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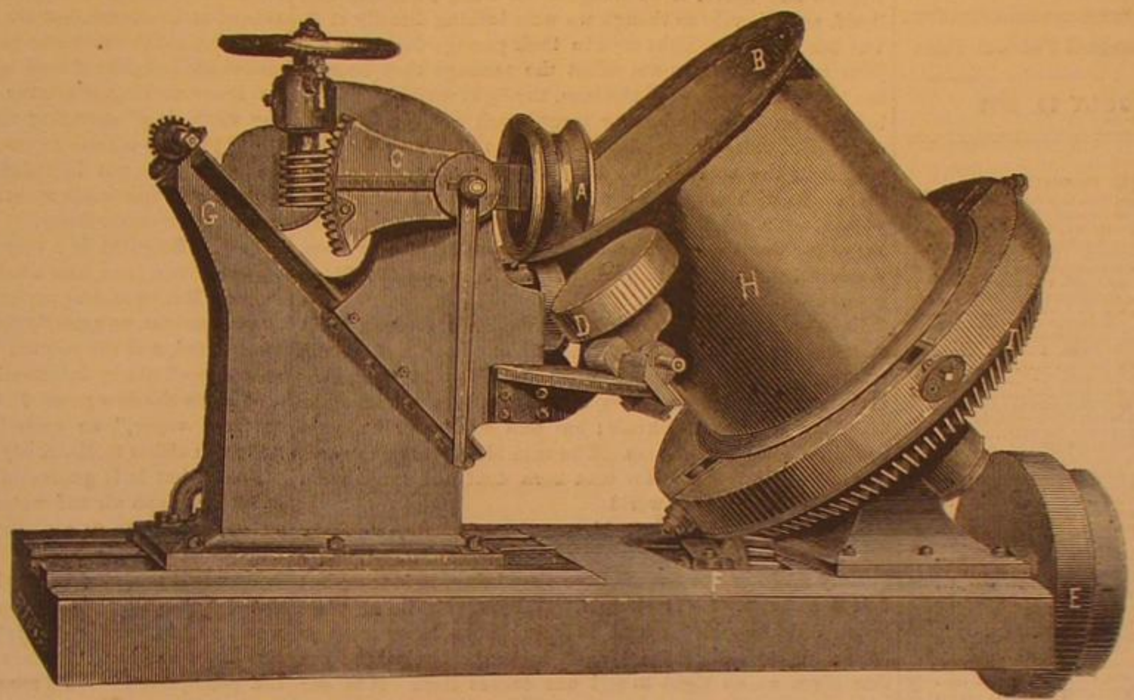
IMPROVED FLANGING MACHINE.

We illustrate herewith a machine for forming flanges on metal bars, and on plates for constructing boilers and other vessels. It is the invention of Mr. David Hanson, of England, and attracted much attention at the Vienna Exposition.

A is a steel roller, revolving upon a bearing on the end of the segmental rack, C, the angle of the roller, A, to the flange, B, being adjusted by means of the rack, C, and the worm wheel attached thereto. B is the turning or bending flange of the cylinder, H, which can revolve by friction, but whose position is at all times stationary. The distance between the roller, A, and the flange, B, is adjusted, to suit various thicknesses of plate, by means of the slide upon which the head carrying the roller, A, and its attachment is affixed, the head being operated by the bevel gears, G, and a screw and nut operating upon the head in the center of the slide. H is the revolving cylinder, driven by the gearing, J, operated by the pulley, E. The roller, D, serves to guide and steady the cylinder, H, which would otherwise be apt to spring from its duty. In operation, the roller, A, is set to the required angle of flange to be made, and the head and roller, A, are set to suit the thickness of the metal to be flanged; then the slide set screws are set up to relieve the worm and rack, C, of any strain. The work is then passed between the roller, A, and the flange, B, the latter carrying the plate through and the former revolving by friction.



HANSON'S FLANGING MACHINE.

The machine is substantially made, and is well proportioned in all its parts, and it is of simple and durable construction.

DUPLEX WHEEL LATHE.

We illustrate herewith a very fine duplex lathe recently constructed by Messrs. New, of Nottingham, for the Great Eastern Railway locomotive works, at Stratford, England. The lathe is arranged with four compound rests, A, constructed to turn a pair of 6 inch locomotive wheels on their axle, and for bossing and boring, as described below. The headstocks and rest saddles are fitted on a massive bed plate, B, 18 inches deep, and 23 feet long over all, with planed surfaces. The face plates are carried on cast iron spindles 15 inches diameter in the front neck, running in parallel bearings of cast iron, forming anti-friction working surfaces. They are driven by external wheels from a main shaft, 6 inches diameter, running the length of the bed, and supported by five bearings. On this shaft are two sliding pinions moved by levers, C C, to give independent motion to each plate for bossing and boring, and to work simultaneously in turning. The plate for the fast headstock is also provided with an internal wheel, D, for giving an independent quick speed by means of a pinion, E, carried on the cone shaft; the pinion on the main shaft being drawn out of gear by the lever, C, this gives the necessary fast running for bossing or boring a wheel on this face plate, while a tyre is being worked on at the other face plate, for which purpose the plates are arranged with slide seats to carry portable gripping jaws. The driving power is given by a 6 inch belt and a 5-speeded cone through powerful double gear.

The compound slide rests have each a double swivel arrangement to enable the cutters to be placed at any angle of flange or tread, and they have a double feed traverse of seven cuts to the inch worked by an overhead rocking shaft lever and chain—each pair of rests from their own headstock. To dispense with a crane, the dogs and bolts are arranged to be readily removed from the rests, so that the wheels may be run into the centers. Each saddle carries two rests, and it is recessed out in the center, so that each rest may be brought fairly opposite the tread of the wheel, and thus have full cutting power. For facility in working the saddles and tool pillars, they are each arranged to move by quick-thread screws, both longitudinally and transversely. The loose headstock shoot is worked by a hand wheel, and the headstock itself can be quickly traversed on the bed by a screw, so as to get adjustment of centers, if necessary, from 7 feet 3 inches to 10 feet.

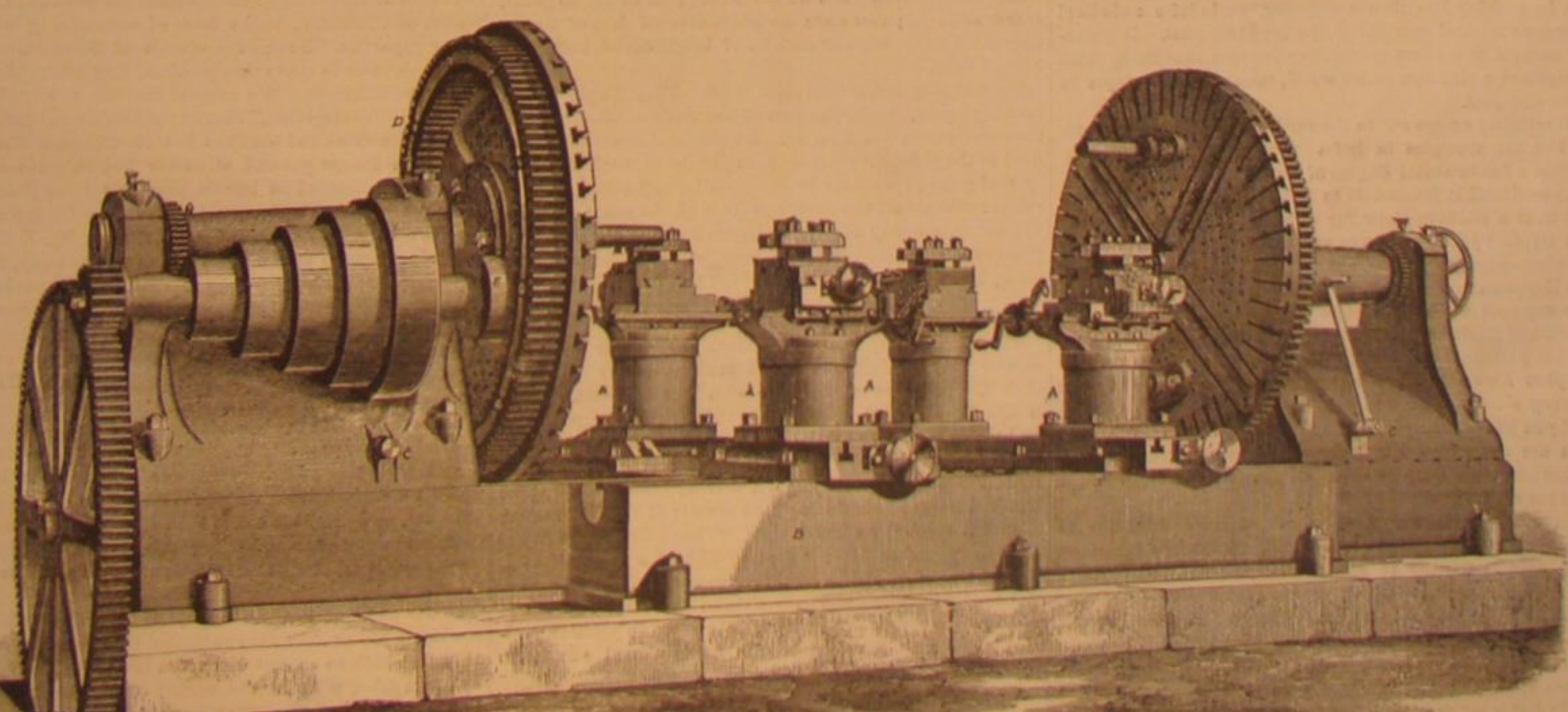
This is a most complete modern tool for the purpose, being at once a special wheel-turning and general boring or bossing lathe, combined in the most simple and effective manner, so as to be readily used for whichever purpose is required. The lathe is a fine tool, and will maintain the reputation of the makers.—*The Engineer.*

A Hint on Healthy Dress.

Multitudes of persons of both sexes lose health, and oftentimes life, by busying themselves until warm and weary, and then throwing themselves on a bed or sofa, without covering, or in a room without a fire, or by removing their outer garments after a long walk. If you have to walk and ride both, do the riding first, and, on returning, go to a warm room, and keep on all your wraps until cool, even if you suffer some discomfort.

A Grasshopper Parasite.

There appears to be a chance that, after all, the grasshopper infliction will not be productive of such widespread devastation as has heretofore appeared probable. Messrs Dunkee and Stout, farmers of extensive tracts of land near Fort Scott, Kansas, according to a report in the *St. Louis Republican*, have examined by dissection large numbers of grasshoppers, and have found that about three quarters of them contained a well developed live maggot. As heaps of dead grasshoppers have been encountered, literally alive with the parasites, it is believed that the latter may ultimately cause an extinction of these most troublesome vegetable-destroying insects.



NEW'S DUPLEX WHEEL LATHE.

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VOLUME XXXIII., No. 2. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, JULY 10, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

THE TRUSTWORTHINESS OF THE SENSES.

This world is all a fleeting show, for man's delusion given, wailed poor Dr. Young, when the lady of his affections cruelly told him that, however much she might love his soul, she could not abide an alliance with the diminutive casket that enshrined it.

Since that day thousands have sung the mournful song without the author's excuse, and curiously unconscious of the terrible charge it carried against the Being they were professedly worshipping. If the world is really such a misleading affair, for our delusion given, surely the giver of it can be nothing less than a swindler, an infinite swindler! It was no original thought of the love-lorn poet. It probably occured to the first speculative lounger that thought he recognized a phantom under world, mimicking the upper in some still pool.

It certainly creeps out in the earliest speculative writings. It had its disciples in India thousands of years ago. It was a fundamental dogma of the founder of Buddhism, who confessed it impossible to tell how far the world without us is a phantom, how far a reality. The followers of the Greek Pythagoras were more positive; the world and its phenomena, they said, are all illusions. Centuries later the Egyptian mystic Plotinus taught the same doctrine, that the external world is a mere phantom; and the mystical schools of Christianity took it up in turns. Nor did Mahommedan philosophy escape the delusion. The Arabian philosopher Algazzali writes in this strain: "I said to myself: During sleep you give to visions a reality and consistence, and you have no suspicion of their untruth. On awakening you are made aware that they were nothing but visions. What assurance have you that all you feel and know when you are awake does really exist?"

In every age the mystically inclined have delighted in dreaming that everything is a dream. A favorite American poet does it prettily in one of his poems. He lies on a grassy river bank, watching the clouds sail across the sky, seemingly far down in the still water. The image of a kingfisher flits across his vision. He knows that a corresponding bird flew through the air above his head, while he gazed upon the phantom beneath his feet. He calls it a real bird; but what assurance has he that the kingfisher in the air is any more real than the image in the water? May not it be merely the visible reflection of an invisible reality?

"All this that you call material," said a fanciful friend the other day, in response to some remark of ours implying the absolute existence of those "permanent possibilities of sensation" known as *things*, "all this is but the fleeting image, the reflection, as in a glass, of the truly real, that is the spiritual, to which we shall some day attain."

Just here, perhaps, in the misapprehension of the phenomena of reflection, we may find the key to the entire scheme of mystical philosophy, and prove it based, not on the refinement of reason, as its disciples fondly imagine, but on an optical blunder. We may possibly find also a sufficient answer to the aspersions which the same school of thinkers are wont to cast on the integrity of our senses.

Sitting at our table, we seem to see at this moment, in the broad window of a shop across the street, the image of a workman repairing the street. By direct vision, we can see neither the man nor the work he is engaged upon. Across the room hangs a mirror; in it appears the reflection of a window, and in the window the reflection of a passing cart. Neither cart nor window is directly visible from where we sit. Using a form of common speech inherited from an unscientific age, we say we see, in the glass and on the window, images of the objects mentioned; but in reality we see nothing of the sort. The cart seen through the double agency of window and mirror is no image of an image, but the cart itself, as positively as though we were looking directly at it. The bending of the light rays in their passage from the objects to our eyes does not affect the message they bear in the least. In the case of the man, the light which brings us information of him is bent or turned back once, in the case of the cart, twice; our vision is indirect, not direct; yet it is absolutely the man and the cart that we see, not images of them. So with the poet's kingfisher. It was the living bird he saw, not a phantom; the seeming under world was really the upper world indirectly seen. In this and all similar cases, the delusion lay in the mind of the mystic, not in the things seen.

Equally so with the Arab philosopher's dreaming. It matters not whether the reflection is at one or a thousand removes; it is the reality which we see. By what means the brain mingles and combines the impressions of sense in dreaming we may not know; but this we know, it always combines and never creates. The man blind from birth sees no visions in his sleep; the man born deaf and mute hears no voices in the dream world.

The alledged untrustworthiness of our senses, we flatly deny. In health, they invariably tell us the truth. We frequently misinterpret the message they bring, it is true, but that is no fault of the senses. The interpretation of sense impressions is something to be learned; we never learn it fully; we are liable to blunder throughout all our days; but that gives us no right to call our senses liars. It is our judgment, not the sense of sight, that is deceived when we stumble, with the mystics, into Alice's "World behind the Looking Glass."

We learn, for example, to associate certain plays of light and color with certain natural gems. When we see the same effect produced by artificial pastes, we mistake them for real gems; but it is not our eyes that cheat us; they simply report the flashing lights, and, through our lack of knowledge, we make an inference not in accordance with fact.

Again, when we see the same play of color, we say it is produced by a gem, natural or artificial,—and it may be neither, but only a bit of glass with tinsel underneath. We discover the imitation, and therefore know that there are three ways of producing that particular play of color, and we estimate the probable one in any case by the attending circumstances.

We witness a spectacular play, and see the actors luminous with—what shall we call them? Not real gems, for they are too numerous; possibly imitation gems, still even they would be too costly; we reason therefore that they must be tinsel-lined glasses. But we are wrong; there are no gems, real or artificial; there are no glass-covered bits of tinsel; they are simply angular cavities of bright metal bathed in colored light.

Did our eyes deceive us? Not at all. They simply told of flashing lights, the mechanism of the flashes being left for the other senses to determine. A child bred in a theater, and used to the phantom gems only, might be as much deceived by real gems as we were by the metallic reflections; but in neither case would the deception lie with the sense of sight. We not only wrong our honest senses but lose our grip upon this most substantial world of ours when we let mistaken metaphysics persuade us to doubt the testimony they bear.

THE KEELY MOTOR DECEPTION.

The value of any known substance as a heat or force generator may be determined and mathematically expressed with the precision of a simple sum in arithmetic. Thus, it has been settled that the combustion of one pound of coal yields a motive force equal to a weight of eleven millions of pounds: if the combustion occupies one minute of time, the pound of coal yields a driving force of over three hundred horse power during that period; if the combustion is spread through an hour's time, we have five horse power from the pound of fuel; while one fifth of a pound of coal, burned per hour, yields one horse power during that period. But our best engines and boilers are so imperfectly made and managed that so much power as this is never, in practice, realized. The best practical results rarely exceed one horse power per hour from 1½ lbs. of coal.

This result, although defective, although indicative of the need of improvements in steam apparatus, is, nevertheless, economical as compared with any other known method of generating power. Reduced to money, with coal at $5 a ton, the cost for steam power fuel, in Philadelphia, using the best engines and boilers, is less than three cents per day of ten hours for each horse power.

We think it will be hard for Keely and his assistants to supply motive power any cheaper than this, allowing them the full benefit of the extravagant assertions they set up.

They now aver that they cannot transmit the new "power" under a less pressure than 1,000 lbs., to the square inch, and expect to keep their "receivers" full of their "new cold vapor," at a pressure of 30,000 lbs. per square inch. To manage this pressure will involve expenses that steam power does not require, even though the air and water, out of which the "cold vapor" is manufactured, cost nothing.

But what is the new power, of what is it composed, from what is it generated, how is it prepared, what are the principles involved, what is the nature of the apparatus?

During the past week we have had conversations with Mr. H. C. Sergeant, of this city, who is one of the principals in the Keely motor concern, the chief machinist of the establishment, and one of the four persons to whom only, Mr Sergeant assures us, the nature and *modus operandi* of the "great secret" has been communicated. Mr. Sergeant has long been known in this city as an able mechanician, and is a gentleman of the highest integrity. He informs us that neither Mr. Keely nor himself have anything to do with the sale of stock shares, but are honestly engaged in the endeavor to reduce the motor to practical working harness. The shares are bought and sold by other persons who have faith, but know nothing whatever of the principles involved or the method of operating the apparatus. This informant states that the official report, from which we made extracts last week, was not intended for publication, and contains statements which more recent experiments have shown to be untenable or unnecessary.

As Mr. Sergeant is a very practical man, we hoped to be able to obtain from him a full history and description of the motor. But he said he preferred to defer the matter until the new apparatus, now nearly finished, has been tried, its results ascertained, and the patents secured. However, he gave us a little preliminary information:

What is the new power? Our informant avers that it is a "cold vapor," an entirely new article, its composition unknown either to Mr. Keely or himself.

From what is it generated? It is generated, our informant states, from air and water, without fuel, heat, chemical action, or the use or consumption of any substance, save air and water.

How is it produced? Mr. Sergeant states that it is produced "purely by mechanical manipulation, which evolves a cold vapor; and by graduating his vaporizer or generator, Mr. Keely is able to produce a pressure of 10,000 to 15,000 lbs. per square inch in a receiver of greater volume than the total contents of the generator, with great rapidity and certainty."

What are the principles involved? The principles are not yet accurately determined, but appear to consist in the communication to the air and water, by mechanical means, of a certain sort of initial vibrations, the resultant whereof is the aforesaid "cold vapor."

What is the general nature of the apparatus employed? A series of simple pipes, nozzles, and check valves. Nothing more.

As to the properties of the "cold vapor," Mr. Sergeant gravely avers that its natural volume is over five hundred thousand times greater than the water from which it is derived; and that by a sudden enlargement of its containing chamber, the vapor suddenly condenses into water again.

These are curious statements, especially when we consider that the elementary gases resulting from the decomposition of a given body of water, H_2O, have a volume of only two thousand times that of the water from which they are obtained.

Our informant states that he has searched the principal fountains of knowledge and consulted the most eminent professors of chemistry, in the hope of ascertaining what the "new vapor" is. But all the oracles of Science are dumb; they are unable to grasp the problem, they afford him no information whatever. We suggest that the new article may be "luminiferous ether," that imponderable substance that fills infinite space and occupies the interstices of the molecules of hydrogen gas and all other bodies. No one has heretofore succeeded in imprisoning this intangible ether, for it passes through glass, metal, and all substances in Nature as if they were so much fog. But then, Mr. Keely, it is alleged, generates an enormous pressure, suddenly, rapidly, with certainty; and perhaps by this means, without knowing it, he compresses several of the atoms of the luminiferous ether into one, before they have time to escape, thus enlarging their size sufficiently to prevent their passage through the molecular spaces in the metallic walls of his generators. But this is merely a suggestion of ours.

Such, in brief, is the latest information we have been able to obtain, from probably the best informed individual connected with the affair. That our informant is laboring under a strange hallucination is most certain. That so able, practical, and excellent a man should, under the pressure of a delusion, become the unwitting assistant of a deception by which hundreds of innocent people are being led to loss of their property, is a matter of profound regret.

In our paper of last week we quoted from an article upon the Keely Motor Deception published the previous year, May, 1874, in which an extract was given from the Keely Company's pamphlet, wherein the names of several well known professional gentlemen were given, by the Keely people, as witnesses and referees to the correctness of the motor performances, and the truth of the statements given in the pamphlet. Among the witnesses so cited by the Keelyites was Wm. W. W. Wood, Chief of Bureau of Steam Engineering, U. S. N. In view of the following letter, our Keely friends will have to cross out that gentleman's endorsement:

NAVY DEPARTMENT, Washington, D. C.

To the Editor of the Scientific American:

My attention has been directed to an article in your paper of recent date, relating to the so-called Keely motor.

My name has been mentioned as one of the advocates of the alleged invention without my authority. I know nothing about the construction or operation of the device; and as I am not in the habit of endorsing inventions of which I am ignorant, of course I could not endorse the so-called Keely motor. I am, respectfully, your obedient servant,

June 24, 1875. WM. W. W. WOOD.

The editor of the *Leader*, of Cleveland, Ohio, has been to Philadelphia, seen with his own eye the Keely gage go up, has become a full convert to the wretched deception, and answers the strictures of the SCIENTIFIC AMERICAN by calling us a scientific ass. Well, it is better to be an honest ass than a blind back-leader of a deception.

Every perpetual-motionist, for the last generation, has considered us an ass, because we could not recognize his errors as truths, or his deceit as facts. The Ericsson hot air stockjobbers pronounced on us the same epithet. Paine and his water gas people did the same. So did the Paine electromotors, of more recent date, and the pendulum motors, and the spirit motors, and now we have it from the cold vapor motors. We candidly admit that it requires but a small amount of intelligence to discern such deceptions, less even than that of the dullest member of the long-eared but useful family to which the *Leader* refers.

Besides the epithet mentioned, the *Leader* gives as a reason for its support of the Keely deception that the SCIENTIFIC AMERICAN is chiefly devoted to the puffing-up of inventions patented through its agency. It is true that a very large portion of all the patents granted for new inventions are obtained through the agency established thirty years ago by the proprietors of this paper. Our experience has undoubtedly been greater in this line than that of any house in the world. But it is equally true that the SCIENTIFIC AMERICAN is an impartial recorder of all interesting or important inventions and discoveries, and that its scientific information is in general reliable and valuable. This is shown by such facts as that, in patent trials in this country, the back volumes of the SCIENTIFIC AMERICAN are constantly produced as authorities upon disputed scientific points; while in the hundreds of libraries and reading rooms, scattered the world over, it will be found that the volumes and files of the SCIENTIFIC AMERICAN are more closely studied, more highly valued, and in greater demand than any other scientific publication extant.

When the editor of the *Leader* recovers from his present Keely delusion, when this attack of new motor epizoötic passes over, he will, we feel confident, think better of the SCIENTIFIC AMERICAN.

We gave in our last number a few brief examples of ways whereby small quantities of "cold vapor" might be readily produced by concentrating water weights upon confined air. On this our friend of the *Leader* argues, in support of the Keely motor, that he could, by simply turning a hydrant pressure of 26 lbs. to the inch into a six-gallon kitchen water boiler, make the water issue from the boiler into a bath tub at a pressure of 240 lbs. to the inch. We will not dispute the hydraulic capabilities of our friend; but we feel confident that no one but an out-and-out disciple of the Keely-motor confederacy could accomplish what he claims, in the way he describes.

THE NATURAL HISTORY OF SWINDLES.

The swindler is perennial, and always busy. His methods vary with time and circumstance, but at bottom he is always the same. And there is, in the permanent propensity of men to be swindled, a never-ending inducement for him to concoct his swindling schemes. He simply furnishes what the public call for.

What is the basis of this irrepressible tendency to be "taken in"? What are the fundamental conditions of its development?

We refer chiefly to the amazing gullability which induces or suffers men—practical men, so called—to honestly enter upon mechanical and financial schemes of enormous promise and certain failure. The swindler has a motive that cannot be mistaken; but what is the motive of the victim? Is it native stupidity, invincible ignorance, eagerness for sudden riches, or what, that makes capitalists, notoriously shy of taking hold of enterprises of real merit, so ready to invest their money in palpable frauds?

There is need of another Darwin to study the genesis of the various species of swindles. Do they follow a consistent law of evolution, and mark successive stages of individual unwisdom and popular incapacity for learning? It would be a curious study—a consumedly interesting study: we fear it would be as humiliating to human pride and disastrous to our theories of popular progress. To say the best, it does take mankind a terrible while to learn anything, by experience or otherwise.

A good deal of light has been cast on many phases of gregarious foolishness—of human sheepishness, as Sir Arthur Helps cleverly characterizes the tendency of men to "go with the crowd," right or wrong—by the study of epidemic delusions, wherein whole communities, often whole nations, have gone mad with some dominant idea, as of witchcraft or the like; but such studies throw little direct light on the philosophy of swindles. Those take possession of crowds; these are limited in their operations to individuals.

Besides, epidemic delusions are always of an emotional character, and have to do primarily with spiritual affairs, though their manifestations and results are often enough grossly physical; while the swindle has always a material object. To use a rough but sufficiently accurate figure, the one usually speculates in corner lots in the New Jerusalem, the other in swamp lots in some wild cat city of the Far West. The one trades on the transmutation of the base metals of human weakness and wickedness into celestial gold by the violation of all social and moral principles; the other on the conversion of common lead into double eagles by some impossible circumvention of the laws of Nature.

In both there is a firm, often intense, belief in the incredible. In both there is a confident expectation of getting a very large something out of nothing, or what is worse than nothing. In both epidemic and individual delusions, too, the victims are often men who, on other subjects, are shrewd, sane, practical.

The social conditions and current beliefs, which prepare the way for the reign of the first, can be clearly made out. Is it possible to do the same for the second? To estimate how far the two rest upon a common basis of misconception as to the conditions of existence, and how far the swindle depends on individual conditions of heredity, environment, want of knowledge, and greed of gain?

We are inclined to think it is quite possible; but we leave it to the future Darwin of this department of natural history to undertake the task. It will be sufficient for us, when time and space permit, to notice a few of the determining conditions which make the trade of the swindler so enticing and remunerative

RECENT IMPROVEMENTS IN GLASS MANUFACTURE.

The recent discoveries and inventions of M. De la Bastie, in France, in annealing glass, the improvements on his process by Mr. Charles Pieper, of Germany, and the method of hardening glass by Mr. Macintosh, of England, show that, whatever we may know about the chemical constituents of different varieties of glass, its physical properties are still almost a *terra incognita*.

We have been so accustomed to consider fragility as unavoidably connected with the conception of any glass object, that the idea of a glass bottle or goblet which may be knocked about and thrown on the floor, or of a glass pane which will not break when a stone is flung against it, appears an impossibility, if not an absurdity.

At the same time, all well informed persons know that the value of precious gems consists in their hardness, which enables them to keep their polish, while all glass imitations tarnish soon; that the test wherewith to distinguish a gem from a glass imitation is the application of the corner of a steel file, which will scratch glass but not a real gem. If now Mr. Macintosh finds a way to make glass as hard as a diamond, so that powder obtained from such glass can be used in place of diamond dust, what will become of all the comparative degrees of the value of gems? If paste (a soft lead glass imitation of diamond, which very nearly equals the diamond in luster) can be made as hard and as lasting as the genuine gem, what is the difference to the wearer, except that be knows that his ornament cost only $5 or $10 instead of $1,000 or $5,000? We have heard the most eminent jeweler of New York city declare that paste imitations are often so fine that, when worn in the evening, it is impossible to distinguish them from the real article. He confessed that he was unable to decide as to their genuineness unless he were allowed to have the articles in his hands under daylight illumination.

Glass appears, then, to have properties similar to those of steel which relate to hardening and annealing. We may change the temper of a steel tool by heating and slowly cooling, and this is what is done with glass by De la Bastie and Pieper, by the intervention of a proper bath, the chemical nature of which undoubtedly plays an important part. On the other hand, we may make steel hard by suddenly cooling it when very hot, and we may modify the nature of the steel by exposing it to the action of diverse substances, among which carbon is the most important, the influence of the carbon being very powerful, as the addition or abstraction of one half to one fourth per cent of carbon, to or from the steel, results in a great difference in its physical qualities. It is so with glass. Mr. Macintosh, after having pressed the heated glass to the proper shape in iron molds, according to the usual method, transfers it to thin platinum molds, brings it nearly to the *fusing* point, and then suddenly plunges it into a freezing mixture containing snow, ice water, and salt, or their equivalents, or in some other mixture producing an intense cold, different kinds of glass requiring different mixtures. This latter point is now under investigation, and the results promise to teach us a great deal more about the most remarkable and useful material, without which, as Liebig remarked, our progress in Science could only have been very limited. It is hardly necessary to enumerate our obligations to glass. Without it no telescope nor microscope, no barometer, could have been invented; and no modern astronomy, hardly any chemistry, and but a little physical science would have been possible.

THE PLANETARY ATMOSPHERES.

The most recent researches into the nature of the gaseous envelopes of the planets are embodied in a work lately written by Dr. Vogel, director of the observatory of Bothkamp, Germany, in which the author describes the results obtained by analyzing the light of each planet by the aid of the spectroscope. A previous study with the telluric lines, lines produced in the solar spectrum though the absorption of the terrestrial atmosphere, enabled him to draw comparisons between the latter and the atmosphere of the planets, and to recognize in some instances a similarity.

The principal lines in the spectrum of Mercury coincide absolutely with those of the solar spectrum; and it further appears that certain lines, which are not produced in the latter save when the sun is very low on the horizon, and when the absorption of our atmosphere is very considerable, permanently exist in the Mercurial spectrum. There is, therefore, a gaseous envelope about that planet, the absorption of which is equal to that of the earth's atmosphere at its maximum.

The light emitted by Venus resembles in its essential traits that of the sun, with a few lines added, which may be identified with those of the absorption spectrum of the atmosphere of the earth. Since the modifications of the solar spectrum which can be traced to the planet's atmosphere are very slight, it must be concluded that the majority of the solar rays are almost wholly reflected from the cloud envelope which encompasses the planet. According to Janssen's observations, the telluric lines are due largely to watery vapor, and hence it may be admitted as very probable that the atmosphere of Venus contains water.

A large number of the lines of the solar spectrum are found in the spectrum of Mars. In the less refrangible portions of the latter appear certain bands, which do not belong to the solar spectrum, but which coincide with the terrestrial absorption spectrum. It may from this be concluded with certainty that Mars possesses an atmosphere which does not differ essentially from our own, and which is rich in watery vapor. The red color of the planet is owing to a complete absorption of the blue and violet rays. There appear to be some lines which are peculiar to the planet, but their position has not been definitely fixed, owing to the too feeble luminous intensity.

The majority of lines which distinguish the spectrum of Jupiter coincide with the solar lines. The Jovian spectrum, however, differs from that of the sun in the presence of a few obscure bands in the less refrangible portion, and especially in one band in the red, the length of an undulation of which has been determined to be 2471·5 hundred millionths of an inch. The other lines foreign to the solar spectrum coincide with the telluric lines. The more refrangible blue and violet radiations are uniformly absorbed. The Jovian atmosphere, it is concluded, exercises on the solar rays which traverse it an action analogous to that produced by the earth's atmosphere, whence the presence of the vapor of water in the former may be predicated. It is doubtful whether the band in the red, above mentioned, results from the presence of some special body not found in our atmosphere, or from the fact that the gases encompassing Jupiter are mixed in different proportions from those in air. It is possible, however, that the two atmospheres are similar, but that their actions on the solar rays differ on account of circumstances of temperature and pressure. The spectra of the dark belts, observed on the disk of Jupiter, are characterized by the marked uniform absorption of the blue and violet rays. No new absorption bands appear, but the lines are broader and more marked than elsewhere, proving that the dark belts are deeper than the adjoining regions. The solar light penetrates more profoundly into the atmosphere of the planet at such belts, and hence is submitted to more marked alteration.

The spectrum of Saturn shows the most marked lines of the solar spectrum, and gives bands which, with one exception, coincide with those of the spectrum of our atmosphere. In general, the Saturnian spectrum is closely analogous to that of Jupiter. The spectrum of the ring, however, is very different, and shows no atmosphere, or at most a thin gaseous envelope of feeble density.

The faint light of the spectrum of Uranus does not admit of distinguishing the Fraunhofer lines. Certain bands have been noted, the undulations proceeding from which have been measured, and which without doubt result from the absorption of solar rays in the enveloping atmosphere of the planet. To what bodies such absorption is due, it is impossible to tell. One band, however, corresponds exactly with another found in the spectra of both Jupiter and Saturn. The spectrum of Neptune differs essentially from the solar spectrum and is characterized by a few large absorption bands, generally, it appears, identical with those of Uranus.

Among the small planets, M. Vogel has examined Vesta and Flora, with uncertain results, however, owing to their lack of brilliancy. There appear to be indications of an atmosphere about Vesta.

What Inventions Do.

The following colloquy recently took place between Recorder Hackett and a criminal before him for examination in this city. From it we conclude that, while human depravity is not less prevalent than formerly, modern inventions protect mankind from the depredations of the vicious, by rendering their operations considerably more hazardous.

"What is your business?" asked the Recorder.

"I am obliged to work."

"Don't you like it?"

"No."

"Why not? What was your business?"

"A cracksman." (Frank answer.)

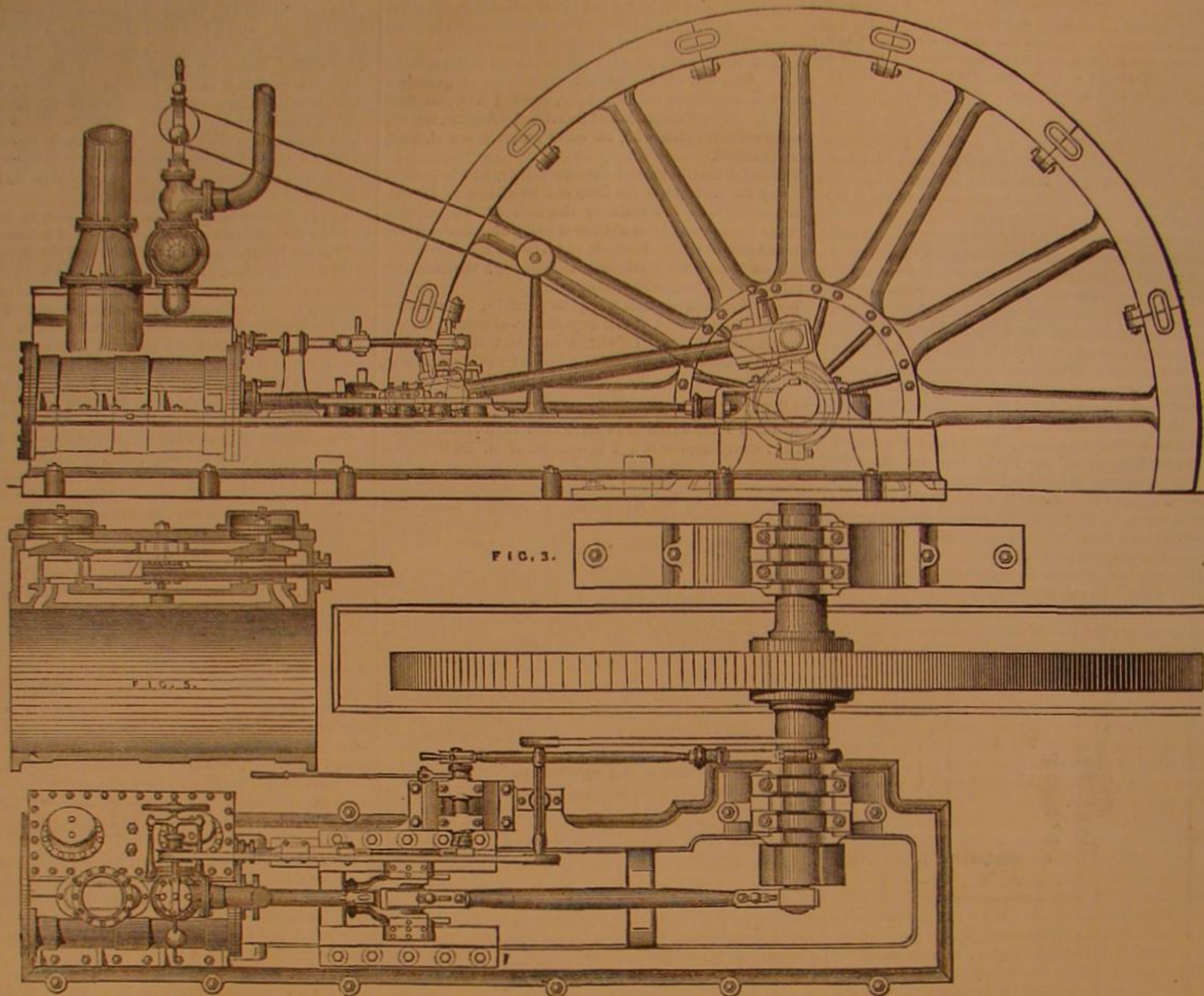
"Well, then, you have given up that business?"

"Yes. You see, Counsellor, what with the burglar alarms in houses and stores, and the district telegraphs, and people growing economical and careful, and the newspapers hounding us, burglary, garotting, and highway robberies, and such things, is actually hazardous, and ain't so easy to be did."

To make waterproof packing paper, dissolve 1·82 lbs. white soap in 1 quart water. In another quart water, dissolve 1·82 ozs. troy of gum arabic and 5·5 ozs. glue. Mix the two solutions, warm them, and soak the paper in the liquid, and pass it between rollers or simply hang it up to drip.

ENGINE FOR BLOOMING MILL USE.

The John Edgar Thomson Steel Works, near Pittsburgh, Pa., have recently been adding very largely to their extensive plant, and among the new machinery is a large and powerful steam engine, which deserves special mention for its excellent construction and the high finish that has been put on all its parts. The engine has a 36 inch cylinder with 4 inch stroke, and the fly wheel, which is 25 feet in diameter, weighs 50 tuns. The whole engine is of massive proportions, but the only detail of which we need speak here is the slide valve, which is shown in detail by Figs. 4 and 5. This is Hemphill's balanced slide valve, which, as shown, moves between the usual face and a relief plate. The relief plate is prevented from moving with the travel of the valve, by arms extending from its sides interlocking with lugs cast on the side of the steam chests, leaving the plate free to expand from the center towards the ends.



BLOOMING MILL ENGINE AT THE THOMSON STEEL WORKS, PA.

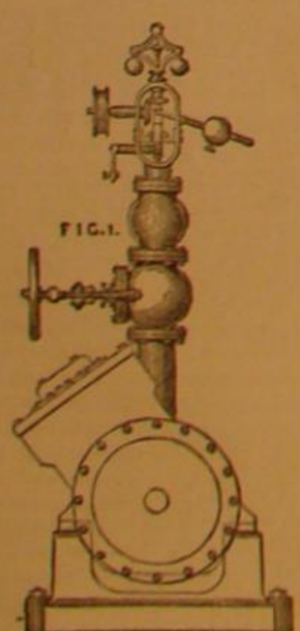
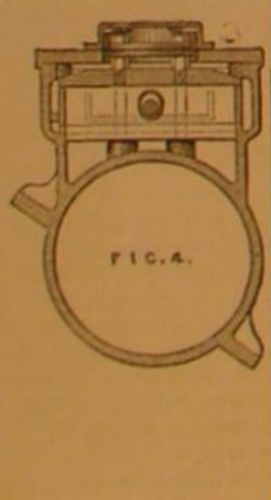


FIG. 1.



Near each end a stem is tapped into the relief plate, and on this stem are two disks, as shown. Between these disks is held a copper diaphragm about one sixteenth of an inch thick, covering the hole in the steam chest lid, and secured to the latter by a bonnet or cover. This copper diaphragm, when not deflected, is one sixteenth of an inch above the outer face of the steam chest lid. Bolting down the bonnet draws the edges of the diaphragm down to the steam chest lid, making the joint and securing the proper seating of the valve. The area of the inside of each bonnet is made equal to the area of the extreme edges of the corresponding valve, minus the area required to secure a sufficient downward pressure to hold the valve firmly to its face. The relief plate is thus held between two forces, the pressure of the steam downward on an area equal to that of the valve, and the pressure upward on the diaphragm.

The set bolt, shown at the top of each bonnet, is adjusted to leave a space of about one sixteenth of an inch between its point and the point of the diaphragm stem, thus allowing the valve to rise from its seat to allow the escape of water from the cylinder when necessary. Experience has proved that the flexibility of the copper is ample to secure the desired relief on the valve.

The Stevens Institute Commencement.

On the 4th ult., the great hall of the Stevens Institute, Hoboken, N. J., was filled with a large audience on the occasion of the first annual commencement. Governor Bedle presided; and the proceedings having commenced with music and prayer, Professor Morton delivered a pointed and practical address on the objects and scope of the Institute, and the nature and importance of the instruction there afforded. Three theses were read—one on a design for a fifty-tun floating derrick, by Adolph Sorge; another on the theory of the traction of locomotive engines, by James E. Denton; and a third on heating and ventilating, by J. Hector Fezandie.

Professor Thurston delivered an address to the graduates, giving them some sound, common sense advice as to their conduct and life in the world into which they were entering. Governor Bedle followed with an interesting speech, in which he eulogized the late Edwin A. Stevens, and spoke in fitting terms of his liberality and the noble institution on which he bestowed his wealth and his name. Degrees were conferred on eight gentlemen, the three above mentioned, and Messrs. Bachman, Roezly, Leavitt, Wall, and Yokichi Yamada. Mr. Bachman's thesis was on the subject of flouring mills, Mr. Roezly's on sugar refining, Mr. Leavitt's on overshot water wheels, Mr. Wall's on wire rolling and drawing; while that of Mr. Yamada, who is a native of Japan, was on a design for a turbine water wheel.

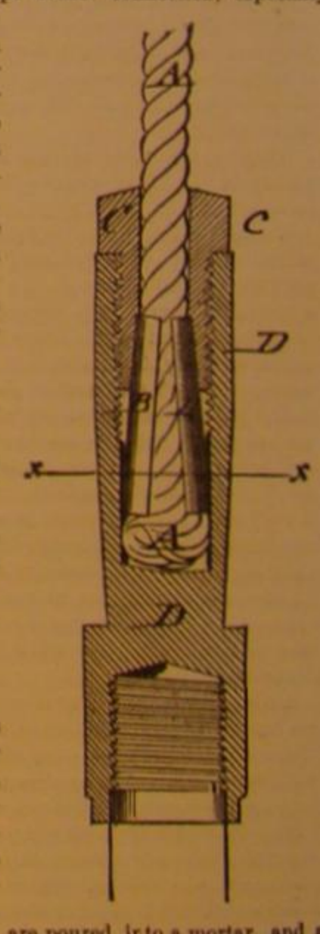
THE luster of morocco leather is restored by varnishing with white of egg.

Railway Liability for Freight.

In the case of a railway company that receives freight for transportation over its own and connecting lines, the Supreme Court of the United States holds that such receiving company is not liable for losses that occur on the connecting road, unless the receiving road contracts to be responsible. The receiving road becomes a contractor for the entire route when it fixes a price for the whole distance, and receives the goods for such transport.

IMPROVED ROPE SOCKET.

This is a convenient rope socket connection, especially adapted to hoisting the shafting in oil wells, though susceptible to many other uses which will readily suggest themselves. The end of the rope, A, is first unlaid: and two sleeve-shaped tapering pieces, B, are applied so as to wedge against the collar, C, which is screwed into the connecting piece, D. This last is similarly attached to the shafting. The piece, D, might be made stationary, in which case the device would be useful in any arrangement in which it is necessary to fasten tightly the end of the rope.



Patented through the Scientific American Patent Agency, October 27, 1874, to Mr. Bowen, of Peachville, Pa.

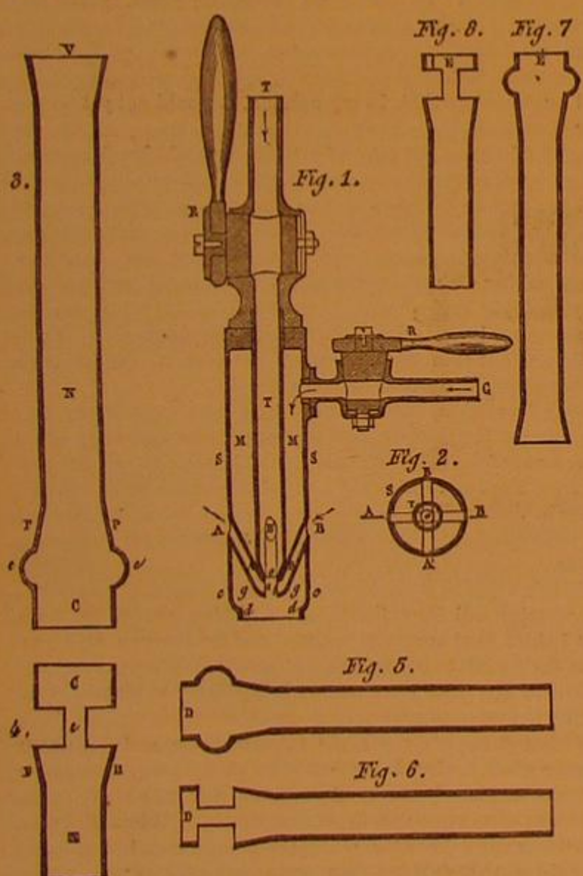
The Magnetic Curves.

Rev. G. H. Hopkins gives the following method for fixing the curves which steel filings take when under the action of a bar magnet. The filings, having been prepared so as to be as nearly the same size as possible, and that size very minute, are poured into a mortar, and a small quantity of finely powdered resin is added: these are stirred together until the two substances are completely mixed, and then, considerable pressure being exerted upon the pestle, they are rubbed until the resin adheres to the filings in a very fine coating. The filings can then be sprinkled as usual, and the curves formed. It is best (after the curves are formed) to heat the plane surface (glass, paper, or wood, according to convenience) over a stove or in an oven, which easily allows it to be sufficiently as well as uniformly heated. For projecting the curves on a screen, the following, we believe, is a very effective method: Cover the glass with thin gum water, allow it to dry perfectly; obtain the curves on dry gummed surface; finally, breathe on the plate; the gum is thereby softened, and the curve permanently fixed. Substituting correspondingly shaped pieces of paper for the magnets (a pinhole can be used to indicate the north pole), the curves can be covered with a second plate of glass, and thus preserved as an ordinary lantern slide.

A NEW GAS BLOWPIPE.

The apparatus herewith illustrated, in natural size, is a new gas blowpipe burner, designed also for forges and for similar uses where intense heat is necessary. The advantages of the invention are that, when the air blast is supplied by water pressure, it insures the delivery of sufficient air completely to consume all the gas, and in a thoroughly dry state so as not to cool the flame.

The device, as shown, consists of a brass tube, T, to which the air blast is led, and which is screwed in an outer tube, S, which receives the gas from the pipe, G, the gas filling the annular space between the two tubes, and being regulated by the cock, R'. Cock, R', governs the air supply. The orifice, *o*, of the air tube terminates just within the interior of the tube, S. In order to augment the quantity of air injected into the gas, four copper pipes, A A', B B', are inserted in S, and are so arranged that the current is drawn into that leaving the tube, T, at *o*, mingling with the latter, and so filling the annular space, *g*, and escaping at *d*. A plan view of the tubes, A A', etc., is shown in Fig. 2.



To the orifice, at *d*, various mouthpieces, some of which are shown in Figs. 3, 7, and 8, may be attached. Each piece consists of a ring, which either slips over or inside of *d*, and this ring is joined to the main tube, N, Fig. 3, by two thin pieces of metal, *e*. The openings on the sides thus produced give an additional supply of air, determining a complete mixture within the tube, N, which burns at the exit orifice. A gas lamp under the tube, N, which is disposed laterally, serves to dry the current.

M. Cougnet, the inventor, claims that by this apparatus a very intense heat may be produced at a decreased expenditure of gas, owing to more perfect combustion.

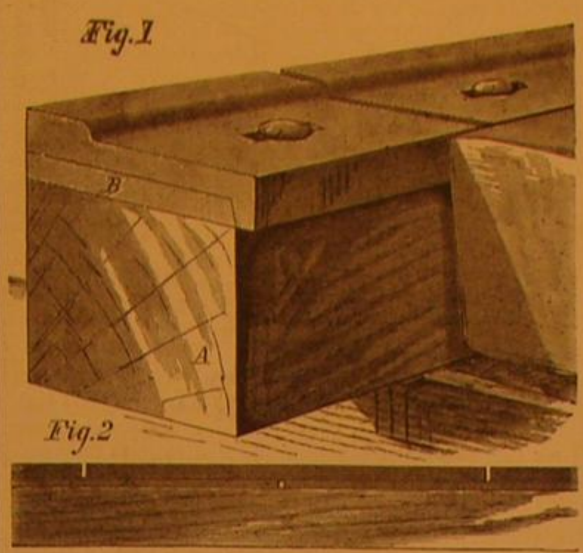
Mr. Thomas Webster, Q. C.

This eminent patent lawyer died suddenly on June 3, at his residence in London, England. On the previous day, he was engaged in the duties of his profession; and was in good health up till late on the day of his death, when he felt fatigued. In the evening, he rose to leave his room, and fell dead in the arms of his servant.

Mr. Webster had for many years held a high reputation for learning and forensic ability at the English bar; and his experience in patent matters, and his wise and strenuous advocacy of a peremptory protection, by all governments, of the rights of inventors, make his death a matter of regret with all who sympathize with progress and the arts and sciences. He visited Vienna in 1873, and was appointed a member of the International Patent Association which held its meetings there; and he expressed to Hon. J. M. Thacher, now United States Commissioner of Patents, who was also a member of the Commission, great admiration for the patent system of this country, and desired that the English practice should be, in its main features, assimilated to it.

NESSLE'S STREET RAILWAY RAIL.

In the invention herewith illustrated, the rails are supported by a continuous line of plates, thus, it is claimed, rendering the track firm and solid, and lessening the expense of repairing. The greatest advantage, however, is that, when the rails become worn out, they can be removed, leaving the plates in their places, when simply new top rails alone need be put down, thus, according to the inventor, decreasing the expense nearly one half



It is also claimed that the compound rail is stronger than a solid rail of the same thickness, and that, as it has no battering or bending points, the jarring so destructive both to rails and rolling stock is avoided.

A, in the engraving, is the timber ordinarily laid down to form the base for the track. On this is secured a series of flat plates, B, and on top of the plates are laid the rails, in such a manner as to break joints with the under plates. The fastening spikes extend through the rails and plates, securing both, suitable slots allowing of the contraction and expansion of the metal being made for their introduction.

Patented May 4, 1875. For further particulars address the inventor, Mr. John P. Nessle, 23 Frelinghuysen avenue. Newark, N. J.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the computations of the following notes (which are approximate only) and for most of the observations, I am indebted to students. M. M.

Positions of Planets for July, 1875.

Mercury.

Mercury cannot be seen in the early part of July, as it rises after the sun, on the 1st at 5h. 27m., and sets at 7h. 45m. P. M. On the 31st, it rises before the sun, at about half past 3, and sets a little after 6 in the evening. It can be best seen on the 27th, when it is at its greatest elongation.

Venus.

On the 1st of July Venus rises at 3h. 2m. A. M., and sets at 5h. 50m. P. M. On the 31st, it rises at 3h. 42m. A. M., and sets at 6h. 30m. P. M.

Mars.

Mars rises, on the 1st of July, at 6h. 50m. P. M., and is easily recognized by its ruddy light. Although very low in altitude, Mars will be very conspicuous all through the month, coming to the meridian at about 11 P. M. early in the month. On the 31st Mars rises at 4h. 37m. P. M., and comes to meridian at 8h. 45m. P. M., at an altitude, in this latitude, of 20½°.

Jupiter.

On the 1st, Jupiter rises at 1h. 12m. P. M., and sets a little after midnight. Jupiter rises on the 31st at 11h. 26m. A. M., and sets at 10h. 26m. P. M.

On the 5th of July the second satellite of Jupiter will disappear, by being behind the planet, for nearly three hours (in the evening), while the first is unseen in consequence of being in the shadow of Jupiter. The second satellite comes out from behind the planet, is seen for a few minutes, and then disappears by going into the shadow.

On the 7th, Jupiter, when first seen in the evening, will be without its largest satellite, that moon being behind the planet. On the 14th the same satellite disappears after 10 P. M., by again going behind the planet.

Saturn.

Saturn rises soon after 10 P. M. on the 1st of July among the small stars of *Aquarius*.

Mars, Jupiter, and Saturn can all be seen in the evening hours throughout the month; when Mars is seen directly south, Jupiter will be seen in the southwest, and Saturn in the southeast.

On the 31st, Saturn rises at 8h. 3m. P. M., and sets a little after 6 the next morning

Uranus.

Uranus is not in position for observations. It rises in the morning and sets early in the evening all through the month.

Sun Spots.

The report is from May 22 to June 17 inclusive. In the photograph of May 22 no spot is seen. Photography was interrupted by clouds from May 22 to May 27, and from that date till June 2 no spots were observed. In the picture of June 2, two small spots appeared coming on, and the pictures of June 4 and 5 show the regular motion of this group across the disk, on account of the sun's motion on its axis. On June 7 one of these spots was seen to be much smaller, and in the next picture, June 10, it had disappeared. The other did not appear to change, and was last seen, June 11, on the very edge. In the photographs of June 12, 14, and 15, no spots are observed. The picture of June 16 shows a group of spots on the eastern limb, which do not appear on the picture of the previous day, and the photograph of to-day, June 17, shows the motion to be regular. For a month past the spots have been very few and small.

Another Steam Horse.

Mr. Fortin Hermann, says *Les Mondes*, is testing a machine which is moved by articulated feet which are successively planted upon the ground. Two feet act from the front body and two from the rear, being pressed downward by steam, which besides; in a horizontal engine, oscillates rods which, acting upon the feet, cause the apparatus to drag itself along. From experiments cited, it appears that the feet, when shod with rubber and charged with a weight of 2·2 lbs. per 0·4 inch, indicated an adhesion equal to 0·75 of the weight of the motive machine. The apparatus travels at the rate of from 4 to 4·8 miles per hour; and by a new arrangement, in which one pair of feet trot while the other pair amble, it is expected to run at the rate of 12 miles. It will ascend grades of 1 in 10 with quite heavy loads.

BALDWIN'S ROTARY HAND STAMP.

Mr. Charles E. Baldwin, of New York city, has patented a hand stamp by which the operator is enabled to print any number of colors at one time by a single movement across the paper. In Fig. 1, in the engraving, A represents a cylinder, on which the type is set. The said cylinder has its bearings in the arms of the frame, B, and is held from making more than one revolution by the spring catch, C, which strikes against a pin or lug on the cylinder end. The ink and color rollers rest in slots, D, on the arc, forming bearings for them to revolve in, and are held in such a position by elastic bands, E, attached to rings slipped over their ends, and to a ring set over each end of the type cylinder journals, as shown in Fig. 1. F F F F represent notches or rests, into which such rollers as are not required to be used are lifted, so as to clear them from the type cylinder.

Fig. 1

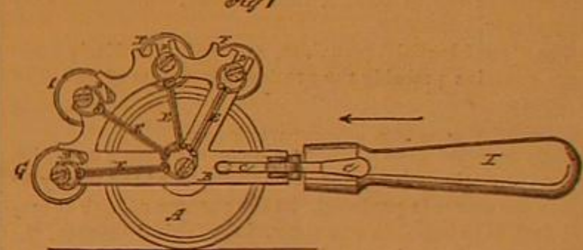
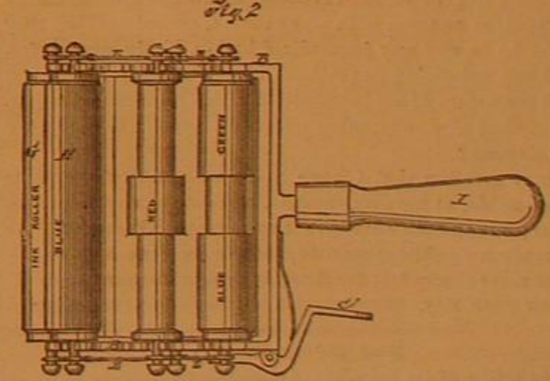


Fig. 2



The engraving represents the device ready for printing in blue, red, and green, and showing the other rollers lifted out of connection with the type. When it is desired to print in black or any single color, it will be necessary to use a single roller, as G or H, and raise all the others off the type cylinder into their respective rests, F. The rollers are wrapped with flannel or its equivalent, so as to absorb a sufficient amount of coloring material to feed the type uniformly.

How can the Grasshoppers be Utilized?

The Minnesota State authorities have hit upon a way of clearing the four counties to which the grasshoppers have confined their ravages, which certainly deserves credit. It is praiseworthy for several reasons, for it has set the people inventing, provided them with lucrative work at a time when the destruction of their crops threatened to cut off all income, and actually put the grasshopper at a premium. The plan is simply to buy the grasshoppers from the farmers at ten cents a quart. The people have fairly jumped at the offer, and it is said that, in every town in the four counties, wagon load after wagon load of the hoppers is arriving, until now the pest is almost exterminated. In one county 1,000 bushels were paid for, and this was one day's catch. One farmer made $55 for the labor of his family for twenty-four hours. Another has driven parties off his farm with a pitchfork since the bounty system has been adopted, claiming the grasshoppers as his, and that he alone had a right to catch them. Still another individual, of a pious turn of mind, who refused to aid in burning the hoppers, on the ground that they were a dispensation of Providence and should not be interfered with, as soon as the reward was offered set his entire family to work, and added his own labor all day Sunday, making a nice sum by his endeavors.

Several ingenious traps have appeared, propelled by horse power, by means of which from five to twenty bushels of the insects are easily taken in a day. When brought to the designated receiving places, they are immediately paid for and buried in a deep trench. Blue Earth county has already bought fifteen thousand dollars worth.

Now, who will invent a use for these millions of collected insects? There is an enormous fortune in the invention, and it seems a waste to dispose of them by simple burial. Will they not yield a coloring matter, or an oil? Desiccated and ground, would they of any use as a fertilizer? Cannot some of our chemical readers experiment and favor us with results?

Correspondence.

The Keely Motor Deception.

To the Editor of the Scientific American:

I was much pleased, as I have no doubt most of your readers were, with your recent able articles on the Keely motor, and which, I am sorry to say, are the only ones (that have yet appeared) calculated to expose to the public the deception of this so-called invention. All the other articles in the daily papers on the subject that have come under my notice have evidently been written to mislead persons, ignorant of scientific subjects, into investing their money in, or rather throwing it away upon, this chimera. Whether these articles were paid for or not, I am unable to say; but they certainly could not have been better advertisements.

The most remarkable feature of this deception is the endorsement it has received from such men as Haswell, W. W. Wood, and others, and which, I believe, has done more to bring the scheme into favorable notice than anything else. It is true that their expressions of opinion, so far as they are made public, are very guarded, and do not absolutely amount to anything; yet the fact of their names being associated with the invention in any but an antagonistic manner amounts to a tacit endorsement of the statements made by the promoters. The hallucinations of otherwise shrewd business men are not so extraordinary, as they must of course base their opinions on those of men conversant with the subject; and when these go astray, it is but a natural sequence that the capitalist should also. This was notably the case in the Ericsson engine bubble, first exposed, I believe, in the Scientific American.

The "confidential" pamphlet, got up by the Keely Company, contains probably the greatest percentum of the chaff of verbiage, compared with the wheat of fact, of anything yet published. The "experiments" therein and subsequently reported give neither a statement of facts on which to base any calculations, nor an explanation of the theory by which the power is produced. In the absence of both theory and fact, it is impossible to show, in a logical manner, the fallacy of an invention; and in this lies the unassailable position of the company, which can only be reached by generalizations. If the publicity which the company is evidently anxiously to give to the invention is not injurious to its interests, I, in common with many others, cannot see that they would be in any way jeopardized by Mr. Keely coming forward and informing us (without communicating his secret) what the nature of his invention is. Has he invented a costless method of decomposing water, or has he discovered a new element?

I may mention that I have made two attempts to go to Philadelphia, at my own expense, and see the engine in operation; but on both occasions it was either "dismantled" or not ready for public inspection, though there were, I believe, a few more shares left for those desiring to invest.

New York city. ARGUS.

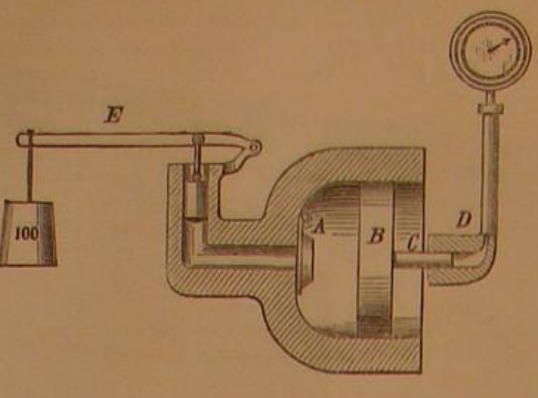
The Keely Motor.

To the Editor of the Scientific American:

You are doing the public valuable service in exposing the Keely motor humbug. Not a week has passed during several months but one or more innocent enthusiasts have inquired: "What do you think of the Keely motor? Isn't it wonderful?" Wonderful indeed; Aladdin's lamp in the older, and the woolly horse in recent, times were not more so.

The motor is said to have generated a pressure of 10,000 lbs. per square inch, which appears to the uninformed to be unprecedentedly high; but it is in reality only a moderate one. In an article in the Scientific American of May 2, 1874, is an account of a pressure forging machine which worked at a pressure of 19,480 lbs. per square inch. Pontifex & Wood, of London, England, once informed the writer that, in making lead pipe, they employed a constant pressure of 17,000 lbs. per square inch. Messrs. Harding of London, England, produced in 1865 sufficient pressure to weld steel ingots together cold, the weld being equal in strength to the solid metal. Mr. Dudgeon will supply any one with an hydraulic jack, which, by interposing a piece of steel ½ of an inch square between the ram and the duty, will exert far more than ten or twenty thousand pounds per square inch. Here is an hydraulic pump:

A is a cylinder, say 5 inches in diameter, provided with a piston, B, the piston rod, C, of one square inch sectional area, acting as a ram in the barrel, D, attached to the pressure gage. E is a lever, say 50 inches long, attached to which (and 2½ inches from the end) is a pump plunger of a sectional area of a square half inch. Now supposing a boy to exert a force of 100 lbs. on the end of the pump lever, he could pump a pressure on the gage of 156,800 lbs. per square inch, if the various parts were strong enough to stand it. Of course in the absence of any air or other elastic fluid, the least motion of the piston, B, would destroy the pressure; in the case of attaching an air receptacle of any kind, and suddenly releasing it after the pressure was obtained, an expulsion of the same nature in every respect as those made by the Keely motor may be given, the length of duration of time of the expulsion being in precise ratio to the quantity of air contained in the air receptacle. That this, in effect, is what Keely virtually accomplished is proved by the acknowledged



fact that his motor consists of chambers containing air and water, the initial pressure being the 26¼ lbs. per square inch supplied by the hydrant, which would of course compress the air (without any mechanical aid whatever) to the same pressure, the space of time necessary to do so being in proportion to the quantity of water passing into the motor, and the quantity of air to be compressed. If the cubical contents of the air space are very small, as would appear to be the case, from the small amount of time necessary to charge and exhaust the motor (as certified to by the operators themselves), a very short time would suffice to obtain the full initial pressure.

Then there are any number of devices by which a cubic foot of air, at a pressure of 26 lbs. per inch, could be compressed into 4 cubic inches of air at a pressure of 11,232 lbs. per inch, which, applied to a small model engine (having a very small conducting pipe so as to wiredraw the compressed air, and cutting off the air supply at one twentieth of the stroke) would run it at a very high velocity for several minutes, as was done in the Keely trial.

If Mr. Keely has anything to exhibit as a force generator, and wishes to demonstrate that it will develop power, let him place a water meter and a pressure gage on the supply pipe *while it is feeding the motor*, and let there be a section of gage glass in the supply pipe, together with a small cock attached, so that visitors may ascertain what amount and at what pressure the liquid, be it water or otherwise, passes into the motor, so that they may see through the glass the appearance of the material, and (by means of the cock) draw off from time to time some of the entering liquid for examination; then let the motor drive a friction pulley, to which a brake is attached in the usual manner, to serve as a dynamometer. Thus we may ascertain what enters and leaves the motor in the form of power, neither of which conditions are complied with in the present exhibitions, neither of which conditions would interfere with a perfectly maintained secrecy as to the nature, design, or mechanical arrangement of the motor, and neither of which conditions can be dispensed with if a fair exhibit is to be made.

I am only astonished that any engineer can be found to certify to the generation of a cold vapor or gas, having unknown qualities and an enormously expansive energy, without taking one step toward definitely ascertaining, by measurement or otherwise, what entered and escaped from the device. It is true these gentlemen certified to little or nothing; but under color of their names, an unmeaning exhibition of hydraulic compression and re-expansion has been foisted upon the unmechanical public as a force generator, to the scandal of the whole profession of engineering.

New York city. JOSHUA ROSE.

The Bastie Glass.

To the Editor of the Scientific American:

So many exaggerated and untrue statements have been made in journals at home and abroad concerning the new glass (called, from its maker, the Bastie glass) that it is the duty of some one to quiet the fears of manufacturers and dealers, who have thought that their occupation was gone and a revolution in their business imminent, by giving the true facts in the matter. Let me first make a few quotations from the journals, and then give the truth, as we understand it, from seeing the article and hearing an explanation of its properties.

It is called "malleable," or "almost malleable," and "unbreakable." It is said to be "annealed" in some oleaginous bath. It is said that "its fragility is diminished, while its transparency remains the same." It is stated that it can be polished, and cut, and engraved by the sand blast, wheel, or acid, just like ordinary glass. Finally, we read that "we may expect that glass will supersede the use of metals for household and manufacturing purposes."

I am aware that all these statements are not authorized by De La Bastie; but they have been so widely spread in the newspapers that many believe them, and interested parties ask each other: "Are these things true? Have we indeed malleable glass?" etc.

As the objective point of the whole business is, I suppose, the sale of the patent in America, for which millions are asked, it is well that a more correct account of the glass should be given.

1. The glass is not malleable, and is not claimed to be so by the inventor. Malleability and brittleness in glass are incompatible; and only in the fabulous stories of ancient and modern writers is malleable glass named, and its possibility was, I think, never allow by any practical glass maker.

2. The glass is not unbreakable. It is only much tougher than common glass, and will bear a much stronger impact. But there is no piece which cannot be broken, and many specimens are purposely fractured at every exhibition.

3. It is not annealed. It is only tempered, toughened or hardened, by its submersion in the hot, oily bath.

4. It cannot be cut and engraved like ordinary glass. Flint and other glass can be ground and cut on the wheel or by the sand blast throughout its entire thickness. Now, although a few specimens exhibited were ground by the sand blast to a very slight depth, yet, if the blast goes beyond a certain depth, it will break into a thousand pieces, just as a Rupert's drop is shivered when ground. I am telling you a fact, for I have in my possession a piece of the fractured glass as it came from the sand blast after being ground, perhaps through a third of its thickness, or about $\frac{1}{24}$ of an inch.

5. It does not preserve its transparency after its transformation by tempering, as most of the specimens exhibited were only translucent. The glass is thus robbed of one of its chief beauties, rendering it unfit for any use where clearness and transparency are required.

6. The glass cannot be cut with a diamond, making it of little or no value for window glass or photographic uses, both of which purposes frequently require the pieces to be cut more than once before exactly fitting the frame or the window sash.

I add, after the above statements, that it cannot supersede the use of metals. Can I call it anything more than an enlarged Rupert's drop, exhibiting many of its optical and crystalline properties? It is a great scientific curiosity, just as the Rupert's drops were 200 years ago, and has excited no more discussion than they did. Hundreds of pages were written upon them, and some of these drops were tempered in oil instead of water, and did not break as the others did. More than half a century ago, a writer in the "Gentleman's Magazine," in an article on tempering glass, gives this direction: "If the glasses are to be exposed to a higher temperature than that of boiling water, boil them in oil." These are curious facts.

I ought to say that, in my opinion, it would not yet be safe for glass makers to throw stones at those who pass, for the impact of a stone, as generally thrown, would break any windows, even of the Bastie manufacture; and although, ordinarily, a saving is made in the squares cut from fractured pieces of window glass, the Bastie article is shivered into the minutest fragments, and entails a total loss. A stoneware baking dish, if broken in the oven, would not necessarily spoil the loaf of cake it contained; while the accidental fracture and explosion into minute fragments of a Bastie article might ruin the contents of the oven, as ground glass forms a very dangerous article of food.

May I add that, before your readers take stock in the Bastie process, it would be well to consult the agents of other processes of a similar character, which are now represented in New York or in Europe? If the papers are to be belived, Baur in Vienna, Pieper in Dresden, Stahl in Berlin, and Meusel in Geiersthal are busy with their processes of tempering glass.

While I do not wish to say, in these times of wonderful discoveries and inventions, that anything cannot be done, yet I think that our glass makers and dealers can still possess their souls in peace, and not lose their temper over the Bastie or any glass yet made, as being likely to make a revolution in their business.

Although formerly a glass manufacturer, and for many years a glass dealer, I am not interested in any tempering process, or glass business of any kind, and only write in the interests of scientific truth and accuracy. When M. De La Bastie, or any other man, can make glass which is malleable, as unbreakable as iron or tin, and tough, and is also transparent, which can be cut with a diamond, and cut and engraved deeply on a wheel, just like Baccarat's glass or that of Bohemia, we will not say "don't" to those who want to take stock. GLASS.

Powder Mill Explosions.

To the Editor of the Scientific American:

When a powder mill explodes, the men at work are unable to explain its cause; this leads me to think that such calamities may be caused by electricity. At all events it is a well known fact that persons dressed in woolen clothing for the body and leather shoes for the feet can, when the air is dry, by moving and twisting their bodies so their clothing will rub against them, produce from their finger ends a spark of electricity sufficient to ignite a gas jet. Can it be that the men who work in powder mills, dressed as above described, in preparing for their work, create so much electricity in their bodies that, when their hands come in proximity with any metal, a spark is given off, which, even if insufficient in tension to explode the powder, may ignite some inflammable gas generated from the chemicals? The powder is exploded, the mill goes up, and the people cry "spontaneous combustion." C. F. ROBERTS

Cottonwood Springs, Neb.

A Method of Destroying Grasshoppers.

To the Editor of the Scientific American:

I wish to suggest a cheap arrangement which, I believe, could be effectively used for the destruction of a swarm of grasshoppers. The instrument is a tin cylinder about five inches in diameter, flattened so as to be elliptical in form, and about ten inches in length. One end is closed completely, but it has a socket into which is fitted a stick or broom handle; the other end is shaped like a grocer's scoop. At the extremity of the cylinder, where the bevel of the scoop commences, is a sliding door of tin, which, when shut, closes the cylinder entirely. Across the base of the scoop and immediately in front of the door is a groove; into it is fastened a piece of lamp wick saturated with alcohol. The cylinder is filled, through the sliding door, about one third with powered rosin; the door is then pushed down until only a small space or slit is left, about ¼ inch or sufficiently to allow the powdered rosin to trickle in a shallow stream over the ignited alcohol, whenever the instrument is held at an angle downwards. The whole thing should cost about $1. When the instrument is held by the handle in a nearly upright position, the rosin will not burn; but directly it is lowered, as in the act of striking, a flame will issue of the width of the cylinder and three or four feet long; and this flashing can be repeated in quick succession as often as the instrument is raised and lowered. Three or four men thus armed could in an hour traverse a large lot of planted corn. The sudden flash, directed to the corn, would be too brief to wither the plant; but it would spoil the appetites, legs, and wings of a mass of grasshoppers. It may be found necessary to mix the rosin with a small quantity of fine gravel or sawdust.

Omaha, Neb. CHARLES PONTEZ.

PRACTICAL MECHANISM.

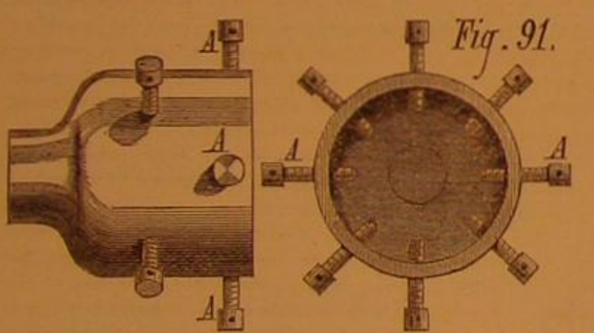
BY JOSHUA ROSE.

NUMBER XXVI.

LATHE CHUCKS.

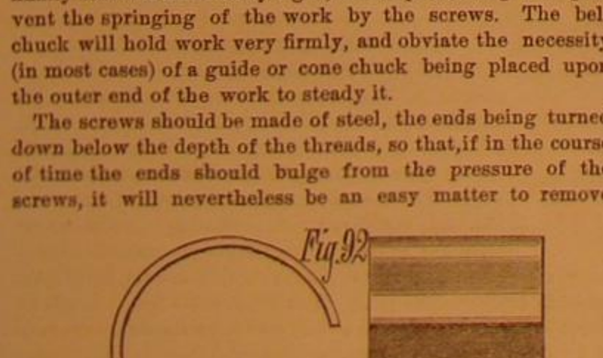
That class of lathe work which, by reason of its shape, cannot be held and driven between the lathe centers, is what is termed chucked, that is to say, it is fastened to the face plate of the lathe by suitable plates and bolts, or held in special chucks. Of special chucks, the universal chuck is the the most useful, and is so common that a description of it is unnecessary. When the running center of the lathe is removed in order to put a chuck on the spindle, the hole into which the center fits should be carefully plugged with either rag, cotton waste, or paper, to prevent the metal turnings or dirt from getting into it; and the screw on the lathe spindle and the face of the collar at the end of the screw should all be carefully wiped, as should the face of the hub or boss of the chuck, since the presence of any dirt there will cause the chuck to run out of true. When the chuck is removed from the lathe, it should be put away standing upright and not laid flat upon its face, in which position dust would accumulate in the thread.

If a piece of work requires to be operated upon at a distance from the face of the chuck, a universal chuck will not hold it sufficiently firmly; and the bell chuck, shown in Fig. 91, should be brought into requisition. In using this

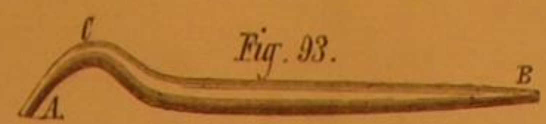


chuck, is best to set it the work as nearly true as possible, using the front screws, A A, before attempting to adjust the four back screws, and to set the work true near the front face of the chuck, striking the work with a mallet (on the end standing out farthest from the chuck) to true it; and then, when the work is adjusted as nearly true as possible, to set up the four back screws, until they each bear lightly upon the work, and then tighten them gradually and successively, giving them not more than a quarter turn each at a time, and continuing from one to the other until they are finally screwed sufficiently tight, which proceeding will prevent the springing of the work by the screws. The bell chuck will hold work very firmly, and obviate the necessity (in most cases) of a guide or cone chuck being placed upon the outer end of the work to steady it.

The screws should be made of steel, the ends being turned down below the depth of the threads, so that, if in the course of time the ends should bulge from the pressure of the screws, it will nevertheless be an easy matter to remove



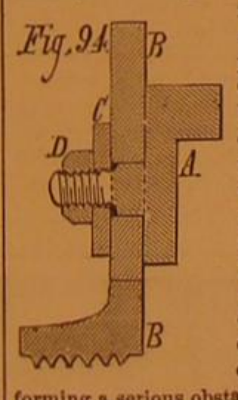
them from the chuck, to replace them when necessary, or to straighten them if they become bent, as is sometimes the case. To prevent bulging, the ends should be tempered to a straw color. When tubes, brass work, or finished work, which is liable to be damaged by the pressure of the screws, is held in a bell chuck, a piece of soft metal, as copper or brass, should be interposed between the screws and the work; and here it is as well to remark that the same precautions should be taken in fastening a carrier, driver, or dog to work driven thereby. Pieces of copper, both flat and of circular form, such as shown in Fig. 92, should be kept for this especial purpose. The object of leaving a space between the two ends is to allow them to close, when required for work of a smaller diameter than the ring of copper, it being obvious that the same piece can be opened or sprung outwards to accommodate work of a larger diameter. To hold rings or hollow work larger in diameter than the bell chuck, the screws may be inverted, that is, put into the chuck with the heads inside and the ends protruding outside the chuck; it is, however, at times difficult in such cases to obtain access to the heads of the screws, but whenever this can be done, the bell chuck will be found a most effective and serviceable tool. A special implement should be kept for inserting into the holes of the heads; for if promiscuous pieces of steel are used, they will destroy the screws by bulging outwards the edges of the holes, making them taper and causing the lever to slip outwards and away from the screw head. Such an implement is called a "Tommy," and is shown in Fig. 93;

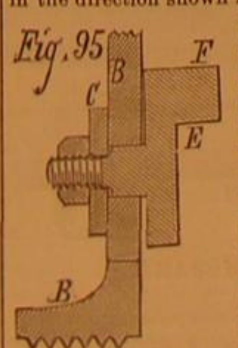


it is made of round cast steel and left soft, the sizes of the ends, A and B, being made to fit the holes in the screw heads. The object of curving the end, A, at C, is to enable the end, A, to be used in instances when the end, B, could not be employed, by reason of some obstruction or interposing projection upon the work.

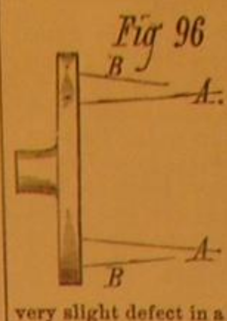
The next form of chuck to be considered is the dog chuck; and of this there are two kinds, the first being one in which the screwing inwards or outwards of one dog operates one or more of the others, by means of gearing or other suitable devices, and the second being those in which the dogs slide in grooves or slots in the chuck plate, and are adjusted to accommodate the work and then bolted firmly to the chuck plate, the work being held by screws passing through the jaws of the chuck.

The first kind of chuck is a very useful tool for ordinary work, and is a necessity to every lathe; but however well it may be made, and no matter how carefully it is used, it will become in time out of true and unfit for work requiring great nicety. For work which does not require reversing in the chuck, it is of course at all times good; but if the work does require reversing, the jaws of the chuck will require adjustment to keep them true; and since such jaws are hardened they cannot be turned up in their places unless they are first removed from the chuck and softened. There can be no doubt that, in a majority of causes, ill usage causes these chucks to get out of true rapidly; and a common reason for their depreciation arises from the following causes: The jaws are, of necessity, adjusted to fit the slots or grooves in the chuck plate with great exactitude, after the manner shown in Fig. 94, A being a jaw to which is secured a sliding fit in the slot of the plate by means of the plate and nut, C and D; from which it will readily be observed that the presence of any dirt upon the face plate will make it very difficult to move the jaw either towards or away from the center of the chuck, and that even the absence of sufficiently frequent lubrication will produce the same effect, because the dust and fine particles of metal collect upon and in the grooves of the chuck, and form a species of gum coating not unlike india rubber, forming a serious obstacle to the movement of the jaw. Instead of properly cleaning the chuck, to obviate the difficulty, the artisan, especially if his job is in a hurry, is apt to slack back the nut, D, thus causing the jaw to fit loosely to the thickness of the chuck plate, so that, when the jaw is forced against the work, it springs away from the face of the plate in the direction shown in Fig. 95, the amount to which the nut is loosened determining the degree to which the lower end of the jaw will spring away from the chuck plate in cases where the work is being held by the inside face, E, of the chuck. If, however, the outside face, F, of the jaw is gripping the work, the jaw will spring in the opposite direction, so that the lower end of the jaw (shown above to be away from the chuck) will be close to it, and the outer end will spring off, the conditions of pressure being exactly reversed. It will be at once perceived that the wear of the face of the jaw and of the face of the plate, C, which fits against the face plate, B, will, if not taken up by the nut, produce in time the same defect; and it is this wear, together with that of the screws, nuts, and gearing, if there be any, to operate the screws, which causes this class of chuck to get out of true, even if carefully used.

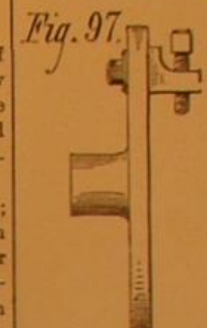




Many cases arise in which it is necessary that the inside face of a piece of work requires when chucked to bear against the face plate if the jaws grip at F, and against the face of the jaw if the jaws grip the work at E, so as to ensure the work being set true with that face. When, however, the jaws of the chuck are loose in the slots or slides, as shown in figure, tightening the jaws upon the work will force the latter away from the face plate to an amount proportionate to a degree of looseness of the jaw, as is shown in Fig. 96, in which the lines, A A, represent the direction in which the inside face, E, of the jaws would stand to the chuck when gripping the work, and B B the direction of the same when the outside face, F, is gripping the work, the effect being, in both cases, to spring or force the work away from the face of the chuck jaws as the case may be, rendering it very troublesome to set the work true, and entailing a great loss of time; for a very slight defect in a chuck is, by reason of reversing the work in the lathe, multiplied upon the work; and when it is considered how many times in a year that defect is encountered, how many times it has performed its duties imperfectly, and how much extra labor in fitting and adjusting has become necessary, it will be readily perceived that it is better to throw away a dozen imperfect chucks, if needful, to obtain a good one.



Chuck dogs are detached dogs which fit into the square holes of the chuck plate or face plate, as shown in Fig. 97, being held to the plate by the nut and washer. These dogs are movable to any part of the plate, their position being regulated to conform to the shape of the work, which renders possible their employment in cases where a dog chuck would be of no service, such, for instance, as holding a triangular piece of work. The center line of the screw should stand exactly parallel to the face of the face plate, or tightening the screws, which in this case grip the work, will force the latter towards or away from the face of the plate, according to the direction in which the screws are out of true. The screws should have their ends turned down below the thread, and should be hardened as directed for bell chuck screws, since these screws may be also reversed in the dog for some kinds of work. The dog should be screwed very firmly against the face plate, so as to avoid their springing.



Universal or scroll chucks, containing screws or gear wheels which are enclosed, should be occasionally very freely supplied with oil, and the chuck worked so as to move the jaws back and forth to the extreme end of their movement, so as to wash out any particles of metal or dust which may have lodged or collected in them; for proper cleaning will reduce the natural wear to a minimum, and prevent the internal parts from cutting, as they are otherwise apt to do.

SCIENTIFIC AND PRACTICAL INFORMATION.

A NEW USE FOR MAY BUGS.

Dr. Chevreuse, of Switzerland, announces a new and curious utilization of the may bug or cockchafer. It consists in decapitating the living insect one hour after it has fed, when, on opening the stomach, several drops of a colored liquid are obtained, which varies with the nature of the plant fed upon. This substance has been used as a water color for painting with considerable success, Dr. Chevreuse having formed a scale of fourteen different tones or shades. It is a permanent pigment, unalterable by air or light, and imparts this quality, it is stated, to other paints with which it may be mixed.

A CURE FOR SOOTY CHIMNEYS.

F. C. R. says: About fifteen years ago, a dwelling was raised one story higher, and a chimney had also to be raised some feet higher; and as the chimney was built up, it was plastered on the inside with salt mortar, to prevent the adhesion of the soot. The result is that the part plastered with salt mortar is white and clean to this day, while the other part gets filled with soot up to the very line where the salted part begins, and has to be cleaned each year, the chimney being in almost constant use. The proportions used were 1 peck of salt, added while tempering, to 3 pecks of mortar.

A NEW GENERAL ANTIDOTE FOR POISONS.

M. Jeannel gives the following formula for an antidote for a number of deadly poisons: Solution of sulphate of iron (D. 145) 100, water 800, calcined magnesia 80, washed animal charcoal 40. These ingredients are kept separate, the solution of sulphate of iron in one vessel, the magnesia and charcoal in another, with some water. When needed, the sulphate solution is poured into the last mentioned receptacle and violently agitated. The mixture should be administered promptly in doses of from 1·6 to 3·3 ounces. From experiments M. Jeannel finds that this antidote, employed in proper proportions, renders preparations of arsenic, zinc, and digitaline completely insoluble. It does not render oxide of copper absolutely insoluble, however, and leaves in solution notable quantities of morphine and strychnin. It neither decomposes nor precipitates cyanide of mercury nor tartar emetic. It saturates free iodine entirely, and acts but partially upon solutions of alkaline hypochlorites. Four ounces of the antidote are found to neutralize the poisonous effect of 1·6 ounces of arsenite of soda. It retards the toxic action of sulphate of strychnin, affording sufficient delay to administer evacuants. One third of an ounce is efficacious against digitaline injected into the intestines. The formula, says M. Jeannel, is certainly preferable to the officinal hydrated peroxide of iron, which, in course of time and at a temperature of 59° Fah., undergoes molecular modifications which render it unreliable as an antidote for arsenical preparations.

IMPROVED GANG PLOW SPRING.

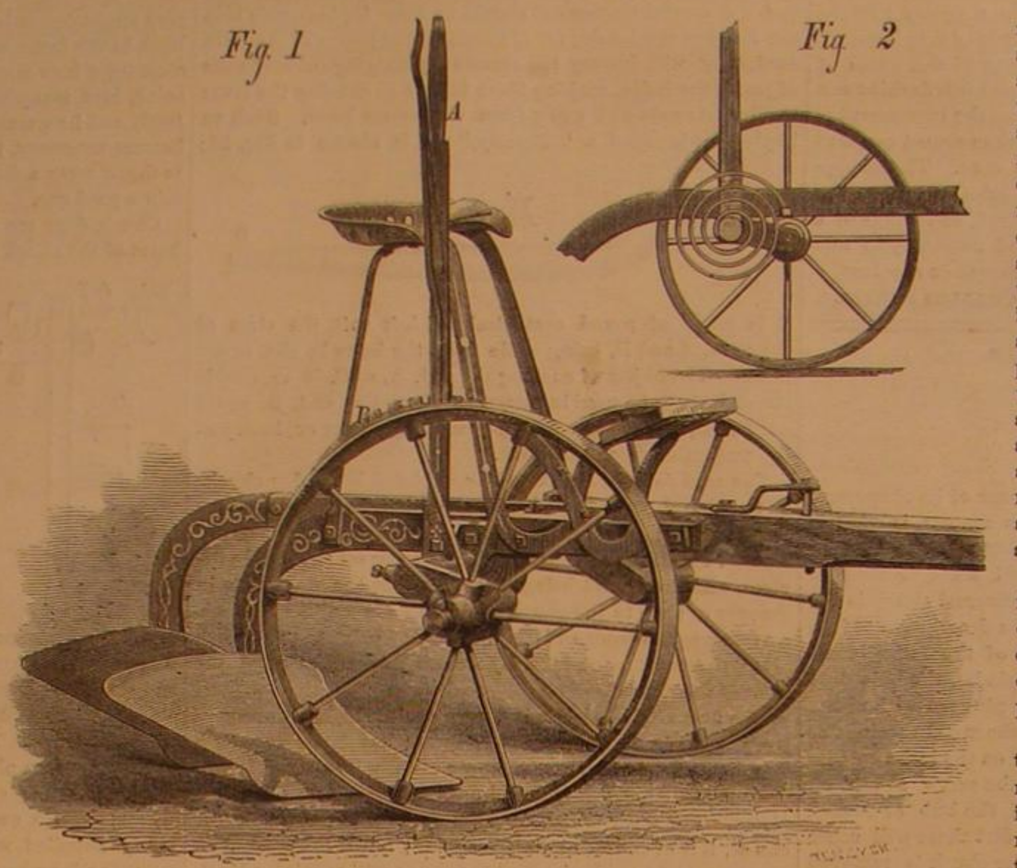
The object of this invention is to afford a simple means whereby the plows may be easily raised and lowered while at work. The essential feature of the device, which we illustrate in the annexed engravings, is a coiled spring which acts upon a crank axle, turning the latter so that the plow may work to a depth of nine inches into the ground or be raised seven inches above it. The inventor points out that plows at present cannot work to a depth of over four inches and a half without requiring changing in some manner, and that it is very difficult to lift them while in operation.

The general appearance of the machine is shown in Fig. 1. From Fig. 2 the arrangement of the spring will be more clearly understood. The ends of the spring are attached to the crank axle, and to the frame of the implement, so that, when the crank, and consequently the frame, is lowered, thus allowing the plows to enter the ground, the spring is caused to wind tightly about the axle. The parts are then held by the lever, A, which is attached to the crank and secured as desired by a simple spring stop in a notched arc, B. To raise the plows so that they may operate at any less depth, or be lifted entirely free of the ground, it is only necessary to release the spring through the medium of the lever, A.

The elasticity of the spring then revolves the axle in such a direction as to raise the frame, and with it the plows, more or less, according to the space through which the said axle is allowed to revolve.

A long crank axle can be used, and thus a wide range of depths in plowing gained. The general construction of the implement embodying the invention is of the most durable description, all parts being of iron except the pole, foot rest, and plows, the latter being of superior cast steel.

Patented through the Scientific American Patent Agency. For further particulars address the inventor, Mr. H. N. Dalton, Pacheco, Contra Costa county, Cal.



DALTON'S GANG PLOW SPRING.

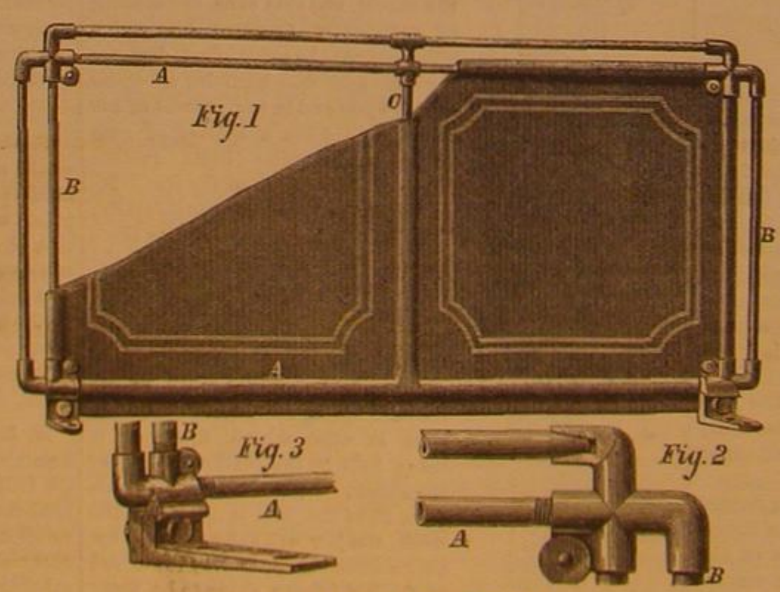
IMPROVED DASHBOARD.

The novel feature, in the improved dashboard represented in the annexed illustration, is found in the construction of the frame, whereby the latter may be contracted or expanded should the leather cover be made too tight or too loose, and which, besides, enables all the stitching to be done before the cover is applied to the frame. The iron work, the inventor states, can be made for half the cost of the old welded frame, and the leather can nearly all be sewn by machine, the ends and tops only requiring hand-stitching. A good workman, we are informed, can, through these advantages, produce thirty or forty dashboards in a day, as against three, which would be considered fair work in the same space of time, if boards constructed in the usual manner were made. The inventor is a practical saddle and harness manufacturer, and has submitted the device to the test of experience, on the results of which he bases the above claims and statements.

From Fig. 1 it will be seen that the frame is composed of iron rods united by T and elbow couplings, and that the construction of the latter enables a rail above and two handles at the sides of the board to be added. The opposite ends of the horizontal bars, A, and of the vertical bars, B, are screw-threaded in reverse directions, so that, by turning said bars in one direction the couplings will be drawn toward each other, and the frame will be contracted; by turning the bars in the other direction, the couplings will be pushed from each other, and the frame will be expanded, so that the leather or cloth cover can be adjusted as required. The center bar, C, may be secured to the top and and bottom bars by T couplings, and the ends of the upper rail and the handles may be conical in shape and held in recesses in the elbows of the corner couplings, as shown in Fig. 3. The last mentioned figure represents an upper coupling, and Fig. 4 shows the shape of a lower coupling, with the manner of attaching the iron which secures the dashboard to the body of the wagon. The bars may be either solid or hollow, as desired.

In constructing the board, the cover is, as above noted, first partly stitched; the bars are then inserted, the couplings are put on and adjusted to give the proper tension. In case of breakage, the entire frame can be removed by ripping the end and top seams, and the device may afterwards be put together. With the old form of dashboard, in such case, it would be necessary to rip every seam, and to replace the cover would involve more labor than the making of a new one. Sheet metal may be used for covering instead of leather, if desired.

Patented through the Scientific American Patent Agency, February 16, 1875. For further information relative to royalties, price, etc., address the inventor, Mr. C. C. Schwaner, P. O. Box 153, Winterset, Madison county, Iowa.



SCHWANER'S DASHBOARD.

India Rubber Sidewalks.

The *National Car Builder* says: India rubber sidewalks are coming into fashion out West. For small towns they are admirable, combining economy with durability. The first experiment was made in Danville, Iowa, where 300 yards were put down on one of the principal streets. All the boys in the place ran over it, but there was no noise. A leading merchant stopped in front of his house, then jumped on his heels. The elastic forces hidden in the rubber threw him over the gate to the roof of the piazza. But after a few trials he was able to alight on the steps with the graceful accuracy of a flying squirrel. The chief drawback to the walk is its odorous familiarity in hot weather, but it can be neutralized by a weekly wash of borax and coal tar. Its principal advantage is that it can be stretched. As the town grows, it is pulled out towards the suburbs. Two yoke of cattle can lengthen it three miles a day.

Window Ventilation.

A recent number of the London *Times* contains a glowing account of a new invention, just brought out in London, whereby it is alleged that apartments of all kinds can be ventilated by a contrivance placed at the window for the admission of air in upward currents. The air so admitted is intended to blow up against the ceiling, and thence spread throughout the apartments without creating drafts injurious to the health of occupants. Our British cousins think that this improvement is the greatest thing out in the ventilation line, and so now that they devote much space to its discussion in their leading papers. Mr. Tobin, a retired merchant of Leeds, is credited with the origination of the improvement.

We should be sorry to detract from the just claims of Mr. Tobin as an inventor, but the truth in such matters is always in order. Our readers will find on page 403 of the Scientific American, for December 23, 1871, an engraving and description of this method of ventilation, which was patented here in 1870 by S. C. Maine of Massachusetts. This device is extensively used in this country. It consists of air pipes set in a board placed under the window sill. The inner mouths of the pipes are bent upward, so that the inrushing air impinges against the ceiling and spreads without creating drafts.

Prizes for a New Method of Preserving Plaster Casts.

The Prussian Government has offered two prizes of the value of about $750 (3,000 marks) and $2,500 (10,000 marks), respectively, for the discovery of a new method of cleansing plaster casts, statues, etc., and for the invention of a new material possessing the advantages of plaster, but which will not deteriorate by repeated washings.

The first prize of $750 is offered for a method which will give plaster casts the power of resisting periodically repeated washings, without injuring in the least the delicacy of the form or the tint of the plaster.

Special conditions.—(*a*) The method must be applicable, in equal degree, to all kinds of plaster occurring in trade, and must not diminish the hardness of the cast. (*b*) In order to entirely preserve the delicacy of the form, those materials are absolutely excluded which do not soak into the plaster. (*c*) It is not necessary to preserve the original color of the plaster; a yellowish tint, or any warmer tint, may be allowed; but the evenness of the color is, at any rate, indispensable. (*d*) Plaster casts prepared according to the method must stand repeated washings with soap and lukewarm water. (*e*) The method must be applicable to plaster casts of any size and shape. (*f*) Competitors for this prize are to prove the practicability of their respective methods by sending samples, and, if desired, by preparing casts placed at their disposal

The second prize of $2,500 is offered for a material for making casts of art works possessing the advantages of plaster, but which, without any special preparation, will not deteriorate by periodically repeated washings.

Special conditions.—(*a*) The new material must easily allow casting in original molds without their becoming more injured than with plaster, and it must reproduce the mold as exactly as plaster. (*b*) It is not required that the material should have the color of plaster; a yellowish tint, or any warmer tint, may be allowed, but the evenness of the color is indispensable. (*c*) The solidity of the material must not be less than that of plaster, so that it may be used for the largest casts. (*d*) Casts made of this material must stand repeated washings with soap and lukewarm water. (*e*) The price of the material must not considerably exceed that of plaster, and the price of the molds for casting must likewise not considerably differ from that of plaster molds. (*f*) Competitors are to prove the practicability of their material by sending samples in applied and unapplied states, and also to give proof, if required, by the actual execution of casts.

General conditions referring to both of these prizes.—The Ministers reserve to themselves the nomination of a committee of experts, in order to examine the consignments which may be received. Competitors are to send with their consignments sealed envelopes, provided with mottoes, and containing the names of the senders. On the outside of these envelopes also is to be written the address to which the returned samples or any communications are to be sent. The consignments which have been found to correspond with the conditions stated above will become the property of the Government, and the names of the successful competitors will be published. The remaining consignments will be returned to the addresses given on the envelopes. Competitors are to forward their consignments to the Royal Prussian Ministry of Public Worship, Instruction, and Health, not later than 31st December, 1875.

Decolorising Property of Ozone.

One of the most striking properties of ozone, says M. A. Boillot, is its bleaching power. The effects ascribed to chlorine are really due to ozone. Ozone employed directly acts as an oxidizing agent laying hold of the hydrogen of the substance with which it is in contact, whence results bleaching, if the body is colored. On allowing chlorine to act upon any animal or vegetable matter, it decomposes a certain quantity of water and seizes its hydrogen, forming hydrochloric acid. The oxygen set free by this reaction is transformed into ozone, which, in its turn, lays hold of hydrogen present in organic matter.

Memory in Birds.

A carrier pigeon which was captured in a balloon during the siege of Paris, and sent by Prince Frederick Charles to his mother, recently escaped from captivity and returned to the house of its former owner in the French capital. This is certainly a remarkable instance of the exercise of memory in the lower animals, to which it would appear difficult to find a parallel case. The bird must have kept its former haunts in its recollection for nearly five years.

To detect sulphuric acid in vinegar, put in a little starch. Then add a minute portion of iodine. If sulphuric acid be present, the starch will not take a blue tint.

MODEL RESIDENCES.

Messrs. Isaac H. Hobbs and Son, of Philadelphia, Pa., have recently designed a villa residence for Mr. William M. Weigley, of Shafferstown, Pa. The architects describe their work as follows: The design is an evolution of the ovo laws of proportion, with a mansard roof. It is built of a very fine stone, of a peculiar rich, reddish brown color. The work will be rock-faced range work with draft base course, and other dressings of picked centers. All the stone work will be very fine; the building is to be finely finished in the interior, with hard, natural wood. The situation of the house rendered it of advantage to have a broad front and not to be deep. The building will cost $22,000. The interior arrangements, as shown in Fig. 2, are as follows:

First story: V is the vestibule, 6 by 12 feet; H the stairway, 10 feet wide, connecting main hall 10 feet, separated by an ornamental arch connection; P the parlor, 15 feet wide, 30 feet long; L is the library and sitting room, 15 feet long by 15 feet wide; an octagonal corner room, 10 feet in diameter, forming an alcove of beautiful proportions; A is a conservatory, connecting the library and side porch by windows running down to the floor; D R is the dining room, 15 feet wide by 26 feet long; K is the kitchen, 13 feet by 17 feet; S is the scullery, 15 by 16 feet. This story is supplied with ample store room, butlery, pantry, and a lavatory under the main stair, also a lift from the cellar to this story.

The second story contains four fine chambers, C, Fig. 2, all of which are 15 feet wide and of the following length; one with octagonal projecting tower alcove, 15 by 15 feet, alcove 10 feet; second, 15 by 25 feet; third, 15 by 17 feet 4 inches. This story also contains a dressing room or boudoir, 11 by 13 feet; a bath room, 11 by 10 feet, with ample linen and other closets. There is a verandah in front and a covered verandah upon its side.

The third story will contain the same number of rooms and accommodations as the second story.

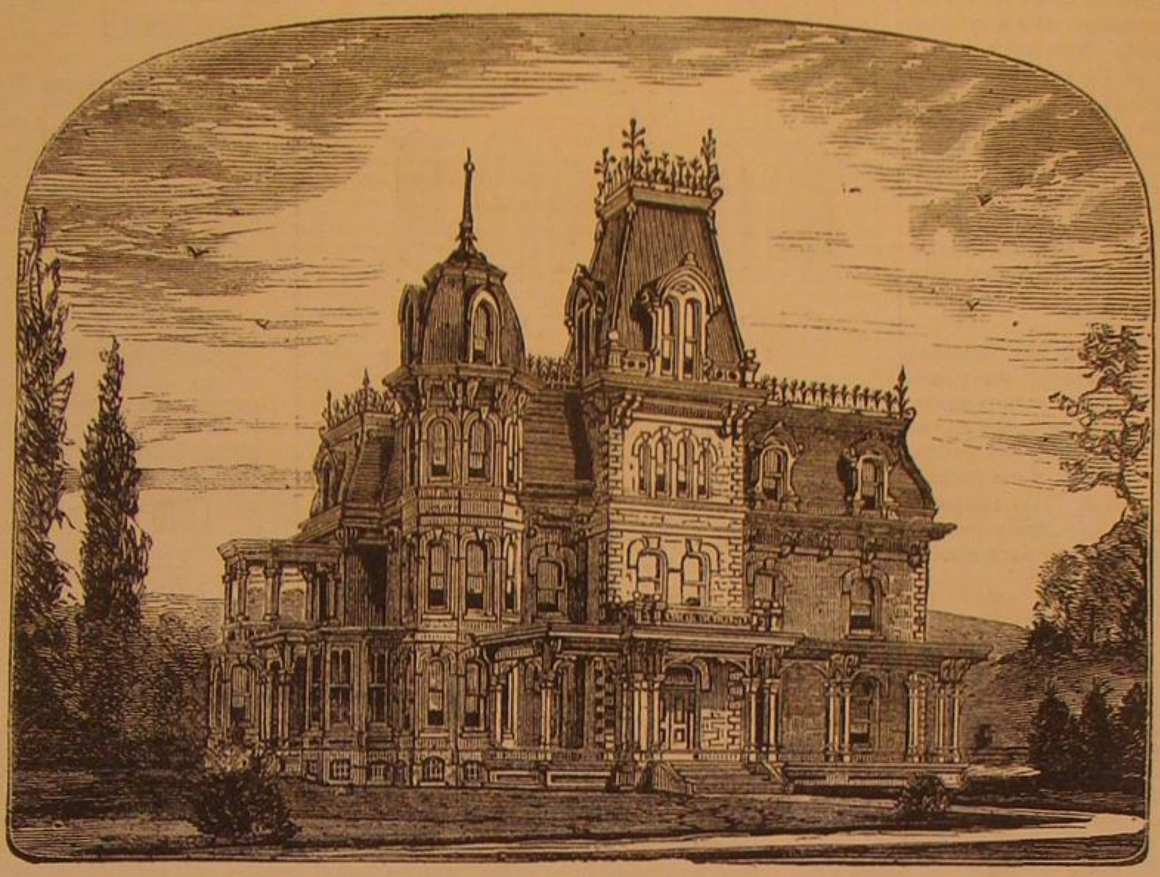


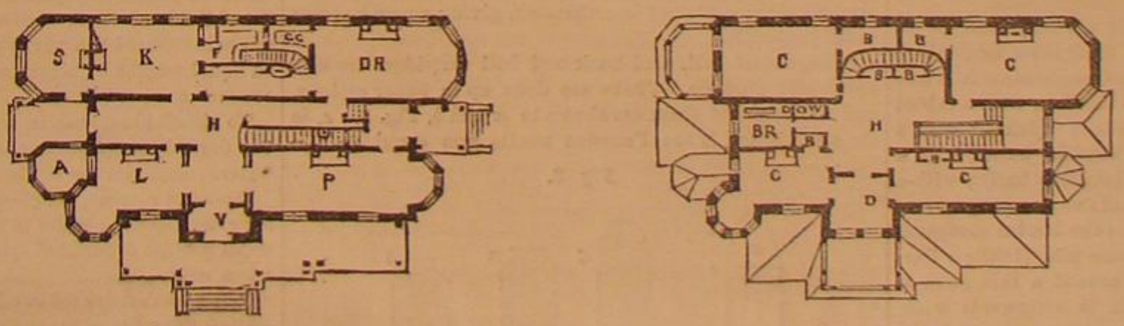
Fig. 1.—DESIGN FOR A MODEL VILLA.

Weighted Silks.

M. J. Pierson states that an increase of weight is produced in silks by treatment with salts of iron and astringents, and with salts of tin and cyanides; this factitious increase of weight may be carried to the extent of from 100 to 300 per cent. It cannot be too widely known that, by this adulteration, silk is rendered very inflammable, and under certain circumstances, spontaneously so.

The Cost of Modern Guns and Armor.

The Engineer places the cost of a vessel, protected by the latest modern armor and armed with an eighty-one tun gun, at $1,500,000. Ships carrying this tremendous weapon have yet to come in conflict; but when such combat does occur, it will probably be the question of but one well aimed shot to send either antagonist to the bottom. The same end may be more easily and certainly accomplished by a properly managed torpedo. The war of the future, on the water at least, bids fair to prove expensive to the losing side.



SECOND STORY. FIRST STORY.

Fig. 2.—PLANS OF A MODEL VILLA.

Celluloid---What is it?

In reply to various correspondents asking for a description of this substance, which is now coming into extensive use, we would state that celluloid is the name given to a kind of solidified collodion. The latter is composed of some fiberous material, such as cotton, which is dipped in sulphuric and nitric acid. The cotton then possesses the quality of solubility and sudden explosion, and is termed "gun cotton," or pyroxylin. This pyroxylin can be dissolved in ether and alcohol, and when so treated is called collodion, and is used in photography for covering the glass plates on which the negatives are made. The dissolved pyroxylin is poured on the glass plate. The alcohol and ether rapidly evaporate, leaving on the glass a fine transparent membrane or skin, of considerable toughness, something like fine horn.

Celluloid is made by using camphor in place of alcohol and ether, in connection with the pyroxylin. The following is the description given by the inventors of celluloid, Messrs. John W. Hyatt, Jr., and Isaiah Smith Hyatt, of Newark, N. J.

"In the practice of our invention, we prepare pyroxylin by grinding it in water to a fine pulp in a machine such as is used in grinding paper pulp. We strain off the water as far as practicable, and then subject this pulp to powerful pressure—for example, in a perforated vessel—to further expel the aqueous moisture, and to bring it to a comparatively solid and dry state, yet still retaining sufficient moisture to prevent it from burning in the further stages of the process.

We comminute gum camphor by grinding it in water, or, preferably, by pounding or rolling it, and thoroughly incorporate, with the pyroxylin pulp in the condition last above described, this finely comminuted camphor, in about the proportion of one part, by weight, of camphor to two parts, by weight, of the pyroxylin in the pulp. These proportions may, however, be somewhat varied with good results. The moisture in the pulp serves to counteract any tendency of the camphor to prematurely develop its converting power under any stimulus incident to its being incorporated with the pulp, or to the further stages of the process.

With the camphor we also thoroughly incorporate, with the pulp, any pigments, coloring matter, or other minerals that may be adapted to the requirements of the articles into which the product is to be manufactured. The camphor, or camphor and other ingredients, having been thus thoroughly mixed with the pulp, we next subject the mass to a powerful pressure, in order to expel the remaining aqueous moisture, and thereby not only dry the mixture, but force the camphor into more intimate contact with the pyroxylin throughout the mass, so that every atom of the camphor shall be in condition and place to exert its utmost converting power as developed.

The dried and compressed mass is next placed in a suitable mold or vessel open at the top, and into this open top is fitted a platen or plunger. The vessel is then placed in a hydraulic or other powerful press, and a heavy pressure, applied to the platen or plunger, is brought to bear upon the mixture, which, while thus under pressure, is heated up, by steam or other convenient means, to a temperature of from 150° to 300° Fah., varying according to the quantity of the mixture; and the mixture is kept at this temperature and under this pressure until the converting power of the camphor shall have been exerted upon the pyroxylin throughout the mass, the heat developing the latent converting power of the camphor, and the camphor exerting this converting power actively upon every atom of the pyroxylin, with which the pressure maintains it in close contact. The process of transformation is rapidly effected, and is completed almost as soon as the mass attains its maximum temperature, the resulting product being a homogeneous product, solidified collodion, or collodion compound having the qualities or properties hereinbefore specified.

This product, as it comes from the press, is of a consistence resembling that of sole leather, but upon exposure to the atmosphere it hardens, by reason of a slight evaporation of the camphor. The ultimate product includes, however, a large proportion of the camphor as a permanent accretion to the mass, which accretion is not only a great gain over the use of ether, alcohol, or other solutions or volatile solvents, which would be entirely expelled or lost, but by its presence gives the solidified collodion or compound the new capability of being again rendered plastic by heat, and remolded into any desired form or shape, without requiring the use of solutions or volatile solvents, or the addition of fusible gums, as heretofore.

A recent improvement on the foregoing consists in transforming pyroxylin into solidified collodion or celluloid, by using a liquid instead of a solid solvent, which liquid solvent, like the solid, is latent at ordinary temperatures, but becomes active and dissolves the pyroxylin upon the application of heat.

The following is the process: We make a weak solution of camphor in alcohol, the proportions being, by weight, one part of camphor to eight parts of alcohol. This solution of camphor is not a solvent of pyroxylin at ordinary temperatures, and we therefore term it a latent liquid solvent, but it becomes an active solvent at an elevated temperature.

In using this latent liquid solvent we first reduce the pyroxylin to a pulp, and mix therewith such coloring or other matters, if any, as are suitable to the required character of the product. The aqueous moisture is then expelled from the pulp. We then add to the dried pyroxylin or pyroxylin compound the above described latent liquid solvent in about the proportions, by weight, of fifty parts of the solvent to one hundred parts of the pyroxylin. The solvent is stirred into the pulp, and the whole kept in a closed vessel until the solvent becomes evenly diffused throughout the mass, no solvent action taking place to retard or prevent this even diffusion, as would be the case in the use of solvents that are active at ordinary temperatures. The compound is then subjected to heat and pressure in a similar manner to that employed when using the solid solvents."

Among the various uses for which celluloid is now employed is the production of dental plates for artificial teeth. It is regarded as superior to rubber in many respects. A beautiful species of artificial ivory is also produced from celluloid as follows:

"We take, say, one hundred parts by weight of ivory dust, one hundred parts of pyroxylin, and fifty parts of powdered gum camphor. The pyroxylin is ground into a pulp while moist, and it is afterward deprived of nearly all of its moisture, leaving it slightly damp, as a protection against its taking fire from any cause. It is thoroughly mixed with the ivory dust and gum camphor, in the proportions just named. After being mixed, the mass is deprived of all remaining aqueous moisture, preferably by pressure between absorbing pads. To this compound, deprived of moisture, we then add fifty parts of nitric ether, and keep the whole within a closed vessel for several hours, or until the nitric ether has become evenly and thoroughly diffused throughout the mass.

The nitric ether permeates and semi-dissolves the ivory dust, the camphor, and the pyroxylin, and thus properly disposes them for final treatment, which consists in bringing the whole compound together into a solid within a heated cylinder or molds under heavy pressure, or by passing it through heated rollers. From 150° to 250°, Fah., of heat is required. The result is a compound which, after being dried or seasoned, resembles natural ivory in compactness and homogeneousness. It is free from grain, is not affected by moisture, and is with great facility remolded into any desired form by heat and pressure in suitable molds.

The proportions of ingredients above set forth may be considerably varied to suit the consistence required and the use to which the new compound is to be adapted.

To the mixture may be added such pigments as are appropriate to the production of various colors."

IRON may be cemented in wood by dropping in the recess prepared in the latter a small quantity of strong solution of sal ammoniac. This causes the iron to rust, rendering it very difficult to extract

BULLETS, CANNON PROJECTILES, AND CARTRIDGES.

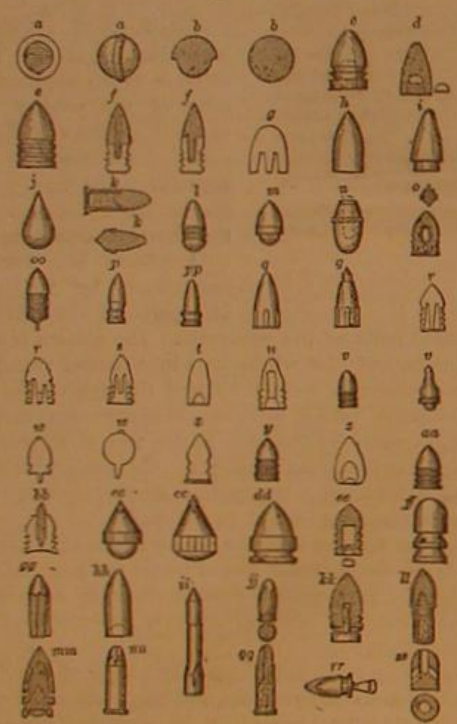
The extracts, from Mr. E. H. Knight's "Mechanical Dictionary,"* given below, comprise the most instructive illustrations and facts therein published on the subjects of projectiles and cartridges.

Fig. 1 represents a large number of improved bullets, beginning with the Brunswick, *a*, which was one of the earliest adaptations of the ordinary musket ball to the requirements of the rifle. This projectile was intended for a two-grooved barrel, and was provided with a simple circumferential belt. The Delevigne bullet, *b b*, involved the use of a sub-caliber powder chamber, and it rested, by an annular shoulder, upon a wooden *sabot*. It had a patch of greased serge. Minié and Thouvenel introduced an elongated bullet, with a cylindrical grooved body and a conical point. This had a greased paper patch, and was expanded to fill the grooves by being driven down upon a *tige* in the breech of the gun. This was adopted in the French service in 1846. Delevigne subsequently patented an elongated bullet with a recessed base, which he called the cylindro-ogival.

Minié produced, in 1857, the well known bullet, *c*, in which the *tige* was dispensed with, and the bullet expanded by the explosive force of the powder in the cup, which was inserted into a frustro-conical cavity in the base of the bullet. The English substituted a conoidal wooden plug in their Enfield rifle bullet, *d*.

In 1856, after a series of experiments by the Ordnance Department, an elongated bullet, *e*, with a cavity, was adopted for the United States army. Two varieties were made, precisely similar on the exterior, but differing in the size of the cavity; that for the rifle musket weighing 500 grains, and the one for the pistol carbine 450 grains. *f f* is the bullet of Thirouse, a French artillery officer. It is composed of lead backed by a *sabot* of wood, with three circular grooves near its base. The Nesler ball, *g*, was intended for a smooth bore.

Fig. 1.

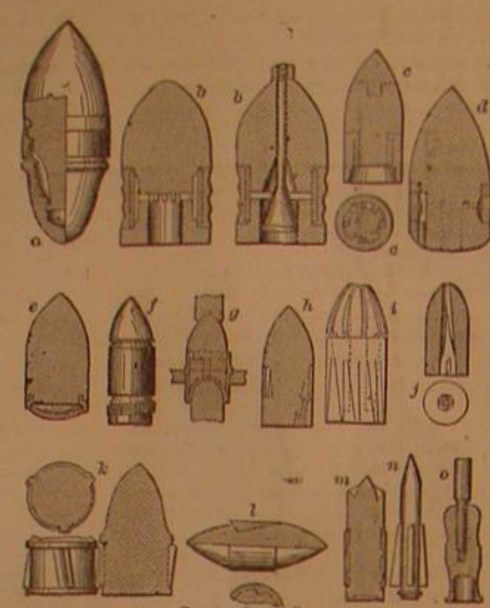


Bullets.

Of the other bullets in Fig. 1, some are celebrated on account of the ingenuity or success of their inventors, others as having been adopted by different governments. *h* is the American conoidal pointed bullet; *i* the Colt, with a rabbet for the cartridge capsule; *j* the American "picket," with a hemispherical base; *k k* Haycock's Canadian bullet, with a conoidal point and a conical base; *l* Mangeot's bullet, with a conoidal point, hemispherical base, and two circular grooves; *m* is the Prussian needle gun bullet; *n* the Norton elongated percussion rifle shell, fitted with wooden plug (1830); *o* Gardiner's explosive shell bullet, cast around a thin shell of copper attached to a mandrel, which is afterwards withdrawn, leaving a fuse hole in the rear, through which the charge is exploded in about one and a quarter seconds; *o o* is a Spanish bullet, containing a charge of powder and a fulminate. The use of exploding projectiles for small arms, such as the three last mentioned, is now generally condemned, and the nation employing them would be adjudged to be without the pale of civilized warfare. *p* is the Swiss federal bullet; *p p* the Swiss Wurtemberger bullet; *q* and *q* are views of Mr. Jacob's bullet and shell; *r* and *r* are views of the Peter's ball, having an interior *tige;* one view shows it distended and battened. *s* is the Belgian bullet; *t* Pritchell's; *u* Mangeot's; *v v* the Austrian; *w w* Deane and Adams' bullets with tails; *x* English bullet with wad; *y* Sardinian; *z* Beckwith's; *a a* steel-pointed bullet; *b b* the Charrin bullet, with zinc or steel point; *c c* and *c c* Tamissier's steel-pointed bullet, one view showing it intact, and the other after compression in the grooves of a rifle; *d d* is the Saxon bullet; *e e* the Baden modification of the Minié, with tinned iron cup; *f f* Wilkinson's; *g g* Whitworth's hexagonal bullet; *h h* Lancaster's; *i i* Metford's sub-caliber bullet, with spiral grooves on the shoulder to impart rotation; *j j* McMurtry's bullet with spiral grooves; *k k* Williams' bullet with a headed *tige* to expand a rounding disk at the base; *l l* Dibble's bullet with a recess for the powder; *m m* Shaler's triple bullet, the pieces of which are intended to diverge after leaving the muzzle; *n n* Madell's bullet, which is built up of interlocking portions, which part as they leave the capsule and muzzle; *q q* Shock's perforated bullet, with a *sabot* in the rear; *r r* Hope's bullet, with a bent tail to direct it in a curved path, and *s s* Matteson's bullet having spiral openings.

* Publishers, J. B. Ford & Co., New York city.

Fig. 2.

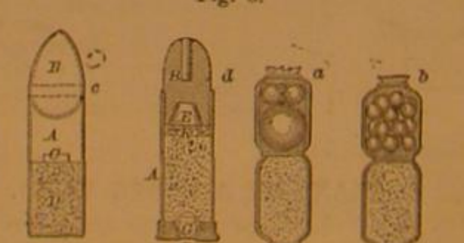


Cannon-Projectiles.

Fig. 2 shows a few of the numerous kinds of cannon projectiles which have been devised. *a* is the Hotchkiss. At the moment of firing, the wedge-shaped piece, shown in section, is driven forward, expanding a soft metal ring which fills the grooves. *b b* is the James. In this the gas passes through the aperture at the back, driving out a number of pins, which expand a fiberous mass surrounding the slot and encircled by a metallic ring, which is thus forced to enter the grooves. In the second view, this is effected without the aid of pins. *c c* are vertical and longitudinal sections of a similar projectile, having a detachable point; *d* is the head, in which the gas enters through holes around the base and expands a band. In the Shaler, *e*, the gas drives forward a metallic cup, flattening it and expanding the *sabot*. A band of copper wire in the Cochran, *f*, is expanded by forcing forward a cup against a surrounding cylinder. *g* is the Boekel. The illustration shows the annular soft metal packing, being attached to the projectile by a swage and dies, while the point is held on an anvil. A packing of wire webbing in the Atwater, *h*, is expanded by wedges driven forward by plungers at the base of the shot. The Woodbury, *i*, is spirally grooved, having a *sabot* for firing from a smooth bore gun. The Taggart, *j*, has a spirally flanged central aperture intended to cause the projectile to rotate on its axis by atmospheric action when fired from a smooth bore. *k*, the Sigourney, has projecting spiral ribs to take the grooves, and annular belts which fit the lands and direct the flight. The Currie, *l*, is conoidal at each end, and has a soft metal packing ring in an annular groove. *m* is a bolt, with chisel-edged points for cutting through iron plating. The annular groove between the cutting edges and the point is filled with soft metal, to prevent retardation. *n* is an elongated bullet, with spiral flanges to import rotary motion when fired from a smooth bore. *o* is an accelerating projectile. This has in front a plunger which, on striking an object, explodes (by percussion) a charge contained in a chamber, giving a new impetus to the projectile.

Plain, round ball, and buck and ball cartridges are now practically obsolete. These are done up in paper casings, and two forms of them are shown in *a* and *b*, Fig. 3. *c*, in the same figure, is the Prussian needle gun cartridge. In this the outlet, B, has a *sabot*, A, separating it from the powder, D, and at its base a cavity, C, for fulminate. Snider's cartridge, *d*, is made up of a sheet brass cylinder, A, in which is inserted a bullet containing a plug of clay, E, in a recess. G is a *sabot*, in the cavity of which fulminate is placed.

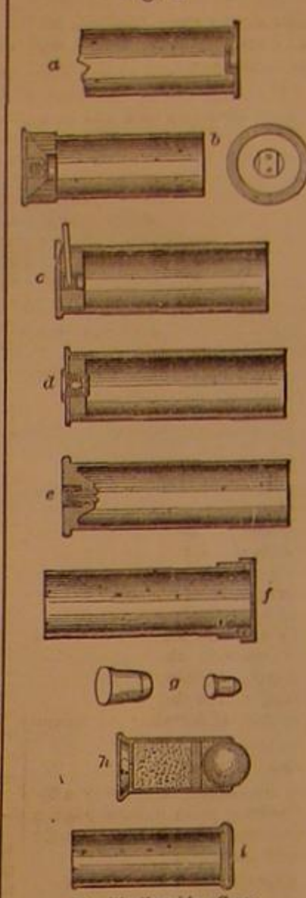
Fig. 3.



Cartridges.

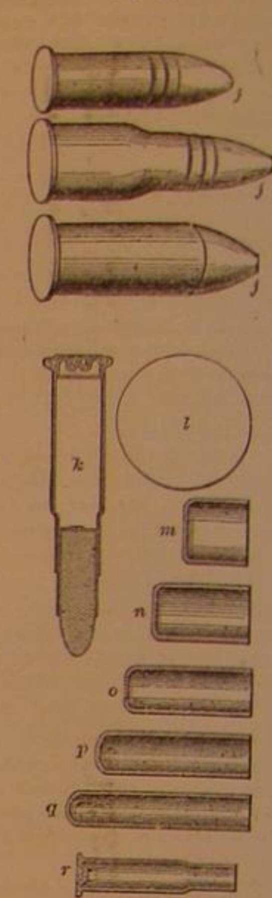
Metallic cartridges are divided into two classes, rim fire and center fire, the first having the fulminate arranged within a cavity around the interior of the flange, and the latter having it at the center of the head or base. In 1826, Cazalat patented the cartridge shown at *a*, Fig. 4, which has a receptacle with a waterproof cover for fulminate. *b* and *c* present two forms of the Lafaucheux cartridge, one of the earliest of its kind. In *b*, the cap is secured to an anvil block; in *c*, a plunger, struck by the hammer, explodes the fulminate in a base chamber. *d* and *e* are modifications of the same without the pin. In *f* there is an annulus at the base to contain fulminate. *g* is the Flobert cartridge, a charge of fulminate at the base of which does the duty at once of priming and propelling. *h* and *i* are Smith and Wesson's patents, 1854 and 1860. In the first of these, the fulminate is contained in a capsule at the base, and in the latter, in an annulus within the flange, surrounding the base of the cartridge and secured in place by a pasteboard disk. *j j j*, Fig. 5, show some other forms of metallic cartridge. *k* is the Berdan cartridge; this has an exterior central recess in the bottom, to receive the cap, which is exploded upon an anvil. The mode now generally adopted for forming metallic cartridges is to punch the blank out from a sheet of brass and to draw it between successive rolls and punches until it assumes the required shape. The forms which the case assumes, during the different stages of the process, are shown in the views, *l* to *r*, Fig. 5.

Fig. 4.



Metallic Cartridge-Cases

Fig. 5.



Metallic Cartridges.

Useful Recipes for the Shop, the Household, and the Farm.

In the Rhine district, grape vines are kept low and as near the soil as possible, so that the heat of the sun may be reflected back upon them from the ground; and the ripening is thus carried on through the night by the heat radiated from the earth.

A non-drying cement of great tenacity, useful to fastening plates of glass so as to exclude air, but which may be easily separated, is formed by adding freshly slaked lime to double its weight of india rubber, and heating to about 400° Fah., when the rubber will be converted into a glutinous mass.

To stop new boots squeaking, drive a peg in the middle of the sole.

To extract the silver from old watch cases and similar articles composed of alloys, dissolve in nitric acid and precipitate the chloride of silver with a solution of common salt. The silver is reduced to a pure state by mixing the chloride with an equal weight of bicarbonate of soda and smelting in a common sand crucible.

To bleach glue, soak in moderately strong acetic acid for two days, drain, place on a sieve, and wash well with cold water. Dry on a warm plate.

Diamond cement, for glass or china, is nothing more than isinglass boiled in water to the consistence of cream, with a small portion of rectified spirit added. It must be warmed when used.

It is said that dry rot in cellar timbers can be prevented by coating the wood with whitewash to which has been added enough copperas to give the mixture a pale yellow hue.

Mercurial steam gages can be kept clean by putting a little glycerin on the surface of the mercury. This serves as a lubricator of both glass and metal, and prevents their contact.

To guard bolting against being gnawed by rats, anoint it with castor oil.

Old engravings, woodcuts, or printed matter, that have turned yellow, may be rendered white by first washing carefully in water containing a little hyposulphite of soda and then dipping for a minute in Javelle water. To prepare the latter, put 4 pounds bicarbonate of soda in a kettle over a fire; add one gallon of boiling water, and let it boil for 15 minutes. Then stir in one pound of pulverized chloride of lime. When cold, the liquid can be kept in a jug ready for use.

An excellent liquid glue is made by dissolving hard glue in nitric ether. The ether will take up only a certain amount of the glue, so that the solution cannot be made too thick. If a few bits of pure india rubber, cut into scraps the size of buckshot, be added, the mixture will, when dry, resist dampness to a considerable degree.

Some brands of albumen paper are subject to blisters when taken from the hypo solution. To prevent this, remove the prints, when fixed, from the hypo into a dish of salt water (a handful of salt to a gallon of water) before the regular washing, and allow them to remain therein for several minutes.

Recent American and Foreign Patents.

Improved Child's Carriage.

William Wuerz, New York city.—This carriage may be conveniently folded up into narrow compass after use. The invention consists in constructing the body and axles of the carriage of hinged sectional parts that may be folded up toward the central longitudinal axis of the carriage; each axle being made of two parts, an interior solid axle, and an outer hollow sectional part, which folds up by its sections on the withdrawal of the solid axle.

Improved Sash Holder.

Ripley R. Calkins, St. Joseph, Mo.—The invention consists of a screw bolt with a thumb piece passing through the sash, and acting on a flanged and spring-acted clamping socket that is guided in a recess of the sash and a face ring of the same. The turning of the screw bolt in one direction carries the socket forward to project beyond the sash and bind firmly against the window casing, retaining the sash at any hight, while the turning of the bolt in opposite direction releases the fastening socket.

Improved Ventilating Barrel.

E. B. Georgia, Clifton, Va.—The invention relates to a peculiar construction of barrel wherein fruits may be packed and transported long distances, and yet preserved with all their original flavor. It consists in perforating the staves with slots and forming a readily removable head, so that the fruit is aerated and the exhalations immediately carried off, while fruit may be entered or removed with great facility.

Improved Electric Fire Alarm.

Wilson E. Facer, Toronto, Can.—This invention relates to certain improvements in non-interfering electric fire alarms; and it consists in the combination with the bolt of the fire alarm box door of a mercury balance operated by the armature of a magnet, whereby the said door bolts of all the instruments except the operating one are locked to provide against any interference of signals. It also consists in the peculiar construction of a notched disk and transmitting lever whereby the alarm signals are sent through the said transmitting lever. It also further consists in the combination with the actuating mechanism of a centrifugal friction governor, to regulate the speed of the clock gearing, and in the peculiar construction and arrangement of auxiliary details forming secondary features of the invention.

Improved Tobacco Knife.

E. T. Shelton, Laurel Grove, Va.—The invention consists in a tobacco knife having a blade provided with a push cutting edge, a draw cut edge, and an intermediate blunt edge, by which previously topped tobacco may be conveniently split and cut off.

Paper Lining for Metallic Shells of Cartridges.

Baker D. Wilson, Shreveport, La.—This invention consists in a paper lining for the metallic loading shells for breech-loading shot guns; the object of which said lining is to hold the load in tightly, keep the powder dry, and preserve the shell.

Improved Cracker Machine.

Adam and John Exton, Trenton, N. J.—The invention relates to an improved means of docking and finishing crackers, and automatically transferring them to the backing pans.

Improved Cracker Machine.

Adam and John Exton, Trenton, N. J.—The object of this invention is to furnish an improved means for conveying or transferring crackers from the molding to a docking and finishing apparatus; and it consists in a horizontally reciprocating rock shaft provided with radial arms or fingers, which work in parallel grooves or channels, and serve to push and roll the molded crackers along to the tubes by which they are conducted to the docking apparatus.

Improved Heel and Shank for Boots and Shoes.

Henry Freiburg and Wm. Meyer, Quincy, Ill.—This invention relates to certain improvements in boots and shoes having wooden heels and shanks; and it consists in a shank and heel made of a single piece of wood with a rabbet and a triangular recess upon its upper front end, to which the leather sole is attached in such a manner as to make a stiff and durable connection for the two.

Improved Windmill.

Geo. Desbrough, Utica, N. Y.—The invention is an improvement in the class of windmills in which the wheel is arranged in the center of a fixed frame, and the access of the wind or blast thereto is controlled by slides or gates. The improvement relates to the arrangement of an annular rack or toothed ring adapted to reciprocate circularly, and flanged friction rollers for supporting and guiding the same, also slotted gates which are pivoted to said rack or ring, and partake of its movement so as to be simultaneously opened or closed.

Improved Knitting Machine.

Albert Tompkins and Ira Tompkins, Troy, N. Y.—The invention consists, first, in combining the take-up roll or rolls with a pair of gear wheels differing in size, and so connected with intermediate mechanism that the operation of drawing the fabric from the needles or cylinder will take place at constantly varying points, and thereby avoid the now common objection of having the draw of the take-up always at the same point relatively to the cam, or some similar device, which never varies its position. The invention also comprehends an improvement in the means of connecting and disconnecting the take-up roll with the gear wheels that operate it.

Improved Thread Tension for Sewing Machines.

John Reece, Stanstead, P. Q.—The invention relates to an improvement in the manner of controlling the supply of thread to the needles. At certain times in the formation of the stitch, a spring clamping device releases the thread entirely from all tension, except that unavoidably due to friction of the thread in the guide hooks, etc., which conduct it to the needle, and during the remainder of the time it holds the thread immovable. The invention also includes an adjustment of the clamping device for governing the time and force of the clamping action.

Improved Hand Corn Planter.

John Beers, Greenville, O.—The planter is carried or suspended vertically by either hand of the operator, and provided with a foot which, when the weight of the planter comes on it, pushes up the seed slide and opens the jaws that form the discharge mouth or passage. The jaws enter the earth and go down, to allow the escape of seed, by means of a trip mechanism, of which the seed slide forms the chief element.

Improved Electric Motor.

Charles J. B. Gaume, Williamsburg, N. Y.—The invention consists in the frame or box armature, made with four, more or less, plain or concaved sides, having half round or square enlargements formed upon their outer or inner surfaces. With this construction of armature, the engine, it is claimed, will run and do its work with a much smaller battery than is ordinarily required.

Improved Spring Trace Carrier and Back Loop.

William Davis, Petaluma, Cal.—The back loop terminates at each end in circular joint pieces which are attached to the back iron. This loop is curved upward. The back iron is curved to fit a pad, to which it is fastened. The lines of the harness may be drawn through trace loops.

Improved Mousing Hooks.

Nels. E. Johnson and Samuel Adams, Chelsea, Mass.—This hook is moused securely when it is closed by a slide on the link of the hook, which is so fastened to the link that the hook is prevented from opening until the slide is moved.

Improved Whiffletree Hook and Clip.

Isaac N. Pyle, Decatur, Ind.—The clip is formed of two wire wrought metal rings, spread apart at one end and welded together at the other, to adapt it to different sizes of single trees. The hook is of twisted and doubled wire.

Improved Hand-Protecting Attachment for Drills.

William M. Hance, Dover, N. J.—In the body of an iron disk is formed a slot, the inner end of which terminates at the center of the disk, and is made of such a size as to fit upon the drill. In the outer part of the slot is placed a metal block, upon the inner side of which is formed a recess to receive a rubber block, and to its outer side is swiveled the forward end of a hand screw, which works in a screw hole in the said disk. When the disk is adjusted in place, the screw is turned forward, which forces the rubber block against the drill, so that the elasticity of the rubber may hold the disk from being jarred down by striking upon the drill with a hammer, and may bring said disk back to its place should it be struck. By this device the hand holding the drill wi'l be protected from a miss blow, and from pieces of metal flying from the head of the drill.

Improved Stone Cutter's Gage.

Edwin R. Batchelder, Prospect, assignor to himself, Charles McLeod, of South Thomaston, and Thompson H. Murch and Henry J. Snow, Dix Island, Me.—This invention relates to an improved device to be used by stone cutters and carvers for facilitating the working of molding and carving, and also for ascertaining the different depth and angle of complicated members in carving in stone. The invention consists of an adjustable gage that is clamped to the tongue of a square, and capable of being set to any angle or depth of sinkage.

Improved Washing Machine.

Edward J. Robinson, Schenectady, N. Y.—This invention relates to the manner of attaching the journals of the cylinder and securing the same. The cylinder is revolved by means of a crank on one of the detachable journals. The latter are screwed into flanged plates cut into the ends of the cylinder. The journals and journal boxes, which are screwed into the box from the inside, and the screw nuts, through which the journals pass, may be removed at any time for the purpose of lubricating the journals or for taking the cylinder from the box.

Improved Traction Engine.

William H. Milliken, Sacramento, Cal.—In this machine the power can be applied to all the wheels, and they can at the same time be turned readily from right to left, and *vice versâ*, for steering and for turning around. The body is mounted so that the weight will be equally distributed, and at all times borne on the wheels alike, no matter what irregularities there may be in the surface, and at the same time the connection is made by springs to obtain the necessary elastic support without the use of rubber. Each wheel is mounted on a short independent axle, which is supported in the lower end of a yoke extending up over the wheel, and pivoted vertically by its inner member to the body, so as to turn, and at the same time allow the body to rise and fall. The inner end of the axle is connected by a jointed section with a middle section having the driving wheel, and geared with the driving engines. For turning the wheels and axles laterally to steer the machine and to turn around. Rock levers draw the wheels together on one side, and force them apart on the other side, and thus direct the machine as desired. The second part of the invention is effected by the use of equalizing supports.

Improved Machine for Sawing Staves.

William Barber, Cape Vincent, assignor to himself and Lewis Parker, Lyme, N. Y.—An adjustable guide or gage, by which the thickness of the stave or other article sawn is regulated, is made with a projecting lip, so that the bearing will be in about the middle of the piece sawn. The cylinder saw of any diameter and width is revolved on a series of rollers. Each roller is made in two parts, the latter of which is adjustable on the arbor to suit the width of the saw. There are wings on the side of the adjustable roller, by means of which a current of air is produced for expelling the sawdust. It is claimed that, with this invention, staves of any length may be sawn, as well as moldings and other stuff for joiner or cabinet work, or other purposes, and that the stuff sawn off is pushed through the same as when sawn by the common circular saw.

Improved Seed and Guano Distributer.

Robert Sappelt, Springfield, N. Y.—The distributing drums are secured sidewise of each other on a lateral shaft, and are revolved by suitable gearing. They are thrown in and out of gear by a spring clutch of the wheel axle, which is connected, by operating lever mechanism, with the handles at the rear part, for producing the instant interruption of the revolving motion of the drums and the dropping of the seed. The lever mechanism is set by a rack arrangement of the handles in the required position for causing the throwing in and out of gear of the drum-revolving parts, and giving thereby the full control over the depositing of the seed and guano. A lateral frame is rigidly attached to the side pieces, for the purpose of supporting the seed-conveying guard plate, which is provided with separate spouts for the seed and guano, so that the same are not deposited at the same point, but at a short distance from each other.

Improved Apparatus for Cutting Out Garments.

Kenneth McKenzie, Hamilton, Canada.—There is a strong iron frame, similar to a printer's chase. The cutters are thin flexible strips of steel, similar to printer's rules, but with sharp edges. For cutting irregular forms, a kerf of the desired form is cut in a pattern block, of wood, with a band saw. The rules are then fitted into the kerf, and the block is secured in the chase by side and foot sticks, interfilling pieces, and wedges, in the same way as type are secured in a chase in making up a form. As thus constructed, the dies may be used upon an ordinary printing press, or upon any other kind of a press that has the requisite power.

Improved Car and Carriage Heater.

John Schmitt, Williamsburgh, N. Y.—This is a heater adapted to hang below a car or coach, and consists in a fire pot having a short pipe opening into a discharge pipe at one side of its outer casing, and held in position by springs.

Improved Sugar Skimmer and Cooler.

John L. Morgan, Savannah, Ga.—In the process of evaporating cane juice for manufacturing sugar, it is usual to have a hand whose special business it is to remove the scum from the boiler, and another to cool the contents and prevent overflow. The invention consists in a strainer, which is placed on the boiler, through which the boiling juice overflows, is cooled, and again descends, leaving the scum on the strainer, the strainer being suspended over the boiler from pulleys by cords attached thereto.

Improved Water Wheel Gate.

James M. Hart, Apple Grove, Va.—This invention consists in the combination of the chutes and cylindrical gate in one piece, so that the vertical adjustment of the chutes and gates delivers the water at full or partial gate, while the hanging of the chutes admits their turning in case of obstruction.

Improved Clothes Dryer.

Edwin S. Heath, North Hope, Pa.—Crooked hanging bars have holes in the ends, by which to hang upon pins in the wall. Cross bars are pivoted to the hanging bars at the projections of the crooks, to be held sufficiently far away from the wall for holding the clothes properly. The pivots allow the rack to be folded up compactly when it is put away.

Improved Coupling for Thrashing Machines.

Edwin Knock, Vermont, Ill.—Four balls are placed in separate cells of hemispherical form, and so loosely arranged that they can readily and freely revolve in all directions. These four balls are placed so that the shank of the coupling clevis is inserted between them. The advantage of this coupling is that it works with as little friction at an angle as when used on a level.

Improved Rotary Cultivator and Chopper.

George W. Fenley, Nacogdoches, Tex.—When the plows are desired to throw the soil to or from the center, standards are adjusted upon a shaft in V form, so that the two outer plows may strike the ground first, then the next two, and so on to the middle one. In chopping, the standards are adjusted upon the shaft at such a distance apart as to leave enough stalks for a stand between them when the machine is drawn across the rows. A lever projects into such a position that it may be conveniently reached and operated to raise and lower the rear end of the frame, and with it the plows, for convenience in passing obstructions, turning, etc. Caster wheels serve as gage wheels to regulate the depth to which the plows enter the ground.

Improved Derrick for Stacking Hay.

Henry John Hay, Omph Ghent, Ill.—A foot block sustains a pivoted upright shaft. The latter is further held up by braces, which may be adjusted to hold the shaft vertical, and to resist the side draft of the hay while being raised and swung over the stack. The derrick arm is composed of three bars, which may be adjusted at any desired hight.

Improved Machine for Pressing Horse Collar Pads.

Arnold P. Mason, George Chamberlin, and Henry W. Chamberlin, Olean, N. Y., assignors to George Chamberlin & Son, same place.—This invention consists of screw-adjusted side jaws, sliding intermediate center piece, and a screw follower, corresponding in shape with the center piece to press the leather and sheet metal tree of the pads into shape thereon. Any size of pads may be pressed by inserting different sized center pieces and followers, and setting the jaws to the width of the same.

Improved Gas Regulator.

David P. Mayhew, Detroit, Mich.—This invention comprises a chamber receiving gas from the main, in which is an exit valve, which is balanced by a water valve, and is also connected by a lever and a couple of rods with another lever, having a counterpoise to be set according to the pressure wanted. The mechanism is arranged in relation to another water valve receiving the gas from the exit chamber, and acting upon the lever to close the exit valve whenever there is an excess of pressure in the exit chamber.

Improved Method of Booking Gold Leaf.

John Varley, New York city, assignor to Stephen Hickson, same place.—This method of booking gold leaf consists in applying each leaf to a perfectly dried sheet of tissue paper or other suitable backing, and then subjecting the same to heavy pressure. The gold leaf adheres intimately to the backing, and may be handled without difficulty, even by unskilled hands, being applied to the parts prepared by sizing to receive it by placing the leaf with the backing thereon, when the leaf will be retained and leave the backing on account of the great adhesiveness of the sizing.

Improved Wind Wheel.

John Julius Kimball, Napierville, Ill.—A stop bar is applied on the lee side of the buckets to hold them to the wind, and is controlled by a weighted lever, so as to serve as a regulator.

Improved Die for Forming Horseshoe Calks.

Leonard Prichard, Sweet Valley, Pa.—This is an improved die for forming, quickly and accurately, horseshoe calks of superior shape and quality. It has a base part to be secured in the anvil, and lateral top grooves, one for forming the shape and tapering base of the calk, the other for producing the central connecting spur.

Improved Fence Post.

John E. Warren, Westbrook, Me.—The standard is cast with upright extension arms, which are stiffened by outer flanges, which last support thereon a cast iron collar, that passes around the extension arms and studs for binding them rigidly together. The studs or half posts are made of such thickness that they fill, together with the intermediately placed rails, the space between the extension arms of the standard. The latter are extended to any desired hight, and are made sloping or inclined at the outer sides, for securing a greater base, a better appearance, and, in connection with the collar, a rigid attachment of the whole wooden superstructure to the supporting standard.

Improved Slate Cutting Machine.

Thomas W. Parry, Danielsville, Pa.—A wing piece projects from the front, on a level with the top of the frame, in which are notches for receiving the back edges of the pieces of slate and squaring the same against the flange. The cutter plate is fastened to the top of the frame. The knife is attached to the end of a lever so as to cut with the cutter plate like a shears, and is composed partly of steel and partly of cast iron. A stand from the sill pieces of the frame is forked at its upper end to receive the cutting lever. The machine is operated by means of treadles connected with the lever at different points. The operator holds the piece of slate over the cutter plate, with its back edge resting in one of the notches, according to its width, and its straight side against the flange, which is at right angles with the cutter plate.

Improved Trace Fastening for Whiffletrees.

John L. Wingate, Mooers Forks, N. Y.—A thimble is made fast on the ends of the whiffletree and has a lug on the outer end. The thimble is stationary; and after the eye is slipped on it, a slot in the latter drops down from the lug, which securely confines the eye between the lug and a collar. In this position the eye plays freely on the thimble, the trace keeping it in position until the horse is detached from the vehicle, and then the eye is turned on the thimble till the slot and the lug correspond in position, when the eye is readily slipped off.

Improved Combined Hames and Horse Collar.

Ezra Stroud, Riceford, Minn.—At the neck the connection is made by a bow rod on each side of the hames, in the ends of which are holes, and also holes through the hames, which allow of an adjustment in width, and also in hight, to fit the size of the horse.

Improved Saw Filing Machine.

William B. Bizzell, La Grange, N. C., assignor to himself and W. H. Hardee, same place.—This invention is an improvement on the saw-filing machine patented to the same inventor, July 1, 1873, which consists mainly of a circular frame which moves along the bed frame in which the saw is clamped, and carries the saw frame above the saw to shift the file from tooth to tooth. The saw frame is capable of shifting around the circular frame to adjust the file to the angle of the teeth. The invention consists of a peculiar feeding gage by which to shift the file frame and the circular frame in which it rests along the saw to shift the file from tooth to tooth.

Business and Personal.

Charge for Insertion under this head is $1 a Line.

Notes & Queries

R. J. will find a description of a steam lithographic press on p. 15, vol. 24.—N. F. S. will find directions for gilding carriage work on p. 288, vol. 24.—J. R. N. will find details of the two-battery spectroscope on p. 355, vol. 24.—K. N. will find a description of fish glue on p. 408, vol. 24.—E. P. will find some interesting particulars as to the Australian blue gum tree on p. 165, vol. 30.—J. F. will find directions for building cement walls on p. 218, vol. 30.

(1) F. H. W. asks: 1. How should animal charcoal be used for filtering sirup? A. The bone black is placed in the form of small lumps on sieves in a tall cylindrical vessel, having at the top a large reservoir in which a constant level of the liquid is maintained by means of an automatic valve. The juice is allowed to gradually percolate through the mass of carbon, and is received at the bottom in large tubs or other vessels. 2. Could I burn the bones in a common cook stove, or would they have to be burnt in an oven made especially for the purpose? A. No. It would be necessary to first exhaust them of all fat and grease, by immersion in bisulphide of carbon. They must then be broken up, placed in iron retorts, and subjected to destructive distillation.

(2) E. F. K. asks: How can I make a cheap barometer that will indicate the changes with tolerable accuracy? A. Obtain a straight fine glass tube about 33 inches long, and as nearly cylindrical as possible, sealed at one end, and having an even uniform bore of about 2½ lines diameter. The mercury to be used should be perfectly pure and free from all air and moisture. This latter requisite may be assured by heating the mercury in a porcelain dish to nearly the boiling point, previous to using it. The tube is then held securely with the open end uppermost, and carefully filled with the liquid metal. The open end of the tube is then securely covered with the finger, the tube inverted, and the end covered by the finger plunged below the surface of a little mercury placed in a small vessel to receive it. The finger is then removed, when the mercury in the tube will immediately fall to a level of about 30 inches above the surface of that in the small reservoir below. In order to attach the scale correctly, it will be necessary to compare the indications with those of some good instrument.

(3) J. B. S. says: In a recent issue you say, in answer to inquiry for a freezing mixture, that 8 parts sulphate of soda and 5 parts hydrochloric acid will reduce the temperature from 50° to 0°. I have tried it, placing one tin can inside another, with about ½ inch between, and I filled the inside can with cool water. I could not see that filling the space with the salt, and saturating with the acid, made any perceptible difference with the temperature of the water. What is the trouble? A. It will be necessary for you to use either thin glass, silver, or other metallic vessels not attacked by the acid used, as any such action interferes seriously with the success of the experiment. If the chemicals used are not worthless, and the proper proportions are used, failure is impossible. You should use a thermometer in the experiments, as the finger is hardly sufficiently sensitive. It should also be borne in mind that the low degree of temperature mentioned in the recipe, as attainable by the solution of this salt, is the temperature indicated by the solution itself; and it cannot be hoped that any large body of liquid contained in a separate vessel and immersed in the solution will immediately, or even ultimately, assume the precise degree of temperature of the other liquid.

(4) S. S. J. asks: 1. What is the philosophy of spontaneous combustion? A. At the ordinary temperature of the atmosphere, oxygen frequently enters (slowly) into combination, without any perceptible disengagement of heat, as when a bar of iron is gradually rusting in the air. In other instances, where the process is more rapid, the heat accumulates, and sometimes it rises high enough to cause the materials to burst into flame, producing what is called a case of spontaneous combustion. This phenomenon is often exhibited in large piles of cotton waste saturated with machinery oil for a long time, moist hay placed in stacks, etc. These bodies expose large surfaces to the atmospheric oxygen; and considerable heat accompanies the rapid oxidation or fermentation that ensues. These bodies being very poor conductors of heat, the result is simply an accumulation of energy with a corresponding rise in the temperature, and this rise in temperature reacts to accelerate the rate of combustion, until a point is reached where the temperature is sufficient to decompose and inflame the gaseous products of the decomposition. The point of inflammation of various substances is, of course, determined by widely different degrees of temperature; phosphorus will sometimes become inflamed at the ordinary summer temperature, while bodies at the other extreme would require, perhaps, thousands of degrees for their ignition. 2. It is said that spontaneous combustion sometimes occurs in the human body. Has there ever been such a case? A. Liebig has demonstrated the impossibility of the living body ever taking fire and being more or less completely consumed through the agency of spontaneous combustion. He affirms that no amount of fat, alcohol, or phosphorus, which the living body could possibly contain, would render it combustible. Upon investigation, the alleged instances of spontaneous combustion were found in no case entitled to credence.

(5) W. T. C. asks: How can I reduce wood to a pulp? A. The fibers of the wood are first separated by passing between large rollers plentifully supplied with water. The excess of water is then removed by pressure, and the fibers are cut into small pieces by revolving cylinders. These pieces are placed in a stamping mill or beating machine with water, in which they are reduced to the consistence of pulp. After this the mass is transferred to another machine, and bleached by a solution of chloride of lime, chlorine water, chlorine gas, or other bleaching agent. To remove all trace of hydrochloric acid, the pulp is washed in solutions of potash, soda, or antichlore, and then in water. In spite of careful chemical bleaching, it is found necessary to add bluing matter in sufficient quantity to neutralize the yellow cast of the pulp.

Will crude petroleum oil injure the skin? A. No.

What is meant by an atmosphere? A. The atmosphere (used as a degree of pressure) is equal to the weight of a column of air reaching from the earth's surface to the limits of the atmosphere, a distance of about forty-five miles. It corresponds to a barometrical column of mercury 30 inches high, and exerts a pressure of about 15 lbs. per square inch.

(6) B. B. asks: I am engaged in the manufacture of glue, and at times am troubled that the glue does not set quickly enough. Can you recommend something which I can use as a dryer? A. Your trouble is probably due to insufficient cleansing of the materials at the beginning of the operation, and imperfect drying of the product at the last.

(7) J. T. asks: What are the proper proportions of salt, manganese oxide, and sulphuric acid, to make chlorine? A. Chlorine may be easily prepared from a mixture of 7 parts by weight of oil of vitriol, previously diluted with 7 parts water, and allowed to cool, and 4 parts powdered salt, mixed intimately with 3 parts finely powdered black oxide of manganese. The gas comes off slowly in the cold, but freely on the application of a gentle heat. The small quantity of hydrochloric acid that comes over with the gas may be easily removed by passing it through a wash bottle containing a little water. 2. How is lime impregnated with the chloride to form chloride of lime? A. The slaked lime is placed in layers several inches in depth upon perforated shelves in airtight leaden chambers, and exposed to the action of chlorine. The gas must be admitted gradually, in order to prevent a rapid rise of temperature, consequent upon its quick absorption by the lime. 3. How much gas will 1 lb. slaked lime absorb? A. Good lime will absorb about one half its weight of chlorine gas.

(8) F. H. W. asks: 1. In manufacturing rubber stamps, do they oil the type before making the plaster of Paris cast? A. Yes. 2. How do they prevent air bubbles from forming? A. The type is first covered with a film of plaster of the consistence of cream. This is worked into all the cavities and around the lines with a camel's hair brush, thus excluding all bubbles of air. Immediately afterwards the thicker plaster paste is poured in, and the whole allowed to set.

(9) G. F. says: I have some silver-plated buckles to my harness, and the plating is all worn off. How can I silver them again without taking them from the harness? A. We think the metal work in question could not be satisfactorily replated without removing it from the harness. 2. How can I japan them black without taking them off? A. A good japan varnish may be made by mixing together 1 oz. of asphalt, 2½ ozs. umber, and 1 pint boiled linseed oil. Thin with oil of turpentine until of the desired consistence.

(10) R. K. W. asks: What is meant by the radiation of steam cylinders? A. The term refers to the heat lost by radiation.

(11) G. B. says: There is a church basement floor which is very moist in winter. It is 70 by 120 feet. Which is the best cement to coat it with? A. Lay a concrete floor, 3 inches thick, of Rosendale cement, clean sharp sand, gravel, and small stone chips. It will take some time to set, but will ultimately become hard and dry.

(12) L. S. asks: 1. Is it better to paint wood work, inside and outside of dwelling houses, with paint mixed with raw linseed oil instead of boiled? A. Raw oil is usually used with a dryer added, but boiled oil requires no dryer. The work has a more shining surface with boiled oil than with raw. 2. How should inside shutters and front doors, which are exposed to the hot rays of an afternoon sun, be painted, in order to prevent blistering? A. Give them a good coat of oil before painting, and give plenty of time for one coat of paint to dry before putting on another.

(13) A. F. A. M. asks: What is the composition of Babbitt metal? Why is it put in journal bearings, and from what did it derive its name? A. It was invented by Isaac Babbitt, of Boston, and is used because it makes a good bearing without any fitting. Its composition, by weight, is: Tin 50 parts, antimony 5 parts, copper 1 part. There are numerous other recipes for Babbitt metal of different grades, but this forms a good composition for general use.

What is the fine and penalty for using a United States postage stamp a second time? A. The penalty is a fine of $50.

(14) T. G. J. asks: What is the best method of filling the pores of cement put on the outside surface of wooden buildings? We propose to first lath and plaster in the usual way, and then cement over that in imitation of brown stone. A. A coat of linseed oil is sometimes put upon brickwork for the purpose of closing the pores of the brick and preventing the absorption of water; and this might also serve the same purpose upon a cement surface. We have very little faith, however, in the permanency of lath and plaster on the exterior of buildings.

(15) J. J. N. asks: I am having built an experimental canal boat, length 21 feet, beam 5 feet. What size of engine, boiler, and grate surface will be necessary? Would you use a long cylinder with small diameter, and an upright boiler? A. We should prefer an upright boiler and a vertical engine. We could not give you dimensions without knowing more particulars; but as your boat is an experimental one, you will doubtless find the best proportions most readily by experiment.

(16) N. A. V. says: The hydraulic tyre press, illustrated in your issue of June 12, has given a little interest to an old question: Is water compressible? If a perfectly tight vessel is full of water, at a pressure of 15 lbs. per square inch, can any more water be forced in? A. Water is slightly compressible. The efficiency of the hydraulic press depends upon the fact that a pressure applied to water is transmitted equally in every direction.

(17) W. P. B. says: 1. I have a small boat, 15 feet long and 1 foot wide, in which I use a double paddle. I would like to run it by steam, and want to know how large an engine I must have. Would an engine of 2 inches bore by 4 inches stroke be large enough to move her, using side wheels? A. Yes. 2. How large a boiler would it need? A. Put in one with from 8 to 10 square feet of efficient heating surface. 3. Would wood do for fuel? A. Yes.

A friend says that he or any one else can tell by the looks of the new moon whether the following month is to be dry or wet. I hold that he cannot. Which is right? A. You are.

(18) H. P. says: I have an engine which was cleaned to a very bright surface; and I was told that, if I whitewashed it, it would keep its polish. I did it, and now it is rusted very badly. How can I remove the rust, and get it bright again? A. Use fine emery and oil.

(19) A. S. says: I have a 60 horse power engine, and run it with 100 lbs. steam, making 60 revolutions a minute, for running a mill. I want to change the cog wheels, making the driving wheel on the upright shaft larger, and the cog wheel on the engine shaft smaller, and to increase the number of revolutions per minute to about 70. How could I best do this? A. Change the governor pulleys so that the governor will have the same speed as at present, when the engine is making 70 revolutions, and adjust the valve, if necessary, so as to give more opening. These directions suppose that you are using a governor adjusted to a certain number of revolutions per minute.

I have tried different experiments to manufacture varnish as used by the larger gun manufactories to varnish guns and revolvers, but without success. It does not last, and has not the same bluish color. How can I prepare it? A. The coloring is generally effected by the use of acids, or by heating the metal. See p. [illegible], vol. 25.

Is there any invention which will save vessels at sea from sinking? If so, please state it. I have a plan which would answer very well, it being cheap, easily adjustable to the vessel, and sure to perform its duty. A. We think you have the market to yourself at present.

(20) E. D. D. says: Suppose a large steam generator be placed in each square of a city, would it not be profitable to connect the steam so as to warm the houses and extinguish any fire that may take place, particularly inside the houses, leaving the engines to play upon the outside? A. The idea is a very good one and has often been proposed. Nearly all modern steamships have steam pipes leading into the holds for extinguishing fire.

(21) P. S. F. asks: In plastering, how much lime, sand, and hair should be used to make a good solid material? A. Use 1 measure of quicklime to 5 measures of sand for brickwork; and 1 measure of quicklime to 4 measures of sand, and one third of a measure of bullock or horse hair, for plastering mortar. Put on the first or scratch coat ⅜ an inch thick, the second, or brown coat, ¼ inch thick. The third, or finishing coat, ⅛ inch thick, contains no hair, and is made of 1 measure of lime to 2 of sand, and the purest sand is used; this is called stucco. Hard finish requires 1 measure of ground plaster of Paris to about 2 of quicklime, without sand.

(22) M. C. B. asks: What will remove white paint from all woolen brown goods? A. Try a mixture of equal parts of alcohol and chloroform.

(23) C. J. H. asks: Will water always seek its own level? We have in our factory a coil of pipes; and at about fifty feet from the coil, we have a tank which holds about 40 barrels. The bottom of the tank is about 12 feet above the top of the coil. We cannot induce water to flow through this coil from the tank. We can readily attach our pump and force it through, but the water will not flow through of itself. Can you explain the trouble? A. It is probably due to the accumulation of air at the high points.

(24) J. M. S. says: I am running a locomotive, and her slide valves are nearly worn out. They are 15 inches long and 5 inches wide, and flat on top. Will it reduce the friction caused by the steam pressure on the valve if I make the new ones in the shape of a half circle instead of flat on top? A. No.

(25) B. B. says: We have an engine with cylinder 8x8 inches, furnished with steam at 60 lbs. pressure through a 2 inch pipe 550 feet long, the pipe being about 8 feet underground. Can we, at that distance, get the full benefit of the steam? A. The engine is large enough, but it is probable that the steam pressure is greatly reduced in passing from the boiler to the engines. If this is the case, it is due to an improper arrangement of the pipe; and you can easily satisfy yourself in regard to the facts by attaching a gage to the steam pipe, near the engine.

(26) W. H. M. asks: In building a large smoke stack, is it advisable to have it octagon in form? Would not storms have a better chance to blow such a stack down than if it were circular in form? A. One form will answer as well as the other.

(27) C. W. asks: Please decide who is right in the following question: The subject is the drive wheel of a locomotive engine supposed to be standing still on the track. I claim that, when the wheel slips, on the starting of engine or when the steam is let on suddenly, any point on the wheel makes a complete circle; but when it makes a revolution in running, it does not make a complete circle. My friend claims that the point on the wheel forms a complete circle in any case. A. When the wheel advances in revolving, each point in the periphery describes a cycloid, a curve resembling a series of semicircles or semi-ellipses.

(28) C. B. W. asks: 1. Is not the side of the firebox of a locomotive boiler the place where contraction and expansion is the least? A. Generally, yes. 2. What shall I put on my engine to keep the bright work from rusting? A. Keep it well oiled; but you will be obliged to clean it often.

(29) J. H. asks: 1. I have a boat 15 feet long by 4 feet beam, a vertical engine, cylinder 3 inches in diameter by 2½ inches stroke, and 3 cylinder boilers 8 by 24 inches each, made of $\frac{3}{32}$ inch steel with heads $\frac{3}{16}$ inch thick, connected by a steam dome. I mean to throw the exhaust into the smoke stack. What pressure can I carry with safety? The boilers have stood a hydrostatic test of 175 lbs. per square inch. A. About 150 lbs. 2. Will the boilers be large enough for the engine? The grate surface is very large, being 24x24 inches. A. Yes. 6. Will the engine be large enough for the boat? A. Yes. 4. What size of screw propeller shall I use? A. Diameter, from 15 to 18 inches; pitch, from 2 to 2½ feet.

(30) G. A. S. asks: 1. What is the horse power of the largest engine in the United States, where is it, and what is it used for? A. We are not sure that we can answer this question correctly; but if any of our readers will send us particulars, the matter can soon be decided. 2. How is the power of a locomotive estimated? A. Builders generally rate locomotives by the load that they can draw under given circumstances.

(31) A. W. says: In your issue of May 15 you say: "When you find that the water is below the bottom gage tap, and the steam is rising rapidly, you should haul the fire at once." If you are gaining steam, and then start and haul the fire, you will gain from 10 to 15 lbs. more, as I have experienced in locomotives. I would recommend this: Fill the furnace with coal so as to choke the fire, keeping the engine and pumps on until you get water in gage glass or steam gets low, then haul the fire if required. How would that do? A. In this case it might not be advisable to start the feed; and if you could stop forming steam more quickly by throwing coal on the fire than by hauling it, you would find the quickest way to be the best way. We believe that, in general, hauling the fire will be most efficient. 2. We have a direct acting locomove engine with cylinders 16 inches in diameter by 24 inches stroke. Steam pressure is 150 lbs., and driving wheels 5 feet, four wheels coupled. She weighs, when coaled and ready for running, about 47 tuns. What is her horse power? A. We could not answer this question without having some idea of the mean pressure in her cylinders.

(32) C. E. R. asks: Will a brass spring ½ inch wide, $\frac{1}{16}$ inch thick, and 2 inches long, lose its elasticity under ¼ inch depression in the middle? A. Not for a long time, and the elasticity can be restored by hammering.

(33) C. R. P. says: We have a brick smoke stack, 70 feet high, and burn wood shavings: when we have not sufficient shavings, we burn anthracite coal; the draft is strong enough to carry out large sparks, and we put a screen of No. 10 galvanized wire over the top, which was used up in 6 months so that we could pick it to pieces; and the copper wire (No. 10), with which it was fastened on, was also eaten up. Is there anything that will do for such a screen? A. Use heavier wire.

(34) C. T. S. asks: What fractional part of the breaking weight of the best steel wire rope, as used for mining cables, is allowed for a permanent load? A. About ⅙ or ¼.

(35) W. F. S. says: I have been using water for a steam boiler from a tank into which the drip from the engine cylinder goes, and the water is consequently quite oily. The tank also takes the drip from the heater. Do you think the water is injurious to the boiler? I have thought that the oil might adhere to the iron of the boiler, and prevent the water coming in contact with it, and so burn the iron. A. You will find it better to use clean feed water; although if the oil is of good quality, and is not excessive in quantity, it will not do any serious harm.

(36) M. A. R. asks: How long would either native or vulcanized rubber endure as a packing for kerosene oil? A. Possibly for a few days.

(37) A. B. says: 1. We have a pump with a steam cylinder 15 inches in diameter, and a water cylinder of 10 inches diameter. The ram is of 10 inches diameter, and discharge opening 8 inches, discharge pipe 6 inches; we pump the water vertically 200 feet. It requires 60 lbs. steam to run the pump. Would it require less power, or more, to pump the water through a 10 inch pipe? A. It would require less power, if the pipe were enlarged, but not much, unless the pump is run very fast. 2. Would the entire weight of the water in the 10 inch pipe rest on the pump ram? A. The pressure on the pump ram, due to the hight of the column of water, is independent of the size of the pipe; but as this pressure is increased by the resistance of the water in the passages and pipe, it is greater for a large pipe than for a small one, if a similar quantity of water is discharged through each.

(38) A. M. P. C. asks: 1. I have a double engine, cylinders 1¼ inches bore by 3 inches stroke. Will a plain cylinder boiler, 1 foot in diameter and 4 feet long, set in brickwork, be large enough to run it up to its full capacity? A. The boiler would be rather too small. 2. If the boiler aforesaid be constructed of $\frac{3}{16}$ iron, how great a pressure could be carried with safety? A. If well made, it would be safe to carry a pressure of 150 lbs. to the square inch. 3. How much grate surface should be allowed? A. Make the grate 1 foot square. 4. What should be the dimensions of the smoke stack? A. From 5 to 6 inches in diameter.

(39) L. L. H. asks: Will Babbitt metal do to make a 3 x 1½ inches cylinder for a steam engine? A. A hard Babbitt metal will wear very well.

(40) L. C. & Co. say: Your reply to E. A. (No. 14, January 30, 1875) regarding draft of street car interested us, but we are quite unable to agree upon the meaning of your reply. We admit and believe that, if the end of the axle of a wagon stands equally high with the point of draft on a horse's shoulder, it makes no difference how far the horse is from the wagon; but suppose the axle to be 2 feet high, and the point of draft on the horse's shoulder be 3 feet high, will the horse draw a load as easily 10 feet from the axle as he will 2 feet from the axle? Is it not easier for a horse, under ordinary circumstances, to be harnessed close to his load, so that the act of drawing lifts a certain amount upon the load? A. It is better to harness the horse so that his whole force is expended on traction, and none on lifting.

(41) N. O. P. asks: What is the rule for measuring the inside of a furnace stack? I wish to know the number of bricks it will take to line it. A. Find the solidities of two frusta of cones, each having for its altitude the hight of the chimney, one having for its diameter that of the interior of the lining, the other of the exterior. The difference between these two volumes will be the volume of the lining.

(42) F. S. Jr. says: Bourne, in his "Catechism of the Steam Engine," states that "if we take the tensile strength of cast iron at 15,000 lbs. per square inch, a fly wheel rim of 1 square inch sectional area would sustain 30,000 lbs." Please elucidate the above for me by stating what is meant by a rim of 1 square inch sectional area. A. It means that, if the rim is cut in the direction of a line passing through the center of the wheel, the area of the cut end of the rim will be 1 square inch.

(43) W. asks: 1. Is it possible to drive a vehicle, large enough to carry a man, by spring power? A. Yes. 2. How large or strong a spring would be necessary? A. You can readily calculate the required strength of the spring for any proposed arrangement of a vehicle of given weight, assuming that the tractive force required, on a good road, will be from 80 to 100 lbs. for a vehicle weighing 1 tun.

(44) R. H. A. says: I have an engine with a utilized steam space of 8 cubic inches, more or less. The fly wheel (of 50 lbs.) is mounted on a pillar about 30 inches high, tapering from 3 to 2 inches diameter, with a strong pedestal of 12 inches spread, bolted to a 3 inch oak platform. There is positively no spring in the standard. When this wheel runs 500 in a minute it is pretty steady; but as the speed increases, agitation begins, until at or about 860 the thing is fearful, and bystanders leave. It seems as if the thing must fly from its fastenings. There are two ways of checking it, one by turning on steam, and the other by turning it off. At about 1,100 revolutions a minute, which is by no means its maximum, it runs so quietly that hardly any vibration happens. Can you give the *rationale* of these movements? A. The trouble seems to be caused by a lack of balance. It may possibly be remedied by making the fly wheel run perfectly true.

(45) J. B. C. says: I have seen statements that decarbonized steel, for gun barrels, would withstand the strains of firing better than plain twist, laminated steel, or Damascus twist. I would like to have your opinion on the relative merits of each of the above barrels, considered in regard to strength and durability. A. The plain twist, we believe, is the best.

(46) A. C. says: We have a mill with an engine 14 inches bore x 30 inches stroke. Our boiler is 24 feet long by 52 inches diameter, with 12 seven inch flues. The engine makes 65 revolutions per minute, and is geared to an upright shaft with bevel wheels. We lack power, and it takes hard firing to make steam. What would be the result if we ran the engine at 100 revolutions per minute, and geared the bevel wheels to run the upright shaft as now? We would gain power, but would the boiler make steam any more easily than now? A. If the engine exhausts into the smoke stack, running it faster may increase the draft. Otherwise we do not see that you will gain much from the change.

(47) W. B. D. says: I am running a 56 inch five gang saw, direct from water wheel shaft pulley 6 feet in diameter to pulley on saw mandrel 2 feet in diameter. I wish to get power into a shop standing in a direct line down stream 50 or 60 feet. I do not use the saw all the time. Can I get as much power on the saw if I run my belt to a line shaft, and then up to my saw, as I now have? A. Some power will be taken to drive the belt and shafting.

(48) C. F. says: H. S. S. asks: "What, if any, is the difference in power required to transmit a given amount to the same sized pulley, if the belt be long enough to run loosely without slipping, or be a short belt with a tightener, or be a short belt stretched very tight?" After many years' experience with belts of all kinds, I have learned that it will require the most power with the short, tight belt, especially if the pulley receiving the power be much smaller than the one giving it. With the tightener there is a greater length of belt brought in contact with the pulley, consequently the belt can be much looser, and thereby lessen the friction upon the bearings. The tightener should be only heavy enough to take up the slack of the belt, which should be quite loose when relieved of the weight of the tightener, which should always be close to the pulley receiving the power. If the power is carried horizontally, the long and loose belt will have a similar effect, as the slack of the belt will always be found on the side of the belt going from the giving to the receiving pulley, which will, if it be the top side, sag so as to bring a much greater length of belt in contact with the pulley than in the case of the short tight belt. A. We would have been glad to receive some facts, as the result of experiment, in corroboration of your views. Matters of this kind cannot be finally settled by mere reasoning, because there is a question of fact involved which can only be determined by experiment. Your views, however, strike us very favorably, and we shall be glad to hear from you again if you will send us some particulars of your experience.

(49) C. S. W. asks: Am I right in claiming that light travels faster than galvanic electricity? A. Yes, as a general rule.

(50) T. C. S. asks: What is the amount of heat generated by passing a current of electricity over a long, thin platinum wire, and the amount of zinc required to generate the necessary quantity of electricity? A. The amount of heat generated would be proportional to the amount of zinc consumed.

(51) E. E. M. says: I have a book on electricity which says that, if a current is sent through a hollow coil of wire, and an iron bar brought to the mouth, that it will be drawn in. I have tried this but have failed. How can I construct such a coil? A. Use 100 feet of No. 14 copper wire, covered with cotton and wound into a helix, and charge with Bunsen's cells whose zincs are connected together for one pole and carbons for the other.

(52) I. A. says: I have a Bunsen battery. The porous cup is 2 inches in diameter and as high as the cell, and about ⅜ inch thick. I cannot get a current through. I think the porous cup is too thick. How can I remedy it? A. Soak the porous cup in warm water.

(53) G. H. A. asks: 1. In what respect do a relay and sounder differ? A. A sounder is wound with coarser wire. 2. How can I coat copper wire with gutta percha for use in batteries? A. Melt the gutta percha and press it on. 3. In what respect is silk-covered copper wire better than cotton for making the magnets of a sounder? A. It is a better insulator. 4. Which is the most economical, as far as battery is concerned, to keep the circuit closed or open when not in use? A. Open. 5. For a line of telegraph a mile or less in length, what number and how much insulated wire will I need for the magnets to the sounder? A. Use 270 feet of No. 24 copper wire. 6. In batteries, should the surface of the zinc and copper be similar? A. Approximately. 7. How can I construct a battery using zinc and lead, so that the blue vitriol will cut the lead instead of the zinc, as is generally the case? A. By first turning your lead into zinc. 8. How can I nickel plate with a battery, using nickel 5 cent pieces? A. Rivet the 5 cent pieces on to a nickel plate.

(54) J. H. asks: Will a Leclanché battery answer for electroplating such articles as watches, chains, rings, etc.? A. It can be used, but Smee's or Daniell's is better.

(55) D. L. G. asks: 1. Is a lightning rod of any benefit whatever as a conductor of an electric charge? A. Yes. 2. Which is the best rod in use? A. Copper. 3. How much space will a rod protect? A. A space equal to its projection above the building. 4. What are the merits of a platinum point? A. It does not rust.

(56) A. O. B. asks: 1. Is there danger of lightning striking telegraph wires and entering the buildings to do damage, if we can cut the offices out and leave the circuit closed? A. Not much. 2. How much No. 11 iron wire (in length) will give 1 ohm of resistance? A. 190 feet.

(57) A. E. C. asks: How is shellac prepared so that it can be put on evenly, between the successive layers of the secondary wire in an induction coil? A. Put 1 oz. of shellac into a wide mouthed 8 oz. phial containing 5 ozs. of well rectified naphtha. Close the bottle with a cork, and let it stand in a warm place until perfectly dissolved. Shake the mixture frequently and pass the fluid through a paper filter; add rectified naphtha to the solution from time to time in such quantities as will enable it to percolate freely through the filter. Change the filter when necessary.

(58) I. R. says: I would like to find the cheapest and simplest way of producing the electric light, and how to construct a battery for that purpose. A. You will require 50 cells of Grove's or Bunsen's, or 100 cells of Daniell's battery, to produce an electric light. Attach the two poles of the battery to two carbon pencils. Touch the pencils together and then separate them, and the light will appear.

(59) G. C. B. says: 1. I have an electrica gas lighter which occasionally gives me a great deal of trouble. When I want to light up, it refuses to work altogether. What is the trouble? A. Soak the carbons for a few days in hot water. Thoroughly amalgamate the zincs, and put new solutions in your battery. 2. Is the Tom Thumb or miniature electric battery strong enough to work a wire from Newark to New York? A. Yes. 3. Is it difficult to telegraph? A. It is as easy to learn to telegraph between these two places as anywhere else. There is no difficulty in the matter. It requires practice to become a good operator on any line.

(60) H. P. M. says: I have just built a privy, the vault of which is 5½ feet deep, being 24 feet from my neighbor's well of drinking water. The well is 33 feet deep in a gravelly soil. Will the use of the privy foul the water of the well? A. The probability is that it will, in the kind of soil that you name.

(61) W. F. S. asks: 1. How should one proceed who wishes to study practical chemistry? Is it best to work in some laboratory at first, and attend lectures on chemistry? A. Yes. 2. Can one have a good knowledge of the science without understanding pharmacy? A. The study of pharmacy is never included in a chemical course, except by those working for the degree of M. D., etc., as it pertains wholly to the preparation of medicines.

(62) P. S. asks: 1. What is considered the best and safest way to make gas for the oxyhydrogen light? A. You will find a full description of obtaining these gases, etc., on p. 218, vol. 32, in answer to J. H. L. 2. I see a notice of a self-condensing cylinder. Are they safe for a new hand to use? A. We cannot consider them safe in unpracticed hands. 3. I also want to know which is the most portable kind, for using with the magic lantern? A. In the larger cities gas may be obtained under pressure in small cylinders suitable for transportation. But as obtained in this form it is necessarily somewhat more expensive, and in the end it will be found more economical to manufacture the gases when required, and to use them in the bags manufactured for this purpose.

(63) A. K. says: 1. We have a brick cistern that was cleaned out a few months ago. The water has a very bad smell. When it is hot, there is a scum on it that is hard, like lime. What will remove the smell, and what causes the scum, as the water ought to be perfectly soft, being rain water? A. Try adding a small quantity of alum to the water before using, and allow to settle for a short time.

(64) O. R. asks: How can I calculate the flow of water in a trough 2 feet wide, 1 foot deep, and 20 feet long? The water runs through with great rapidity, and I do not know any certain method of ascertaining the velocity, and consequently the quantity in a given time. A. Your best plan will be to ascertain the velocity by means of floats, on the surface as well as submerged at different depths.

COMMUNICATIONS RECEIVED.

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

On Patent Politics in Ohio. By A. K. S.
On the Iron Horse. By F. G. W.
On Hydrogen. By T. G. B.
On a Universal Language. By J. C.

Also inquiries and answers from the following:
R. L. N.—J. C. Y.—R. J. F.—J. M.—S. C.—J. K.—A. C. J.—N. T. W.

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.

Enquiries 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 the best silk-covered wire for magnets? Whose is the best line wire insulator? Whose is the most economical turbine water wheel? Who builds the fastest steam launches? Why do not makers of drawing instruments advertise in the SCIENTIFIC AMERICAN?" 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 be in this way be expeditiously obtained.

[OFFICIAL.]

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8,373.—NEWSPAPER RACK.—H. Baker, Providence, R. I.
8,374.—STOVES.—J. V. B. Carter, Detroit, Mich.
8,375.—COOK STOVE.—J. Dwyer, Detroit, Mich.
8,376.—TYPE.—C. E. Heyer, Boston, Mass.
8,377.—MEDAL.—I. Y. Knight, Philadelphia, Pa.
8,378.—CARPETS.—J. C. G. Libert, Paris, France.
8,379.—TYPE.—A. Little, New York city.
8,380.—VALVE WHEEL.—D. McLaughlin, Bridgeport, Ct.
8,381.—SAW FRAME.—H. L. Pratt, Brooklyn, N. Y.
8,382.—WRITING TABLETS.—J. M. Quackenbos, Jr., New York city.
8,383.—VASE.—A. Schlank, New York city.
8,384.—BUTTONS.—J. R. Smith, Waterbury, Ct.
8,385.—FOUNTAIN INKSTANDS.—L. Tower, Boston, Mass.

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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, June 9 to June 15, 1875.

4,827.—C. G. Herbert, New York city, U. S. Plumber's joint. June 9, 1875.
4,828.—E. Caswell, Lyons, N. Y., U. S. Clamping attachment for vises. June 9, 1875.
4,829.—S. Bartlett, Westport, N. H., U. S. Saw set. June 9, 1875.
4,830.—W. Haney, London, Ont. Child's folding carriage. June 9, 1875.
4,831.—C. Hutchinson, Tonica, Ill., U. S. Nut lock. June 9, 1875.
4,832.—S. Nutting *et al.*, New Haven, Vt., U. S. Wheel hub. June 15, 1875.
4,833.—W. Fingland *et al.*, Ottawa, Ont. Salesmen's check book. June 15, 1875.
4,834.—C. Laliberté, Montreal, P. Q. Boot heel finishing machine. June 15, 1875.
4,835.—J. C. Baker, Mechanicsburgh, O., U. S. Screw feed grain drill. June 15, 1875.
4,836.—W. McCammon, Albany, N. Y., U. S. Pianoforte. June 15, 1875.

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