SCIENTIFIC AMERICAN

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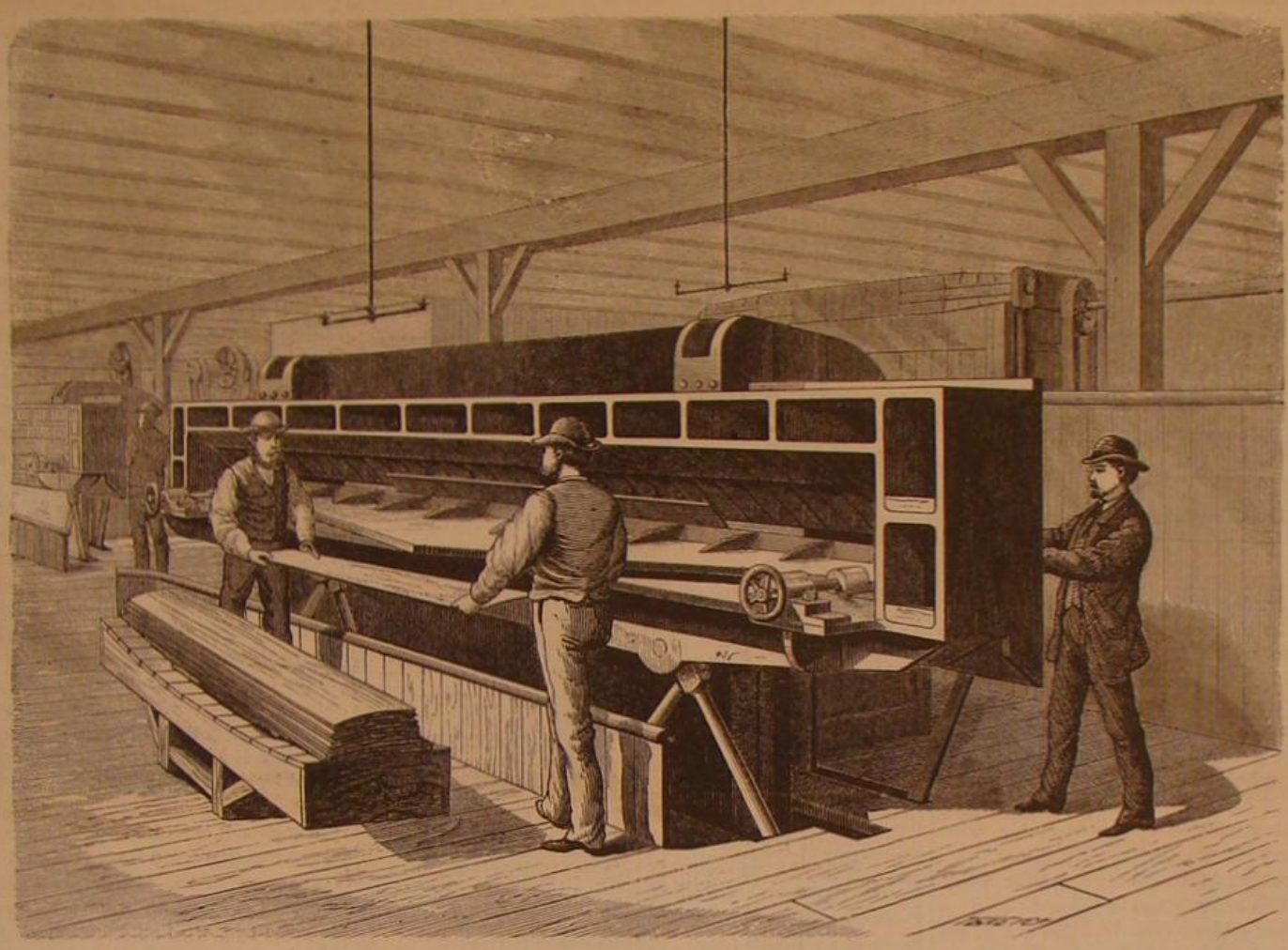
IMPROVED BOARD CUTTING AND SEASONING MACHINES.

In the annexed engravings we represent a new machine for cutting boards and also an improved steam seasoning press. Fig. 1 is the board cutting machine, the invention of Mr. H. T. Bartlett. It is claimed to cut from the thinnest veneer up to boards of $\frac{1}{8}$th to $\frac{3}{4}$ inch in thickness, equal in quality to the same thickness of sawed material and requiring no further planing, both sides being perfectly smooth.

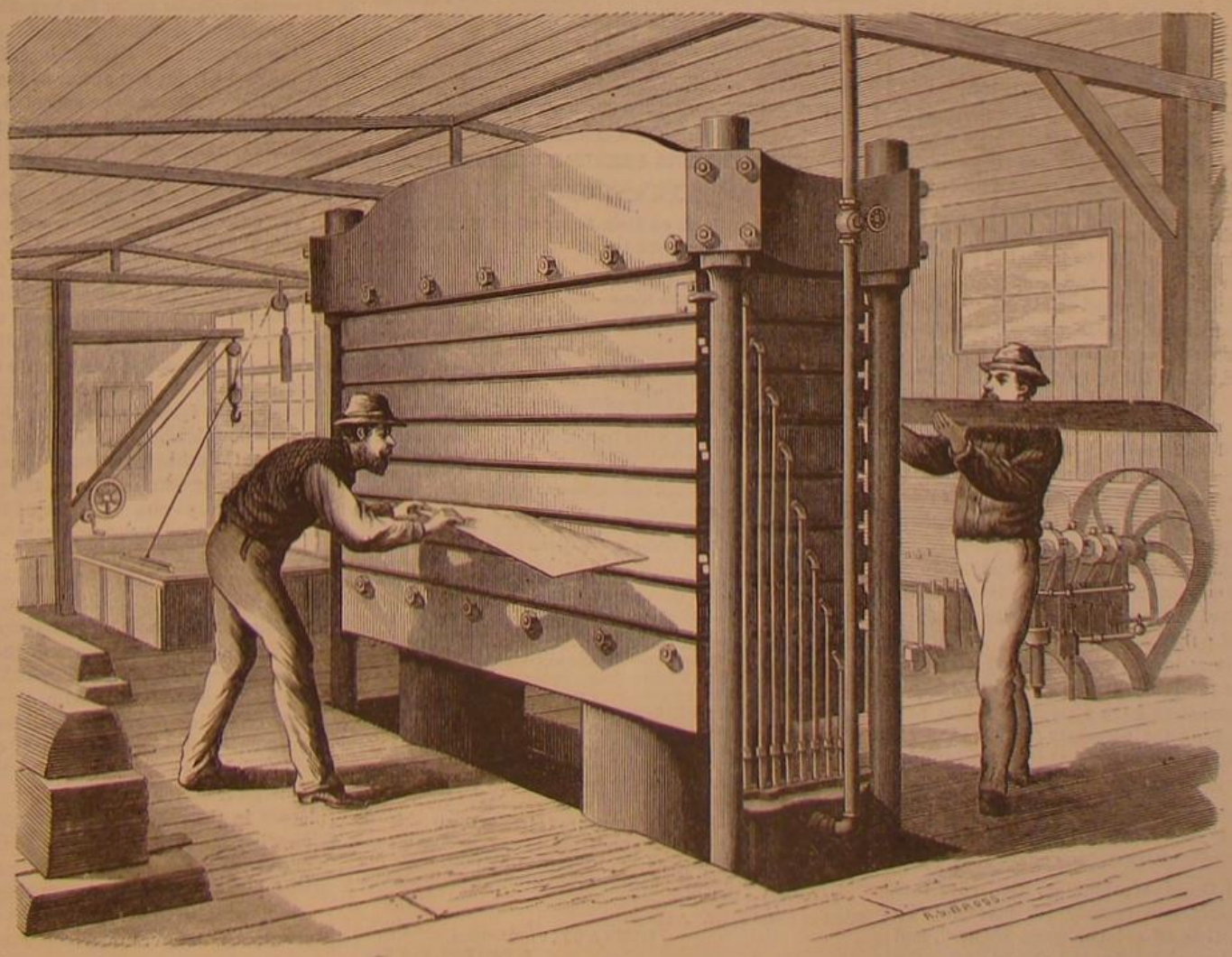
To accomplish this result the usual conditions of cutting are reversed, the log being held stationary while the knife moves through it with a drawing motion.

This is the important feature of the machine; the drawing stroke of the knife being effected by a vertical and horizontal movement of the frame to which it is attached by means of crank and radial rods, with their driving mechanism situated beneath the floor, entirely out of the way. Power is applied by a single 12 inch belt giving the main driving wheels 20 to 25 revolutions and cutting a corresponding number of boards per minute. The several devices for holding the log and the automatic feed during the operation of cutting, while possessing much merit, need not be enlarged upon here. The machine is constructed to cut logs square or round, 8 feet 4 inches long, 28 inches thick, 36 inches wide.

The variable drawing motion of 16 to 40 inches of the knife, we are informed, enables the machine to accommodate itself to all the variations in the texture of the material. There is no dead point during the cut, which is continuous, so that the work is done with comparatively little friction and with economy of power. Another valuable feature in the machine is the adjustability of the cutting table to any height so as to bring narrow logs into the first or longest part of the drawing stroke. With three men to attend the machine and one or two to prepare logs, the apparatus, running at full capacity, 10 hours per day, can, we are informed, produce 280,000 feet of veneers; or its average production is about 50,000 feet of veneer, 20 to 25 feet of $\frac{1}{6}$ to $\frac{1}{4}$ inch and 10,000 feet of half inch stuff. The facility with which the machine cuts boards of the thickness last named is remarkable, and it is, we believe, the first invention which improves upon the work of the saw in that respect. A $\frac{1}{4}$ inch mahogany board 24 inches in width was exhibited to us, which had just emerged from the knife, and which, so far as firmness of grain and smoothness of surface were concerned, was ready for immediate use. Hitherto the work of cutting machines has been confined entirely to veneers, by means of the apparatus represented in Fig. 3, the construction of which will easily be understood. The present machine is the first, however, as we are informed, to produce cut boards of $\frac{1}{8}$, $\frac{3}{16}$, $\frac{1}{4}$, and up to $\frac{3}{4}$ inch thick, with the grain firm and unbroken, and the surfaces so smooth as to need no further dressing.



BARTLETT'S MACHINE FOR CUTTING BOARDS.—Fig. 1.



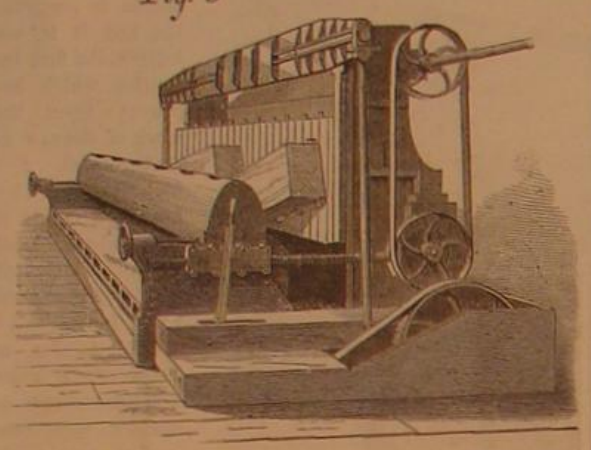
STEAM LUMBER-SEASONING PRESS.—Fig. 2.

By the steam press, Fig. 2, the use of the dry kiln is obviated, and thin lumber of all kinds can be thoroughly seasoned in from two to twenty minutes. It is unnecessary for us to review the present requirements for drying and seasoning lumber. Large space is required for air-drying, which is a slow and expensive process, and after it is concluded the wood is often warped, and exhibits wind buckle or season checks. All these disadvantages are claimed to be avoided in the new steam drying press—the invention of Philip Pfeffer. This consists of a series of steam-heated chambers, the steam being introduced by a pipe at one end of each chamber and passing out at the other, thus keeping a constant circulation of hot steam.

Valves are arranged to govern the entrance and exit of the steam as may be desired. The chambers are adjusted to separate, leaving an aperture between each of an inch or more, according to the thickness of lumber to be seasoned. The boards are then inserted between the faces of each chamber and the pressure applied by forcing the chambers together, either by hydraulic or steam power. The heat of the chambers causes the sap in the wood to become vaporized, which passes off through vents or channels in the opposing face of each chamber, or through perforations in the faces of the lining plates leading to grooves or channels in the inner sides.

The rapid action of the machine was well shown by a test conducted in our presence upon a cedar board 11¼ inches wide, ¾ thick, and weighing four pounds, and wholly unseasoned, being just from the cutting machine. It was placed in the press for five minutes, at the end of which time it was found to have shrunk ¼ of an inch in width, and to have lost 1¼ pounds in weight. The same principle is applied to curved plates, and thus lumber is seasoned and shaped at one operation. This will particularly apply to coffin, piano, and chair

Fig. 3



manufacturers. It is hardly necessary to point out that these machines are of the character which work revolutions in the manufactures to which they relate; and this, not merely from their capability of yielding better material, but from the fact of the economy which they insure. It certainly can be no longer economical to saw thin boards when it is possible to produce the same without loss by sawdust, and without requiring the subsequent planing to fit them for use, resulting in a gain of 40 per cent to 50 per cent on material. The saving of time effected by the seasoning press is too obvious to need any reference here.

Both machines were patented through the Scientific American Patent Agency in this country and in Europe.

For further information, address Geo. W. Read & Co , 186 to 200 Lewis street, foot of Fifth to Sixth street, East River, New York city, at whose large veneering and hard wood lumber establishment both machines are in daily and successful operation, and with whom arrangements may be made for the purchase of territorial rights or licenses to use either or both patents.

THE WOODRUFF SCIENTIFIC EXPEDITION.

We have to acknowledge the receipt of a new prospectus of the Woodruff Scientific Expedition, an enterprise which, as we recently explained, has for its object the conveying of a class of students around the world on a two years' voyage of combined instruction, amusement, and science. We observe that the fee (payable in advance fifteen days before the ship sails) has been reduced from $5,000 to $2,500 per head, and that the steamer Ontario, a larger and more commodious ship, has been substituted for the vessel originally proposed. There are various other inducements offered, which, if the entire enterprise were not, as we learn, based on a series of contingencies, would render the project a very attractive one.

But it appears that not only does the necessary capital for its execution depend on the obtaining of 400 subscribers at $2,500 or $2,000 each—naval cadets being taken at the latter figure—but the various scientific gentlemen who are to accompany the vessel have agreed to go under the conditions that such material support is first secured. Similarly we understand the testimonials quoted in the prospectus to be given by these eminent writers, with the understanding that if the scheme as explained to them can be carried out, then the project is worthy of public attention.

In the present hard times, probably no capitalist would invest so large a sum as a million dollars in a project of this kind, and hence the promoters have adopted the best and most feasibly way of raising the necessary funds. But on their success depends the realization of the scheme, and it, perhaps, is open to question whether 400 people can be collected willing or able to pay down the goodly sum required in advance. We shall probably revert to this subject again.

H. F. ANDREWS, M.D., of Washington, Ga., says that cologne water is an efficacious remedy for poisoning by poison ivy. A good article of cologne must be used, and frequently applied. The vesicles should be broken when the remedy is applied.

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VOL. XXXVII., No. 10. [NEW SERIES.] *Thirty-second Year.*

NEW YORK, SATURDAY, SEPTEMBER 8, 1877.

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DISCOVERY OF SATELLITES OF MARS.

Professor Asaph Hall, of the Washington Observatory, has recently announced the interesting discovery of two satellites attendant upon the planet Mars. At about 11 o'clock on the night of August 16, Professor Hall, by the aid of the great 26 inch refractor telescope, noticed a very small star following Mars by a few seconds. Two hours later he looked again, and to his surprise found that the distance between planet and star had not increased, although the former was moving at the rate of 15 seconds per hour. Hardly crediting his discovery, Mr. Hall delayed further observation until he could bring the matter before his colleague, Professor Newcomb, and that astronomer, being confident that the discovery of a satellite had been made, calculated roughly its time of revolution, which he found to be 1 day and 8 hours. This enabled the prediction of the probable place of the satellite on the following night—a prediction which was verified. On the morning of August 17 another satellite appeared, and its identity was fully recognized.

The distance of the first satellite from the planet is between fifteen and sixteen thousand miles, which is less than that of any other known satellite from its primary, and only about $\frac{1}{16}$ the distance of the moon from the earth. It is exceedingly small, having a diameter of not over 100 miles. The inner satellite is believed to be still closer to the planet, and to have a period of less than 8 hours. The first moon is distant 80, the second 30 seconds from their primary. Further and more accurate details will, however, soon be forthcoming, as probably the keen eyes of astronomers the world over will now be turned upon Mars. Next to our moon, more full and accurate knowledge is possessed regarding Mars than of any other heavenly body. Venus is nearer to the earth, but when most closely approximated she is invisible, being concealed by the solar light. Mars, however, may be examined under favorable circumstances, and during the present year the conditions are especially advantageous, owing to the planet being in opposition to the sun, near perihelion. The apparent disk is now larger in the proportion of 3 to 1 than when the planet is in aphelion, while the illumination is more brilliant in the proportion of 3 to 2. At the same time the planet is nearer perihelion than previously for more than 30 years; so that in the heavens its brightness is but little inferior to that of Jupiter.

While the surface of Mars has been mapped with remarkable accuracy, and although probably no other planet has been subjected to more keen and continuous scrutiny, yet up to the present time all searches for satellites attendant upon upon it have been fruitless. Most astronomers have not hesitated to assert that none such existed, though it has been said that if Mars has moons they are too small to be recognized by any telescope extant; but in any event the probable presence of Martial moons was not to be predicated on any phenomenon exhibited by the planet itself, and if their existence was suspected it was because it would be more in accordance with the nebular hypothesis that they should be present than absent. In a work on astronomy published some 40 years ago, we find mention of a phenomenon on Mars which might possibly lead to the idea that the planet was subjected to reflected light from some near body, and that was, that a curious and persistent illumination of the planet had been noticed, which, under the circumstances, was unaccountable, save under the hypothesis that the planet was slightly phosphorescent.

The discovery is a triumph both for Professor Hall and for Mr. Alvan Clarke, the maker of the great telescope. It, besides, shows what may be expected of the still more colossal instrument which at no very distant day we hope to see established in the Lick Observatory.

MACHINE HONESTY AND ITS CIRCUMVENTION.

The exceedingly ingenious mechanical devices often found among the tools of burglars and safe-breakers are in themselves sufficient to demonstrate the fact that all the inventive ingenuity is by no means confined to honest people; and it is scarcely necessary to say, to any one conversant with that peculiar instinct of the inventor which causes him to regard almost any mechanical obstacle as a challenge to his abilities, that in the bell-punch and similar apparatus of "machine honesty" the desire to overcome the difficulty is added to the nefarious incentive. Hence attempts to "beat" the machine, as the crime is vulgarly termed, are not uncommon, nor yet unsuccessful, although the perpetrators are usually in the end found out. The use of this apparatus began in this city about two years ago, when it was discovered that stage drivers and car conductors were in the constant habit of supplementing their scanty earnings with drafts on the fares collected. Accordingly that ingenious contrivance known as the bell-punch was largely introduced, receipts of the companies at once increased, and it was hoped that the evil was prevented. The bell-punch perforates a slip and the piece punched out is retained in a receptacle in the machine. At the same time a bell is sounded and a hidden indicator moved on a dial. Hence the fares collected are shown first by the number of holes in the slip, second, by the number of pieces punched out, and third, by the indicator; while a placard in the vehicle warns the passenger to listen for the ring when his fare is collected. Hardly had the punches come in use when frauds were detected. A smart mechanic drove a thriving business by making neat little bells which were inserted in the conductor's coat sleeve. The latter would, on collecting a fare, pretend to punch a hole in the slip—covering, however, a hole already made—and at the same time by pressing his arm against his body would sound his

concealed bell and so satisfy the passenger. This, by the employment of detectives, was soon stopped; but the ingenious conductors still managed to "keep ahead of the punch" by simply neglecting to use it when the cars, as is often the case, were so packed as to render close observation of their movements impossible. Several city car lines eventually abandoned the device for apparatus much more simple, to which we shall refer further on. Recently, however, another detection of bell-punch frauds has been made, and a regular conspiracy has been revealed between sundry ingenious scamps who showed the conductors how to pick the locks of their punches and set back the indicators, for the considera- of $1 per day, the conductor, of course, making up this amount and as much more as he safely could by theft.

There are various other devices analogous to the bell punch now in use on our city car lines. None of them, however, punch slips. One is a metal box suspended in full view on the conductor's breast. On receiving a fare he is required to move a catch which sounds a bell and changes a number indicating the quantity of fares received, which appears on the front of the box. Another machine displays no number, but simply rings a bell and moves an indicator locked up inside. Some of these machines were constructed at first to register only a certain number of fares, say 1,000, and then to return to the naught point. The conductors soon discovered this, and after collecting the money they would ring the bell up to its limit, help themselves to the amount of money they wished, and then register anew fares to correspond with the amount they left for their employers.

It will be observed that the tendency of all these machines is to make the passenger a policeman over the conductor to keep him in the path of rectitude, and it is curious to notice that the more of these devices there are invented the more is this duty imposed upon the passenger. The largest street railroad line in this city, that on Third Avenue, has abandoned the bell-punch for a simple dial in the car, with which is connected a square rod which traverses the length of the vehicle near the roof. In order to turn this rod, and so sound the bell and move the index, which the conductor is required to do on the receipt of each fare, a wrench must be used, and, of course, the arm lifted high above the head. This compels the conductor to take a noticeable position, and as the rod is accessible only while he is on the vehicle, the conductor can not, as with the bell-punch or other portable device, pretend to register fares while temporarily off his car. The movement of the dial hand attracts attention, and thus the watchfulness of the passenger is still further enlisted.

There are two devices, however, which advance considerable further in this same direction. One is the fare-box, by the use of which the railroad company tacitly asserts that it prefers to trust to the honesty of the public in general than to that of its employees, and the other is a most ingenious apparatus, of which we shall presently speak, and which literally compels the passenger to look after the employees in order to keep himself from being swindled.

The fare-box is, however, fast becoming a bone of contention. It is simply a box into which the passenger is invited to place the correct fare. The driver—there is no conductor in such cases—is not allowed to receive or put in money, and the extent of his pecuniary duty consists in handing back change for small bills, said change being previously sealed up in envelopes, and as the driver aforesaid has always to return the amount he starts out with, he cannot conveniently steal any. When the passenger puts in his money the driver can see and count it, and that done he moves a slide which dumps it into a locked box below, whence it is removed by an official at the terminus. The box, we have stated, is a source of aggravation to the sovereign public, first, because one set of unthinking individuals are constantly throwing in too much and clamoring for change after the money is engulfed in the locked receptacle, when removal is impossible, and second, because perverse people decline to be ordered to do anything by the railroad company and demand that if their fares are wanted somebody must come and get them. The latter have multiplied of late, and are vigorously asserting themselves. The driver cannot take the fare, and if the passenger refuses to comply with the rules, that passenger must be put off the car. The passenger resists and a disturbance results, the upshot of which may be to block the line, and, as was the case here recently, keep some 200 other passengers in rear cars waiting a considerable time.

By far the most ingenious of all these devices is that devised for use on city cabs. There is a metal circular case on the face of which are two concentric circles. The inner one is marked as a clock, the other is divided decimally to indicate dollars and cents. The hands on the inner circle are controlled by clockwork, that on the outer circle must be moved by the driver. From one side of the clock extend wire rods on which is a sign with the words "to hire." Between the rods is a watch. The whole is pivoted on the cab just in rear of the driver's seat, and in such a manner that when the "to hire" sign is turned uppermost it stands above the roof and is plainly visible. In face of the passenger in the cab is an opening through which the watch is seen when the sign is turned down.

If, when the cab is hired, the driver does not turn down the sign, the passenger will demand it, because otherwise the watch cannot be seen, and by this watch the time for which the cab is used and paid for is determined. But the action of turning down the sign starts the clock, and this then goes on registering hours and minutes. When the passenger leaves the vehicle he pays his fare, and this the driver registers on the dial bell-punch fashion. The driver must then turn his sign up. If he does not, the clock will continue running, and he will have to pay for the time himself at the regular tariff of 50 cents per hour. So from the two dials at the end of the day the inspector sees just how long the cab has been used and the amount collected. On the back of the clock is still another dial, on which is an index which moves over one division every time the sign is turned down. This shows the total number of trips, and is locked so that the driver has no access to it. It prevents the driver charging for trips only a fraction of an hour in duration as for a full hour. It will be seen, therefore, that by noting the trips and number of hours employed, the inspector can at once calculate the amount which the driver owes.

It is difficult to see how such a device as this can be defrauded. The objection to it is its inapplicability of such conveyances as stages and street cars; and for these vehicles some device which shall absolutely ensure the honesty of their conductors or drivers is still a necessity. We commend the subject to inventors as a promising one for their efforts. Only let them remember that, however ingenious they may be, ingenuity as sharp as theirs will probably be brought to bear to circumvent their apparatus. Perhaps the safest rule to go by is to try to contrive a device which shall, like some of those wonderful intricate locks, be impracticable of access or alteration even to the inventor himself.

FOOD.

In discussing, last week, the subject of how shall working men live, we quoted a table prepared by a working man's wife, showing a list of necessaries on which her husband, herself, and five children (under 9 years of age) subsist. This category, which is claimed to represent the cheapest and most economical living attainable by the compiler, we here republish, as we propose to use it as a text for some further remarks.

WEEKLY.		DAILY.	
Rent	$2 00	1 quart milk, 6c	$ 42
1 barrel wood	25	2 quarts potatoes, 6c	42
2 pails coal	16	2 8-cent loaves	1 12
Burial society	22	1¼ pounds meat, 20c	1 40
Oatmeal	14	Salt	2
2 pounds butter	60	Pepper	2
3½ pounds sugar	40	Mustard	2
Half gallon oil	9	Matches	1
2 cakes soap	14	Starch	3
1 pound soda	3	Bluing	1
Half pound tea	25		
Newspapers	12	Total	$3 47
Shaving	10		4 50
Total	$4 50	Total	$7 97

It will be observed that this, among other things, is intended virtually as a practical answer to the question as to the minimum amount of food on which a family of presumably average size and weight can live without detriment to health. The ultimate destiny of food is, to quote Dr. Wilson of Edinburgh, "the development of heat and other modes of motion, which together constitute the physiological phenomena of animal life." Food not only, however, supplies potential energy—which becomes converted into actual or dynamic energy—but it supplies the material for the development of the body. Hence inorganic and organic matters are both necessary, the latter, however, being alone oxidizable or capable of generating force. The organic constituents are divided into nitrogenous, fatty, and saccharine compounds—the inorganic into water and saline matters. Of these the nitrogenous portion constructs and repairs the tissues, it is the muscle and brain producer; the carbonaceous portion goes to maintain animal heat, aids the conversion of food into tissue, generates fat, etc.; the saccharine portion has heat-producing powers inferior to the fatty constituents, and finally the water and saline matters dissolve and convey food to different parts of the system, consolidate tissues, remove effete products, etc. In general, however, the phenomena of nutrition depend mainly on the chemical interchanges of nitrogen and carbon with oxygen, and therefore different articles of diet are estimated in nutritive value according to the amount of nitrogen and carbon they contain.

Dr. Letheby, in his valuable work on "Food," gives a table showing the amount of carbon and of nitrogen in a large number of articles of diet. From this table we have taken the values of the varieties of food in the above list, and we find that the sum total of the entire regimen amounts to 18,117 grains of carbon and 751 grains of nitrogen daily. According to Dr. Wilson, the dietaries of women should be about one tenth less than those of men, and of children under ten years about one half (maximum) those of women. Applying these rations to the aggregate, we find that the husband's daily diet is 4365 grains of carbon and 180 grains of nitrogen; and the wife's 3928 grains of carbon and 162 grains of nitrogen, and the remainder constitutes the food of the children.

Now this diet is not enough to support life in the husband and to enable him to work. In other words, we mean to say that a man that attempts to do even moderately hard work on food containing the proportions we have mentioned, is steadily falling behind in the struggle for existence. And it is mathematically obvious that he cannot improve matters save at the expense of other lives. From the mean of all the researches which have been made by eminent physiologists—and they cover thousands of instances—Dr. Letheby gives the following as the amounts required daily by an adult man for idleness, for ordinary labor, and for active labor:

	Carbon grs.	Nitrogen grs.
Idleness	3816	180
Ordinary labor	5688	307
Active labor	6823	139

Compare these figures with those quoted, and it will be seen that the nitrogenous products in the latter are just equal to the requirements of an idle man, and far below those of one at work, while the carbonaceous products—which do not form muscle—are somewhat in excess in one case, and too low in the other. But a better idea of the comparative nature of diets can be obtained from some of the following instances of the dietaries of low fed and well fed operatives in England, which we take from the tables of Drs. E. Smith and Playfair.

The mean of twelve classes of low fed operatives, which include the farm laborers and weavers over the different sections of the kingdom, shows an average daily dietary of carbon 4881, and nitrogen 214. These are about the worst fed people in England. The staple of diet is breadstuffs, and then potatoes—not a class on the list gets more than 18·3 ozs. of meat in a week—yet the average of all is above that of the American workman. Let us examine, however, some instances of well fed operatives. The English railway navvy (whose class corresponds to that of the workman under consideration) has 8295 grains of carbon, and 482 of nitrogen; the blacksmith, 6864 carbon, 437 nitrogen; soldiers in peace, 5246 carbon, 297 nitrogen; prize fighters (training) 4366 carbon, and 690 nitrogen. The mean of eleven classes of well fed operatives is carbon 5837, nitrogen 400.

The trouble with the diets of our working men is not in their cost, but, as in the present case, in their bad selection. Here are 5½ lbs. of food (butter and sugar) which together aggregate 23234 grains of carbon and no nitrogen, at a cost of one dollar per week. The butter could be altogether abolished, and the sugar reduced one half; the eighty cents so saved could be laid out in Indian meal, or dried peas, beans, rice, barley meal or fish, all of which contain large proportions of nitrogen. A pound of red herrings, costing say 10 cents, contains 217 grains of nitrogen; a pound of skim cheese at the same price contains 485 grains; split peas, worth about 8 cents a quart, contain carbon 2699, nitrogen 248; beef liver, always cheaper than beef, contains carbon 934, nitrogen 204, while beef itself contains carbon 1854, nitrogen 184.

It may be said that working men cannot be expected to consider chemically everything they eat. Perhaps not, but it is the duty of sanitary authorities, and others charged their welfare, to do it for them. Half a pound of cheese, a pound of Indian meal, and a quart of milk, together aggregating 5187 carbon, and 449 nitrogen, cost 14 cents. On this a man could do steady work for one day, and could keep on on the same diet continuously. The same sum would purchase one loaf of bread and a quarter of a pound of butter, on which, as a continuous diet, a man could not subsist. For the guidance of working men who wish to base their living on proper and cheap food, we give herewith Dr. Letheby's table:

	Grs per lb. Carbon.	Nitrogen.		Grs. per lb. Carbon.	Nitrogen.
Split peas	2099	248	Skimmed milk	438	43
Indian meal	3016	120	New milk	599	44
Barley meal	2563	68	Skim cheese	1947	483
Rye meal	2693	86	Bullock's liver	974	204
Seconds flour	2700	116	Mutton	1900	189
Oatmeal	2831	156	Beef	1854	184
Baker's bread	1975	88	Fat pork	4113	106
Pearl barley	2660	91	Dry bacon	5987	95
Rice	2732	68	Green bacon	5426	76
Potatoes	769	22	White fish	871	195
Turnips	363	13	Red herrings	1435	217
Green vegetables	420	14	Suet	4710	—
Carrots	508	14	Lard	4819	—
Parsnips	554	12	Salt butter	4285	—
Sugar	2955	—	Fresh butter	6456	—
Molasses	2395		Cocoa	2834	140
Buttermilk	387	44	Beer	274	1
Whey	154	13			

The American Institute Exhibition.

It will not be the fault of this paper if the coming exhibition of this Institute should prove to be a chaotic mass of half arranged merchandise on the opening day (September 12), for we have so often given notice of the fact that an exhibition is to be held, and have as repeatedly given notice of the time; nor will it be the fault of the officers of the Institute, for the building is always ready in time; but will, we presume, be the fault of the exhibitor, who, as a general rule, procrastinates, and is often many days behind. We should think that, if an exhibition is worth attending at all, that the exhibitor would desire that his exhibit should be arranged upon the opening day, and not a week or ten days later. For information address General Superintendent, room 22, Cooper Union Building, New York.

A Remarkable Railway Bridge.

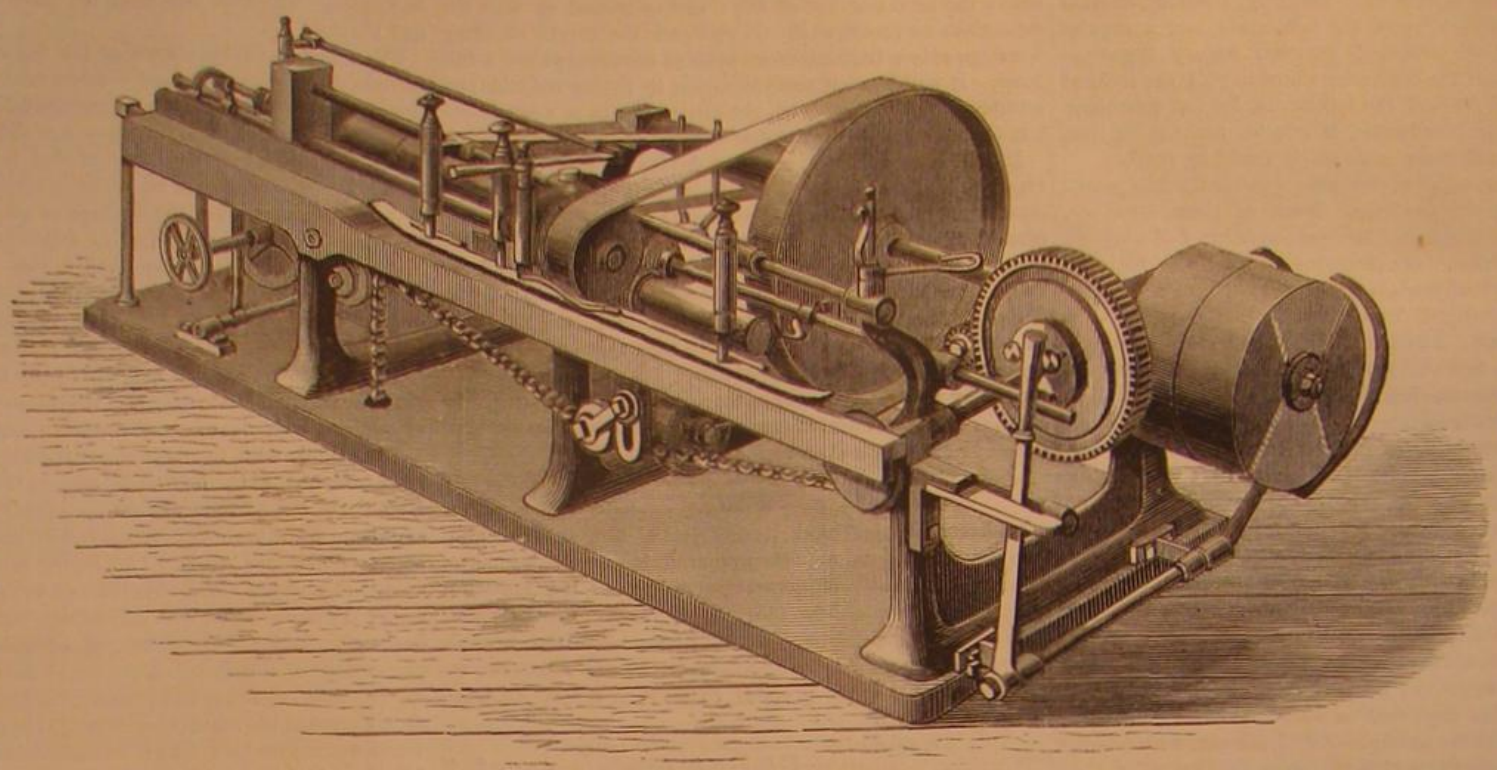
The new iron railway bridge over the river Douro, near Porto, Portugal, crosses it with an arch of a single span which measures 160 meters (520 feet) and has a rise of 42 meters (138 feet 6 inches). It is crescent-shaped in form; that is, the extrados and the intrados, which are connected by struts in the form of St. Andrew's cross, are farthest apart at the crown.

MANUFACTURE OF EBURINE.—Eburine is a composition formed from the dust of ivory or bone cemented together with gum tragacanth or albumen, and colored at pleasure. In some cases pressure and heat render the addition of any glutinous matter unnecessary.

A NUBIAN TEMPLE.—The temple of Ypsambul, in Nubia, is cut out of a solid rock, and is of vast dimensions. In it are four colossal figures sixty-five feet high, twenty-five feet across the shoulders, with faces seven feet high, and ears about a yard long.

IMPROVED OVERHEAD SEWING MACHINE.

We extract from *Iron* the annexed engravings of Laing's patent overhead sewing machine, which has the rare merit of being an entirely novel and unique method of producing a stitch. It causes the needle to pass completely through the fabric from "overhead" to the under side, and then passing upwards round the edge, once more pierces and passes through the material, and so on, *ad infinitum*. This is a copy of the action of hand-sewing in making a seam where the thread or cotton continually encircles the two edges which are brought together to be united.



LAING'S OVERHEAD SEWING MACHINE.

This effect, or stitch, is beautifully produced by a circular helical needle, *a b*, Fig. 3, which makes two or three turns round a central spindle, I, Fig. 3. The interior diameter of the circular needle is considerably greater than that of the spindle within it, and as the driving band, H, is arranged by guide pulleys, *f*, to pass only round one side of the needle and spindle, I, the needle is thus pressed away from the spindle upon one side, and is suitably placed for piercing the material as it revolves. One end of the spiral needle, *b*, is, of course sharpened, and the other end, A, by a hook, engages the thread, and which thus carries it through and through the material, making a lapping stitch round the edges of the seam, which cannot thus be distinguished from hand sewing except by its wonderful regularity and evenness. In Figs. 1 and 2, D and C are the fast and loose pulleys, which may be driven by the strap from an engine shafting, or may be replaced by a hand wheel or treadle. Upon the main shaft, B, is a *miter* gearing, which drives, by the changeable cog gearing, 12, the spiked feed chain, 9. This spiked feed chain seizes the fabric as soon as it is fed upon the feed table, and passes it over from left to right at a speed which may be varied by changing the cog gearing, 12. Upon the same principal shaft is also a large pulley, F, which operates the band, E, that passes round the series of rollers, as shown in Fig. 3, and thus drives the needle. A countershaft has another pulley, G, upon it that drives by a band the thread cylinder. Upon the countershaft, between the two standards, is a driving cone, L, which, by an adjusting band, *i*, may be set to drive the opposite cone, Q, at a varying speed, according to the position of the band, which is determined by a guide traveling upon a screwed spindle.

The use of these two differential cones is to give a horizontal variable sliding motion to the thread or string barrel. The end of the cone through which the screwed portion of the spindle passes is provided with a movable catch which gears with the screw; the action of the machine itself throws the catch in and out of gear with the screw according as the stage of sewing operations requires that the string or thread barrel should recede slowly into the hollow cylinder, or emerge suddenly therefrom to resume its

Fig. 1.

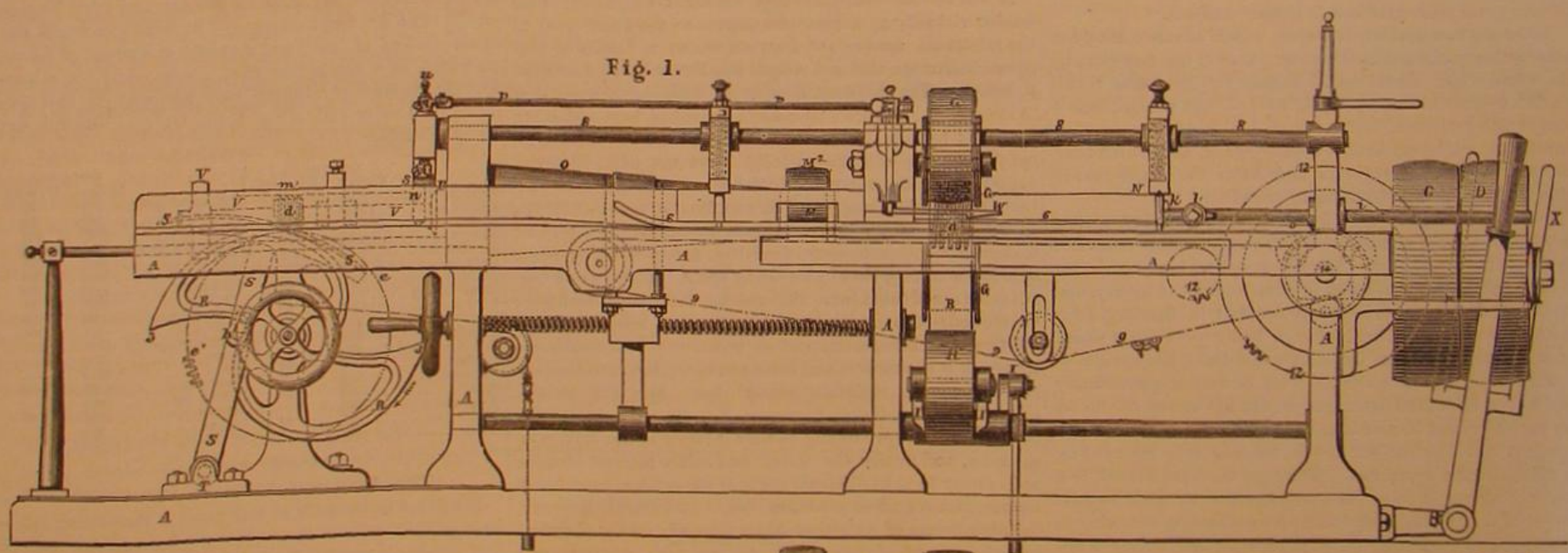


Fig. 3.

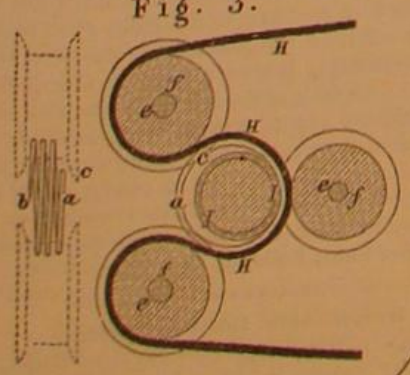
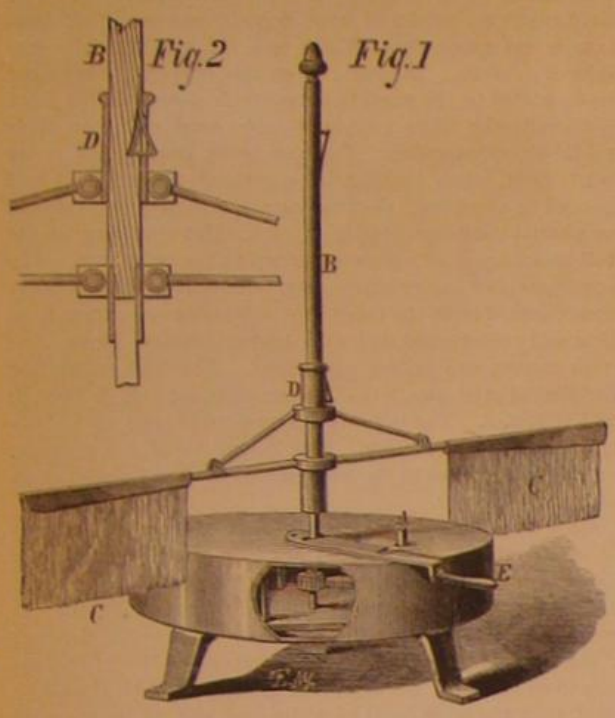


Fig. 2.

LAING'S OVERHEAD SEWING MACHINE.

normal position. This action is very ingeniously obtained by a weight to bring the thread barrel out, and by the screw-engaging catch gradually drawing it in.

This means of obtaining the sliding motion of the thread barrel has, in the latest designs, been considerably modified. The use of the drawing thread, which also carries the whole of the suspended weight, has been substituted by an involute cam, with a double throw and deep step back to the axis, as shown in Fig. 1. The slow revolution of the cam causes the inclined surface of its throw to bear upon a stud in a rocking lever, S. At the extremity of this rocking lever, in a radius from its axis, T, is a toothed quadrant, which gears in a rack attached to the thread barrel, and which is thus steadily drawn in. When the half revolution has been completed, the drag weight, X, draws over the lever, S, down the sudden step, and thus shoots out the thread barrel ready for its next gradual feed. The length of feed may be varied by change of cams



FLY FAN.

The thread is held against the circumference of the hollow spindle when thrown from the barrel. The barrel in revolving carries round with it the thread thus held or jambed against it, and pulls tight the stitch last made, the slack of the thread being transferred to the barrel by the action of the thread catch or drag.

The fabric to be sewn is fed upon the table of the machine from left to right in a direction parallel to the axis of the spiral needle.

The amount of grip or edging embraced by the over-edge stitching will be regulated by distance from the axis of the needle at which the material is fed in, and this may be determined by a fence upon the feeding plate. As the fabric is fed past the plate or fence, it is caught and carried forward by a spiked endless chain, which passes over two chain pulleys, one at each end of and situated below the feeding table. One of the said chain pulleys is fixed upon a countershaft, which is driven by gearing from the main shaft of the machine. The speed of the feed will be varied according to the rate of revolution of the chain wheels, which can be regulated by the use of change wheels in the intermediate gearing. The fabric is held down to the feeding table by a pressure whose tension may be regulated by a screw.

The latest practical improvement in this arrangement consists in the presser being carried in two brackets from a spindle, which runs parallel to the axis of the needle. In the brackets are a couple of coiled springs, which give the necessary pressure upon the material, and when the pressure is not required it may at once be lifted up clear of the material.

An exceptionally fine adjustment for the rate of feed is now applied to the machine. This is effected by using friction wheels to pinions instead of the spur gearing, and by introducing a friction clutch on the shaft that drives the pitch chain by which the width of the stitches is regulated, as well as the tension on the spiral needle. This tension is prevented from reaching an extent which would be dangerous to the needle, by reason of the friction clutch slipping before that degree of tension is reached.

In course of time the thread coiled upon the barrel becomes exhausted, when the spiral needle may be automatically re-threaded, so that a fresh thread is placed in the eye of the needle, without stopping the machine or interrupting the progress of the work: and the string and thread barrel being again brought out of the cylinder by the action of the weight, a fresh supply of thread or string is coiled thereon, and the work proceeds as before.

The thread may be supplied to the machine in banks of such a length as to fill the thread or string barrel. A perhaps preferable arrangement is to use a reel driven by the machine, and alternately measuring from a bobbin and transferring its measured contents to the exhausted thread or string barrel. The re-threading of the needle is effected by a tube, which, after feeding the thread or string to the reel, catches it into the hook or eye of the needle, and afterwards severs the thread by bringing it in contact with a knife edge.

In sewing with this machine the pitch or width between each stitch may be regulated by the relative speeds of rotation of the needle and the travel of the feed chain. When the latter feeds slowly, the pitch of the thread or stitch will be very short; when the latter travels quickly, the pitch will be large. The elastic nature of the needle enables it to extend to suit the varying pitch of the stitching. The relative speeds of the feed chain and rotating needle may be adjusted by the change wheels, W.

The speed of movement of the thread barrel towards the feeding end of the machine is adjusted according to the breadth or grip of cloth through which the seam is made, that is to say, the barrel is caused to unwind the thread or cord faster or slower, according as a broader or narrower "grip" is required. This adjustment is made by shifting the driving belt on the cones by means of the belt shifting operated by the screw and hand wheel.

The automatic threading is accomplished by a very ingenious and simple operation. So long as the needle is working with a supply of thread from the sliding string box, and so long as the string box is continuing its steady travel outwards, the threading lever is pushed back out of the way. But as soon as the cylinder has almost completed its travel, the inclined side of a plate comes in contact with the end of the threading lever, which carries the end of a fresh hank, stretched across an open fork, in its extremities. Just as the stroke of the string cylinder is completed, the lever is suddenly thrust forward, so that the tail of the needle catches up the string from the loop, and re-threads itself, when at once the threading lever returns out of the way. The eye of the needle is thus not a perforated one, but a species of hook in which the string is gripped by the rotation of the needle.

IMPROVED AUTOMATIC FLY FAN.

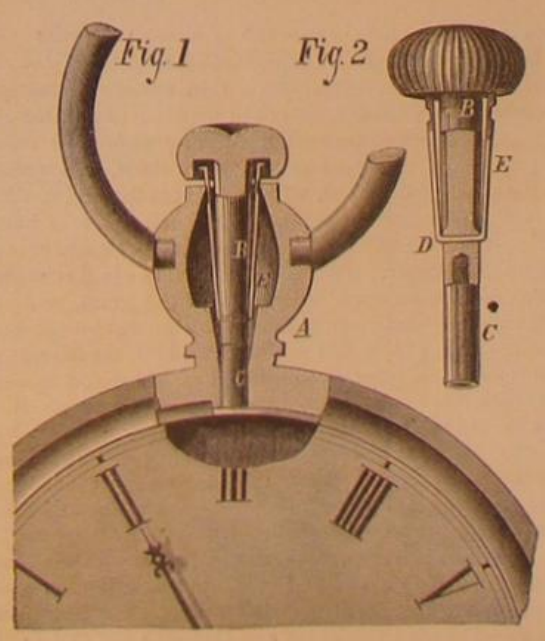
The invention illustrated herewith consists of vanes or fans which are rotated by suitable mechanism with the object of agitating the air and driving away flies. The device may be placed upon a dining table, in show windows, beside invalids' beds or children's cradles, and will prove especially convenient for confectioners.

The circular box which forms the base contains a simple train of clockwork, which is wound up by a key applied to the shaft, A. This mechanism rotates the vertical shaft, B. On said shaft is a sleeve having a ring flange, to which last are suitably hinged the arms which carry the fans, C. To the middle of the arms are attached braces which are hinged to another flanged sleeve, D. On the shaft, B, are catch springs, as shown, by means of which the upper sleeve, and consequently the arms and fans, may be adjusted to any hight. The motion of the fans is thus regulated. The pivoted bar, E, has a notch which slips over the squared end of the shaft, A, preventing the latter from turning and thus stopping the movement of the clockwork when desired. In Fig. 2 a sectional view of the sleeves and method of hinging the arms and braces is given.

Patented August 21, 1877, through the Scientific American Patent Agency. For further particulars address the inventors, Prather and Shirley, Lineville, Iowa.

COMBINED PUSH-PIN AND WATCH KEY.

This invention consists in a removable push-pin for watches, which is provided with spring for holding it in place in



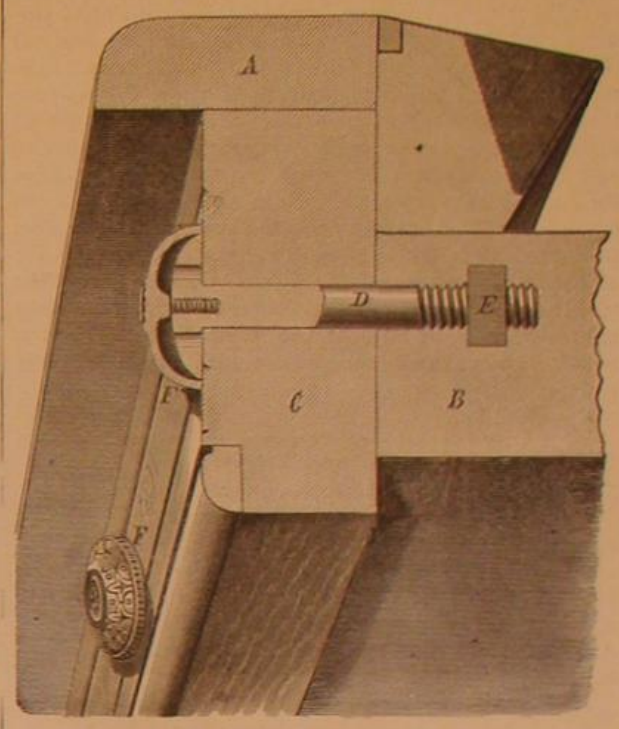
the stem of the watch, and with a watch key point at its inner end which may conveniently be used for winding the watch.

Referring to the illustration, Fig. 1, which is an enlarged sectional view of a watch stem containing the improved push-pin and key, A is the stem of a watch, which is chambered out, leaving an internal angular edge at the top of the stem. B is a push-pin, seen detached in Fig. 2, having a milled head, into the inner end of which a steel watch key point, C, is screwed. The push-pin is drilled transversely at D, and is grooved longitudinally from this point to the head to receive a wire spring, E. This spring extends upward at each side of the push pin, and is notched to receive the edge of the watch stem. The notches are of sufficient width to permit of moving the push-pin sufficiently to operate the case spring. When it is desired to wind the watch, the key is drawn from the watch stem and used as an ordinary key. When the point, C, becomes worn or broken it may readily be unscrewed and replaced by a new one. The advantages claimed for the invention are that it obviates the complication of stem winders, and at the same time provides a key that always accompanies the watch.

This improvement was patented through the Scientific American Patent Agency, by Augustus A. Fisher and Simeon H. Lucas, of Santa Fé, New Mexico, June 26, 1877.

IMPROVED FASTENING DEVICE FOR BILLIARD CUSHION RAILS.

It has hitherto been customary to use, for the attachment of the cushion rails to the bed of a billiard table, bolts,



which were provided with large finished heads, and which were so applied that, while the body of the bolt passed through the cushion rail, and its threaded end engaged with a blind nut let into the bed, the head of the bolt took its bearing on the outer face of the cushion rail. This head, in which were holes to allow of its being turned by a suitable tool, has commonly been exposed to view. We illustrate herewith a novel device for covering the head, which may be applied without the use of any separate screw or washer, and without requiring any countersink or other alteration on the rail.

A is the cushion rail; B the bed, and C the frame of the table; D is the bolt, the threaded end of which is engaged by the nut, E. In the head of the bolt a hole is drilled and tapped to receive the screw teat of the ornamental cover, F, which is set in place after the bolt is inserted. A knurled surface near the outer edge of the cap allows of its ready manipulation in screwing it upon the bolt. The cap is struck up of sheet metal in a tasteful pattern, or it may be an ornamental casting of bronze or other metal, having the screw a part of the same. By this construction the cushion rail is not weakened, as is the case where the bolt head is countersunk or let into the rails; the screw of the ornamental cap being a part of the cap itself, makes few parts; and when replating or a new design may be wished, for ornament, the cap can be readily unscrewed from the bolt, while the table can be employed as usual. It may be made, we are informed, at a small cost, and it saves the usual expense of finishing the bolt heads, besides being an ornament to the table.

Patented July 31, 1877. For further information address the inventor, Mr. H. W. Collender, 738 Broadway, New York city.

Preparation of Celluloid.

Paper is treated by a continuous process with 5 parts of sulphuric acid and 2 of nitric acid, which convert it into a sort of gun cotton. The excess of acid is removed by pressure, followed up by washing with abundance of water. The paste when thus washed, drained, and partially dried, is ground in a mill, mixed with camphor, ground again, strongly pressed, dried under a hydraulic press between leaves of blotting paper, cut, bruised, laminated, and compressed again in a special apparatus suitably heated. It is said to be hard, tough, transparent, elastic, fusible, becoming plastic and malleable at 125°. It ignites with difficulty, is decomposed suddenly at 140° without inflammation, and gives rise to reddish fumes. It is inodorous, and does not become electric on friction.—*Bull. de la Soc. Industrielle de Rouen.*

STEAM POWER IN FRANCE.—It is computed that France now possesses steam engines of an aggregate force of 1,500,000 horse power. This is equal to the effective labor of 31,000,000 men, or about ten times the industrial population of the country.

Communications.

Manufacture of Tobacco.

To the Editor of the Scientific American:

Your answer to J. W. F., who asked how the raw taste of tobacco can be removed, is a wilful insult both to the tobacco user and to the manufacturer. He has a reputation to preserve as well as the sugar refiner, or the baker, or any other man. In the manufacturing of chewing tobacco the leaf is taken out and carefully examined, and all dirt removed; then it is put in large bins, where it is sprinkled with a sirup made of best brown sugar and licorice; after it becomes partly dry, it is made into rolls, then taken to press.

If G. W. F. wishes to manufacture his own chewing tobacco, let him first get some green hickory or sugar maple, cut into small logs, say two or three feet long and from five to eight inches diameter, then with a large auger bore holes three parts through. Make a stick of hard wood to fit the hole easy; leave it a little longer than the depth of the hole. This stick is to be used for a rammer. Wash your tobacco clean, let it dry or nearly so, remove stems and all bad portions, stuff it into your logs hard; the tighter it is rammed the better. When nearly full make a plug and drive it in so tight that it will keep cut all outside moisture. Pile up your logs in the woodshed or some place where they will not be exposed to the weather or the wet ground. After stuffing your logs let them rest for about two weeks, then examine for the ones that show a tendency to split. Take the ax and cut open. If you open only one log at a time, as you need the tobacco, it will keep good for years. If you keep the air from it the last plug will be better than the first. The wood sap will give it a pleasant flavor. If you wish to make it sweeter, make a sirup of 1 lb. sugar to ¼ lb. licorice, boiled in two or three gallons of water. Sprinkle lightly and toss well.

Mansfield, Pa. ALEX. THOMPSON.

Bees and Hives.

To the Editor of the Scientific American:

Since the appearance of my communication in SCIENTIFIC AMERICAN of April 21, many of your readers have written me for more definite information in reference to certain points connected with bee-keeping, and with your permission I will answer through the columns of the SCIENTIFIC AMERICAN. The information asked comes under the following heads:

First, The distance bees will go to collect honey.
Second, Is it necessary to provide food for the bees?
Third, A more particular description of the hive I use.
Fourth, How to prevent loss in winter.
Fifth, How to prevent the ravages of the moth.

First, then, as to the distance bees will go to collect honey. There has been much speculation in reference to this point, and many conflicting opinions advanced. As I was the first to obtain the Italian bee in this section (none of this variety, at that time, within twenty miles of mine), I decided to investigate thoroughly, during the honey season, and the result was I found the Italian bees seven miles from their hives, collecting honey. The great difference in color of the Italians from the native bees rendered it a very easy matter to trace them. I think the native bees, being smaller, do not go as far for honey as the Italians. It is not so easy, however, to determine, as there are some of the native bees in every section, which renders it very difficult to trace, from any one apiary; but from what evidence I have been able to obtain bearing upon this point, I think it safe to say the natives go five miles at least to collect honey. There are many amusing traits in the habits or instincts of bees. If a hundred hives are ranged side by side with the entrances not more than two feet apart, and the bees leave such hives in quest of honey, they return by thousands every hour, yet not one fails to enter its own hive if unmolested. But if the hives are changed so that bees enter other than their own hives, they are immediately slain and cast out of the hive. There are traits in the nature of bees which seem to be akin to reason as manifested in the human family.

It is not absolutely necessary to furnish food for bees. The myriads of flowers in forest and field afford honey in great abundance. Some of the principal sources of honey are clover, buckwheat, basswood, fruit flowers, red raspberry, catnip, etc. Yet under my system of management I find it profitable to furnish my bees with nearly all the food they require for their own use. I have constructed a feeder on entirely new principles, so I can put each stock in its own hive, and so that all the bees of the hive can have access to it, and not a bee from any other hive reach it. The food I prepare for them costs only about seven cents per pound, and meets all the wants of the bees as well as honey collected from flowers. By this arrangement I furnish nearly all the food my bees require for their own use, and thus secure as surplus all the honey the bees gather from flowers throughout the season, which is a great increase over the amount otherwise obtained. As the bees consume a great deal of honey in rearing their young, constructing combs, and for their own daily wants the year round, with my arrangement I have had a swarm of bees take from the feeder, in one hour, over a gallon of food, and store it in combs in the hive.

It is hardly possible for me to describe the hive I use, on paper, with sufficient accuracy as to give a correct idea of all its parts; it must be seen to be fully understood. I will, however, give a general description of some of its leading points, and here let me say that I have no objection to any one using it who wishes to do so, and if I possessed sufficient skill I would describe it so that every bee keeper could construct one for his own use. The central portion has six movable comb frames suspended on rabbetings on the ends; this section will hold about 40 lbs. of honey, and is for the permanent occupancy of the bees; here they build their combs, in the movable frames, here they rear their young and store up sufficient food for their own use. At the sides and top are arranged thirty small glass boxes, in which the bees store their surplus honey. Each box holds about 4½ lbs., and gives the honey in the best possible shape for market. The boxes are so placed in connection with the hive that in entering them the bees are not obliged to pass through any partitions, but pass directly to the boxes. These boxes when filled are removed, and empty ones substituted in their places. They are so arranged as to be removed separately or collectively. A ventilator is arranged for winter use, so that the bees winter in perfect safety on their summer stands. In connection with straw packing, I consider the use of this ventilator renders bees safe in any climate.

As to the bee moth, a strong stock of bees is never injured by this pest; bee keepers who keep their bees strong and in a healthy condition will find no trouble from this source. Stocks must first become weak and diseased from some cause before they will be injured by the bee moth.

Bee keeping is a very profitable occupation when managed on correct scientific principles. Great progress has been made within the past twenty years. I know of some bee keepers in New York State that keep upwards of 300 stocks, and some years sell more than seven thousand dollars worth of honey.

West Gorham, Me. MRS. L. E. COTTON.

Architectural Science Class.

ELEMENTARY REPLIES.

QUESTION.—*Describe different materials used by painters. Describe ingredients of color.*—The materials used by painters are paints, oils, driers, stains, varnishes, etc. Colors or paints may be divided into five classes, according to their principal ingredients. Lead paints, most commonly used, have white lead or carbonate of lead as a basis. This material is ground up in oil in a stiff paste. Linseed oil, with litharge or other driers, and sometimes turpentine, are added to it to form the paint ready for use. The required tint is obtained by adding to this the proper coloring pigment. The exact proportion of ingredients is regulated by the nature of the work, climate, etc. Red lead enters into the composition of the priming coat because it is a good "drier," and sets "hard." Linseed oil is used as a medium for applying the paint; it fills up the wood pores, and acts as a preservative. Turpentine makes the paint easier to work, and more liquid, but it plays no part in the preservation of the wood, as the greater part evaporates. Driers are mediums to cause the contained oil to dry and set quickly. Various materials are used, as litharge, sugar of lead, etc. Zinc paints have zinc oxide as a basis. Silicate paints are manufactured from almost pure silica, which is not acted upon by any metal or acid—in fact, is almost indestructible. This kind possesses the advantages of great durability, has no galvanic action when applied to iron, as in the case of lead paint, and does not tarnish by the action of gases. Colors are made same as the lead paints, and are mixed in the same way. Oxide of iron paint acts as a good preservative for ironwork. Bituminous paints are used for a similar purpose, and for rough carpentry. Stains are mixtures used to darken wood to the color of the imitated wood. Varnishes are of various kinds—copal, etc.—and are used to preserve the paint, and give a gloss to the finishing coat.

QUESTION.—*Describe the process of common painting wood and ironwork.*—Woodwork is prepared for painting by brushing over all resinous knots with a thin coating of knotting (a compound of shellac dissolved in naphtha) or gold size, to confine the resin, and prevent it running under the paint. The priming is then laid on, any plain color, well worked into the pores of the wood, with and across the grain; when this is dry, the stopping is done. All nail and brad holes, etc., must be well filled up with putty, and lightly rubbed off with glass paper. The second and following coats are applied with more care, brushed with the grain, and the work covered equally everywhere, showing no tool marks or running edges. If the last coat is to be light, the second and third should be similar in color, and if it is to be finished dark, dark color must be used for the previous coat. Ironwork should be cleared free of all rust, oil, or grease before painting. A good first coat is color made up with red lead; the other coats may be similar to that used for wood. Iron being almost non-absorbent, three coats are sufficient for new work, unless in very exposed situations, and for the same reason, care must be taken, especially in ornamental work, not to fill up the fine lines of leafwork, etc., by using too much paint, as the character of the work would thereby be injured. It is not so much a thick coat as a thorough one that is the best protection.

QUESTION.—*In coloring walls what precautions should be used?*—The walls should be thoroughly dry. In coloring walls the coats should be carefully laid on and smoothly, each coat being rubbed slightly with sand paper before applying the next. The "flatting" or finishing coat should be made a few shades lighter than the pattern, as it darkens in drying. Japanner's gold size, if used, should be applied quickly, as the turps evaporates quickly, leaving an indelible glossy surface. A certain time should be allowed between the coats, the drying of the same depending upon the quantity of driers used, the weather, and temperature of the apartment. To expedite the work, new walls are generally "distempered" when not dry enough to receive the permanent decorations. Distempering is a kind of painting with color prepared with size or some other glutinous substance. In distempering, the walls must be dry and free from damp; if not, at the completion will be shown all the defects. Two or three coats should be applied, in order to obtain an even color.

ADVANCED REPLIES.

QUESTION.—*Explain the theory of coloring.*—The accepted theory is that there are certain colors that cannot be produced by any combination of other colors. They are termed primaries, because all other colors can be obtained by mixing them in certain proportions. The primary colors are red, blue, and yellow. Some authorities substitute green for yellow. Secondary colors are derived from mixtures of the primary colors in pairs—as violet from red and blue, orange from red and yellow, and green from yellow and blue. Tertiary colors are produced from secondaries—as citrine from orange and green, etc. White and black are usually considered neutrals. To secure "harmony of colors" they must be equalized to the varying proportions shown in the solar spectrum—the three primaries being used either in their purity or compounded. The eye being constructed to see white light, when looking on a colored surface, it is best pleased by a contrast. Contrasting colors to harmonize should be mutual complementaries of each other—making up the full complement of colors contained in the solar rays. The complement of any primary—say, red—will be the secondary compounded from the other two primaries—as green from blue and yellow—red will thus harmonize with green, blue with orange, and yellow with violet. The best proportion for mixing primaries, so as to harmonize, is; red, 5; blue, 8; and yellow, 3. The latter is the most vivid, and should obtain a prominent position. Blue is least vivid and retiring, and should be kept in the background—red to be used as an intermediate color.

QUESTION.—*Describe the proper mode of painting wall surfaces.*—To paint wall surfaces properly often five coats are necessary; but if the plaster be not very absorbent four will be sufficient. If the work is required without gloss the last coat is mixed with turpentine only, which is called flatting; if the work be not flatted the finishing coat is two of turpentine to one of oil. For the priming coat boiled oil should be used, then the three coats of white lead and oil, or more if required; generally the first coats should be some shades darker than the finishing coat. The proper drier to be used for walls is sugar of lead, and in painting wall surfaces great care should be used in selecting the very best quality of oils and white lead—the older the oil the better.

QUESTION.—*What is the best paint for ironwork?*—The best paint for ironwork is either the oxide of iron paint, known as the Torbay paint, or the silicate oxide paint, both consisting of oxide of iron and silicious matter, to which any color may be added and applied in the usual way. They can be applied even after the surface has commenced to rust, as from their nature they amalgamate freely with the rust, forming an impervious coating adhering well to the surface, and yet sufficiently elastic to prevent cracking when the iron expands or contracts under variations of temperature. Bituminous or tar mixtures, thinned with linseed oil, are well adapted for ironwork, especially when they can be applied hot, or to the heated surface of the metal, so as to insure a firm adhesion by entering the pores. A mixture of silicate oxide with tar also forms a good durable coating on iron. When ironwork is to be painted with ordinary lead paint red lead should be used. The adhesion of such a coating on ironwork can seldom be depended on in consequence of the non-porous surface. This is further prevented by the galvanic action that sets in between the iron and lead. Galvanizing, or coating the surface with a preparation of zinc, is also frequently resorted to as a preservative. With all such coatings the surface must be perfectly clean and free from rust. It is advisable, so as to prevent rusting, that all ironwork should be coated with some preservative soon after it leaves the mould, forge, or mill.—*Building News.*

Converting Iron into Steel without Melting.

The known processes for transforming iron into steel (refining by the oxygen of the air, or the Bessemer method, or Reaumur's method, improved by Siemens, Martin, and others), ingenious as they are, do not and cannot give but imperfect intermediate compositions between the castings of true iron and steel. Although of undoubted utility and low in price, these products are not applicable to any of the manufactures requiring fine steel. To overcome these defects, and to give to the metals the requisite qualities, Messrs. Kraft & Julien-Sauve Fils, of Paris, subject them for some hours to a red heat in a retort filled with carbonaceous matter, over which is slowly passed a current of azote of carbonic oxide, and of various carbonated hydrogens. They introduce wood, vegetable charcoal, peat, coke, or any kind of vegetable materials, very dry, and heated to a temperature of about 50°, into a hydrocarbon oil of any kind (such as the heavy oil of schist), which is also heated to the same temperature. This latter is absorbed in the proportion of from 12 to 15 per cent, and they form with bars of Bessemer metal, Martin metal, or any other product arising from the refining of cast metal, as above mentioned, alternate layers, the whole being enclosed in a vessel, similar to a gas retort and of desired form, and heat gradually to a red heat.

By these means the excess of oxygen that is contained by the vegetable materials in presence of the vaporized hydrocarbons is transformed into carbonic oxide, and their azote into ammonia, in such wise that the metals under treatment are immersed in a gaseous medium, which is allowed to be the best for the purpose of converting them into fine steel.

Now, as it may occur that before this absolute conversion the productive source of the gas may be exhausted by distillation, they provide against this inconvenience by passing through the apparatus a current of carbonic acid or carbonic oxide mixed or not with azote. When they obtain this gaseous mixture from the products of the combustion of the furnace which serves to heat the apparatus, they separate from it its free oxygen, and change it to carbonic oxide by causing it to pass over carbonaceous matter heated to red heat before it is passed to the metals. In the Siemens, Ponsard, Muller, and other retorts, the principle of which consists in the gasification of combustibles, they give a mixture of the gases, which they employ equally to the heating of the apparatus as to the transformation of the metal to steel. The gas which escapes from these furnaces also serves for this double purpose. When, on the contrary, they obtain this gaseous medium by direct calcination of limestone, or the mixture of this with other carbons, the gaseous products (carbonic acid and carbonic oxide) are passed directly into the apparatus containing the layers of charcoal and metal. They obtain at the same time from the lime, which they may convert into pyrolignite of lime, the little pyroligneous acid which separates equally from the wood as from the hydrocarburetted peat during the heating to red heat, and which they take care to collect as is ordinarily done in the distillation of wood.

It will be understood that the mixed gases produced and composed in and that have passed through the apparatus may on their passage therefrom be collected in a gasometer to be again used for the same purpose, or passed under the furnace of the apparatus, where they will be utilized as combustibles. If the products prepared according to their process are melted, cast steel of the finest quality will be obtained, and by these means they may obtain without melting steel of the first quality for the manufacture of files and other articles from Bessemer metal, Martin metal, and generally from all metals which are obtained from castings, either by refining with the oxygen of the air, or by refining by reaction. In addition to the steel they obtain simultaneous and at will, from the lime, the ammonia, and the pyroligneous acid, tarry hydrocarbons, which they use over again, and wood or peat charcoal of denser quality than that used originally, not only fit for domestic purposes, but for use in metallurgy.

If cast iron particularly acted upon, and if this cast metal heated to red heat is exposed in a retort to a current of carbonic acid alone or mixed with air, it will be transformed into steel, and the gas will become carbonic oxide, which in passing into another retort charged with Bessemer metal at red heat will effect the conversion of this metal into fine steel, and will itself be converted into carbonic acid. Thus the carbonic acid (CO_2) raised to the casting its excess of carbon (C) is transformed into carbonic oxide (2CO); this passing over the iron of the Bessemer metal and the like will give up the carbon (C), and will return to the state of carbonic acid (CO_2). From this a given volume of carbonic acid gas being given enclosed in a gasometer they may, by passing this gas in the retorts heated to red heat and charged, the first with cast iron, the second with Bessemer metal, the third with cast iron, and the fourth with Bessemer metal, and thus in succession (provided that the series commencing with cast iron terminates with one or two retorts charged with Bessemer metal) transform the whole of the metal into steel, and on collecting the gas in a second gasometer the same operation may be recommenced, and so on indefinitely. If the passage of the gas takes place in a converter charged with melted cast iron, the transformation of the casting is more regularly and easily done, and with less loss of iron.

A FIRE ESCAPE ACCIDENT.

A distressing accident occurred at the Astor House, New York, just across the way from this office, recently, through the breaking of a fire escape while the owner and exhibitor of the same was endeavoring to lower himself from a lofty window. The apparatus known as the Kenyon Fire Escape consists of a wire rope $\frac{5}{8}$ inch in diameter, one end of which is secured within the room. The other end is wound on a drum, which is provided with brakes and arranged in connection with a stout belt, so that by regulating the brakes the wearer of the belt can cause the wire slowly to unwind and thus may lower himself in safety. The exhibitor, Mr. S. E. Hardman, of Providence, R. I., attempted to do this, but some part of the apparatus became inoperative; and in endeavoring to fix it, he brought some sudden strain on his rope so that it broke at the point where it turned over the sharp edge of the window sill, causing the unfortunate man to fall headlong to the pavement beneath, killing him instantly.

The failure of the wire rope simply indicates that it must have been of poor quality. Had a single wire of steel or even iron been used, the tensile strength would have far exceeded any strain which one person descending could have put on it. As it is, probably deterioration of the metal, coupled with the abrasion by the sharp stone edge of the window sill, determined the break. The casualty only goes to show another source of danger which should be provided for by making lowering ropes not only abundantly strong but also by applying to them means of protecting them from accidental injuries. In general, however, we do not think the portable fire escape problem is by any means solved yet. There is still an excellent opportunity for inventors to devise some system which shall be absolutely safe and certain in its action, and at the same time shall require nothing or nearly nothing to be performed by the presumably thoroughly frightened person whose life it is designed to protect.

Artificial Gems.

What we popularly call paste is technically known as strass; this is also the French word for the same substance (from M. Strass, its reputed inventor). Paste, then, is a material with which diamonds are imitated, and by mixing up with it metallic oxides of various kinds, colors in great variety are imparted to the paste, by which it serves as a representative of the various colored gems. Strass is prepared, according to the method of M. Donault, who has attained great proficiency in this art, from silica, potash, borax, and oxide of lead, and sometimes arsenic. Rock crystal and flint consist almost entirely of silica; but as flint generally contains a little iron, the silica obtained from it is liable to have a tinge of color, which is detrimental to the fidelity of the imitation; rock crystal is therefore employed.

The crucible in which the materials are melted claims particular attention, since, if the substance of which it is formed contains metallic particles, color would be imparted to the strass. Hard porcelain and Hessian clay are the best materials for this purpose. When the crucibles are supplied with the proper quantity of ingredients, they are placed in a porcelain furnace, where they are exposed to a steady heat for twenty-four hours, and then allowed to cool very slowly, so that a kind of annealing goes on. By this means is produced a strass, or paste, which, after passing through the hands of the lapidary, who gives it the form necessary for "setting," presents us with an imitation of the diamond.

Having once produced strass which imitates diamond, all the other gems may be imitated, by mixing with strass various metallic oxides and other substances, according to the color which it is desired to produce. Herein is manifested great diversity of opinions, different experimenters advocating different modes of procedure and different ingredients. One experimenter recommends the following ingredients: To imitate topaz, add glass of antimony, precipitate of Cassius, and oxide of iron, to the white strass; for ruby, add oxide of manganese; for emerald, oxides of copper, iron, and chromium, and acetate of copper; for sapphire, oxide of cobalt; for amethyst, oxides of manganese and cobalt, and precipitate of Cassius; for beryl, glass of antimony and oxide of cobalt; for garnet, glass of antimony, precipitate of Cassius, and oxide of manganese.

M. Donault has given directions somewhat different from the above; but we need not particularise them, as it would carry us into too minute details. We may, however, mention that he produces the imitative rubies by a particular treatment of the composition employed for topaz. This composition is 1,000 parts of strass to 40 of glass of antimony and 1 of purple of Cassius; at a certain stage of its preparation it affords an opaque mass, translucent at the edges, and affording thin laminæ of a red color. A part of this opaque topaz matter, added to 8 parts of strass melted in a Hessian crucible, and left 30 hours in a potter's furnace, affords a beautiful yellowish crystal. If this crystal be remelted by means of a blowpipe, it produces a strass nearly equal to the finest Oriental rubies. The art of producing imitative gems, ingenious as it is, is necessarily a confined one; for as soon as faithful copies of certain jewels are obtained, the object of the art is attained. The object is to deceive the eye; for, as M. Dumas remarks, "the most perfect description of strass, if it imitate no particular and identical gem, has no value, because it deceives nobody." There is a less perfect but a curious mode of producing artificial gems, with what are called doublets, by a process of cementation. The artificial gem consists, in this case, of two pieces of white transparent glass, or of crystal, which is cut into two pieces, conjointly so shaped that both together present the external form of the gem about to be imitated. A transparent cement is then formed of Venice turpentine and mastic melted up together in certain proportions, and to the mixture is added a portion of some coloring matter, according to the nature of the gem. Carmine, crimson lake, Prussian blue, verdigris, dragon's blood, Spanish annatto, etc., are employed, either separately or mixed one with another, until the required tint is imparted to the gummy mixture.—*British Trade Journal.*

The Manufacture of Mosaics.

The modern process of making mosaics now commonly followed at Rome is this: A plate, generally of metal, of the required size is first surrounded by a margin rising about three quarters of an inch from the surface. A mastic cement, composed of powdered stone, lime, and linseed oil, is then spread over as a coating, perhaps a quarter of an inch in thickness. When set, this is again covered with plaster of Paris rising to a level with the margin; upon which is traced a very careful outline of the picture to be copied, and just so much as will admit of the insertion of the small pieces of smalto or glass is removed from time to time with a fine chisel. The workman then selects from the trays, in which are kept thousands of varieties of color, a piece of the tint which he wants and carefully brings it to the necessary shape. The piece is then moistened with a little cement and bedded in its proper situation: the process being repeated until the picture is finished; when the whole, being ground down to an even face and polished, becomes an imperishable work of art. The process is the same for making the small mosaics so much employed at the present day for boxes, covers, or articles of jewelry; and this work is sometimes upon almost a microscopic scale.

The Florentine mosaic, which is chiefly used for the decoration of altars and tombs, or for cabinets, tops of tables, coffers and the like, is composed of precious materials in small slices or veneers; and by taking advantage of the natural tints and shades which characterize the marble, the agate or the jasper, very admirable effects may be produced in imitation of fruit, flowers, or ornaments. The use of this kind of mosaic is extremely restricted, on account of the great value and expense not only of the materials, but of the labor which is spent upon them. None but the hardest stones are used; every separate piece must be backed by thicker slices of slate or marble to obtain additional strength; and every minute portion must be ground until it exactly corresponds with the pattern previously cut.

Formic Acid as an Antiseptic.

The number of antiseptics is now so considerable that it seems almost hazardous to wish to increase it. Each new antiseptic that appears is extolled as the only saviour, and page after page of testimonials proves its excellence and infallibility. As the people may easily be distracted if every "discoverer" pours forth the abundance of his paternal joy over his offspring, which is frequently far from ripe, it is easy to see that the series of experiments made without prejudice by disinterested persons are of great value. In these experiments, made and published recently by Bidwell and others, they overlook, says G. Feyerabendt, one substance which for certain purposes cannot be replaced by any other, namely, formic acid. He does not lay claim to priority, for Dammer, in his excellent dictionary, mentions its antiseptic properties, nor is he a manufacturer of the article; so he does not speak in his own interest, but in that of the subject.

In acid solutions, formic acid far surpasses carbolic acid, and is especially adapted to the preservation of fruit syrups. Experiments made by Feyerabendt in his own household for two years have, without exception, been crowned with success. He has two jars of pickles made with vinegar and sugar from the year 1875, that have only been covered with a loose glass cover, yet they have preserved their freshness and show no trace of mould or decay. The taste of formic acid is pure, acid, and pleasant, the price low, and its use very simple. He has employed from $\frac{1}{4}$ to $\frac{1}{2}$ per cent of it in vinegar, fruit juice, glue, ink, etc., and is convinced that even smaller quantities will answer the purpose.

He especially seeks to excite the attention of housekeepers, and feels confident that they will be satisfied with the results and introduce formic acid as a good and true friend in pantry and kitchen.

Ordinary formic acid is made by heating together to 110° C. equal parts of dry oxalic acid and glycerin, until no carbonic acid is evolved. The pure concentrated acid is obtained by decomposing the formate of lead by sulphuretted hydrogen, and might contain lead.

The Oregon Silver Mud.

Professor Silliman of New Haven informs us that the alleged argentiferous mud of Wasco county, Oregon, an account of which we recently copied from the *San Francisco Examiner*, is a fraudulent production. As regards the form in which the silver was added, Professor Silliman says that the metal in the sample analyzed by him was spongy, in a gray powder, and generally in the condition in which silver appears when reduced by zinc. An authentic example from the locality, obtained by a trustworthy correspondent of Professor Silliman, yielded no silver whatever.

Coloring Zinc Roofs.

Among recent German inventions is a simple process, depending on the use of acetate of lead, by which every kind of color is applicable to sheets of zinc. By mixing black lead, for instance, with the salt, a very agreeable light brown hue is obtained. It is by this process that the cupola of the synagogue at Nuremberg has been painted. A sufficient length of time has already elapsed, it is said, to show that the atmosphere has had no influence on the zinc sheeting of the roof, thus showing the practical value of the process in such cases. By the addition of other coloring matters, light or dark shades of yellow or gray may be produced.

A Large Steam Pump.

Messrs. Cramp and Sons have now completed, with the exception of the boilers, the immense steam pumping engine which is intended for the Frankford Water Works, Philadelphia. The entire machinery will be ready to go into operation by October 1. This engine was built at the contract price of $46,000, and has a pumping capacity of 10,000,000 gallons per day. It is a double cylinder engine, the smaller cylinder being 40 inches and the other 60 inches in diameter. The pumps are 21 inches in diameter, and five feet stroke. The Frankford reservoir has a capacity of 36,000,000 gallons, to which have been run a 30 inch pumping main and 20 inch distributing main. There will be three boilers, two of which will furnish steam for 500 horse power. The third boiler will be held in reserve for emergencies.

IMPROVED STEAM ENGINE GOVERNOR.

We illustrate herewith a new and simple device which acts both as a governor and as an automatic cut-off. It is quite sensitive, may be adjusted so as to allow of the engine being

Fig. 1

run at any desired speed, and is so constructed that in case of its rupture the engine is caused to stop.

A, Fig. 2, is the eccentric which connects with the valve rod in the usual way. Its hub is guided by gibs, B, which rest on the slides shown; and at the same time are provided with lateral grooves into which the edges of the slides enter, as shown in the sectional view, Fig. 3. The slides are adjustable so that wear may be taken up. To the eccentric are attached the system of levers, C, which are pivoted to the arms of the disk in which the device is disposed, and to which are attached the weights, D. Also attached to the eccentric is the coiled spring E, the outer end of which is fastened by a screw and nut, by means of which the tension of the spring may be increased or diminished at will.

The shaft passes through the slot shown in the eccentric, which slot is of such length as to permit sufficient lateral motion of the eccentric to prevent the valve from opening at the minimum throw. It will be obvious that, when the speed of the engine increases, the weights, D, are thrown out by centrifugal force, and the eccentric is moved across the shaft. The travel of the valve is thus reduced until the engine is brought back to its former speed. If there is a tendency to decrease the speed, the spring, E, draws the eccentric in the opposite direction so as to impart a longer stroke to the valve. The joint action of the tension spring, E, and weighted levers, C, on the sliding eccentric thus serves to keep up the uniform motion of the engine according to the degree of speed to which the engine is adjusted, while in case of breakage of the spring it will be clear that the action of the weights will be such as to reduce the valve throw to minimum and so stop the machine.

The device has been applied with much success to small engines of the type shown in Fig. 1, which are especially constructed for small steam yachts. We are informed its addition does not increase the cost of the engine over that of one fitted with the usual ball governor.

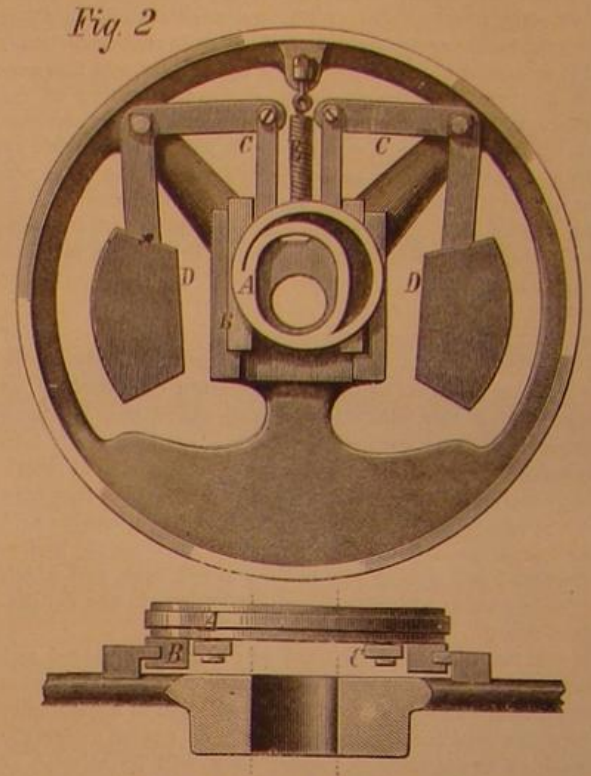
Patented through the Scientific American Patent Agency, by Mr. H. Tabor, May 22, 1877. For further information address the makers, Messrs. B. W. Payne & Sons, Corning, N. Y.

Docks of Liverpool.

The docks on the Mersey are, perhaps, the most magnificent series in the world. They extend over a water area of 255¼ acres, and possess 18½ miles of quays. Facing the river they present an unbroken line of more than 6 miles. On the Birkenhead side, the water area, including the Great Float, is 165 acres, the quays are more than 9 miles in length, making in the whole 421 acres of water area and 28 miles of quay space, a set of statistics which will probably afford a clearer idea of what has been done than the most elaborate attempt at word painting.

The Corn Dock is of comparatively recent construction, and boasts a splendid range of warehouses and elevators. Into this dock the largest ships engaged in the grain trade can be brought with perfect ease, and here they can lie against a range of magnificent warehouses ten stories in height, and with a cellar story below the level of the water. The corn is discharged from the vessels which bring it in bulk by very simple yet effective machinery worked by hydraulic power. From the ships it passes into the cellar floor, which is perfectly rat-proof and water-tight, and thence is raised in a species of hopper worked by the same power to the topmost floor. Each of these hoppers, of which there are ten in all, carries exactly one ton, and it can be filled, raised, and discharged in something over a minute. On reaching the topmost floor a valve opens and the grain pours out in a steady stream upon an endless band of india rubber about 15 inches wide, which is kept in constant and rapid motion over a series of rollers. The effect of this motion is very curious. The corn keep its place exactly on the band; not a grain falls to the ground on either side until, on arriving at the point of discharge, a guiding shoot sends the stream into the section of the particular floor marked out for it. By a simple system of registration the keepers of this vast granary—which is believed to be the largest in the world—can point out with unfailing accuracy the whereabouts of each consignment in store. The precautions against fire are elaborate in the extreme—a fact which need surprise no one who remembers how cruelly Liverpool has suffered from its ravages in the past. In addition to the usual orders about lights, no steam engine is allowed in the place, and fire hose ready for use are fixed on every landing of every stair. The motive power of the engines is, as we have said, water, which is obtained from a lofty tower at the dock gates. The water is pumped into the machinery at the top of the tower by steam, the engine used for the purpose being capable of producing a pressure of 700 lbs. to the square inch. This same power is also utilized for the purpose of opening or closing the dock gates, and it is said to be even more perfectly under control than steam itself. One last matter of detail—the warehouses will hold 165,000 quarters of corn, and the elevators and machinery are capable, without any undue pressure, of lifting from the ships and putting into place in the warehouses 250 tons of corn per hour.—*British Trade Journal.*

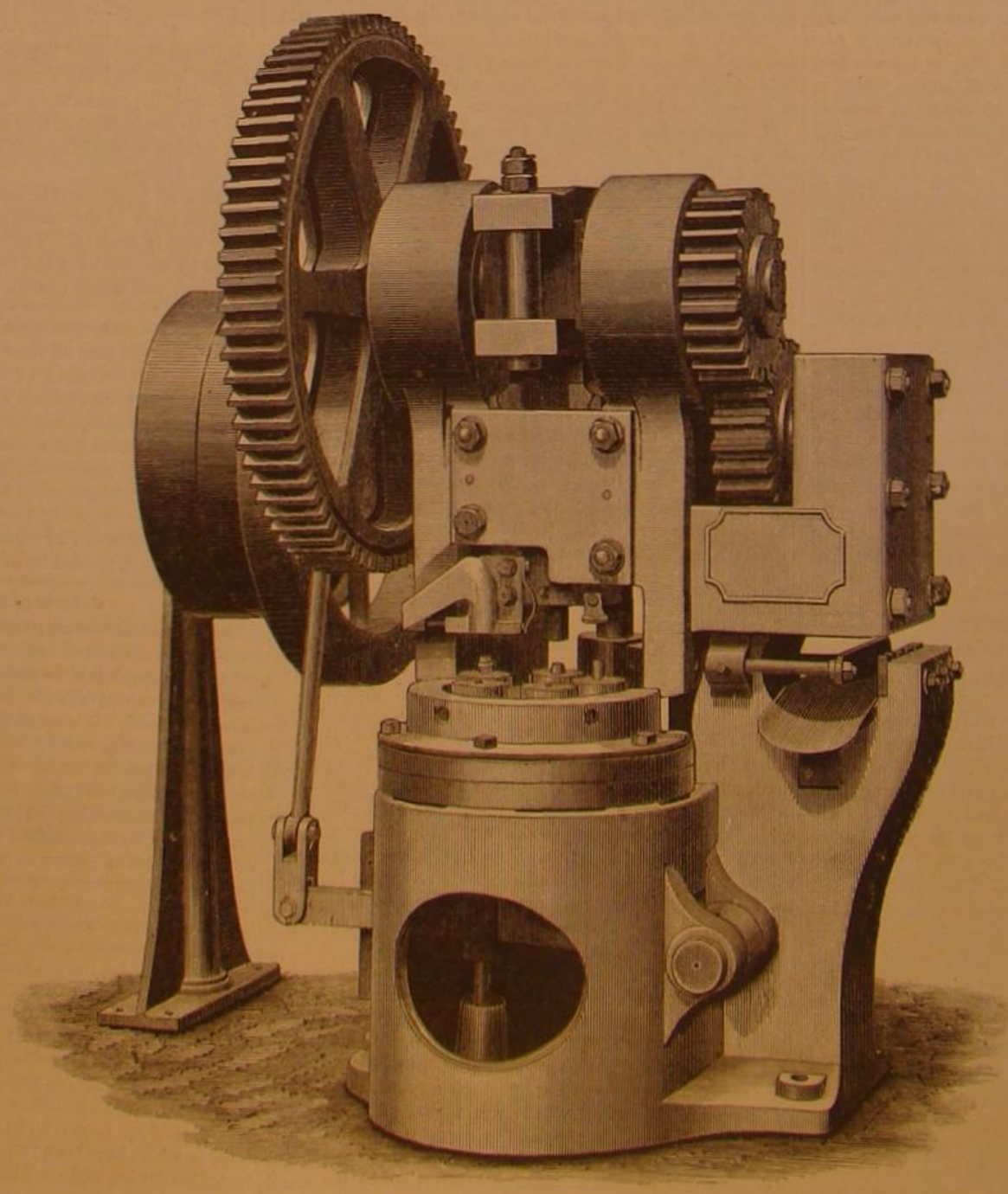
Fig. 2



STEAM ENGINE GOVERNOR

IMPROVED RIVET-MAKING MACHINE.

We illustrate, from *The Engineer*, a new and simple rivet-making machine, recently patented by Messrs. W. Collier & Co., of Salford, Manchester, England. One of the great defects in all previous rivet-making machines has been their liability to form the head of the rivets out of center with the shank, and one of the principal objects Messrs. Collier & Co. have had in view has been completely to obviate this, and render it impossible to make crooked headed rivets in the new machine. The general design of the machine and its mode of working will be readily understood from our engraving. The header or "snap" is carried in a vertical slide which has a reciprocating motion imparted to it by an eccentric shaft driven by suitable gearing. The dies, five in nmber, are carried in a circular table and brought successively under the header or snap by an intermittent feed motion, which not only moves the table until the die is perfectly central with the snap, but locks it, and holds it firmly while the rivet is headed, so that should the iron get more to one side than the other it will right itself by pressure and not spring the table and form a crooked head. The motion for moving and locking the table is carefully protected from scale and water. An ejecting apparatus lifts the headed rivets out of the dies, and a simple self-acting motion picks them up and delivers them clear of the machine into a wrought iron trough or other suitable receptacle placed by the side of the machine. An apparatus is also attached for cutting the iron into the required lengths for making into rivets, with adjustable measuring stop to measure the pieces.



COLLIER'S RIVET-MAKING MACHINE.

THE CLAMOROUS FROG.

BY C. FEW SEISS.

This frog, first described by Merrem as the *rana clamitans*, is a widely distributed species, and, although numerous in many sections of this country, is commonly supposed to be the young of the bullfrog (*rana catesbiana* of Shaw). It is, however, a distinct species.

There is one strong specific character in the clamorous frog by which it can always be identified, namely, the elevated fold of skin which originates behind each eye, passing over each tympanum, and disappearing near the bend of the back. These cutaneous elevations are always present in the clamorous frog, even in quite immature animals, while they are never found in the bullfrog at any age.

I have seen specimens of this frog colored almost exactly like the bullfrog, so color alone cannot be taken as a criterion in the specific identification of frogs; nor can it in the majority of animals.

I subjoin descriptions of three living specimens of *rana clamitans*.

No. 1 (male). Form rather robust; snout somewhat pointed. Head, anterior part of body above, and back of tympanum, bright green; posterior portions of the back and sides pale olive brown, or light greenish brown. Arms and legs pale olive brown. Upper posterior surface of body and legs, also the sides, spotted with small pale blackish-brown blotches and spots; nates mottled darker brown and white. Tympanum almost twice the size of the eye, bronzed, with a light green center. Throat lemon-yellow, passing into yellowish white on the abdomen. A few dark marks on the upper jaw. Body and posterior extremities slightly tuberculous. Latero-dorsal cutaneous ridges prominent, extending from orbit to bend of back. Length, from tip of snout to vent, 2⅛ inches.

No. 2 (female). Snout less pointed than in No. 1. Head, and anterior part of back, grass-green; posterior part, and legs, olive brown, much darker than the preceding. A few blackish brown spots on the rear back. Legs barred with black-brown. Sides spotted black and white. Labials marked with blackish brown wavy lines, inclosing whitish spot. Tympanum but little larger than the eye. Nates and latero-dorsal ridges, as in the male; the brown mottling of the nates darker, almost black. Skin more or less tuberculous. Length 2¼ inches.

No. 3 (female). Before each orbit, below each nostril, a large green spot. Rest of head and fore part of body, dull olive green, with a tinge of brown. Remaining parts as in No. 2, but the colors paler and the markings less distinct.

The male, as described above, was called the spring frog, *rana fontinalis*, by LeConte, Holbrook, and DeKay; and the green and yellow frog, *rana flavi-viridis*, by Harlan. Holbrook says the spring frog is only found in cold spring water.

THE CLAMOROUS FROG.

The typical *clamitans* I have found to be the most common about ponds and streams, and our spring frog was captured in a creek, far distant from any spring. Its abrupt croaking note is exactly similar to that of the other. Its habits are the same, and I have witnessed a male of this variety embracing a female of the typical variety, *clamitans*.

The food of the clamorous frog is various. Insects of all kinds, crawfish, worms, salamanders, and small frogs, I have known it to devour. I have seen a female seize and swallow young frogs of her own species, and which probably were her own offspring. The young frogs were invariably swallowed head foremost, and the devourer presented a ludicrous appearance, when a posterior extremity of the unhappy young frog protruded from either side of her mouth, having the appearance of a huge waxed moustache.

Electricity of the Heart.

Muscular contraction, it is known, is always accompanied with electric phenomena; the difference of electric potential between two points of a muscle, undergoes a diminution, which, according to Bernstein, precedes, by about one one-hundredth of a second, the contraction of the muscle. This electric variation has been observed on various muscles, and in particular on the heart (by Du Bois Reymond and Kühne), and recently M. Marey has represented it graphically by photographing the indications of a Lippmann capillary electrometer. The *Journal de Physique* states that M. De la Roche has tried the experiment on the heart of a living man. Two points of the epidermis of the chest were connected with the poles of a capillary electrometer, by means of electrodes, formed each of a bar of amalgamated zinc, with a plug of muslin at its lower end saturated with sulphate of zinc. Held with insulating handles, the bars were applied, one with its plug opposite the point of the heart, under the left nipple, and the other to another point of the chest. The mercurial column was then seen to execute a series of very distinct periodical pulsations synchronous with the pulse; each pulsation even marked the double movement of the heart (of the auricles and ventricles). The amplitude corresponded to about one one-thousandth Daniell.

THE IWAKUNI BRIDGE, JAPAN.

We are indebted to the *Illustrated Adelaide News* for the annexed engraving of a very curious bridge, in existence near the town of Iwakuni, Japan. The structure is simply a series of arches from pier to pier, but instead of filling up the space between the arches to the tops, or bridging across from summit to summit, and thus providing a straight and level pathway, the designer has placed steps on the arches themselves, so that the traveler is obliged to ascend and de-

A CURIOUS BRIDGE AT IWAKUNI JAPAN.

scend five eminences to make the crossing. This extraordinary structure is three hundred years old and is regarded as one of the natural curiosities. The supporting pillars are of stone, and the superstructure of wood.

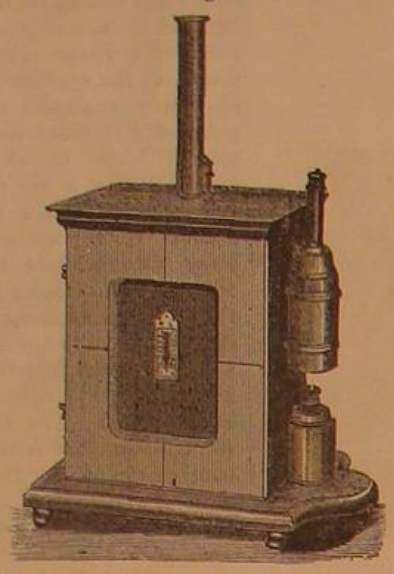
IMPROVED GERMINATING APPARATUS.

The apparatus represented in the accompanying cuts is intended to test the germinating capacity of seeds, and is designed to be used by seed dealers, gardeners, and others.

The apparatus is shown in Fig. 1, and in Fig. 2 is seen a vertical longitudinal section. Fig. 3 is a vertical cross section, and Fig. 4 shows one of the perforated seed plates with which the apparatus is provided.

As shown in Fig. 1, the apparatus is enclosed in an iron covering with a tightly closing front door, through which the seed plates, *a*, *a*, *a*, are placed. The plates are introduced into the apparatus and supported on shelves, *c*, *c*, *c*, made of perforated sheet metal. The seed plates are made

Fig. 1.



of a mixture of pulverized firebrick, sawdust, and powdered charcoal. Every seed plate has a number of oval indentations or cells, in which the seeds are placed, and these cells are made proportionate to the size of the seed. The seed plates are placed in sheet metal pans, *b*, *b*, *b*, in which is a sheet of felt of the same size as the plate. Both seed plates and shelves are enclosed in a jacket formed of two rolls of sheet metal, the space, *d*, *d*, *d*, between them being filled

Fig. 2.

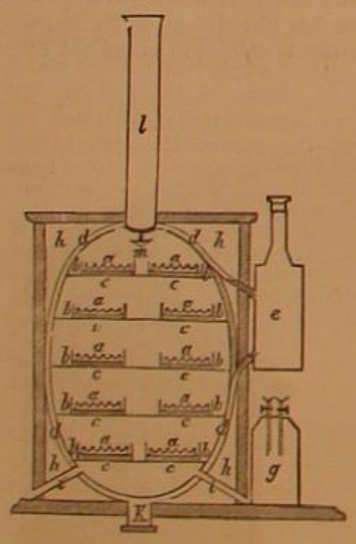
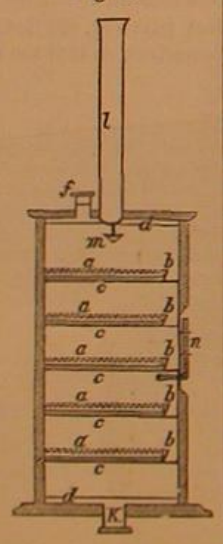
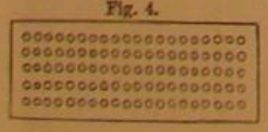


Fig 3.



with water which is heated by a communication with the vessel, *e*, which is also filled with water and heated by a petroleum or alcohol lamp, *g*. To prevent the loss of heat by radiation, the spaces, *h*, *h*, are filled with ashes or any nonconductor of heat. Cold air is admitted to the interior through the channels, *i*, *i*, and the moisture is conducted away through the pipe, *l*, which has a small drip cup, *m*, for the water of condensation. At *k* is shown means for drawing off the water if desired.

Fig. 4.



The temperature in the interior of the apparatus is observed by the thermometer, *n*, Fig. 3, whose mercury bulb is placed in the interior of the apparatus.

When it is desired to use the apparatus, the seed plates are dipped into water, absorbing a certain amount. The plates are then placed in the pans, in which water has been previously poured. The seeds are then wet and placed in the cells. If it be desired to germinate the seeds at the temperature of the atmosphere, all that has to be done is to keep up the supply of water in the pans, but if a more rapid germination is wished, the apparatus is heated by the lamp until the requisite temperature is obtained, when that heat is kept up by reference to the thermometer and regulating the lamp.

THE article upon the gorilla in our last issue should have been credited to Frank Buckland, in *Land and Water*.

NOTES OF PATENT OFFICE DECISIONS.

PATENTS.

Adams brought a suit in equity against the Joliet Manufacturing Company for infringement upon his letters patent for an "Improvement in Corn Shellers." The object of the invention in question was to secure an operative automatic feed, which, without the care of an attendant, would keep the stream of ears of corn steadily and uniformly running into the sheller, instead of permitting it to pile up or choke in the throat. This he accomplished by a series of wings, wheels, or projections, so arranged on a shaft as to revolve in the same direction in which the corn was running, and so placed relative to the throat as to force into the corn sheller all misplaced or hesitating ears. Upon the question of novelty, a large number of devices for feeding or regulating the feed of corn shellers, thrashing machines, straw cutters, planing machines, carding machines, etc., were introduced in evidence. One of these devices, in feed regulators for corn-shellers, which preceded the complainant's, was, in form of construction, almost precisely like that of complainants, except that it revolved in a contrary direction. It consisted, in brief, of a winged shaft, or beater-bar, over the throat of the sheller, so arranged as to revolve in the opposite direction to the stream of the ears of corn, and to drive back the overriding ears as they approached the throat. When at rest, however, and without the gearing by which the motion was secured, the two devices would strike the eye as substantially alike. The circuit court, however, has just rendered its decision sustaining the complainant's patent. It holds that the prior device was found to do but little towards securing the desired result, as the ears thrust or knocked back only got in the way of others, and the machine was therefore still liable to clog, so as to make the feed irregular, and require frequent attention from an attendant, and that an improved result was obtained by the complainant's device.

In the infringement suit of Henderson *vs.* The Cleveland Co-operative Stove Company, it appeared that the specification of the complainant's patent for an improvement in coal stoves, described *a combination* of a combustion chamber, and a circulating air chamber surrounding the hopper, as the substance of the invention, and further stated that, in whatever form of stove the said improvement was applied, *both elements*, namely the combustion chamber and the circulating air chamber, must be preserved. The Circuit Court holds, however, that a separate claim of the patentee to *each* of the elements can, nevertheless, be maintained, and that no inference of the abandonment of an individual element made the subject of a distinct claim can arise from the mere fact that the specification states the invention to consist of its *combination* with another feature.

The Supreme Court of the United States has lately rendered its decision in the equity suit of Russell *vs.* Place, for infringement of letters datent. The main question involved was whether the defendant could set up certain defenses—such as want of novelty in the invention, its use by the public for more than two years prior to the application for the patent, etc.—a judgment in an action at law for infringement of said letters patent having previously been recovered against them by the said complainant. The court decides that before the judgment of a court of competent authority, rendered in a prior action between the same parties, can prevent the defendants from availing themselves of such defenses in a subsequent suit, it must be certain that the consideration and determination of the particular matter set up in the defense to the subsequent suit was necessarily involved in the verdict and judgment in the prior suit; and that if this did not clearly appear from the face of the record, extrinsic evidence consistent with the record might be admitted to establish the fact.

COPYRIGHT CASES.

A decision has lately been rendered by Judge Shepley, in the suit of Richardson *vs.* Miller for the infringement of a copyright for circular playing cards. The defendants contended that their prints were unlike the cards copyrighted by Richardson, and did not infringe the copyright. They further insisted that his copyright was invalid for the reason that his prints were not the fit subject of a copyright. It appeared that there were certain marked differences between the prints of the copyrighted court cards of the complainant and the court cards of the defendants. There was much less space in the center of the cards. The faces of the kings and queens were turned in a different direction. There was a difference in the spaces between the heads on the court cards. There were marked differences in color, also, so that the cards of the defendants were easily distinguished from those of the complainant. But on the other hand, there was a striking similarity in those distinctive features of the main design wherein the printed cards of the complainant differed from other playing cards previously used. In the court or face cards of both complainant and defendants, there was a suit spot in the center of a circular card, with five similar heads arranged at equal distances from each other around the central suit spot, with five smaller suit spots near the outer margin of the circle, at equal distances apart and intermediate between each pair of heads. The court holds that these distinctive features of the main design being thus reproduced in the impressions of the defendants' prints, it is no answer to the charge of infringement that the whole of the design has not been copied, if those features of it have been appropriated which substantially embrace the novelty of the conception and the value in the application of the art of the designer. The doctrine is as applicable to prints and engravings as to books, that one cannot take the vital part of another's work, although it may be but a small part in quantity, or insert distinct and material portions of one work into the general texture of another, constituting its chief value, without being chargeable with infringement.

In regard to the second ground of defense, the court, while admitting that it would not lend its aid to protect the authors of immoral works, says that there is nothing immoral or improper in the complainant's playing cards themselves, and the fact that they may be used by persons to violate the laws against gambling will not, of itself, deprive them of the protection of the law.

GIANT LILY.

This huge lily is quite different in aspect from any other in cultivation. Leaves very broad, those near the root and lower part of the stem, stalked, oval-acute, with a heart-shaped base; the upper stem leaves nearly stalkless, with a

rounded base, and diminishing in size; in size and shape very much like a catalpa leaf. Blooms in summer on a stalk from 7½ to 9½ feet high. The flowers are greenish-white outside, tinged with violet on the inside, large, 6 to 7 inches long, funnel-shaped, with divisions slightly reflected, fragrant, pendulous, 8 to 15 (sometimes 20) on each, tall and stout stem. Native of the Himalayas. Usually grown in greenhouses, but will grow in the open air if well protected. A well drained position, good, deep, and very sandy soil, are indispensable. The best position for it is isolated, a few feet within the margin of a shrubbery, with a warm exposure. Also suitable for association with hardy subtropical plants. A box or barrel should be turned over the plant in the fall, and well filled with leaves.

Bulbs are very large, conical, with scales which are very broad at the base and narrow at the top, very fleshy, not compressed, and of a greenish-white color.

New Haven as a Manufacturing Center.

The New Haven Chamber of Commerce, through its Secretary E. S. Wheeler, is inviting the attention of manufacturers to the advantages offered by New Haven to manufacturing enterprises. These consist of a good harbor, ample wharfage, cheap and rapid communication with New York by water and rail, ample facilities for foreign exportation, direct rail communication with New England, the West and Southwest, with low freights, a large body of skillful mechanics, a smaller indebtedness than any city of its size in the Union, a low rate of taxation, a low rate of assessment, thirty-three miles of sewerage, an ample water supply with one hundred miles of water mains, an admirable fire department, a healthy location, building cheap, and sales plenty and low priced, and educational advantages unsurpassed. Manufacturers wishing to escape excessive taxation and secure a location for manufacturing goods economically and marketing them at home and abroad successfully, should go to New Haven.—*N. Y. Tribune.*

Adulteration of Beeswax.

The recent adulteration of yellow beeswax with rosin has led to the invention of a new method for its detection. E. Schmidt recommends the following process for the rapid and accurate detection of relatively small quantities of pine resin. He heats 5 grammes (75 grains) of the wax to be tested in a flask with four or five times the quantity of crude nitric acid, specific gravity 1·31 to 1·33, until it boils; and it is kept boiling a minute, then an equal volume of cold water is added, and enough ammonia (which must be added very cautiously) put in and shaken to cause it to smell strongly of ammonia. The alkaline liquid is decanted from the precipitated wax into a cylindrical vessel. If the wax was pure the liquid will have a yellow color; if the wax was adulterated with rosin the liquid will have a more or less intensely reddish-brown color from the formation of nitro-products. This being a colorimetric test, it is well to have some perfectly pure wax for comparison. The reaction is much more violent during boiling if rosin is present. As little as 1 per cent can be detected in this way.

A New Gold Salt for Toning.

BY DR. J. SCHNAUSS.

Until now there have been used only the single and double chloric salts of gold for toning During the past winter Mr. Neumayer, student of chemistry from Munich, visited my establishment and undertook under my directions the preparation of a gold bromide and a gold bromide of calcium, for the purposes of experimenting with these salts and their uses in photography.

Thin leaves of gold are readily dissolved in bromine water and in bromine gas. But a more rational and less disagreeable mode of preparation is by the action of hydrobromic acid, nitric acid, and aqua-regia.

During the evaporation of the gold bromide, which has a dark appearance and smells strongly of bromine, great care is necessary, owing to the fact that the gold bromide vaporizes more easily than the chloride. Bromide of gold is difficult to crystallize. By the addition of an exact equivalent of bromide of calcium dissolved in water, and evaporated, small granite-red crystals of double salts are obtained. $KBr + AuBr_3 + 3H_2O$ can be with difficulty dissolved in water; but a thin solution is of a deep red color, and effloresces in dry air.

I have tried these double salts, also the gold bromide, with several additions as a toning bath. In its general effect on silver copies it is analogous to gold chloride combinations, except that in the same proportions it acts more energetically.

The addition of soda bicarbonate gives a blue-black tone, melted acetate of sodium a purple colored tone.

For a lasting gold bath, in form of a *sel encaussé*, these salts are recommended.—*Archiv.*

How to Prepare Photographs for Printing Blocks.

In the *Photographisches Archiv* appear the details of a simple method of securing an outline photograph in metal suitable for printing with type in the ordinary printing press. It is necessary to be somewhat of a draughtsman, no doubt, in order to be able to do the work well and rapidly, although nothing is said on this head, but hardly any one could, haphazard, undertake the matter.

Only a well marked photograph with bold lines, and in which minor details are of no account, is suitable, and the negative is in the first place put into a camera or other apparatus to furnish an enlarged positive. Upon this enlarged positive are traced, in Indian ink, the bolder lines which it is desired to retain, a pen or brush being employed for the purpose, according to the nature of the work or the desire of the draughtsman. After all details have been in this way traced, with thoroughly black pigment, the lines of a thickness corresponding to the original object, and of such a nature as to be readily reproduced by photography, the print is treated with chloride of lime or other bleaching agent, and in this was the whole of the image obliterated with the exception of the block lines made by the draughtsman.

The picture is now photographed, and in this way a small negative secured, or one, at any rate, of the dimensions of which the printing block is to be. In this case the negative will be perfectly opaque in the lights and transparent in the shadows, and from it may be easily produced, by any of the etching processes, an engraving upon zinc capable of being used in the printing press with type.

Chloride of lime is specially mentioned as the bleaching agent wherewith to render invisible the details of the silver image, after the draughtsman has done his work. We should think that a solution of bichloride of mercury would be much more effectual in making the original photographic image disappear.

Aluminum.

In a recent meeting of the Miners' Union at Freiberg, Professor Winkler described some experiments made to measure the power which aluminum possesses of resisting external influences. Tablespoons made of aluminum, of silver (75 per cent), and of German silver of best quality, were the subjects of experiment. They were in the same daily use, and were weighed at regular intervals. These spoons were purposely brought into contact with the greatest variety of food, and each time after using were rubbed with soap, washed in hot water, and rinsed with cold water. They were also occasionally washed with a dilute solution of carbonate of soda, so that they were in daily contact with hot and cold acid and alkaline liquids.

In the course of time there was a change in the appearance of the spoons. The aluminum, which at first was a beautiful white, lost its brightness and acquired a dead, bluish-grey color; the German silver also lost its brightness, while its color changed to a disagreeable greyish-yellow; the silver stood best, as it only lost its polish, but remained comparatively white. Repeated weighings showed an average annual loss in weight of:

0·630 per cent for aluminum,
1·003 " " German silver,
0·403 " " silver;

so that if it were possible to use them until entirely used up, a silver spoon would last 248 years, one of aluminum 158 years, and one of German silver 99 years.

The spoon form was selected merely because it offered the best opportunity for measuring the amount of chemical and mechanical loss in comparison with other metals and alloys tested. The results of these experiments showed that aluminum is not nearly so easily attacked as has hitherto always been supposed, but is more like zinc; and if it could be made at a low price, it might be employed for a great variety of purposes.

NEW BOOKS AND PUBLICATIONS.

LIGHT—A SERIES OF SIMPLE EXPERIMENTS, ETC., by Alfred M. Mayer and Charles Barnard. D. Appleton & Co. 549 and 551 Broadway. 1877.

There have been so many attempts to popularize scientific experimenting, that we took up this little book with some curiosity as to the new guise in which we were sure Dr. Mayer would present his experiments. The way in which that curiosity is gratified is to us very satisfactory. The experiments are capitally selected and equally as well described. In fact the book is conspicuously free from the multiplicity of confusing directions clear enough to the writer but not to the reader, with which works of the kind too often abound. Beginning with the heliostat and its simple construction, Dr. Mayer takes up the phenomena of reflection, refraction, and decomposition of light, giving a few—and carefully avoiding too many—experiments in each branch, which are the best suited to fix the particular principle under study. Complicated and expensive apparatus is avoided, and everything needed for the entire course may, we are told, be bought for 15 dollars. There is an abundance of excellent illustrations, and Mr. Charles Barnard, who describes the various experiments as they were produced before him, has certainly ably supplemented Dr. Mayer's work. Altogether the book is very commendable, and especially so to the readers of the SCIENTIFIC AMERICAN.

A TREATISE ON ENGINEERING CONSTRUCTION. By J. E. Shields, C.E. New York: D. Van Nostrand & Co., Publisher, 23 Murray street. Price $1.50.

A plainly written clear and readable little book, which owes its value to the fact that it is claimed to be the results of the author's own experience gained in a professional practice of many years. It deals with practical subjects throughout. There are chapters on sand, concrete, caissons, pile driving, etc., under foundations—a division is devoted to masonry, another to tunnels, and the last to engineering geodesy. An excellent work for young students in the profession, and a handy book of reference for any civil engineer.

THE RAILWAYS OF NEW SOUTH WALES. A report on their Construction and Working from 1872 to 1875 inclusive. By John Rae, A.M., Commissioner for Railways. Published by the Government, Sydney, N. S. W.

Mr. Rae's report shows with much clearness the advantages accruing from investing capital in railways well managed and opening up a new and growing country to commerce. At the end of the four years noted there were 437 miles of road in the colony in operation and an additional length of 251¼ miles in progress. The expenditure for rolling stock, machinery shops, etc., had been about $32,536 per mile—43·18 per cent of the earnings were spent in maintenance and working. For every mile open the earnings were $7,435—the expenditure being $3,610 and the net earnings $3,885. The net earnings show an increase of 13 per cent for the year 1875 over that of the year 1871. A supplement to the report gives detailed descriptions of the lines and works of construction, which will be found of value to railroad civil engineers for purposes of reference and study.

MANUAL OF THE RAILROADS OF THE UNITED STATES FOR 1877. By Henry V. Poor. 10th series. Published by H. V. & H. W. Poor. 68 Broadway, New York.

Poor's manual gives as usual a valuable and very full compilation of statistics relative to all the railroads of the country, showing their present status and also their history during 1875. The past year, we learn, has been one of great depression in the railway business although the aggregate results of all operations has been "fairly satisfactory." The number of miles of road opened during the year was 2,565 against 1,919 miles for 1875, 1,911 miles for 1874. This increase is due to activity in the Southern Pacific lines and in narrow gauge lines in Ohio, Texas, and Colorado. No new lines of any magnitude have been undertaken. The gross earnings of the business have fallen off $3,837,345, and the net earnings have increased $946,314, the latter owing to the economies practiced in operating the roads. The information given regarding the various lines covers financial condition, property, etc., with much detail. There is a valuable appendix showing State debts and liabilities.

A TREATISE ON THE USE OF BELTING FOR THE TRANSMISSION OF POWER. By John H. Cooper, M.E., Philadelphia. Claxton, Remsen, & Haffelfinger, 624 Market street

A thorough and complete treatise on the subject of belting has been needed by mechanical engineers for a long time. Information on the subject, of which there has been no lack, has remained scattered through the files of this and other journals or has appeared in the shape of chapters in works covering very much wider ground. Hence the matter of belting has not obtained that exhaustive treatment which its importance really warrants for it, and hence we are more gratified to see so well qualified an engineer as Mr. Cooper undertake and carry the task to a successful completion. The only blemish—if it indeed be one at all—is that his work is too full; original papers are quoted in abundance where perhaps condensation would have better suited the needs of the practical reader while the risk of repetition might have been avoided. But as a whole the book is excellently well compiled from a large number of sources. The best and newest of all on the subject has been culled. Practical hints and suggestions abound, there is a multiplicity of rules, recipes, and useful tables, and an ample supply of good woodcuts.

Inventions Patented in England by Americans.

From July 31 to August 6, 1877, inclusive.

AXLES.—B. T. Babbitt, New York city.
BARBED WIRE FENCE.—H. W. Putnam, Bennington, Vt.
BOOK.—E. S. Boynton, New York city.
EXTRACTING WORT FROM MALT.—R. d'Heureuse, New York city.
FIRE ARMS.—E. T. Starr, New York city.
GAS APPARATUS.—W. W. Batchelder, New York city.
PLUMBER'S TRAPS, ETC.—J. E. Folk, Brooklyn, N. Y.
PUNCHING AND SHEARING MACHINE.—D. Brickner, New York city.
SEWING MACHINE.—L. R. Blake, Boston, Mass.
SHOE MACHINERY.—H. G. Thompson, Milford, Conn.
TELEGRAPH INSTRUMENT.—T. A. Edson, Menlo Park, N. J.
TOOL HOLDER.—E. F. Bengler, Williamsport, Pa.

Recent American and Foreign Patents.

Notice to Patentees.

Inventors who are desirous of disposing of their patents would find it greatly to their advantage to have them illustrated in the SCIENTIFIC AMERICAN. We are prepared to get up first-class WOOD ENGRAVINGS of inventions of merit, and publish them in the SCIENTIFIC AMERICAN on very reasonable terms.

We shall be pleased to make estimates as to cost of engravings on receipt of photographs, sketches, or copies of patents. After publication, the cuts become the property of the person ordering them, and will be found of value for circulars and for publication in other papers.

NEW HOUSEHOLD INVENTIONS.

IMPROVED SHADE HOLDER.

Gustavus H. Reck, Bethlehem, Pa.—This invention relates to an improved shade holder that adapts itself to any shape of burner, with iron, brass, lava, or other tip of a larger size than the body; and the invention consists of a shade holder having arms and springs fastened by their bent ends into a U-shaped collar or ring. The springs produce a firm fitting of the shade holder to the burner without being liable to get shaky or loose, as the arms and springs are attached without solder, and retained firmly by the binding action of the collar or ring, forming thus a strong, durable and tightly fitting shade holder.

IMPROVED LAMP BRACKET.

John Forster, Coal Valley, Ill.—This invention relates to an improved safety lamp stand for sewing machines, pianos, or ans, and other purposes, and consists of a base part clamped or screwed to the table of the sewing machine or other object, and provided with a detachable standard and oil cup stand, the standard having an adjustable stand and collar for the lamp, and a pincushion at the top.

IMPROVED RECIPROCATING CHURN.

Daniel A. Fiske, St. Louis, Mo.—When the dasher of this churn is raised the wings turn down, permitting the dasher to rise easily through the cream. When the dasher is forced downward the wings are thrown up, and the inclined surfaces of the various portions of the dasher cause the cream to rotate The upward motion of the dasher checks this rotation. The intermittent rotary motion of the cream is effective in separating the milk and butter, and the same motion tends to unite the particles of butter.

IMPROVED WRINGER.

Edwin Banfield, Jermyn, Pa.—This machine is designed for use as a wringer and as a mangle upon table linen, bedclothes, and other plain articles that are free from buttons, hooks and eyes, and other fasteners. The invention consists of the combination of wringer rolls, of a bevel guide to transfer the waste water where it is guided by cleats into a tub, and inclined tables or levers, to which the guides and cleats are attached. When the machine is to be used as a mangle, the table, with the cleats, is inverted, and the tables are adjusted in a horizontal position.

IMPROVED ROTARY CHURN.

William Knaggs, Richview, Ontario, Canada.—The object of this invention is to furnish an improved churn dasher which shall be so constructed as to bring the butter very quickly, and gather it quickly and thoroughly. The dasher rod is made square, passes through square holes in the centers of crosabar, and its end revolves in a step or socket attached to the bottom of the churn body. The other end of the rod is enlarged, passes through a bearing, inserted in a hole in the top of the churn body, and attached to or formed upon a small plate secured to the top. By this construction, when the dasher is turned forward the milk is drawn inward by the bars, is forced through the opening between their inner edges, and strikes against the inclined bars, by which it is divided and thrown in opposite directions. When the dasher is turned backward the rear sides of the bars act as paddles or ladles for gathering the butter.

IMPROVED ROTARY CHURN.

Honoré G. Fougeu, Cape Girardeau, Mo.—This invention relates to a new motive power which is especially designed for mixing liquids, for churning butter, and for other purposes where a rapid and alternate rotary motion is found useful. The sperture may be made small enough to fit an ordinary tumbler, or can be constructed on a scale large enough for churning butter or washing fabrics. The upper end of a spindle has a bearing in a handle, which is screwed fast upon the cap. The lower end of the spindle is screw-threaded to receive the shaft of a dasher, which may be of any desired form. Between the upper end of the dasher shaft and the top of the cap a balance wheel is applied, on the tapering part of the spindle, and confined by friction, so that in the event of the dasher meeting with a resistance which would be liable to injure the machine the said wheel will slip. Inside of the cap is fitted a collar which may be made of sheet metal, and which is constructed with a circular flange that receives upon it a cylinder. The collar will prevent fluids from getting inside of the cap. The cylinder is designed to prevent fluids which are being agitated from flying out of the vessel containing them. The machine is operated by means of a strong chord, which is wound around the pulley on a spindle, and which may be held in the hand or attached to a lever, and guided by a pulley. This improved agitator will be found very useful for mixing all kinds of fluids, for churning, making ice cream, beating eggs, washing fabrics, and for many other purposes.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED CORN PLANTER.

William M. Steel, White Day, W. Va.—This invention consists in the combination of the U-shaped iron bars with the axle of the sulky, to adapt it to receive the operating parts of the machine; and in the combination of the bar, the hopper or hoppers, the dropping slides, the spring bar, the stud, and the block or blocks with the U-bars and the axle and wheel of the sulky. To the rear side of the axle are bolted the forward arms of two U, shaped iron bars, within which is secured a wooden bar To this bar is attached a long hopper, or two short hoppers, to receive the seed, and from which the seed is removed by dropping slides which have holes formed in them of such a size as to contain enough seed for a hill, and pass through slots in the front and rear sides of the hopper. The forward ends of the dropping slides are pivoted to a spring bar, one end of which is attached to a stud attached to the axle near one wheel, and its other end projects so as to be struck by a block or blocks attached to the spoke or spokes of the other wheel. The slides are kept from carrying out any more seed than enough to fill their dropping holes by rubber blocks attached to the forward side of the hopper. The seed drops from the slides, through holes in the bar, into the conductor spouts, attached to the lower side of the said bar, and upon the lower ends of which are formed, or to them are attached, points to open the soil to receive the seed and points to cover the seed. The spouts are connected by a rod, so that their lower ends may be adjusted to plant the rows wider apart or closer together. The distance apart of the hills is regulated by the number of blocks attached to spokes of the wheels. The amount of seed dropped for a hill is regulated by using slides with larger or smaller dropping holes.

IMPROVED STONE-QUARRYING MACHINE.

John B. McRae, Mount Holly, Ark.- The object of this invention is to work the large quarries of soft white stone which are found in Texas and other States, and which produce a very useful building material, by a machine which is designed to cut the stone in the quarry directly into blocks of the required size in a quicker and more economical manner than with the present slow and tedious methods of quarrying them; and the invention consists of a car with a steam engine or other motor driving a vertical and adjustable front saw, a horizontal and adjustable saw back of the same, and a third vertical rear saw, at right angles to the front saw, to divide the long pieces of stone cut from the bed into blocks of the required size. The rear saw is made vertically adjustable by a suitable lever and guide arrangement. A car of suitable size is propelled to the place of work on a track laid in the quarry. The car is provided with a steam engine or other motor, by which the cutting saws are revolved and the car moved forward while the machine is in operation. The car is moved up along the bed of stone as the cutting progresses. At the front part of the car is placed a vertical saw, of suitable diameter, that cuts down into the bed of stone.

IMPROVED HYDRANT VALVE.

Frederick Shriver, Grand Rapids, Mich.—The object of this invention is to construct a hydrant valve that cannot freeze or become obstructed so as to be inoperative. Above the valve seat openings are made through the sides of the part of the valve that projects into the supply pipe and passages are formed in the projections on opposite sides, which extend downward below the casing to permit the escape of waste water. The valve consists of a follower, which is reduced in diameter to receive the packing which caps over its end and extends upward to the shoulder, which is undercut to retain the edges of the packing. Below the packing a centrally perforated disk is placed, which is provided with a lip around its outer edge that projects downward. Below the disk there is a leather or rubber

packing disk, and a screw passes through the disks and packing into the follower, holding all of the parts together. Above the shoulder the follower is reduced in diameter to permit the waste to escape through the passages when the valve rests on its seat. A rod is screwed into the valve for operating it. The part is connected with a supply pipe, and the casing with the upper portion of the hydrant by a pipe. When the valve is raised it closes the waste passages and allows the water to pass from the passage through the openings to the chamber, and thence through the pipe. When the valve is closed the water remaining in the pipe escapes through the waste passages, and should one of the passages become clogged the other is sufficient for the escape of the waste water. The valve casing may be made partly from pipe fittings, or it may be cast entire from steam metal or other suitable machinery.

IMPROVED MILLSTONE-DRESSING MACHINE.

Frank Miller, Lapeer, Mich.—The object of this invention is to furnish a device for dressing millstones which will keep a perfectly true surface upon a stone, and will feed the cutter forward automatically as each cut is made. The invention consists in a combined frame and slotted arm, a pivoting bolt, pivoted slotted lever, sliding crosshead, cutter, pawl, ratchet wheel, and a swiveled screw adapted for use in dressing millstones. A small rectangular frame is planed perfectly true, from the inner end of which an arm projects which is slotted longitudinally to receive a bolt, by which the inner end of the lever is pivoted. The inner end of the lever is slotted longitudinally to receive a pivoting bolt, so that the said bolt may be adjusted to cause the cuts to approach each other at a greater or less angle, as may be desired. The lever rests and vibrates upon the top of the frame and arm. The part of the lever that is over the frame has longitudinal flanges formed upon its upper and lower sides, to serves as ways for a crosshead to slide upon. To the crosshead is pivoted the end of a pawl, which rests upon the upper end of the cutter, or upon some other stop attached to the said crosshead. The cutter makes the cut as the crosshead is drawn inward, and as the said crosshead is pushed outward the engaging end of the pawl strikes against the teeth of the ratchet wheel and turns it. As the screw is turned by the outward movement of the crosshead the lever will be moved laterally to bring the cutter into the proper position for making another cut. With this construction the stone will be dressed from the eye to the skirt, just the same as a stone will wear, facing the stone at the eye or center, and cracking it at the skirt.

IMPROVED ADJUSTABLE GAUGE FOR SAWMILLS.

Franklin Wheeler, Berlin, N. H.—This invention has relation to gauges for circular-saw mills; and the nature of the invention consists in a gauge or guide applied to a bar which is adjustable between guides, and provided with a handle and a latching device. The bed plate of the gauge is secured upon a solid foundation, and arranged at right angles to the plane of the saw. On this bed plate are constructed two parallel guides, between which is a sliding gauge bar. A gauge roller is applied on a post, so as to rotate freely, which post is rigidly secured to one end of the bar, and stands perpendicular to it. A handle is secured to a bar at the end bearing the roller, and which is perpendicular to this bar. To this handle is pivoted a latch bar, to the free end of which a shouldered latch pin is loosely applied, which passes freely through the bar and enters one of a number of holes made through the bed plate between the guides. Rising from the pivoted end of the latch bar is a tongue, between which and the handle is a spring that acts to keep down the latch pin. By firmly grasping the handle and tongue the pin will be raised out of its hole, and the gauge bar can be adjusted endwise, according as it may be desired to edge the stuff to be sawed. The top of one of the guides is graduated by marks corresponding to the holes, and a pointer fixed to the bar opposite to the latch pin is used to indicate the position of the roller with respect to the saw.

IMPROVED TWISTING SPINDLE FOR MAKING CORDAGE.

Charles E. Brownell, Moodus, Conn.—The object of this invention is to furnish an improved spindle for twisting twine and other three or more strand cordage, which shall be so constructed as to enable the twist to be made tight or loose, which shall be evenly balanced, and which will stop itself automatically should one of the strands break. To the spindle is attached two plates. In the plates are formed holes to receive the journals formed upon the end plates of the fliers. To the upper side of the upper plate are attached the ends of springs which have bends formed in them near the hollow journals of the fliers to receive the strands. The springs are so formed that when left free their bends will be upon the outer sides of the hollow journals, and their outer ends will project beyond the periphery of the plate. By this construction the tension of the strands will draw the free ends of the springs inward; and, should the said strands break, the elasticity of the said springs will throw their outer ends outward, to strike against the frame of the machine or against stops, attached to said frame to stop the device and prevent waste of material. The springs thus act as tension devices and as automatic stops. The tension upon the strands may be varied by regulating the force of the springs and increasing or diminishing the number of coils of the strands around the arms. The ring plate on the spindle can be driven at different velocities, thus imparting to the fliers any relative number of revolutions to one of the spindle. In this way the twist of the strands can be exactly adjusted to the last twist, so that the completed cork will not kink.

IMPROVED DREDGE BUCKET.

James McSpirit, Jersey City, N. J.—The object of this invention is to provide a device for operating dredge buckets and grapples by means of levers and connecting rods, and to dispense with the usual windlass and other objectionable devices. This arrangement of the lever and connecting rod forms a pair of toggle joints for each half of the bucket, which are capable of forcing them together against great resistance. A roller is journaled in the upper part of the frame for guiding the chains that operate the buckets. A chain is attached to the sheave, and winds partly around it when the buckets are closed, and extends upward to the crane that supports the buckets, and a chain is attached to the upper end of the lever, and passes under the roller and upward to the crane before mentioned. It is obvious that the levers and devices described in connection with dredge buckets may be employed with equal advantage to operate grapples.

IMPROVED INDICATOR FOR MINING SHAFTS.

Calvin O. Richardson, San Francisco, Cal.—This invention consists of a bell having a spring tongue or clapper that vibrates easily, so that when the bell is attached to the hoisting rope of a mining shaft, and the tub or cage descending, the clapper will strike the bell when there is a slight checking or variation in speed, which is caused by the momentum of the clapper overcoming the slight resistance of the spring tongue. Thus warning is given of the descent of the cage or tub. A more violent ringing is caused as the tub approaches the bottom, by the brakesman making a few sudden pressures upon the brake, thus warning the workmen to stand from under.

IMPROVED STEAM ENGINE.

William Walker, Bury, England.—This is a tri-cylinder engine of the vertical pattern. The pistons have reduced extensions, and a bored passage extends through both. When a piston recedes in its cylinder the extensions uncover the live ports and admit steam to the contiguous cylinder which thus acts on the contiguous piston and forces it down. When this last-named piston rises, an aperture in its extension registers with the live steam port and the exhaust of the contiguous piston then takes place down through its bored passage. Thus, as each piston descends, it opens the port of a contiguous piston, and, as it rises, it opens the exhaust for the piston on the other side. The engine is reversed by a suitable rotary valve.

IMPROVED HOISTING MACHINE.

Henry Batt, Kentish Town, London, Eng., assignor to Leonard G. Tabraham, Boston, Mass.—This invention consists in the combination of the fast and loose pulleys, short shafts, sliding gear wheels, large gear wheels, and clutches with each other. When certain wheels are in gear the machine works with great power and slow movement. When other wheels are in gear a faster movement is obtained, but less power. When other wheels are in gear it will work as a single purchase hoist and with medium power and speed. Brake straps are arranged for controlling the movement of the apparatus, which are attached at one end to the frame, passing over a drum wheel, and their outer ends are attached to the short arms of bent levers, which are pivoted at their angles to the frame, or to supports attached to said frame, and are provided with catch bars to hold them in place when adjusted.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED HORSE-DETACHING APPARATUS.

Warren Jones, Berlin, Wis.—The object of this invention is to provide an improved horse-detaching apparatus for vehicles, designed to enable the driver to entirely disconnect the team without getting out of the vehicle, either for convenience in practical every-day use, or for special emergencies in the event of a runaway or fall of the horse. To this end the improvement consists mainly in the particular construction and arrangement of a locking stud for the trace combined with the ferrules on the whiffletree, so as to be moved outwardly from the end thereof to release the tracer; and it also consists in the combination with the detaching devices of a peculiar form of brake designed for simultaneous and joint operation with the detaching devices, to stop the momentum of the vehicle and prevent accidents which might occur, after the horse is loose, in going down hill or over dangerous roads.

IMPROVED HANDLE ATTACHMENT FOR CARPETBAGS, ETC.

Abraham Kaufmann, New York city.—The object of this invention is to provide for satchels, traveling-bags, pocketbooks, and similar articles an improved spring clasp for holding the jaws of the satchel frame rigidly in closed position, the spring clasp being used in connection with the handle or separately at the ends of the satchel frame, as desired, and forming a neat and reliable closing device in addition to the lock. The pivot clasps at present in use on satchels and bags bind sometimes too tightly on the jaws so as to chafe the leather of the same, or work too easily so as not to close the frame reliably, or get bent or broken, or present other objectionable features, which this clasp is intended to overcome, as it will always fit the frame, lock the same rigidly, and be operated especially when connected to the handle by the mere raising of the handle, without separately taking hold of the clasp for closing. The invention consists of a clasp, of angular or other shape, pivoted to posts of the outer jaw and binding over the other jaw. The clasp is retained in locked position by a spring pin entering a hole of one of the posts, and being pushed back for releasing the clasp by a sliding thumbpiece. The swing clasps are provided with sockets, into which ferrules at the ends of the satchel handles are inserted and locked by a kind of bayonet joint.

IMPROVED BOOKBINDING.

Oswald Routh and John S. Routh, New York city.—This invention relates to the binding of books; and it consists in fastening the leaves together by means of metallic clips which take the place of the usual tape. The invention is especially applicable to schoolbooks, but it may be applied with advantage to books of other descriptions. The common difficulty with tape-bound books is that the tape becomes torn or broken by the constant and usually careless opening of the book, and the leaves of the book become loose, and are soon lost or destroyed. Another difficulty with books bound in usual manner with tape is that the cover must be formed on the book; a finished cover cannot be applied. By this improvement these difficulties are avoided, and the book is made stronger and more durable, and may have applied to it an embossed or ornamental cover.

IMPROVED BALE TIE.

Robert G. Stewart, Augusta, Ga.—This invention relates to means for fastening bands around bales of all kinds of material; and the nature of the invention consists in a novel way of uniting the lapped ends of a bale band by means of a screw, whereby a substantial and safe fastening can be made with great facility. A screw is passed through one of the holes of the end of the band until the neck comes within the hole. The upset portions are then reset or pressed back, so that they will not allow the screw to be removed, but will allow it to turn freely. The screw thus permanently attached to the band will not get lost. When the ends of the band are lapped around a bale, the screw is set home into the end, and a firm fastening is made. By means of a wrench of a suitable kind, the ends of the hoop can be very forcibly drawn together and held fast.

IMPROVED COFFEE CLEANER.

Patrick McAuliffe, New York city.—This invention has reference to an improved machine for cleaning and polishing coffee in superior manner, the machine being of simple construction, run with comparatively small power, and producing a very satisfactory result, as all the skinny particles are screened off and the appearance of the coffee greatly improved. The invention consists of revolving scoop-shaped wings or stirrers, in connection with a drum or cylinder mounted loosely on the stirrer shaft, and following the motion of the stirrers, the drum being made of sheet metal, with laterally alternating perforated and not perforated sections. The weight of the coffee and the motion of the stirrers impart to the loosely mounted cylinder a motion in the same direction as the stirrers, but considerably slower than the same. This produces continuous changes in the position of the coffee in the cylinder, so as to exert an additional cleaning and polishing influence upon the same. The influence of the lifting and dropping of the coffee by the stirrers, in connection with the difference of the motions of the stirrers and cylinder, produces the effective polishing of the coffee by a machine of simple construction and operation.

IMPROVED COPYING PRESS.

Elias Gill, San Francisco, Cal.—This invention relates to an improved copying press, of simple and effective construction, that combines economy, utility, and convenience with lightness and facility in handling, the same requiring no extra stand, but being placed, without fastening, on any table or support, and readily put away when not required for use. The press is readily operated by bringing the cam handles toward each other, allowing the top board to remain for a short time in this position, and then reversing the cams, so that the rubber springs raise the top board and admit the taking out of the copying book. The press may be furnished at less cost than any one of the common screw presses in use, while it furnishes just as good copies. It needs not to be screwed or fastened down to keep in place, as the pressure is exerted at the same time at both ends of the same. The press, when of wood, is light and easily handled or removed, but strong enough for all the purposes required.

IMPROVED CONCRETE PAVEMENT COMPOUND.

Edwin Jacques, Great Falls, N. H., assignor to himself and Raphael Gotier.—The object of this invention is to construct street pavements, sidewalks, and basement floors of a compound or concrete which will not be liable to crack, nor to be injuriously affected by frosts or extremes of temperature, and which will be cheap and require only ordinary skill to lay it down. Formula: For about twenty-seven square yards of pavement, mix together, in about the same proportions named, 1 barrel of gas tar, 20 lbs. of "gum" tar, 1 lb. of alum, 1 lb. of washing soda, ¼ lb. of brown potash, 19 ordinary sized wheelbarrow loads of sharp sand. The gas tar is boiled with the gum tar about one hour and a half. Then add the potash, alum, and soda, dissolved in about one gill of water. The sand is then added by making alternate layers of it with the first named ingredients. The concrete is then run through a machine suitably adapted to the purpose, which thoroughly mixes the ingredients. The bed or ballast for the pavement is composed of small stones, properly tamped down, and then the hot concrete is spread on the gravel to the thickness of about three inches, and rolled down solid. For gutters, add a finishing coating of boiled tar.

IMPROVED TOOL STOCK FOR DENTAL ENGINES.

Edwin Telle, New Orleans, La.—This stock is formed by coiling a wire spirally and then coiling another wire around it in the other direction. This construction makes the stock flexible, and prevents the wires from uncoiling when in use. The stock may be made of steel or other suitable metal, may be made of any desired flexibility, and may be made flexible for the entire length, or may be made partly flexible and partly solid, as may be desired. With this construction the various operation of smoothing rough surfaces upon teeth, and of shaping, smoothing, and polishing complicated gold filling, will be much more pleasant to the patient than when said operations are performed with the wheels, disks, and points mounted upon rigid stocks, and there will be much less liability to break thin and delicate corundum disks.

IMPROVED MEASURING DEVICE FOR FILLING CARTRIDGES.

John D. Wilkinson, Plattsburg, N. Y.—The object of this invention is to furnish to sportsmen and others an improved cartridge loading implement, by which the charges of powder of the required size are obtained in quick and accurate manner, and the loader consists of two cylinders, one sliding within the other and turning between top and bottom plates, to which they are pivoted. The top cylinder has an opening and changing tube, registering with an opening of top plate and funnel, and the lower cylinder a connecting tube and opening registering with exit opening and spout of bottom plate. When the loader is clamped to the table, adjusted to the charge desired, and the powder placed in the funnel, the drums or cylinders require only to be turned from the supply hole to the discharge hole and back, and a charge is furnished with each forward turning of the drum, so as to produce the rapid and accurate charging of the shells in uniform manner.

NEW AGRICULTURAL INVENTIONS.

IMPROVED RIDING PLOW.

James L. Florance, Plano, Texas.—The object of this invention is to furnish an improved riding or sulky plow which is so constructed that the plow may be readily lowered into, raised from, and adjusted to run at any desired depth in the ground, and which may be adjusted to take or leave land, and to hold the carriage level when both wheels are running upon unplowed land, and when one wheel is running in a furrow. To the rear part of the side bars of the frame are attached the upper ends of two bars, the lower ends of which are bent outward, or have hooks formed upon them, to catch upon a crank when the plow is raised out of the ground to pitch the plow forward and prevent the forward end of the beam from interfering with the tongue or its brace frame.

IMPROVED CORN HARVESTER.

Washington B. Mayfield, Seneca, Mo.—The object of this invention is to furnish an improved machine for harvesting corn by stripping the ears from the stalks while standing in the field; and the invention consists in the combination of strippers, bales, levers, and a box made with an inclined bottom, a vertical flange or apron, and a detachable back, with the wheels and axle and the frame work of the machine. The strippers are formed of a number of parallel fingers, placed about an inch and a half apart, and made about an inch and a half wide upon their upper sides. The fingers are made thinner upon their lower sides, so that the stalks cannot wedge themselves while being drawn through. The ears, being thicker than the spaces between the fingers, will be stripped from the stalks and left upon the said fingers. The strippers are made to move up and down vertically by guide pins attached to their rear ends, and which pass through vertical slots in the apron or flange. The strippers are hung with their forward ends inclined upward so much that when the said strippers are raised above the level of the forward side of the box the ears will slide from them into the said box. When a sufficient quantity of ears has been collected the sliding back of the box is raised and the ears are allowed to slide out, and are left upon the ground in a heap.

IMPROVED DEVICE FOR DEPOSITING FEED IN TROUGHS.

Andrew J. Rush (Simpson's Store P. O.), Nineveh, Pa.—The object of this invention is to furnish an improved device for feeding grain to sheep in troughs, which is so constructed as to spread the grain evenly through the trough, and prevent the spilling and waste of the grain from the crowding around of the sheep. The invention consists in the combination of bars, wheels, sliding bottom, and lever with the feed box; in the combination of regulator and its lock with the feed box, the lever and the sliding bottom, and in the combination of the curved rods; and the sliding stroke board with the sliding bottom, the lever, and the feed box. To the outer corners of the sliding bottom are pivoted the ends of two rods, which pass through the guides attached to the forward parts of the sides of the box, and through the projecting ends of a bar attached to a board, that slides up and down upon the rear side of the lower part of the box. The rods are so curved that, when the sliding bottom is drawn outward to allow the grain to flow out, the sliding board will be lowered to stroke off or level the grain in the trough, so that it may be of uniform depth, giving all the sheep an equal chance at the feed.

IMPROVED MILK COOLER.

Charles W. Loller, Unionville, Pa.—This invention has reference to a milk cooler that admits the action of the cooling medium on the bottom and sides of the pan, together with an adjustment of the level of the water to the level of the milk in the pan. The invention consists of a milk pan with bottom inclined from the sides toward the center line. The pan is set into and connected to an inclosing water tank, having adjustable exit pipe to regulate level of water in the same. The cold water enters at one corner and passes around the pan in the surrounding space to an exit pipe at the opposite corner, its level being controlled by a vertically sliding pipe, to correspond to the level of the milk in the pan. The bottom of the pan is made dishing by being inclined at a suitable angle from the longer sides to the center line of the pan. This produces triangular spaces between the bottom of pan and vat, into which the cold water may enter, so that the bottom of the milk pan is cooled off in the same manner as the sides. The connection of pan and vat forms a connected cooler that is conveniently handled. The vat may be readily cleaned by taking out the sliding tube, and the milk drawn off from the pan by an exit pipe and suitable stopper, in the customary manner.

IMPROVED TOBACCO PLANT PLANTER.

Robert A. Knox, Ghent, assignor to himself and Darcall Brothers, Louisville, Ky.—This is a hand-machine for setting out tobacco plants, and is so constructed as to open a hole to receive the plant, guide the plant into the hole, and press the soil around it. In using the machine, it is carried by the handle, and is placed upon the spot where the plant is to be planted, and the other hand is pressed down upon the knob of a rod, which forces the head into the soil and opens a hole to receive the plant. The operator then removes his hand from the rod, allowing the head to be withdrawn from the ground by a spring, takes a plant from a sack that he carries around his neck, and drops it root downward into the spout, a semi conical plate guiding it into the hole opened by the head. The operator then presses two handles together, which forces sliding bars downward and presses the soil around the plant. The two handles are then released, allowing the spring to raise the bars, and with the thumb of the hand that grasps the two handles the operator presses the rod, which swings the lower part of the plate back and allows the machine to be raised, leaving the plant standing in the ground.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion.

Notes & Queries

It has been our custom for thirty years past to devote a considerable space to the answering of questions by correspondents; so useful have these labors proved that the SCIENTIFIC AMERICAN office has become the factotum, or headquarters, to which everybody sends, who wants special information upon any particular subject. So large is the number of our correspondents, so wide the range of their inquiries, so desirous are we to meet their wants and supply correct information, that we are obliged to employ the constant assistance of a considerable staff of experienced writers, who have the requisite knowledge or access to the latest and best sources of information. For example, questions relating to steam engines, boilers, boats, locomotives, railways, etc., are considered and answered by a professional engineer of distinguished ability and extensive practical experience. Inquiries relating to electricity are answered by one of the most able and prominent practical electricians in this country. Astronomical queries by a practical astronomer. Chemical inquiries by one of our most eminent and experienced professors of chemistry; and so on through all the various departments. In this way we are enabled to answer the thousands of questions and furnish the large mass of information which these correspondence columns present. The large number of questions sent—they pour in upon us from all parts of the world—renders it impossible for us to publish all. The editor selects from the mass those that he thinks most likely to be of general interest to the readers of the SCIENTIFIC AMERICAN. These, with the replies, are printed; the remainder go into the waste basket. Many of the rejected questions are of a primitive or personal *nature*, which should be answered by mail; in fact, hundreds of correspondents desire a special reply by post, but very few of them are thoughtful enough to inclose so much as a postage stamp. We could in many cases send a brief reply by mail if the writer were to inclose a small fee, a dollar or more, according to the nature or importance of the case. When we cannot furnish the information, the money is promptly returned to the sender.

(1) F. R. asks: How is liquid bluing made? A. The greater part of the laundry blues in the market consist of Prussian blue dissolved in water by the aid of oxalic acid or potassium ferrocyanide (yellow prussiate). The quantities are about 17 per cent dry oxalic acid, or 18 per cent potassium ferrocyanide.

(2) G. L. D. says: Why can a person turn a screw easier with a long screw driver than with a short one? A. Because the long screw driver tips a little and so gives more leverage on the screw than the short screw driver.

(3) G. W. S. asks: 1. Will eosine make a reliable ruling ink that will not fade? A. No. 2. What is used for setting aniline colors, so as not to copy when dampened? A. You will not succeed in making an eosine ink that will not copy more or less when moistened.

(4) W. H. T. asks how to make collodion of dark purple color for the purpose of insulating fine copper wire? A. Collodion may be made by dissolving gun cotton (the low grade) in equal parts of absolute alcohol and ether. It may be colored or tinted to suit by slight additions, to the solvents, of the various coal tar dyes. The drying may be expedited by the use of hot air.

(5) J. S. B. asks: 1. How can I electro-plate with gold and have the deposit have the appearance of 16 and 18 karat gold? A. The following is said to give fine results when properly worked; Make the anode of an alloy composed of 1 part silver, 9 parts copper, and 30 parts gold. Immerse this, connected with the positive pole of a strong battery, in a hot aqueous solution of potassium cyanide contained in a small porous cup, and place the cup in a large vessel of copper. Fill up around the cup with water to which has been added a little ammonium nitrate, connect the copper with the zinc of the battery, and heat the whole to about 110° Fah. on a stove, while the current is passing. When the solution has taken up enough of the alloy (which may be determined by means of an hydrometer, or by weighing the dry plate before and after), remove the solution and plate from it in the usual manner, using the alloyed anode. 2. By what means can I best solder small pieces of steel together? A. Heat the joint sufficiently, flux with acid zinc chloride solution, and use a plumber's solder. 3. How can I best nickel plate on zinc? A. Give the zinc a good coating of copper, using a strong battery, and then plate on the nickel from an ammonio-nickel chloride bath.

(6) S. A. S. asks: Of what dimensions should I make a tank to hold 1,200 gallons, height and width to be the same, length one third longer? A. The proportions (inside measurement) should be 4 feet 9 inches width and depth, and 7 feet 4 inches length.

(7) R. E. M. B. asks: Can you give me a recipe for making a varnish impervious to water, to use on a fishing rod? A. To make it, put gum shellac in a vessel, with alcohol sufficient to cover itf and keep it in a warm place until the gum is dissolved. If too thick, add alcohol until thin enough to flow readily.

(8) A. S. says: I have been trying to solder zinc, but cannot get the solder to adhere. I have used rosin and sal ammoniac, but neither will make it adhere. A. Use as a flux, muriate of zinc. To make it, dissolve zinc in muriatic acid and use after ebullition has ceased.

(9) F. B. H. asks: Would an apparatus constructed of india rubber lose its efficiency (strength and elasticity) if required to work in steam in a boiler, and would it lose this if immersed in water? A. Yes, in time.

(10) J. G. says: I am running a corn mill by water. I notice that at times my leather belt, which runs on a wood pulley at one end and an iron pulley at the other, gives off sparks of electricity. What is the cause? A. Friction of the belt upon the pulleys.

(11) J. J. H. asks: Why is it that the shadows of two objects appear to protrude and meet each other when the objects are moved toward each other, and that the protrusion proceeds from the shortest shadow? A. The effect is produced by the overlapping of the penumbra at the sides of the shadow. The penumbra of the long shadow or the shadow of the object the farthest away is the largest, and reaches the shadow of the nearest object first, making that side more dense, which makes it appear to protrude from that side first.

(12) H. H. asks: Can a spindle be made to run 32,000 revolutions per minute? A. It does not seem impossible.

(13) H. S. W. says: I find in using varnish that numbers of small bubbles rise on the surface of the work and seriously detract from the smooth appearance. What is the cause? A. It may be due to roughness of the surface varnished, presence of moisture in the wood, unevenly cut brush, imperfect fluidity of the varnish, or poor spirit solvent, etc. Use a well cut fitch or fine varnish bristle brush, see that the wood is dry, and do not lay on the coatings too heavy. With shellac varnish, perfect smoothness in the coating is with difficulty obtainable unless the first coat is rubbed down properly with pumice.

(14) W. H. G., Quebec, asks for a recipe for waterproofing cloth? A. In one vessel dissolve 1 lb. of the lead acetate in about a gallon of rain water, and in another dissolve 1 lb. of alum in 3 gallons of water. Pass the cloth first through the lead bath, then through the alum solution, and finally wash in water, and dry. Another common method of waterproofing is the following: Boil 4½ ozs. of white soap in 2½ gallons of water, and separately dissolve 5¾ ozs. of alum in 2½ gallons of water. Heat these two solutions to 100° Fah., and pass the goods once through the soap bath, and afterwards through the alum solution. Lastly, dry it in the open air. The alum causes the precipitation of an insoluble alum soap within the fiber.

(15) I. F. B. asks: Will it be safe to run a six feet fly wheel up to four or five hundred revolutions a minute? The wheel has six arms and an oval-shaped rim about four or five inches wide. A. You do not send sufficient data, but if the wheel is well proportioned, it can be safely run at the higher speed named.

(16) W. G. says: I have a velocipede of the three wheel kind; how is it I cannot make it go advantageously on a good level and solid gravel road? A. If, as we suppose, the trouble in the gravel road is caused by the wheels cutting in too deeply, the remedy is to make them with wider treads.

(17) J. N. J. asks for a recipe for making citrate of magnesia? A. Take carbonate of magnesium 25 parts, citric acid 75 parts, distilled water *q. s.* Mix, reduce to a thick paste, which dry at a temperature of about 75° Fah. To make the effervescing mixture take of the above 14 parts, and mix with bicarbonate of sodium 13 parts, citric acid 6 parts, and powdered white sugar 3 parts. Moisten the mixture with a sufficient quantity of alcohol and pass it through a tinned iron sieve to form a coarse powder. Dry in a moderately warm place and keep in a well closed jar.

(18) L. E. says: Will you give me the best method of casehardening iron? A. Pack the articles to be casehardened in an iron box filled with bone dust or animal charcoal made of burnt leather. For small articles short pieces of gas pipe will do instead of an iron box. The ends must be stopped and luted with clay. The leather may be burnt in a pan or in a stove, and it must be reduced to powder before being packed around the work. Heat the receptacle and the contained work red hot, in a furnace, for a length of time proportionate to the size and thickness of the articles. Thin articles will require to be kept at a red heat only a few minutes, while heavy articles may require half an hour or more. When sufficiently heated, quench the work as soon as possible in cold water.

(19) E. M. asks how malleable iron is made? A. Malleable cast iron is the mode of decarbonizing cast iron by a process of cementation by means of hematite, which imparts a portion of its oxygen to the carbon in the cast iron, forming a chemical union and extracting the carbon from the castings. Scales derived from the process of rolling iron bars are sometimes used. The castings are packed in iron boxes, carefully luted, and kept in a furnace at a red heat for several days.

(20) F. T. M. asks: How can I weld malleable and wrought iron together? A. Try a high heat, and use powdered borax as a welding flux.

(21) G. W. D. asks for a method of separating iron ore in fine grains from common sand, and also asks if the mass can be passed through water resting on a liquid of greater density than the silicate portion, but not too dense to allow the iron particles to pass through? A. Metallic iron and many of its oxides and other combinations may be cleanly separated from sand by means of powerful magnets, preferably grouped into batteries the poles of which form part of the surface of a cylinder. We do not know of a fluid having all the requisite qualities to be of practical value in the way you suggest.

(22) H. V. asks: What is the method of diluting tinctures, etc., that is, what quantity of spirits and water are used in reducing from the tinctures to the 30th and highest dilution? A. The rule is, we believe, to reduce the strength of the tincture one hundred times at every dilution, thus: 1 part (by weight) of standard tincture (=a)+100 parts diluent=a^1; 1 part a^1 +100 parts diluent=a^2, and so on. The diluent is usually either water or a spirit just strong enough to hold the substances in solution.

(23) S. T. asks: Was a post mortem examination ever held on the bodies of the Siamese twins? What was the result of the investigation? A. Yes. The result showed that there was a union at the two ensiform cartilages, which were joined very near the median line of the band. There were three pouches, the lower one being separated from the skin by a very delicate layer of tissue, and passed from the abdomen of Chang and was lost in the duplicature of the suspensory ligament of the liver of Eng. Above this was a similar pouch belonging to Eng, and between this and the under surface of the ensiform conjunction was the third and largest pouch, also prolonged from Chang's abdomen, until it reached the peritoneal cavity of Eng, but was not continuous with it. Thus two of the pouches belonged to Eng. A connecting band was also found between the livers. The two portal circulations were connected and the peritoneal process extended across the ligament.

(24) L. K. says, in answer to E. C. H., No. 7 (22), who asks how to make a good Babbitt box: When the shaft or journal is adjusted to the proper place, sprinkle on some powdered rosin. When the metal is poured in on this rosin it burns, causing the metal to flow, by keeping it hot, into all parts of the box.

(25) Gas, Pittsburgh, asks: What was the process employed for the manufacture of oxygen gas by the company which attempted to introduce it into use in conjunction with the ordinary gas? A. It was produced by the union of a jet of oxygen and a jet of common street gas, the street gas supplying the hydrogen. The oxygen gas was made by subjecting a quantity of manganese, placed in a retort, to a heat of 850° Fah. in combination with a steam jet whereby the oxygen was liberated and carried into a gasometer for use.

(26) W. H. B. asks: Will you give me the name of some good work on optics and lens grinding? A. Consult Lommel's work.

(27) C. H. J. S. asks: Will you give me directions for making putty? A. Glazier's putty is made by working up whiting with drying oil. Polisher's putty, or putty powder, may be made by keeping molten tin exposed to the air at a strong red heat, in an open crucible, till it is converted into a white powder.

How can I make the magic water pens? A. Triturate any of the aniline colors soluble in water with enough thick gum solution to form a paste. Place a little of this in the hollow part of the pen with a tight spring to keep it in place when dry, and to direct the flow of liquid when in use.

(28) C. H. K. asks: 1. How is caustic ammonia used for rheumatism, as recommended in the SCIENTIFIC AMERICAN? A. It should be diluted with about 20 parts of water and applied externally. 2. I am somewhat confused by the different names: "Caustic ammonia," "liquor of ammonia," "aqua ammonia," etc. Are they not different names for the same thing? A. Yes. It is a solution of gaseous ammonia in water. The proper name for it is ammonium hydrate.

(29) A. L. L. asks how far apart to space the holes in a pantagraph, and by what mathematical rule it is figured? A. There is no rule for spacing the holes. Make them as close as consistent with the strength of the instrument. The scales of the drawings are to each other as the distances of the pencil and of the tracing point from the pivot.

(30) D. N. B. C. asks: Is there any simple method by which to determine whether well water, still palatable, is contaminated with sewage or other dangerous material? A. Add to a small sample of the water enough of an aqueous solution of potassium permanganate to impart a slight but perceptible tint. If this disappears shortly, it may be concluded that the water is unfit for drinking purposes. Add to another sample about $\frac{1}{15}$th its volume of a saturated, cold aqueous solution of tannic acid, and allow to stand covered for 24 hours. Any notable quantity of organic matter in the water will be indicated by the formation of a precipitate.

(31) T. R. asks for a preparation that will keep white holly (wood) from getting soiled? A. Use a thin varnish made of bleached shellac dissolved in alcohol.

(32) A. H. W. asks for a recipe for a cement to be used cold, for cementing pieces of glass together without heating the glass? A. Boil isinglass in water, to a creamy consistence, and add a little alcohol. Warm before using.

How can I make the best dark bronze for cast iron? A. Melt together equal quantities of sulphur and white oxide of tin.

(33) Enquiring Reader asks: What is the best and cheapest process for manufacturing table salt from rock salt? A. Ordinarily it is simply washed and ground. All qualities are not sufficiently pure for table use.

(34) W. B. asks: Can I obtain glass that will melt in an iron ladle over a common coal fire as lead is melted? A. Soluble glass, composed of 1 part silica and 2 parts potassium or sodium carbonate, melts at a low temperature.

(35) W. F. R. asks for the number of stars stripes, and arrangement of the American flag? A. The number of stars should be thirty-eight. The number of stripes thirteen. The first stripe at the top red, the next white, then the colors alternately, making the last stripe red. The blue field for the stars is square, of the width of the first seven stripes, namely, four red and three white. The proportions of the flag should be as three to five.

(36) W. S. F. asks: Will you tell me how to galvanize hoop iron? A. Clean and scour the iron, and dip it into a bath of melted zinc covered with a layer of sal ammoniac.

(37) B. A. W. says: I have a quantity of brass chain, and I want to give it the color of gilt or gold that will not tarnish? A. Boil the articles in a dilute solution of terchloride of gold, to which some bicarbonate of soda has been added.

(38) D. R. K. asks: Why is it necessary to have a siphon to a steam gauge? A. The siphon is used for the purpose of keeping water in contact with the gauge.

(39) I. M. B. asks: What is the *modus operandi* of washing brass and copper vessels with lead without a battery? A. You probably refer to what is known as tinning, which is effected by dipping the articles into a tin bath, having first washed them with a solution of sal ammoniac.

(40) P. W. asks: What is the duty required of the fusible plugs placed in the crown sheet of locomotive fireboxes? A. To give the engineer warning. There might be no water in the crown sheet when the plug melted.

(41) E. W. D. asks; How are buggies polished? A. After the varnished surface is fully dried, rub down with rottenstone and a piece of woolen cloth, wet with water. Raise the polish by rubbing with the bare hand on which a few drops of sweet oil have been rubbed.

(42) T. E. B. says: A. contends that by taking a given point as a center and with any radius, describing an arc, you obtain an angle as of 20°, 45°, 90°, and so on until an angle of 360° is reached, when you have described a circumference. B. claims that you obtain arcs and not angles of those degrees, although the angles are measured by the intercepted arcs. B. considering an angle as the space included between any two lines running from a given point. Which is right? A. A. has the correct idea.

(43) W. A. K. says: Can you give me an effectual method of dispatching house crickets? A. Insect powder may be efficacious, but a surer remedy is to stop up all cracks or crevices where they resort.

(44) F. H. asks: Why are the sunset tints colored red and gold? A. Little is known of the causes that produce the brilliant and varied colors assumed by the sky, particularly at sunset. They are unquestionably, however, connected with the aqueous vapor contained in the atmosphere: and the reddish hue, the most common of all, is probably owing to the greater facility with which these rays are transmitted through the watery particles.

(45) C. J. F. asks (1) for the analysis of the springs of Seltzer, Vichy, Carlsbad, Kissingen, and Congress water? A. You will find books at the leading drug stores that will give you an analysis of these waters.

2. Can I combine the different salts together so as to resemble the true waters, to bottle and charge in a fountain with carbonic acid gas? A. Yes 3. How is the extract made that is used in ginger ale? A. It is composed of ginger extract with a little wild cherry, lemon, or other flavoring, and water.

(46) E. M. H. says: 1. Having a two horse power engine making 200 revolutions per minute, I wish to use it to pump where I want 30 lifts of the pump bucket per minute. The pulley on line shaft of engine is 9 inches in diameter. By running a belt from this 9 inch pulley on a 5 feet in diameter pulley, would it give the required number of lifts in the pump? A. Yes, if there is no slip. 2. There being a crank 9 inches long (on the same shaft that the 5 feet pulley is on) to which the rod of pump is fastened, what is now the power of the engine on the pump? Is not the power increased by thus decreasing the motion? A. You have not increased the motion, but the mechanical effect per stroke will be greater, in the proportion of the pulleys, neglecting friction.

(47) M. C. asks: What can I use to take coal tar off greenhouse pipes? A. We think a solution of potash will answer very well.

(48) S. C., of Mexico, asks: What advantages are there in the short-horned cattle over those of other classes, that make such great difference in their value? A. They give better milk, and their flesh is more valuable.

(49) O. M. M. asks how to make gold lacquer? A. To 1 gallon of methylated spirits of wine, add 10 ozs. seed lac and 4½ ozs. of red sanders; dissolve and strain.

(50) O. P. asks: What per cent of 1 horse power will it take to run a sewing machine, as it is run by any one sewing in the ordinary way? A. About 10 per cent.

(51) R. S. B. asks: What preparation can be used for painting the chimneys of steamships with red lead, so that the heat will not destroy the color as it does with common paint? A. We think it is difficult to make this color permanent, under the circumstances. Good varnish, ½ gallon; boiled linseed oil, ½ gallon; add red lead sufficient to bring to consistence of common paint.

(52) J. B. says: What is the best method of propelling a rowboat? A. By oars.

(53) I. N. D. asks: Will ripe tomatoes make strong vinegar? A. Probably not economically.

(54) J. W. D. McC. asks: Can copper be galvanized with gold? If so, what is the most simple but effectual method? A. A hot aqueous solution of the double cyanide of gold and potassium is used for the bath, with a battery of over two Smee cells for small work. Or the gold solution may be poured into a porous cup immersed in a quantity of salt water contained in a small copper cup. The whole is set on a fire until the gold solution has attained a temperature of about 110° Fah. A rod or plate of zinc is then placed in the salt bath, and the article to be plated, previously thoroughly cleaned, is immersed in the gold solution, and connected by means of a copper wire with the zinc. Under these conditions a deposit is soon obtained.

(55) W. T. R. asks: Can steam be introduced in a steam boiler from a pipe (1 inch) 400 feet long and used from boiler same as if made in boiler? We are using a rotary engine direct on to pipe. I want to put in a cylinder engine, but condensation is so great in the pipe it will knock out the cylinder head. I want the boiler in case supply from pipe fails us at any time. A. Yes. In lead of passing steam into the boiler before use, connect the engine directly to the pipe. You can easily attach a branch so that the boiler can be used when desired. Felt the pipe well, and provide a trap to carry off the condensed water.

(56) C. C. H. asks how "fraud" vinegar is made? A. It is probably a cheap, weak vinegar, the acidity of which has been strengthened by addition of a little oil of vitriol or acid lime sulphate. Vinegar of like properties has been made from pyroligneous acid—a product of the distillation of wood.

(57) M. M. asks how silk is dissolved with a liquid? A. Dissolve 16 parts (by weight) of copper sulphate in 144 to 160 parts of pure water, add 8 to 10 parts of glycerin (specific gravity 1·24) and mix by shaking. Into this, while cold, drop slowly a solution of caustic soda, while stirring, until the light blue precipitate at first formed is completely dissolved to a dark blue liquid. This fluid dissolves silk readily.

(58) C. G. C. says: I have a large, square, cut-glass inkstand, which is broken. Can you give me the composition of a cement with which I can repair it, and which will withstand the action of the ink? A. Use a strong solution of best gelatin in warm acetic acid. As ordinary inks contain tannic or gallic acid, the gelatin will only be rendered more insoluble if the ink comes in contact with it at the joint. The cement may be obtained at most druggists—one of the latest names under which it is known is "stratina."

(59) C. H. asks: Of what is belt lacing leather made? A. It is made of calf skins.

(60) Mc. Bros. ask: What is used for filling the letters of zinc signs? A. Use pitch 11 lbs., lampblack 1 lb., turpentine *q. s.* Mix with heat.

(61) S. R. R. asks: What does the foundation of the towers of the Brooklyn bridge rest upon? A. Upon bed rock in some places; gravel, boulders, etc., in others.

(62) J. P. F. says: I wish directions for melting brass in crucibles in an ordinary blacksmith's fire? Also directions for brazing iron or steel? A. Heat the crucible slowly with the contained brass; when melted, cover the surface with a layer of powdered charcoal. To braze, file the surfaces clean, and unite them carefully, and retain them in place by riveting or by winding with wire. Deposit spelter solder or soft brass where the union is to be made, heat carefully in a clear fire (charcoal is best) and flux with borax.

(63) C. M. asks: 1 What is the best method of making vinegar from grapes? A. Provide two wooden vats, made of oak. At a little distance from the bottom of each fix a wooden grate, on which place a layer of small grape twigs, leaves, and stems. Press the juice from the grapes. Fill one of the vats and half fill the other. As soon as fermentation begins in the half filled vat, fill it from the full one, and every day fill the one that has remained half full with a part of the contents of the other. By this daily transfer of half of the contents of one vat to the other, the *vinous* liquid is brought into contact with the air until acetification is completed. 2. Is there any inexpensive and effective method of preserving grapes for winter use? A. Yes, keep in a dry cool place. 3. If wood ashes are a good application to the soil of a grape vine, why would not a weak solution of commercial potash answer the same purpose? A It would.

(64) E. W. D. asks: 1. For the period of the comets 1680, 1811, 1843, Donati's, Coggias, and 1556? A. 1680, 10,000 years; 1811, 3,065 years; 1843, 376 years; Donati's, 2,000 years; Coggia's, 10,000 years; 1556 was predicted for 1860. 2. If the form of the earth is due to its being thrown from the sun in a hot state? A. The sun in condensing from a nebulous mass left behind portions which condensed and formed planets, etc., these planets taking on a rotary motion before they fully solidified naturally become globular.

(65) R. & W. ask for a recipe for making best varnish for household furniture, and best process for polishing when done? A. Best African copal 4 lbs., drying oil 1 gallon, turpentine 1¾ gallons. Boil the gum and oil until it strings well. When somewhat cooled, add the turpentine. To make it dry quicker, dryers may be added during the cooling. To polish, after an even surface is produced by rubbing with powdered pumicestone applied with a woolen cloth, rub with rottenstone and oil, and finish by rubbing with the bare hand moistened with a few drops of oil.

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

G. W. E.—It is a combination of iron with sulphur—called pyrites. You can find something about it on p. 7, vol. 35.—C. F. C.—The package marked A. contains only quartz pebbles. Quartz is, when not contaminated, pure silicic acid—a combination of the element silicium with oxygen. B. is a calcium phosphate, chloride, and fluoride, called apatite. Unmarked specimen contains tennantite—a sulphide of copper, iron, and arsenic.—M. F. M.—No. 2 contains oxide of iron, alumina, lime, and silica. No. 2 is felspar. No. 3 is partially decomposed orthoclase, with oxides of iron and a little copper. No. 4 contains clay, mica, and oxides of iron. No. 5 is pyrites. No. 6 is felspathic rock, the coloration of which is due to iron oxides. No. 7 is partially degenerated syenite. No. 8 consists principally of lime carbonate. No. 9 is gypsum. No. 10 is hornblende with pyrites.—A. K.—It is iron pyrites.—R. L.—It is a quartzose rock, with bright specks of pyrites. It is not valuable.

COMMUNICATIONS RECEIVED.

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

On Electrical Experiments. By F. J. M.
On Curving a Base Ball. By R. D. W.
On Remedy for Poison Oak. By H. F. A.
On Labor and Capital. By A. B. W.
On the Silver Mud Springs of Oregon. By B. S.

Also inquiries and answers from the following:

F. J. A.—D. C. H.—C. C. H.—W. T. & Co.—T. P.—C. R. M.—A. L.—I. A.—E. H.—A. P. A.—J. O. R.—I. M. D. McC.—C. E. T.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

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

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

Hundreds of inquiries analogous to the following are sent: "Who deals in optical glasses? Who makes Bessemer steel wire? Who makes and sells miniature engines? Who makes a good composition for covering steam pipes?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

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

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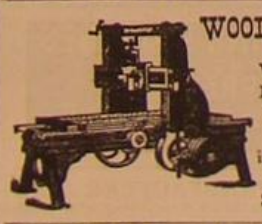

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