that it miraculously sprang into existence, fully grown,

at the command of the Prophet. Palm branches still enter as symbols of rejoicing into Christian religious ceremonies; and throughout Palestine constant reference is found to the date and the palm in the naming of towns. Bethany means "a house of dates." Ancient Palmyra was a "city of palms," and the Hebrew female name Tamar is derived from the word in that language signifying palm. In Africa there is an immense tract of land between Barbary and the great desert named Bilidulgerid, "the land of dates," from the profusion of the trees there growing.

In this country, the date as an article of food is classed

in growth, it shoots up a magnificent stem, to the height sometimes of eighty feet, the summit of which is covered with a graceful crown of pinnated leaves. The trunk is exceedingly rough and spiny; the flower spathes, which appear in the axils of the leaves, are woody, and contain branched spadices with many flowers; more than 11,000 have been counted on a single male spadix. As the flowers are dioecious, it is necessary to impregnate the female blossoms artificially in order to insure a good crop; and to this end the male spadices are cut off when the pollen is ripe and carefully shaken over the female ones. At from six to ten years

of age, the tree bears, and then remains fruitful for upward of 200 years. An excellent idea of the palm in full bearing may be obtained from our illustration, which represents the mode of gathering the dates, of which a single tree will often yield from one to four hundredweight in a season. The fruit varies much in size and quality; and in the oases of the Sahara forty-six varieties have been named.

The utilizations of the date palm and its products are very numerous. The stem yields starch, and timber for houses, boats, fences, fuel, etc., as well as an inferior kind of sago. The leaves serve as parasols and umbrellas, and for material for roof covering, baskets, brushes, mats, and innumerable utensils. At their base is a fiber, which is spun into excellent rope. When the heart of the leaf is cut, a thick honey-like juice exudes, which, by fermentation, becomes wine (the "toddy" of India), or vinegar, and is also boiled down into sugar. The young shoots, when cooked, resemble asparagus; and the dates themselves are dried and ground into meal, from which bread is prepared.

Panthers as Seed Distributors.

It is well known that bees carry pollen from flower to flower, and that eggs of marine animals are often car-

ried long distances in the stomachs of aquatic birds. A very curious instance of this kind, showing how vegetable species may be diffused by means which no botanist, however acute, would be likely to think of, is mentioned by Mr. Alfred Smea, who states that, attached to the skin of a panther recently shot in India, were found numerous seeds, each of which had two perfect hooks, manifestly designed to attach themselves to foreign bodies. As the panther moved about it collected the seeds on the skin and carried them about wherever it went; but when it rubbed against the shrubs, it of necessity brushed some off, and thus distributed them. One of the seeds produced a handsome plant, and beautiful clusters of tubular flowers. It was immediately recognized to be the *Martynia diandra*—a plant which, although introduced into England as far back as 1731, has scarcely ever been cultivated, although it has been commented on by botanists and other writers.

The date palm (*Phoenix dactylifera*) is the most important species of the dozen which make up its genus. Though slow



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On the other hand, who can estimate the value of the knowledge lost beyond hope of recovery, or the checks to human progress experienced, in the repeated wiping out, so to speak, of the higher races and the civilizations they embodied? And who can say that similar disasters may not come again and again to humanity?

Suppose a pestilence peculiarly fatal to the white race should fall upon the world to-day, crippling, perhaps exterminating, the now dominant civilized nations; how long would the material elements of our science and art or general culture remain with power to enlighten the barbarous tribes that would inherit the earth? Human progress has more than once been set back for centuries by such natural or unnatural causes, leaving the sites of once splendid civilizations to be overrun with barbaric hordes knowing nothing of the better times that went before.

Suppose, again, that, by one of those geologic changes so numerous in the history of our unstable globe, the existing continents should sink a thousand feet. Every center of modern civilization would be submerged. The great social and political organizations of humanity would be broken up, and in the wreck of nations that would ensue very little of the glory and culture of the race could survive. The earth is dotted with vestiges of lost and forgotten empires. Can we reasonably assume, in the face of such facts, that the nations of to-day are immortal?

The question is: Shall we continue to trust to chance, as all other civilizations have, for the preservation of the conquests we have made among the forces and secrets of nature; or shall we do something positive for posterity, and leave the ages to come some certain and abiding legacy of our treasures of art and learning?

It may be that human progress will go on and on to the end of time without a break; that in the course of centuries mankind will surpass us in civilization, knowledge and power, as much as we surpass the earliest and rudest men we have yet found traces of: maybe infinitely more.

In such a case, what would not the scholars of, say the year 5000 A.D., or any other future age, be willing to give for a comprehensive picture of humanity as it exists to-day—for a reasonably complete library of our literature, science,

and art? We may safely assume that nothing of the sort will be possible if matters are left to take their natural course. By that time every structure, every machine, every book, every work of art, now in use or stored away in our libraries and galleries of art, will have disappeared, a prey to time, the elements, or the more destructive violence of man.

On the other hand, it may be that, through repeated disasters of one sort or another, mankind, three thousand years hence, will have lost all the knowledge men ever possessed, and be slowly struggling upward for the hundredth time from inherited barbarism. In such a case, what enormous benefits might not accrue to man from a fortunate opening up of the wealth of knowledge we possess!

In any supposable case between these extremes of progress or degradation, a legacy of art and learning, such as we might easily set apart for remote posterity, would certainly be acceptable, perhaps extremely useful. Besides, it might be possible for us to set such a worthy example to those who shall come after us that, come what might, humanity would never be left absolutely void of the means of instruction, nor any worthy human achievement be absolutely lost or forgotten. The experience of these later years has demonstrated the value of such legacies even when unintentional, unselected, and wretchedly fragmentary. It has made clear also how a legacy deliberately made may be indefinitely preserved.

Roughly outlined, the carrying out of such a truly philanthropic enterprise would involve nothing more difficult than—
First. The construction of a practically indestructible treasure chamber in some secure place; and

Second. The preparation of a library well calculated to withstand the corroding tooth of time.

Two kinds of structures would meet the first demand—massive pyramids of covered earth or of solid masonry, or chambers hewn from the heart of some granitic hill. In low latitudes, where glacial action is not to be feared, the pyramidal form might be preferable: in more northern regions the rock-cut chamber would probably be at once cheaper and more durable. In either case, an elevated site should be chosen as a safeguard against submergence.

To secure the permanence of the records would be more difficult. Ordinary books and papers would clearly be unsuitable for long keeping; though for comparatively limited periods they might answer if securely packed in airtight waterproof cases. Nothing liable to spontaneous decay should be admitted. Stereotype plates of metal would be even more open to objection than printed sheets. The noble metals would be too costly, the baser would corrode; and with either the value of the plates as metal would be a standing danger to the deposit. The material basis of the library must be, as nearly as possible, worthless for other uses (to insure them against the natural greed of man), yet such as will hold the records sharply and faithfully under all circumstances. The *terra cotta* tablets of ancient Assyria are instructive in this connection. Possibly plates of artificial stone, or sheets of a *papier-maché*-like preparation of asbestos, might be less bulky and equally durable.

Having determined this point, and dug from the solid rock a chamber for the reception of our legacy, the next step would be the selection of its contents. Obviously the books to be preserved should embrace first of all lexicons and grammars of every known form of speech, since it is impossible to tell which of the dialects of to-day will be the parents of the dominant tongue of any distant future time; while we may be practically certain that some one or more of the languages of to-day will furnish a key to any language that men will ever use. Next in order would come encyclopaedias, the most comprehensive and complete that there might be room for. The sacred books of all nations might come next; then the works of the great poets, historians and novelists; after them, the best obtainable records of art, science, the various industries, and so on, with specimens of the best and most typical of our works of art, manufacture, and the like.

The spaces between the various articles should be filled in with some insoluble and neutral substance, to prevent corrosion, or the infiltration of water and consequent damage to the plates. Then, the entrance to the chamber being securely sealed, permanent records should be made in many places and in various ways, setting forth the purpose of the deposit, its exact location, and the nature of its contents. Among such records not the least valuable would be deeply cut polyglot inscriptions on natural cliffs in different parts of the world, observation having shown that such records may remain to challenge human curiosity for ages after all other records of their time have disappeared.

Even a single deposit of this sort might prove of enormous value to the race at some critical period of its history. But the probability is that the good work would not end with one deposit. From age to age this and other nations might repeat the experiment, commemorating in this way important epochs in their history. The fashion once set might easily become a permanent feature of all great national celebrations. The cost would be comparatively small: a penny contribution from each of the visitors to the Philadelphia Exhibition, for example, would have been quite sufficient to provide for a memorial of our first Centennial year that would have carried an imperishable picture of the civilization of the day to the end of—our first millennium, at least; and we may safely infer that, whatever may be the condition of the world at that not very remote epoch, a memorial of that sort would be something worth having.

As we have intimated, the custom might easily become

general, so that in the course of ages the earth would become dotted with such repositories of art and learning. Then, come what might to humanity—whatever might be the ups and downs of nations—whatever moral, social, or intellectual advances mankind might make—whatever lapses or disasters might befall them—it could hardly happen that a knowledge of any considerable period of human history, or the advantage of any worthy human achievement, could ever be permanently blotted out and lost.

It is true that "posterity" has never done anything of the sort for us. It is true that "posterity" may have no valid claim on us for such a legacy. But we might venture to make "posterity" a present! It would not cost us much, and it might turn out to be immensely valuable and useful to some far future age.

THE LOST ARTS IN NEW YORK.

While the objects of ancient art contained in the Castellani collection, recently placed on exhibition in the Metropolitan Museum of Art in this city, are individually of great rarity and archaeological value, they derive additional importance from the fact that, viewed conjunctively as a collection, they represent connected histories of two great industrial arts extending over many centuries. Both in the work of the goldsmith and of the potter, we are enabled to trace progress from the earliest stages up to a period when the greatest skill was attained, and even subsequently into the era of decadence. In both industries, we find that ancient and medieval workmen possessed knowledge which we do not possess; and among Signor Castellani's treasures may be seen handiwork which is the embodiment of two lost arts, the secrets of which the modern world, with all its infinitely superior wisdom, has not yet rediscovered.

The productions, in the Castellani collection, of precious metal workers dating from prehistoric epochs, the exact dates of which are wholly unknown, and covering the long period ending in the thirteenth century, are represented by the contents of some twenty cases. The first three of these receptacles bear no dates. The ornaments which they contain are of bronze, amber, silver, and glass (the latter having become converted into opalescent silicic acid), and were found in Praeneste (modern Palestrina, Italy), and in the territory which was ancient Etruria. Case No. 4 bears date 700 B.C., and here is a rich treasure of primitive Etruscan and Phœnician ornaments of gold, adorned with granulated work. Signor Castellani considers that the workmanship of these objects is so perfect that it is impossible at the present time to explain the process of execution, and very difficult to imitate it. The ornaments are of two kinds—those for ordinary use and those for funeral purposes. The first are massive, and might be worn for years without injury; the others are extremely delicate. All are made of the purest gold, and their decoration evinces the most consummate skill and taste on the part of the artist. There is, for example, a small flask, shaped something like an antique wine jar, and about five inches in height. It is of beaten gold, and is covered with a pattern intended to imitate the similarly shaped designs of variegated glass of the Græco-Phœnician period. This pattern is entirely produced by minute globules of metal soldered to the surface in tiers of zigzag or vandyke patterns. Another specimen is a strip of gold covered with granulated lines and bearing a row of birds in relief. On other ornaments are exquisitely carved heads and flowers, produced apparently by hammering on the reverse of the object, but with a delicacy and precision of touch which is simply marvelous.

The closest students of this ancient handiwork are entirely at a loss to understand how the processes of melting, soldering, and wire drawing, which were employed in the art, were performed. Modern workmen have failed in their attempts exactly to imitate the old ornaments; and it is certain that the secret of the mechanical agents, whereby it was possible to separate and join pieces of gold hardly perceptible to the naked eye, is lost. Signor Castellani has taken great pains to solve the problem, reading all the treatises of medieval goldsmiths, inquiring of all classes of Italian jewelers, and experimenting with all kinds of chemicals, in the hope of finding the solder wherewith the minute grains were attached to the surface of the metal. At last he found some of the old processes still employed in a remote district, hidden in the recesses of the Apennines, far from the great towns. Bringing away a few workmen, he gave them much more instruction, and at last succeeded, not perhaps in equalling, but certainly in rivalling the ancient productions.

We question whether the Etruscans used fire at all in their soldering, as it would be almost an impossibility to keep the excessively fine tools necessary for the work at a proper heat. Mr. Joshua Rose offers the plausible suggestion that a cold flux was employed, with which the workman followed the lines or dots of his pattern. Then the gold granules were possibly sprinkled over the surface, and adhered only to the solder, the superfluous grains being brushed off after the solder had set.

There is also a fragment of a finely woven fabric, made of threads of pure gold, found on the body of a woman in a tomb at Metapontum. This is without doubt the material to which the Psalmist refers in speaking of "the King's daughter" having "clothing of wrought gold;" and in the Pentateuch there is reference to gold threads being used upon looms.

As we follow the various objects in the twenty cases above mentioned, the decline of the goldworker's art when the use of enamels came into vogue is evidenced. Continuing on to later

periods, the decadence is more marked under the successors of Alexander. In Rome, under the emperors, we find gold used as a mere setting for precious stones, and finally the collection terminates with examples of workmanship of the time of Charlemagne, when the workmen had lost their cunning, and the noble metal had been altogether debased to secondary uses.

The second instance where a lost art is exemplified in Signor Castellani's collection is in the glazing of the Gubbio majolica. We have not space here to review the magnificent series of ancient specimens of pottery in detail; and thus it will suffice to say that, beginning with some of the earliest pieces made by the Arabs when they occupied Sicily, from the twelfth to the sixteenth century, the collection presents examples of all the finest types of later medieval art. Gubbio, where the peculiar kind of majolica above noted was made, is a small town once in the territory of the dukes of Urbino; and in the sixteenth century it became famous for its pottery. This was attributable to the talent of one man, Giorgio Andreoli, who is reputed to have invented the wonderful luster characteristic of the Gubbio ware. The body of majolica is mere common clay; and after the piece is finished on the wheel, it is dried and burnt in a furnace. After the biscuit thus prepared has been dipped in the glaze, the colors are applied on the soft surface of the latter, and the vitrifying process fuses all into a glossy enamel of the color of the pigment. This is still the common practice; and we mention it merely to show that to his pigment and glaze Andreoli must have added some third substance, which rendered the enamel capable of reflecting white light as blue, red, green, or yellow light—in other words, of giving the object a luster of a color wholly different from the tints of the pigment. He evidently could produce any desired color at will, and the effects gained are indescribably beautiful. The Castellani collection contains 130 superb specimens, which glow like jewels. In one, the scene of the nativity of Christ is provided with the figures in low relief, and the exquisite cerulean lustre is imparted to give the effect of moonlight. The rarest pieces are those of which the luster is a delicate green. Some blaze with yellow, as if of gold; others exhibit the brilliancy of the ruby; while others resemble the interior of the pearl oyster shell. Whether this sheen is produced by polarization of the light in some manner, or whether it is at all analogous to fluorescence, is yet to be decided. The impression of the surface with fine microscopic lines might produce an iridescence, but not separate and clearly defined hues. The ware was intended for ornamental purposes, not for household use; and it was suspended against the rich, dark tapestries of the period with which walls were covered, thus aiding, as it were, in illuminating the apartment with its exquisite radiance.

THE BLUE GLASS DECEPTION.

On September 26, 1871, General A. J. Pleasonton, of Philadelphia, Pa., obtained a patent for "utilizing the natural light of the sun transmitted through clear glass, and the blue or electric (1) solar rays transmitted through blue, purple, or violet colored glass, or its equivalent, in the propagation and growth of plants and animals." In his specification, of which the above constitutes one claim, he states that he has discovered "special and specific efficacy in the use of this combination of the caloric rays of the sun and the electric blue light in stimulating the glands of the body, the nervous system generally, and the secretive organs of man and animals." He also states that he finds that vegetation is vastly improved by the transmitted blue light.

These alleged re-discoveries—for the General only claims to have devised the method of utilizing them—were extensively promulgated through the press early in 1871. Subsequently, in 1876, General Pleasonton published a book on the subject, the volume being appropriately bound in blue and printed in blue ink. Recently public attention has again been called to the subject by a New York daily journal. The peculiar kind of glass in question is known as "pot metal blue," that is, it is stained a bluish violet throughout, and is not clear glass covered with flashings of blue glass. It is used in greenhouses, etc., in connection with clear glass; and in General Pleasonton's graperies it appears that only every eighth row of panes was blue. Some of the results alleged to have been obtained by exposing animals and plants are as follows: Twenty grape vines, in their second year, after being set out under the blue glass, bore 1,200 lbs. of splendid fruit. A very weak Alderney bull calf was in four months developed into a strong and vigorous bull. Heifers when kept under blue glass may safely bear young when 18 months old. A weak child, weighing but 3½ lbs. at birth, weighed at the end of four months 22 lbs.—the light in this instance having come through blue curtains. Two major-generals with rheumatism were cured in three days. A young lady whose hair had come out regained her tresses; and to these must be added various other cures of severe ailments which we have not space here to recapitulate. The above are the alleged facts; and we propose to consider the supposed discovery in the light of previous investigations.

With reference to the theories of electricity, etc., advanced by General Pleasonton to account for his phenomena, their absurdity is so complete that we shall waste no time over them. The important question in the matter, and the only one in which the public is interested, is whether or not blue glass is capable of producing all or any of the results imputed to its use. In order to clear the way for the examination of

the investigations, the records of which we have carefully collected, let us consider first those which General Pleasonton quotes in support of his views. These are (1) Seubert's researches, which go to show that the blue and violet rays are the most active in determining the decomposition of carbonic acid in plants, and (2) experiments of Dr. Morichini, repeated by Carpa and Ridolfi, proving that violet rays magnetized a small needle. The first statement has been totally disproved. Dr. Von Bezold, in his recent work on color, states that "the chemical processes in plants, as far as they are dependent upon light, are principally caused by the rays of medium and of lower refrangibility. The development of the green color of the chlorophyll, the decomposition of carbonic acid, as well as the formation of starch, etc., in the grains of the chlorophyll, are induced by the red, green, and orange rays." The blue, violet, and ultra violet rays, the same authority goes on to explain, influence "the rapidity of growth, compel the so-called zoospores to move in certain directions, and alter the positions of leaves, etc. In confirmation of this, we have Sach's experiments in 1872, which show that light, transmitted through the yellow solution of potassium chromate, enables green leaves to decompose over 88 per cent. of carbonic acid; while that passed through blue ammonia copper oxide decomposes less than 8 per cent. This proves the superiority of the yellow ray to decompose carbonic acid; and this fact Professor J. W. Draper discovered a long time ago by the direct use of the spectrum. In still further confirmation, we may cite the investigations of Vogel, Pfeiffer, Selim, and Placentim. The last three have conducted researches in full knowledge of those of General Pleasonton, and their experiments show that yellow rays are more promotive of the evolution of carbon in animals and its absorption in plants than any others in the spectrum, the violet rays having least power in these respects, with the exception of the red rays in the case of animals. The absorption of carbonic acid by plants, and its evolution by animals, we hardly need add, are prime essentials to the growth and health of each. The notion that light possesses a magnetizing power on steel was upset by Niepce de St. Victor in 1861. After removing every source of error, he "found it impossible to make one sewing needle, solarized for a very long time under the rays of light concentrated by a strong lens, attract another suspended by a hair, whether the light was white or colored by being made to pass through a violet-colored glass."

We can proceed further and even show that violet light is in some respects hurtful to plants. Cailletet, for example, says in 1868 that "light which was passed through a solution of iodine in carbonic disulphide prevents decomposition altogether." Baudrimont says that "no colored light permits vegetables to go through all the phases of their evolutions. Violet-colored light is positively injurious to plants; they absolutely require white light." This scientist instituted the most elaborate experiments on the subject, ranging over 11 years, from 1850 to 1861; and the result of all his labor may be summed up in the simple statement that no illumination which human ingenuity can devise is so well adapted for promoting natural processes as the pure white light provided by the Creator. So much by way of general denial of the claims of superior efficacy residing in blue light of any kind.

Now we have yet to examine the peculiar variety of blue light here used. Sunlight can, by means of the prism, be split into colored rays, any one of which we may isolate, and so obtain a certain colored light. Similarly we may obtain light of a desired color by the use of a colored glass which will stop out the rays not of the hue required. So that we may obtain violet light from the spectrum or by filtering sunlight through violet glass. When, however, Dr. Von Bezold, as above, asserts that the violet rays have such and such an effect, he means the violet of the spectrum, which has its specific duty to perform in the compound light of which it is a necessary portion. But the violet light of the spectrum and filtered violet sunlight are altogether different things. The first, as our valued contributor Dr. Van der Weyde has very clearly pointed out, is "a homogeneous color containing, besides the luminous, the invisible chemical rays without any caloric rays; while the light colored by passing through violet glass is a mixture of blue rays with the red rays at the other end of the spectrum; and it contains a quantity of the chemical rays belonging to the blue and the caloric rays belonging to the red. In fact, violet glass passes a light identical with sunlight, only much reduced in power, containing but a portion of its caloric, chemical, and luminous agency: being simply deprived of its strongest rays." And this the spectroscopic has clearly demonstrated. Reduced to its simplest terms, then, the necessary conclusion is that the violet glass acts purely as a shade for decreasing the intensity of the solar light. And in the simple fact that it does so serve as a shade lies the sole virtue (if any there be) of the glass. In 1856, Dr. Daubeny made experiments on the germination of seeds, and in his report is this suggestive sentence: "In a south aspect, indeed, light which had passed through the ammonia sulphate of copper (blue solution), and even darkness itself, seemed more favorable than the whole of the spectrum; but this law did not seem to extend to the case of seeds placed in a northern aspect where the total amount of light was less considerable."

In our next issue, we shall review the effects of light and darkness upon the animal organization, and endeavor to account for the curing of diseases and the production of other phenomena which have been erroneously ascribed to the influence of the blue filtered sunlight.

THE WETLI MOUNTAIN RAILROAD AND ITS DISASTROUS TRIAL TRIP.

Among the various means proposed of late years for building lines of railroad on the steep slopes of mountains, that of M. Wetli, of Zurich, Switzerland, has attracted considerable attention from European engineers. We have already laid before our readers the system of central toothed rails used on the Righi and other mountain roads in Europe. In the Wetli system, instead of this rail and the pinion on the vehicle engaging it, there is a drum having a helicoidal thread which engages with triangular rails. This drum is attached to the locomotive. The construction will be readily understood from the illustrations given herewith, which we take from *La Nature*. The thread on the drum is precisely that which would be formed could a rail similar to one of the central angular rails be wrapped around it; so that it always is in contact with the mid rails, and necessarily prevents any bodily sliding or rolling of the vehicles over the regular track when the drum is held motionless. The V-shaped mid rails are securely fastened to horizontal iron ties, which rest on wooden traverses. The angle of the V is 50°; the distance between any two traverses is 2.8 feet.

The locomotive has three coupled axles, on the mid one of which the drum is attached so as to be raised or lowered to engage the rails at the will of the engineer: it being possible to cause it to act on the rails with a pressure of 3.7 tons. The diameter of the drum is 3.14 feet. Its spiral thread is of steel, very solidly attached, and so made as to grip the rails to a distance of 0.6 inch below the level of the track. In order to insure this contact, on the drum axle are two pulleys which run on the exterior road, and of which the diameter determines the depth of the hold of the threads. These pulleys are 34.7 inches in diameter, while the driving wheels are very slightly in excess, to provide for the use of tyres.

M. Wetli's invention, as we have described it, was placed between Woodenswell and Einsiedlen, Switzerland. The difference in altitude between these points is 1,513 feet, the distance 9.6 miles. The grade is from 4 to 5 per cent over the first six miles of the way, and subsequently decreases to 1 per cent. The Wetli railroad was established last October only on the heavy grade, that is, the first six miles

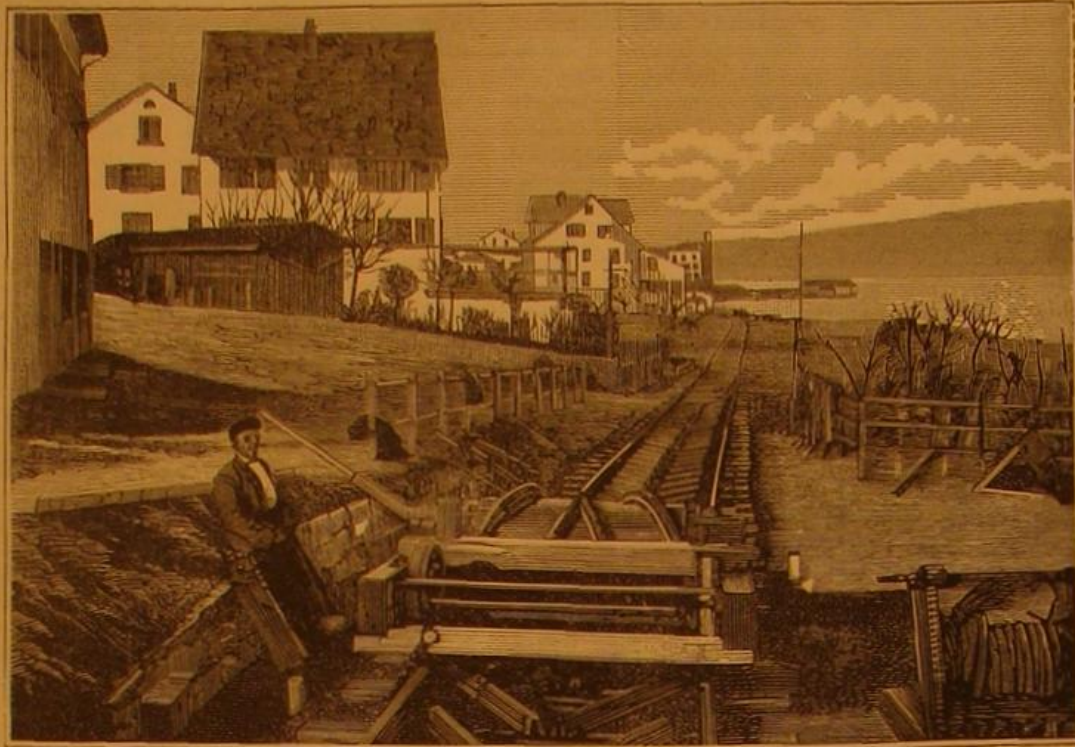


Fig. 1.—THE WETLI MOUNTAIN RAILROAD.

started again; but hardly had the descent been resumed when it was evident that the drum was not holding, and that the speed was accelerating rapidly. Brakes and steam were both found useless, and the engine went tearing over the rails at the rate of a mile a minute. Of the fourteen persons in the vehicles, three were thrown out and killed, and the rest were more or less seriously injured. The heavily loaded car left the track, and tore up both central and side rails until its coupling broke. The engineer, with great intrepidity, clung to his engine, coolly giving signals to open switches so that the locomotive might run upon the level track and so expend its momentum; but the engine left the rails at a sharp curve, destroyed the track for about a hundred feet, and finally stopped a mass of ruins, with its brave engineer mortally wounded. Whether the Wetli system can be made to work as intended by the inventor is regarded as doubtful by the engineers who have examined into the causes of the disaster.

Leghorn Hens.

If a man keeps Leghorns he must have no garden, or he must cover the top of his hen yards. That Leghorns are great layers and active hens, there can be no denying, but they are great flyers. We have built our yard a lath and a half high, says the *Poultry Review*, but what do these saucy things care for that? Although they have the whole outside world to range in, yet the garden seems to have a greater attraction than all the rest. The other day we found it necessary to feed a weak chicken in the garden by itself, so that it might be sure of its share. A few minutes afterwards, on looking out of the window, we discovered the weak chicken in the henyard and two Leghorn hens finishing up its food. We went out, but the two robbers had fled. Going around the corner, we found them rolling in a flower bed. A Leghorn will do as much mischief in a garden in five minutes as anything we know of.

Sawdust in Rough Casting.

Siehr recommends very highly the use of sawdust in mortar as superior even to hair for the prevention of cracking and subsequent peeling off of rough casting under the action of storms and frost. His own house, exposed to prolonged storms on the seacoast, had patches of mortar to be renewed each spring, and after trying without effect a number of substances to prevent it, he found sawdust perfectly satisfactory. It was first thoroughly dried and sifted through an ordinary grain sieve to remove the larger particles. The mortar was made by mixing 1 part cement, 2 lime, 2 sawdust, and 5 sharp sand, the sawdust being first well mixed dry with the cement and sand.

SUINT FOR WATERPROOFING FABRICS.—A German chemist has patented the waterproofing of finely woven fabrics, linen, cotton, etc., by means of suint composition. He adapts his method to securing the suint to wool-washing establishments at a small cost.

Absence of White Color in Animals.

Some very curious physiological facts bearing upon the presence or absence of white colors in the higher animals have lately been adduced by Dr. Ogle. It has been found that a colored or dark pigment in the olfactory region of the nostrils is essential to perfect smell, and this pigment is rarely deficient except when the whole animal is pure white. In these cases the creature is almost without smell or taste. This, Dr. Ogle believes, explains the curious case of the pigs in Virginia adduced by Mr. Darwin, white pigs being poisoned by a poisonous root which does not affect black pigs. Mr. Darwin imputed this to a constitutional difference accompanying the dark color, which rendered what was poisonous to the white colored animals quite innocuous to the black. Dr. Ogle, however, observes that there is no proof that the black pigs eat the root, and he believes the more probable explanation to be that it is distasteful to them, while the white pigs, being deficient in smell and taste, eat it, and are killed. Analogous facts occur in several distinct families. White sheep are killed in the Tarentino by eating *hypericum criscum*, while black sheep escape; white rhinoceros are said to perish from eating *euphorbia candelabrum*; and white horses are said to suffer from poisonous food where colored ones escape. Now it is very improbable that a constitutional immunity from poisoning by so many distinct plants should, in the case of such widely different animals, be always correlated with the same difference of color; but the facts are readily understood if the senses of smell and taste are dependent on the presence of a pigment which is deficient in wholly white animals. The explanation has, however, been carried a step further by experiments showing that the absorption of odors by dead matter, such as clothing, is greatly affected by color, black being the most powerful absorbent, then blue, red, yellow, and lastly white. We have here a physical cause for the sense-inferiority of totally white animals which may account for their rarity in nature. For few, if any, wild animals are wholly white. The head, the face, or at least the muzzle or the nose, are generally black. The ears and eyes are also often black; and there is reason to believe that dark pigment is essential to good hearing, as it certainly is to perfect vision. We can therefore understand why white cats with blue eyes are so often deaf—a peculiarity we notice more readily than their deficiency of smell or taste.—*Dr. Wallace, British Association, 1876.*

IMPROVED TROLLING HOOK.

Mr. Henry C. Brush, of Brush's Mills, N. Y., has patented through the Scientific American Patent Agency an improved troller, the novel feature in which consists in attaching a float to the shank of the implement under the revolving blade, the object being to keep the troller near the surface of the water, where the fish may see it more readily, and where by the liability of catching in weeds and logs is obviated.



A is a float, attached to the shank, *a*, of the troller. B is the spoon, which is swiveled in the usual manner. The device is very simple, and is claimed to prevent all the annoyance arising from the hook catching in sunken obstructions.

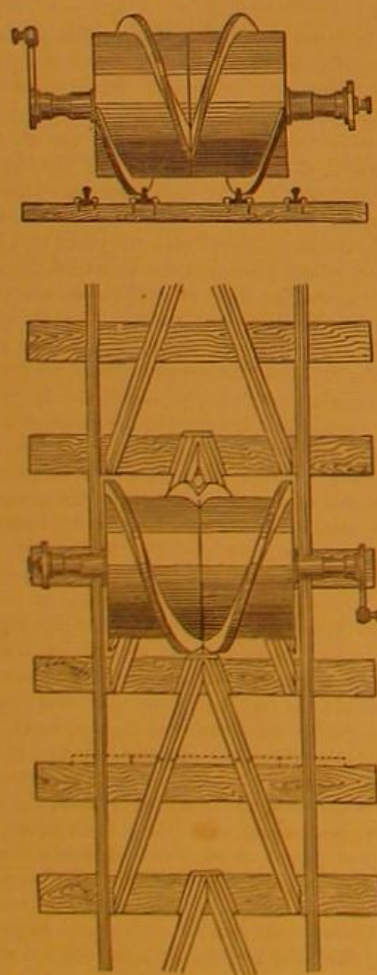
Purification of Wool and Woollen Stuff.

The process, patented some time ago, for the removal of straw, burrs, etc., from wool, by treatment with sulphuric acid, has been modified by Lisc as follows: The stuff is worked for one to two hours in a bath consisting of about 26 gallons sulphuric acid, of 3° to 6°, 1 lb. alum, $\frac{1}{2}$ lb. salt, and 750 grains borax. It is then treated in a centrifugal machine, and afterward subjected to a temperature of 212° to 248°. For removal of the acid it is first washed with pure water for 1½ hours, then treated for two hours with fuller's earth, soda, and lime, and finally washed for two hours with fresh water. As sulphuric acid can only be employed with uncolored cloths, or such as have been dyed with indigo, chloride of zinc and chloride of manganese diluted to 6° are substituted with fabrics otherwise dyed.

Caffeone.

Caffeone, the aromatic principle of coffee, may be isolated by distilling 5 or 6 lbs. roasted coffee with water, agitating the aqueous distillate with ether, and afterwards evaporating the ether. It is a brown oil, heavier than water, in which it is only very slightly soluble. An almost imponderable quantity of this essential oil will suffice to aromatize a gallon of water.

Fig. 2.



Early in November, trial trips were made which did not prove satisfactory. Sometimes the drum thread gripped the triangular rails properly and acted well; again it would wedge itself upon them, and often would simply roll over their tops without engaging at all. After the first trials, during

THE HEMI-PLUNGER.

The novel form of vessel, to which the above odd name has been given by its inventor, M. Donato Tommasi, of Paris, France, is a combination of a boat wholly submerged with a raft: a connecting link, to borrow the naturalist's expression, between the submerged torpedo boat and the monitor. The advantages which are expected to be realized from this hybrid craft, the inventor describes as follows: "It is evident that a vessel, plunged several yards below the surface of the sea, is no longer influenced by wind or wave. Let the sea be agitated, let there be the most violent tempest, yet the boat which navigates under water will never be wrecked, for the same reason that a fish cannot be drowned. * * * What a beautiful vision, that of traversing the ocean, as a balloon floats through the air, with the same tranquillity, without shocks, without the insupportable rolling and pitching!" etc. The construction of the invention introduced in this glowing manner will be understood from Figs. 1 and 2. A is the plunger cylinder, shown with its side broken away in Fig. 2. In Fig. 1, G is the rudder, H the propeller, and I the tube through which sea water passes to the pump. In Fig. 2, C is the smokestack, M M are compartments in which water may be admitted to increase the weight, and hence the depth of flotation of the plunger, the same being filled or emptied by the pump, P. N is the hold for merchandise, partitioned off from the boiler room as shown.

From the plunger, A, rise two hollow columns, E, to which metallic plates, F, are attached to diminish friction through the water. These support the upper division or platform, B. The second shaft (not lettered), which rises above the platform in Fig. 1, serves to ventilate the plunger. The columns, E, serve as shoots down which merchandise is lowered to the compartments, N; and their upper ends are received in two immense inverted cups attached to the bottom of the part, B. Through these cups pass large screws, which confine the columns so that, by removing the connection, the whole submarine apparatus may in case of necessity be freed from the upper works. On each side of the platform, B, which is of elliptical figure, is a large float, seen in Fig. 3, which, by means of racks and gearing, may be raised or lowered at will. Usually these floats are carried at a height of a yard above the water. In calm weather, this distance is increased, and in storms it is diminished, the object of the floats being to keep the whole vessel on an even plane, and to prevent too violent oscillations. In order to facilitate navigation in shallow water, the columns, E, may be made telescopic, and operated by hydraulic apparatus, so that they may be shortened at will. Any form of engine or propeller may be used.

Besides the advantage of the vessel being unaffected by waves, since its submerged portion travels far below them, the inventor claims that it will meet less resistance from the water than would a vessel of corresponding volume sailing on the surface. It will make faster progress, because it has no waves to mount and descend; and hence it always travels in a nearly right line. The screw being submerged at a great depth will not tend to turn the vessel from her straight path. The platform being easily detachable may serve as a raft in case of injury to the submarine boat. For fast travel, on lakes, rivers, and shallow water generally, M. Tommasi proposes to support his platform on two floats which rest on the surface of the water. No weight, therefore, is thrown on the submarine vessel, which need be constructed with only just enough buoyancy to sustain itself and its engine. In this way, the upper craft has no engine or other load than its cargo; and as it merely rests upon the surface, the inventor thinks that it will skim over the same like an ice boat on ice.

For war purposes, the hemi-plunger is especially adapted, because the vulnerable portions, engines, boiler, rudder, etc., are wholly out of the reach of shot. Guns are mounted on the platform, which thus becomes a circular or elliptical turret, just above the water when the vessel is in fighting trim. Instead of steel armor, M. Tommasi has a new invention which he calls hydro-metallic plating. He reserves the details of this for future publication; but generally the armor consists of tubes in which liquid is forced under a pressure equivalent to the resistance, say, of forged steel. He thinks this will oppose shot as effectually as the solid metal, and will have the additional advantage of superior lightness.

IN-soles saturated with salicylic acid have been introduced as a remedy for perspiration of the feet.

Supreme Court Patent Decision.

A United States patent was granted May 23, 1854, to John Myers and Robert G. Eunson for a wood-sawing machine for cutting boards into thin stuff for making picture frame and mirror backs. One of the principal claims was for the employment of two deflecting plates, one on

Planing Mill Machinery.

The planing machine, next to the saw, is perhaps the most important agent for the conversion and manipulation of wood in use; and before proceeding to consider it, in its present form, says the author of this article, Mr. F. H. Morse, in the *Northwestern Lumberman*, it may not be out of place to notice briefly its origin and history.

The first man to employ power in the operation of smoothing the surface of wood was Sir Samuel Bentham, of London, England, and to him belongs the honor of having discovered the principle upon which all planing machines operate. A brief personal notice of this remarkable inventor will serve to show under what circumstances the planing machine originated. His education was secured at the Westminster school of London, and, as far as can be ascertained from the meager records of his life that have come down to us, was of the most thorough kind, both classical and scientific, that could be obtained at that time (1770). When his education was finished, he was bound to the master shipwright of the Woolwich dockyard, to whom he served an apprenticeship of seven years, acquiring in that time a practical knowledge of the methods of working in both wood and iron then in vogue, and receiving the best scientific instruction that the development of that period afforded. After his term of apprenticeship had expired, he spent about two years in looking up the local peculiarities of other shipyards whose methods of working differed in some respects from those of the Woolwich mechanics.

In 1779 he was ordered by the government to examine into the progress of shipbuilding to be repaired to Russia, where he invented the first machine for planing wood. Its mode of operation, whether reciprocating or rotating, it is impossible to ascertain positively, but the conclusion arrived at, after referring to the specifications of his first patent, which was issued in 1791, is that it worked upon the former principle by means closely analogous to the operation of planing by hand. He seems to have made no use of his venture in Russia, though he resided there several years and filled several important positions under the Russian Government. He returned to his native country in 1791 and joined his brother, Jeremy Bentham, who had at that time just received an appointment from the government to introduce industrial prisons in England. To utilize the unskilled labor of the convicts, the talents of Sir Samuel were called into use, and he devised a number of new machines, the greater part of which were for working wood. For want of a more suitable place, these machines were constructed at the residence of Jeremy Bentham, which was thus converted into the first manufactory for woodworking machines.

This factory was established in 1794, but was soon found to be too small for the purpose, and another building was occupied. In a lecture before the Society of Arts, in 1853, Professor Willis, referring to the shops of the Bentham, stated that "there were constructed machines for all general operations in woodwork, including planing, molding, rebating, grooving, mortising, and sawing, both in coarse and fine work, in curved, winding, and transverse directions, and shaping wood in complicated forms; and further, as an example, that all parts of a highly finished window sash are prepared, also all parts of an ornamented carriage wheel were made so that nothing remained to be done by hand but to put the component parts together."

In 1797 the Admiralty consented to the introduction of such of these machines as could be used to advantage in the different dockyards, and they were manufactured under the direction of Jeremy Bentham, and forwarded from time to time to Portsmouth and Plymouth, where they were used with good results, performing all that was claimed for them.

Bentham was joined in 1810 by another genius (formerly in the employ of the brothers) by the name of Brunel, who had invented several valuable machines, among which was one for shaping block shells, which seems to have had Bentham's indorsement. As Inspector General, in 1803, Sir Samuel advised the Admiralty to introduce many of his new machines, and also to permit the use of steam engines; accordingly, the dockyards were fitted with engines for sawing, planing, boring, tenoning, mortising, etc. The labor saved by their use can be inferred from the fact that Brunel, who had assisted in their construction, received as a premium for his inventions the amount saved in the yards by their use in one year, which reached the respectable sum of \$80,000. In the same year the government settled with Jeremy Bentham, after arbitration,

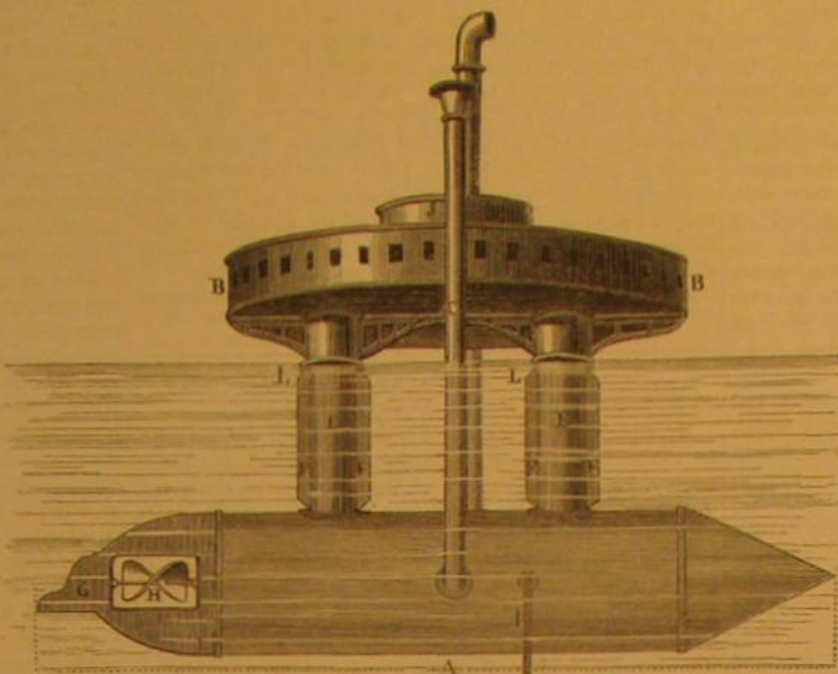


Fig. 1.—TOMMASI'S HEMI-PLUNGER.

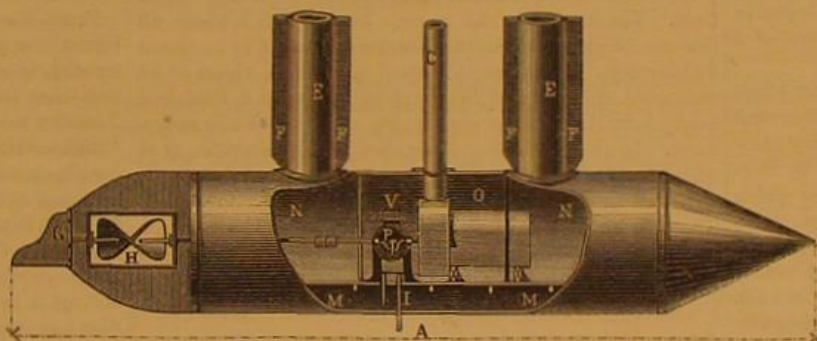


Fig. 2.—THE HEMI-PLUNGER, THE SUBMERGED PORTION.

which tribunal has reversed the finding of the Circuit Court and dismissed the complaint. It was held by the Supreme Court that, inasmuch as the use of a single deflecting plate was old, well known, and in common use, it was simply an exercise of ordinary mechanical skill, and not a patentable invention, to employ a second deflecting plate, although the superiority of the double deflectors, for certain kinds of work, appears to be conceded.

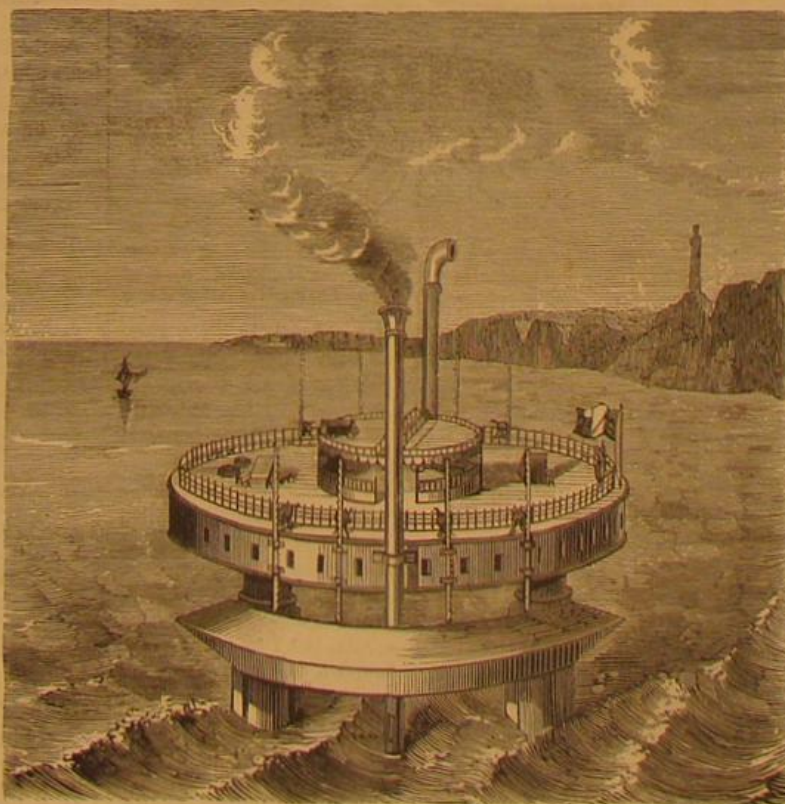


Fig. 3.—THE HEMI-PLUNGER ON A VOYAGE.

and allowed him for machines furnished the yards and prisons, \$100,000. We learn from testimony given before the arbitrators that "Sir Samuel Bentham prepared a system of machinery for the employment of men without skill, and particularly with a view to utilizing convict labor. In 1793 patents were taken out on these inventions to secure their exclusive use for the prisons." The testimony states that no skill was required in the use of these machines; they were introduced into the dockyards and worked by common laborers. It was claimed that nine tenths of the labor was saved by the use of Bentham's machines, which proves that they were at least effective, which cannot be said in all cases of those of modern manufacture.

The patent of Bentham, issued in 1793, is doubtless one of the most remarkable ones ever issued, both for the importance of the inventions it protected and the clearness with which they and the principles on which they operated are described. Richards, in referring to that section of this patent which relates to rotary tools for woodcutting, quotes the inventor as saying: "The idea of adapting the rotative motion of a tool with more or less advantage, to give all sorts of substances any shape that may be required, is my own, and, as I believe, entirely new."

For those not skilled in nor acquainted with the nature and extent of the various operations in wood conversion which come under the head of shaping with rotary cutters, it will be difficult to convey an idea of the invention here set forth; it includes, indeed, nearly all operations in woodworking, and as an original invention may be said to consist in the discovery of the fact that flat surfaces, or surfaces of any contour, can be properly prepared by the action of rotating tools. It is not to be wondered at that such an operation should not have been sooner discovered, for even at the present time there are few processes in treating material which seem so anomalous as that of planing a flat surface with cutters revolving in a circle of a few inches in diameter.

In reference to planing mouldings, it is said: "If the circumference of a circular cutter be formed in the shape of any moulding, and projecting above the bench no more than necessary, the piece being shoved over the cutter will thus be cut to a moulding corresponding to the cutter—that is, the reverse of it, just as a plane iron cuts the reverse. If a plane cutter, such as that above spoken of for cutting a groove in the breadth of a piece, be made so thick, or, as we might be apt to say now, so broad, or so long, as to cover the whole breadth of the piece, it will present the idea of a roller. This I call a cutting roller; it may be employed in many cases with great advantage to perform the office of a plane."

The cutting roller of Bentham is the present cutter block of England, or the cutting cylinder of America, and after what has been quoted it may be seen that the idea of rotary planing and moulding machines had been fully grasped by Bentham. He goes on as usual to the various conditions which attach to the process of planing, and says further: "If a cutting roller of this sort be placed with its axis horizontal and the bench beneath, it may be made to rise and lower. The bench (machine) may be very readily adjusted, so as to determine the thickness to which a piece will be reduced by being passed under the roller." "To gain time, cutters may be applied to different sides of a piece at once, and such of them as make parallel cuts may be mounted on the same spindle."

These extracts would not be out of place in an explanatory lecture or essay on woodcutting at the present day, and cannot help awakening surprise that they should have been written eighty-three years ago, when there had, so far as we know, been no precedents, nor even suggestions from previous practice.

The foregoing shows that nearly all the fundamental principles, upon which woodcutting by machinery in its present development depends, were familiar to Sir Samuel Bentham, and though his name has been almost forgotten, it may be safely asserted that he gave to the world more useful inventions than any other man of his age. His work shows throughout a constant method and system of reasoning, which point rather to a life of persistent labor than to one of what would ordinarily be called genius. That latter quality he must certainly have possessed in the highest degree, for without it even his knowledge and experience could not have been equal to the work he accomplished. Directed to different ends, his talent and genius would doubtless have secured for him a fame that would live for years, though it does not seem possible that he could have conferred upon the world a greater benefit.

Suicide Statistics.

A curious and suggestive table of statistics has recently appeared in France, which will doubtless prove of much value in the hands of students of psychology and nervous mental ailments. It relates to suicides; and the conditions, etc., of the people who made away with themselves in 1874 in France are taken as the basis of the figures. In that year, 5,617 suicides occurred, the largest number ever known in any one year in the country. Of these, 4,435, or 79 per cent., were committed by men, 1,182, or 21 per cent., by women. In spite of the careful investigations of the police, the ages of 105 people could be determined. The 5,512 others are divided as follows: 16 years, 29; between 16 and 21 years, 193; between 21 and 40 years, 1,477; between 40 and 60 years, 2,214; exceeding the last mentioned age, 1,599. About 36 per cent. of these unfortunates were unmarried, 48 per cent. married, and 16 per cent. widowers. Of those which con-

stituted the last two classes, nearly two thirds had children. More than seven tenths of the suicides were effected by strangulation or drowning. The crime was most frequently committed during spring, when 31 per cent. of the whole number destroyed themselves; during other seasons the percentages were: in summer, 27; in winter, 23; in autumn, 19.

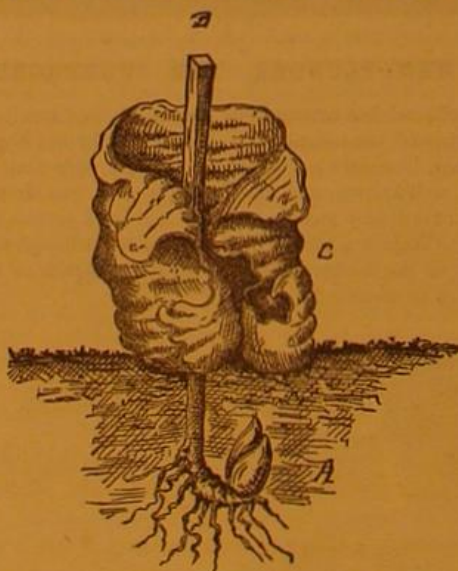
Included in the tables are the results of the judicial inquests, showing the professions and callings of the deceased. About 33 per cent. were farmers, 30 per cent. mechanics, 4 per cent. merchants or business men, 16 per cent. members of the liberal professions, 4 per cent. servants, and 13 per cent. were destitute of any calling. The table even analyzes, in all but 481 people, the motives which caused the fatal act. Thus we are told that 652 killed themselves because of reverses in fortune, 701 through family troubles, 572 through drunkenness, 243 through love, debauchery, etc.; 798 died to avoid physical suffering, 59 to avoid the penalties of capital crimes, 489 for unclassified troubles, and 1,622 were clearly shown to have been afflicted with some mental disease.

Communications.

The Frost Plant of Russia.

To the Editor of the Scientific American:

Mr. Charles Williams, of Wino, Ohio, has written a letter to that veteran botanist, Humphrey Marshall, of Chester county, Pa., on the subject of the abovenamed plant, and my opinion concerning it has been asked for. Seeds of this plant were obtained by citizens of Boston, who had snow brought from the White Mountains and from the coast of Labrador, and who stated that they have "now the most unbounded satisfaction and pleasure of announcing that all signs are favorable to the realization of their fondest hopes." This wonderful plant, it seems, was found amid the perpetual snows of the northern boundaries of Siberia, in 1863, by Count Swinskoff, the eminent Russian botanist, and it was by him cultivated at St. Petersburg. The account sent me is very vague, and is evidently not from the pen of a botanist. It is stated that it comes forth on the first day of the year, grows to the height of three feet, and flowers on the third day. It continues in bloom for twenty-four hours, then dissolves itself, being of the finest snow; it has a stalk one inch in diameter, and leaves, three in number, $1\frac{1}{2}$ inches wide, covered with infinitesimal frost or snow cones. The flower is of the shape of a star, with petals 3 inches long and $\frac{1}{2}$ inch wide at the broadest part, forming a basketwork of frost. The seeds are like a pin's head. This is about all that can be gleaned from the description, and is by no means satisfactory. Allow me to present my humble views of an analogous discovery of frostwork on December 6, 1856, in a sandy loam in Chester county, Pa., near the Paoli monument. In the *Horticultural Journal* of Philadelphia, then edited by J. Jay Smith (New Series, volume vii., page 73, 1857), an account was published of my observations then. These I have since more fully confirmed. The common dittany (*cunila Mariana*) is frequently met with in December, with the base of the stem surrounded with shellwork of



Root-bud and frost-flower of the *Cunila Mariana* (Maryland Dittany). A, the developing or budding root. B, the old stem of the previous year. C, the congealed vapor or hoarfrost, forming the first flower of various shapes.

ice, of a pearly whiteness. Dr. Darlington, in his "*Flora Cestrica*," published in 1853, page 199, under the article *cunila*, observes: "In the beginning of winter, after a rain, very curious ribbons of ice may be observed, attached to the base of the stems, produced, I presume, by the moisture of the earth rising in the dead stems by capillary attraction, and then being gradually forced out horizontally, through a slit, by the process of freezing. The same phenomenon has been observed in other plants. See observations on *helianthemum*, page 27." Had the doctor given a more extended investigation, I fancy he would have agreed with me as to the cause. I found hundreds of diversified specimens. I am not aware that it was after a rain, but I took up a number of the plants, and always found a vigorous scaly root bud, undergoing development at this early season under ground, to produce a new stem the following spring. I came to the conclusion that, as the temperature was below freezing and snow was on the ground, the expanding bud, in close proximity to the surface, gave out sufficient caloric or warmth to generate vapor from the moist soil. This

vapor rising around the stem of the plant, and attracted by it, becomes congealed into what we term hoarfrost, in numerous forms; some like shellwork, others like tulips, with radiated petals, variously contorted, and often as symmetrical as snowflake crystals.

That plants in germinating have the power of generating heat was proved by Mr. Hunter and by Lamarck. Experiments of Hales and Du Hamel show that vegetation is not wholly suspended, however cold it may be; and that there is a regular and gradual progress till the returning warmth of spring gives a greater degree of velocity to the juices, rendering their development more vigorous and apparent. If the crystallization takes place when the air is calm, the crystals will be regularly formed; otherwise, when windy, I have seen them like a shell within a shell, very thin, of a pearly whiteness. Professor Tyndall has shown in a very beautiful manner that ice is but an agglomeration of snow crystals: the transparency of the former being due to the expulsion of the air, entrapped in and causing the whiteness and opacity of the latter. There is a formation called the snow plant of California, which arises to some height, and has been compared to various things, a fountain convoluted and enlarged above, a crystallized small bushy shrub, etc.; but on closer inquiry, I have failed as yet to get any definite ideas to its true character. Some bulbs in the soil might cause such formations by the congelation of vapor deposited successively upon itself, or the stems of the previous year's growth yet remaining, and thus give them a sheathing of frosting.

The shape of a star is common in snow crystals, which we all know assume the most beautiful forms, and which are illustrated in various publications. The eminent botanist Count Swinskoff should give us some clue as to the genus or character of the plant, the flower of which, we are told, melted away on being touched, and as to the stamens, the diamond seeds like a pin's head, etc. The whole needs further explanation.

I trust those Bostonians who are in such hope will edify the public as to the final result of their experiment. What has that veteran in botany, Dr. Asa Gray, to say about it? Let some one well qualified tell us more about this frost flower of Russia.

J. STAUFFER.

Lancaster, Pa.

Patent Matters in Washington, D. C.

To the Editor of the Scientific American:

From the report of the Commissioner of Patents, just issued, it appears that its surplus revenue for the past year amounts to over one hundred and five thousand dollars, and that there is nearly a million dollars in the United States Treasury to the credit of the Patent Office; and yet, notwithstanding that this enormous amount is lying idle, our pseudo-economists at the Capitol refuse to grant the Office sufficient of its own funds to carry on its business promptly. So much is the work behindhand in some of the departments that, as the Commissioner states in his report, some of the attorneys who require certified copies of papers have been obliged to employ their own clerks to do office copying, and then had to pay the full legal rate of ten cents per hundred words, the same as though the Office had done the work. This style of economizing, by making inventors pay two prices for their work, may be "reform" in the eyes of the average Democratic Congressman; but speaking for myself, as one of those who have had to pay twice, I would prefer to dispense with this style of "retrenchment and reform," and therefore ask you, Messrs. Editors, in behalf of the inventors of the United States, to so stir up our legislators that they will allow the Office sufficient of its own funds to do its work properly, and not delay the work of the inventor—work that he has to pay for in advance—and so prevent the discouragement and trouble which these delays always cause.

As the Patent Office has been doing a good business lately, there appears to be some attempt at rivalry at the Capitol, as the following list of applications for extension will show:

LIST OF APPLICANTS FOR EXTENSIONS OF PATENTS NOW BEFORE CONGRESS.

- Reynolds, power loom brake.
- Strong & Ross, scales.
- Wm. & W. H. Lewis, photographic plates.
- T. A. Weston, differential pulley.
- S. S. Hartshorn, buckles.
- H. A. Stone, making cheese.
- N. Whitehall, cultivator.
- J. R. Harrington, carpet lining.
- H. L. Emery, cotton gins.
- J. Stainthorp, moulding candles.
- Walter Hunt's heirs, paper collars.
- A. B. Wilson, sewing machines.
- S. A. Knox, plows.
- Rollin White, firearms.
- Aikin A. Felthousen, sewing machines.
- H. Woodman, stripping cotton cards.
- L. Hall, heel trimmer.
- J. A. Conover, wood splitter.
- J. Dyson, carding engine.
- G. Wellmann, card strippers.
- E. Brady, safety valves.
- Jearum Atkins, harvester rakes.
- John Thomas, re-rolling railroad rails.
- Thomas Mitchell, hair brushes.
- Stephen Hull, harvesters.
- T. R. Crosby, wiring blind slats.
- G. W. Laban, mitre cutting machine.
- T. A. Whitenack, harvesters.
- J. J. Vinton, furnaces.
- A. Fuller, faucets.
- D. Baker, pitcher spouts and lids.
- G. F. Chandler, refining sugar.

G. H. Nott, boiler furnace.
William Hall, lightning rods.
B. F. Rice, paper bag machines.
S. D. Nelson, shovels.
E. T. Russell, car springs.
Hubbell & Conant, steam pumps.
C. A. Chamberlain, shovels.
C. A. Adams, locks.
E. A. Leland, paint can.

In addition to the above, I find the following names as applicants for extensions, but the inventions covered by the patents sought to be extended is not mentioned: S. S. Turner, Arculous Wyckoff, De Witt C. Cummings, Moses Marshall, J. W. Fowler, and Holloway & Graham. Many of the applicants have apparently given up their cases for this session, but they may be only lying back to its close in hopes that in the final rush their "little bills" may slip through easily.

Several bills tinkering at the patent laws are before Congress, and one of these (House Bill, No. 3,370) passed the House on the 30th ult. It has one section that may be made to work great harm to inventors, as it prevents infringers being sued for more than one year's damages previous to notice of infringement being given. By this bill, if it is allowed to become a law, a person will be able to build and use patented machines or processes for years in some out of the way place where the inventor cannot easily find him; and should he be discovered, he can only be sued for one year's damages. There are other sections in this bill which will bear ventilating.

Another bill, introduced into the Senate by Mr. Paddock, provides that all appeals from the Board of Appeals shall be direct to the Supreme Court of the District of Columbia, instead of to the Commissioner as heretofore; and that the fees shall be the same as now paid to the latter official.

Mr. Sampson has introduced into the House a bill changing section 4886 so that it shall read as follows: "Sec. 4886. Any person who has discovered any new or useful art, machine, manufacture or composition of matter, or any new or useful improvement thereof, not known or used by others in this country, and not patented or described in any printed publication in this or any foreign country, before his invention or discovery thereof, and not in public use or on sale for more than two years prior to his application, unless the same is proved to have been abandoned, may, upon payment of the fees required by law, and other due proceedings had, obtain a patent therefor: *Provided, That the manufacture or composition of drugs as a medicine shall not be patentable.*" The change is the addition of the words in italics.

The Smithsonian Institute has sent to Congress a memorial setting forth that the present Institute building is already too small for the vast amount of articles already placed there on exhibition; that at the late Centennial Exposition the Commissioners of various countries presented their entire collection of exhibits to the United States, which had delegated their care to the Smithsonian Institute, and they had no place for them; that the armory building was being fitted up for the reception of the United States Centennial collection, and they therefore asked that a building be erected for the foreign collection, which could be used as a national museum, or otherwise we should have to offend the donors by keeping their valuable gifts stowed away in cellars and other rubbish receptacles.

Mr. Eads, who is now here on the lookout for his pay for his work on the South Pass of the Mississippi's mouth, has received intelligence from the resident engineer at the jetties that the channel through the shoal at the head of the South Pass is now twenty-two feet deep, and that the least width at which twenty feet depth is found is one hundred and ten feet. The principal works to improve this shoal were constructed during the last six months. The low stage and feeble current of the river has delayed their effect until the recent flood from the Ohio reached them, and the problem of deepening the shoal has been fully solved by the rapid scouring away of the obstruction. It is stated that the channel is quite straight and is deepening rapidly. The channel through the jetties at the mouth of the Pass is twenty-one feet deep. The entrance from the sea through the jetties is one thousand feet wide, and through the works at the head of the Pass eight hundred feet.

A recent telegram from Nevada states that the Sutro Tunnel (of which I gave you some particulars in one of my letters) has now progressed a total distance of 15,565 feet and has fairly entered the mineral belt, and will soon help to increase the already vast products of the Comstock lode.

While on the subject of mining, I will state that the amount of quicksilver produced in California has increased so immensely during the last two years that it has attracted the attention of all interested in the article throughout the world. The receipts for the year have been 63,928 and the exports 48,010 flasks. In addition to the receipts there, probably about six thousand flasks were shipped direct from the mines to Nevada, thus bringing up the total production to over 70,000 flasks, a gain in round numbers of from twelve thousand to fifteen thousand flasks over 1875. The exports in that year were 34,844 flasks, or 13,666 less than in 1876.

OCCASIONAL.

TYRIAN PURPLE INK FOR MARKING LINEN.—Von Bele gives the following method for preparing an ink for marking linen and cotton: Neutralize 75 grains of carbonate of ammonia with pure nitric acid, and triturate 45 to 60 grains of carmine with the solution. Mordant the fabric with a mixed solution of acetate of alumina and tin salt, and write upon it, when it is perfectly dry, with the ink.

NEW YORK ACADEMY OF SCIENCES.

On Monday evening, January 29, 1877, a meeting of this Academy was held at the School of Mines, Columbia College, Dr. J. S. Newberry, President, in the chair. Mr. A. A. Julian, A. M., read a paper on the

PREPARATION OF ROCK AND MINERAL SECTIONS FOR MICROSCOPIC STUDY.

The speaker described in detail the various operations, exhibited the different kinds of apparatus employed, showed the operations, and exhibited the finished sections. In some rocks a thin chip can be broken off, others require to be sawn, and for the latter purpose the diamond saw is best. Having obtained the chip, it is first polished on one side, then cemented to a little square of glass, and the other side polished in the same way. The sections must not be too thick, nor too thin; they are usually made from a hundredth to a thousandth of an inch thick. Lathes employed in polishing minerals require to be provided with conical spindles, so that the wear, due to grit and emery dust getting on them, may be readily taken up. The grinding wheel may be either horizontal or vertical; the former has the advantage that the mineral can be held in either hand; with the latter only the right hand can be employed, and that in an awkward and tiresome position. Mr. Julian then referred briefly to the kinds of emery, its preparation by elutriation, etc., and cautioned operators against using rouge or tin putty powder in polishing rock sections, although they may be employed in polishing certain minerals and gems. The object of making the rock sections being to study their constituents and determine what minerals enter into their composition, it is important that no foreign substance, liable to adhere to the specimen and to be mistaken for one of its ingredients, be placed on the section while grinding. Lastly, the minerals are mounted on glass, with or without covers, by means of Canada balsam. Square glasses are to be preferred to the long and narrow strips, usually employed, as less liable to break in the center, and more easily revolved on the stage of a microscope.

Mr. L. H. Landy then exhibited, by means of the gas microscope, several beautiful rock sections, both American and German. The same gentleman also showed the effect of passing polarized light through certain crystal sections, the black cross and rainbow-hued rings revolving like so many wheels as the polarizer was turned.

At the conclusion of this brilliant exhibition, Dr. P. T. Austen made some remarks on

LABORATORY MANIPULATIONS.

The points referred to were the apparently unimportant details which often contribute so much to the ease and pleasure of working. First, the use of square pieces of felt, such as are used under beer glasses in saloons, for setting hot beakers and flasks on to prevent chilling and consequent cracking. Second, in crystallizing substances for examination under the microscope; one watch glass is placed upon another with the substance between them, and the upper glass filled with ether, the cold produced by its evaporation hastening the crystallization. Third, removing precipitates and solid matter from flasks, by heating to boiling, and inverting in a vessel of water. Fourth, crystallization by gradual dilution. Fifth, filter paper without ash. In German laboratories it is customary to dissolve out the mineral matter from white filtering paper by washing in dilute hydrochloric and hydrofluoric acids. Sixth, the use of infusorial silica for drying purposes. Being very porous, it will absorb five times its own volume of water. If a filter paper, holding a wet precipitate, be placed upon a layer of this earth, it will become quite dry in a very short space of time. Mr. Austen also remarked that substances retain their heat for several days when placed in cork boxes. To keep a substance air-tight, it may be placed in a flask, the neck painted with a solution of india rubber in chloroform, and a plate of glass laid upon it. The solvent quickly evaporates, leaving a delicate film of rubber, which holds the glass tightly in place.

The next meeting of the Chemical Section will be held February 12; of the Mineralogical Section, February 19.

ANNUAL REPORT OF THE PATENT OFFICE.

The annual report to Congress of the Commissioner of Patents, for the year 1876, has made its appearance.

The amount received on applications for patents, reissues, designs, extensions, caveats, disclaimers, appeals, trade marks, labels, copies, etc., was \$757,987.65. The amount paid for salaries was \$425,930; other expenses, \$226,612. Total payments, \$652,542.

Number of applications for patents during the year 1876.....	21,425
Number of patents issued, including reissues and designs.....	15,305
Number of applications for extension of patents.....	2
Number of patents extended.....	3
Number of caveats filed during the year.....	2,097
Number of patents expired during the year.....	814
Number of patents allowed but not issued for want of final fee.....	3,353
Number of applications for registering of trade marks.....	1,081
Number of trade marks registered.....	959
Number of applications for registering of labels.....	650
Number of labels registered.....	402

Of the patents granted there were to—

Citizens of the United States.....	16,399
Subjects of Great Britain.....	511
Subjects of France.....	104
Subjects of other foreign governments.....	173
Total.....	17,096

The number of applications for patents was a little less than during the previous year. The Commissioner suggests that Congress should appropriate \$50,000 to promote the printing of the old patents; that additional examiners be

employed, and more clerks, for the purpose of expediting the business of the office; that the price of the *Official Gazette* be reduced, also the fee for trade mark registration; that the library fund be increased; that more space be provided for models, and for the transaction of business.

In respect to the Centennial, the value of new improvements, and the service of the Patent Office in stimulating discovery, the Acting Commissioner speaks as follows:

"The display made at the Exposition by the Patent Office was creditable in every respect, and excited general attention. About 5,000 models of inventions, representing the leading branches of the arts and manufactures, were exhibited in suitable cases, and properly labeled, the various publications of the Office were displayed, its practice fully explained to all inquirers, and copies of the Patent Laws and the Office regulations and forms freely distributed. The knowledge of our patent system thus imparted to foreigners and all others unable to visit Washington has more than repaid the small cost attendant upon the representation. The exhibits were sent from and returned to the Office with scarcely any damage being suffered.

"But the array of models, etc., made by the Patent Office at the Exposition was not needed to illustrate the value of our patent practice. The wisdom of that system was demonstrated in the most practical and triumphant manner in nearly every branch of that munificent enterprise. Not only in the grand display of labor-saving machinery, but in the vast collection of manufactured articles, and even in the department of fine arts, were seen the fruits of that provision in our Constitution giving to Congress the power 'to promote the progress of science and the useful arts by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries.'

"Whatever persons may do in a 'perfect condition of society' in sharing, without price, the fruits of their labors with others, it must be apparent to the dullest observer that the wonderful growth of the useful arts in this country is due, thus far, to the protection given by our Government to property in inventions—a property as sacred as any other class of property, and whose value is determined by the same general law of supply and demand.

"It may be safely said that two thirds of the manufacturing interests of the country are based upon patents, and the welfare of all such interests are intimately connected with the welfare of the patent system. During the past seven years a larger number of applications for patents were filed and patents granted than during the entire seventy-eight preceding years, reaching back to the enactment of the first patent law. The needs of the Office have advanced in proportion to this sudden and vast increase of work, but have been but partly supplied. Nay, in fact, its already scanty force and accommodations have been actually reduced at a time when most required. If these vast interests, and the future promotion of science and the useful arts are to be encouraged, a liberal recognition must be made of the wants of this Office.

"The Examining Corps, the duties in which are most arduous and exacting, comprises gentlemen of legal, as well as scientific, attainments. It should be re-inforced by more of the same character. They should be relieved, by legislation, of continual embarrassment by reason of meager salaries and fears of removal incident to merely political changes. The Office would then be spared the continual loss of its most experienced and efficient men."

The Iron Trade in England.

The British *Mercantile Gazette* of January 15 states that the situation and prospects of the iron trade have not materially improved in the month of December, but some week or two must elapse yet before trade returns to its regular channels. In the north of England the tone of the market is tolerably cheerful, and prospects, though still vague, are considered encouraging. Makers of pig iron go into the next quarter with a good supply of orders on their books, and merchants and consumers are desirous of buying over the first half of the year. Notwithstanding the great depression which has ruled throughout 1876, there is likely to be a greater production of pig iron by several thousand tons than ever there was before, and the total make must considerably exceed two million tons, which is twice the quantity turned out in Scotland, though in the latter district a greater number of furnaces have been kept in blast. Prices are nominally the same as were quoted last week, but show an upward tendency. The bulk of the mills and forges, foundries, etc., have resumed work, and the finished iron trade is again in full swing. The plate department is well provided with orders, but the rail manufacturers, though rather better off than they were, are still in a poor position. The miscellaneous branches of the iron trade, such as the foundries and tube, wire, and cut-nail manufactories are generally well off for orders, and engineers find plenty to do. The wages agreement in the finished iron trade ends this week, but it is thought that no alteration will be made. In the South Staffordshire iron trade, work has been only partially resumed as yet, and many of the mills and forges will not be started until the quarterly meetings, next week. Orders have rarely been so scarce as they are at this moment, arrears having been pretty generally cleared off before the holidays, and no new ones coming in. Nevertheless, the feeling of the trade is more hopeful than it was a month ago. The number of furnaces in blast in this district is now only 58 out of 153; but should the expected improvement in trade arrive with the quarterly meeting, this number will soon be increased. In the finished iron branch, in which quotations for marked iron contain the basis of \$45 for bars, makers of leading brands of sheets and bars are better off than the manufacturers of cheap iron, who suffer much from competition in the north. Some considerable contracts for girders, bridges, gasometers, etc., are under execution at the works devoted to constructive ironwork; but the merchant iron trade, as a whole, is very dull. Unmarked iron is weak and variable, and to this circumstance may be attributed the reduction, announced this week, in various descriptions of common iron hardware.

IMPROVED LATHE CHUCK.

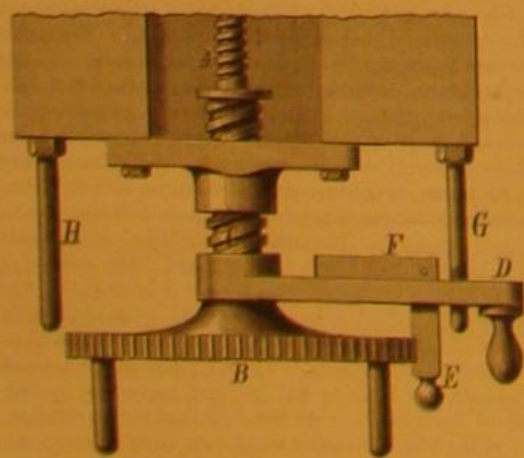
The annexed engravings represent a new lathe chuck, which may be constructed of any size, which holds tools with great firmness, and which is provided with an improved device for taking up wear and for the separate adjustment of the jaws. The implement is made of the best steel, by special machinery, so that its parts are interchangeable.

Figs. 1 and 2 represent the chuck taken apart so as to exhibit the interior. Figs. 3 and 4 are sectional views. A is a collar which encircles the spindle, and has formed on its outer face a bevel gear wheel, B. C, Fig. 3, is the rear portion of the shell of the chuck inclosing the forward part of the collar, A. Also on said collar, A, is a washer, D, which rests against the shell, C, and a nut, E, which travels on a thread formed on the collar. As it is necessary, as will be explained further on, to turn the entire shell in order to move the jaws, the use of the nut just described is to jam the part, C, and the enlarged portion of the collar, A, tightly together, and so rigidly hold the jaws in any position in which they may be adjusted. Fig. 1 represents the outer face of the chuck with the jaws and their working mechanism. Within the chuck, each jaw has attached to it a screw, F. This enters a bevel wheel, G. As the jaws are incapable of any but radial motion, it follows that, when the chuck is rotated bodily and the bevel wheels engage on the motionless gear wheel, B, the effect of the rotation of said bevel wheels is to cause the jaws to travel toward or from the center of the chuck face. And it will be further clear that this motion must be simultaneous in all the jaws. As the outer portion of the chuck is rigidly secured to the shell, C, by screws, of course when that shell is jammed, as already stated, by the nut, E, it becomes impossible to turn the chuck bodily; and hence the bevel wheels cannot be rotated around the main gear wheel, and consequently the position of the jaws cannot be altered. The above comprises the mechanism proper of the device, that is to say, all that is necessary for moving or clamping the jaws.

There is, however, another feature of considerable importance yet to be described, and that is the device for taking up any play of the jaws due to wear, and which enables each to be adjusted so that the motion of all may be uniform. By referring to Fig. 4, it will be seen that, above the bevel wheel, there is a projection, into the threaded interior of which, as already explained, the jaw screw enters. Surrounding this projection is a sleeve, G, the outer surface of which is threaded to fit a similarly threaded aperture, cut partly in the shell and partly in the face plate. The upper portion of the sleeve is notched to receive a wrench or driver; and beneath the sleeve an armed washer, H, is slipped over the projection. The arms of this washer enter recesses in the face plate. It will be evident that, by turning the sleeve, F, so that the screw works inward, the jaw and all its appendages will be moved bodily in corresponding direction. But its movement is limited by the arms of the washer, G, which, through the narrowness of the recesses, are allowed only just enough play to compensate for slight changes in the jaw. As the above device is applied to every jaw, it follows that any one of them may be nicely adjusted from the outside, so that all are caused to grasp the tool accurately. The spindle, instead of being solid as represented, may be made hollow. Patented to J. H. Vinton, August 18, 1874. For further information, address the manufacturer, Mr. F. Armstrong, Bridgeport, Conn.

SCREW-CUTTING LATHES.

An English lathe, now in use at the Rogers Locomotive Works, Paterson, N. J., contains several novel features. The



ways are flat on the faces, instead of having raised Vs; and this is a feature of all English lathes, and of those known in this country as the Freeland lathes. A great deal of discussion has at various times taken place as to the relative qualification or merits of these two forms of lathe bed. The advocates of the flat way, with Vs at the edges of the way,

claim superiority on the score of steadiness, increased wearing surface, and strength; while, on behalf of the raised Vs, it is urged that, the Vs being true, the saddle is bound to travel true, because there can be no lost motion on the slides; whereas any lost motion, from want of adjustment of the slides in flat ways, is liable to be reproduced twofold in the work, for the reason that $\frac{1}{16}$ of an inch lateral movement of the slide carriage becomes $\frac{1}{8}$ of an inch in the diameter of the work. Then, again, the most of the wear upon a lathe bed takes place at the part at and near the running center of the lathe, because the saddle is, on account of short jobs, more used in that part than on any other. As a result, when wear has taken place, the saddle, if adjusted to suit the worn part, becomes too tight to travel over the unworn part of the bed; and hence, after the wear has taken place, a proper ad-

justment of the lathe saddle becomes impossible if the job is a long one. In the case of raised Vs, however, the wear simply causes the saddle to fall vertically, so that an amount of wear equal to $\frac{1}{16}$ of an inch would have the same effect as lowering the tool $\frac{1}{16}$ inch, its effect upon the work being almost imperceptible by ordinary measurement. On the other hand, however, V lathes are usually made with either a weight or a spring to keep the saddle down; and as a result, when the cutting tool stands far out from the tool post, the saddle is apt to tip, especially in the case of boring with a lathe tool. In some cases, the raised Vs are accompanied with gibs to secure the saddle; but in many instances the gibs are given too little wearing surface. In the lathe above referred to, there are three ways in one casting, with the slide angles on the outer edges. There are also three separate and independent tail stocks fitting into the two openings between the ways. The running head has one cone pulley connected by suitable gearing to three face plates. The three centers at the running head are stationary. The slide rest saddle spans the three ways, having a V slide which contains three separate slide rests, all connected by a nut to the feed screw, so that all three are operated by the one screw. In addition to this, the two back slide rests have the nuts so attached that they can be moved by means of a separate screw, the object being to facilitate setting the cuts, since it would be a tedious matter to set all three tools to an equal cut, or to their desired respective cuts, without means of operating two of them independently. To set the cut during screw-cutting operations, the ingenious device shown in our engraving is provided. A represents the cross-feed or slide rest screw, which operates the three slide rests. It is fast to the notched wheel, B, and is operated by it in the usual way. C is a short screw which provides journal bearing for the screw, A, by a plain hole. It is screwed on the outside, and the plate in which it fits acts as its nut. It is fast to the handle, D, and is in fact operated by it. The handle or lever is provided with a catch, E, pivoted in the enclosed box, F, which also contains a means of detaining the catch in the notches of the wheel, or of holding it free from the same when it is placed clear. If, then, the lever, D, be moved back and forth the feed screw, A, and hence the three slide rests, will be operated; while, if the catch be placed in one of the notches on the wheel, B, both the screws, A and C, will act to operate the rests. When, therefore, the operator is cutting screws, he sets the catch, E, into one of the notches so soon as the tools are properly adjusted to the work; and then lifting the catch, E, he turns the wheel, B,

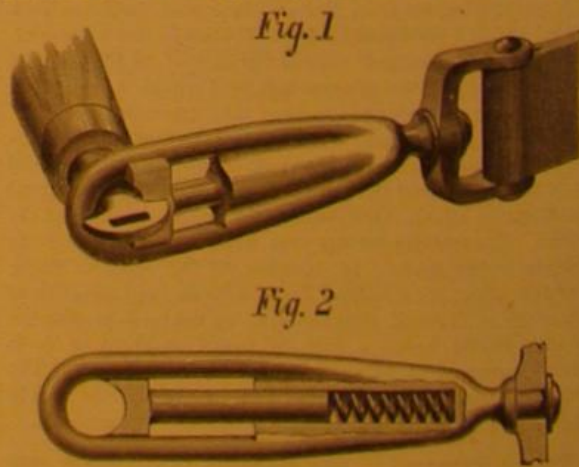
Natural Ornaments in Winter.

Now that the hedges are no longer green, and the trees stand black and bare on the landscape, is the time to seek for endless variety and beauty waiting to be admired in its turn. What miniature fairy glens and grottoes are distributed over the hedge banks of our country lanes! Mosses, delicate and beautiful, may be found in the interstices of any old wall, or at the foot of almost any tree or shrub. In the winter time mosses and lichens are found in fruit, and are beautiful objects. A pocket microscope lens is essential for their proper observation; and though the delicate carmine cups of the species known as the cup moss, and the familiar gray and yellow mosaic appearance we see on twigs and branches on our way, are easily recognized, the study of this form of winter vegetation is an inexhaustible one, and is an occupation for a lifetime, if earnestly pursued. We do not, however, suggest that every one who endeavors to recognize the different species of moss, lichens, or fungi should necessarily do so through the medium of the microscope; but it will greatly add to the pleasure of making a collection out of doors if there be a good microscope at home, so that when the contents of the basket be turned out, after the winter's walk, there should be interest even in the fragments left, after a little pile of varied bits has been constructed, rivaling the choicest summer bouquet in beauty of form and color. We have seen such a collection formed into a beautiful object by raising a little mound of rough bits of bark in a plate or saucer, and placing on it varieties of fungus of every shade of red, brown, yellow, and gray. They seem to spring forth from a bed of sphagnum or bog moss of brightest emerald green; while a clump of the screw will moss in fruit, with its curious little box-like capsules, supports a gray or yellow lichen, which has been gently removed from some old wall or tree. A bit of stick or a twig, incrusting with a bright orange-colored lichen, supports a trailing branch of delicate green ivy, the most beautiful and adaptable of all winter foliage. Over this little arrangement is placed a bell glass, to preserve it from dust and the effect of a dry atmosphere; and we know how pleasing to the eye is its varied beauty of form and color, lasting thus, a constant source of pleasure, for many a day without renewal.—*Chambers' Journal*.

IMPROVED HARNESS COCKEY.

We illustrate herewith a very simple little device for attaching traces to the single tree. It forms a secure fastening which may be instantly attached, and which, by its construction, is prevented from wearing out rapidly.

Fig. 1 shows the cockey attached to the single tree, and Fig. 2 exhibits parts in section, displaying the construction very clearly. The yoke is of the usual pattern. Swiveled to it is a long loop, which is chambered out to receive a spiral spring which acts upon a plunger. The latter is provided with a follower having a semicircular notch, which corresponds in form to the inside of the end of the loop. The follower also has guiding lips which extend over the



sides of the loop. Through the yielding of the spring, the space between the follower and loop adjusts itself to studs or hooks of any size. Patented December 12, 1876, through the Scientific American Patent Agency. For further particulars, address the inventors, Messrs. F. W. Knapp and C. Schallhorn, Fiddletown, Amador county, Cal.

PROPOSED CREMATION TEMPLE.

Cremation, in this country at least, is not popular. For a time, it occupied here some public attention, but only in a sensational way; and the sober discussion of the subject, which followed after its novelty had worn off, led to the general opinion that, while every one might be quite willing to see his dead neighbors cremated, no one would acquiesce

name, etc., of the deceased are recorded, and which is set up in a suitable niche.

The building, which we illustrate both in elevation, Fig. 1, and in plan, Fig. 2, is designed to contain 100,000 urns, and is adapted for a town of 200,000 inhabitants. The architect has certainly exhibited much taste in his design for the building, and has provided every convenience in the in-

Mr. Bonaffon also had an especial fondness for electrical apparatus. His windows were provided with ingenious burglar alarms, his rooms with fire alarms, and he ignited his gas always by electricity. His place of business, his stable, the Continental Hotel where he dined, were all connected with instruments in his room; and he even had perfected arrangements so that he could set at home and send

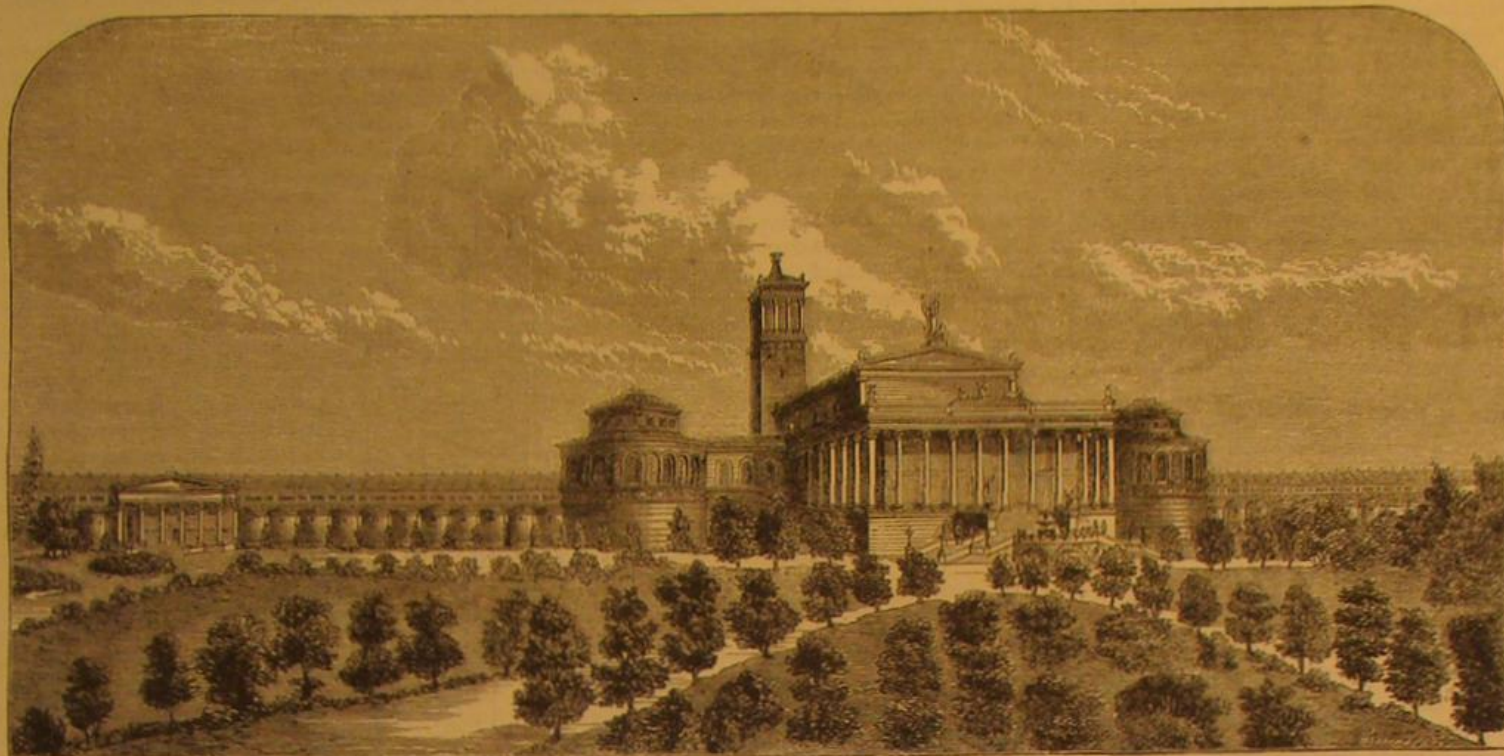


Fig. 1.—DESIGN FOR A CREMATION TEMPLE.

in the disposal of his friends and relatives in so abnormal a manner. Hence, with the single exception of the late revolting exhibition in Pennsylvania, which we alluded to at the time, the dead in this country have continued to be deposited in their hallowed resting places, and have not been packed away, in an incinerated state, in labeled urns. In Europe, however, cremation still finds many warm adherents; and during last summer a congress of the "Friends of Cremation" (a society which, we are informed by *Engineering*, whence we take the annexed engravings, has branches in various parts of the world), was held in Dresden. Before this meeting, a large number of designs for cremation and mortuary buildings were brought in competition, and finally the prize was awarded to Mr. G. Lilienthal, a Berlin architect, for the imposing structure illustrated herewith.

This will be the grand temple of cremation when it is erected—a proceeding to take place in the dim future: when or where not stated. On each side of a central chapel there is a circular memorial hall; and extending so as to inclose the garden of the establishment, on the sides of the halls are wings containing a large number of niches for the reception of funeral urns.

The cremation ceremony is proposed to be as follows: The body, having been brought into the hall, is subjected to the usual medical examination; or when an inquest is necessary, it is removed to offices in another part of the building, where the required investigation can be held. When all is ready, the body, placed on the platform, B, Fig. 2, is raised by a lift into the hall, A, where visitors are gathered, and here the result of the medical examination is declared, and whatever preliminary religious ceremonies that are desired are performed. The body is then transported to the chapel, E, in front of the pulpit, F, where the burial service is performed. The bier is afterward lowered mechanically, and brought to the furnaces, which are arranged in a semicircle and partitioned for the reception of several biers. The ashes are subsequently placed in an urn, on which the

tern arrangement for carrying on a large business in the cremation line.

How to Rejuvenate an Old Rose Bush.

Never give up a decaying rose bush till you have tried watering it two or three times a week with soot tea. Make the concoction with boiling water, from soot taken from the chimney or stove in which wood is burned. When cold, water the bush with it. When it is used up, pour boiling hot water on the soot a second time. Rose bushes treated in this way will often send out thrifty shoots, the leaves will become large and thick, the blossoms will greatly improve in size and be more richly tinted than before.—D. H. Jacques.

A Clock Collector.

One of those odd geniuses, who spend their lives and means in collecting curious and rare articles, lately died.

his own messages to California. Besides the clocks and electric apparatus, there was an immense collection of bric-a-brac of every conceivable variety, which was sold at the auction—as is usually the case—at prices much below those paid by its late owner.

Fertilizing Influence of Snow.

Snow is often called the "poor man's manure;" and if it is true that it has any manurial value, the farmer's prospects for the next season are certainly flattering. The body of snow upon the ground in all the Northern and Middle States is very great, and millions of acres of land are covered by it as with a blanket of the whitest wool. It is probable that seldom, perhaps never, has so wide an area of our country been covered as during this month of January, 1877. The question whether snow is capable of affording to lands any of the elements of fertility is one often asked; and in reply, the *Boston Journal of Chemistry* says that it probably is. The atmosphere holds ammonia and some other nitrogenous products, which are without doubt brought to the soil by snow flakes as well as by rain drops.

Experiments both here and abroad would seem to prove the truth of this conclusion.

Rains are not only valuable for the moisture which they supply, but for what they bring to us from the atmosphere. During a thunderstorm nitric acid is produced in considerable quantities.

ties; and dissolved in the rain drops to a high degree of attenuation, its effects upon soils are highly salutary, as the nitrogen permeates the entire soil.

Action of Sea Water on Lead.

The *Journal of the Chemical Society* says that freshly cut strips of lead were kept in a bottle of sea water for four days, the bottle being frequently shaken. No trace of lead could be detected in the water, but the bright surface of the strips was coated with an insoluble lead compound. Hence lead pipes may be used in marine aquaria without any fear of injury to their inhabitants.

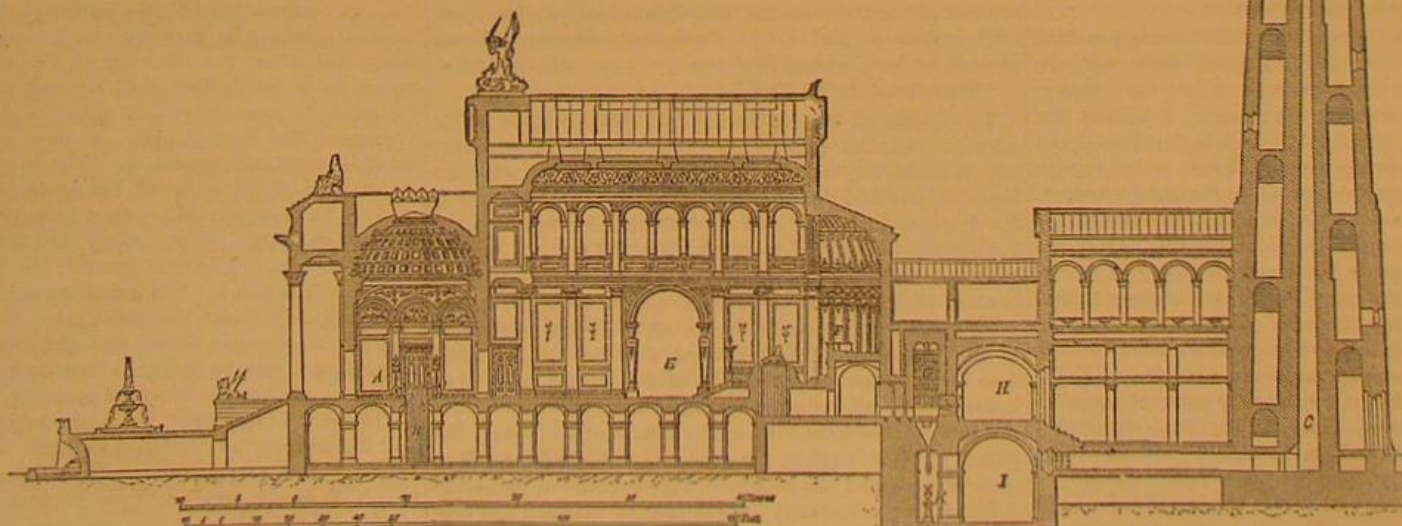


Fig. 2.—SECTION OF A CREMATION TEMPLE.

His name was Sylvester Bonaffon, a retired merchant of Philadelphia. His elaborate collections were sold at auction, and their oddity has attracted general attention. His chief mania was for clocks, which literally covered every portion of available space in his apartments, whether they were placed on chairs, tables, shelves, or hung against the wall. Some of these timepieces were of unique construction. One clock was made to run for 400 days after one winding; another was set in the dashboard of his carriage, and he used to regulate his drives to an exact period by it. In fact, he seems to have utilized his clocks to maintain his reputation for minute punctuality.

PAPIN'S STEAM ENGINE.

BY PROFESSOR CHARLES A. JOY.

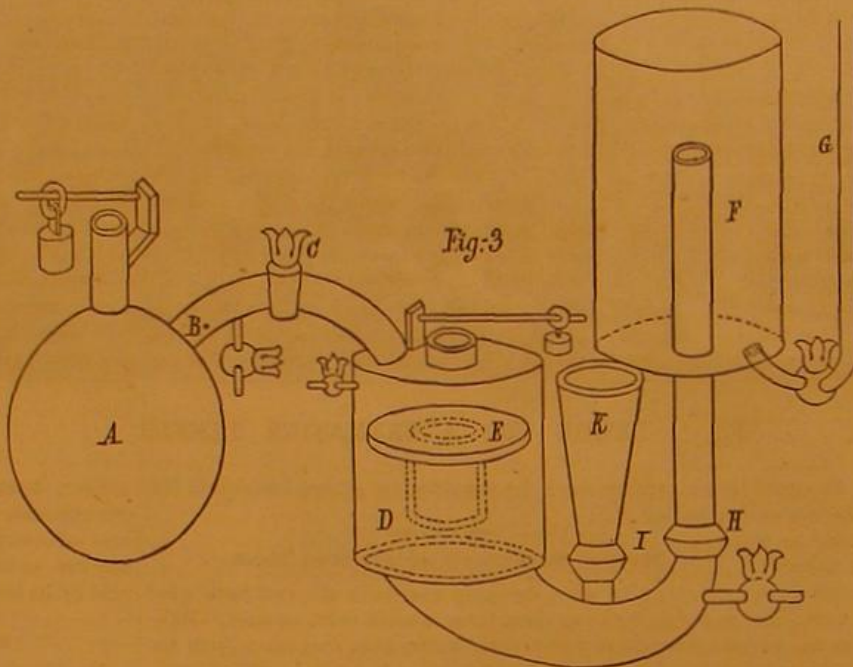
It is a matter of history that, as early as 1688, Denis Papin, Professor of Physics and Mathematics at the University of Marburg, proposed to substitute steam for powder in the engine invented by Huyghens, and that in 1695 he published a description of several new inventions, in which steam played an important part. The Elector Carl, of Hesse-Cassel, was anxious to be free from the annoyances and impositions practised upon his boatmen by the authorities at Münden, and he proposed to avoid that city by constructing a canal connecting the Weser with the river that flowed through Cassel. Much of the work was accomplished, and the half finished line of the canal can be traced even at the present day. Papin was authorized to build a powerful steam pump by which the supply of water was to be regulated. A working model of this pump was completed; and the Elector was on the point of visiting the laboratory to witness its operation, when a fearful explosion frightened the workmen, and afforded an opportunity for enemies to intrigue for the expulsion of Papin from the country. The model was preserved for a long time in Cassel; but at the time of the French invasion, it disappeared, and no trace of it has since been found. In writing about his inventions, Papin says, in 1695: "It would occupy too much space for me to describe in what manner this principle could be applied to removing water from mines, throwing bombs, sailing against the wind, and for many other similar purposes; everyone according to his wants can imagine the constructions that could be made. I cannot, however, refrain from remarking how much preferable this power would be to oars for those whose business calls them to the sea." And further on he says: "The steam cylinders could be employed for a great variety of purposes." One of the cylinders, which was to form a part of the pump, was cast at the foundry in Cassel, and after various vicissitudes has finally become the property of the Historical Museum in that city, where it will be preserved, with jealous care, from any further injury. During the recent exhibition of philosophical instruments in London, this remnant of Papin's invention played an important part, it having been generously loaned by the authorities for that occasion.

After the flight of Papin from Germany, the cylinder was used as a receptacle for iron turnings and borings in the royal works; and after the destruction of those works by fire, it came into the possession of Henschel, the founder of one of the most extensive locomotive works in Germany. This man fully appreciated the value of the historical relic; and when I visited him at the works, twenty-five years ago, he pointed out with pride to me the inscription on its side, "Papin's Cylinder," and said that he intended to have it placed upon a solid pedestal near the gate. His grandson has since presented it to the city, and its preservation from destruction or sale is now secured. A copy of the drawing made by Papin of the pump of which this cylinder was to form a part, and which was published in 1695, has recently appeared in Dingler's *Journal*, and I send it to you, hoping that you will have it engraved and perpetuated in your valuable paper. It is a peculiar combination of Savery's invention and Papin's piston engine, suggested for another purpose, and is a decided improvement on Huyghens' powder engine.

A is the boiler for the generation of the steam, provided with a safety valve (an invention of Papin). On opening the stopcock, C, the steam passes through B into the cylinder, D, and by its expansion drives the plunger, E, against the water contained in the cylinder, D, which is thus forced into the chamber, F, compressing strongly the air, which in turn expels the water through the pipe, G, to the height desired. K is a funnel for the fresh supply of water, and at I and H are valves opening upwards and downwards. After the condensation of the steam in D, a renewed supply of water, through K, forces the plunger, E, to the top of the cylinder, ready for the next action of steam. The strokes of such a pump could not be frequent, and it would not compare very favorably with the wonderful machinery exhibited in Philadelphia last summer; but it contains the germ of the idea, and is worthy of all honor. Having often seen it stated that Papin had invented a steamboat, I resolved during a recent visit to Germany to investigate the matter, and especially to search for the correspondence between Papin and Leibnitz in the library at Hanover. It will be borne in mind that two hundred years ago, on December 4, 1676, Leibnitz was appointed to take charge of the library in Hanover, and that he remained in this position until his death in 1716. He bequeathed his manuscripts to the library; and as he had the habit of writing upon all manner of loose scraps of paper, it has cost much labor to assort and classify them.

On making my application to the librarian to be permitted to see the correspondence between Papin and Leibnitz, my request was at once granted; and a table having been assigned me, I was able to examine these precious relics at my leisure. I was also shown a copy of an original treatise on the steam engine by Papin, which contained numerous marginal notes by Leibnitz. In one place, Leibnitz criticized Papin's method for condensing steam, and makes a drawing

on the margin, showing a piston and valve which he thought would be more practical. It is somewhat remarkable that the Germans have not caused a fac-simile of this little volume to be published. After considerable search, I found a copy of the original letter addressed by Papin to Leibnitz in 1707, asking Leibnitz to assist him in obtaining the consent of the Hanoverian Government to navigate the river Weser with a sidewheel steamboat. The letter was dated July 7, 1707, and contained among other interesting passages the following sentence: "The new invention will enable one or two men to accomplish more effect than several hundred oarsmen." It is evident that Leibnitz was deeply impressed by Papin's letter, and he supported the simple and reasonable request contained in it by the following petition addressed to the Councillors of State. This communication from Leibnitz bears two indorsements, one by the clerk of the council, "pro memoria respectfully, in reference to the passage of a ship from the river Fulda into the Weser;" the other is in the handwriting of Leibnitz: "Papin's sidewheel ship." This last indorsement is of great value, as indicating the fact that Papin proposed to apply side wheels for the propulsion of his new invention. The following is a translation of Leibnitz' letter, the original of which I saw in the library:



PAPIN'S STEAM ENGINE.

"Dionysius Papin, Councillor and Physician to his royal highness the Elector of Cassel, also Professor of Mathematics at Marburg, is about to dispatch a vessel of singular construction down the river Weser to Bremen. As he learns that all ships coming from Cassel, or any point on the Fulda, are not permitted to enter the Weser, but are required to unload at Münden, and as he anticipates some difficulty, although those vessels have a different object, his own not being intended for freight, he begs most humbly that a gracious order be granted that his ship may be allowed to pass unmolested through the electoral domain, which petition I most humbly support. G. W. LEIBNITZ.

"Hanover, July 13, 1707."

This letter was returned to Leibnitz with the following indorsement: "The Electoral Councillors have found serious obstacles in the way of granting the above petition, and, without giving their reasons, have directed me to inform you of their decision, and that in consequence the request is not granted by his Electoral Highness. H. REICHE.

"Hanover, July 25, 1707."

This failure of Papin's petition was the deathblow to his effort to establish steam navigation. A mob of boatmen, who thought they saw in the embryo ship the ruin of their business, attacked the vessel at night and utterly destroyed it. Papin narrowly escaped with his life, and fled to England, where he endured great hardships and poverty, and all traces of him were soon lost, so that it is uncertain in what country he finally died or where he was buried.

This remarkable man was driven out of France on account of his Protestant faith, and found a refuge in Germany; here he was again persecuted on account of the injury that ignorant and jealous people believed his inventions would inflict upon the industries of the country; and when the climax of steam engines for pumping water and propelling ships was reached, the enlightened government of the period "found serious obstacles" in the way of granting him protection, and, without condescending to state what those "objections" were, secretly instigated the mob to make an end of the trouble. It is another instance, unfortunately too often repeated in history, of the mischief men dressed up in a little brief authority can work upon their generation. If Papin had been permitted to navigate the Weser with his ship, and to carry it to London, as was his intention, it is possible that we should have had steamboats one hundred years earlier than they were given to us by Fulton. The plan proposed by Papin was highly impracticable; but a knowledge of what Savery had done in the way of steam machinery, aided by the shrewd suggestions of Leibnitz, combined with the practical assistance of Englishmen, would, no doubt, have enabled him to improve upon his invention until it had obtained sufficient credit to be secure

against the misfortune of being totally forgotten. After the lapse of 100 years from the date of Papin's invention, when the first steamboat was put upon the river Rhine, the vessel was fired into by concealed marksmen on shore, and navigation was more dangerous than it is now on the upper waters of the Missouri in times of Indian hostility. It was only after stationing troops along the banks of the river to protect the boatmen that the government, fortunately more enlightened than in the days of Leibnitz, was able to establish steam navigation on a secure footing.

I have thought it worth while to make this contribution to the history of steam navigation, particularly as I have been able to authenticate a portion of it by reference to original documents.

Columbia College, New York city, January, 1877.

The Speaking Telegraph.

We have heretofore given accounts of the wonderful success of Professor Bell in transmitting the vibrations of the human voice by electrical means over a telegraph wire. He has lately made improvements in his method of transmission, by which he dispenses with the use of the battery, and substitutes the magneto-electric plan of producing the current.

The Boston *Transcript* describes a recent experiment with the new apparatus, by which conversation and singing was successfully carried on between Boston and Malden, a distance of six miles. The telephone, in its present form, consists of a powerful compound permanent magnet, to the poles of which are attached ordinary telegraph coils of insulated wire. In front of the poles, surrounded by these coils of wire, is placed a diaphragm of iron. A mouthpiece to converge the sound upon this diaphragm substantially completes the arrangement. As is well known, the motion of steel or iron in front of the poles of a magnet creates a current of electricity in coils surrounding the poles of the magnet, and the duration of this current of electricity coincides with the duration of the motion of the steel or iron moved or vibrated in the proximity of the magnet. When the human voice causes the diaphragm to vibrate, electrical undulations are induced in the coils environing the magnets, precisely analogous to the undulations of the air produced by that voice. These coils are connected with the line wire, which may be of any length, provided the insulation be good. The undulations which are induced in these coils travel through the line wire, and, passing through the coils of an instrument of precisely similar construction at the distant station, are again resolved into air undulations by the diaphragm of this instrument.

The experiments were as follows: Telephones having been connected with the private telegraphic line of the Boston Rubber Shoe Company, conversation was at once commenced. Stationed at the Boston end of the wire, Professor Bell requested Mr. Watson, who was at the Malden end, to speak in loud tones, with a view of enabling the entire company at once to distinguish the sounds.

This was so successful that a smile of mingled pleasure and surprise played on the features of those present. That it, however, might not be supposed that loud speaking was essential to intelligibility, Mr. Bell explained that soft tones could be heard across the wires even more distinctly than loud utterances, even a whisper being audible. In confirmation of this statement, Mr. Watson commenced speaking in turn with each member of the company; and after the efficiency of this method had been proved to the satisfaction of all, he took up a newspaper and informed the assemblage that gold had closed the previous evening at New York at 105½. As there were quite a number of business men present, the effect that this practical demonstration of the value of the telephone produced can scarcely be exaggerated. Other passages from the daily journals were then given, and by this time the desire for conversation having become general, Mr. Watson was plying with questions such as: "Is it thawing or freezing at Malden? Who will be the next President?" etc. It was remarkable that Mr. Watson was able to distinguish between the voices at the Boston end, he calling at least one gentleman by name as soon as the latter commenced speaking.

This went on for some time, until a lady at the Malden end sent the company an invitation to lunch per telephone, and an appropriate response was made by the same medium. At length the Boston company were requested to remain quiet while a lady at the other end conveyed to them the sweet strains of music. The assemblage thereupon listened with rapt attention while a young lady commenced singing "The Last Rose of Summer." The effect was simply charming. The sound of the voice penetrated into the Boston end of the telephone with a distinctness equal to that attainable in the more distant parts of a large concert room, and a unanimous vote of thanks was sent by the handy little instrument which had procured for the assemblage so agreeable an hour.

The superb steam engine built by C. H. Brown & Co., of Fitchburg, Mass., which was illustrated and described on page 1 of our current volume, has been purchased by Messrs. Phineas Jones & Co., and is being erected in their extensive carriage wheel works at Newark, N. J.

Crossing a River on a Wire.

A reporter of the New York Sun wanted to realize the sensation of being suspended on a wire 275 feet from the surface of the earth. He applied to the engineer of the Brooklyn bridge for permission to cross the East river on a wire, three quarters of an inch in diameter, which hangs between the two towers. He was refused permission; but he finally saw the president of the company, who granted his request. Arriving at the appointed time, the engineer, Mr. Farrington, said: "Well, sir; whenever you're ready, I am."

"All ready, said I, as bold as brass outside, and as nervous as the Endorian witch on the inside. He walked on and I followed, when, Horror of Horrors—capital H's to both Horrors—instead of leading me to the 'cradle,' which I called a raft, he took me to a little square board held up by two crossed iron arms, called a 'buggy.' It was about three feet square, and depended from the 'traveler,' a three quarter inch wire which crosses the river, and is run from tower to tower over apparatus, by means of a stationary engine. It was too late to back out, but I didn't feel exactly prepared to plunge in. He did.

"He jumped in, and the little buggy swung from side to side, precisely as a swing does when you jump on the board and try to steady it by the ropes. I looked at him, at the scale—that's it; it's exactly like a pair of scales, with one scale—at the deep depths below us, and at myself. I imagined the ticklish thrill which would permeate my body when we started. I fancied the glories of the prospective perspective before me.

"Come, hurry up, please," interrupted Farrington, and with resignation I hurried down. He stood up. I crouched down. Perhaps you think you'd have stood up as he did. You're mistaken. I crouched down and held on tight. Make no mistake. I held on tight and waited for my thrill. It didn't come. Then I stood up, and Farrington gave the word 'Go.' 'Wouldn't you better take a rope along?' said one of the men. 'Yes, I think I would.' What did he want of a rope? He feared I would be nervous. He meant to grapple me in the middle of the river, and tie me in. I knew it. I felt it. But I didn't say a word.

"With a gentle jerk we started—slow, slow, very slow. Farrington stood in front and watched the wire. I stood behind and watched myself. I felt nothing. I wasn't exhilarated. I wasn't scared. I wasn't even timid. I can't look from the top of a house without desiring to jump off, but I looked down from the buggy and hadn't the least desire to jump. Farrington says: 'It's because it's so high up.' Well, we went on without any special sensation till the buggy struck against a stay rope which reaches from one of the cables to the tower. In the effort to free the buggy, Mr. Farrington gave a push which swung us out some little distance and back again, at which a little piece of indigestion seemed to be monarch of my interior, and for a moment I was on the verge of a sensation. Having passed the middle, the ascent was more labored. I waved my handkerchief to the people on the ferryboats. I looked out toward the sea. I looked up at the heavens. I even looked toward Harlem, but, like the buyer in the Bible, I said: 'It is naught, it is naught.'

"In about eight minutes we touched the New York side—all but ten feet. The red flag waved for the engine to stop. There we hung in mid-air 275 feet above the level, swinging to and fro like a drunken buggy, at an angle of forty degrees, and quite uneasy. The rope which was to haul us on was fastened to the iron—blest be the tie that binds—and with a few hearty pulls we were brought so near the New York tower that without difficulty we clambered up. I had made the trip, but I had not felt a feel. From the top of the New York tower I saw much, but the chief point of interest was the innumerable jets of steam which flourish in the air, and fantastically curl off into space.

"Again the steeples, the tower, and the long, narrow, dirty river filled the prospect, and the bright sun of a charming day lightened up the western sky. That was all, except to say 'thanks and good-bye,' and descend the stairs. There were 417 of them stairs, and before I reached the bottom I was dizzy, faint, seasick, and filled with a decoction of tickle, so that I had to shut my eyes and rest from my labors.

"Thus ends the trip which filled my anticipatory imagination as the waters fill the sea, but which resolved itself in realization to a simple, childlike faith in the fixtures on the wire, and in the skill and competence of the man who guided them.

MONSIEUR X."

Blue Glass Science.

There is nothing more reassuring in these days, when new "isms" of the scientists are slowly sapping the foundations of cherished beliefs, than to remember that, after all, the much vaunted dicta of Nature are yet opposable by the sound operations of honest common sense. See for example how one of our evening dailies, tossing the dogmas of so-called science contemptuously aside, evolves such profoundly original thoughts as these, to explain the lucid blue glass theory of General Pleasonton: "The blue glass presents an obstruction to the sun's rays which can only be penetrated by one of the seven primary rays—the blue ray; the remaining six rays, travelling with the velocity of 186,000 miles a second, falling upon the blue glass, are suddenly arrested; the impact evolves upon the surface of the glass friction, heat, electricity and magnetism; the heat expands the molecules of the glass, and a current of electricity and magnetism passes through it into the room; this current, falling upon animal

or vegetable life within, stimulates it to unusual vigor. Certainly the results achieved, and abundantly certified to, are marvellous, and sufficient to provoke further experiments and inquiry." Prior to these splendid original discoveries of our contemporary, we ignorantly believed that blue glass only partially sifted out the orange and yellow rays from the spectrum, and that with this exception, it acted merely as a screen to diminish the intensity of all the rays. We also supposed that there was a sharp distinction to be drawn between sunlight after passing through blue glass and the blue spectral ray: that in one case all the colored rays were more or less present, and that in the other but one was. But think of the utter dismay of such pretenders as Helmholtz, Tyndall, and Henry when they learn that the undulatory theory of light with which they have so long taxed our credulity is overthrown—that of the seven primary rays, six bounce off from blue glass and distribute themselves over the adjoining neighborhood. That the glass is heated by the impact; and as the sun persistently emits more rays, there are more impacts and more heat. The glass gets hotter and hotter; but—mark the scientific acumen here—just as we are wondering whether it will reach the melting point, the pores open. It is the Turkish bath of Nature. Electricity and magnetism, no longer shut out, rush in between the separate molecules. Hand in hand, these great curative powers seek a proper subject. They meet (we learn from a report, also in our contemporary, of Pleasonton's latest triumph) a pig or a young lady whose hair has come out—a heifer, a rooster, or a rheumatic child. Forthwith the pig fattens, hair equal to that produced by the finest tricothorus pervades the female scalp, and "unusual vigor" and general happiness prevail. Such is the boon which Pleasonton bestows on humanity, as elucidated by the original genius of our contemporary.

Infectious Disease Propagation.

In view of the alarming prevalence of scarlet fever in many parts of the country, the following hints by the *British Medical Journal* are wholesome warnings: "There are three common ways by means of which infectious diseases may be very widely spread. It is a very usual practice for parents to take children suffering from scarlet fever, measles, etc., to a public dispensary, in order to obtain advice and medicines. It is little less than crime to expose, in the streets of a town and in the crowded waiting room of a dispensary, children afflicted with such complaints. Again, persons who are recovering from infectious disorders borrow books out of the lending departments of public libraries; these books, on their reissue to fresh borrowers, are sources of very great danger. In all libraries, notices should be posted up informing borrowers that no books will be lent out to persons who are suffering from diseases of an infectious character; and that any person so suffering will be prosecuted if he borrow during the time of his illness. Lastly, disease is spread by tract distributors. It is the habit for such well meaning people to call at a house where a person is ill and to leave him a tract. In a week or so the tract is called for again, another left in its place, and the old one is left with another person. It needs not much imagination to know with what result to health such a practice will lead if the first person be in scarlet fever or smallpox."

Dr. Hutton offers "a warning on the reckless manner in which parents allow their healthy children to run into the houses of acquaintances who have members of their families suffering from scarlatina, etc., and states that he has seen the infection thus carried from the patient, and several families attacked."

Toughened Glass Making in Brooklyn.

A World reporter has lately visited the works in Brooklyn where the manufacture of the La Bastie toughened glass is now in active progress. The manufacturer states that, in June last, his factory was destroyed by fire, and the introduction of the glass into our markets has for that reason been delayed. Only one kind of goods, lamp chimneys, are now made, and the process is as follows: A workman, having in his hand a pole about eight feet long, with a knob on the end of the size of a lamp burner, fits a chimney on the knob and plunges it into the flame of a furnace. He withdraws it twice or thrice that it may not heat too quickly, turning the pole rapidly the while, and when the glass reaches a red heat quickly shoots it into one of a dozen small baths fixed on a revolving table, and seizes another chimney. A boy keeps the revolving table always in position, and as the chimneys come around to him, having been the proper time in the bath, he takes them out to be dried, sorted, cleaned, and packed. The bath has to be of just the right temperature, as, if it be too hot or too cold, the chimneys are liable to explode. In either case the process of annealing is imperfect. By working the tables at a certain rate, the baths are kept at the right temperature by the immersion of the red hot glass. Oil or tallow is used in the bath. Any greasy substance will do, though tallow has proved most satisfactory.

M. De la Chapelle, the manufacturer, states that he has already sold \$150,000 worth of the chimneys. The toughened chimneys are about 60 per cent dearer than those of ordinary glass. The factory is in Delavan street, Brooklyn, N. Y.

Alexander Bain, Electrician.

This ingenious man, whose inventions in connection with the electric telegraph entitle his name to be held in grateful remembrance, died in January last at the new Home for Incurables at Broomhill, Kirkintilloch, near Glasgow, Scot-

land, and on Saturday his remains were interred in the burying ground in the neighborhood of that town known as the Old Aisle Cemetery. Mr. Bain, who was about sixty-six years of age, was a native of Thurso. He was the inventor of the electro-chemical printing telegraph, the electro-magnetic clock, and of perforated paper for automatic transmission of messages, and was author of a number of books and pamphlets relating to these subjects. Sir William Thomson, in his address to the Mathematical Section of the British Association at its meeting in Glasgow last year, said: "In the United States Telegraphic Department of the Great Exhibition at Philadelphia, I saw Edison's automatic telegraph delivering 1,015 words in 57 seconds. This was done by the long neglected electro-chemical method of Bain, long ago condemned in England to the helot work of recording from a relay, and turned adrift as needlessly delicate for that." Mr. Bain was stricken by paralysis, and suffered from complete loss of power in the lower limbs. For some time he had received a pension from the government, obtained for him, we believe, through the instrumentality of Sir William Thomson. Mr. Bain was a widower, and has left a son and daughter, the former of whom is in America, and the latter at present on the Continent. Photographs of him by Mayall were recently presented to the Society of Telegraph Engineers and the American Society of Telegraphers at Philadelphia.—*The Engineer*.

Self-Reliance Necessary to Success.

Self-reliance, conjoined with promptitude in the execution of our undertakings, is indispensable to success. And yet multitudes live a life of vacillation and consequent failure, because they remain undetermined what to do, or, having decided that, have no confidence in themselves. Such persons need to be assured; but this assurance can be obtained in no other way than by their own successes in whatever they may attempt for themselves. If they lean upon others, they not only become dissatisfied with what they achieve, but the success of one achievement, in which they are entitled to but partial credit, is no guaranty to them that, unaided, they will not fail in their very next experiment.

For want of self-reliance and decision of character, thousands are submerged in their first essays to make the voyage of life. Disappointed and chagrined at this, they underestimate their own capacities, and thenceforward, relying on others, they take and keep a subordinate position, from which they rise, when they rise at all, with the utmost difficulty. When a young man attains his majority, it is better for him, as a general rule, to take some independent position of his own, even though the present remuneration be less than he would obtain in the service of others. When at work for himself, in a business which requires and demands foresight, economy, and industry, he will naturally develop the strong points of his character, and become self-reliant.

A glance at the business men of any community will show who have and who have not improved the opportunities of their earlier years. The former transact their business with ease, promptitude, and profit. They rely upon themselves, and execute what they have to do with energy and dispatch. But those who shirked everything in their youth are compelled to rely on their clerks and salesmen for advice, and are never ready to act when occasions of profit arise. Many parents commit a lamentable error in this respect. They lead their children to believe that they can do nothing without the constant assistance of their superiors, and after awhile the child becomes impressed with that idea. Fortunate will it be for him when he emerges from the parental roof, if he can at once acquire the self-reliance which has been kept down at home—otherwise he must necessarily fall in whatever independent enterprise he undertakes; and in such a case, while the misfortune is his own, the fault lies at the door of misjudging parents rather than at his own.

Something to Do.

It is an old trick of despots, and a good one, to employ their subjects. Why? To keep them out of mischief. Employed men are most contented. There is no conspiracy. Men do not sit down and coolly proceed to concoct iniquity so long as there is plenty of pleasant and profitable employment for body and mind. Work drives off discontent, provided there is compensation in proportion to the amount of labor performed. There must be a stimulant. God never intended a man should sweat without eating of the fruits of his labor—reaping a reward—more than he intended the idle man should revel in plenty and grow gouty on luxuries. Industry is a great peacemaker—a mind-your-own-business citizen. Something to do renders the despairing good-natured and hopeful—stops the cry of the hungry, and promotes all virtue. The best men are the most industrious; the most wealthy work the hardest. They always find something to do. Do you ever wonder that men of wealth do not "retire" and enjoy their substance? We know some young men look forward with anticipation to the time of "retiring." It is doubtful if a man should ever retire from business as long as he lives. We think we know men who, were they to abandon business, would be ruined, not pecuniarily, but mentally—their lives would be shortened. God never intended man's mind should become dormant. It is governed by fixed laws. Those laws are imperative in their exactions.

Something to do! "Oh, if I had something to do!" There are young men who sigh for it, yet one thing they can do—that is, seek for a job. Once found, provided it is an honest one, do not hesitate to perform it, even if it does not pay as well as you expected.

Moneyed Men.

The Cleveland *Herold* said, twenty years ago, during a stringency of the times, that moneyed men are the veriest cravens on earth: so timid, that on the least alarm they pull their heads, turtle-like, within their shells, and, snugly housed, hug their glittering treasure until all fear is removed. The consequence is that a few days' disturbance of the monetary atmosphere brings on a perfect dearth of not only the precious metals, but even of paper money, their representative. Moneyed men never adopt the tactics of mutual support; hence, as soon as a shot is fired into the flock, they scatter, each looking out for himself, each distrustful of the other, and each recognizing only the great law of selfishness, which is to take care of number one. Courage has saved many an army, even when ammunition was low; and many a foe has been scattered by one yell of defiance when there was not a cartridge left.

NEW BOOKS AND PUBLICATIONS.

ARCHAEOLOGY, OR THE SCIENCE OF GOVERNMENT. By S. V. Blakeslee. Price \$1.25. New York and San Francisco: A. Roman & Co.

This book is a very metaphysical treatise on theories of government and the duties of citizens to the law, each other, and themselves. Theoretical politics are little in favor with thinking men of this day; and the social difficulties of our age will have to be solved by practical wisdom founded on experience. The people that know that a certain course of legislation has destroyed an empire, and that a contrary policy has developed one, will care little as to whether or not "the will controls the feelings by mediate and indirect force." We are unable to find in this book any attempt to apply the finely worded theories stated to practical use and popular instruction in political science.

GRAPHICAL ANALYSIS OF ROOF TRUSSES, FOR THE USE OF ENGINEERS, ARCHITECTS, AND BUILDERS. By Charles E. Greene, A. M., Professor of Civil Engineering in the University of Michigan. Chicago, Ill.: George H. Frost.

The author of this work truly says that any designer who fairly tries the graphical method will be pleased with the simplicity and directness of the analysis, even for apparently complex forms. The hindrance to the general use of the method is the want of knowledge of the higher mathematics, which are largely used in most treatises on the subject. Professor Greene has avoided this stumbling block, and given us a treatise which may be understood and appreciated by any one of common school education. We therefore give his work a hearty commendation, and we hope that every carpenter and builder may be induced to analyze the stresses which affect the different parts of structures, which he can readily do by carefully reading this volume.

THE HUB: A Journal devoted to the Carriage Building Trades. Published monthly. Subscription price, \$3.00 a year. New York city: The Hub Publishing Company, 333 Pearl street.

This journal is widely known for its accurate and extended information as to carriage building, trimming, lining, painting, etc.; and since its first issue it has maintained its reputation, and given the public an immense amount of instruction in a spirited and practical manner. The illustrations and typography are excellent, and every number shows how extended an area it serves as an authority on the important industry to which it is devoted.

ASSIGNATS AND MANDATS: the Money and the Finances of the French Revolution of 1789. By Stephen D. Dillaye. Price, free by mail, 30 cents. Philadelphia, Pa.: Henry Carey Baird & Co., 810 Walnut street.

Mr. Dillaye differs with the Hon. A. D. White, President of Cornell University, as to the relative merits of money and promises to pay money; and he begins with the assertion that the President's "object is to depreciate American credit, stability, and honor." Further personal, to ascertain the meaning of this attack on a patriotic and useful member of society, shows us what Mr. Dillaye thinks he means. He talks of credit being the vital element of national power; and from this he argues that the more "credit" a nation has—that is, the deeper it is in debt—the more powerful it becomes. In short, he confuses credit as opposed to discredit with credit as opposed to cash—a grievous blunder, surely. A nation's credit is like a merchant's; it becomes greater only as his debts become smaller; and people trust a government for the same reason as they trust an individual, mainly because every previous obligation has been honorably observed. It is gratifying to know that persons of Mr. Dillaye's way of thinking are few and unimportant, and their number is diminishing daily.

CROTON WATER SUPPLY FOR THE CITY OF NEW YORK: an Address by George B. Butler to the New York Municipal Society. New York city: Published by Order of the Society, 87 Madison avenue.

A review of the whole subject of our water supply, its sources and the area they drain, the geographical features of the district, and the works erected by the city. Mr. Butler maintains that the Croton valley, with proper storage reservoirs, can abundantly supply the whole city; and that no new aqueduct need be constructed in the present condition of the public debt.

EINE KURZE ALLGEMEINE EINLEITUNG ZU DEN AROMATISCHEN NITROVERBINDUNGEN. Von Peter Townsend Austen. Leipzig, Germany: Winter, Publisher.

We are glad to see that an American is able to publish a very useful chemical treatise in Germany, the great head center of chemistry. Dr. Austen, one of our most distinguished young chemists in the field of original research, has produced a work which bears the marks of much patient thought and study. The book is dedicated to the renowned German chemist, Professor A. W. Hofmann.

OUR YOUNG FOLKS' MAGAZINE: a Monthly Journal of Instruction and Amusement. Subscription price, \$1.60 a year. Boston, Mass.: Post Office Box 3090.

A readable little periodical, well calculated to amuse the little ones for whom it is intended.

GLASS FOR THE STUDIO AND DARK ROOM. By Thomas Gaffield. Philadelphia, Pa.: Benckman & Wilson.

There is much useful information in this little pamphlet, and photographers especially should read it. The matter first appeared in the *Philadelphia Photographer*.

Recent American and Foreign Patents.

NEW AGRICULTURAL INVENTIONS.

IMPROVED GANG PLOW.

Ezra Peak, Montana, Kan.—This invention is so constructed that it may be easily raised from and lowered to the ground, and adjusted to work at any desired depth in the ground. It is claimed to be of lighter draft than plows constructed in the usual way, also to be simple in construction and inexpensive in manufacture. The wheels, the faces of which are notched to give them a slight up-and-down movement as they are drawn forward, slightly jar the plows, and thus cause them to be easier drawn than when smooth wheels are used. The shaft can be provided with a ratchet wheel and pawl to hold it in any position into which it may be turned; and to it is attached a rope or chain, the other end of which is attached to the forward end of the frame, so that by turning the shaft the plows may be raised from, lowered to, and adjusted to work at any desired depth in the ground.

IMPROVED PLOW.

James Willis Hendley, Cedar Hill, N. C., assignor to David N. Bennett and Samuel T. Wright, of same place.—The objects here are simplicity and cheapness of construction, and such arrangement of parts as will prevent the plow becoming clogged with weeds, etc. The mold-board is welded to the land side, or cast in one piece with it, so that no brace or other connection is required between the mold-board and standard; secondly, the curved beam is attached to the heel of the land-side and supported by a brace, which is bolted to the middle portion of the latter, and arranged in such relation to the mold-board that a space is left between them, into which the trash will fall, and thus be drawn into the furrow and covered.

IMPROVED GRAIN DRILL.

George W. Osborn, Parkville, Mich.—This is an improved attachment for seed drills, for gaging the depth at which the grain shall be deposited in the earth. It consists in an adjustable spring gage bar attached to the shank of each drill tooth, whereby the teeth may be made to enter the ground a greater or less depth. It is claimed to ensure the planting of seeds at equal depth in hard or soft ground, and to diminish the draft.

IMPROVED HORSE HAY RAKE.

Joseph B. Wakeman and John L. Wager, Deposit, N. Y.—The construction of this implement is such that a large space is afforded beneath the rake head for the collection of hay. The pivots of said rake head back are also brought back, so that the teeth may be readily raised to discharge the collected hay. By an ingenious lever arrangement the driver is enabled to hold the rake to its work by the pressure of his foot, and also readily to discharge the hay gathered.

IMPROVED BEE HIVE.

George W. Atkins, Bridgeton, Pa.—In this hive, holes are bored in the sides of the compartment for ventilation, and windows are flared for the purpose of inspecting the inside of the hive. A frame is used whenever it is desired to have the honeycomb of any particular shape. It consists of a form of tin or other suitable material, placed on a frame or slide, and having the shape required in the comb. Bees will build inside of the form, leaving about one fourth inch space between the form and the comb. The tin sheet receives a portion of the refuse matter, and can be readily taken out and cleaned. On the 1st of May the bees are driven out into another hive and the frames examined. Three frames are taken out and set in a new box, and three empty frames are put in their place. The old queen must be put with the new colony, and half of the bees must be put in each box and shut up, and put on a stand. The hives are to be opened the next morning. At the next natural swarming time the swarms can be again divided. The hive cannot freeze, and it is proof against mice.

IMPROVED PLOW STOCK.

Robert Weber, New Ulm, Texas.—In this invention, by loosening a nut, the point of draft attachment may be raised and lowered to cause the plow to work deeper or shallower in the ground, or turned to one or the other side, to cause the plow to take or leave land, and may be secured in place when adjusted by again tightening the nut.

IMPROVED COMBINED HAY TEDDER AND SIDE RAKE.

John Huber and Henry Snell, Girard, Ill.—This machine may be used simply for stirring up and turning the hay, or for turning the hay and gathering it into windrows. The shaft of a reel revolves in bearings attached to the side bars of the frame near their rear ends. To the bars of the reel are attached spring teeth, which, as the machine is drawn forward, take hold of the hay, carry it up and over the reel, and drop it to the ground in the rear of the machine. A carrier takes the hay from the teeth, when it has been brought to the top of the reel, carries it over the shaft, and discharges it into a trough, down which it slides, and is deposited in a windrow along one side of the path of the machine.

IMPROVED GRUBBING MACHINE.

Ira Burley, Redwing, Minn.—This invention consists in the combination of wheels and axle, tongue, adjusting bar, adjustable brace, uprights, cross bar, two ropes, and four pulley blocks with each other. To the forward end of the tongue is attached a loop or clevis, to receive an iron pin, to be driven into the ground to keep the machine from moving about while being used. To the pulley block is swiveled a hook, to be hooked into a loop, attached to the forward end of a lever. The rear end of the lever passes through a slot in the upper end of a fulcrum post, and has a notch formed in its lower side to receive a bolt or pin, attached to said post to serve as a fulcrum to said lever. Several notches are formed in the lever to receive the fulcrum bolt, to enable the position of the fulcrum post to be adjusted to regulate the leverage, and as circumstances may require. To the lever is attached a strong clevis, to receive the hook of the chain, that is secured to the stump to be pulled.

IMPROVED SEED PLANTER.

Daniel J. Davis, Red Bolling Springs, Tenn.—In this invention two wheels revolve upon the journals of the axle. Upon the end parts of the axle are attached the rear ends of side bars, the forward ends of which are bolted to the outer sides of the forward ends of the plow beams. The forward ends of the beams are bolted to the ends of the front bar, to the center of which is secured the forward end of the central bar. To the beams are attached the plows for opening furrows to receive the seed as it passes from the conductor spouts. The lower ends of the spouts or tubes pass in through the sides of the plows, so as to conduct the seed into the bottom of the furrows before they have been partially filled by the falling in of the soil. The dropping plate is concaved around its dropping holes, and is provided with a plate that may be adjusted to cover one set of dropping holes to drop the hills twice as far apart as when both sets of holes operate.

IMPROVED ANIMAL TRAP.

Thomas N. Hughes, Muddy Creek, Tenn.—This trap is for animals of all kinds, as rats, mice, and larger animals, as foxes, minks, coons, etc., that are allured by bait, and is automatically set again by the animal caught, to be ready for the next animal attracted by the bait. It is divided by a longitudinal partition into two main sections, in which the working parts are disposed. The entrance at the end of one section has a drop door, which is arranged back of the same, resting, when closed, on side strips in inclined position, and being supported on an upright arm, of a centrally pivoted treadle door, at the bottom of the trap, when the trap is set. The treadle door is only required to swing sufficiently on its pivots to release the drop door from the arm, suitable seats at the under side of the trap, at both sides of the treadle door, preventing the door from swinging farther than necessary. The bait is placed in a grated receptacle, near the treadle door, and entices the animal to pass in, so as to close the drop door when it arrives at the part of the treadle door near the bait. The back end of this section is perforated or grated to admit light, which attracts the frightened animal and induces him to pass toward the light. The top part of the trap may be grated to admit air, and the glass door at the end, made to slide, to admit the taking out of the animals for killing them.

NEW MISCELLANEOUS INVENTIONS.

APPARATUS FOR THE HYDRATION OF CHLORINE GAS.

William Maynard, New York city.—This invention relates to an improved construction of apparatus for the hydration of gases, and more particularly chlorine gas for the manufacture of chlorine water for use in the industrial arts of bleaching, etc. It consists mainly in a case having an inlet for the water above, an inlet for the gas below, and provided with an intermediate water percolating medium; combined with a reservoir located below the level of the case and having a water-sealed communication there-

with, which reservoir receives the hydrated gases, and which water seal prevents the heavy gas in the case from passing out through the bottom inlet. The case for the percolation of water and the absorption of the gas is made of conical shape, with the largest diameter at the bottom, to produce the greatest absorption of the heavy gas when first admitted; while horizontal partitions, or shelves, in said case are provided with upwardly projecting tubes which hold a permanent surface of water on the said partition or shelves. The tubes permit, by their peculiar shape, the water to pass down on one side and the gas up on the opposite side of said tube, while their alternating arrangement in the alternating shelves gives a zigzag and long continued passage to the gas and water in moving in opposite directions through the case.

IMPROVED PROCESS OF PREPARING GAS FUEL.

Martin N. Diall, Terre Haute, Ind.—This inventor saturates wood by immersing it in any hydrocarbon oil for from six to twelve hours, as required by the nature of the wood, so that it may take up the necessary quantity of oil for the required strength of gas. The wood is then immersed in a bath of water, for taking up a quantity of water outside the oil, and is then charged in the retorts, the same as coal, and distilled in the same way. By this process the inventor claims that he produces fixed gas equal to coal gas, much faster, and with less expense, the wood and water furnishing the hydrogen, and the oil furnishing the carbon.

IMPROVED FISHING LINE LEADER.

Welmer T. Jahne and Anthony Moore, Jersey City, N. J.—This consists of a leader made of spring wire, bent into V form, provided with a swivel and eye at its middle part, and with eyes or loops at its ends to receive the line and snells. By this construction the snells and hooks will be kept apart however the line may be thrown, and however they and the leader may be turned about by the tide or current. The device is one well calculated to meet with a favorable reception from fishermen.

IMPROVED ABDOMINAL CORSET.

Christina Lascell, Newark, N. J.—The object of this invention is to furnish an improved abdominal corset, which supports the weight of the abdomen in a perfectly comfortable and easy manner, and throws the strain on the shoulders and hips of the wearer. The corset is adjustable to the varying conditions of the abdomen, does not interfere with the motion and different positions of the body, and is readily put on and taken off. It has adjustable elastic shoulder straps, and opening at the sides by lacing and elastic bands and buttons. The front part of the corset is stiffened by a stay that slides in a pocket to provide for stooping. A central front and lacing admit the front part of the corset to expand. The lower extension part of the corset has short stiffening stays, and it is connected independently of the upper stays by short side lacing and elastic straps to the side or hip parts of the corset. A hernial band extends from the lowermost part of the corset-extension between the legs to the rear, and is attached by adjustable hip straps to the sides of the corset.

IMPROVED FIRE ESCAPE.

John F. Werner, New York city.—The terrible disaster in the Brooklyn theater is serving as a stimulus to induce the invention of devices looking to the prevention of a like occurrence. The present inventor has devised a new fire escape for theaters, concert halls, and other public places of amusement, by which the space at the upper parts of the entrances, halls, or vestibules of the buildings is utilized for the purpose of forming additional passage ways for the persons in the buildings, to be used in case of fire for the more convenient and less dangerous exit of the same. The invention consists, mainly, of a movable floor, suspended by chains, pulleys, and weights, near the ceiling of the entrances, and lowered in case of fire. It is supported on projecting rests of the side walls, at suitable height above the floor. Sliding extensions and swinging stairs and rear sections connect with the ground outside of the door, and with the staircases of the gallery, so as to form separate exits above the regular entrances.

IMPROVED ELECTRO-MAGNETIC DENTAL PLUGGER.

James E. Dexter, New York city.—This invention consists, first, in a magnet having a centrally bored iron core, surrounded by a magnetic coil, which is enveloped by an iron shell that is concentric with the central core, and is attached to a flange formed on the lower end of the said central core. One side of both shell and core are split for the purpose of obviating residual magnetism. The invention also consists in combining a spring yoke, a vibrator, and a spring contact piece, as hereinafter particularly described. The third part of this invention consists in the arrangement of the key for completing the circuit, which is made with an insulating exterior, and is provided with one of the terminals of the magnet coil, and bears against the side of the key to insure a constant contact of the surfaces. The various parts of the plugger are combined, so that pressing the key with the finger makes the circuit, and a succession of regular strokes is produced, the force of which may be varied by an adjusting screw.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED COTTON GIN.

Joseph W. Thorn, Inka, Miss., assignor to himself and M. W. Beardsley, of same place.—In this machine there is a new construction of the brush drum for simplifying the same, and facilitating the application of the brush wings, so that they can be readily taken off and put on; also, an arrangement of the ribs between the saws for facilitating the separating of the seed from the cotton without breaking and injuring the fiber. There are also ingenious devices for preventing the seed from gathering and clogging at the ends of the saw drum.

IMPROVED SAFETY CHECK FOR ELEVATORS.

Nathan H. Fogg, Boston, Mass.—When the car is suspended normally from the rope, the rubber balls, arranged in sockets near the lower part of the car, are supported on their seats in a state of rest; but the instant that the rope breaks or gets detached from the bolt the action of a spiral spring throws an actuating plate downward, and levers and ball-carrying rods upward. The balls are thus thrown off their seats and wedged between the inclined sides of the pockets and the guide posts of the elevator so as to stop thereby the car.

IMPROVED COMBINATION LOCK.

Achille Parise, Naples, Italy.—This is a new combination lock for doors, trunks, safes, etc., that admits of a large number of combinations, and may be opened and closed quickly. It consists of sliding tumbler plates, having longitudinal slots and a number of perforations placed at different relative positions to the slots of each tumbler. The trunks are connected by screw set pins attached to face slides, and passing through any one of the perforations, admitting the setting of the tumblers and opening of the lock by outer projections or buttons of the slides to fixed exterior guides.

IMPROVED MACHINE FOR WIRING AND BINDING HATS.

Mari A. Cumling and Judson Knight, New York city.—This is a machine for binding hats, felt skirts, and similar articles, by a uniform and parallel pressure on the rims, and by facilitating the applying and taking off of the articles from the machine, and accomplishing the cutting of the binding or braid and wire in a reliable and improved manner. Pressure rollers attach the binding and the wire, if one is required, in connection with a grooved gage that is supported on a seat of the shaft of the lower pressure roller. The wire is guided by annular recesses or chamferings at the rear circumference of the pressure rollers and the groove of the gage. The gage is so connected to its seat that it may be turned and another guide groove of the same be exposed to face the pressure rollers, so as to adapt the same for a variety of work.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion. If the Notice exceeds four lines, One Dollar and a Half per line will be charged.

Manuf. of Scissors address J. W. D. E., Harmony Grove, Ga.

For Sale—36 in. Lathe, \$4.00; 72 in. Lathe, \$4.50; 10 in. Pratt Whiting Shaper, \$2.75; 35 H. P. Loco. Boiler, \$300; 12 in. Lathe, \$35; at Shearman's, 131 N. 3d St., Phila.

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For Sale—Baldwin No. 4 Foot Lathe and fittings; in perfect order. Address P. O. Box 196, Clinton, Mich.

National Steam Pump—Simple, durable, economical. Reduced price. National Iron Works, N. Brunswick, N. J.

Manuf. and dealers in Cotton Gins, Grist Mills, and Rice Hullers and Polishers, address with terms, Y. L. Ridley, Liberty, Texas.

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Mill Stone Dressing Diamonds. Simple, effective, and durable. J. Dickinson, 64 Nassau St., N. Y.

Will purchase or introduce, on a reasonable royalty, some good, useful article. Address, with description and full particulars, A. E. Lowison, Boston, Mass.

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Set of Mechanical Curves, as illustrated in Sci. Am. Supplement, No. 50, mailed on receipt of \$5.25, by Keuffel & Esser, New York.

Hyatt & Co.'s Varnishes and Japans, as to price, color, purity, and durability, are cheap by comparison than any others extant. 246 Grand st., N. Y. Factory, Newark, N. J. Send for circular and descriptive price list.

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F. C. Beach & Co., makers of the Tom Thumb Telegraph and other electrical machines, have removed to 530 Water St., N. Y.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N. Y.

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Walrus Leather and supplies for polishing Iron, Steel, and Brass. Greene, Tweed & Co., 18 Park Place, N. Y.

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M. Shaw, Manufacturer of Insulated Wire for galvanic and telegraph purposes, &c., 250 W. 27th St., N. Y.

Shingle, Heading, and Stave Machine. See advertisement of Trevor & Co., Lockport, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Articles in Light Metal Work, Fine Castings in Brass, Malleable Iron, &c., Japanning, Tinning, Galvanizing. Welles Specialty Works, Chicago, Ill.

See Bout's Paneling, Moulding, and Dovetailing Machine at Centennial, B. 5-35. Send for pamphlet and sample of work. B. C. Mach'y Co., Battle Creek, Mich.

Wanted—Novel and practical invention, by a reliable house, for manufacturing. Address Post Office, Box 25, Chillicothe, Ohio.

Chester Steel Castings Co. make castings twice as strong as malleable iron castings, at about the same price. See their advertisement on page 125.

Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., U. S. A.



Notes & Queries.
S. J. S. will find good recipes for laundry soaps on pp. 331, 379, vol. 31. For toilet soaps, see p. 289, vol. 28.—R. F. T. will find directions for putting a black finish on brass on p. 362, vol. 25.—J. C. S. will find directions for coloring a meerschaum pipe on p. 90, vol. 35.—A. B. will find a good recipe for Babbitt metal on p. 122, vol. 28.—G. A. D. will find directions for coloring butter with annatto on p. 187, vol. 31.—L. O. J. will find something on iceboats sailing faster than the wind on p. 107, vol. 36.—J. M. L. will find directions for clarifying cotton seed oil on p. 91, vol. 36.—D. V. will find a good recipe for shoe polish on p. 107, vol. 36.—A. B. will find directions for japanning on metal on p. 498, vol. 30.—T. S. D. will find recipes for all kinds of colored fires on p. 233, vol. 34.—G. S. C. can fasten his paper labels to wood with flour paste.—W. R. B. will find directions for dyeing billiard balls on p. 98, vol. 34.—G. W. M. will find directions for making raisins on p. 59, vol. 34.—T. F. T. will find something on burning petroleum in steam boilers on p. 165, vol. 30.—S. B. U. will find some illustrations of lathes for turning spokes, tool handles, etc., on p. 98, vol. 36.—W. E. P. will find a formula for safety valves on p. 393, vol. 32.—A. O. will find directions for removing mildew on p. 138, vol.

27. For mending rubber boots, etc., see p. 203, vol. 30.—W. C. L. will find directions for preserving eggs on p. 306, vol. 34.—H. M. G. will find a recipe for root beer on p. 138, vol. 31.—W. F. H.'s plan for a refrigerator might answer. See p. 251, vol. 31.—J. C. can remove the wool from pelts by steeping the skins in water, and hanging them up till the wool putrifies. Then scrape with a blunt knife. For cleansing wool, see p. 6, vol. 32.—W. H. J. will find a recipe for a cement for marble on p. 344, vol. 32.—T. B. can glid his steel scabbard by following the directions given on p. 105, vol. 34.—A. H. B., J. A. C., W. H. H., J. F. P., D. S., J. N. H., J. P., F. F., M. N., M. C., R. C., K. S. W., T. J., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) R. H. C. says: We have a slate roof which leaks very much. I have not discovered any defect in the way in which it was put on; it appears to be perfect. The pitch may be too low, and the rain may be driven through by the wind on this account. Is there any wash, paint, or cement that might be used for the purpose of remedying this defect? A. There is an india rubber paint which is used to make leaky roofs tight, but we have not learned of its being applied to slate roofs.

(2) C. C. B. says: I am making a small steam engine. The cylinder has, inside diameter, about 1 inch with 2½ inches stroke. What would be the most suitable material and dimensions for the boiler? A. Make one 10 or 12 inches in diameter and 18 inches high, of ½ inch iron. You can carry 60 lbs. steam pressure.

(3) M. C. says: I have had charge of some greenhouses that were erected about four years ago; they are thoroughly heated, and all the pipes have a thick coat of black paint. The houses never gave any satisfaction, no matter how healthy the plants were in the fall. Soon after the fires were lighted both leaves and flowers began to drop, and some plants died. My predecessors attributed it to gas getting into the houses. Upon inquiry I found no gas was there except when the pipes were hot, and that the hotter they were the worse it was. In my opinion, the cause of the trouble was a strong smell of paint from the pipes. Since then I only keep heat enough to save the plants from freezing. A. From your statement there is no doubt that the paint used on the pipes was an imperfectly purified coal tar. Such tar contains a great number of hydrocarbons—naphthalene, anthracene, phenol, several organic alkalis, hydrosulphuric and hydrocyanic acids, etc., all of which are more or less volatile at the temperature to which they must have been subjected. These exhalations have proved fatal to plant life when in sufficient quantity. We do not know of a better remedy than that of removing the cause. Painting the pipes with a strong solution of washing soda and lime would, in a measure, prevent the escape of the most objectionable constituents into the air, by forming with them compounds non-volatile at any temperature to which they are likely to be subjected in contact with the pipes; but the former would be the surest plan.

(4) C. D. W. asks: The roof of the new Illinois State House, as well as the stylobate cornices and upper portion of the dome, are covered with zinc. It has been on about three years, and I am told is materially affected by oxidation. The theory is that zinc, though subject to oxidation, has the peculiarity that the oxide does not scale off as from iron, but forms a permanent coating impervious to the action of the atmosphere. Some mechanics, however, assert that neither zinc, copper, nor lead will withstand the action of our atmosphere, as bituminous coal strongly impregnated with sulphur is almost the only fuel used. It is claimed by some that the sulphurous acid in the atmosphere tends to corrode zinc so as to make it worthless for roofs or gutter linings. A. Are you sure that the roof and gutters in question are not of galvanized iron, iron coated with zinc? This is the material most commonly used for that purpose at the present time. Zinc has been found to be too brittle for the strain to which it is subjected, in such cases, by the expansion and contraction induced by changes of temperature. A slight oxidation will adhere to the surface, but an acid deposit from the atmosphere will penetrate the coating in points and deteriorate the metal.

(5) N. J. S. says: I have a floor of ash and black walnut which has been oiled with raw linseed oil once. How can I finish it so as to get a hard, smooth finish that will not be scratched by boot heels nor be sticky or retain the dirt as a waxed floor does? A. Oil raises the fiber of black walnut and gives it a rougher surface than when free from it. To polish any wood, it is only necessary to fill the pores well, and then rub it down to a smooth surface. Thus painters prefer to put on a coat of shellac varnish first, before oiling walnut and other hard woods. For fine floors, a thin coat of liquid wax is applied as a finish.

(6) A. J. S. asks: What is the best plan for putting up a cheap dry house of lumber, for drying (by steam) white oak, hickory, and other lumber used in wagon and buggy making? A. Make as tight a house as possible with tongued and grooved siding-boards, floors, roof, etc., and provide a stack of steam pipe containing 1 foot of heating surface to every 50 cubic feet of air contained in the building. Set the steam pipe in compact shape and enclose it with a casing of galvanized sheet iron open at the top; supply cold air from outside of the building by a boxed conduit to the bottom of this stack. The air when heated will rise and diffuse itself into the room, and as it cools will fall to the floor; provide registers in the floor, through which it may escape into other boxed tubes under the floor leading to an upright chimney discharging above the roof. Let a smoke pipe from the boiler enter the chimney and extend up inside the fine far enough to heat the same. The change of air is necessary to dry the lumber. The size of the house of course will depend upon the quantity of material required to be stacked up into it at any one time.

(7) G. asks: 1. How do you calculate the amount of pipe of a given size to warm a room of a given size? A. One square foot of plate or pipe surface is generally taken as sufficient to heat about 70 cubic feet of air in dwellings. 2. What allowance should be

made for doors and windows? A. The said foot of surface will heat, in accordance with varying conditions, from 40 to 100 cubic feet of air, and allowance should be made for extra exposures, to correspond with that scale. A steam pressure of 5 lbs. is sufficient for heating purposes. 3. What is meant by the terms direct and indirect radiation, in giving capacity of steam generators for heating houses? A. Direct radiation is used when the pipes are located in the room, and indirect when they are located in a chamber in the cellar, to warm air which is conducted to the room by air pipes.

(8) D. M. says: After reading L. S. W.'s reply to J. B. C., p. 75 (6), vol. 36, I think the following demonstration will be more acceptable to J. B. C.: Imagine three spheres of which the given circles are great circles, and a plane tangent to the three spheres. Any two of the spheres may be conceived to have been generated by the revolution of two of the circles about the line joining their centers. During such revolution, the lines tangent to the two circles describe a conical surface. We have, therefore, three spheres and three conical surfaces. Now the plane, which is tangent to the three spheres, is also evidently tangent to the three conical surfaces; and therefore the vertices of those conical surfaces are all in the tangent plane. Now those vertices are the points (1), (2), (3). But the same points are also in the plane passing through the centers of the three spheres, which is the same with the plane of the paper on which the figure is drawn. Those points, being in two planes at the same time, must therefore be in the intersection of those planes, that is to say, in a straight line.

(9) C. W. H. asks: Can dyeing or coloring be done in cold water? A. Many of the coal tar colors may be used in this way: For animal fibers—wool, silk, etc.—the affinity of these colors is so great that, in most instances, no mordants are necessary. The baths are usually made slightly acid. With vegetable fibers, however, a fast dye is not assured without mordanting. Some of the finer goods are prepared by treating with steam coagulated albumen (animalizing), gelatin, various tannates, tin salt, alum, and other metallic salts. The following is the usual method of treatment, except with goods intended for very light shades: Pass the goods through a strong decoction of sumac or other tannin solution for an hour, and afterwards for an hour or two through a weak solution of stannate of soda; wring out, dip into a dilute solution of sulphuric acid, and rinse well in water. The goods are then ready to be passed through the color bath, slightly acidulated. For different tints, these baths are worked at different temperatures.

(10) F. W. says: I wish to lay the face tier of a brick wall in black mortar. How can I make the coloring material and mix it? A. Some prefer to use red mortar and afterwards pencil the joints with black. Color the ordinary white mortar with Spanish brown for red mortar, and with ivory black for black, by mixing in enough of the color in a powdered state to give a good deep tone.

(11) H. A. S. asks: 1. How many prisms are required in a spectroscope to detect mineral elements in presence of all the ash ingredients of organic bodies? A. If we understand you, one 60° prism will answer. 2. What is the best and cheapest form of apparatus to heat such compounds for examination? A. Mix the substance with a little pure hydrochloric acid and glycerin, and introduce into the flame on a coil of platinum wire. 1. Has soap prepared by dissolving meat bones in a Papin's digester ever been known to produce ossification of any of the soft tissues? A. We have never heard of such a result. 2. Has it ever been known to produce a new crop of teeth in toothless persons? A. We have no data as to such a fact.

I have seen a statement that May 19, 1780, was so dark a day that candles were necessary everywhere; and I have heard that another occurred about the year 1830. Has any scientific explanation ever been given of this phenomenon? A. The darkness on the days you mention were the result of solar eclipses. They occurred on days of unusual cloudiness. Perhaps the darkest day in modern history was that caused by the total solar eclipse in the year 1866.

(12) A. B. says: 1. I have built a boat 15 feet long and 4 feet 6 inches wide. How large a boiler and engine do I require to work her to best advantage? She is 22 inches deep from top of rail to top of keel. A. Cylinder, 2½ x 3 inches; boiler, 30 inches in diameter and 3 feet high. Propeller, 18 to 20 inches in diameter, and of 3 feet pitch. 2. How fast ought she to run? A. Probable speed, 5 miles an hour in smooth water.

(13) L. L. asks: 1. Does it make any difference in what position a watch is in when running? A. For watches adjusted to temperature and position, it does not make much difference. 2. When not being carried, what position should it be left in? A. In the case of ordinary watches, we imagine that the wear will be rather more uniform when they are in a vertical position. 3. If a person sleeps in a cold room, would a watch be better under his pillow than on a table or hung up in the same room? A. It is best not to subject them to great changes of temperature.

(14) W. G. says, in reply to C. W. W., who has an engine, of 2½ inches bore and 4 inches stroke, which runs slower with increase of pressure: Having had much experience with small engines and boilers, I will state that I have had the same difficulty when using an upright tubular boiler, and discovered the following to be the cause: The upper portions of the tube superheat the steam to such a degree as to prevent lubrication on the valve and piston surfaces by condensation, and thereby reduce the speed of engine. Even with increased pressure, this effect will be more appreciable when the area and travel of slide valve are in excess.

(15) J. M. T. asks: Is there friction between two bodies while at rest, or only when one or both are in motion? A. Both when at rest and in motion. Why does a balloon rise in the air? A. See p. 64, vol. 32.

(16) S. J. S. asks: 1. How are augers twisted? A. By special machinery. 2. How are twist drills made, and are they single or double fluted? A. They are double fluted or double twisted, and are cut out in a milling machine.

Can weights, springs, or water from a tank be used to any advantage to run a lathe? A. No.

How much do iron and brass, in rods or bands, expand in length when heated to red heat? A. Iron about ½ inch per foot, brass ⅓ inch.

Is the pressure of the air to be added to the weight of water in the bottom of a vessel in estimating the pressure on the bottom? A. No.

Does a watch or clock run faster when just wound up? A. No.

Is it not moisture in the air that makes it heavier, and so affects the barometer? A. Yes.

Is the pressure in a siphon equal throughout, or is it greater in the upper end? A. Equal throughout.

Will it take more power to run two millstones in opposite directions than it will to run one at the same speed, the other being stationary? A. Yes, it will take double the power.

1. How are common screws made? A. In lathes, with tools and dies. 2. How can I make wooden screws perfectly smooth? A. By using keen tools.

What is the simplest way of cutting a square hole in a bar of iron? A. Drill a round hole and square it out.

(17) G. E. C. asks: Could I have a brick range 2 x 3 feet, built on a platform about 1 foot from floor, with two compartments, to be heated with petroleum, the lower one to be used as an oven, the upper one to have a stove top to set cooking utensils on, and have a ventilating pipe run from each compartment of the oil receptacles into the place in the chimney where the stove pipe usually goes, to carry away any gas or smoke? I want the oil receptacles to be arranged to be drawn out, to be filled and trimmed, and I would like four burners to heat an oven 22 inches square, as hot as the same oven could be heated with wood. A. We doubt the propriety or the economy of substituting oil for wood, but something may be done to make the atmosphere of kitchens more endurable in summer, and permanently so in warm climates. A double faced range could be made and set in the center of the thickness of the chimney, with the space above the top of it open to the exterior of the house; a very slight structure, simply having a good floor and roof and open around the sides, and built against the chimney as an extension to the house, would answer for a summer kitchen, while the ordinary kitchen inside the house could be used in winter. The transposition could be made by a pair of iron sliding doors shutting off the kitchen not in use; and these doors could be transferred from one side of the chimney to the other when the change of season required it.

(18) A. X. A. says: In your issue of December 2 is a recipe in which "insoluble acid chromate of lime," and gelatin are to be used; and in a succeeding number of your paper the modes of preparing the insoluble acid are given. I have made the acid according to your directions, but the result of my manipulation of the recipe is a failure. You say: "Take of insoluble acid chromate of lime one part, and of gelatin five parts; but you do not say what further is to be done. Will the acid dissolve the gelatin, or must warm water be added? In my experiment the acid would not dissolve the gelatin, and I had to add considerable warm water before it would do so. A. Dissolve the bichromate of lime in the smallest possible quantity of warm water, and filter; then add the gelatin, previously softened by immersion in cold water. Heat the mixture over a water bath until the gelatin is completely dissolved, stir well, and use while hot. The recipe should have stated that this cement was best suited for glassware. The bichromate of potash or of ammonia will answer nearly as well as the lime salt.

(19) E. C. N. asks: How must a stove be constructed to burn pea coal, for heating outbuildings? Is there any way of constructing a draught below the grate of any common heating stove, sufficiently strong to do without an extra long chimney? A. Use a broad grate to spread the coal out well, so as to avoid the necessity of heaping it up much; make the opening for the draft some distance below the grate, and regulate by the usual slide dampers in the lower and upper doors.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the result stated:

F. R. R. S.—The substance you send is carbonate of iron. It is held in solution in the water by the large excess of carbonic acid which the water contains. On boiling the water the carbonic acid gas is expelled and the iron salt is precipitated from solution. The removal of this and some other objectionable salts which the water very probably contains, may be removed by the addition of the proper quantity of clear lime water to it—the lime in this instance will combine with the excess of carbonic acid and fall to the bottom together with the carbonate of iron. To determine the precise quantity of lime water requisite, add the reagent (saturated solution) to a small portion (of known volume) of the freshly drawn water, in small quantities at a time, and with constant stirring until no further precipitate forms. Then by a simple operation in proportion the quantity of the reagent necessary for the purification of a given quantity of the well water may be easily determined. An excess of the reagent must be avoided. This impurity would probably prevent the successful working of an injector.

W. S. W. asks: How is the best rosin, used on violin bows, prepared?—W. F. asks: What is a simple method for washing clay for brick and tile making?—E. S. D. asks: What is the best kind of wood to construct a guitar?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Rheumatism. By A. R. E.
On Postage Stamps. By E. B.
On Boiler Explosions. By G. B. B.
On Reaching the North Pole. By J. H. S.
On Heating Street Cars. By P. T.
On a Hybrid Fruit. By R. S. R.
On an Air Vessel. By J. T. R.

Also inquiries and answers from the following:
E. B. M.—F. F. P.—N. B. H.—B. B.—O. F.—R. V. J.
—F. M.—N. B. C.—C. F. E.—W. T.—C. W. C.—T. F.—C. A. S.—S. N. M.—J. R. D.—P. J. D. C.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells a tool for turning up a crosshead wrist? Who sells tools for refitting steam valves without unscrewing them from the pipes? Who sells spoke-turning lathes? Who makes machinery for freeing wool of burrs and dirt? Where can tangsters, or tangsten steel, be procured, and at what price? Who sells silicate of alumina and silicate of potash?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were

Granted in the week ending

January 16, 1877.

AND EACH BEARING THAT DATE.

[Those marked (r) are renewed patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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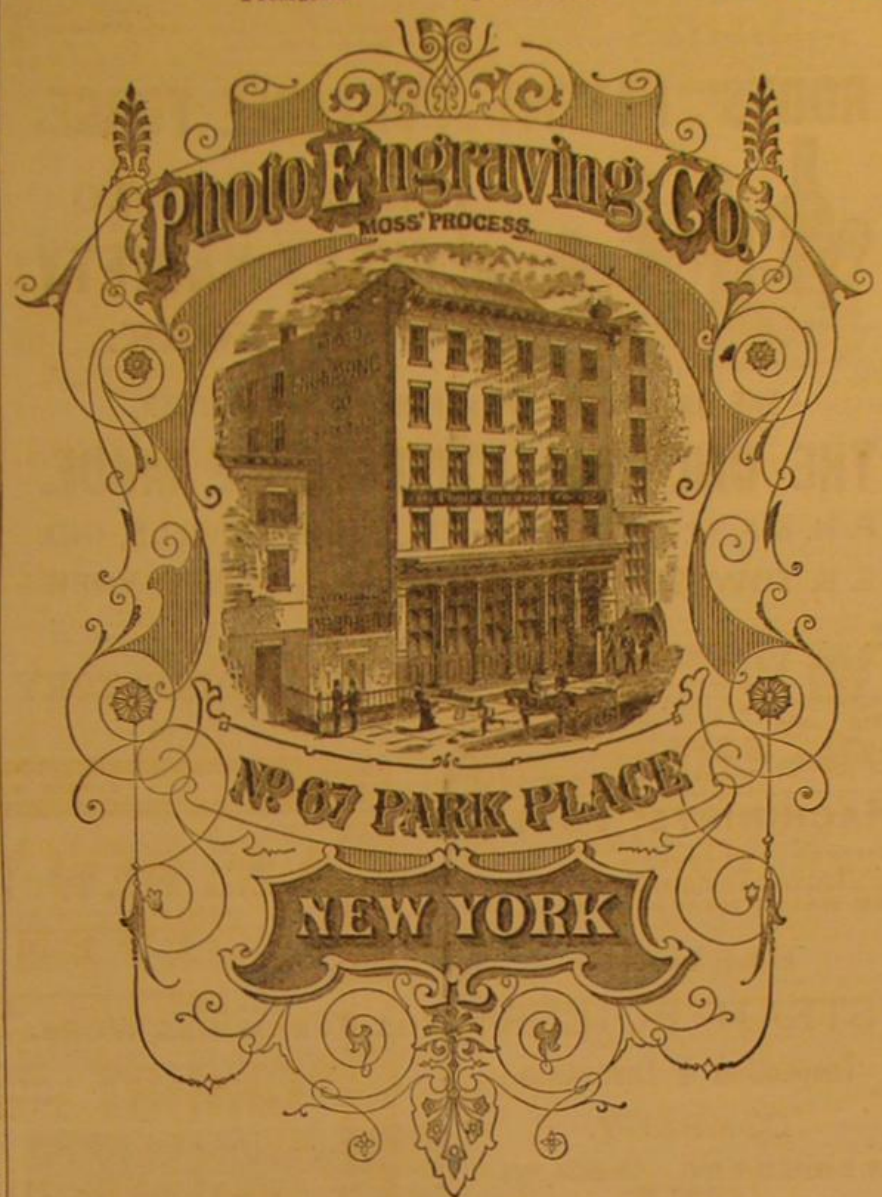
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