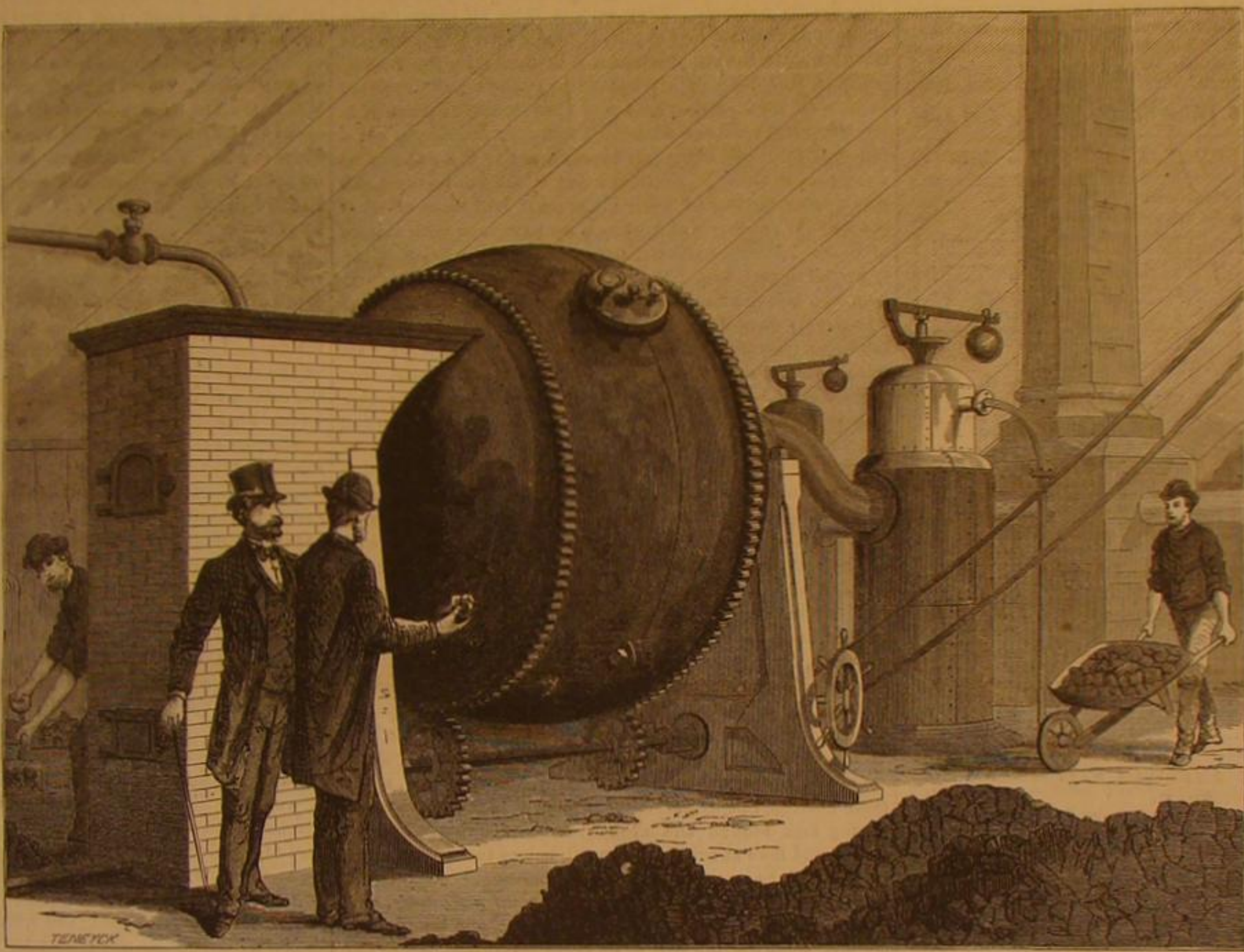
SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XXXIV.—No. 6. [NEW SERIES.] | NEW YORK, FEBRUARY 5, 1876. | $3.20 per Annum. [POSTAGE PREPAID.]

IMPROVED REVOLVING FURNACE.

The roasting of ores, having for its object the removal of all such volatile substances as sulphur, antimony, arsenic, etc., and the rendering of the subsequent smelting and reducing processes more easy, is ordinarily done either in mounds or heaps or in stationary furnaces (reverberatory or otherwise), according to the nature and kind of ore. As a substitute for these various means employed, the invention illustrated in the annexed engraving is intended, and it is constructed so as to perform effectively all the operations of roasting, annealing, smelting, extracting mercury, drying, reducing ores, etc. The three views here given show, first, (Fig. 1) a perspective view of the apparatus; second (Fig. 2), a longitudinal section of the furnace as used for roasting ores, and third (Fig. 3), a transverse section of the invention arranged for smelting purposes. It will be seen also from the engravings that the furnaces are intended to grouped about a central chimney, one opening into each of the four faces of the base of the latter. Referring to Fig. 2, A is a sphere of boiler plate or cast iron, lined with ganister, fire brick, and asbestos, the effect of which lining, we are informed, is to keep the exterior of the sphere cool, even while an extremely high heat is maintained within. This globe is suspended on hollow journals, and on its exterior surface are circular racks, B, which engage with the gear wheel, C, and the latter communicates with the hand wheel, L. By turning this hand wheel the globe is easily rotated. E is the furnace, the blast from which enters the globe, which is previously filled with ore and closed, through the water tweer F, which, as shown, passes through one of the hollow journals. During the operation of roasting, the globe is constantly rotated, so that the ore within is kept in agitation, thus allowing the heat to pass through and act upon every part of its mass. The volatile products make their exit through the opposite journal, G, and entering the condenser, H, are condensed by a fine shower of water entering through the perforated diaphragm, I. In this way such materials are reduced so as to be easily removable; and at the same time, if precious metals be under treatment, such portions of the latter as would otherwise escape are caught and retained. From the condenser, the blast passes, as shown, into the chimney.



MANES' REVOLVING FURNACE.—Fig. 1.

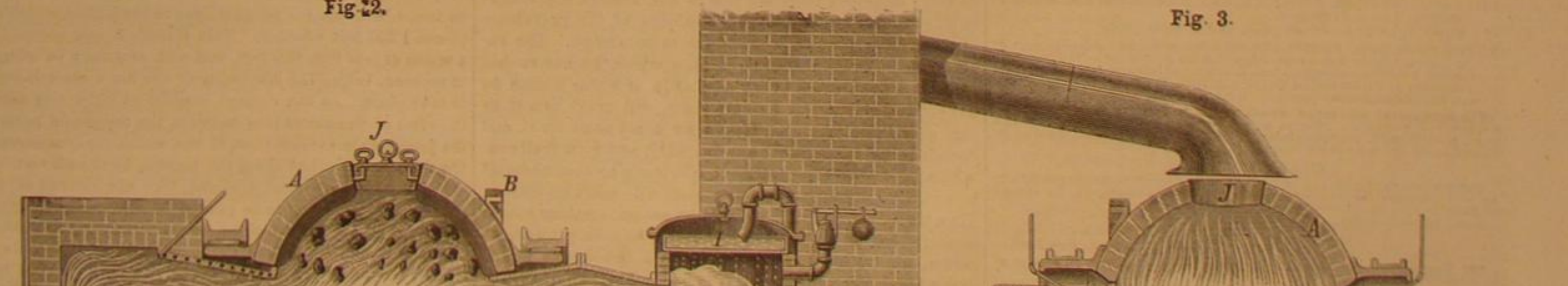
For handling refractory and low grades of gold and silver ores, the inventor claims for the apparatus special advantages, as by its use several tuns can be worked daily, and the labor of but one man to attend the furnace will be required. The globular form adopted is one easy of construction and well suited to sustain its great weight from two points of support. The lining of the interior can, it is claimed, also be rendered more stable than in any other form, while it presents less surface for the radiation of heat. The inventor has also introduced a new and effective process for amalgamating gold and silver ores, which, used in connection with the furnace, adds greatly to the advantages of the latter as a means of extracting the precious metals from their ores. Many of the ores hitherto found most difficult to handle, such as nickel, cobalt, antimony, arsenic, zinc, bismuth, lead, copper, can be safely worked, as no injurious fumes save such as pass through the condensers can escape. Iron and steel can also, as already indicated, be treated and made with important advantages, as the annealing of malleable iron and the use of crucibles in converting or making steel are, by this device, altogether obviated. The first of these furnaces is now, we earn, being constructed at the works of the Hartford, Conn., Machine Company for the new Nickel Smelting and Refining Company of the same city. Four complete furnaces of like pattern are to be erected by the corporation last mentioned.

The adaptation of the furnace for smelting purposes is easily understood from Fig. 3. The globe is of course held stationary during the operation; and the blast, entering by water tweers through both journals, passes down through the charge, is reflected up, and exits through the open manhole above. The tweers can be continued downward and entirely around the bottom of the globe, if required. When the process is complete, the globe may be tipped to discharge its contents through the manhole at J, or it may remain stationary and the charge be removed through the vent at K.

Patented April 6, 1875. For further information address the inventor, Mr. James Manes, 74 Asylum street, New Haven, Conn.

A German firm has recently introduced an alloy of 62 parts copper, 18 parts lead, 10 parts tin, and 10 parts zinc. It is called dysiot, and is a kind of whitish brass, readily fusible.

Fig. 2. Fig. 3.



MANES' REVOLVING FURNACE.—SECTIONAL VIEW.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year, postage included $3 20

One copy, six months, postage included 1 60

Club Rates.

Ten copies, one year, each $2 70, postage included $27 00

Over ten copies, same rate each, postage included 2 70

☞ By the new law, postage is payable in advance by the publishers, and the subscriber then receives the paper free of charge.

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VOLUME XXXIV., No. 6. [NEW SERIES.] *Thirty-first Year.*

NEW YORK, SATURDAY, FEBRUARY 5, 1876.

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(Illustrated articles are marked with an asterisk.)

THE SCIENTIFIC AMERICAN SUPPLEMENT.

No. 6.

For the Week ending February 5, 1876.

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"Science Record" for 1876.

To prepare the matter for a volume of 600 pages is a work of considerable magnitude at any time; and to gather the requisite material, so that it includes everything new in the fields of mechanical, chemical, and physical science discussed during an entire year, and then to arrange and classify the subjects, is by no means a small task. The SCIENCE RECORD, which we expected to issue on January 15, and for which several hundred persons are waiting, will not, for the reasons above hinted at, be ready till about February 10. The printers and binders have promised us a large edition early in February, when the orders on our books will be filled in the rotation in which they were received.

The volumes for the previous four years, from 1871 to 1875, are on hand, ready for present delivery. See advertisement on another page.

MACHINE MERCY.

While crossing one of the ferries between this city and Brooklyn the other day, we formed one of a knot of persons who curiously watched an individual who had clambered up on the walking beam of another steamboat that was passing us, and who, clinging to the beam, was swayed up and down as he coolly scrubbed at some portion of the bright work. The general sentiment of the people about us seemed to be one akin to admiration at the man's daring; but in that view we profoundly differed from our neighbors, and thought to ourselves that the workman was, to say the least, a fool. Why could he not wait five minutes until his boat came to rest in the slip, and then clean and polish to his heart's content while the beam was stationary? In fact there was no reason that we could perceive, and hence we were driven to the above uncomplimentary opinion, as we always are whenever we witness a presumably rational human being peril life or limb uselessly.

"Familiarity breeds contempt" is a trite old proverb, and one which appears to be especially true in regard to people accustomed to dealing with machinery. It is not so in many other cases; soldiers who handle fire arms and explosives all their lives are proverbially the most careful persons with their deadly weapons. They seldom blow off their fingers or the tops of their own skulls, through pure negligence, as many an unfortunate sportsman has done: for the reason, perhaps, that long experience with gunpowder impresses them with the merciless nature of that material when it is ignited. But machine attendants somehow manage to get a different idea, and almost, it appears, arrive at a notion that a machine is a sort of sentient being which knows them, and won't smash or bite off their limbs as it will those of other people. What scores of workmen we have seen with stumps of fingers! Machine and circular saws especially are peculiarly partial to such diet. We read of a case recently of a workman who was descanting on the advantages of his saw, and who merely wanted to point out how truly it ran. He pushed his finger forward a little too far, and whiz! off it went. He felt a peculiar sensation, not a hurt (for it is well known that there is no pain attending the lopping off of a member by a very rapidly revolving blade), and, half instinctively, he poked out another finger, and that likewise departed. Then he discovered that something was wrong, and subsequently that he was *minus* two fingers. Fingers cut off are trivial accidents to some that occur through carelessness. Not very long ago, a woman in a New England mill went to work with her hair down. She moved carelessly around among the buzzing wheels and shafts, and the first thing she knew her tresses were caught, and no Pawnee on the plains could have scalped her more neatly. Her misfortune benefited Science, however, for it gave the doctors a splendid opportunity to try the efficacy of transplanting skin. Medical skill healed the wound, we believe, but her flowing locks were gone. A workman was strangled in a somewhat similar way, his loose neckcloth catching and twisting itself about a shaft, which could not be stopped in time; another, we remember, met a more horrible fate by becoming entangled with a shaft which swung him around and around, dashing him against the beams and floor at every turn, until, before the motion could be arrested, he was literally torn to pieces. We have seen men on steam vessels crawl down among the machinery, with a light in one hand and a tool in the other, and try to work, dodging some moving part at its every revolution, the rolling of the ship making their position still more perilous. A case happened, a very short time ago, in which a machinist entered the narrow enclosure in which the paddle shaft crank of a steamer worked. He knew perfectly well that steam was up, and that the vessel would shortly get under way; but for some unaccountable reason, he chose at the last minute to get under the crank, perhaps to put the last touch on some repairing job. It was his last touch, for the engineer, whom he did not notify of his intention, happened to work the starting bar to give the engine a turn or two. The crank came over and smashed the unfortunate being out of all human semblance.

We might go on and multiply instances of this kind indefinitely: doubtless there are few of our readers who cannot do likewise. But despite the knowledge of the prevalence of these casualties, people continue to be careless. The engineer doesn't realize that the engine which he has rubbed till he can see his face in any part of it, or whose motion he has controlled for the last ten years, will crush him if he once gets in its clutch. Hasn't he a pet name for it, and doesn't he pat the cylinder affectionately, and view it all over with a kind of fatherly interest? Certainly he reasons somehow that the insensate iron and steel will spare its master. Then there is the machinist. Did he not put up those countershafts, and fit that belting? What if he does get up on a ladder, and try to slip a belt already on the driven pulley over a big driver with the latter in motion? He laughs while the risk of his getting caught between belt and pulley is pointed out, guesses he knows this gear, and "he's done it a thousand times," and the thousand and first time may result in a horrible death. Locomotive engineers are also frightfully reckless. With an engine going forty miles an hour, it is much more prudent to slow down or even stop in order to oil a squeaky bearing than to climb out on the side and hang over so as to reach the place with the oil can. Better lose a minute or two of time than risk life. The men who run our locomotives have plenty of chances to display heroism and daring at the right time; and it is for the very reason that they are so rarely found wanting in those qualities that we hate to see them uselessly peril their lives.

In a word, workmen should learn that there is no such thing as familiarity with machinery. Study your machines, we say, know every bolt, every nut, every piece of metal in them, know how to repair, to build, to invent improvements, know how to exact their utmost capabilities; but for your own safety, and for the sake of those dependent on your labor, do not relax one instant's care, nor persuade yourself that you can rely upon your dexterity or upon any half supposed merciful attribute in moving masses of metal.

PROGRESS OF THE GREAT JETTY WORKS AT THE MOUTH OF THE MISSISSIPPI.

On January 15, 1876, the jetty works constructed under the United States grant, made to Mr. James B. Eads on March 3 last, had been so far extended into the sea that the almost complete control of the river discharge had been accomplished through a distance of $1\frac{1}{2}$ miles from the land's end, and within 2,500 feet of the crest of the bar.

Through the extent of this mile and a half, the river current had swept out 1,263,222 cubic yards of the bar on December 25, 1875, and the removal by the river is progressing at the rate of about 30,000 cubic yards per day; 2,000,000 yards more will have to be scoured away before 20 feet depth of water is secured across the bar.

The works on each line of jetty are partially constructed out beyond the crest of the bar to the full distance they are intended to be built, and the work on this portion of the jetties is being pushed with the utmost vigor, over 25,000 cubic yards of willow mattress work having been constructed and securely placed in position, and ballasted with stone, within the last 30 days—the total amount laid thus far being about 125,000 cubic yards. The construction of 20,000 additional yards is all that is now required to build the jetties up above mean low tide, and out to the crest of the bar, 10,500 feet from the land's end at the mouth of the Mississippi.

It is confidently believed that a sufficient amount of material is now in place, if no more work were done, to insure a depth of 20 feet of water across the bar, within three or four months. One remarkable feature, thus far developed, is the deepening of the water between the incomplete jetties on the outer slope of the bar, which is doubtless caused by the tidal action that is now partially controlled by the jetty works beyond the crest. This deepening clearly shows how groundless are the fears that the effect of the jetties would simply be to pile out the excavated material on the outer slope of the bar. The fact that the crest of the bar has not deepened, notwithstanding the immense amount of material excavated from above it, between the lines of the jetties, is in exact accordance with the theory upon which Mr. Eads has based his application of the jetty system to the improvement of the mouth of the Mississippi.

Those predicting the failure of the system have constantly asserted that the chief part of the sedimentary matter of the river was pushed out to sea, on the bottom, by the action of the current; while Mr. Eads has persistently declared that this was a grave error, and that these matters were almost wholly borne to the sea suspended in the water of the river, and that, the more rapid the current, the greater would be the amount of material held by it in suspension; and hence an increase of current above the normal in any part of the river, flowing over a strictly alluvial bed, would cause the water to take up an additional load of this matter, which it would retain in suspension so long as the velocity of current was maintained; and when thus charged, it would be simply impossible for it to take up any load or produce any additional scouring. The current receives its first acceleration at the upper end of the jetty works, and here it first becomes charged with the surplus load. It receives no further acceleration in its passage over the crest of the bar (owing to the incompleteness of the work there), over which it escapes laterally. The enlargement produced by the excavation gradually reduces the current, where it occurs, by the enlargement of the channel, and the acceleration and extra loading of the water then takes place lower down and nearer the crest of the bar. The effect of this is to shorten up the base of the bar, and to deepen the channel above it, before the crest of the bar is reduced.

The original crest of the bar was a plateau 3,500 feet wide, over which an average depth of only $7\frac{1}{2}$ feet of water could be found, between the parallel lines of the jetties, which are placed 1,000 feet asunder. This plateau is now reduced to a width of less than 600 feet, and will gradually be reduced to nothing, before the deepening of the bar crest will begin to take place. As the current is quite as rapid now across the crest of the bar as it is between the completed parts of the jetties, it is evident that, if the sedimentary matters of the river were pushed along the bottom, by the current, the deposits which are most elevated, like the summit of the bar, would be the first to be pushed off, and piled up beyond the bar crest, in the sea water beneath the river discharge, or in what has been termed the "dead angle." The base of the bar on the 20 feet line of depth was nearly 10,000 feet long when the jetties were commenced. This base has been shortened still more than the plateau forming the bar summit, and is now only about 6,200 feet long, measured in the direction of the jetties.

REMOVAL OF SNOW FROM CITY RAILWAY TRACKS.

For a considerable time past litigations have been prosecuted on the part of residents along the line of some of our city street railways, with the object of preventing the companies from piling up the snow at the sides of the tracks.

On behalf of the residents it was shown that the companies were in the habit of using plows and rotary sweeps, piling the snow up in continuous banks between and at the sides of the tracks and in front of the adjoining dwellings, rendering all approach to the latter by ordinary vehicles practically impossible. It was claimed that the companies by thus doing became almost exclusive occupants of the street, the householders being shut off. It is quite common for dwellers on our street railway routes to wake up on winter mornings, and find a compact bank of snow from three to four feet high along the front of their premises, deposited there during the night by the industrious railway people, aided by their powerful machinery.

On the part of the railway companies, it appeared, during the course of the recent legal proceedings, that the use of the plows and sweepers was necessary to the proper working of the roads; that the snow must be removed, or the passenger cars could not run; that their charters required them to run the cars; that if they were to be enjoined from clearing the tracks, the court would nullify the act of the legislature; that consequently the companies could not be legally prevented from clearing the snow, as they were in the habit of doing.

Judge Sedgwick, before whom the last proceedings came, has rendered a decision which, we think, will commend itself to the people by its plain, common sense, practical way of solving the difficulty.

He admits the right of the companies to clear their tracks of snow, and to pack it up at the sides of the streets as they now do; on the other hand, he decides that the companies must not obstruct the use of the streets, and requires them to remove their snow banks within a reasonable time after every storm. This decision gives general satisfaction, and fully meets the requirements of the case. It is true it imposes a laborious and expensive work upon the companies, as they are unprovided with special means for the removal. But we cannot doubt that some of our ingenious inventors will study out the proper machinery to do the business cheaply. With them we leave the subject. Whoever can devise the proper mechanism ought to reap a handsome reward. Now let us see what mechanical genius can do in the matter.

HIGH GAS BILLS AND THEIR PREVENTION.

A conflict exists at present in Brooklyn, between the gas companies on one side and some of the gas consumers on the other. The price of gas has reached lately $3 per 1,000 feet, and even at this high cost has by many been found to be of poor and unsatisfactory quality. As a result, some people have abandoned the use of gas and substituted lamps.

It is well to remember that large gas bills are due not merely to the cost per 1,000 feet of the gas burnt, but to the number of feet consumed. As any one can easily learn to read his meter index from the instructions printed on the back of the bills rendered, it is presumable that the consumer is informed of the quantity of gas he is using, and hence cannot dispute bills which accord with the meter. But the meter is sometimes the object of the consumer's suspicion. Now supposing him to be certain that no gas unknown to him has been wasted, the question of the veracity of the meter is easily settled by a simple test. The wet meter is simply a circular box filled with water to a point a little above its center. The axis carries a series of curved buckets, each capable of holding a definite quantity of gas, which is admitted at the central part of the meter, and which causes the buckets successively to rise, thus keeping them in continuing rotation. As the edge of each bucket rises from the liquid, the gas escapes and goes to the delivery pipe at the circumference, while the quantity so discharged is measured by the rotation of the bucket axis, acting on gearing which communicates with an index. Now to test this meter, provide any large airtight vessel, say a good sized jar, of which the exact content in cubic feet and inches is easily calculated. Fill this with water and reverse it, mouth down, in a good sized pan, on the bottom of which are two or three inches of water. The atmospheric pressure will keep the water in the jar. The connection between the house pipe and the meter being previously cut, and a piece of rubber tubing attached to the meter, lead the end of the tube into the throat of the jar. Turn on the gas, which will bubble up and displace the water. The moment all the water in the jar is driven out, stop off the gas. Fill the jar with water again, thus expelling the gas collected, and repeat the operation. Do this, say five times, until in fact the previously determined cubic contents of the jar, multiplied by the number of fillings, equals exactly (for example) 10 cubic feet. Now compare the result thus obtained with the indication of the index on the meter, allowing a slight margin in favor of the latter to compensate for any inaccuracy on your part, and the error of the meter, if any there be, will at once be apparent.

The causes of error may then be searched for; and generally the trouble is that the meter has either too much or too little water. This water is put in through a screw, on top of the front box and to the right. It should be admitted until it escapes from the vent in the side just below, when the same is opened. It sometimes happens that a plumber, in filling a meter, will fill above the vent, and yet not sufficiently raise the float (which is supposed to regulate the entrance of the gas and shut the same off when too much or too little water is the case). The effect of this is to diminish the cubic contents of the buckets, while the index shows no change in the number of revolutions of the drum. So that the consumer then pays for more indicated cubic feet than he has really consumed. To remove water, try the bottom screw, and take out the water from what is called the dry well. When there is too little water in the meter, its proper quantity is easily added, and the contents should just escape from the lower edge of the vent. In winter, the meter is very prone to freeze: this need not occur more than once, if the consumer will pour a little glycerin into the water after the thawing is accomplished. Sometimes also the water in old meters becomes thick, from the accumulation of tar and dirt from the mains. This causes a slow and unsatisfactory action, and should be remedied by cleaning the meter out and replacing the impure with fresh water.

There are various other causes of high gas bills, which the householder might well look to, but into which we cannot enter in any detail here. Prominent among these are the burners, a poor one of which may easily burn double the gas and not give half the light of one properly constructed. The ordinary type of burner, besides, burns out, and, through the enlargement of its orifice, soon becomes very wasteful of gas. Another cause of waste is due to people trying to read or work by several lights located in a high chandelier or fixture, instead of by one light brought near them. A single burner, one foot distant from the page of a book, will shed on that page thirty-six times more light than the same burner six feet away; or in other words, the single burner, located as first stated, will light up the page as brilliantly as six chandeliers, of six burners each, hung six feet from the book. The absolute quantity of light is the same at all distances, but it is spread out over an area which increases with the square of the distance from the flame; so that it is obvious that lights are used very wastefully when they are placed far away from the objects which they are to illuminate.

A NEGLECTED INDUSTRY.—BEE CULTURE.

There is one industry in this country which is not overworked nor overcrowded, and which offers reasonably large and sure profits, because for its products there is always a demand. It is one which hundreds of people can carry on without interfering with their regular occupations, and which might serve to give employment to many now seeking labor, or additional income to others of straitened means. We refer to beekeeping, and we speak of it now because the opening of spring is a good time, for those who may heed our advice, to make a beginning. Out of the 40,000,000 people in this country, only 70,000 are beekeepers, and these send to market about 15,000,000 lbs. of honey and wax yearly. Now to see how enormously below the average, of what the country ought to produce, the above yield is, we have only to make a brief calculation based on the assertion of the late Mr. Quinby, one of the best and most reliable authorities on apiculture. He says that, on an average, every acre of ground ought to yield 1 lb. of honey—cities and all, be it remembered, because it has been practically demonstrated that the bees will find excellent materials for honey in the refuse and garbage as well as in the few green spots enclosed within brick and mortar walls. There are 1,897,146,240 acres in our national domain; and even if we deduct 50 per cent of this for utterly uninhabited localities, the yield should be about sixty times greater than it is. To proceed a step further, every pound of honey is worth, on an average, 25 cents, and each pound of wax, 30 cents. Taking the figures in the last census as a basis, the value of the annual product is: Wax $189,338, and honey $3,676,703, total $3,866 041. But this is only $\frac{1}{62}$ of the value which might be produced, and therefore the said possible value is worth $240 000,000, consequently there is a waste of $236,000,000 worth of valuable produce, which evaporates into the air. One well known authority plainly asserts that the amount of honey lost, in California alone, yearly, exceeds in value the quantity of gold gathered in the State during the same period. The census says that, in 1870, there were but 136 professional apiarists in the country; a monthly publication devoted entirely to discussion of bee culture is our authority for the statement that, altogether, 70,000 persons keep bees. Only 1 person, then, out of every 570 in the United States, is engaged in preventing the abovenamed waste, or, more strictly speaking, in trying to divert some of the evaporated value into his own pockets; 1 person in about every 300,000 is engaged in doing this as an exclusive business. The census says that there are nearly 290,000 clerks alone in the country, clerks and salesmen be it noticed, not employees in general, one to every 144 of the population. There is not a year elapses that does not see hundreds of young men and women swarming into the great cities looking for clerical employment, nor can a winter pass but that we are not brought face to face with terrible destitution, and merchants everywhere are compelled to deny, for their own immediate welfare, appeal after appeal which strongly excites both sympathy and charitable feelings. An advertisement in a daily journal of this city for clerical help results in answers by the hundred, as we personally know. Now is there not something wrong in a system under which, on one hand, an industry, not a new one born yesterday, but one almost as old as the human race itself, goes begging for people to follow it, the resources of which are suffered to run to absolute waste to the extent of millions of dollars yearly; and under which, on the other hand, thousands of the best part of the population manage to crowd into big cities and there starve because there is no honest labor for them?

We do not argue that each and everybody should instantly provide himself with an improved hive and a swarm of bees, and therein find sooner or later a fortune; we merely point out one industry, more thoroughly and uniformly neglected than any other that we now can recal. It is, moreover, in the development of industries of this kind that the solution of the much agitated woman question lies. Apiculture is one of the few pursuits that a woman is physically able to follow in its every branch; herein it is of especial advantage. Again, its development would prove a general blessing in that, besides enlarging the field of labor for every one it might serve to attract men, out from behind counters in millinery and dry goods stores, away from the cities and into the open air of the country where, in agriculture, man's natural calling, the muscles which Nature has given them, and denied the weaker sex, could be put to profitable use. We shall revert to this subject of bee culture in its more practical bearing at some future time.

Mr. Edison's New Force.

To the Editor of the Scientific American:

I notice in your issue of January 29, 1876, some experiments conducted by a gentleman signing himself "Electron," who attempts to prove that the phenomenon observed by me, and which I have called etheric force, is due to the "extra" current from an electromagnet.

There are several sources of error, I think, in his experiment, among which may be mentioned bad insulation of battery or leading wires and binding posts, and the close proximity of the galvanometer to the vibrating apparatus.

Owing to the extreme delicacy of a mirror galvanometer, the sources of error are extremely numerous, and it requires long practice and careful manipulation to eradicate them. If "Electron" will use large gutta percha wires, take the reading of his galvanometer in another room, suspend his battery by insulating cords, use a large hard rubber base for his vibrator, and keep a sharp look out for possible sources of error, he will obtain a brilliant etheric spark *right through* his galvanometer without a tremble of the spot of light.

In reply to your correspondent J. P. H., who sees nothing inexplicable in obtaining a spark from an uninsulated wire laid for a long distance upon wet earth and connected to a highly insulated source of power, I will state that his telegraph experiment is not a similar one. If he had disconnected one pole of his battery from all connection with anything except air, and placed his battery upon an insulated stand, he would hardly have succeeded in working with a relay or any other electric instrument under the conditions he mentions. With this, there is no chance for circuit, and it is the same with the source of etheric force.

Newark, N. J. THOMAS A. EDISON.

Captain James B. Eads.

We give in another article a report from an authentic source concerning the progress of the Jetty-works at the mouth of the Mississippi, which shows a gratifying improvement in the channel so far as the works have been carried, and indicates that within a very short time we may expect to see the great river freely opened to navigation by vessels of the largest class.

The opening of the Mississippi will have a wonderful influence upon the material prosperity of the Republic, and will form a crowning event during this centennial year of our country's history. The region thus thrown open to the world's commerce is one of unsurpassed richness, capable of supporting an immense population.

To the noble engineer by whom, at his own cost, this great work was undertaken, the highest honors are due. In war and in peace, his commanding talents and remarkable sagacity have been devoted to patriotic labors, which have always resulted in public benefits of the most extensive, far-reaching nature; and he well deserves the nation's gratitude. We nominate for the Presidency Captain James B. Eads of St. Louis, the man of genius, of industry, and of incorruptible honor.

A Curious Explosion.

The Virginia City (Nev.) *Enterprise* gives an account of the explosion of what was supposed to be simply a pail of water, or rather of ice. It was being heated near a forge so as to thaw the contents, when, just as it was being removed, it suddenly blew up, tearing the bucket to shreds and severely injuring two men near by. The local journal thinks that the casualty was due to nitroglycerin from a giant powder cartridge, which previously had been thawed in the vessel, forming an unremarked film on the inside. We doubt this explanation. There appears to have been nothing but a moderate heat applied, and that certainly would not have exploded the nitroglycerin. If the latter were present, it probably exploded through being on the outside of the bucket, and so suffering a shock by the latter being swung, by the person who was lifting it from the forge, against an obstacle.

Dr. Henry J. Anderson.

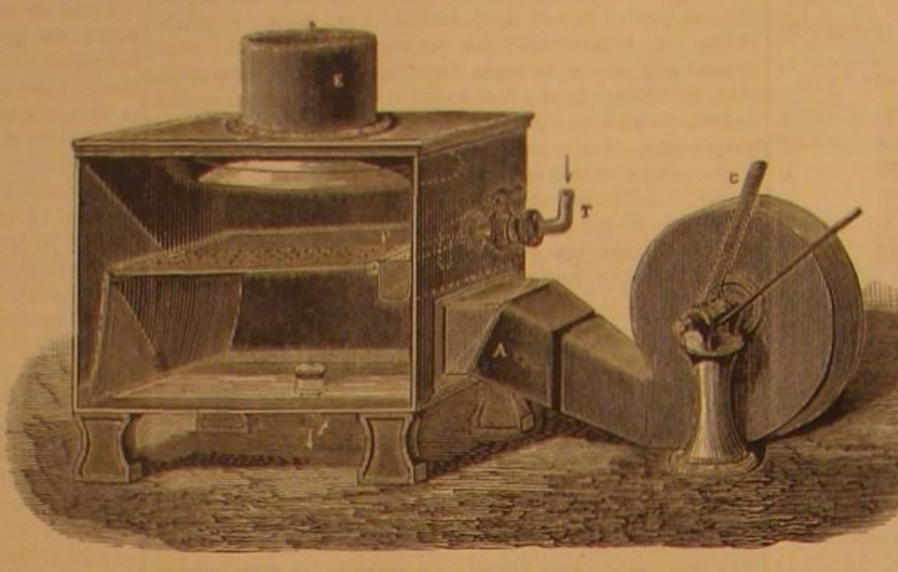
The funeral ceremonies of Dr. H. J. Anderson, who died in India several months ago, were recently held in this city. Dr. Anderson was formerly a Professor of Mathematics in Columbia College, and, although not distinguished for any especially great work, was nevertheless a gentleman of remarkably wide scientific attainments, and a vigorous promoter of scientific research and progress. He went to Australia to observe the transit of Venus from a station of his own selection, north of Melbourne; and on the way home, at Lahore, India, while making explorations in the Himalaya mountains, he contracted, through exposure, the malady which terminated his life. He was seventy seven years of age, and was the oldest living graduate of the abovenamed college.

Road Steamers.

Referring to the reward offered by the State of Wisconsin, of ten thousand dollars, for the invention of a road locomotive or steamer, capable of traveling five miles an hour on common roads, published in last week's SCIENTIFIC AMERICAN: In our SUPPLEMENT No. 6, issued this week, we give a drawing of the most recent English example of this kind of mechanism, from which it is possible that our inventors may derive useful hints.

A NEW AIR REFRIGERATOR.

We extract from *La Nature* the annexed engraving of a novel and ingenious device, which may be used with equal facility either as a refrigerator or as a heater or purifier of a current of air. A fan blower, at C, driven by the belt, forces a blast in by the conduit, A. The air passes up through a finely perforated plate, P, over which runs a stream of water, entering at T, and escaping below at *t*. The air finally emerges at E. If cold water, drawn from a well or cistern, or admitted from a running brook, be supplied at T, the air, by passing through it, becomes thoroughly cooled; and if hot water be used, the reverse is the case. At the same time the blast is deprived of any atmospheric germs or dust which may be in it, and is delivered purified. Or it may be impregnated with antiseptic or perfumed material, by suitably mingling such with the water. The apparatus is the invention of MM. Nézereaux and Garlandat, and would seem practicable for use in many localities.


NEZEREAUX AND GARLANDAT'S AIR REFRIGERATOR.

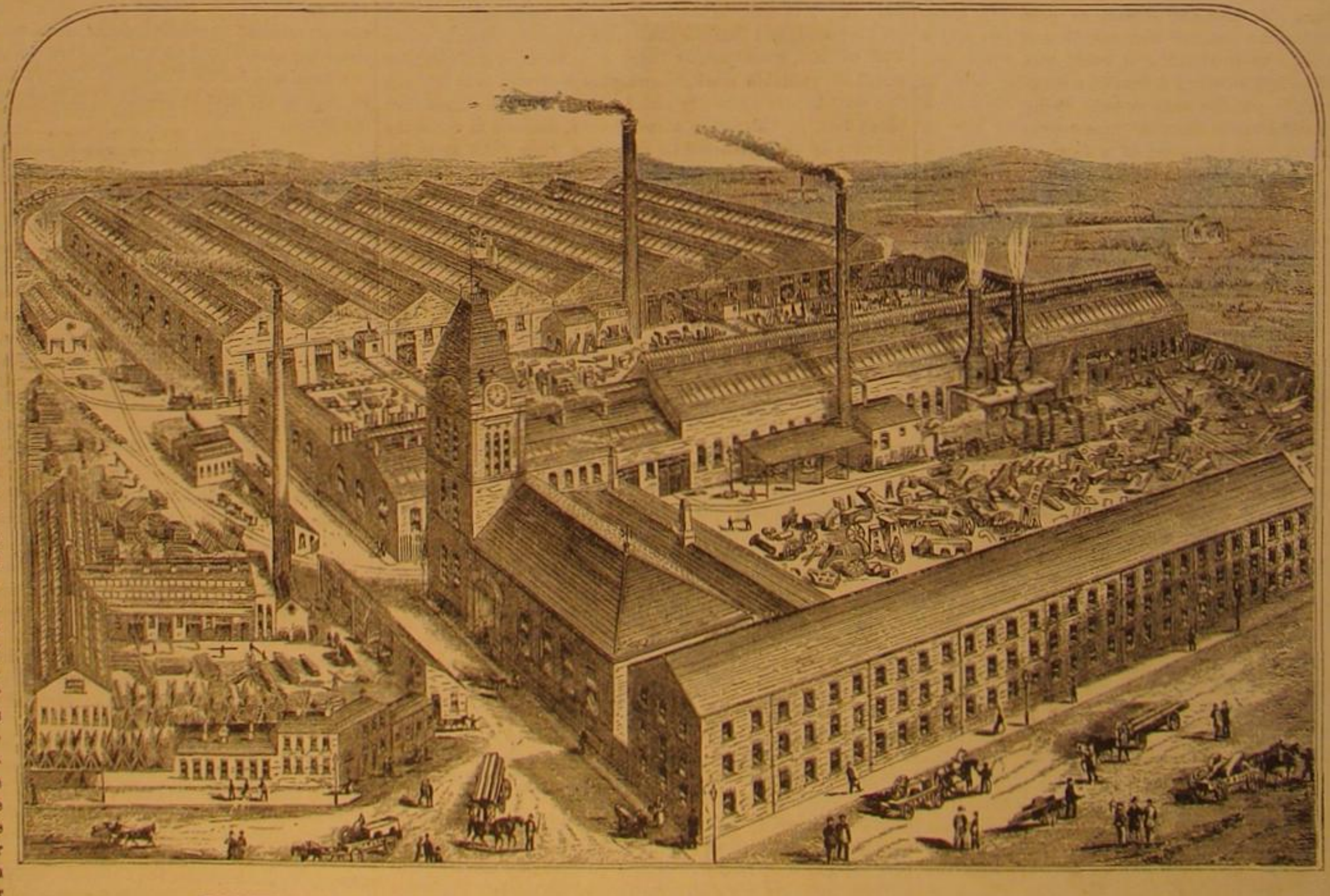
The Emperor Bell.

The third largest bell in use in the world was recently placed in the southern tower of the cathedral in Cologne, Germany. Three castings were made, of metal obtained by melting French cannon captured during the Franco-Prussian war. Two were unsuccessful, but the third was perfect. The twenty guns used weighed 50,000 German pounds, and to these was added 80,000 lbs. of tin. The time of melting was but ten hours, and twenty-nine minutes sufficed to fill the mold. The cooling continued for four weeks. The bell is 10 feet 8 inches high, and 11 feet 2 inches in diameter. Its total weight is over 25 tuns. Of the larger bells in existence, two, those of Moscow, weighing respectively 193 and 63 tuns, are broken. Pekin has one bell weighing 53 tuns, and Novgorod, Russia, one of 31 tuns—both of which are in use.

WOODWORKING MACHINERY IN ENGLAND.

Our engraving gives an excellent birdseye view of a very extensive woodworking machinery establishment in England. It is owned by Messrs. Thomas Robinson & Son, and the *Timber Trades Journal* states that it is the largest factory in the world of its kind, machines for special woodworking operations, such as shipbuilding, cooperage, wagon building, door and window sash making, being constructed in large numbers, and railway and car-building companies being applied with complete sets of plant. The works cover an area of about seven acres, and give employment at present to 1,200 men.

The general arrangement may be seen from the engraving. The fitting shop is built in sheds, on one flat, except 178 feet of the end, which is built with a gallery round, and left open up the middle for a traveling crane. It has a total length of 537 feet, and a width of 103 feet. It is fitted up with all kinds of tools by the best known makers. There may be seen in different stages of progress all kinds of machinery for the conversion of timber to its various uses. Particularly to be noticed in course of erection are some very fine machines for railway wagon building for the Midland and the Lancashire and Yorkshire Railway Companies, and for the Japanese Government. All these machines, many of which are completed, exhibit strength combined with elegance. The galleried end of the fitting shop is devoted to the erection of steam engines, to the designing and construction of which this firm has paid especial attention, so as to make them suitable for the driving of sawing machines. The gallery round this shop is used for the fitting of small machines, principally saw benches and light engines.


ROBINSON & SONS' WOOD-CUTTING MACHINE WORKS, ROCHDALE, ENGLAND.

Passing out of the fitting shop at the end, we come into the boiler shop, where boilers of all kinds are constructed, a specialty being made of those intended for sawmills, where it is desirable to burn up the waste from the machines. This shop is fitted up with a steam riveting machine, and all the most modern tools used in boiler making. The smithy runs parallel with the fitting shop, and is separated from it by a yard in which are stored the castings as they come out of the foundery. An overhead steam traveling crane runs the whole length of the yard, as far as the boiler shop, and is found very convenient both for economizing space and for loading purposes. The smithy is fitted up with steam hammers, forging, punching, and shearing machines, and all the most modern appliances. It is of proportionate extent with the fitting shops, being 298 feet long by 49 feet wide. Parallel with the smithy, a railroad and offices and stores intervening, stands the pattern shop and foundery.

The pattern shop is a large three-storied building, 183 feet long by 48 feet wide, the ground floor being occupied by pattern makers, and the upper rooms for storing patterns. Messrs. Robinson & Son turn out some very heavy castings, and their foundery is one of the special objects of interest. It is one of the largest in Lancashire, having a length of 316 feet by 94 feet wide, and is divided up the center by a row of massive cast iron pillars, on each side of which are two overhead steam traveling cranes, which traverse the whole length of the building, thereby effecting very great economy of labor. Outside the building are stoves for drying cores, sand-mixing sheds, grinding mills, and three cupolas for melting the metal. Another important branch of this establishment is the forge. Messrs. Robinson perform themselves all the various operations of converting the metal to a suitable state for the fitting shops. All shafts for log frames and engines, and other heavy forgings, are made here from the scrap produced in the other departments. The scrap is heated in two furnaces, the escaping gases from which pass at a high temperature through the flue of a vertical boiler, and are sufficient to generate steam for the supply of two large steam hammers, one of three tuns and one of one tun, underneath which the metal is worked. This not only prevents any waste of material, but insures to the firm a material for the principal working parts of their machines of exceptional strength and quality.

Separated by the street from the buildings just described, as shown on the left of our illustration, Messrs. Robinson and Son have a large woodworking establishment, where they have for many years carried on an extensive business in sawing up logs of timber, and working the same into various forms suitable for building purposes, such as doors, windows, and moldings of every variety. This, by giving practical experience of the requirements of the work, and of the actual working of the machinery for it, has doubtless conduced to the attainment of the simplicity and efficiency for which their woodworking machinery is especially renowned.

Preserving Fodder and Leaves.

A correspondent of the *American Farmer* says that, when roots or potatoes are either frozen or in any way so damaged that they cannot keep good a long while, or when these products in the spring begin to grow or sprout, the only way to save them without loss is to preserve them in trenches. These trenches ought to be about eight feet broad, at least five feet deep, and of any length. The sides ought to be perpendicular, so that the mass may settle equally. To keep the food clean and to save all the juice, it is preferable to build these trenches of bricks laid in cement. The roots are cut, packed, and stamped as closely as possible; and should there be a great surplus of juice, chopped straw may be mixed with it, to enlarge the bulk. Salt is not at all necessary to preserve this fodder, but it may be used about in the proportion of a quarter of a pound of salt to one hundred pounds of leaves or turnips. Above the filled trench the fodder is to be heaped up like a roof, so that the rain water may run off easily. After this the heap is covered with tree leaves and with soil. A straw cover would be too porous, likewise a stiff soil is better than sand. The earth ought to be rammed so that a closed cover of about two feet and a half in thickness is formed; and should the soil begin to burst or to break, stamping ought to be repeated. The principal matter of importance is to keep off the atmospheric air, else the mass proceeds to molder and to putrefy. Leaves and chopped roots treated in this way will keep good many years.

The Old Grievance of Car Ventilation.

The vexed question of car ventilation, says the *National Car Builder*, has again come to the front, and is vigorously handled in the local columns of our city journals. The writers on the subject are doubtless commuters, who travel on the crowded night and morning trains that run to various points in the neighborhood of the city. A more severe test of their endurance can hardly be devised, and it is quite natural that the grumblers, in what they have to say, should speak feelingly. Fancy a car on a moist December evening, packed to its full capacity—doors and top ventilators closed, windows doubly closed with weatherstrips, and two stoves in full blast; then imagine a conglomerate odor, increasing in power every moment, made up of musk, baked peanuts, cigar stumps, kerosene, old boots, fried onions, and tanglefoot whisky—and the peculiar inwardness of the situation is partially realized. And yet, strange to say, the smallest current of outside air, let into this seething pit of foulness, is pretty sure to give offence to some one, and he too seeks an outlet for his indignation in the newspapers. This shows that the proper ventilation of cars is an impossibility so long as it is subject to the control of passengers.

THE MANUFACTURE OF DYNAMITE.

Our illustrations show the apparatus commonly used for the preparation of nitroglycerin, the dangerous substance to the peculiar properties of which the fearful slaughter at Bremerhaven is due. A contemporary states that Nobel, the inventor of dynamite, tried many experiments "in order to bring nitroglycerin within the range of articles of transport, and finally hit by accident upon the one which resulted in the production of the powder known as dynamite." This description is a severe criticism on the inventor and his discovery, for every change of temperature produces free nitroglycerin from dynamite, and the latter substance is thus far more dangerous than the former; and an attempt to send dynamite over land or sea will soon show how it is regarded

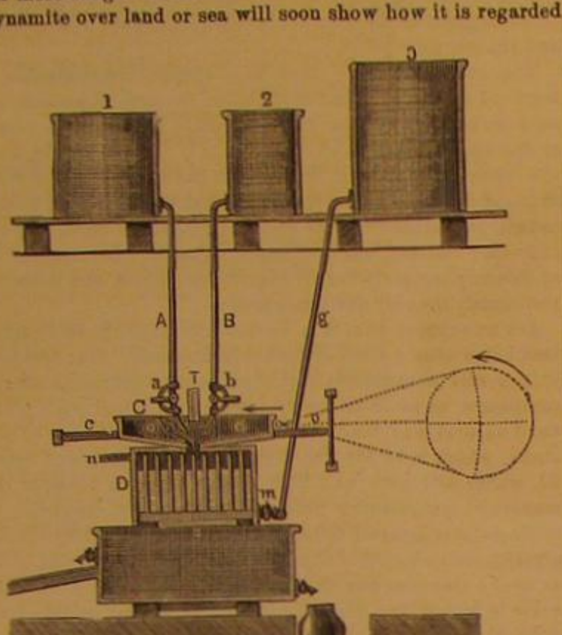


Fig. 1.—PREPARATION OF NITROGLYCERIN.

as an article of article of freight by railroad and ship authorities.

Nitroglycerin is usually commenced by mixing 2 parts nitric acid with 4 parts sulphuric acid. This mixture heats spontaneously, and is left for 24 hours to cool. Then 1 part glycerin is added to the combination of the two acids by the method shown in Fig. 1, the acids being in the vat marked 1, and the glycerin in vat 2, the vat 3 being a reservoir of water. The vats 1 and 2 communicate with a box, C, which is lined with lead, and divided into compartments which open into the trough, D. This box is provided with machinery to give it an oscillating motion, indicated by the dotted lines; it also has a thermometer to show the temperature. A constant stream of cold water is made to flow around the vat, D, and out at N. As soon as everything is ready, the acid is allowed to flow through A into C, and the glycerin through B into the same vessel. At the same time an oscillating motion is imparted to C by workmen who are stationed at a distance of thirty or forty feet, protected by a strong wall. As soon as all the glycerin has flowed in, the operation may be considered as ended, for the nitration takes place instantly. The oil from D is drawn into the vat below, which is half filled with water. The nitroglycerin sinks to the bottom and can be decanted from the dilute acids.

The nitroglycerin being now ready for use, the next step is to mix the oil with inert silica. The infusorial earth has three constituents which must be removed—water, organic salts, and coarse gravel. The first two are removed by calcining at a red heat in an oven with four shelves, one above the other, on which the earth is placed and slowly pushed from the upper to the lower. The organic matter which is considered dangerous to the stability of the dynamite, but which is less dangerous than the nitroglycerin, is thus burnt out. It is then pressed with hard rollers

Fig. 3.—MICROSCOPIC ENLARGEMENT OF INFUSORIAL EARTH.

and sifted, which separates it from the larger grains. It is now ready for use.

Fifty lbs. of the infusorial sand are put into flat wooden tanks and covered with 150 lbs. nitroglycerin, when the workmen mix them with the naked hand. Gloves of india rubber were at first provided, but the workmen preferred to knead the mixture with the free hands. In half an hour the incorporation of the oil with the sand is complete, and the dynamite is ready for filling in the cartridge molds. The cartridges are simple cylinders, protected by parchment paper. If ordinary paper is used the oil soaks into it, and there is great danger of premature explosion. Dynamite is a brownish gray, sometimes reddish, inodorous, pasty, greasy mass, having the specific gravity of 1·6. When ignited by an ordinary flame it burns up quickly without detonation, and must therefore be fired with a patent exploder containing fulminate of silver inclosed in a copper capsule. When in its normal state, it requires a heavy blow of a hammer on an anvil to explode it, and even then only the portions struck are fired. Nitroglycerin, however, is easily exploded by percussion, and it exudes from dynamite on the slightest change of the temperature; and the wood of the boxes in which dynamite is packed becomes, by slow degrees, impregnated with nitroglycerin, and forms a most dangerously explosive material, which may give rise to serious accidents in warehouses where it is stored.

The sulphuric acid used in this dangerous manufacture is the oil of vitriol of commerce, an acid too well known to need description here. The nitric acid is usually made from native saltpeter, imported from Chili or elsewhere; and as it is required to be highly concentrated, the preparation of it is a peculiar process, which is shown in our Fig. 2. In a cast iron vessel, A, is placed the nitrate to be operated upon, to which is added, by means of a funnel, strong sulphuric acid. The lid is replaced, and the vessel connected, by means of the clay-lined tube, B, with the glass tube, C, dipping into the large stoneware flask, D, which serves the purpose of a receiver. This flask is connected by means of a tube, a, to a similar vessel, D', and that to a third vessel, D'', and so on, in order to completely condense the vapors which might have escaped through the first, second, and third vessels. The iron vessel, A, is heated by means of the fire placed in the hearth, F, the smoke and hot gases being carried off by G, H. At the outset of the operation, the damper, d, is so regulated as to shut off the lower channel and cause the smoke and hot gases to pass through E, heating the vessels, D, D', and D'', this precaution being required to prevent their cracking by the hot acid vapors entering from A. As soon, however, as the distillation has fairly commenced, the damper is altered to shut off E, and pass the hot air and gases through G. The product from each retort is so mixed that the average specific gravity shall be equal to 47° or 48° B. A weaker acid than this does not work well.

The acids being mixed as above described, the next step is the mixture of them with the infusorial earth, called by the Germans *kieselguhr*, which is found in most countries. The polishing powders known as tripoli and electro-silicon are specimens of it; and it is composed of the skeletons of a vast number of diatoms, which yield a spongy silica, admirably adapted for a polishing powder, or as an absorbent for oils and liquids. It is also used in the preparation of soluble

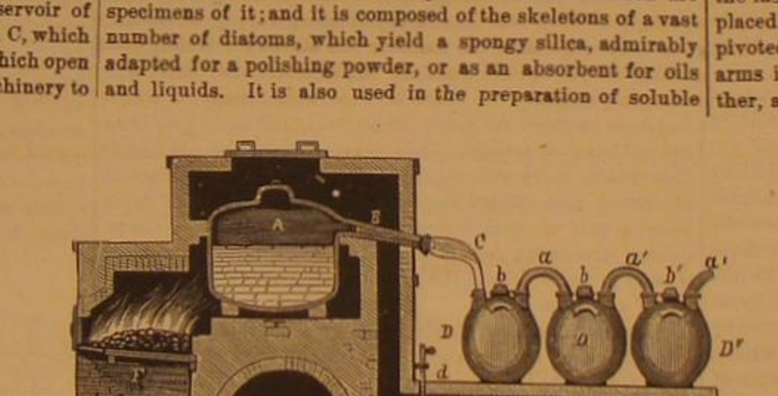


Fig. 2.—PREPARATION OF NITRIC ACID.

glass for pigments, and fireproof packing and numerous other purposes. A microscopic view of a portion of this substance is shown in Fig. 3, which fully exhibits the remarkable porosity which makes it adaptable for absorbing the perilous fluid which gives it its efficiency as an explosive.

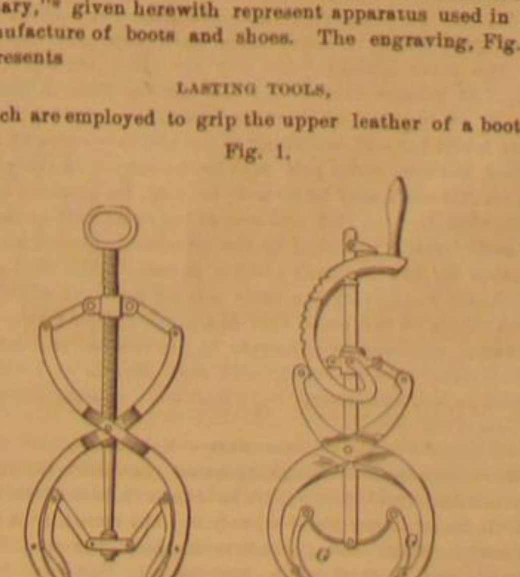
BOOT AND SHOE APPARATUS.

The illustrations, selected from Knight's "Mechanical Dictionary,"* given herewith represent apparatus used in the manufacture of boots and shoes. The engraving, Fig. 1, represents

LASTING TOOLS,

which are employed to grip the upper leather of a boot or

Fig. 1.



Lasting-Pinchers. *Tool for lasting Boots and Shoes.*

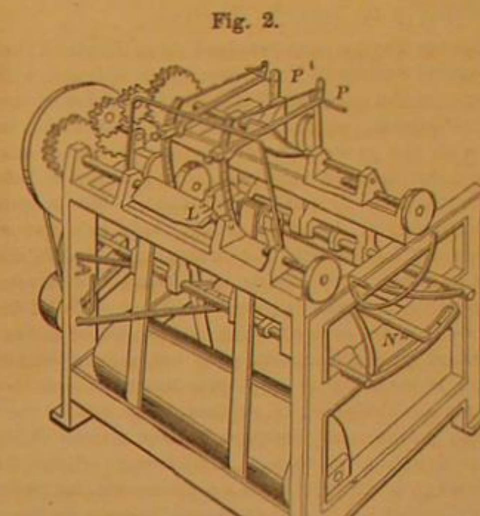
*Published in numbers by Messrs. Hurd & Houghton, New York city.

shoe, and draw it over the last. In the tool on the left, the two jaws act simultaneously upon the leather through the motion of the nut, C, upon the screw. The same movement brings the jaws toward each other and stretches the leather around the last. The two pairs of jaws in the second tool engage the sides of the leather, and are then drawn thereupon and also inwardly by the action of the cam lever. Lasts are usually made upon the ordinary type of lathe employed for turning irregular forms. For this purpose, however, special machinery has been devised, to which class belongs the

LAST LATHE,

represented in Fig. 2. In this machine, the block, L', from which the last is to be cut, is, by a train of gearing, made to present a face to the cutters precisely corresponding to the face of the model against the guides, P P'. By moving links on these rods, up or down on their graduated scales, the last

Fig. 2.



Frohock Last-Lathe.

may be enlarged or reduced in its relative proportions to the model. A similar variation of the bar, N''', on the sector at the end of the machine, will vary the work in relation to its length as compared with that of the model.

In Fig. 3 is a

BOOT SHANK MACHINE,

used for drawing the leather of the upper or boot leg over the last into the hollow of the shank. The leather being placed over the last is inserted between the jaws, which are pivoted to the plate. The screw connecting the jaws by arms is thus turned, causing the jaws to be brought together, and thus stretching the leather. The same figure also shows a boot stretcher, for stretching the uppers. The last is divided into an upper and an under section which are connected by a lever. The fore end of the upper section is pivoted to the fore end of the lever, and the middle end of the lever has its fulcrum at the mid-length of the lower section. The screws operate to raise the rear end of the upper section directly, and its fore end through the medium of the lever. The upper surface of the last has changeable knobs to stretch the leather in particular places.

Fig. 4 represents a

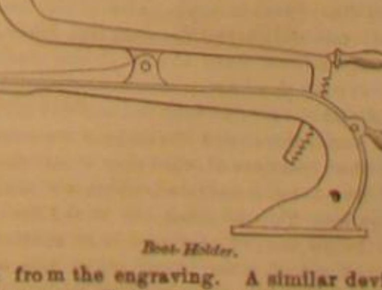
BOOT HOLDER

or jack, for holding the boot during the process of manufacture. The base piece is attached to the bench and has a stationary prong. The movable prong containing the foot piece is attached to the other, and is held at its adjustment by a rack and pawl. The operation may be clearly

Fig. 3.

Boot-Shank Machine *Boot-Stretcher*

Fig. 4.



Boot-Holder.

understood from the engraving. A similar device is sometimes used to stretch the boot while blacking or varnishing it.

Fig. 5 shows a boot sole with steel calks attached, for the use of pedestrians in winter weather or when scaling the snowy tops of mountains or crossing glaciers. These calks are readily arranged to screw into plates fastened to the sole and heel of the boot, and are then removable at will. In walking over ice, these or similar appliances are indispensable; and many bruises, and sometimes limbs and even lives, have been saved by their use.

Fig. 5.

Boot-Calk

Correspondence.

Employers and Trade Unions in England.

To the Editor of the Scientific American:

Intelligence having been received from England that the Amalgamated Society of Engineers is in dispute with the employers, on the question of the re-introduction of the system of piecework, which dispute has culminated in one strike, with the probability of the occurrence of others, I take the opportunity of ventilating this question a little, premising my remarks by stating that they are based upon personal knowledge of the actual facts. As a rule the editors of newspapers have very little mercy upon trades' unions, and this has been often said to be because the interests of newspapers lie with the employers of labor. This I believe to be a mistake, for even a mechanical newpaper has as large a circulation among workmen as it has among employers. The truth is rather that employers are more apt to avail themselves of the press, to present their side of the question to the public, and workmen are not usually skillful as writers or as special pleaders. Furthermore, editors, having no knowledge of the real evils of piecework (for piecework has its evils), and not being enlightened thereon by the workmen themselves, whose interest it is to ventilate that side of the question only, cannot be expected to form an equitable judgment upon the issues involved.

All the real causes of the opposition of trades' unions to the introduction of piecework will be found to be elucidated in the following recital of facts, in which it will be made apparent that, between employers and employed, there is, so far as abstract justice between them is concerned, but little to choose, and that the balance, if any there be, is decidedly in favor of the workmen, excepting in so far as acts of violence are concerned; and the occurrence of these acts is due only to the fact that a strike or lockout renders the condition of the workman a positively desperate one, whereas to the employer it is a mere question of his capital lying idle.

Public opinion is largely influenced by the publications of such works of fiction as Charles Reade's "Put Yourself in his Place," in which injustice is done to the workman, not in describing the terrible deeds which have been wrought by one workman on another, but by gathering together isolated cases of extreme violence, and attributing them all to the hero. This was perhaps a necessity for the author, in order to give this book the flavor of sensation necessary to the success of such works. But the excuse for the author by no means debars the artisan or trades' unionist from protesting against the injustice he sustains at the hands of the writer, whose impression on the public mind, by the description of such outrages, is grossly partial.

Towards the end of the year 1860, a young man who had been in business in South America and had returned to England, was re-engaged in the workshop in which he had served his apprenticeship; and having himself been an employer, he resolved to so perform his duties as a workman that he would prove to others that a good workman had only to study the interest of his employers to secure promotion. He wished to demonstrate that employers were watchful of those who were capable and who studied their interests, that the interests of the two were bound up together, and that the success of the one involved the success of the other; but alas! his employers were a railroad company, and that companies have no souls was amply "proven in the sequel." Labor was, in the estimation of this workman, a commodity whose value, like that of any other article, was just what it would fetch, its price being regulated by the quantity and quality delivered, and varying with the same. It was, therefore, not very encouraging to him to be told that it did not matter how much work he did, nor how well he did it, and that his wages at starting could not in any event exceed £1.12s per week, for that was the highest price paid to a new hand. That labor was not, therefore, the same as an article of merchandise, became to him at once painfully apparent; as it is not a rule of trade to pay less for an article because it is the first time you have purchased such a thing. There was nothing for it, however, but to accept the situation, and trust to time to obtain a higher rate of pay in the future. However, time passed, on, and the workman found no improvement in his condition until at last it was decided to have much of the work done by piecework. Accordingly a set of engine connecting rods were set aside to be fitted up by piecework, and some dozen workmen were selected and invited to give an estimate of what they would do the job for; and the young man in question, whom we will call Tom, gave the lowest bid and took the work, the price being sufficiently below the ordinary cost to be satisfactory to the managers. A set of axle boxes, other sets of rods, and several other jobs were done by Tom under similar conditions, he earning as much again as his day's work wages. This caused a sharp competition, as other workmen, anxious to better their condition, gave in lower prices; Tom, however, kept the lead, always managing by shrewdness, luck, or whatever else it may be termed, to take every job he bid for. Nothing daunted, however, his fellow workmen continued to compete, thus compelling Tom to either reduce his prices or lose the work. Some of the competitors bid because they would be satisfied if, by working piecework, they could increase their pay only twenty-five per cent; others competed upon general principles, saying that, if Tom could do it, they could. At length, however, Tom's repeated success discouraged competition, not, however, without raising some little feeling among the men, on account of his having, as was charged, cut the prices of the work down. This charge was scarcely fair, since it was in consequence of the competition of others that the prices had been reduced. It cannot, however, be denied that, since Tom was always the lowest, he was the most instrumental in the reduction of prices, notwithstanding the fact that his price was as a rule remarkably close to the next lower one. But the feeling among the men did not amount to positive estrangement, and it only found vent in upbraiding Tom by statements that he was ruining the trade and injuring the other workmen. At length, however, Tom began to make from 60 to 70 per cent more than his day's wages would have been: and this notwithstanding that the prices of his work had been very materially reduced since the piecework began. He innocently believed that the unusually low cost of his work, and the unusually large amount of his earnings, would open the eyes of his employers to his expertness, to the methods by which he saved time and work, or to whatever other cause may have enabled him to do so well. How far this was the case, he learned by an intimation that the prices of his work must be reduced because *no piecework man was allowed in that shop to earn more than 50 per cent more than his ordinary daily wages.* He pleaded that the cost of his work was at least 50 per cent less than the large quantity of the same kind of work being done in the same shop by men who had had from 7 to 15 years' experience on it. He was told it didn't matter what time the day's work men had taken, nor what their work had cost, or was now costing; he was making *too much money,* and must reduce his prices. He urged that, since no one else would take the work at so low a price as his, he could not perceive why he should be called upon to still further reduce the price; and he was informed that he must either reduce the prices of all those kinds of work on which he earned more than 50 per cent above ordinary day's wages, or else he would be put back to day's work on his old day wages; and as an alternative he had to reduce the prices

Now, this was not a new shop, or one in which a constant change of work was had; but, on the contrary, there had probably never been, at any one time during the then preceding 15 years, less than 70 workmen in that shop who were employed on the same kind of work, many of whom had been engaged for years on precisely the same jobs from the selfsame drawings. Tom learned from the old hands that similar rules with regard to the amount of earnings of piecework men existed throughout England, that the rules were a sort of tacit understanding, and that as a consequence piecework men who had any wisdom in them gaged it so as to never exceed the allotted amount of "time and a half," as it is called.

At this time Tom's reflections were anything but rose-colored, as he had commenced with the idea of being an example to other men and a student of his employers' interest; but although he had practically demonstrated the identity of interests of the employer and the employed, he had advanced sufficiently far in his programme to be on questionable terms with many of his fellow workmen, and at loggerheads with his employers. His situation, so far as his personal relations with his business acquaintances were concerned, threatened ostracism; he felt almost like a criminal, and was only consoled by the consciousness that, in his own mind, he could not believe that doing a large amount of labor for an unusually small price, which is perhaps the most severe language in which his struggle to better his condition can be termed, deserved the meted punishment. "So much work for so much money," and "the more the work, the more the money," sounded exceedingly well as aphorisms; but when the workmen shouted: "No extra work, and no extra pay," and the employer added: "No more pay, however much more work you may do," and (in the same breath) "*less pay for more work for you only,*" it became exceedingly difficult for Tom to put his theory of identity of interests into any sort of practice. Tom found himself, according to the ordinary rules of commerce, the very worst paid man in the shop. In every article (as his work may be termed) he sold, he obtained a less price than any one else, and was at the same time grumbled at and virtually punished by the purchaser (his employer), because he had so many articles to sell; while that same purchaser was buying the same quality and kind of articles from others on the same spot at a much higher price. He, however, resolved to persevere in his course, and let the future take care of itself, with such results as I will describe in another letter.

PIECEWORK.

New York city.

A SIMPLE mode of roughing horses, practised in Russia, consists in punching a square hole in each heel of the shoe, which, in ordinary weather, may be kept closed by a piece of cork. When the ground is slippery, the cork is removed, and a steel spike inserted. If this steel rough be made to fit the hole exactly, it remains firm in its place, and is not liable to break off short at the neck, like some of the screwed spikes.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

NUMBER XLI

TO DIVIDE A CIRCLE INTO ANY NUMBER OF EQUAL PARTS.

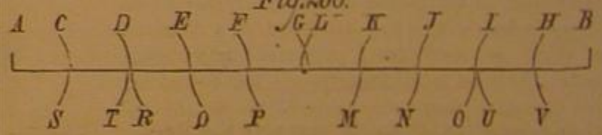
When a circle requires to be marked with a number of holes equidistant from each other, it is a very difficult matter to set the compasses so that, commencing at any one point and marking off the centers of the holes continuously in one direction, the last center marked will come true with the one first marked: because, if the points of the compasses are only one half the thickness of a line out, the error becomes, supposing the circle to require 60 holes around it, 60 times as great in the distance between the center last marked and the starting point.

The consequence is that it is almost impracticable to mark off any large number of holes in such a manner, not only on account of the frequent trials necessary to obtain so fine an adjustment of the compass points, but because the frequent trials will leave upon the surface of the work so many compass marks that those last made become almost indistinguishable from the other and incorrect ones. By the following method, however, such holes may be marked off, sufficiently correctly for all practical purposes, and more expeditiously than by any other means:

Let us suppose that it is required to mark off 60 equidistant holes upon a circle 30 inches in diameter. Our first procedure will be to ascertain at about what distance to set the compasses, so as to be nearly correct at the first trial. The most natural way would be to find the circumference of the circle, which is 94·248, and divide it by the number of holes, 60, which will give us 1·5708 as the distance between the centers of neighboring holes. The difficulty, however, of setting the compasses to the distance represented by the decimal fraction becomes apparent; and though this plan gives as near a result as any that can be arrived at, even in those cases in which the diameter of the circle may contain fractions of an inch and the number of holes required may be an odd one, still, in the matter of our example and, in fact, in all circles of whatever diameter, if the required number of holes is even, we may adopt a much better plan as follows:

We know that the radius of any circle will divide its circumference into six equidistant points; and since we require ten times as many of such points, we have only to divide the radius of our circle into 10 equal parts to get the required distance, between the compass points, more correctly than by any other method. In many cases a simple mental calculation will give us the required distance. If, for example, our 30 inch circle requires to be divided into 18 equidistant points, we would say: If the radius (15 inches) of the circle gives us 6 points, one third of it, 5 inches, will give us 18 holes. Such instances are, however, the exceptions; and it is therefore necessary, in all cases where the required number of holes or points is an odd one, to divide the circumference by their number; and if an even number be required, to divide it into the radius of the circle, which may be done readily enough if the number of holes is small, but if they are many, the following method is the most expeditious: In Fig. 200, let A B represent the radius, 15 inches, of

Fig. 200.



our circle, and therefore the distance between any two points when the circle is marked off into 6 equal divisions. It is apparent, then, that each of such divisions will require to contain ten equidistant points, which we mark off as follows: Setting the compasses as near as practicable to $\frac{1}{10}$ of the radius of our circle, we commence at A, and mark on one side of the line only the line, C, and from that the line, D, and so on up to G. Then recommencing at B, we mark off in like manner the lines, H, I, etc., up to L, and the exact center between the lines, G and L, will be the true position for the center hole, notwithstanding that none of the other points are in their proper positions, nor at proper distances apart. We now note that, as the lines, G and L, overlap one another, the compass points were a shade too wide open. This defect we remedy to the best of our judgment; and starting from the center point, between L and G, we mark off the lines, M, N, and O, on one side, and P, Q, and R, on the other. Then commencing again at A, we mark off the lines, S and T, and then from B, the lines, U and V: the junction of the lines, T and R, forming another true point, and that of O and U forming another, the fifth practically true division. It will be readily observed that, by marking the lines, from C to L, on one side only of the line representing the radius of our circle, and then subsequently marking the lines, from O to V, on the other side only of the said radius line, we keep them distinct, and are enabled readily to perceive the difference between them. For all ordinary purposes our compasses will now be set sufficiently exactly; but if a greater number of holes be required, we make a light centerpunch mark at the points, A and B, and at the junction, in the center of the nearest approach of the lines, T, R, O, and U; and rubbing out or chalking over all the lines save the one representing the radius, we proceed as above to mark out other holes to justify the compass points' distance. The centerpunch marks, however, should be made very lightly, and all of about one depth. If this second adjustment is necessary, it may be concluded by commencing at A and continuing on to B, so as to have the longest possible distance for the justification.

Whenever the number of holes required is a multiple or divisor of the diameter of the circle, we may obtain the first approximate distance of the compasses as follows: Every inch of the diameter of the circle represents 3·1416 inches of its circumference; and since, in our example, the diameter of the circle is supposed to be 30 inches and the number of holes required is 60, it is evident that every 3·1416 inches of the circumference will have to contain 2 holes; and therefore 3·1416÷2 = the proper distance of the compass points. Had the number of holes required been 30 instead of 60, their distance from center to center would be 3·1416 inches, while had their number been 15 their distance from center to center would be 6·2832. Now supposing the compasses to be set as nearly as possibly correctly, we proceed upon our circle as follows: Commencing at A, Fig. 201, we mark off

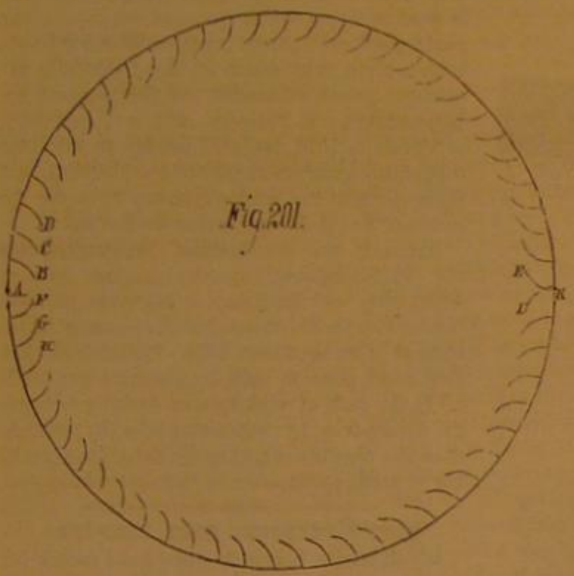


Fig. 201.

continuously one from the other, and taking care to be very exact in placing the point of the compasses exactly on the mark at its junction with the circle) the 30 points, B, C, D, etc., ending at E. Then commencing again at A, we mark off continuously and equidistantly the 30 marks, F, G, H, etc., ending at T; and the center, K, between the two lines, E and I, will be the true position of the point diametrically opposite to the point, A, from which we started.

It will be perhaps observed by the reader that it would be more expeditious and perhaps cause less variation were we to set the compasses to the radius of the circle and mark off the point, K, as shown in Fig. 202, commencing at the point,

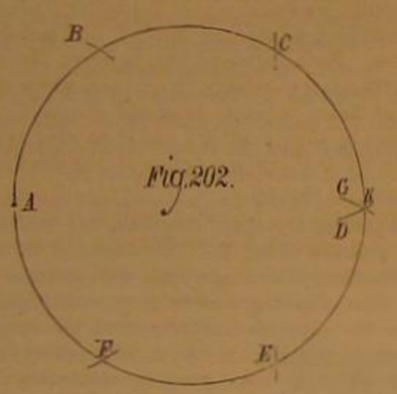


Fig. 202.

A, and marking off on the one side the lines, B, C, and D, and on the other side, E, F, and G, the junction or center, between G and D, at the circle being the true position of the point, K. For circles struck upon flat surfaces, this plan is decidedly advantageous: and in cases where there are not at hand compasses large enough, a pair of trammels may be used for the purpose; but our instructions are intended to apply also to marking off equidistant points on such circumferences as the faces of pulleys or on the outsides or insides of rings or cylinders, in which cases the use of compasses or gages is impracticable. The experienced hand may, it is true, adjust the compasses as instructed, and mark off three or four of the marks, B, C, D, etc., in Fig. 201, and then open out the compasses to the distance between the two extreme marks, and proceed as before to find the center, K, but as a rule, the time saved will scarcely repay the trouble; and all that can be done to save time in such cases is, if the holes come reasonably close together, to mark off, after the compasses are adjusted, three or four spaces, as shown in Fig.

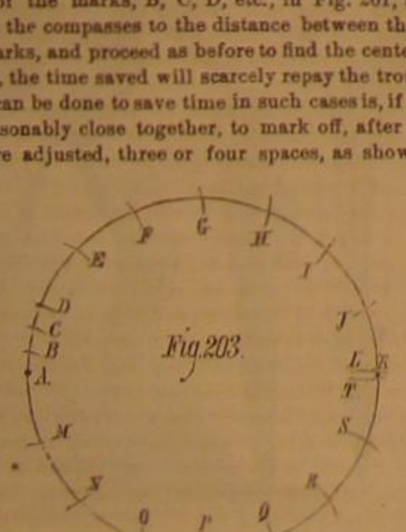


Fig. 203.

203. Commencing at the point, A, and marking off the points, B, C, and D, we then set the compasses to the distance between A and D, and then mark, from D on one side and from A on the other, the marks from F to L and from M to T: thus obtaining the point, K. This method, however expeditious and correct for certain work, is not applicable to circumferential work in which the distance between two of the adjacent points is at the most $\frac{1}{30}$ of the circumference of the circle; because the angle of the surface of the metal to the compass point causes the latter to spring wider open in consequence of the pressure necessary to cause the compass point to mark the metal. This will be readily perceived on reference to Fig. 204, in which A represents the stationary, and B, the scribing or marking point of the compasses.

Having found the two diametrically opposite points, A, K, we note how much out of true the two lines last marked, E and I, in Fig. 201, vary, and we alter the compass points (in this case) to $\frac{1}{30}$ of the variation, that is, we divide the amount, of the variation between them, by the number of holes or points required; and setting our compasses as nearly as our judgment dictates, we mark off our next two points, as shown in Fig. 205. Commencing at A, we mark off (on the other

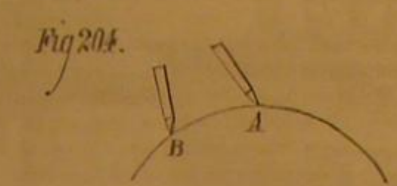


Fig. 204.

side of the circle, so as to keep them distinct from the marks previously made) the lines, B, C, etc., as far as the line, G, that is to say, we make as many of such marks as are equal to one quarter of the whole number required. The object of showing a less quantity in Fig. 205 is to keep the illustration distinct and clear. Then we start from the point, K, and mark off the same number of points, represented by the lines, H, I, and ending at M; the center between the lines, G and M, at their nearest point of contact, is the true position of point No. 3, the point, A, being No. 1, and K, No. 2. By proceeding in a similar manner on the other half of the

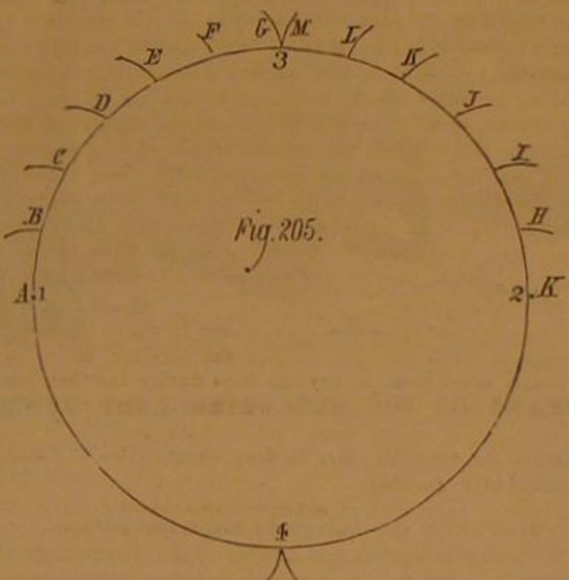


Fig. 205.

circle, we get the true position of point No. 4. If, in obtaining points 3 and 4, the compasses are not found to be set dead true, the necessary adjustment must be made; and it will be seen that, so far, we have obtained four true positions, and the process of obtaining each of them has served as a justification of the distance of the compass points. From these four points, we may proceed in like manner to mark off the holes or points between them; and the whole will be as true as it is practicable to mark them off upon that size of circle. In cases, however, where mathematical precision is required upon flat and not circumferential surfaces, the marking off may be performed upon a circle of larger diameter, as shown in Fig. 206. If it is required to mark off the

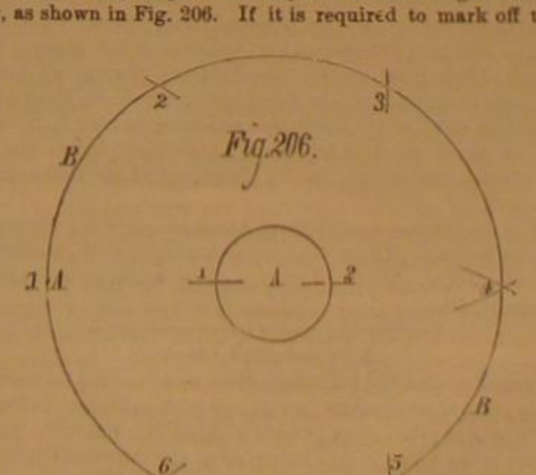


Fig. 206.

circle, A, Fig. 206, into any even number of equidistant points, and if, in consequence of the closeness together of the points, it becomes difficult to mark them (as described) with the compasses, we mark a circle, B B, of larger diameter, and perform our marking upon it, carrying the marks across the smaller circle with a straight edge placed to intersect the centers of the circles and the points marked on each side of the diameter. Thus, in Fig. 206, the lines 1 and 2 on the smaller circle would be obtained from a line struck through 1 and 4 on the outer circle; and supposing the larger circle to be three times the size of the smaller, the deviation from truth in the latter will only be $\frac{1}{3}$ of whatever it is in the former. If the number of points to be marked off on any circle is an odd one, the only variation from the above instructions is as follows: Suppose that we have commenced at the point marked 1, in Fig. 207: we mark off half the re-

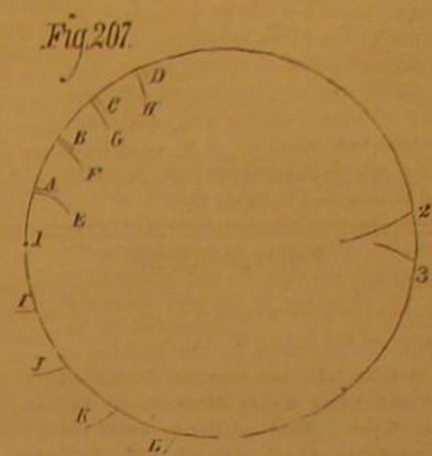


Fig. 207.

quired number of holes on one side and arrive at the point 2; and then, commencing at the point 1 again, we mark off the other half of the required number of holes, arriving at the point 3. We then apply our compasses to the distance between the points 2 and 3; and if that distance is not exactly the same to which the compasses are set, we make the necessary adjustment, and try again and again until correct adjustment is secured. It is highly necessary, in this case, to make the lines drawn at each trial all on the same side of the circle and of equal length. For example, let the lines, A, B, C, D, in Fig. 207, represent those made on the first trial, and E, F, G, and H, those made on the second trial; and when the adjustment is complete, let the last trial be made upon the outside or other side of the circle, as shown by the lines, I, J, K, L. Having obtained the three true points, marked 1, 2, and 3, we proceed to mark the intermediate holes, as described for an even number of holes, save that there will be one more mark made on one side of holes 3 and 4 than there are on the other side of them. In cases where mathematical exactitude is not a requisite, and an odd number of holes is required, after setting the compass points as nearly true as necessary, and obtaining from them the points 2 and 3, we may take another pair of compasses, and find with them the center between points 2 and 3. Then taking the first and adjusted pair of compasses, we make a mark, as shown in Fig. 208. We first draw the line, E, and, resting one leg of the compasses on the point, A, we draw the segment of a circle, B; then resting the point of the compasses on the point of intersection of B and E, we draw the segment of a circle, C. The distance, at E, between the two segments, B and C, represents the required distance apart of the holes. We now take our extra pair of compasses, and find the center of B and C, as denoted by the point, F, setting the compasses to the exact center, so that, when one point rests on F, the other will come fair with the lines, B and C. We turn to our work represented on Fig. 207; and from the center found between points 2 and 3, we make, with our extra pair of compasses, a mark on each side of that center, which will represent the correct position of points 2 and 3; and we then correct the variation between them nearly enough for ordinary purposes without the tedious process of going over the whole ground again, because the distance between points 2 and 3 was not precisely correct.

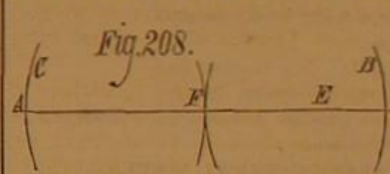


Fig. 208.

In marking off any number of holes varying in their distances one from the other, the variation being regular, as for instance holes around a 30 inch circle, 60 in number but each two holes being 1·57 inches apart, the distance between the next two would require to be 1 inch, and so on, as shown in Fig. 209. The total number of holes must in this case be an even one; hence we mark off, by the rules already given, one half of that total number, making them equidistant all round the circle or circumference, as the case may be, which points will represent the distance apart of the holes that are widest apart, as the holes, A, B, C, D, and E, in Fig. 209,

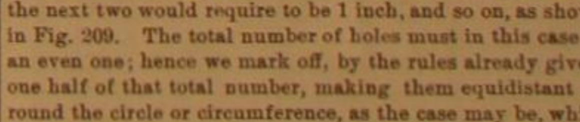


Fig. 209.

amounting in our example to 30 in number. We then set our compasses to the required distance apart of the two holes nearest together; and commencing at A in Fig. 209, we mark the center for the hole, F, and from the center of the hole, B, the center of the hole, G, and so on, continuing all round the circle, but taking care to mark the new center in each case in advance of or behind the points, A, B, C, etc., according to the manner in which the first of the holes nearest together was marked. Thus in Fig. 209, the points, F, G, H, and I, are marked to the right, in each case, of the points from which they were struck.

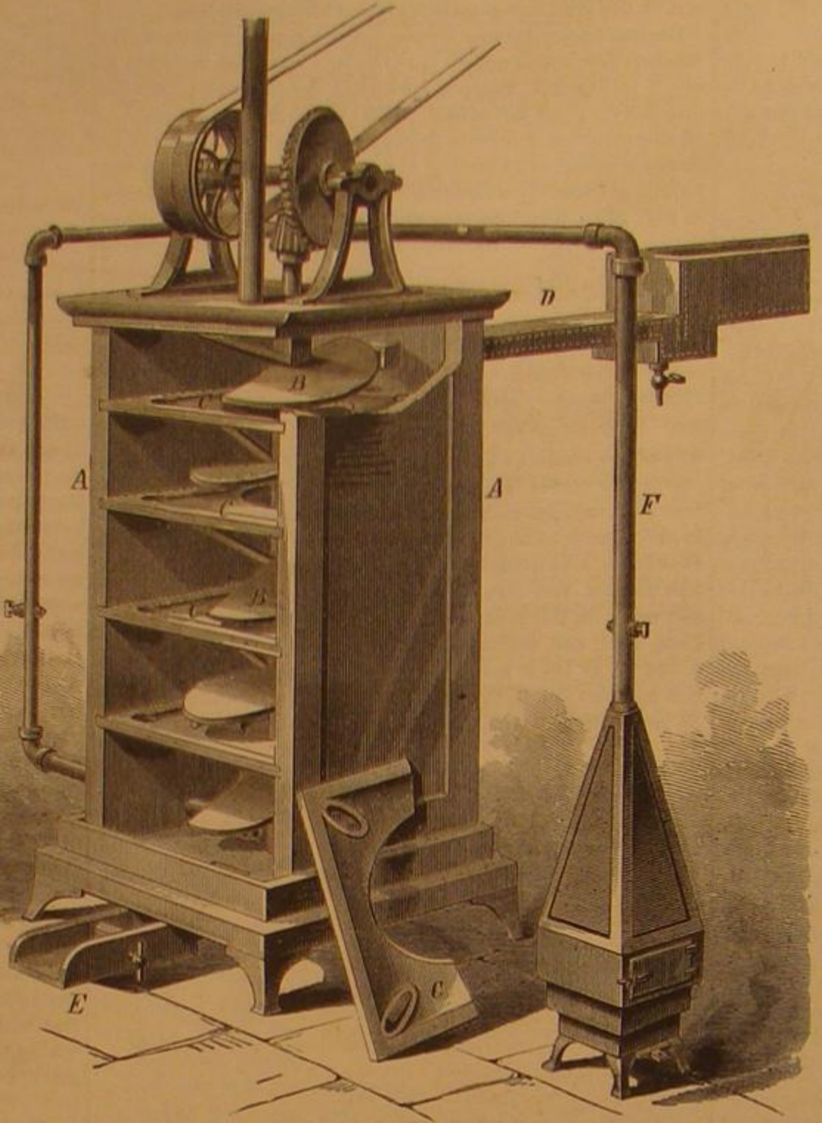
There are of course many variations in the grouping of holes around a circle, but all the principles involved in marking them off are shown in the examples given above.

IMPROVED SULPHUROUS ACID APPARATUS FOR BLEACHING CANE JUICE.

We illustrate herewith a new apparatus for bleaching cane juice through the action of sulphurous acid gas. It is claimed to introduce less acidity into the juice, and consequently to produce sugar more dry and of a superior grain to that ordinarily made by machines in use, to obviate the use of bone black in the clarification of refined sugar, to work uniformly in any kind of weather, to bleach efficiently, to admit of easy cleaning and repair, and to be adapted to any mills. A is an airtight chamber, in which is a vertical shaft which carries the wings, B, the latter extending spirally around the shaft in the spaces between the shelves, C. The juice is admitted to the chamber through the pipe, D, and falling upon the upper set of wings is thereby dispersed and collected by the shelf immediately beneath. Through apertures in the corners of the shelf it then falls, meeting the second set of wings, and being again dispersed by the centrifugal force. This continues until the lowest compartment is reached, when the fluid escapes by the pipe, E. In both pipes, E and D, are sealing chambers, which prevent entrance of air into the main chamber, A.

The sulphurous acid gas is generated by burning sulphur in the furnace shown, out of which it passes by pipe, F, which extends over the apparatus and finally enters the lower compartment. The gas is about two and a half times heavier than air; and in order to produce a draft sufficient to draw it up and through the chamber, A, the wings, B, are again utilized, so that they thus perform a double office. These wings, rotating at the rate of 300 revolutions per minute, necessarily produce a strong upward current, which therefore meets the descending liquid, which is already beaten into a fine spray. That the latter will thus be brought into intimate contact with the bleaching agent is obvious; and furthermore, it will be observed that the cane juice, just before it is drawn off, meets the freshest supply of entering gas. The juice thus bleached, if left to rest and defecate at least ten hours, will have, we are informed, a most beautiful appearance, and will make a very superior quality of liquor. The machine acts especially well in treating cane badly injured by frost, and has already been practically tested on a large scale.

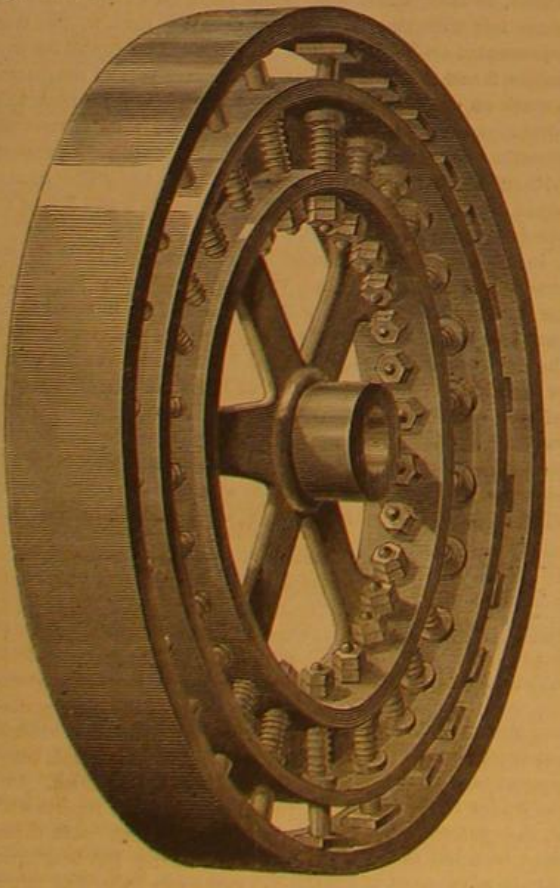
Patented March 30, 1875. For further particulars address the manufacturers, Messrs Lescale & Guedry, Paincourtville, Assumption Parish, La.



APPARATUS FOR BLEACHING CANE JUICE.

HARDING'S CUSHION EMERY WHEEL.

We illustrate herewith a new form of emery wheel, the principal feature in which is the flexible or cushion rim. This is so constructed as to be soft and yielding to pressure, thus especially adapting it to the polishing of articles, both heavy and light. The rim is also adjustable, and never needs truing, and is therefore durable and economical.



The device is composed of a strong cast iron wheel having a double periphery, through which several apertures are made. The outer rim consists of several layers of leather or other suitable material, firmly cemented together and varying in thickness from one half to three quarters of an inch, according to the purpose for which the wheel is needed. This leather rim is attached to T-headed bolts which rest on springs, as shown, and are set up and adjusted by nuts within the inner periphery of the wheel. In operation the flexure of the rim will move around the wheel in wave form, as the object to be ground is pressed against its surface, the transfer of pressure from one point of support to another taking place in a perfectly uniform manner.

Patented January 17, 1871. For further particulars, relative to sale of rights for Eastern and Southern States, etc., address the inventor, Mr. Thomas Harding, No. 3 Second street, Lafayette, Ind.

Journal of the American Electrical Society.

We have received the first number of the Proceedings of the above society, which, in respect to beauty of typography and excellence of contents, is one of the most valuable documents we have seen for a long time. The Society comprises among its members all the principal practical discoverers and workers in electrical science, and perhaps it is therefore not surprising that the selections of its contributions to electrical knowledge should be unusually good.

The first article is by Elisha Gray, whose remarkable inventions in the transmission of musical sounds by telegraph have from time to time been noticed in the SCIENTIFIC AMERICAN. The present article gives a full and intelligible description of them, and the article is of so much interest that we reproduce it in full, with its excellent illustrations. It will be found complete in our SCIENTIFIC AMERICAN SUPPLEMENT, No. 6. We are indebted to the Society for a loan of the excellent engravings that accompany the paper. Mr. F. W Jones contributes to the Society's journal an excellent paper on Quadruplex Telegraphy: Mr. C. H. Haskins, a paper on the Use of Condensers as Repeaters: Mr. I. N. Miller, a paper on Lightning and Lightning Rods: Mr. R. H. Jewett, an article on an Improved Line Galvanometer etc.

For the present year, General Anson Stager is the President of the Society. The publishing committee are W. H. Smith, F. W. Jones, M. G. Kellogg. The headquarters are at Chicago, Ill.

A Wonderful Clock.

One of our foreign exchanges gives an account of "a marvellous piece of mechanism, which just been exhibited in Paris. It is an eight day clock, which chimes the quarters, plays three tunes every twelve hours, or at any intervals required. The hands go round as follows: One once a minute; one once an hour; one once a week; one once a month; one once a year. It shows the moon's age, the rising and setting of the sun, the time of high and low water, half ebb, and half flood; and there is a curious contrivance to represent the water, which rises and falls, lifting some ships at high water tide as if they were in motion, and, as it recedes, leaving them dry on the sands. The clock shows the hour of the day, the day of the week, the day of the month, the month of the year; and in the day of the month provision is made for the long and the short months. It shows the signs of the zodiac; it strikes or not and chimes or not, as may be desired; and it has an equation table, showing the difference between the clock and the sun for every day in the year."

Working Men's Lodgings at the Centennial.

Our excellent contemporary the Philadelphia *Public Ledger* quotes approvingly our recent suggestions regarding the providing of cheap quarters for working men who may be enabled to visit the Centennial, through concerted action of trades' unions and other societies, but adds that good cheap accommodations are already in existence. The editor says: "As to the matter of lodgings at moderate rates, the SCIENTIFIC AMERICAN may assure its artisan readers that here, if anywhere in the world, working men can secure good, respectable, comfortable, and desirable lodgings and board at moderate rates, for all that may come—unless they come in armies more than a hundred thousand strong in one day." We are certainly glad to learn the above, and no doubt our readers will be likewise; but on the other hand, with a vivid recollection of the frightfully exorbitant prices demanded for the meanest accommodations at Paris in 1867, and especially at Vienna in 1873, we still adhere to our idea that cheap quarters cannot be too plentiful, and therefore that the work suggested by us for the societies would by no means be useless.

Athough we are inclined to congratulate the Philadelphians on the golden harvest which they will thus reap, it behooves us, and indeed everybody, to see that the reaping is restricted to its legitimate field. Philadelphia has very much more to gain, by placing every facility in the path of working men desiring to benefit themselves by witnessing the Exposition, than she possibly can have by her citizens seeking to profit pecuniarily by their attendance.

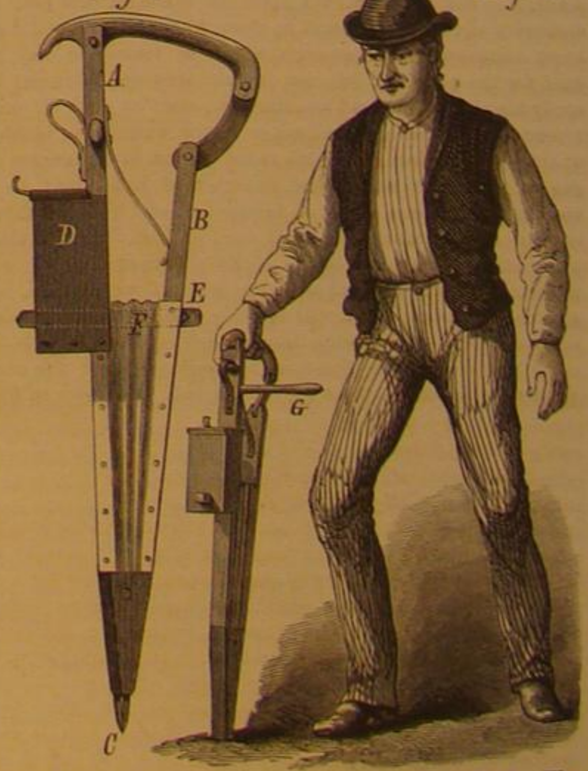
NOEL'S IMPROVED CORN PLANTER.

We illustrate herewith a new hand device for planting corn. According to the inventor, it may be manipulated so easily that the operator may traverse the field as rapidly as if the apparatus were but a walking stick carried in the hand. The invention is fully shown in Fig. 1, and in Fig. 2 it is represented in operation.

A and B are two bars connected together by pivots passing through overlapping plates near the lower ends. At the extremities are secured steel plates, C, which enter the ground and make an opening for the reception of the seed. Between the bars pieces of leather are attached, extending from the overlapping plates to the hopper, D. The seed contained in the latter is removed and dropped between the bars by the slide, E, which enters D through an aperture in the bar, A. The outer end of the slide is secured to bar, B. The seed enters a hole in the slide, indicated by dotted lines at F; and the size of the hole is regulated, so as to take more or less seed, by a suitable sliding piece.

To the bar, A, is attached a convenient handle, the end of which is pivoted to a short connecting bar, which is also similarly attached to bar, B. This allows of the easy operation of the bars, which carry the slide into and out of the hopper, thus allowing seed to pass to the plates, C, and thence, on the latter opening the ground, into the hole made. The object of the loop on bar, A, is indicated in Fig. 2, it serving to afford a secure grasp for the device. The rigid handle, G, may be held by the operator with one hand while he grasps the handle above with the other, so that both hands, when desired, may be conveniently applied. The spring shown between the upper parts of the bars holds the plates, C, together while the machine is being carried, and while said plates are being forced into the ground.

Fig 1 Fig. 2

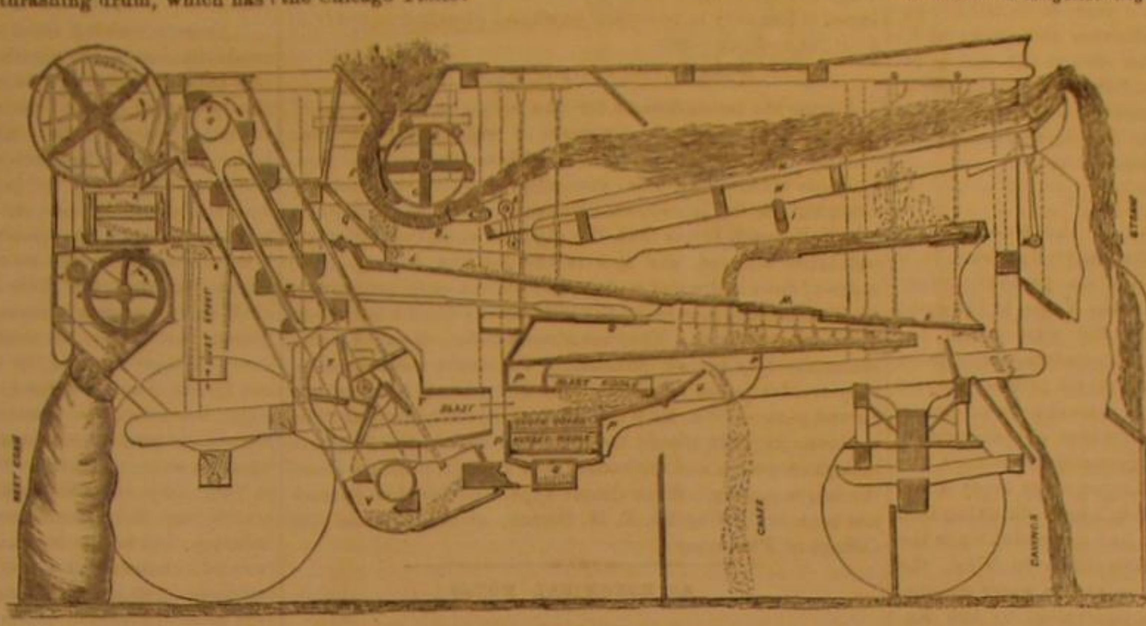


Patented through the Scientific American Patent Agency, January 4, 1876. For further information address the inventor, Mr. M. P. Noel, St. Cloud, Stearns county, Minn.

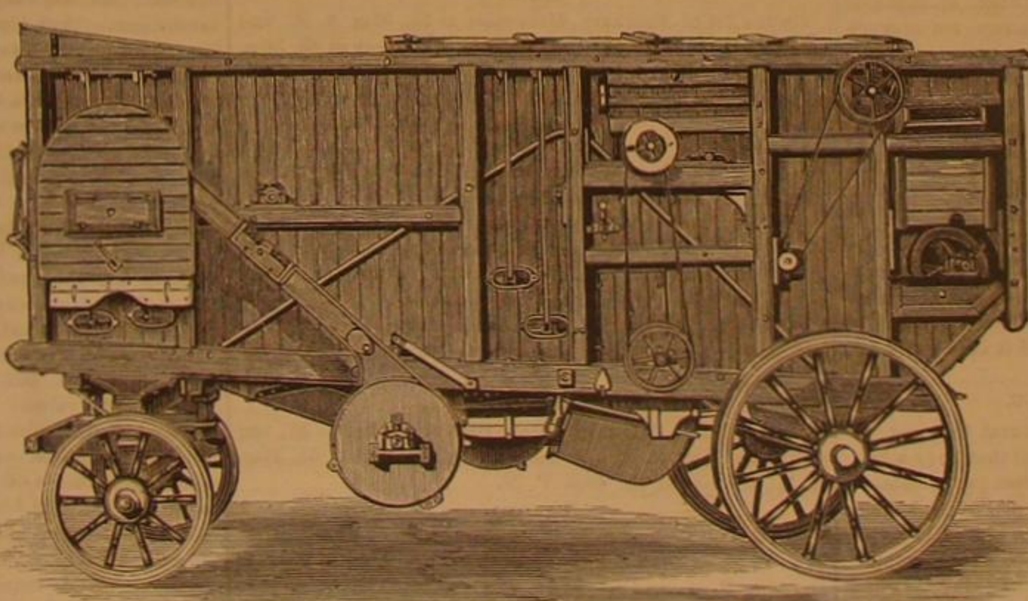
IMPROVED THRASHING MACHINERY.

We publish herewith an elevation of the exterior and one in section of an improved thrashing machine, recently constructed by Messrs. Wallis and Stevens, of Basingstoke, England, and exhibited by them at the recent Christmas exhibition of the Smithfield Club, held at Islington, London. Fig. 2, the exterior view, shows the machine as it stands in the rick yard or the field, and Fig. 1, to which all the letters in the following description relate, shows the construction and working of the machine. This thrasher resembles very much a similar English machine illustrated in this paper last year, but agriculturists will observe that it is quite different in its internal construction.

A is the feed mouth through which the unthrashed corn is fed into the machine. B B, adjustable mouthpieces for increasing or decreasing the size of the mouth to suit different descriptions of corn. C, the thrashing drum, which has a steel spindle, wrought iron head and rings, and either six or eight ash beaters—according to the size of the machine—fitted with Coucher's patent beater faces and plate iron fronts. D, the concave or breasting, made entirely of wrought iron, and provided with adjusting screws, E E, at the hinge, F, for regulating its distance from the drum. G G, casing behind concave which carries the thrashed corn as it passes through the bars of the concave down on the upper shoe on the riddle board, L. H H, the straw shakers worked by the shaker crank, I, each alternate shaker being attached at one end or the other by links, J J, turning on centers, K K. The shaker shakes out of the thrashed straw any loose corn which may be left in it. L, vibrating shoe on which the corn falls from the drum and shakers. In this shoe is fixed the perforated mahogany riddle, M, which separates the short broken straws—technically called "cavings"—from the corn. This, and also the lower shoe, is driven by connecting rods from the riddle crank, N. O, the lower vibrating shoe, to which is fixed the first winnowing machine, P. Both shoes are suspended from the framing of the machine on spring hangers, Q. P, the first winnowing machine, in which are placed an upper perforated zinc riddle marked "blast riddle," which assists the blast in separating the chaff from the corn, and a lower riddle marked "hussey riddle," for taking out the husks containing grains of corn—technically known as 'husseys" or "chobs"—poppyheads, etc. S, spout for conveying the corn to the elevators. In the bottom of this spout is a third riddle—not shown in the section—for separating any small seeds which may be mixed with the corn. T, the fan which supplies the blast of air to the winnowing machine, P. Slides are provided to the openings in the center of the fan through which the air is drawn in, by opening or closing which the strength of the blast can be regulated to suit the particular sort of grain being thrashed; and by regulating these and raising or lowering the hinged flaps, U, at the back of the winnowing machine, the whole of the chaff can be blown over without carrying any of the corn with it. V, the elevator which carries the corn up and delivers it either into the barley horner, W, or else direct into the second winnowing machine without its passing through the barley horner at all. W, the barley horner, the steel blades of which are set at an angle so as to throw the corn out at the upper side of the horner casing, where it is marked "opening." By raising the hinge valve, X, by means of a handle outside the machine, the corn will then fall on the slope board, Y, instead of on the valve, and so pass direct into the second winnowing machine without passing through the horner at all. This arrangement is of importance, as some sorts of grain, and beans and peas, would be injured by being passed through the horner. Z, the second winnowing machine, which has a set of hard wood riddles for thoroughly separating from the grain any chaff, husseys, etc., which may have passed the first winnowing machine, or have been rubbed off in the passage through the horner. It is suspended on spring hangers and vibrated by a connecting rod fixed to the end of the upper vibrating shoe, L. A blast of air is blown through the winnowing machine by a fan fixed outside the framing of the machine, shown by the dotted line behind the barley horner. The husseys, etc., removed from the sample by the winnowing machine, as well as the dust and awns from the barley horner, are carried into the spout marked "dust spout," to the bottom of which a sack is attached to catch them. R, the Penny's patent adjustable rotary screen which separates the clean corn into three samples—namely, best corn, best tail, and small tail. A brush is used for keeping the rotary screen clean. Apparatus for lifting and bagging the chaff is often added, in which case the chaff can either be bagged or allowed to fall, as shown in the drawing, at pleasure. This apparatus is shown, in the external view, fixed to the side of the machine near the front end thereof.



IMPROVED THRASHING MACHINE.—Fig. 1.



IMPROVED THRASHING MACHINE.—Fig. 2.

The Chicago Stock Yards.

The business enterprise which characterizes the people of Chicago is best portrayed by the quick and substantial manner in which they have rebuilt their city. But some idea of the extent of the gigantic stock business of Chicago may be had from the following extracts from a recent article in the Chicago *Times*:

"Stock can now be got in condition for this and all eastern markets at these stock yards with a despatch and perfection unequaled anywhere on the face of the globe. The new works constructed make an imposing showing. A new exchange building has been finished, 50x137 feet in area, containing offices, restaurant, etc., heated by steam and otherwise comfortably arranged. There have also been built four yard offices, a hay barn, a corn crib, large horse sheds, a great stable, a post office, and a new printing press office. There has, however, been other and greater work even than this achieved. Think of twenty acres covered with new and superior cattle pens; and of ten acres of covered hog and sheep pens. There are also six new scale houses, equipped with Fairbanks' standard scales. Beside all this, over five acres of yards and alleys have been replanked. Over 5,000,000 feet of lumber has been consumed in this work of improvement. Twenty double-decked chutes have been made for the shipping division, twelve of these being for the Baltimore and Ohio Railroad. A mile of new water pipes has been laid. Over five hundred new gates, and about the same number of water boxes, have been made. A half mile of eight-feet sidewalks has been completed. The cost of this improvment has been more than $200,000. The company has about two hundred acres of land in active and continuous use for tracks, yards, roads, etc., the whole space covered by the demands of the place, roadway included, amounting to about three hundred and seventy acres. More than twenty-four miles of railroad track are operated at the stock yards; so that the company, in addition to its other features, is really a railway organization of no small pretensions. The rails used here are mostly of steel, and the equipment of the lines includes 160 frogs and switches connected with the various tracks. The stock yards proper contain 475 cattle yards, 675 covered hog and sheep pens, 375 chutes and pens, making a total of 1,525. There are also fifteen corn cribs and ten hay barns, besides the different weighing houses.

"A brief summary of figures will show how business at the stock yards has gone on during the progress of the improvements we have sketched. About four millions of live hogs have been received. Add to these about nine hundred thousand beef cattle and half a million sheep, and we have a total in round numbers of nearly five and a half million head of live stock received. Only about one fourth of that number has been shipped, the remainder having been consumed by the huge packing and other like interests having their headquarters in Chicago. The total valuation of live stock handled at the stock yards during the year 1875 is estimated to exceed a hundred millions of dollars."

A Good Suggestion.

A writer in *Engineering* says: The inadequacy of the present means employed for saving life at sea has been sufficiently demonstrated. No doubt much has been done by inventors to mitigate the perils of the sea, and it does seem a little hard that their exertions should prove of no avail, just because their inventions have not been allowed to get a fair trial. To alleviate this evil he suggests that a competitive exhibition might be got up of apparatus for saving life at sea, to test the relative merits of such inventions, and to enable the Board of Trade to decide what a vessel ought to carry. He also suggests that a ship ought to be provided with means to save at least one third more than her complement of passengers and crew, as it often happens in such circumstances that a boat is rendered useless, and this just means death to a certain number. Besides, did the passengers know that there was more than sufficient means to save all on board, it would help materially to allay any panic. As it is desirable to economize space on board ship, some of a ship's furniture might be utilized for saving life; for instance, the beds might be air beds of waterproof material, which, being provided with couplings, could easily be attached to one another and form a very good raft. Further, a raft provided with provisions and water might be kept in readiness to set adrift in any emergency, so that it could be picked up. He also advises that a whistle, or some such instrument, should be attached to each apparatus for saving life, in order that there might be some chance of those who are shipwrecked letting vessels know of their vicinity, especially at night. All these are good suggestions, applicable not only to England but to this country.

The Stereoscope as a Civilizer.

A "Quaker among the Indians" wishes that a good stereoscope, with suitable pictures, could be exhibited in every Indian camp and properly explained to the people, the effect of an exhibition of stereoscopic views among the Comanches being, according to his experience, most amusing as well as extremely salutary.

"As a body the Indians who have never been East, and, as a consequence, have seen but few white people, are disposed to disbelieve the accounts they receive respecting their numbers, the magnitude of their towns and cities, and the extent of the country they occupy. They believe that their own people who have been East have been duped by some kind of sorcery, or, as they would say, 'medicine.' They also think it is impossible to make an imaginary picture. Hence a picture is to them 'proof positive' of the existence of an original. Consequently, exhibiting towns, buildings, rural scenes and soldiers has had a most convincing effect. This was much hightened by having some mountain scenes from Colorado, familiar to them, and which they recognized at once. This was, in fact, the strongest adducible evidence that the accounts they had received were so far from being exaggerations that the half had not been told them. One middle-aged man, who has always treated these reports with the utmost skepticism, was particularly struck with them. He could not sufficiently express his surprise, but beat upon his mouth in utter astonishment. Sun Boy, who had often told him what he saw in the East, would say to him in Kiowa: 'What do you think now? You think all lie now? You think all chiefs who have been to Washington fools now?' Again and again would he look them over, with his hand upon his mouth, dumb with amazement. After he had looked them over several times, being a war chief, he called in his warriors, and exhibited the pictures to them, talking to them all the time. I could understand but a part, yet would gather such expressions as these: 'Look! see what a mighty powerful people they are!' meannig white people. 'We are fools! We don't know anything! We just like wolves running wild on the plains!' Such an effect on the war chiefs and warriors cannot but be very salutary, and must conduce much toward deterring them from going on the war path against such a 'mighty powerful people.'"

SCIENTIFIC AND PRACTICAL INFORMATION.

THE LIGHTING OF LONDON.

The streets of London have an aggregate length of 2,500 miles, requiring about 5,000 miles of gas mains, and upwards of 54,000 public lamps, which consume something like 1,000,000,000 cubic feet of gas a year, or about 3,000,000 a day. The gas supply of the entire metropolis is about 14,000,000 cubic feet a year, or 38,500,000 cubic feet a day, requiring for its production the coking of 1,500,000 tuns of Newcastle coal. The cost of the coal is reported to be $8,750,000. The value of the residual products, such as coke, breeze, tar, and ammonia liquor is, as much as $3,500,000 The gas rental of the city is $15,000,000, of which $1,250,000 goes for street lamps.

THE CUCUMBER IN RUSSIA.

What the onion is to the Spaniard, or the potato to the Irishman, that the cucumber is to the native Russian. It is the indispensable part of every Russian peasant's every meal. In the account of his trip up the Volga to the great fair of Nijni Novgorod—which, by the way, packs the greatest amount of instructive and entertaining description in the smallest space of any book of travels printed the past season—Mr. Munro Butler Johnstone remarks the profusion of water melons and cucumbers everywhere offered for sale. At the fair and on the road thither, pyramids of melons, like cannon balls in an arsenal, were heaped up in every direction; and as for cucumbers, one couldn't help thinking that a plague of cucumbers, like locusts, had descended upon the earth. All along the Volga, from Astrakhan to Nijni, the whole population seemed engaged in eating water melons, which were sold for three copecks, equivalent to one English penny, two cents. At every station the trade in melons was rivaled only by the traffic in sunflowers.

But if the water melon and the sunflower are luxuries and pastimes, the cucumber is a law and a necessity. One never sees a Russian peasant at dinner without a lump of black bread and a cucumber. "A moujick's dinner may be said to consist of x + cucumber." The x will consist of his favorite cabbage soup, with or without meat in it, and sometimes, in addition to it, the famous grit porridge; sometimes the soup is without the porridge, sometimes the porridge without the soup, but in either case the cucumber is always there; and should x equal zero, then the ever-faithful cucumber does duty for all the rest.

In the hot and arid regions of Southern and Southwestern Asia, these succulent vegetables are highly appreciated, and with good reason. Juicy and cool, they cannot but be always refreshing where water is a rarity; but in a climate like that of Russia, the cucumber is the last thing one would expect for a national dish. Mr. Johnstone suggests that their price—about the fifteenth part of a cent—may help to explain the anomaly. We are rather inclined to think it likely that the Russian peasant eats cucumbers, not so much because they are cheap, as because his remote ancestors, who came from the South, were cucumber eaters. To the one the taste for cucumbers was the natural result of climatic conditions; with the other it remains an inheritance and a national eccentricity, in spite of a naturally unfavorable climate.

NEW MODE OF HARDENING SANDSTONE.

In Saxony, sandstone is soaked in a solution of alkaline silicates and of alumina. The liquid penetrates some inches into the stone, and renders the surface so hard that it resembles marble and will bear polishing. On being heated to a high degree, the surface vitrifies, and it may be colored at pleasure.

A PAVEMENT ANIMALCULE.

Professor Leidy, of the Academy of Natural Sciences, describes in recently published proceedings of that body a curious animalcule which he discovered on street pavements. It is named *gromia* and resembles a cream-colored ball about one sixteenth of a line in diameter. When placed in water, it in a few minutes projects, in all directions, a most wonderful and intricate net. Along the threads of this net (which are less than one thirty thousandth of an inch in diameter) float minute *navicula* from the neighborhood, like boats in the current of a stream, until, reaching the central mass, they are swallowed. Professor Leidy states that during dry weather the creature remains quiet in the dust, and that when rain falls it spreads its net and gathers food.

PREPARING BAMBOO FOR PAPER.

We mentioned recently Mr. Thomas Routledge's investigations relative to the utilization of bamboo as a paper making stock. The following is the method in which he treats the young plants: The stems are first passed through heavy crushing rolls, in order to split and flatten them, and at the same time crush the nodes. The stems then go through a second series of rolls, which are channelled or grooved in order to divide them into strips. The latter, being cut into convenient lengths by a guillotine knife or shears, are delivered by an automatic feeder direct to the boiling pans. Both the boiling and washing processes ordinarily in vogue for producing half stuff or semi-pulp, Mr. Routledge conducts in a series of vessels connected by pipes and furnished with valves, so that communication between the vessels may be regulated as desired, and in such method that, the receptacles being charged in succession, the heated lye (composed of caustic alkali) can be conducted from vessel to vessel. The lyes are thus used over and over again until exhausted, fresh lye being continually supplied, until by degrees the extractive matters combined with the fiber have been rendered soluble. In the same manner hot water is admitted to remove the matters rendered soluble, leaving the fibers sufficiently cleansed. A final cooling stream of water is run on and through the fiber, which is drained and pressed. The semi-dry material is next submitted to the action of a "willow" or "devil," by means of which it is opened or teased out and converted readily into a tow-like condition, when it is dried by a current of heated air, induced by a fan blast. When baled up for storage, it may be kept for an indefinite length of time; and when received by the paper manufacturer, it has only to be soaked down and bleached in order to fit it for making paper.

WAFER CAPSULES FOR MEDICINES.

Among the latest devices for the administration of medicine is the wafer capsule, by means of which any dose, however unpalatable, can be taken without the slightest disagreeable taste. Capsules, generally speaking, are nothing new; but in the present case the novelty lies in the shape, which is much better than the gigantic elongated pill form ordinarily adopted, and also in the fact that the capsule is made of flour and water wafers, and may be supplied to druggists empty, and may be, by the latter, easily filled when medicines are dispensed. They are simple disks cut out of a thin wafer sheet by hollow punches. To render them concave, they are dampened between cloths and placed between two curved plates of tin, by which they are quickly shaped. The medicine is then placed between two wafers, the rims are brought together and moistened, and a slight pressure closes the edges tightly. Some simple apparatus for this purpose has been devised by Mr. E. M. Boring, of the Philadelphia College of Pharmacy.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

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

Position of the Planets for February, 1875.

Mercury.

On the 1st of February, Mercury rises at 7h. 58m. A. M., and sets at 6h. 42m. P. M. On the 29th, Mercury rises at 5h. 31m. A. M., and sets at 3h. 41m. P. M.

Mercury, which was west of Saturn before January 28th, passes east of Saturn at that time, is again very near Saturn in right ascension on the 7th of February, but some degrees further north in declination, and too near the sun to be easily seen.

Venus.

Venus will be brilliant all through the month, setting at 7h. 50m. on the 1st of February, and at 8h. 55m. on the 29th. The moon will be in conjunction with Venus on the 28th.

Mars.

On the 1st of February, Mars rises at 9h. 41m. A. M., and sets at 10h. 13m. P. M. On the 29th, Mars rises at 8h. 36m. A. M., and sets at 10h. 4m. P. M. The moon will be in conjunction with Mars on the 29th.

Jupiter.

On the 1st of February, Jupiter rises at 2h. 15m. A. M., and sets at 11h. 52m. A. M. On the 29th Jupiter rises at 0h. 38m. A. M., and sets at 18h. 11m. A. M.

The most noticeable phenomenon connected with the motions of Jupiter in February is its near approach to the star β *Scorpii*, and the possible occultation of the star, by the planet, on the early morning of the 28th.

β *Scorpii* is a star of the second magnitude, and with an ordinary glass may be seen to have a companion star of the fifth magnitude.

Saturn.

On the 1st of February, Saturn rises at 8h. 3m. A. M., and sets at 6h 21m. P. M. On the 29th Saturn rises at 6h. 21m. A. M., and sets at 4h. 49m. P. M.

Uranus.

On the 1st Uranus rises at 5h. 38m. P. M., and sets at 7h. 34m. A. M. of the next day. On the 29th, Uranus rises at 3h. 40m. P. M., and sets at 5h. 42m. the next morning. It is among the stars of *Leo*, and can be seen with an ordinary glass; its motion among the stars is toward the west.

Neptune.

Neptune can never be seen without a good telescope, and at present is not well situated.

Occultations.

On the 3d of February, the path of the moon will be among the beautiful stars of the *Pleiades*, and the moon will occult, or hide from our view, several of the small stars, and also η *Tauri*, a star of the third magnitude. As the moon will be just past the first quarter in high northern declination, and the phenomena will occur in the evening hours, a fine opportunity will be afforded to those who love to watch these changes. To the astronomer, observations of occultations are valuable for determinations of differences of longitude.

Sun Spots.

The report is from December 18 to January 18 inclusive. Photography and observations have been much interrupted by clouds. Three pictures only have been taken, of the dates December 22, December 23, and December 27. The photographs of December 22 and December 23 show, on the western limb, a large group or spots, which disappeared before the next picture, December 27 In the picture of this date, a pair of small spots was seen on the western limb. From December 27 to January 9, whenever observations could be made, the sun's disk, as seen through a glass of three inches aperture, was free from spots. On January 10 a very small group was observed on the western limb, but after that could not be found.

Success in Labor.

Mr. George W. Childs, of the Philadelphia *Ledger*, is one of the most successful newspaper publishers in the land. He is the friend of the laboring man, and practises himself the precepts which his paper advocates. The following editorial from a recent issue characterises the man—the publisher.

"There is nothing more essential to prosperity than the establishment in the popular mind of the intimate connection between efficient labor and true success. In one sense they are synonymous. Success consists not so much of the reward a man reaps from labor as the value of the labor itself. He who, by honest work of hand or head, is constantly enriching the world is intrinsically the successful man, whether riches or poverty fall to his lot; while he who amasses millions by speculation or fraud, leaving none to bless his memory when he is gone, has made his life a disastrous failure. We trust the time may arrive when this shall be the common acceptation of the word success, but at present it is not so. We usually measure it by what is gained —not by what is given; by the reward which labor brings— not by the intrinsic value of the labor itself. Even by this gage, however, the connection is still closely preserved. Eventually each one's personal welfare is strictly dependent upon his value to others. There may seem to be exceptions to this. Idleness and unfaithfulness may occasionally appear to reap the fruit that belongs of right only to honorable industry; but in the long run it is not so. The cheat is discovered, character is sifted, and justice is indemnified for her dishonored claims. Faithful, patient labor, of some sort that benefits mankind, is the only road to personal prosperity, and the success that seems to follow quicker and easier methods is short-lived and illusory.

"Few, however, believe this in their hearts. To many, work is only a disagreeable necessity, to be taken like medicine, in as small quantities as possible and dispensed with as soon as may be. They do not love it for its own sake, they do not care for its importance to mankind, or its reflex influence on their own characters. They do not specially desire to attain excellence in it, and they only put enough energy into its performance to accomplish immediate and necessary results. Their hearts are not in it; they are ever looking beyond and over it to find objects of interest. Other things excite, stimulate, and inspirit them; their work alone is dull and irksome. Labor thus performed can never be of superior quality, can never greatly add to the happiness or progress of mankind, can never bloom into true success. It has no soul to animate, no hope to inspire, no vital power to develop it. A life spent thus, in unwilling and compelled labor, in which the heart has no place, is surely one of the saddest of failures. There are others again who fail in their life work because they are ashamed of it and think it beneath them. They blame fortune or circumstances for having condemned them to a toil which they conceive degrading If their lot had been cast differently, they think, they migh have made some mark in the world; if their work had beent of a higher grade, they could have pursued it with energy and zeal; as it is, they only follow it from necessity and with no more assiduity than they are compelled to exert. Such persons make a fatal mistake. It is in them, not in their work, that the fault lies. For if they do not perform what is committed to them with fidelity and zeal, how can they be fitted for a higher post? Besides, this separation of work into ranks and grades is altogether artificial and unauthorized. Who can decide which labor is higher or lower than another, which is of more or less value to mankind? It is not the kind of work, but the manner in which it is done, that determines its value. The faithful day's work, in the field, the workshop, or the forge, in the kitchen or the factory, is far more honorable, useful, and elevating than that of the scheming politician or the flushed and eager speculator, who count his votes or his gains by the thousands, but whose labors add nothing to the prosperity, happiness, or virtue of the community.

"It is certainly important for each one to find his own appointed work in the world, that which he loves best, and can do best, as far as practicable; but it is folly to sit down supinely and give way to despair and lethargy because he imagines he ought to occupy a more prominent or important post. Nine tenths of the changes made under this delusion prove to be for the worst instead of the better. The character and capacity that fail of success in the one case fail yet more signally in the other. Froude well says: 'You cannot dream yourself into a character—you must hammer and forge yourself one;' and it is only by laying hold earnestly and vigorously of the work that lies nearest to us, and raising its value by putting into it all the vigor and energy, all the patience and fidelity, all the thought and ability we can command, that we have any right to expect success in any of its meanings."

THE simplest way to dye billiard balls red is to soak them for ten or fifteen minutes in very dilute nitric acid, wipe them dry, and place them for the same length of time in an ammoniacal infusion of cochineal; repeat this until the desired color is obtained.

[For the Scientific American.]

THE NATURE OF THE PHENOMENA DISCOVERED BY MR. EDISON.

BY P. H. VANDER WEYDE, M. D.

Two of your recent issues contain interesting articles on Mr. Edison's recent discovery. One is by Mr. W. E. Sawyer, page 36, and the other by Dr. G. M. Beard, page 57. The writers take directly opposite views of the matter, and therefore some comments may be welcome to such readers as look with interest on new discoveries in electricity, a field remarkably fertile with subjects of purely scientific importance, and also with facts capable of useful practical application.

Mr. Sawyer claims that there is no novelty in the alleged discovery, that two years ago he experimented in the same way, having learned the existence of the identical phenomenon from others, that he considered the spark to be the effect of molecular magnetic vibration, "not, however, purely magnetic, but magneto-dynamic," and "practically of no value."

Dr. Beard was at first inclined to the same view as that taken by the SCIENTIFIC AMERICAN, by myself, and by others, namely, that the phenomena were simply due to electric induction, produced in the atmosphere surrounding any vibratory electro-magnet: but now he appears to have deserted this rational view, and to have gone over to Mr. Edison's idea that it is a new force; and he bases his conclusion on some new experiments, of which he gives an account, and the results of which appear to him to be irreconcilable with the attributes of pure electricity.

I cannot but disagree with both gentleman, as I do not see how the view of Mr. Sawyer, who considers it to be a "molecular magnetic vibration," can convey any definite idea in harmony with what we know of the behavior of the magnetic and electric forces. His assertion that it is practically of no value is bold and hazardous in the extreme; it is always very imprudent to maintain, because we do not succeed in solving a problem or finding the practical application of a phenomenon, that nobody can, and thereby to deny that the problem or phenomenon may some day become a most fruitful source of discovery. For proofs, I point to the fields of physics and chemistry, which abound with illustrations showing the caution which we should observe in pronouncing a verdict.

Dr. Beard's conclusions are tinged with some disregard of the laws of static electricity. I have noticed this frequently to be the case with some electricians of the present day, many of whom have studied exclusively the laws governing voltaic currents; and from such I have often heard assertions, proving that they were total strangers in the field of static electricity, and entirely unacquainted with the characteristic experiments with the old-fashioned frictional electric machines, Leyden jars, etc. I do not say this to throw any reflection upon the capacity of Dr. Beard, whom I know to be a thorough electrician; but still, if he were more familiar with the inducing action of the conductors (not those of the style now used with Rhumkorff coils, but the old style, consisting of two parallel tinfoils or their equivalents placed at a distance), he would not come to the conclusion that the electricity (or whatever it is) passed from one tinfoil to the other through the air between them: but he would see that inductive influence only reaches from the one to the other, the + — + —, etc., condition of the one exciting inversely a — + — +, etc., condition in the other plate.

It is now more than a century since the Abbé Nollet, in France, made a similar mistake by maintaining that the electric current passed through the glass of the Leyden jar. He saw that, when such a jar was insulated, for every positive spark with which the inside coating was charged he could draw also a positive spark from the outside, and therefore he concluded that the positive electricity passed through the glass. This otherwise eminent investigator never obtained in his whole life a clear idea of induction; he could not conceive that a positive electric charge of the inner coating of the jar could, while retained there and without being lost, induce a positive electric charge to leave the outer coating.

The very experiments mentioned by Dr. Beard are to me a most convincing proof that the phenomena are due to induction. Frictional electricity will, when the conducting wire is cut, if the ends are separated beyond the distance that the spark can leap, be totally arrested at the separation; but if we attach large conducting flat surfaces, like tinfoil, to the ends of the wire, so that the charge can diffuse itself over one surface, it will, by induction, cause electric phenomena in the other flat surface and the wire attached thereto. This is not an overleaping of the electric current through the air, but simply an inducing action, exciting the other plate by a destruction of its neutrality, and a separation of its + and — electricities. In fact, the arrangement of the parallel tinfoils, described by Dr. Beard, is nothing but one of the forms of the old-fashioned condenser.

I see no reason why all the phenomena observed by Mr. Edison cannot be considered as: 1. Induced electric currents constantly reversing polarity, so rapidly changing and neutralizing each other that it is very difficult to determine any polarity at all. 2. Induced electric currents, of very low intensity, but enormous in quantity, which at once explains their lack of physiological action and the needlessness of a perfect insulation.

If, after the above explanation, we review the six points which Dr. Beard gives on page 57, against the theory that it is electricity, we find: 1. The various forms of electricity, recognized as such, vary so much among themselves that there is scarcely any one phenomenon that is common to them all. 2. Many forms of the electric force produce no perceptible or demonstrable physiological effects. 3. Induction of electricity is not resisted by air, glass, rubber, or paraffin, as is the case with the electric current itself. 4. The absence of polarity is only a negative proof; and polarity may yet be demonstrated with the proper apparatus, if care be taken in manipulation. 5. The inducing action of electricity passes through non-conductors, such as air, rubber, glass, etc., most readily when the terminals consist of large surfaces. Electricity of low intensity will not pass off at points. 6. Electricity diminishes in intensity with the distance from the exciting cause, in definite ratios determined by the nature of the conductors: while the induction also depends on the distance and the nature of the intervening insulating substances.

To place this supposed new force between heat and magnetism appears to me to be entirely unwarranted. We know that light consist of waves of a velocity of vibration of over 450,000,000,000,000 oscillations per second; non-luminous heat has a less velocity, and its principal effect is to expand bodies, and change their molecular aggregation from solids into liquids, and then into gases; while magnetism manifests itself alone in the attraction and repulsion of a very limited number of bodies; the intrinsic nature of magnetism is still a mystery, and we know little about it, except that it is closely related to electricity, and besides we know the nature of that relation. But of electricity we know more. We know that it may differ greatly in intensity and quantity, that the various forms produce the utmost varieties of phenomena: we know that electric currents induce other currents; that permanent or temporary magnets may induce currents; that this inducing action extends like an atmosphere around electric currents and magnets producing other electric currents or magnetic phenomena. When we look at all this, and at the circumstances under which the assumed "etheric force" is produced, we cannot help considering any attempt to deny its electric nature as a vain endeavor to magnify the importance of the discovery which is, in truth, in itself important enough not to need any such exaggeration.

Another argument that this force is not electricity itself, and is only related to electricity, and not to magnetism, and much less to heat, may be deduced from the new theory of the intrinsic nature of the electric phenomena. This I will reserve for a future occasion.

New York city.

A Hydrothermic Motor.

M. Tommasi, we learn from *Les Mondes*, has recently constructed a so-called hydrothermic motor, from which he has obtained effective results. The dilatation and condensation of oil, caused by the action of heat, transmits motion to mechanism which actuates a piston at the rate of 100 strokes per minute. With M. Tommasi's model, at this speed, about one third of a horse power is developed. It is believed that with large machines an efficiency of several horse power can be realized. The inventor thinks that the chief application of his motor will be its utilization of the heat of the exhaust of steam engines, something after the manner proposed for the bisulphide of carbon and ammonia machines. The alternate dilatation and condensation of oil is, however, not attended by the production of annoying vapors as is the case in the last mentioned motors. This is one advantage of importance, while another is found in the enormous force which exists in the process of dilatation of the oil. The editor of *Les Mondes* states that he saw the cover of the small tubular boiler used by M. Tommasi torn off, and the four heavy screw bolts by which it was secured broken, while the oil infiltrated the apparently hard cast iron as if the latter had been sponge.

From this it will be seen that the motor is apparently capable of yielding almost instantly a powerful force, for a brief period, a quality which might be advantageously utilized on locomotives. In such a case the machine would be operated by the heat of the exhaust, and could be thrown into action whenever a heavy grade was to be ascended, necessitating extra work. By its use, also, after a train had acquired sufficient momentum, steam might be allowed to run down to just sufficient to keep the engine to its duty, with no margin for emergencies or for starting purposes. The hydrothermic motor would start the train or apply the heavy power necessary to increase the speed. This would cause no inconsiderable saving of fuel. The use of the oil as above detailed is not new in principle, as a similar invention appeared in this country twenty years ago. M. Tommasi's application of the power, as near as we can judge from *Les Mondes'* incomplete statement, seems to be novel.

The U.S. Torpedo Boat Alarm.

The *Graphic's* Washington correspondent gives the following particulars of the torpedo boat Alarm, now at the navy yard in that city, in charge of Lieutenant Commander William Bainbridge Hoff.

"It is the first command of this gallant young officer, and by a singular coincidence, next his own is now anchored the Relief, the first command of his father, Admiral Hoff. The contrast between the two vessels is as great in construction as in name, and admirably illustrates the improvements made in our navy. There is much of interest to be seen on the Alarm. She has a single death-dealing turret, a 15 inch gun in the bow, the largest afloat, a formidable prow used as a weapon of attack, and a row of Gatling guns ranged along both her sides. A surprising deal of general utility business is done by an ingenious combination of machinery worked on deck, by means of which the wheel is turned, the ship steered, and torpedoes run out if desired. All this can be directed by one person standing in a small shot-proof enclosure on the deck. The mode of attack of such a vessel as the Alarm is, I am told, first to blind the enemy with an electric light flashed in its face; then to fire the fifteen-incher at the foe; at the same time to run out and explode a torpedo beneath the hostile vessel; next, if there is anything left to attack, to give a *coup de grace* with the incisive prow, and if the enemy still decline to be wiped out of existence, the devastating instruments of the turret are called into requisition, and if they do not suffice the Alarm swiftly turns a broadside to the foe, and brings into range in turn the innocent-looking but fatal rows of Gatlings."

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

A well known druggist gives the following directions for coating pills with sugar or gelatin in the shop: Pills which have been thoroughly dried can be coated with sugar as follows: Boil 32 ozs. of best white sugar with 12½ ozs. of distilled water to a sirup, and use enough of this sirup (temperature 120° to 150°) to moisten the pills in a small copper kettle or pan, exposing it to a heat sufficient to dry the pills while kept in motion and worked with the hand. After this first coat is dry, the operation is repeated until the pill is covered with sugar sufficiently. A very soluble coating for pills is the following composition; 1 oz. flaxseed, ½ oz. Irish moss; boil with 8 fluid ozs. water, strain, add 4 ozs. sugar, boil again and use in the same manner as a solution of gelatin is used for coating pills.

To detect fusel oil in whiskey, the readiest process is to shake one or two fluid ounces of the liquor with an equal volume of pure ether, and about one fourth of its volume of water. The supernatant liquid being decanted, will, on being evaporated at the ordinary temperature, leave behind the fusel oil present in the whiskey, together with some of the flavoring ingredients that may have been introduced artificially.

A very pretty amusement, especially for those who have just completed the study of botany, is the taking of leaf photographs. One very simple process is this: At any druggist's get a dime's worth of bichromate of potash. Put this in a two ounce bottle of soft water. When the solution becomes saturated—that is, when the water has dissolved as much as it will—pour off some of the clear liquid into a shallow dish; on this float a piece of ordinary writing paper till it is thoroughly moistened. Let it become nearly dry in the dark. It should be of a bright yellow. On this put the leaf, and under it a piece of soft black cloth and several sheets of newspaper. Put these between two pieces of glass (all the pieces should be of the same size) and with spring clothespins fasten them together. Expose to a bright sun, placing the leaf so that the rays will fall upon it as nearly perpendicular as possible. In a few minutes it will begin to turn brown, but it requires from half an hour to several hours to produce a perfect print. When it has become dark enough, take it from the frame and put it in clear water, which must be changed every few minutes, till the yellow part becomes perfectly white.

To pickle beef for long keeping: First, thoroughly rub salt into it and let it remain in bulk for twenty-four hours to draw off the blood. Second, take up, letting it drain, and pack as desired. Third, have ready a pickle prepared as follows: For 100 lbs. beef use 7 lbs. salt; saltpeter and cayenne pepper, each 1 oz.; molasses, 1 quart; and soft water, 8 gallons; boil and skim well, and when cold pour it over the beef.

Says a correspondent of *Inter-Ocean* who has had much experience with wire fences: "I would not recommend straight wire with patent barbs, as it is liable to break in cold weather. There is a twisted wire with barbs that does well, as it is said the twist will allow it to expand so that it will not break. Of this kind I have some on my own place. It is a perfect fence for any cattle or horses. I have three wires, and posts two rods apart, but on level ground they might be three or four rods apart."

A Chinese Roger Bacon.

A Chinese scientist has established at Shanghai a scientific laboratory, which will strongly recal the famous workshop of Roger Bacon. With an extraordinary energy, in the possession of which he seems to differ greatly from the generality of his compatriots, this wise Celestial, after purchasing the apparatus merely, has taught himself photography. He has likewise studied medicine with a European doctor, and invented a new, and it is said very efficacious, antidote for the opium habit. In his laboratory are electric bells, a printing press, and a large variety of ingenious philosophical apparatus, mainly of his own device and construction. The principal object of his investigations, however, is to find a way of printing Chinese books in movable type. With the aid of the machinery at the Presbyterian mission, he has already begun the manufacture of the matrices or molds for the type, an immense undertaking when it is considered that, for each single sort or variety of character, no less than 6,664 matrices are required. Moreover, there are over 20,000 Chinese characters. Each matrix must be cut from wood and electrotyped. It will require, it is said, fourteen years' work of the mission machinery to make 24,000 different characters. In the six years in which this benefactor of his race has been at work, he has produced 5,000 matrices of little characters and 6,000 of larger ones. With what he has already of small type, he has printed a little volume. He does not expect to live long enough to complete his immense task, and therefore is educating his children to the proper degree of skill in order that they may continue the undertaking.

NEW BOOKS AND PUBLICATIONS.

A Guide to the Microscopical Examination of Drinking Water. By J. D. Macdonald, M.D., F.R.S., Assistant Professor of Naval Hygiene, etc. With Twenty-four Lithographic Plates. Price $3. Philadelphia, Pa.: Lindsay & Blakiston. New York city: William Wood & Co.

Nearly all the impurities in water may be detected by the microscope. Mineral bodies of course are visible; and when not corrosive, or otherwise intrinsically hurtful to the system, they do harm by mechanical action on the intestines. All the ova of entozoa and minute worms are readily seen *through* the same instrument; and the vegetable bodies (*algæ*, etc.), many of which are perceptible to the unaided vision, may emit sulphuretted hydrogen when acted on by the sulphates in the food. But a *still more* important revelation is the presence of living creatures which subsist on organic impurities which defy detection by the most powerful instruments, and which are the agents by which many of our severest and most loathsome diseases are propagated and spread abroad. Dr. Macdonald has here given us a volume of twenty-four admirably executed plates, in which nearly all the organic impurities are displayed; so that a careful observer can readily detect any unsanitary condition of his water supply. The book is valuable as a contribution to an interesting branch of natural history; but its chief function will be to aid our health inspectors and other sanitary authorities in the investigation of the causes of disease, and for this purpose it deserves our highest recommendation.

Dyeing and Calico Printing, including An Account of the Most Recent Improvements in the Manufacture and Use of Aniline Colors. Illustrated with Wood Engravings and Specimens of Dyed Fabrics. By the late Dr. Crace Calvert, F.R.S., etc., etc. Edited by John Stenhouse, F.R.S., and Charles E. Groves, F.C.S. Price $8.00. Manchester, England: Palmer & Howe, Bond street. New York city: John Wiley & Son, Astor Place.

This is one of the most elaborate and handsome technical works which we have ever read. Dealing with a complicated subject involving many processes of the most elaborate chemical science, it is a treatise which will be useful to the accomplished chemist in his laboratory, and at the same time one which we should unhesitatingly place in the hands of any intelligent workman. The illustrations are nothing short of perfection. The book possesses additional interest as a legacy to the industrial world from one who spent his life in gaining victories over the occult forces of Nature, giving the fruits thereof to mankind. With perhaps the exception of Liebig, no chemist has done more for practical science and for the furtherance of the processes employed in the higher manufactures than Dr. Crace Calvert. A catalogue of his labors would occupy much of our available space; but it would be an enduring monument to his untiring zeal and his inexhaustible inventive power in experiment. His literary executors have done full justice to the labor which Crace Calvert left almost finished when he was called away.

Proserpina. Studies of Wayside Flowers. Parts I & II.—Ariadne Florentina. Six Lectures on Wood and Metal Engraving. Nos. IV, V, & VI.—Deucalion. Collected Studies of the Lapse of Waves and Life of Stones. Parts I & II. By John Ruskin, LL.D., Professor of Fine Art, Oxford, England. Price $1 each. New York city: John Wiley & Son, 15 Astor Place.

These three little volumes faithfully portray their eminent writer, whose style has lost nothing in force or vivacity since the time when the first volume of "The Stones of Venice" astonished the world by the power of its genius. The occasional eccentricity of the author is a matter of little moment either to the critic or the reader; suffice it to say, that all the force of his logic and his intense *sympathy* are used in these volumes on behalf of genuineness, thoroughness, and sincerity in art and in labor. The lectures on engraving are masterpieces of instruction in its best and widest sense.

Martindale's United States Law Directory for 1875-6, containing the Names of Law Firms, Banks, and Real Estate Agents in Each of the Principal Cities of the United States and Canada, together with a Digest of the Commercial Law of each of the States and Territories, and the Bankrupt Law in Full. By James B. Martindale, Attorney and Counsellor at Law.

The extensive scope of this work is fully shown in the above title; and an examination proves that the labor of the author has been thoroughly and faithfully done. The book is especially valuable to merchants, who are frequently subject to serious losses through ignorance of the laws of the various States to which they ship goods.

Revised Statutes of the United States, relating to Mineral Lands and Mining Resources. By Walter A. Skidmore. Second Issue. San Francisco, Cal.: Sumner, Whitney & Co.

This is a valuable compendium of all the mining laws of the United States, fully annotated. Reference is made to the decisions of the Attorney General and of the Interior Department, in cases involving mining questions. The circular instructions of the General Land Office are added, and there is an appendix of special statutes bearing on the general subject. The book will prove useful to lawyers, as it places before them the law in complete form, and so copiously indexed and digested as to admit of the ready applications of its provisions to any case.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From December 17 to December 30, 1875, inclusive

Boiler Tube Stopper.—P. Walker, Jersey City, N. J.
Bottle Stopper, etc.—C. De Quillfeldt *et al.*, New York city.
Caloric Engine.—F. Brown, New York city.
Carving Fork.—C. S. Landers, New Britain, Conn.
Copying Telegraph.—W. E. Sawyer, New York city.
Cord Fasteners.—G. P. Reeves *et al.*, Helena, Mon. Ter.
Cotton Beater.—R. Kitson *et al.*, Lowell, Mass.
Cotton Opener.—W. E. Whitehead (of Lowell, Mass.), Stalybridge, Eng.
Engraving Pantagraph.—J. Hope, Providence, R. I.
Gear Tackle.—G. Stacy, Nanuet, N. Y.
Journal Bearings, etc.—W. A. Hathaway *et al.*
Locking Switch.—D. Rousseau, New York city.
Making Spikes.—W. Haddock, Pittsburgh, Pa.
Printing Machinery.—R. M. Hoe, New York city.
Printing Press Feed.—J. T. Ashley *et al.*, Brooklyn, N. Y.
Rotary Puddler.—W. Sellers *et al.*, Philadelphia, Pa.
Rubber Articles.—H. P. Dunbar *et al.*, Boston, Mass.
Safety Mine Cage.—H. Carlile *et al.*, Steubenville, Ohio.
Sewer Trap.—J. A. White, Concord, N. H.
Slate Desk.—W. Rose, New York city.
Telegraph.—J. Olmsted, Providence, R. I.
Treating Alloys.—B. Silliman *et al.*, New Haven, Conn.
Valve, etc.—J. Wolf *et al.*, Philadelphia, Pa.
Vegetable Parchment.—A. G. Fell, New York city.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED FIRE EXTINGUISHING AND ESCAPE APPARATUS.

William E. Wood and Edward Leonard, Baltimore, Md.—The object of this invention is to provide a means for the immediate suppression and extinguishment of fires, and a safe and expeditious means of escape from factories and other large buildings containing many operatives. The invention consists in a stand pipe upon the outside of the building, with hose pipes and connections at the windows of each story, in combination with balconies upon the outside of said windows, connected with the earth by means of outside ladders. By means of this arrangement, a ready means of escape is afforded, and the firemen or watchmen can play upon the fire in the upper stories in such a position as to be free from the smoke.

IMPROVED SEWING MACHINE THREAD GUARD.

Lillian Roosevelt, Hempstead, Texas.—This is a clamp having oppositely extended arms, arranged as a guard attachment to the Wheeler & Wilson sewing machine, for preventing the thread from being thrown off the tension by the work, and for preventing the thread from running off the spool on the spindle.

IMPROVED TURBINE WATER WHEEL.

John B. McCormick, Armagh, Pa., and James L. Brown, Brookville, Pa.—The object of this invention is to increase the effective power of a turbine water wheel, whereby a wheel of a given depth may utilize a larger proportion of the water than wheels of the same depth heretofore used. It consists in a wheel having a double series of buckets, one of which is arranged to receive its water laterally and interiorly, and the other arranged to receive its water latterly and exteriorly from a common flume, the said two series being also arranged together so as to discharge their water with a confluence which reacts upon the wheel in the direction of its circumference, and utilizes a larger percentage of motive power. The invention also consists in the combination of the said wheel with other coöperating parts.

IMPROVED STREET RAILWAY TRACK.

John Quigley, St. Joseph, Mo.—This is a cast iron tie, with an elevated and broadened seat for the rail at each end, contrived to fasten the rail in the seat by a key. The broadened elevations for the chair are grooved in the sides, so that the earth of the road will pack in and hold the tie down securely. The object is to enable iron to be used, instead of the less durable wood, and to save the cost of fastening the chairs to the ties, and also to secure more permanent seats for the chairs.

IMPROVED COMBINATION LOCK.

George F. Knight, Carroll, Ohio.—This invention relates to certain improvements in combination locks applicable to storehouses, dwellings, safes, vaults, etc., and designed to increase the security of the same against the efforts of burglars and thieves. It consists principally in a number or series of bolts, so arranged with small gear wheels and connecting rods, or their equivalents, that the withdrawal of one bolt shoots into place and locks another until a certain number of turns are made which constitutes the combination at which all of the bolts are withdrawn and the door unlocked. It also consists in the particular construction of a bell-ringing device, which, operating in connection with the bolts, keeps up an incessant ringing during any attempt to unlock the same. The invention also consists in other details of construction.

IMPROVED TURBINE WATER WHEEL.

John B. McCormick, Armagh, Pa., and James L. Brown, Brookville, Pa.—This invention relates to certain improvements in that class of turbine wheels which receive their water from a vertical flume through lateral chutes, and discharge the same centrally through the bottom of the wheel. The invention consists in the peculiar construction and arrangement of a tapering wheel, which is made smaller at the top than at the bottom, to compensate for the different velocities of the water at the top and bottom of the wheel by reducing the radius of leverage of the wheel in proportion to the said decreased velocity.

IMPROVEMENT IN BALANCING MILLSTONES.

William Gosshorn, Waterloo, Pa.—This inventor proposes a bail, which is adjusted centrally in the eye by means of the screws which adjust balancing sections. By turning either of the screws, the section attached thereto will be raised or lowered, as may be required, and, by moving the weights up or down, the stone is balanced on the point of the spindle in the center of the bail. By raising or lowering a section of the balancing ring, the change affects the running of the stone, as the latter is suspended and revolves freely on a center.

IMPROVED TRAP FOR STEAM PIPES

Charles A. Read, Bridgeport, Conn.—This is an improved steam trap for thoroughly draining the water of condensation from steam pipes for heating buildings without allowing the escape of steam. An adjustably seated globe has an interior valve and top perforation for guiding a hollow plug screwed at the end of a drip pipe that connects with the steam pipes to be drained. The valve closes or opens the plug as the pipe is expanded or contracted by heating or cooling.

IMPROVED WELL DRILLING APPARATUS.

Daniel Henry Muir, Racine, Mis.—In this device there is a tube which extends down the bore and along a groove in the drill to within an inch or so of the bottom. The effect of the action of the drill is to drive the mud up the tube when the drill falls. The tube has a check valve to prevent the mud from going back when the drill rises, and it is mounted in a support which turns in unison with the drill. This arrangement keeps the surface of soil under the drill constantly free from dirt and sand. There is also a lever contrivance in connection with the tube, to lower it from time to time, and to hold it above the bottom of the bore. By this contrivance, the taking of the drill out of the bore and removing the mud with the sand pump are avoided.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED WAGON SPRING.

Alexander W. McKown, Honesdale, Pa.—This inventor proposes a novel combination of torsion springs of a vehicle with auxiliary or re-enforcing torsion springs, arranged under the wagon body, and acted upon by a lever connection with the axle, bolster, or other supports, to be thrown in or out of action, according to the weight of the load to be carried. The lever of the auxiliary springs is swung up, and secured, by any suitable fastening device, to the wagon body when not in use. The effect is to utilize more fully the power of the springs, and to render them more durable by rendering the strains upon them uniform.

IMPROVED BRACE ROD FOR VEHICLE SPRINGS.

Alfred Cliff, Lapeer, Mich.—This is a rod for connecting the front and hind springs of a carriage to stay them against forward and backward motion. It has an attaching plate connected by a pivot joint at one end for connecting to the front spring, and a joint near the other end, which allows of longitudinal extension and contraction to compensate for the lengthening and shortening of the distances between the connections on account of the independent vertical movements of the springs.

IMPROVED PUMP.

Henry M Wyeth, Newark, Ohio.—This invention relates to certain improvements in pumps, and it consists in the peculiar construction of a double-acting submerged pump, in which two valves are connected by a slide so as to move together on opposite sides of the piston, and operate both the induction and discharge ports.

IMPROVED HORSE POWER.

Frederick Trulender, Harmersville, N. J.—This is an ingenious arrangement of mechanism, driven by an endless chain and platform, so placed that the horse walks upon a level, while through the inclination of the track his weight produces the same driving power as it would in a machine in which both platform and track were inclined.

IMPROVED CHILDREN'S CARRIAGE.

Thomas Galt and James Blaisdell, Rock Island, Ill.—The body of this carriage is suspended on cross bars between coiled springs, and balanced over the rear axle, so that a slight pressure will tip it either forward or backward, and thus enable the vehicle to be easily operated by a child. The reach is so arranged as to connect the body with the front axle.

IMPROVED THILL COUPLING.

Daniel D. Whitney, Beverly, N. J.—This inventor proposes the combination of a hand screw with the forward end of the rigid arm and the forward end of a hinged arm of the coupling, for securing the pin of the thill iron in the notches of the said arms. This forms a means of quickly attaching and detaching of the thills, allows of wear being readily taken up, and prevents rattling of the parts.

IMPROVED CHAIR.

George Grems and Leonard I. Fowle, Fredericksburg, Iowa.—These inventors have devised a simple and easily adjustable chair back. A back piece independent of the ordinary back, and located above it, is connected by bars to the front of the ordinary arms, so as to swing up and down. Ratchet braces extend from the back down through an eyepiece attached to the bottom of the chair by means of a lever pawl to hold the back at any hight. The device may be used with or without the ordinary back, as desired.

IMPROVED FOLDING OR PORTABLE DESK.

James Miller, Atlanta, Ga., assignor to himself and Luther S. Ames, of same place.—This is an improved portable desk for offices, that may be folded into small space for transportation or storage, and set up readily into open or closed position for use. It is specially adapted in cases in which a frequent moving is rendered necessary. The novel feature is a top section with drawers and pigeon holes, to which the lower section, made of folding front, side, and rear walls, is hinged, to be locked by suitable fastening devices into open or folded position.

NEW HOUSEHOLD ARTICLES.

IMPROVED SOFA BEDSTEAD.

William E. Buser, Chillicothe, Ohio.—The invention relates to an arrangement of cords or pulleys beneath the adjustable false bottom of the two-part folding sofa, for the purpose of elevating the same to a level with the other part of the bed when opened; and also to pins or lugs attached to the side of said bottom to support it in such elevated position. The pins or lugs work in inclined grooves in the vertical sides of the lounge.

IMPROVED FLY TRAP.

Thomas C. Dunn, Promise City, Iowa.—This trap is designed for catching flies at dusk on the ceiling and walls. It consists of a box which is hung to a supporting pivot frame, and provided at the open front half of its top with a swinging spring-acted lid, that is fringed with brushes, and thrown open by a lever when applied to the ceiling, and closed instantly when removed from the same. A corner recess of the flanged front edge allows the emptying of the flies from the box after they are killed.

IMPROVED HEATING STOVE.

William M. Morse and Morris G. Knox, Harmar, Ohio.—In order to utilize the heat of the fire to a great extent, and also to ensure a rapid circulation of air through the air chamber of a cylinder stove, these inventors construct said upper portion in one or more sections, formed with large radial inlet air pipes and a central vertical pipe, which connects with a discharge passage in the top plate for the air.

IMPROVED WASHING MACHINE.

Jesse Bartoo, Plainfield, Ill.—When the clothes have been put in the box, the handles are worked up and down so as to force pounders forward alternately. Each pounder as it moves forward carries down its supply of air, and presses the clothes against the forward side of the suds box, and holds them while they are rubbed by the movements of the other pounder, the clothes constantly changing their position, so as to be operated upon each time in a different place.

NEW TEXTILE MACHINERY.

IMPROVED LOOM TEMPLE.

John C. Thickins, Washington Mills, N. Y.—This is a drum and ratchet contrivance for the weighted cord, so arranged that when the cord is unhooked to shift it along the cloth, the ratchet supports the weight, and thus relieves the operator from the labor of holding it. After hooking on the cord again, the ratchet lever is raised by the operator to let the weight strain the cloth.

NEW AGRICULTURAL INVENTIONS.

IMPROVED HARVESTER REEL RAKE.

Thomas H. Bacon, Hannibal, Mo.—The invention relates to certain improvements in harvester reel rakes; and it consists in the particular construction and arrangement of the revolving reel shaft and oscillating rake arms, with cams for controlling the motion of the rake; and also in the construction of the devices for adjusting the rake for high or low grain.

IMPROVED STUMP EXTRACTOR.

John A. Hart and William A. Grove, Tionesta, Pa.—This device consists of a truss beam, which is supported on side standards and braces, and carries centrally a longitudinally fulcrumed main lever. The rear end of the main lever is connected by adjustable chains, according to the power required to lift the stump, while the front end is connected by pulleys and rope with a tackle block, coupling pivoted V brace pieces, stiffened by chains, to the bed piece. By detaching the tackle block, the V pieces may be swung out of the way of stumps in setting the extractor. The general arrangement is strong, and such as to admit of the application of power to much advantage.

IMPROVED HARROW.

Joseph R. Van Orthwick, Hillsdale, Mich.—This a harrow provided with runners, which are applied by raising the outer end of each section of the machine by means of its handle, while the teeth are inserted. A bar is then slid through notches, to prevent the sections turning on the pivot rod. Thus the harrow is adapted for employment in the transportation of grain to the field, the same being placed or loaded upon the top thereof, thus saving extra or additional means for effecting such transportation.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED POCKETBOOK FASTENING.

Daniel M. Read, New York city.—This inventor has patented two new pocket book attachments. The first relates to the ratchet and hook for engaging the same adjustably, so combined as to form a simple securing device for the flap of the book. The second is a small mirror arranged in combination with a fastener, and so constructed that persons holding it in their hands can be enabled to see a reflection of their entire faces.

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Copyright of a Valuable Leather Preservative for Sale. W. R. Burgess, Maffitt's Mills, N. C.

Wanted—Machines for Knitting Narrow Fancy Worsted Webs suitable for Borders. H. E. Dillingham, 89 West Broadway, New York.

Wanted—Agents in Eastern and Western States (liberal Commission) to sell the Toope Patent Grate Bar, Best in the world. Chas Toope, 88th st., 4th av., N.Y.

How to lay out the Teeth of Gear Wheels. Price 50 cents. Address E. Lyman, C.E., New Haven, Conn.

Wanted—The address of makers of hard solder for Brass. Address Box 3109, New York Post Office.

Leather and Rubber Belting, Packing and Hose. Greene, Tweed & Co., 18 Park Place, New York.

Hearing Restored—Great invention. Book free. G. J. Wood, Madison, Ind.

Wanted—A Bone Crusher, suitable for crushing bones size of nut coal. A stamp mill preferred. P. O. Box 3369, Boston.

Wanted—Second hand Railroad Track Scales, 30 ft. platform, 20 tons draft. Address E. B. Seeley, Bowling Green, Ky.

For Sale—37 in.x15½ ft. Lathe, $300; 18 in.x12 ft. Lathe, $250; 12 in.x6 ft. Lathe, $125; 48 in. Chucking Lathe, $195; 16 ft. Planer, $700; 6 ft. Planer, $275; 4 ft. Planer, $175; 9 ft. Planer, $575. Shearman, 45 Cortlandt St., N.Y.

Wanted—One Heavy Drop, with 600 lb. Hammer, and one Facing Machine. Address P. O. Box 2258, New Haven, Conn.

½, 1, & 2 Horse Engines, $30, 60, & $100; Boilers for same, $75 & $100. T. B. Jeffery, 253 Canal St., Chicago.

For Sale—Engine 4x8; no boiler—new—cheap—good. Will send pho. A. R. C., Lincoln, Ill.

Manufacturers of Middlings Purifying Machines and Chilled Rolls, used in the Manufacture of Flour send Circulars, or correspond with John W. Hopkins, Wilmington, Del.

An Erector, Engineer, and general Machinist desires a permanent engagement. References furnished. Address D. C., 29 Concord St., Brooklyn, N. Y.

Wanted—A Combined Power Punch and Shears for ordinary work. Address Louden M'f'g Works, Fairfield, Iowa.

No 2 Bogardus Mill for Dry Work for Sale at half price. A. C. Stebbins, 98 Liberty St., New York.

Abbe Bolt Headers, the best—Prices reduced; 2 sizes made. Palmer Power Spring Hammers. 10 sizes. See machines, or write for information before buying. S. C. Forsaith & Co., Manchester, N. H.

Piles—No matter of how long standing your case may be, or how many remedies failed, a cure is possible. Circulars free—cause—consequence and cure. Wonder Worker Medicines. Salem, N. J.

Steel Castings, from one lb. to five thousand lbs. Invaluable where great strength and durability are required. Send for Circular. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

Wanted—To purchase the Patent of a good article of general use, or will manufacture and pay royalty. Address B. H. Robb & Co., Cincinnati, Ohio.

Use Yocom's Split-Pulleys on all Shafting, same appearance, strength and price as finished Whole-Pulleys. Shafting Works, Drinker St., below 147 North Second St., Philadelphia, Pa.

Designer or Draughtsman—Engagement wanted by an engineer of practical and scientific education. Woodworking Machinery a specialty. Best references. Address Civ. Eng., 322 East 55th St., City.

Blake's Belt Studs are the best and cheapest fastening for Leather or Rubber Belts. Save ten times their cost. Greene, Tweed & Co., 18 Park Place, N.Y.

Linen Hose for Factories—1, 1½, 2 & 2½ inch. At lowest rates. Greene, Tweed & Co., 18 Park Place.

Manufacturers! Send for illustrated catalogue of Best Belt Pulleys made. A. B. Cook & Co., Erie, Pa.

Fine Castings and Machinery, 96 John St., N. Y.

For Sale—Second Hand Wood Working Machinery. D. J. Lattimore, 31st & Chestnut St., Phila., Pa.

Electric Burglar Alarms and Private House Annunciators; Call, Servants' & Stable Bells; Cheap Teleg. Insts; Batteries of all kinds. G. W. Stockly, Cleveland

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

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co., New Haven, Ct.

Water, Gas and Steam Goods—Send eight stamps for Catalogue, containing over 400 illustrations, to Bailey, Farrell & Co., Pittsburgh, Pa.

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

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

Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

Peck's Patent Drop Press. Still the best in use Address Milo Peck, New Haven, Conn.

All Fruit-can Tools, Ferracute W'ks, Bridgeton, N.J.

American Metaline Co., 61 Warren St., N.Y. City.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street, New York.

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass.

For best Bolt Cutter, at greatly reduced prices, address H. B. Brown & Co., New Haven Conn.

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

Temples and Oilcans. Draper, Hopedale, Mass.

Notes & Queries

R. M. P. will find an answer to his query as to power from compressed air on p. 43, vol. 34. —W. P. C. can make a solution of tin salt by the process described on p. 139, vol. 31, and he can crystallize the metal from the solution by a method described in the same article.—S. R. S. will find a description of a one track railroad on p. 370, vol. 29.—J. E. F. will find a full description of the Keely motor on p. 400, vol. 32.—C. W. J. will find directions for making patent leather on p. 122, vol. 27.—P. P. will find, on p. 91, vol. 32, directions for making chloride of calcium.—H. S. T. will find directions for making imitation black walnut on p. 90, vol. 32. This also answers J. C. A.—W. L. will find an answer to his question as to stones sinking in the ocean on p. 208, vol. 33.—T. H. will find directions for molding rubber on p. 283, vol. 29. This also answers H. F. B.—M. T. will find an engraving of a kerosene lamp for heating a small boiler on p. 229, vol. 33.—F. M. can dissolve gutta percha in bisulphide of carbon.—T. G. will find directions for making glue that will answer his purpose on p. 282, vol. 31. For a recipe for flour paste, see p. 219, vol. 30.—G. G. P. can remove inkstains from paper by the method described on p. 410, vol. 32.—W. N. G. will find directions for stereotyping by the paper process on p. 363, vol. 30. For a recipe for stereotype metal, see p. 186, vol. 24.—T. M. W. will find directions for French polishing on p. 11, vol. 32.—C. C. will find directions for purifying rancid butter on p. 119, vol. 30.—A. will find directions for tempering springs on p. 363, vol. 32.—W. M. B. will find that paraffin varnish is a good non-conductor of electricity. See p. 91, vol. 31.—D. C. H. will find a description of the Mont Cenis tunnel on p. 213, vol. 25.—G. C. will find directions for bluing steel on p. 123, vol. 31.—J. H. will find a description of a good field glass on p. 363, vol. 31.—W. L. S. will find a good article on building a windmill on p. 241, vol. 32.—C. A. S.'s perpetual motion device is very old. See p. 82, vol. 24.—M. S. can bleach paraffin by the process given on p. 309, vol. 30.—W. H. F. will find full information on blast furnaces in "The Iron Trade Manual," published by Wiley & Son, New York city.—M. L. will find a recipe for root beer on p. 138, vol. 31.—J. M. will find directions for making a submarine light on p. 229, vol. 28.—S. E. will find the proportions in which to mix carbolic acid with soap on p. 241, vol. 29.—D. C. will find directions for bleaching tallow on p. 27, vol. 31.—H. B. Jr. can make artificial meerschaum by the process described on p. 193, vol. 26.—G. F. A. will find a description of a spectroscope on pp. 277, 384, vol. 28. —J. M. will find directions for ascertaining the strength of boilers on p. 186, vol. 32.—J. D. can fasten emery on iron by the process given on p. 363, vol. 33.—H. C. S. will find directions for pasting paper labels on tin on p. 26, vol. 34.—T. R. W. will find a description of a cement for cast iron on p. 251, vol. 28.

(1) C. M. B. asks: Will iron decompose corrosive sublimate? Last spring I stuffed a few birds, and used a solution of corrosive sublimate, applying it with a small piece of common cotton batting on an iron wire. In the course of about two months the wire rusted, and the cotton appeared to be full of quicksilver, in little spheres, from the size of a pin's point to that of a pin's head. A. Yes. The action is accompanied by the formation of a basic chloride of iron and a separation of subchloride of mercury.

(2) L. E. B. asks: 1. Is there any known way to dry fish offal without the use of the patent dryer? A. Send us a sample of the patent dryer you have reference to. So much depends upon the condition of the materials, and the temperature at which the operation takes place, that it is impossible to give any very decisive answer. 2. When it is dried, what proportion of ammonia could I safely calculate on obtaining from it? A. The average amount of available nitrogenous matter contained in such waste is from 8 to 10 per cent.

(3) S. E. T. asks: 1. What are grape spirit, French spirit, corn spirit, and English spirit as used by perfumers? A. Grape spirit is the spirit of wine; corn spirit that obtained by the fermentation of corn. The other two grades we do not recognize by the names you give them. 2. Is spirit of jasmine the same as extract of jasmine? A. Probably.

(4) R. H. B. says: I use 8 inch welded boiler flues for stove pipes, etc. How can I cut off the rain at the roof or catch the water below? A. Construct two conical flanges around the flue pipe where it connects with the roof, above the latter, with the largest end of the cones downward; secure the bottom edge of the lower one to the roof, and the top edge of the upper one to the pipe, by soldering or by packing within a ferrule. The upper cone will serve as a cape over the lower one; and as they are not fastened to one another, no harm can come from expansion and contraction.

(5) J. F. M. & B. ask: Can you inform me of an easy manner of steaming geese feathers? We have plenty of steam. A. The feathers may be placed in a long tubular vessel surrounded by a steam jacket. In order to prevent any tendency to condensation of the steam as it passes through the vessel, it should be considerably superheated before being allowed to enter, and be passed through as rapidly as the case will permit.

(6) W. B. W. asks: What substance or substances of a quickly drying and gummy nature will serve as a vehicle for sulphuric acid, or any other acid that will quickly destroy vegetable tissue, without neutralizing the acid or destroying the properties of the vehicle? A. We do not think it is practicable to use any of the stronger acids in the way you propose. All such substances as the gums, gum resins, and oils are more or less acted upon by acids, if the latter are sufficiently strong to accomplish the destruction of vegetable fiber.

(7) A. B. asks: How can I clean jugs in which linseed oil has been kept for a long time, so they will not smell like the oil? A. Remove as much of the oil as possible by means of naphtha or benzine, and then wash the interiors well with a concentrated hot solution of potash or soda (lye). Finally rinse with clean water.

(8) J. H. C asks: What are the greatest conditions of safety under which a steam boiler can be operated? I wish to use a three horse power engine three or four times per week, about five hours at a time; if I get a boiler large enough to run the engine that length of time without adding any water (not providing any pump) the boiler being tested to 150 lbs. and having a valve set to blow off at 50 lbs. pressure, would not danger of explosion be entirely obviated? A. These conditions, supplemented by careful management, should ensure safety in a high degree.

(9) J. H. S. says: I have a bath tub set in wood. How can I paint or coat the surface with an imitation of marble that will resist water? A. The following has been used for this purpose: Boil a quantity of water glass (silicate of soda) in water until a clear sirupy liquid is obtained; then add sufficient oxide of zinc to form a stout body color, and apply several coats to the woodwork if necessary.

(10) J. W. S. says: In your article on p. 283, vol. 29, on molding rubber, you say: "Immerse the rubber in a mixture of bisulphuret of carbon 95 parts, and rectified spirits 5 parts, until it swells into a pasty mass. It may then be molded into any form required." I can dissolve the rubber nicely, but cannot form it in a mold. You say: "Your trouble probably arose from using vulcanized rubber. Try pure rubber in bisulphide of carbon and rectified spirits." I inclose a small piece of the rubber which I used. What is the difficulty? A. Bisulphide of carbon is the most usual and best solvent for caoutchouc (india rubber). This solution, owing to the volatility of the menstruum, soon dries, leaving the caoutchouc in its natural state. When alcohol is mixed with the sulphide of carbon, the latter does not any longer dissolve the caoutchouc, but simply softens it. Alcohol precipitates solutions of caoutchouc.

(11) F. L. B., of Yokohama, Japan, says: I am manufacturing safety matches, and find that they become soft in the warm, damp weather which we have here during the summer months. I use chlorate potassa, oxide manganese, sulphuret antimony, sulphur, and glass, and the best glue for the matches, and amorphous phosphorus, sulphuret antimony, and glue for the boxes. English matches stand this climate, and they are not varnished. What can I use that will keep the composition ends free from the influence of the weather? A. Collodion has been used for this purpose with very good results.

(12) M. R. H., of Mannheim, Germany, says: We have a brick room or oven with an iron floor. By means of furnaces underneath, it is gradually heated (during 12 hours) to 295° Fah. What liquid or substance can be put into an iron globe, communicating with a pipe outside the building, to cause a piston to rise as the heat inside is developed? A. Let the pipe from the globe turn downwards outside the room, a certain distance determined by experiment, and then bend and turn up again in a vertical position; fill the pipe outside the room with water, thus enclosing a certain quantity of air within the globe and in that portion of the pipe which is in the room. Now, if you provide a float upon the surface of the water in the exterior vertical pipe, as a piston, the expansion of the air in the globe will raise the water and the float, without making steam, and so effect the object you desire.

(13) J. S. C. asks: What are the causes of loss of power in the reciprocating engine, and what is the percentage of the loss from each cause? A. The following table, from an article by Messrs. Hunt and Skeel, on "The Methods of Testing Steam Engines," gives a good idea of the quality and amount of the losses, in the case of a condensing engine connected to a propeller:

		Per cent.
Units of heat in 100 lbs. anthracite	1,400,000	
Heat equivalent to weight of ashes	200,000	
Total heat in 100 lbs. of anthracite	1,200,000	100
Carried off by hot gases in chimney	200,000	16⅔
Available to produce steam	1,000,000	83⅓
Lost by leakage and condensation	200,000	16⅔
Available for work in cylinder	800,000	66⅔
Escaped with steam into condenser	660,000	55
Transformed into work	140,000	11⅔
Absorbed by friction, etc., of engine	40,000	3⅓
Available for useful work	100,000	8⅓
Absorbed by friction, etc., of propeller	20,000	1⅔
Usefully applied to propulsion	80,000	6⅔

(14) J. B. M. says: We have a yacht 32 feet long by 6 feet 4 inches beam. Would it make greater speed with two propellers of 26 inches diameter and 35 inches pitch, driven by two engines of 3 inches diameter by 5 inches stroke, than with one propeller of 36 inches diameter and 3½ feet pitch, driven by 1 engine of 4 inches diameter and 6 inches stroke, boiler being same in both cases? A. You do not send sufficient data to enable us to form an opinion. Other things being equal, however, one screw is generally preferable. Of course there may be special cases, as with yachts of very slight draft, where better results might be obtained by using two propellers.

(15) E. R. asks: Will a half horse power motor be large enough to propel a boat 20 feet long by 5½ feet wide, and 5 inches deep at the bow and 16 inches at the stern? A. The boat will not be very effective under the circumstances. 2. I want to use a 16 inch propeller wheel, and drop it 2 inches below the bottom of boat. What pitch shall I give the wheel? A. You can make the pitch of the propeller from 27 to 30 inches.

(16) W. H. B. says: In answer to a question as to pressure in a boiler, you say: "There is a little more pressure at the bottom." I suppose you mean that the weight of the water gives the over pressure, and that, aside from that, the pressure is equal. Am I correct? If so, is the answer a correct one? Does not the water (at its surface) resist the action of the steam in a downward direction? And is not the pressure carried through the whole body of water to the lower part of the boiler? Suppose the boiler is half full of water. Then the upper part of the boiler (on which the steam acts directly) is ½ greater than the surface of the water; and if steam presses equally upon every square inch of surface, then (aside from the weight of water) there is ½ more pressure on the upper part of the boiler. If this is not true, please explain why? A. Your idea in regard to the weight of the water increasing the pressure on the bottom is correct. You will find the other part of your query answered in any good treatise on the pressure of fluids.

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

G. F.—It is a cast of a fossil plant in sulphuret of iron. The material is not valuable.—J. F. B.—It is sulphuret of iron.—J. A. M.—It is hydrated sesquioxide of iron mixed with clay. By burning, it is converted into an inferior brown umber. Mix minium to change its color to a red.

J. M. H. Jr. asks: Can you give me a recipe for making decalcomanie varnish?—R. M. asks: Are black pearls of commercial value?—J. W. C. asks: How are gelatin capsules, such as are filled with various medicines, made?—J. A. B. asks: How can I make a polish or varnish for rubber shoes?

COMMUNICATIONS RECEIVED.

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

On Coal Mine Explosions. By J. F. R.
On a Curious Tree. By W. J. McG.
On Safe Launches. By P.
On Etheric Force. By J. R.
On Water Pressure in Mains. By J. C.

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

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Whose electro-motor is the best? Whose is the best apparatus for drying and evaporating, using steam as the heating medium? Who sells small balloons? Who makes a barometer with a self-adjusting scale? Whose is the best pump for raising water from a mine 45 feet deep? Who makes lead chambers for sulphuric acid works, and what do they cost?" 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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AND EACH BEARING THAT DATE.

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DESIGNS PATENTED.

8,884.—SEWING MACHINE ATTACHMENTS.—H. C. Goodrich, Chicago, Ill.
8,885.—BREASTPIN.—W. H. Halsey, Newark, N. J.
8,886.—BOXES.—M. F. Bell, Fulton, Mo.
8,887.—COFFIN PLATES.—R. H. Burr, West Meriden, Ct.
8,888.—WATCH PLATES.—A. H. Potter, Chicago, Ill.

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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,

December 23, 1875, to January 10, 1873.

5,536.—A. Ramsay, Montreal, P. Q. Station indicator. Dec. 23, 1875.
5,537.—L. Hurd, Kewannee, Ill., U. S. Edible compound. Dec. 23, 1875.
5,538.—R. Lean *et al.*, Stratford, Ont. Fanning mills and separator. Dec. 30, 1875.
5,539.—L. Flagg, Central Falls, R. I., U. S. Automatic gate. Dec. 30, 1875.
5,540.—L. E. Hurd, Cleveland, Ohio, U. S. Compound to prevent scale in steam boilers. Jan. 3, 1876.
5,541.—A. Christin, Chicago, Ill., U. S. Bottle stopper. Jan. 3, 1876.
5,542.—A. D. Crosby, Cuba, N. Y., U. S. Chain pump bucket. Jan. 3, 1876.
5,543.—S. C. Hamlin, Ypsilanti, Mich., U. S. Rubber bucket for chain pumps. Jan. 3, 1876.
5,544.—H. N. Slater, Webster, Mass., U. S. Process of flocking cloth. Jan. 3, 1875.
5,545.—H. Gillmore, Simcoe, Ont. Sash holder. Jan. 5, 1876.
5,546.—H. Wells, Ottawa, Ont. Revolving drag harrow. Jan. 8, 1876.
5,547.—W. P. Widdifield, Siloam, Ont. Weather strips. Jan. 8, 1876.
5,548.—A. Newell, Chicago, Ill., U. S., *et al.* Constructing dead pulleys. Jan. 10, 1876.
5,549.—D. S. Cornell, Warwick, Ont. Barrel. Jan. 10, 1876.
5,550.—D. S. Cornell, Warwick, Ont. Barrel and cylindrical box. Jan. 10, 1876.
5,551.—G. J. Tandy, Kingston, Ont. Boiler for steam engines, etc. Jan. 10, 1875.
5,552.—J. Hawes, Worcester, Mass., U. S. Egg beater and mixer. Jan. 10, 1876.
5,553.—G. W. Robinson, Bennington Center, Vt., U. S. Hand corn planter. Jan. 10, 1876.
5,554.—A. Smith, Clifton, Ont. Applying liquid fuel to the heating of metals, etc. Jan. 10, 1876.
5,555.—A. W. Shaw, Saccarappa, Me., U. S. Hydraulic cement. Jan. 10, 1876.
5,556.—W. D. Edy *et al.* Fanning mill and elevator attachment. Jan. 10, 1876.
5,557.—G. W. Johnson, Yarmouth, N. S. Pump. Jan 10, 1876.
5,558.—C. L. Jeffords, Jamestown, N. Y., U. S. Converting cast iron into steel. Jan. 10, 1876.
5,559.—F. Beauchemin, Rolton Falls, P. Q. Dough mixing machine. Jan. 10, 1876.
5,560.—W. Milner, Strathroy, Ont. Door base protector. Jan. 10, 1876.
5,561.—J. H. Grant, Grimsby, Ont. Mowing and reaping machine. Jan. 10, 1876.
5,562.—A. S. Buckelew, Jersey City, N. J., U. S. Watch case spring. Jan. 10, 1876.
5,563.—T. J. O'Sullivan, Hamilton, Ont. Heating drum. Jan. 10, 1876.
5,564.—R. D. O. Smith, Washington, D. C. Water closet. Jan. 10, 1876.
5,565.—F. G. Butler, Bellows Falls, Vt., U. S. Horse rake. Jan. 10, 1876.
5,566.—T. Northey, Hamilton, Ont. Steam pump or boiler feeder. Jan. 10, 1876.
5,567.—W. T. Lintner *et al.*, Fort Plain, N. Y., U. S. Pad for chair legs. Jan. 10, 1876.
5,568.—B. Barker, Ellsworth, Me., U. S. Stave-jointing machine. Jan. 10, 1876.
5,569.—J. Woolridge, Dean's Corner, Ill., U. S. Land roller. Jan. 10, 1876.
5,570.—G. Blatchford, Mitchell, Ont. Reed organ. Jan. 10, 1876.

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