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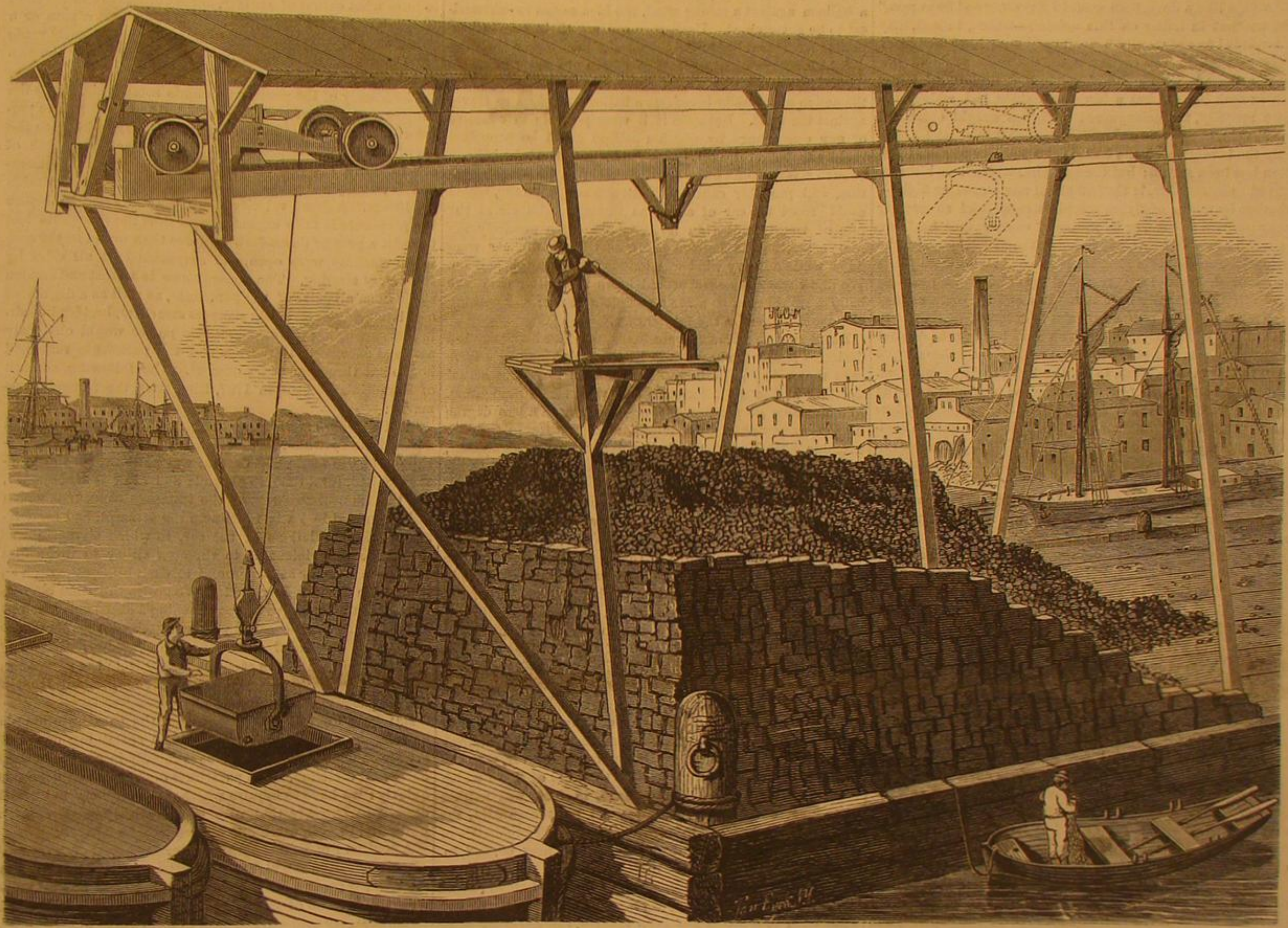
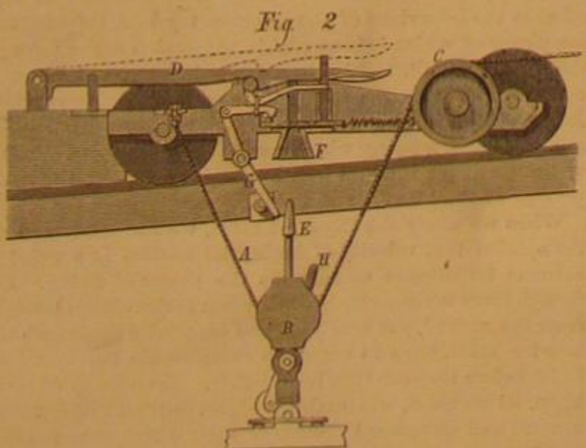


GREEN AND STANCLIFF'S APPARATUS FOR HOISTING AND CONVEYING COAL.

The accompanying engravings illustrate an improved apparatus for hoisting and conveying coal, patented August 1, 1871, through the Scientific American Patent Agency, by Joseph Green, of New York city, assignor to himself and George Stancliff, also of this city, and which is undoubtedly

Fig. 2



one of the most complete devices, for the work intended, yet produced.

The principal engraving shows the apparatus as discharging a cargo of coal at a dock, and is an excellent representation of the general appearance and application of the invention.

Figs. 2 and 3 are details showing the main features of the invention, which are simple and not liable to get out of order.

The elevator bucket is raised by a rope, A, Fig. 2, which passes under the sheave, B, Fig. 2, and over the pulley, C, Fig. 2, attached to the frame of a car which runs on an elevated inclined railway, as shown in Fig. 1. The car is held from moving, while the bucket ascends, by the hook lever, D, Fig. 2, which engages a round cross-bar of the car frame.

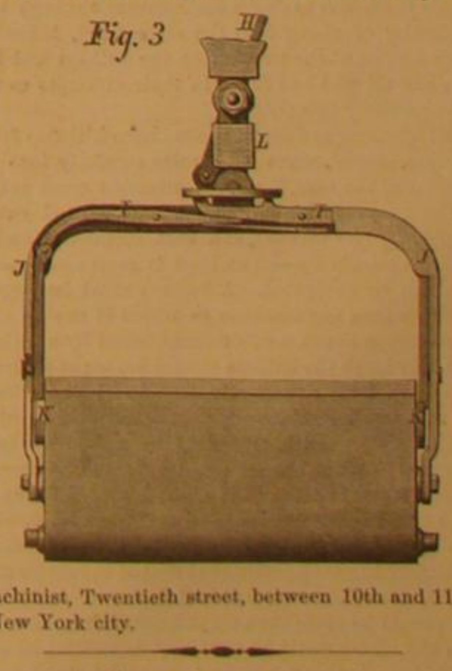
As the bucket reaches the car, the spear head, E, Fig. 2, enters the funnel shaped guideway, F, which directs the point of the spear head up against the hook lever, D, thus releasing the latter from its engagement with the bar which holds the car. The continued traction of the rope then draws both car and bucket to the point at which it is to be dumped. During this part of the movement, the bucket is sustained by the spear head, held by a spring catch plate which is caused, by suitable tripping mechanism, to pass under the lower shoulders of the spear head, and which is released from its engagement from the spear head, and reset on the return of the car, by the action of the tripping lever and hook, G, Fig. 2, attached to the frame of the car.

The bucket is dumped, when it arrives at the proper point, through the agency of the tripping lever, H, Figs. 2 and 3, which operates bent levers or latches, I, that pass down through the interior of the bale, J, and enter catches, K, attached to the pivots of the bucket.

The tripping is effected by an adjustable stud clamped to the lower side of one of the rails. A sleeve on the shank of the spear head allows the bucket to be turned and locked so as to be dumped forward or backward, or to either side, as required.

The facility with which coal can be handled by this apparatus is very great, and we expect to see its universal adoption. The inventor states that one tun per minute may be raised to the ordinary hight, and delivered one hundred feet back, as an average rate of working. The apparatus requires the attention of only two men, and is adapted not only for hoisting coal in yards and gasworks, and for discharging cargoes of coal, but also for use in the elevation of ores and broken crude materials of every sort. The Manhattan Gas Company has already adopted this machine for their coal sheds, (ten of these machines being now in operation and building for this company), at their works on North river, at the foot of Eighteenth street, where they may be seen in operation. For further particulars, address Joseph Cramp

Fig. 3



ton, machinist, Twentieth street, between 10th and 11th avenues, New York city.

ASBESTOS is a silicate of magnesia, containing also about 15 per cent of lime. It has long been known, as its name indicates. The ancients used it for the wicking of their lamps and also for napkins. The Greek word *asbestos*, meaning unextinguished, was appliedto the wicking, as the wick never burnt out and the votive lamps were kept constantly burning. When made into napkins, it was called *amianthos*, meaning undefiled, as the napkins were cleaned by throwing them into the fire. The French have adopted the name of *amianthe*, instead of asbestos, from this latter word.

NOTES ON FLYING AND FLYING MACHINES.

(From the Cornhill Magazine.)

NUMBER I.

It would be difficult to say how many centuries have elapsed since the first attempt was made to solve the problem whether man can fly. Ages before the "philosopher's stone" was ever sought for, or before the problem of perpetual motion had attracted the attention of mechanists, men had attempted to wing their way through the too unresisting air,-by means of more or less ingenious imitations of the pinions of birds or insects. It has even been suggested (see Hatton Turnor's *Astra Castra*), that King David referred to successful attempts of this sort, when he cried, "O that I had wings like a dove, then would I flee away and be at rest." But without insisting on this opinion—which, indeed, may be regarded as not wholly beyond cavil—we have abundant evidence that, in the earliest ages, the same problem has been attacked which the Aëronautical Society of Great Britian took in hand but a few years since, and which, still more recently, the beleaguered Parisians sought earnestly, but in vain, to solve.

By the invention of the balloon the problem of aërial flotation has been solved; but the problem, which has hitherto proved so intractable, is that of aërial navigation or flight—whether by means of flying machines capable of supporting many persons at once, or by means of contrivances enabling a man to urge his way alone through the air. There can be little question that this problem is one of great difficulty. It has, indeed, been long regarded by nearly all practical mechanicians as really insoluble. But of late years careful researches have led competent men to entertain doubts as to the validity of the objections which have been urged against the theory that it is possible for men to fly. Facts have come to light which seem, to say the least, highly promising. In fine, there are not a few who share the convictions of the learned President of the Aëronautical Society, that before many years have passed men will have learned how to navigate the air. The time may not be at hand, indeed, when Bishop Wilkins' prophecy will be fulfilled and men will call as commonly for their wings as they now do for their boots; but it does not seem improbable that before long the first aërial voyage (as distinguished from aërial drifting in balloons), will be successfully accomplished.

It may be interesting to inquire, what are the principal facts on which this hopeful view of the long vexed problem has been founded. In so doing, we shall have occasion to touch incidentally on the history of past attempts at flight; and this history is, indeed, so attractive, that the reader may be disposed to wish that it were entered upon more at length. But our subject is such a wide one, that it will be necessary to avoid discussing, at any length, those strange and sometimes apocryphal narratives, which are to be found in the records of aëronautics. For this reason we propose to consider only such accounts of past attempts as appear to bear on the subject of the actual feasibility of flying.

In the problem of aërial navigation, four chief points have to be considered—buoyancy, extent of supporting surface, propulsive power, and elevating power. At first sight, buoyancy may seem to include elevating power and supporting power, but it will be seen, as we proceed, that the term is used in a more restricted sense.

In the balloon, we have the perfect solution of the problem of securing buoyancy. The success with which men have overcome the difficulty of rising into the air is complete; and this being their first and, seemingly, a most important success, we can, perhaps, hardly wonder that further success should long have been looked for in the same direction. The balloon had enabled men to float in the air; why should it not enable them also to direct their course through the air? The difficulty of rising into the air seemed, indeed, much the more serious of the two before the balloon had been invented; and all who had failed in their attempts to fly, had failed in precisely this point.

Yet all attempts to direct balloons have hitherto failed. It seems clear, indeed, when we inquire carefully into the circumstances of the case, that such attempts must necessarily fail. The buoyancy of balloons is secured, and can be secured, only by one method, and that method is such as to preclude all possibility—so at least it seems to us—that the balloon can be navigated. A balloon must be large, many times larger than any machine to which it can be attached. If we take even the case of one man raised by a balloon, and inquire how large the balloon should be, we at once see how disproportioned the size of a balloon must needs be to the bodies of a heavier nature which it is intended to raise. We know that a man can barely float in water; so that he is about equal in weight to an equal volume of water. But a volume of water is more than eight hundred times heavier than an equal volume of air, even at the sea level, where the air is densest. So that the weight of a man is more than eight hundred times heavier than that of the air he displaces. It follows that if a very light hollow vessel could be made, which should be more than eight hundred times as large as a man, and which could be perfectly exhausted of air without collapsing (a thing wholly impossible), the buoyancy of that vessel would barely enable it to support the weight of a man. But the balloonist is unable to obtain any vessel of this sort. He cannot employ the buoyancy of a perfect vacuum to raise him. What he has to do is, to fill a silken bag with a gas lighter than air, but still not weightless, and to trust to the difference, between the weight of this gas and that of the air the balloon displaces, to raise him from the ground. So that such a balloon, in order to raise a man, must be considerably larger than the hollow vessel just referred to. But further, the balloon must rise above the denser parts of the air; it must carry its own weight as well as that of the man; the balloonist must take a supply of ballast; and other like considerations have to be attended to, all of which render it necessary that the balloon should be larger than we have hitherto supposed. Apart, however, from all such considerations, we find the very least proportion, between the size of the balloon intended to carry one person and the size of the human body, to be about as one thousand to one. Buoyant vessels constructed on such a scale must needs present an enormous surface; and therefore not only must they strongly resist all attempts made to propel them in any direction, but the lightest wind must have more effect upon them than any efforts made by those they carry. As for any power which should avail to propel a balloon against a strong wind, the idea seems too chimerical to be entertained. Until men can see their way to propelling a buoyant body (one thousand times larger than the weight it supports), at the rate of fifteen or twenty miles an hour through the calm air, they cannot expect even to resist the action of a steady breeze on a balloon, far less to travel against the wind. But even if it were possible to conceive of any contrivance by which a balloon could be propelled rapidly through calm air, yet the mere motion of the balloon at such a rate would sway the balloon from its proper position, and probably cause its destruction. A power, which could propel the car of a balloon through calm air at the rate of twenty miles an hour, would cause precisely the same effect, on the balloon itself, as though the car were fixed while a heavy wind was blowing against the balloon. We know what the effect would be in this latter case; the balloon would soon be made a complete wreck; and nothing else could happen in the former case.

But it may be seriously questioned, whether buoyancy is a desirable feature in any form of flying machine. We have seen that a degree of buoyancy sufficient to secure actual flotation in the air is incompatible with aërial navigation. We may now go further, and urge that even a less degree of buoyancy would be a mischievous feature in a flying machine. M. Nadar, the balloonist, makes a significant, though not strictly accurate observation on this point, in his little book on flying. Passing through the streets of Paris, during the ædileship of Haussmann, he heard a workman call, from the roof of a house to a fellow workman below, to throw a sponge up. "Now," says Nadar, "what did the cunning workman, who was to throw the sponge, do? The sponge was dry, and therefore light and buoyant. Was it in this condition that he threw it up to his fellow? No; for it would not have been possible to send it above the first floor. But he first wets the sponge, and so makes it heavy; and then, when it has been deprived of the lightness which is fatal to its flight, he throws it easily to his fellow on the house roof." M. Nadar infers that the first essential in a flying machine is weight!

Now, what is true in the above reasoning is, that buoyancy renders flight—as distinguished from aërial floating—impossible, or, at least, difficult. It is not true, however, that the flight of the wet sponge exemplifies the kind of flight which the aëronaut requires. The sponge, in fact, was neither more nor less than a projectile; and most assuredly, the problem of flight is not to be solved by making projectiles of our flying machines, or of our bodies. It may be, and, indeed, we shall presently see that it probably will be necessary that some form of propulsion from a fixed stand should have to be applied to the flying machines of the future. But after such propulsion has been applied, the flying machine must be supported in some way, not left, as an ordinary projectile is left, to the action of unresisted gravity. M. Nadar's wet sponge is no analogue, then, of the flying machines we require.

Before leaving the subject of buoyancy, however, it will be desirable to inquire whether buoyancy is, in any marked degree, an attribute of the flying creatures we are acquainted with—birds, bats, and insects. The structure of such creatures has been supposed by some to be such as to secure actual buoyancy, to a greater or less degree; and many would be disposed, at a first view of the matter, to regard the hollow bones and the quill feathers of birds as evidences that buoyancy is essential to flight. We have even seen the strange theory put forward, that during life, the quills of birds, as well as their hollow bones, are filled with hydrogen. "Flying animals," says a writer, in *All the Year Round* for March 7, 1868, "are built to hold gases everywhere—in their bones, their bodies, their skins; and as their blood is several degrees warmer than the blood of walking or running animals, their gases are probably several degrees lighter. Azote, or hydrogen, or whatever the gas held in the gaseous structures may be, is proportionately warmer, and, therefore, proportionately lighter than air."

But it appears to us that on a careful consideration of the structure of flying creatures, the hollow portions of their bodies will be found to fulfil a purpose quite distinct from that of imparting buoyancy. If we examine a quill we find that the most remarkable feature, which it presents to us, is the proportion which its strength, especially as respects resistance to flexure, bears to its weight. It would be difficult indeed, to construct any bar, or rod, or tube, of the same length and weight as a portion of a bird's quill, which would bear the same pressure without perceptible flexure; and it is scarcely conceivable that any structure, appertaining to a living creature, could possess greater strength with an equal degree of lightness. In the hollow bones, again, we see the same association of strength and lightness. Precisely as a tubular bridge, like that which spans the Menai Straits, is capable of bearing far greater strain than a solid metal bar of equal weight and length, so the hollow bones of birds are far stronger than solid bones of equal weight would be. We see then, that lightness is secured in these parts of a bird's structure. But lightness and buoyancy are different matters. We can understand that it is absolutely essential that the weight of a machine intended for flight should be as small as may be, due regard being had to strength and completeness. But there is little, we conceive, in the structure of flying creatures, which points to buoyancy as a desirable feature in a flying machine.

We come next to a much more important point, namely, extent of supporting surface. We are to consider the air now, not with regard to its density, the quality which enables a balloon, filled with rarer gas, to float in air, but with reference to its power of resisting downward motion through it; that is, of resisting the effects of gravity. We have to inquire what extent of surface, spread either in the form of wings or as in parachutes, will suffice to support a man or a flying machine. It is here that the researches recently made seem to bear most significantly upon the question of the possibility of flight.

The history of the parachute affords some insight into the supporting power of the air—some, but not much. The parachute has been commonly suffered to fall from beneath the car of a balloon. Suspended thus, in the lee, so to speak, of the balloon's mass, and with its supporting surface unexpanded, the parachute descends under highly unfavorable conditions. A great velocity of descent is acquired before the parachute is fully expanded, and thus the parachute has to resist a greater down-drawing force than would be the case if the machine were open, and surrounded on all sides by free air, at starting. The consequence is a great and sudden strain upon all parts of the parachute, as well as a degree of oscillation which seriously risks its structure, besides impairing its supporting power—since this power would obviously act most effectively if the span of the parachute remained horizontal throughout the descent. The following account of Garnerin's descent, in 1797, illustrates the foregoing remarks:

"In 1797," says Mr. Manley Hopkins, "Garnerin constructed a parachute by which he descended from a balloon at an elevation of 2,000 feet. The descent was perilous, for the parachute failed, for a time, to expand; and after it had opened, and the immediate fears, of the immense concourse which had assembled in Paris to witness the attempt, had been removed, the oscillations of the car, in which Garnerin was seated, were so violent as to threaten either to throw him out, or, on arriving at the ground to dash him out with violence. He escaped, however!" We notice the same circumstances in the narrative of poor Cocking's disastrous attempt in 1837. "When the cords which sustained the parachute were cut, it descended with dangerous rapidity, oscillating fearfully, and at last the car broke away from the parachute, and Mr. Cocking was precipitated to the ground, from a hight of about one hundred feet."

But apart from these considerations, the parachute affords no evidence whatever of the increased sustaining power of the air on bodies which traverse it rapidly in a more or less horizontal direction. The parachute descends, and descends quickly: we have to inquire whether the air may not resist descent so strongly that, with comparatively small effort, a horizontal or even ascending motion may be effected.

A familiar illustration of this supporting power of the atmosphere is given in the flight of an oyster shell or piece of thin slate, deftly thrown from a schoolboy's practised hand. Such a missile, instead of following the parabolic path traversed by an ordinary projectile, is seen to skim along almost like a bird on resting pinions. It will sometimes even ascend (after the projectile force has ceased to act in raising it), as though in utter disobedience to the laws of gravitation.

The fact appears to be that, when a horizontal plane traverses the air in a horizontal direction, the supporting power of the air is increased in proportion as the plane moves more quickly, or in proportion to the actual quantity of air it glides over, so to speak. Indeed we have clear evidence to this effect in the behaviour of the common toy kite, the supporting power of which is increased in proportion to the force of the wind. For a kite, held by a string in a strong horizontal current of air, corresponds exactly to an inclined plane surface drawn swiftly in a horizontal direction during a calm. The same supporting power which results from the rapid passage of the air under the kite will be obtained during the rapid passage of the kite over still air.

When we study the flight of birds, we are confirmed in the opinion that velocity of horizontal motion is a point of extreme importance as respects the power of flying. For though there are some birds which seem to rise almost straight from the ground, yet nearly all, and especially the larger and heavier birds, have to acquire a considerable horizontal velocity before they can take long flights. Even many of those birds, which seem, when taking flight, to trust rather to the upward and downward motion of their wings than to swift horizontal motion, will be found, when carefully observed, to move their wings up and down in such sort as to secure a rapid forward motion. The present writer has been much struck by the singularly rapid forward motion which pigeons acquire by what appears like a simple beating of their wings. A pigeon which is about to fly from level ground may be seen to beat its wings quickly and with great power; and yet instead of rising with each downward stroke, the bird is seen to move quite horizontally, as though the wings acted like screw propellers. We believe, in fact, that the wings during this action do really act, both in the upward and downward motion, in a manner resembling either screw propulsion or the action by which seamen urge a boat forward by means of a single oar over the stern. (Sailors call this *sculling*, a term more commonly applied to the propulsion of a boat by a single oarsman using a pair of oars, or sculls.) The action of a fish's tail is not dissimilar; and as the fish, by what seems like a simple beating of its tail from side to side, is able to dart swiftly forwards, so the bird, by what seems like a beating of its wings up and down, is able—when occasion requires—to acquire a swift forward motion. At the same time it must be understood that we are not questioning the undoubted fact that the downward beat of a bird's wing is also capable of giving an upward motion to the bird's body. The point to be specially noticed is that when a bird is taking flight from level ground, the wings are so used that the downward stroke gives no perceptible motion.

But since a horizontal velocity is thus effective, we might be led to infer that the larger flying creatures, which, *cæteris paribus*, travel more swiftly through the air than the smaller, would require a smaller relative extent of supporting surface. We are thus led to the consideration of that point which has always been regarded as the great, or rather the insuperable difficulty, in the way of man's attempts at flight—his capacity or incapacity to carry the requisite extent of supporting surface. We are led to inquire whether a smaller extent of supporting surface than has hitherto been deemed necessary may not suffice in the case of a man, and *à fortiori* in the case of a large and powerful flying machine.

The inference to which we have thus been led is found to accord perfectly with the observations which have been made upon flying creatures of different dimensions. It has been found that the supporting surface of these creatures—whether insects, birds, or bats—by no means varies in proportion to their weight. This is one of the most important results to which the recent inquiries into the problem of flight have led; and we believe that our readers cannot fail to be interested by an account of the relations which have been observed to hold between the weight and the supporting surface of different winged creatures.

[Concluded next week.]

The Finish and Preservation of Metallic Surfaces.

The following excellent remarks upon the above subject are extracted from the *Technologist*:

All metals in common use are liable to corrosion; and it has always been an object with mechanics to find out the best means of preventing this, since such corrosion is not only unsightly, but tends to weaken the metal and to add greatly to the friction when it occurs on moving surfaces. In general, the greatest safety has been found in surfaces which have been either well painted or highly polished. When a piece of metal has been highly polished, it no longer presents to the air the same extent of surface that is presented by the same piece in a rough state. The reader will readily appreciate this statement if he will consider the difference between the surfaces presented by a smooth lawn, and by the same field after it has been thrown up into ridges and furrows by the plow. Of course, the greater the extent of surface presented by any given piece of metal, the more powerfully will air and moisture act upon it to corrode it. Besides this, it has been found that the condition of the surface has a great deal to do with the force with which water adheres to it. It is almost impossible to wet the blade of a well polished razor; and a highly polished needle, if carefully laid on the surface of water, will float, because the water will not wet it easily. These facts explain why it is that highly polished surfaces do not corrode easily, as is seen in the case of fine cutlery and instruments made of steel; and they enforce the importance of carrying the polishing process to the last degree of perfection.

It is undoubtedly true, however, that we are apt to put too much polished work upon our machinery, and especially upon our engines; and we thereby not only incur a greatly increased expense in the first instance, but the subsequent cost of maintaining this high polish is a serious item. It was therefore with a good deal of pleasure that mechanics saw the new mode of finishing by plating with nickel introduced. This process has already been applied with the very best results to tools of various kinds, and even to machines of considerable size. We have seen an engine which had all the exposed and polished parts nickel plated. The appearance was very fine, and the labor involved in keeping the engine bright was reduced to a minimum. Nickel does not corrode by exposure to ordinary vapors and gases; and consequently a mere wipe with an oiled rag or cotton waste is all that is needed to keep it bright.

Unquestionably, the cheapest and most effective method of protecting metallic surfaces is to paint them. For very coarse articles coal tar is frequently employed; and we have often seen great mistakes made in the methods employed in its application. Coal tar, if simply applied to any surface as a paint, takes a very long time to dry. Indeed, we have seen it remain for years in a sticky, semi-solid condition. To avoid this, the tar ought to be boiled until reduced to pitch, and then, if necessary, thinned by the addition of naphtha, or applied while hot to a hot metallic surface. Tar treated in this way dries rapidly, and forms a hard paint or varnish that does not soil other objects. In using tar, however, we are prevented from obtaining any other color than black—an objection which does not apply to many objects, such as the coarser articles of agricultural implements, boilers, etc. For such purposes, a cheap varnish made from coal tar has come into very extensive use. A very fine black varnish may be applied to any coarse iron surface that will bear the operation, by simply heating it to such a point as will cause it to decompose linseed oil, and then brushing it over with this liquid. When it gets cold, the iron will be found to be covered with a fine, smooth, black varnish which adheres very closely to the metal.

One of the greatest difficulties in the way of protecting iron surfaces by means of paint is the difficulty of producing a firm adhesion between the paint and the metal. When applied to surfaces that have been polished, the difficulty is not so great; though, even in this case, anything that will cause a more perfect adhesion is to be welcomed. It is when paint is applied to the rough surfaces of iron castings, and especially to those that have been scaled by the action of vitriol, that the difficulty of producing a perfect and permanent adhesion is found. In order to secure the best results, iron that has been vitrioled ought to be well washed and carefully dried before the paint is applied. If the articles are small and will bear the application of a strong heat, they should be heated until oil applied to them smokes. They may then be brushed over with a thin coating of boiled linseed oil; and, when this has become thoroughly dry, they may be painted. When the articles are too large, or when, from other reasons, it is impossible or inconvenient to heat them, the oil may be warmed before it is applied. A thin coat of hot oil will penetrate every pore, displace all adhering dampness, and stick to the metal so closely that no exposure to air or moisture will ever cause it to separate. To such an oiled surface paint adheres well; and when this process is adopted, we never find the paint falling off, in large flakes, owing to moisture having crept into some crack and gradually producing a thin layer of rust between the paint and the metal.

These remarks of course apply to metal that is exposed to the open air and subjected to the action of frost, moisture, and air. It is easy enough to protect metal that is kept within doors, in a dry place, and consequently needs no protection; but iron exposed to the elements is a different affair. And here we may perhaps be allowed to remark that these directions, in regard to hot oil, apply to wood quite as well as they do to metal. A coat of oil applied hot and allowed to become thoroughly dry is a powerful preservative, and makes an excellent groundwork for a subsequent coat of paint.

Patents.

[From the Report of the Secretary of Interior.]

There were filed in the Patent Office during the year ending September 30, 1871, 19,429 applications for patents, including reissues and designs; 3,337 caveats, and 181 applications for the extension of patents. Twelve thousand nine hundred and fifty patents, including reissues and designs, were issued, and 147 extended; 514 applications for trade marks were received, and 457 trade marks issued. The fees received during said year amount to $671,583·81, and the expenditures for the same period were $560,041·67, leaving a surplus of $111,542·14 of receipts over expenditures. The appropriation asked for the next fiscal year is $606,400.

The number of applications for patents, including reissues and designs, received during said year, is a small increase over the number received the preceding year, while the number of patents issued is not quite so great. It is worthy of remark, however, that the labors of the clerical force of the office are increased proportionally more than the number of applications would seem to indicate, inasmuch as each year's operations add about 20,000 to the number of patented and rejected applications, with which the examining corps must become familiar, in addition to those previously filed. The examiners are, generally, men of distinguished ability and untiring industry, but their number is inadequate to properly and promptly discharge the increasing duties demanded of them.

The act of January 11, 1871, abolished the old form of annual report of the Patent Office, and authorizes the Commissioner to substitute therefor full copies of the specifications and drawings of all patents issued, these to be deposited in the clerk's office of each United States District Court, and in certain libraries. This law was passed in the belief that there was very little public demand for, or interest in, the annual reports of the Patent Office, which belief the Commissioner thinks was not well founded, although approving of the law, and regarding it as a means of placing fuller information before those interested, and at a much less cost than before. Beside copies of the specifications and drawings for disposition under the law, other copies are printed for subscribers. These publications are rapidly becoming popular among those interested in patents, and will be of great benefit to the office in various ways. For the convenience of subscribers, the publication of the specifications and drawings has been arranged into 176 different classes, according to their subject matter, so that subscribers need not necessarily pay for the entire issue, but only for the particular class or classes in which they may be interested.

The rapidly extending business of the office requires more room; and although additional room has been provided during the year by the transfer of the Pension Office clerks to another building, the Patent Office is still without sufficient room for the transaction of its business in a satisfactory manner. The general business of the office has been promptly and satisfactorily administered during the term of the present Commissioner, and his efficiency and capability for its delicate duties is cheerfully attested.

Science in Prussia.

Sir William Thomson stated in his recent address before the British Association, that in Prussia every university, every polytechnic academy, every industrial school, most of the grammar schools, in a word nearly all the schools superior in rank to the elementary schools of the common people, are supplied with chemical laboratories and a collection of philosophical instruments and apparatus, access to which is most liberally granted by the directors of these schools to any person qualified for scientific experiments. In consequence there will scarcely be found a town exceeding 5,000 inhabitants that does not offer facilities for scientific investigations at no other cost than that of the materials wasted in the experiments. And further, professors, preceptors, and teachers of secondary schools are engaged on account of their skillfulness in teaching; but professors of universities are never engaged unless they have already proved by their own investigations that they are to be relied upon for the advancement of science.

Fireproof Materials.

Mr. H. J. Ramsdell, in a Washington letter to the *Cincinnati Commercial*, giving an account of an interview with Mr. Mullett, the supervising architect of the Treasury Department, elicits some interesting opinions as to the lessons from Chicago, especially the following, relating to fireproof materials:

"Iron," said Mr. Mullett, "I mean cast iron, absurd as the statement may appear, will not resist as much heat as good sound oak timber of the same dimensions. Fire expands the iron and warps it, and it breaks very easily. Indeed, if oak timber should be treated by any of the processes of liquid silicate, it may be considered almost a fireproof material compared with cast iron. As for stones suitable for building purposes, as I told you before, there are few that are fireproof, though some approximate the necessary conditions, and, except in severe conflagrations, may be generally depended upon. Granite, marble, and sandstone are not to be trusted, as they soon perish by exposure to the heat, as has been shown a thousand times. But I am strongly in favor of liquid silicate as a preparation for wood to be used for building purposes. My attention was directed to this material some years since, but I have not had an opportunity to investigate the subject fully. I believe, however, that it merits more attention than any other suggestion that has been made public, and may yet prove one of the most practical solutions of the question of non-combustible construction that has yet been offered. Whether this or some other process for making wood non-combustible is the more desirable, I am not prepared to say. I am, however, decidedly of the opinion that any process by which wood can be rendered non-inflammable at a reasonable cost would not only be an inestimable blessing to the public, but its use should be rendered imperative by law."

"Well, Mr. Mullett, do you still think that brick is the only fireproof material?" "I looked into that subject at Chicago with much interest. Now, it is very hard to make an absolutely fireproof building; but I believe that a building, properly constructed of bricks that are well made, and of iron or non-combustible timber, protected by fireproof shutters and door, will resist the fiercest conflagration. Remember, I say fireproof doors and shutters, not iron. To make an absolutely fireproof structure, however, well burned and homogeneous brick must be used. The walls must be of sufficient thickness, and should be built with an air space to prevent the transmission of heat. The joists should in no case be carried into the walls, but should be supported on corbel courses of brick, and connected with the walls themselves only by wrought iron anchors. The windows and doors to be protected, as I have said, with fireproof shutters, and the roof to be of slate or metal. The use of roofs composed of coal tar, or other similar substances, should be prohibited by law in cities. Ordinary iron shutters are scarcely more fireproof than those of wood. They heat rapidly, warp from their fastenings, and admit the fire to the interior, and are in fact a means of facilitating the conflagration by obstructing the efforts of the fire department. I see no reason, however, why fireproof shutters should not be produced at a price that would place them within the reach of all."

"What do you think of dry pressed bricks?" "I never had much experience with them, and I don't believe in them. They are certainly not so good as the ordinary kind. A very little experience with brick will show that the more thoroughly the clay is tempered the better the bricks are. One great trouble in obtaining good brick is in the indisposition of brick makers to temper their clay enough." "What do you think of terra cotta?" "Terra cotta is a material to which I do not think sufficient attention has been given in this country, though in Europe many beautiful and durable specimens have been produced. I feel confident that it will be found, if properly made, one of the most desirable articles for the use of an architect in the erection of fireproof buildings. It should be used in a legitimate manner, and not as an imitation of cut stone."

For the Benefit of Chicago.

An esteemed correspondent, R. B. S., calls our attention to the following: "The theatres of the Romans were fitted up with numerous concealed pipes, that passed in every direction along the walls, and were connected to cisterns of water or to machines for raising the latter. Certain parts of the pipes were very minutely perforated, and were so arranged that, by turning one or more cocks, the liquid escaped from them, and descended upon the audience in the form of dew or extremely fine rain. This effectually cooled the heated air, and must have been exceedingly refreshing to the immense multitudes, especially in such a climate as Italy.

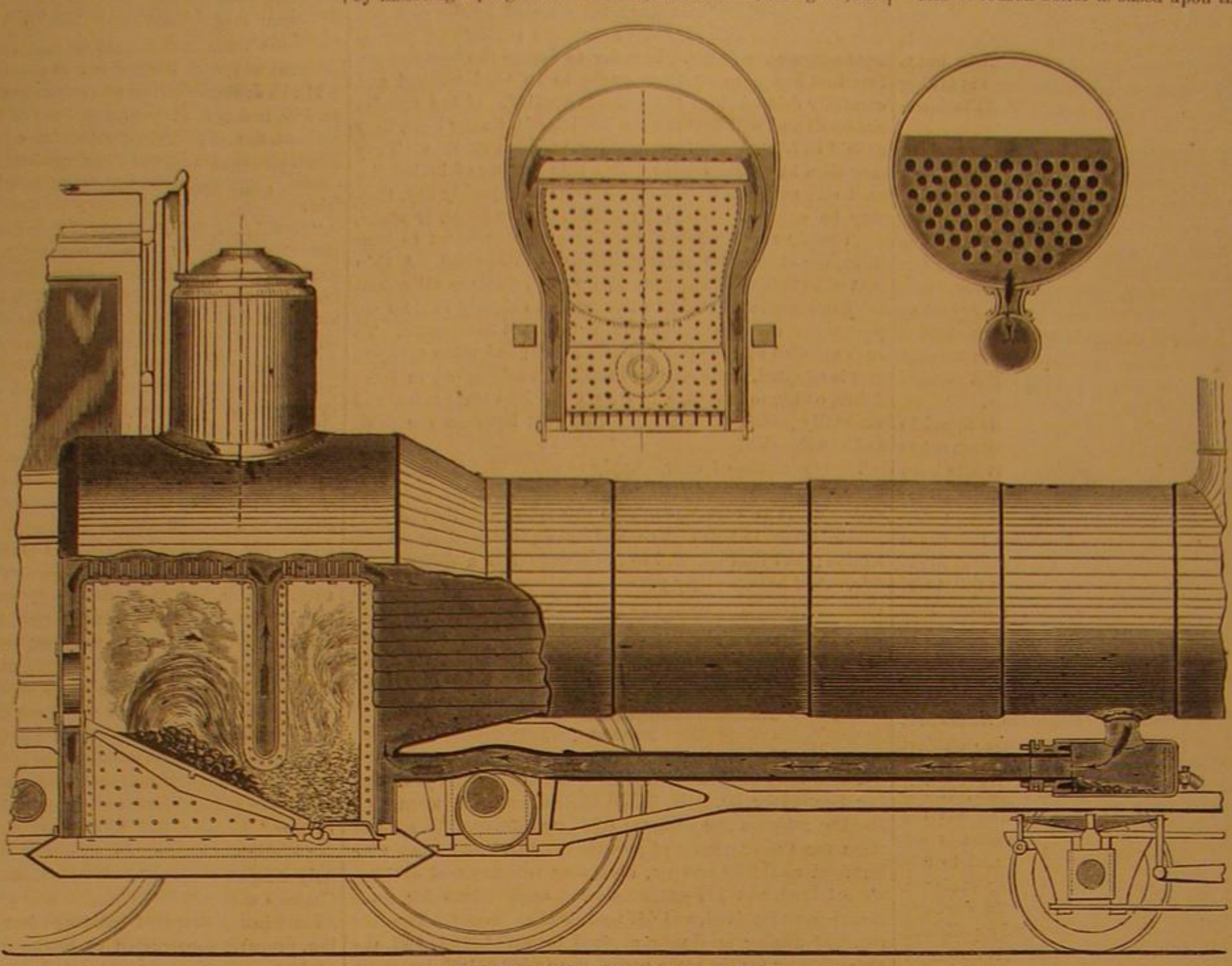
The dining rooms of Nero's golden house were ceiled in such a manner that the attendants could make it rain either flowers or liquid perfumes. At one feast 100,000 crowns were expended in perfumed waters." *Ewbank's Hydraulics*, p. 539.

And it is reasonable to suppose that the Romans extinguished flames in like manner.

"TIME IS MONEY;" do not throw it away, but make every day and every hour tell either for your growth, health, or profit.

Improved Steam Boiler.

The accompanying engravings illustrate a boiler invented by F. A. Woodson, and patented in the United States and England, and for which applications for patents are now pending in Russia, Prussia, Austria, France, Belgium, and Italy.



WOODSON'S STEAM BOILER.

To explain the principles which govern the construction of this boiler, it will be necessary to refer, as concisely as possible, to the laws which control the generation of steam in boilers. When steam is making in a boiler, and, as it is made, is passed off constantly to an engine, the demand being equal to the supply, there is constant motion in the water, arising, first, from the difference in the specific gravity of different portions of the water and the difference in the specific gravity of water and steam; and second, from the expansive force of the steam. The ebullition of water, under these circumstances, is principally due to the expansive force of the steam, generated more rapidly than it can quietly escape by virtue of its less specific gravity. If, under these circumstances, the throttle valve be closed, and the safety valve be kept shut, no ebullition, in the strict sense of the term, can take place; the circulation will then be decreased to that which takes place in water before it is heated to the boiling point. The expansive force of the steam being resisted, it permeates the water like carbonic acid gas in a soda fountain, until the water, becoming saturated, can hold no more. If now the fires be kept up, it is evident that, while the plates in contact with the water and steam continue to receive heat, the power to convey away the heat is greatly decreased, on account of the now almost checked circulation. The consequence is that a thin stratum of steam accumulates next the plates, and separates them from the water. This state of things has been styled *repulsion*, and is assigned as the cause of many destructive explosions. For as soon as this condition takes place, the plates get very hot, and the partial escape of the separating film of steam at once begins, with eruptive force through the stratum of water, the water descending with power enough to force it into contact with the over-heated plates, when the sudden production of steam causes another jump of the liquid, throwing it upward with great force, and, if not exploding the boiler, trying its strength far beyond the limit of safety, and producing symptoms of internal disturbance which are externally perceptible, and often alarming even to experienced engineers.

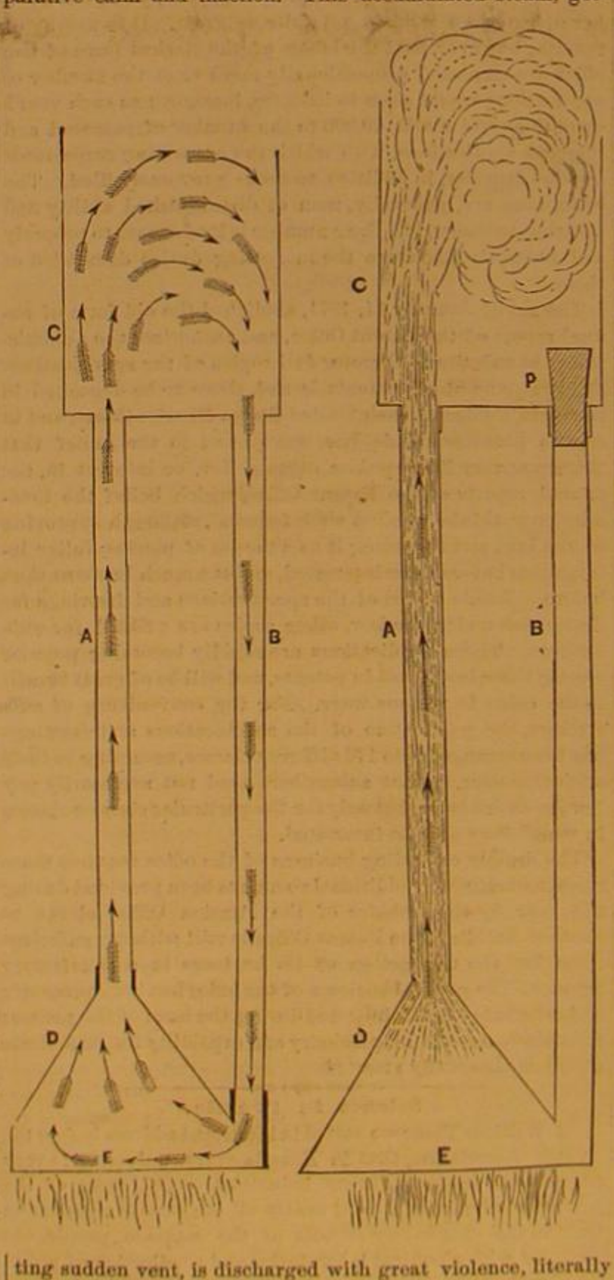
Again, when the circulation in a boiler is diametrical, it is common to find different parts of the boiler very unequally heated. Engineers are aware that it is often possible to draw water in which the hands may be washed from a boiler which is generating steam. Unequal heating causes unequal expansion, and this alone may often strain boilers so near to the point of rupture that the addition of a comparatively moderate steam pressure may complete their destruction.

The separation of the water from the plates, by a film of steam, may take place in a boiler which is delivering steam, whenever the boiler is so constructed that the heating surface makes steam faster that the latter can escape through and by the obstructions above it. The stratum of water may be too deep in proportion to its other dimensions, or the space may be obstructed by flues, diaphragms, or tubes, etc. It matters not what interferes with the circulation; without this we cannot have a quiet and safe generation of steam; and without uniform circulation throughout the boiler, we must have unequal expansion and the dangers that follow it.

This lifting of water, by the effort of steam to escape, is illustrated in the accompanying engraving, Fig. 2, of an apparatus described by C. Wye Williams, in his treatise on the "Combustion of Coal," page 142, from which we make the following quotation:

"The violence and intermittent action which ensues when separate channels or sufficient space is not available (in steam boilers) will be well illustrated in the following experiment: Fig. 84 represents two long glasses, each two inches wide by eighteen inches long, A and B, connected by means of a tin apparatus, C and D, at top and bottom, leaving the communication open above and below, the whole being suspended over a fire. On the heat being applied, a current of mixed steam and water will be seen ascending in one glass and descending in the other, as indicated by the arrows. There being here no confusion or collision, a state of things will be produced highly favorable to the generation of steam, the colder water finding easy and continued access to the heated bottom of the vessel at E.

"If the communication between the two glasses be cut off by inserting a plug in one of them, as seen at P, in Fig. 85, the circulation in the glass, B, will be suspended, and the previous uniform generation of steam will then be succeeded by an intermittent action—explosive violence alternating with comparative calm and inaction. This accumulated steam, get-



ting sudden vent, is discharged with great violence, literally emptying both the glasses and lower chamber.

"Here we see the true source of priming in boilers and a practical exemplification of at least one of the causes of explosions, which have lately become so frequent."

Unequal expansion is, without doubt, one of the causes of the rapid deterioration of boilers, which, upon inspection, have been passed as sound, and which explode subsequently, under circumstances which lead us to doubt the thoroughness of the inspection.

The Woodsen boiler is based upon the principle of uniform *longitudinal* circulation, whereby the steam is easily and constantly brought to the surface of the water with gradually and uniformly accumulating pressure, and the boiler is kept at nearly the same temperature throughout, thus avoiding the evils of unequal expansion, and securing the economy that results from quiet yet rapid circulation. The principle is applicable to all sorts of boilers, but the improvement is shown in our engraving as attached to a locomotive boiler. It consists, principally, in the attachment of a longitudinal pipe, six inches in diameter (more or less) below the boiler proper, and a mud drum, in which an eddy is formed which deposits all the sediment. The water passes from the end of the boiler remote from the furnace downward into the mud drum, thence onward to the water leg at the rear of the furnace, thence upward into the boiler, where it immediately commences to pass back from the furnace over the surface of the tubes, delivering its steam quietly along the route.

The passage of the water, through the pipe or "circulator," is more or less rapid, according to the heat which is generated in the furnace, but in all cases is rapid enough to change the entire body of water in a very short time.

The conflict between ascending and descending currents of water is thus avoided, the back end of the boiler is kept within a degree or two as hot as the end nearest the fire, and the impurities are all entrapped in the mud drum, from which they may at any time be conveniently removed.

From personal observation of one of these boilers, we can vouch for the rapidity and uniformity of the circulation, and the perfect separation of sediment. As to the economy, we have only the testimony of engineers and the statement of the inventor that he will guarantee the boilers to produce 12½ lbs. dry steam at 60 lbs. pressure, by the consumption of one pound of good bituminous coal. That it must be a very economical boiler we judge from general principles; but this amount of evaporation is so large that it is one of the things engineers must see to believe.

The inventor refers this large evaporative power partly to the improved circulation and partly to the construction of the furnace, by which he claims not only to coke the coal when it is first put in, but to wholly consume the combustible gases given off while coking, avoiding loss of fuel and of the heat which the unconsumed gases would otherwise carry away through the uptake.

It will be seen that the grate is inclined, the highest part being in front. The coal thus feeds backward automatically by its own gravity. A descending bridge wall, into the hollow interior of which water constantly flows, intercepts the gases and forms a sort of reverberatory furnace to which air is admitted in sufficient quantity to create perfect combustion.

The plates being thus more highly heated and being brought by the more perfect circulation into constant contact with the coolest water in the boiler, they impart their heat much more perfectly and rapidly, the rate of conduction being, according to Rankin (see page 263 of his work on "The Steam Engine"), "nearly proportional to the square of the difference of temperature, of the heated gases on one side of the plates and the water on the other. This the inventor claims as the principal source of the large evaporative power of the boiler.

In conclusion, we will say that we have formed a very favorable impression of this boiler from inspection of its working, and that it seems to give very much more control, over the uniform generation of steam and gradual accumulation of pressure in steam boilers, than is the case with most other kinds of boilers.

The Woodson Steam Boiler Company, Selma, Ala., or 243 Broadway, New York, may be addressed for rights to use or manufacture.

A Vermont man has established a steam toy factory at Nuremburg, Bavaria.

THE THAMES EMBANKMENT.

This celebrated structure, of which we this week present an excellent engraving, has many points of interest both to the engineer and the general reader. One result of its construction was the reclamation of the land lying between the present beautiful water front and the rear of the houses in Whitehall Place and Whitehall Gardens, London, including all that shown in the engraving between the buildings and the water front formed by the embankment, and which now forms a beautiful park.

The ground between the wall of masonry, that forms the frontage on the river and the buildings, is all made ground. Along the front, parallel to the wall, runs the Metropolitan Railway (underground), one depot being in the extreme background, facing the clock tower of the Houses of Parliament.

The statue in the center of the Park is that of General Sir James Outram, a distinguished soldier and statesman. The Nelson Monument in Trafalgar Square is seen at the extreme right of the picture.

A difficulty as to the title of the ground thus reclaimed arose between the general government and the Metropolitan Board of Works, the former claiming that the title should be vested in the Crown, and the latter that it should belong to the Board. The difficulty was adjusted by a compromise, in which the Board of Works leases the land from the Crown for the purposes of a public garden; so that the Crown derives a rental, and the public get the benefit of the park, as originally intended.

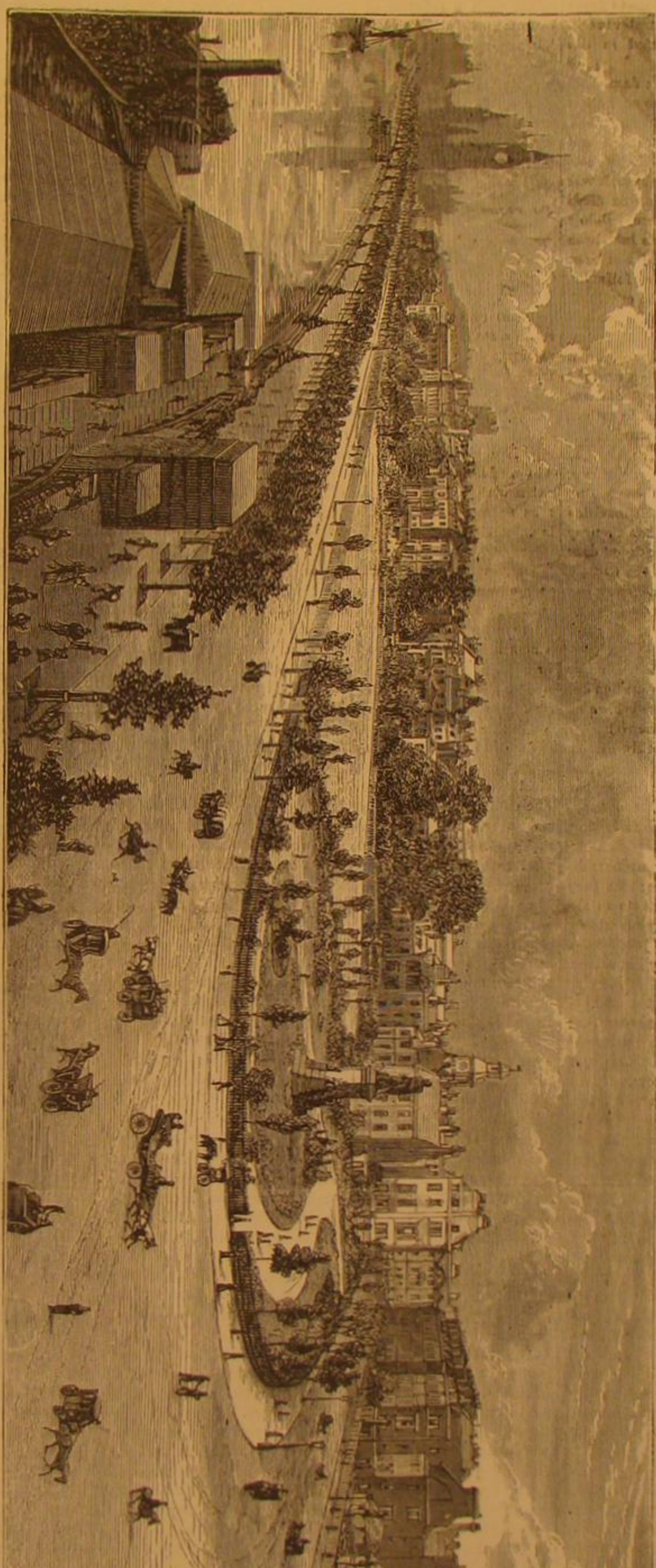
The work exacted some nice engineering skill for its performance. We cannot give our readers a better idea of its general character than by the abstract of a paper read, before the Institution of Civil Engineers at their first meeting of 1870, by Mr. Thomas Dawson Ridley, which follows. The paper read was a "Description of the Cofferdams used in the execution of No. 2 Contract of the Thames Embankment."

This contract extended from the landing pier at Waterloo Bridge to the eastern end of the Temple Gardens, a length of 1,970 feet. Mr. J. W. Bazalgette (M. Inst. C.E.), was the engineer-in-chief, and Mr. Edmund Cooper (M. Inst. C.E.), was the engineer; the author of this paper having charge of the works for the contractor.

The breadth reclaimed from the river by this portion of the embankment varied from 110 feet to 270 feet; the depth of water, when the tide was low in front of the wall, averaged 2 feet; and the rise of tide was 18 feet 6 inches. The borings showed the bed of the river to consist of sand and gravel, resting upon the London clay, at depths varying from 21·58 feet to 27·10 feet under low water mark, while the foundation of the wall was, in all cases, designed to be carried down to a depth of 14 feet under low water mark.

It devolved upon the contractor to design dams to the satisfaction of the engineer, who reserved to himself the power to adopt either caissons or cofferdams. The author considered that dams of timber and puddle would not only be cheaper, but could also be more expeditiously constructed, than iron caissons; and having succeeded in obtaining the engineer's sanction to one of the plans which he submitted, the work was begun.

The Temple Pier was the most important work in the contract, and it was therefore requisite to lay its foundation dry as soon as possible. To effect this, two short dams, one at each end of the pier, completely inclosing a short length of the river wall, were first begun. No. 1 was 111 feet 6 inches long by 25 feet broad, inside measure, and No. 2 was of similar breadth, but a few feet longer. These dams consisted of two rows of piles of whole timbers, averaging 13 inches square, with a clear space of 6 feet for puddle. The piles were from 40 feet to 46 feet in length, having cast iron shoes 70 lbs. in weight, and were driven 40 feet into the clay. Cast iron was used in preference to wrought iron for the shoes, as giving, at an equal cost, a much larger base for the timber to rest upon. Where the driving was difficult, shoes having cast iron bases and wrought iron straps were employed. The piles were secured by three rows of walings of whole timbers, 13 inches to 14 inches square, through which and passing through the puddle space, at distances of 6 feet 6 inches horizontally, were bolts, 2½ inches in diameter in the lower waling and 2 inches in diameter in the middle and upper walings. Cast iron washers, 9 inches in diameter and 2¾ inches thick, were used to distribute the pressure over a large surface of the walings. To avoid the difficulty of having to procure a number of long timbers, the piles were in a few cases only of the full length required, and the others, after being driven, had lengthened pieces fixed to them, so as to raise the dam to a hight of 4 feet above the high water line. Before proceeding with the construction of these two dams, the ground was not dredged, but in all the dams subsequently constructed, the sand and gravel were cleared off to the level of the clay before the piles were driven. Where the ground had not been dredged, great difficulty was experienced in driving the piles, and in the two dams in question one sixth of the whole number pitched, having shown symptoms of failure, were drawn. In all cases the piles so drawn were observed to have cast their shoes, and their lower extremities were usually bruised into a mass of tangled shreds. The failure generally occurred when the piles were passing through a bed of compact sand, resting upon coarse open gravel. Beneath the gravel, and resting upon the clay, was a layer of septaria, which offered a serious impediment to the passage of the piles; but when once the clay was reached, the driving was comparatively easy. The space between the piles was dredged to the level of the clay and filled with well tempered puddle. The transverse struts, of which there was a tier to each waling, were of whole timbers, 8 feet apart in the length of the dam.


THE THAMES RIVER EMBANKMENT, LONDON, ENGLAND.

Simultaneously with the construction of these dams, the filling in of the space behind the Temple Pier was going on, the line of the dam was being dredged, and the driving of the piles begun. The Temple Pier, 470 feet in length, was irregular in outline, projecting in some parts upwards of 30 feet in advance of the river wall, and the breadth across the foundation trench in the center part was 57 feet. To avoid the necessity of having to use a large number of struts of such great length, this dam was strengthened by means of buttresses of piles, somewhat similar to those used in the cofferdams constructed for the Grimsby Docks. These buttresses were placed at intervals of 20 feet, and were backed up by struts extending across the foundation of the pier. The scantlings of the timber and the sizes of the bolts in this dam were similar to those in dams Nos. 1 and 2, the walings only being a little stouter, averaging 14 inches square.

Before No. 3 dam was completed, No. 4 dam was begun, and was followed by dams Nos. 5 and 6. In these and in all the dams, except No. 3, the inner row of piles was placed so as to coincide with the riverward face of the concrete in the foundation trench. The piles, walings, and bolts of these dams were similar to those in dams Nos. 1, 2, and 3; but the shoring was of a different character. Across the breadth of the wall the struts were all horizontal, and abutted against walings of whole timbers, bolted to pairs of piles, driven into the solid ground behind the foundation of the wall. These coupled piles were placed at distances of 18 feet apart from center to center, and were further supported by three back struts to each pair, two of which were horizontal and one raking. These struts abutted against piles driven into the slope of the filling material, and backed up with rubble stones. From the lower waling to the bottom of the trench, or to the solid ground, the space in all the dams was filled up with clay, or with a mixture of clay and gravel, to give further stability to the dam, and to assist the lower bolts to resist the pressure of the puddle. Sluices of 4½ inches elm plank, and having hinged flaps, were inserted in each dam through the piles and puddle at the level of the lower waling. For dams Nos 1 and 2 these sluices were 8x8 inches, internal cross section. In the Temple Pier dam, there were two sluices, 3 feet high and 1 foot wide, and for each of the other dams there was one sluice of similar section. In the Temple Pier dam, two iron cylinders, 8 feet in diameter, were sunk to a depth of 4 feet below the lowest level of the foundation for pump wells, and in each of the other dams one such cylinder was sunk. The volume of water, filled out of the Temple Pier dam, varied from 620 gallons to 1200 gallons a minute, according as a less or a greater area of the foundation was exposed; but in all the other dams there was much less water to be pumped. As soon as the walls in any of the dams had been raised 6 feet above low water mark, no further pumping was needed, as the water which gathered when the tide was high was passed through sluices at low water. Murray's chain pumps were used in all cases, and were found to be very efficacious.

In the cofferdams there was usually a frequent settlement of the puddle, producing channels underneath the bolts, and a consequent leakage. In such cases holes were bored, with a 3 inch auger, through the inner row of piles, immediately below the tie bolts, and pellets of clay were driven through these into the puddle until the leakage was subdued.

When the dams had served their purpose, it became necessary to clear them away, and before the completion of the whole series, the removal of those first constructed had been begun. The piles in front of the ordinary wall were cut off at a level of 3 feet under low water mark, and those in front of the Temple Pier at a level of 7 feet under low water mark. The removal of the piles and puddle was effected in the following manner:

Upon the tops of the piles of each side of the dam half beams were fixed, and upon these rails were laid so as to form a road, upon which the steam cranes and dredging machines, to be used in the removal of the puddle, could travel, and upon which the pile cutter could also be moved. These machines were successively placed in position, and the work was begun. For the first 15 feet in depth, the puddle was filled into skips and hoisted by means of steam cranes. Below that depth, it was dredged by the machines which had been used for excavating the trench. When the puddle had been cleared away to the requisite depth, the pile cutter followed and performed its part of the work. This machine consisted of a platform upon a stout frame, resting upon four wheels which traveled upon the rails before mentioned, and carrying a steam engine with the requisite machinery for driving a circular saw, which was fixed at the lower end of an upright spindle, and adjusted to the proper level. The spindle was placed between the two rows of piles, and revolved in guides at the end of movable arms, so arranged that it would shift to either side of the dam by turning a handle, and by the same motion it could be pressed towards the pile, which was being operated upon, until it was severed by the saw. Two piles were usually cut off on each side before the machine required to be moved backward on the rails. When the way was clear for the pile cutter, and a sufficient length of dam dredged, sixty piles could be cut off in a day; but the excavators could not keep pace with the pile cutter, and the average number of piles actually cut off did not exceed thirty.

A Chance for an Inventor.

The *American Builder* for December, published by Charles D. Lakey, 190 South Sangamon Street, Chicago, appears on our table as fresh and beautiful as though there had been no fire and no wholesale destruction of the appliances by the aid of which it was formerly issued. This monthly has always been one of the most welcome of our exchanges, and we congratulate its editors upon the vitality of an enterprise that could sustain such a shock and still survive. As a specimen of the many good things in it, we extract the following, under the title given above:

"Our inventors seem always happy in getting up new devices for churns, washing machines, and the like; but they seldom trouble their heads about any improvements in the art of building. Architects never invent. They invariably follow in the path of precedent, and are happy just in the ratio that they succeed in doing things as they have been done by others.

"If inventors would examine into our present system of building, with a view to making needful improvements, they would put money in their purses. Just now, we need some method for protecting warehouse windows; a system, too, which shall guarantee the closing of iron shutters, and not the leaving of them open one night in the year, and that night the one when the fire comes. Then, too, we want the street fronts protected by these iron shutters; and they are so unsightly that it can be done by no ordinary method. Here, then, is a plan; and the first man who gets ready the papers can secure the patent:

"Let plain iron shutters (cast iron of sufficient thickness will answer) be constructed and placed in the brick work, which is to be so laid that the shutters shall slide laterally. Arrange for the construction of a series of shafting while the building is going up, which shall be worked from the engine that is used for hoisting. When the store is closed for the night, the engineer, by the simple action of a lever, draws a solid sheet of iron over every outside window and doorway, save the one by which he leaves the building. Such a building, with a roof of stone, concrete or iron—providing the architect has not loaded the cornices with wood—might be considered nearly proof against fire from the outside.'

A Fireproof Man.

About the year 1869, one Lionetto, a Spaniard, (writes a French chemist,) astonished not only the ignorant, but chemists and other men of science, in France, Germany, Italy, and England, by the impunity with which he handled red hot iron and molten lead, drank boiling oil, and performed other feats equally miraculous. While he was at Naples, he attracted the notice of Professor Sementeni, who narrowly watched all his operations, and endeavored to discover his secret He observed, in the first place, that, when Lionetto applied a piece of red hot iron to his hair, dense fumes immediately rose from it, and the same occurred when he touched his foot with the iron. He also saw him place a rod of iron, nearly red hot, between his teeth, without burning himself, drink the third of a teaspoonful of boiling oil, and, taking up molten lead with his fingers, place it on his tongue without apparent inconvenience. Sementeni's efforts, after performing several experiments upon himself, were finally crowned with success. He found that by friction with sulphuric acid diluted with water, the skin might be made insensible to the action of the heat of red hot iron; a solution of alum, evaporated until it became spongy, appeared to be more effectual in these frictions. After having rubbed the parts which were thus rendered, in some degree, insensible, with hard soap, he discovered, on the application of hot iron, that their insensibility was increased. He then determined on again rubbing the parts with soap, and after this found that the hot iron not only occasioned no pain, but that it actually did not burn the hair. Being thus far satisfied, the Professor applied hard soap to his tongue until it became insensible to the heat of the iron; and having placed an ointment, composed of soap mixed with a solution of alum, upon it, boiling oil did not burn it; while the oil remained on the tongue, a slight hissing was heard, similar to that of hot iron when thrust into water; the oil soon cooled, and might then be swallowed without danger. Several scientific men have since, it is said, successfully repeated the experiments of Professor Sementeni, but we would not recommend any but professionals to try the experiments.

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

To Smoke or not to Smoke.

To the Editor of the Scientific American:

The problem: if one drop of nicotin kills a rabbit in three minutes and a half, how many cigars must a man smoke to reach a state of locomotorataxy, reminds me of another arithmetical query no less profound, to wit: If eight shillings make one dollar, how much milk does it require to make a pair of stockings for an elephant?

The mere fact that nicotin is a poison for one species of animals is no proof of its similar effect on all others. I could quote an endless line of examples in favor of this assertion. Thus, *phellandrium aquaticum* is fatal to horses, but may be eaten with impunity by oxen; *doronicum* kills dogs, but fattens antelopes, thrushes, and swallows; the *cocculus indicus* is deleterious to fish and lice, but a salutary ingredient in the best London porter.

But, even granted that tobacco contains matter poisonous to the human system, let me ask what does not? Pôtatoes, cereals, and, in fact, nearly all vegetables, contain alcohol or other matter, which, if taken alone or in overdose, may kill a man in two minutes and a quarter. Even the very air we breathe is replete with nitrogen and other deadly gases which the anti-smoker would do well to avoid. The mere proof, therefore, that the extract of tobacco is a poison should not suffice as a conclusive argument against its use. It is stated that tobacco reduces the vital energy of the system. It may as well be said that nothing draws so much on the vital powers as the hewing of trees or plowing of fields. Such labor virtually tends to exhaust the system; but does not nature, when properly sustained by food and rest, amply repay the outlay? Does not just this exhaustive practice tend to build up a stock of iron nerve and muscle? The same with mental labor. Nothing so draws on the brain as the continuous and active production of ideas; still nothing will make a more powerful mind than just such exhaustive production, if sustained by food and rest. Therefore tobacco can safely be considered a benefactor in the same line as muscular or mental activity. It partially reduces the system only to give nature an opportunity to replenish with opulence. This argument is of course only applicable to healthy persons. Invalids should apply to their medical advisers, even such invalids whose disease consists in lack of courage to withdraw their minds from the molds wherein they were originally cast.

Now let us observe the practical application of the weed: Germans are said to be the greatest smokers; cigars are drawn among the regular rations by their soldiers. And where do you find more powerful men, both mentally and bodily, than in the land of Humboldt and Bismarck? While, on the other hand, the fact that the Chinese and Shakers do not smoke does not speak much in favor of total abstinence.

Nevertheless I would advocate the discharge of that inverted distilling apparatus, the pipe, which, unless kept scrupulously clean, that is, used just for one smoke, appears the filthiest thing on record, the chewer's palate always excepted.

Your statement, Mr. Editor, that you are always willing to give room to both views of a question, makes me bold in submitting mine to your consideration. I would earnestly warn against a too narrow view of any subject. This is no longer the day for the supremacy of any one abstract science. All the exploits of thought should be used in determining our difficult problems. We only heard the doctors thus far. Let us know what the laymen have to say. At any rate, I must personally protest against your concluding sentence, for should I ever see fit to smoke, I will do so deliberately, neither thinking myself a hypocrite, a corrupt man, nor a fool.

V. B.

Influence of the Moon on Timber.

To the Editor of the Scientific American:

In the Scientific American of September 3, 1870, on page 148, I wrote an article on "Moon Fallacies," and asserted that if hickory timber be cut, say three or four days after a full moon, that the worms would devour it; and that if the same kind of wood be cut, say three or four days after a new moon, the worms would not touch it; and I invited some of your country correspondents to give the matter a trial, and report the result. D. E. S., of Oneida, N. Y., claims to have tried it, and in the Scientific American of April 15, 1871, on page 244, his report is that "the piece of hickory cut in the full of the moon shows no indication of being worm eaten." He says: "at the end of another six months, I will again report."

On page 228 of the Scientific American, October 7, 1871, D. E. S., writing from Wallingford, Conn., makes another report on the sticks cut by him. He says: "It is now over a year since I cut two hickory sticks, three days after a full moon, marked them, and placed one in the ground out of doors, and the other in an old garret. Three days after the next new moon, I cut two more sticks, similar to the first, marked them, and placed them beside the first. I send you a section of each, properly marked, by which you will see there is no perceptible difference between those cut in the old, and those cut in the new, of the moon." You add: "the specimens show no difference, and we regard the experiment as conclusive."

After reading the article written by D. E. S. last April, I concluded to give the matter a trial myself; accordingly, on the 9th of May, 1871, four days after a full moon, I cut two sticks of white hickory, marked them, and laid them up in a dry loft; and on the 24th of May, 1871, four days after the next new moon, I cut two sticks of white hickory, similar to the first, marked them, and placed them with the two cut on the 9th. It is now six months since the sticks alluded to were cut, and I send you a section of each. You will find that those cut in the old of the moon, or four days after the full, are so badly worm eaten as to render them almost useless for anything but fuel; whilst those cut in the new of the moon, or four days after a new moon, are sound, hard and dry.

As I stated in my first article; I do not know, or pretend to argue, that the moon exerts this influence, yet it is quite evident that there is a right and a wrong time to cut timber; and so far as I know, we can only be governed by the phases of the moon as to the proper time.

In cutting hickory in the old and new of the moon, the differences, of which I speak, will be perceptible in a shorter time where the wood is cut while full of sap, or while the leaves are on the trees. I feel satisfied that the sticks cut by D. E. S. will show a perceptible difference in the course of time.

This question, of a proper time to cut timber, is a matter of great importance to all who work in timber, either in manufacturing, or using it for posts or building material.

In volume XXV, No. 22, November 25, page 346, in query No. 6, S. F. says he is engaged in a business where he uses hickory, and wants a "simple preventive for worms in hickory." If he will observe the rule I have given about cutting his timber, he will have no trouble, namely: commence cutting white hickory about three days after a new moon, and cut to within about four days before the next full moon. I have never tried this test on "red hickory," (which may be the kind D. E. S. experimented on).

The whole subject is worthy the attention of scientific men; perhaps by further experiments and observation, the true solution may be arrived at; and if the moon *does not* exert this influence on the durability of timber, the true cause may be ascertained.

Cincinnati, O., November 28, 1871. D. A. M.

[The samples sent are as described by our correspondent. The two sticks cut four days after the full of the moon are very badly worm eaten, while the others show no signs of attack. The experiment of our former correspondent, D. E. S., showed no difference in this respect between timber cut shortly after the new and the full of the moon. That this proves the moon has nothing to do with the worms, seems still conclusive to us. If further experiments are to be performed, we advise that many specimens be subjected to trial, instead of making the comparison between two or four. The average result of such an experiment would be a far more reliable indication than can be obtained from so small a number of specimens.—Eds.

Curious Freak of Twin Steam Boilers.

To the Editor of the Scientific American:

I notice the communication of H. P. S. on page 356, current volume of your paper, and now submit the following:

Judging from the description given by him of his boilers, and the manner of setting them, also their feed water and steam connections, I assure him he has a most dangerous arrangement.

In his description, he asserts that even firing is maintained under both boilers at all times, and yet the same water level cannot be maintained in them—that the water level will rise and fall two and even three gages at regular intervals, first in one and then in the other boiler.

Now in regard to uniform firing, it is a feat impossible, even where both boilers are set in one arch and over the same fire, and it must become more difficult when set in separate arches, as in his case. The opening of the fire or furnace doors and the addition of fresh fuel cause a temporary change of the steam generating power of the fires—which change alone would be sufficient to produce the results mentioned, when considered in connection with his descriptions and surrounding circumstances.

The steam pipes leading from his boilers are too small in capacity by fully one half; and the two opposite currents of steam, meeting at the T, and the right angular turn of these united currents with no larger pipes, produce a great reaction and resistance to the steam, which would be avoided by using a steam drum of considerable capacity in place of the T, and taking it thence to the engine by a pipe of double capacity.

As his water supply is admitted to the boilers through the same sized pipes as are used for the outlet of steam from them, and as the water in passing into or from the boilers has neither counter currents, contractions or short angles to overcome, it follows that the water in each boiler will more readily pass from one boiler to the other than the steam through its several obstructions; and consequently any increased pressure, caused by the temporary variation of the energy of the fire under such boiler, will cause the water in said boiler to pass with great rapidity to the other boiler, as described by him. As to any regular intervals between such changes, I think his remedy, of opening the furnace and connecting doors of the empty boiler to lessen the generation of steam and pressure therein, indicates the cause and cure, and is the direct result of uneven firing or generation of steam; and consequently regular intervals between the changes could not well occur.

The small steam space in his boilers, together with the too small, interrupted, and contracted steam outlets, would cause the pressure within either boiler to rise or fall several pounds to the square inch almost instantly, with even slight changes in the generation of steam.

As the pressure of a column of water one foot in hight is only half a pound to the square inch, it follows that an excess, of so little as half a pound in pressure to the square inch of steam in one boiler over the other, would be sufficient to force the water from it to the other until the water level would stand one foot lower in the hotter boiler than in the other; while an excess of one pound pressure would make a difference of two feet in the water level in the two boilers.

REMEDY.—All water feed pipes to boilers should have a check valve as near the entrance to the boiler as possible.

When two or more boilers are to be fed from one source or pump and from the same pipe leading therefrom, each boiler should have its branch from such pipe, and a stop cock, in addition to the check valve in such branch. This effectually controls the flow of the water to each separate boiler and prevents the return from it.

The steam connections from the boilers should be of at least double the capacity for such sized boilers. When two or more such boilers are used together, their steam pipes should conduct the steam to a drum at least equivalent to three or four cubic feet capacity for each such boiler. The steam to be taken from the upper side of such drum to the engine, etc., by a pipe larger than or of a capacity equal to that of all the pipes leading to the said drum combined.

Safety valves as well as pressure gages should be attached directly to each separate boiler, and never to the steam drum nor to pipes conveying steam from the boilers.

With these precautions and directions adopted by your correspondent, all further trouble will be avoided in his own case as well with the other houses alluded to by him.

Albany, N. Y. HORACE L. EMERY.

Ants in Sugar.

To the Editor of the Scientific American:

More than the usual quantity of sugar was recently purchased for my family; and the surplus, above what the wooden box used to keep it in would hold, was put into a paper one, and placed by its side on the same shelf. Black and brown ants had always troubled us, but none of them entered the paper box, which they could have done if so disposed. I sought for but found no reason. Finally, I tried the experiment of keeping it all in paper boxes or bags, and for three years have had no trouble, as formerly, with ants in the sugar boxes. I do not claim to give or any reason; but such are the facts.

Northampton, Mass. M. L. KIDDER.

[For the Scientific American.]

REMARKABLE RELATION BETWEEN THE SPECIFIC HEAT AND THE ATOMIC WEIGHT.

BY P. H. VANDER WEYDE.

Dulong and Petit were the first who, in 1819, pointed out the curious fact that, when the numbers representing the specific heat of elementary substances were multiplied with those representing their atomic weights or chemical equivalents, products are obtained, which are equal to within a small fraction. So taking the specific heat of the substances mentioned, and multiplying it with their atomic weights, we obtain the following table:

Elementary substance.	Specific heat.	Atomic weight.	Product of number of the two former columns.
Mercury	0·033	100	3·3
Gold	0·032	98	3·13
Silver	0·057	54	3·07
Copper	0·095	32	3·04
Iron	0·11	28	3·08
Sulphur	0·2	16	3·2

If the value of atomic weights of many substances are doubled, as for good reasons is done at the present day, the products are of course also double that given in this table and all approximately =6, in place of nearly =3, as is here found to be the case.

A similar relation to that which Dulong and Petit discovered for the elementary substances was found by Neuman in 1831 for compounds; for instance, in case of sulphates and carbonates, he found for the following minerals:

Mineralogical name.	Chemical name.	Specific heat.	Atomic weight.	Product.
Anhydrite	Sulphate of Lime	0·185	68	12·6
Cœlestin	" Strontia	0·135	92	12·4
Heavy spar	" Baryta	0·108	116	12·5
Lead vitriol	" Lead	0·085	151	12·8
Iceland Spar	Carbonate of Lime	0·204	50	10·2
Iron spar	" Iron	0·182	58	10·5
Zinc spar	" Zinc	0·171	62·6	10·7
Witherite	" Baryta	0·107	98·5	10·5
White lead ore	" Lead	0·081	133·5	10·8
Strontianite	" Strontia	0·144	73·8	10·6

Two questions suggest themselves from the above details in every philosophically inclined mind. First: Are these coincidences merely accidental? Secondly: If not accidental, what do they mean? Is there some natural law at the bottom of these remarkable relations?

In regard to the first question, it must be remarked that the law appears quite general, and the exceptions very few, therefore accident is out of the question; besides, the small differences in the products are easily accounted for by the fact that the specific heats differ at different temperatures, and for different physical conditions of the substances under investigation; while it is very significant that, in proportion as the experiments were made more carefully, the numbers calculated became more and more equal, as Regnault has pointed out.

In regard to the second question, as to the cause of this peculiarity, we have only to recall the numbers given on page 372, which show that 30 lb. mercury, 17 silver, 10·5 copper, 8·75 iron and 5 sulphur possess at the same temperature the same amounts of heat; and to remark that these numbers are very nearly in proportion to one another as the respective atomic weights of the substances, 100, 54, 32, 28, and 16. As now these numbers express the combining equivalents, so that, for instance, 100 lb. of mercury will combine with 16 of sulphur and form vermillion, and as we have reason to suppose that, in this case, like in others, each atom of mercury combines with an atom of sulphur, it is more than probable that 100 lb. of mercury contains as many atoms as 16 lb. of sulphur. If the number of atoms in these two quantities of mercury and sulphur is the same, and the amounts of specific heat the same, it is clear *that all atoms must possess the same specific heat.* This, now, is the law which lies at the foundation of the remarkable property explained.

When applying the modern theory, that heat is only a mode of motion, to the fact that all single atoms possess the same specific heat, it follows that it takes the same motion producing force, to increase the atomic oscillation (that means, raise the temperature) of every atom, be it mercury, sulphur, iron or any other substance of this series of elementary substances; and that it takes a greater force (more heat) to increase the oscillation of the compound atom of a carbonate, and still more of a sulphate, etc.

"When these bodies lose their heat," means, in the modern language of the conservation of force, nothing but that they communicate their atomic motion (oscillating or otherwise) to the atoms of the surrounding bodies, and put them in the same motion as they possess themselves, losing an equal amount of their own motion. Or conditions may be so arranged that this atomic motion (heat) is changed into motion of masses, commonly called force; of this arrangement, the steam engine is the great type and example for further development.

Compound Engines in the Navy.

Mr. J. W. King, Chief of the Bureau of Steam Engineering United States Navy, recommends in his report that "all naval engines now in store be sold, and that all our naval vessels be supplied with compound engines." Almost every engineer has his preferences in favor of some particular engine. Isherwood had his, and so had Dickerson and Ericsson. Of course, the hobby each one happens to be riding is considered the best horse, and so a series of costly experiments and changes and repairs are undertaken, for which the country pay and the service is but little, if any better off. Our navy wants the best engines and also the most economical, since frigates cannot tow a coal yard around with them. But changes should only be made after a series of successful experiments demonstrates the fallacy of the rule that "the old way is the safest." Commenting on Mr. King's remarks, the *National Gazette* says: "Until something more definite and satisfactory is known in relation to this type of engine, we think it would be a false economy to introduce them by wholesale into our naval vessels. We see no objection to having one or two experimental sets of compound engines built for the navy, but to make such a sweeping change as recommended by Mr. King is impolitic and unwise. The truth is that compound engines are by no means as economical as their admirers would have us believe. An engineer who is running one of them at the present time, in a large transatlantic steamer, informs us that he would like to have the difference of the price of coal said to be consumed each voyage and what is actually paid for and consumed. Compound engines were given a fair test on our lakes and rivers a quarter of a century ago, and did not prove a success."

Heath's Improved Steam Engines.

This invention relates to an improved arrangement of steam chests, ports, and valves, having for its object to balance the valve as evenly as possible, shorten the steam passages, enlarge the area of the ports without correspondingly enlarging the waste of steam in the ports, and to provide for jacketing the cylinder more readily than can now be done. The steam chest surrounds the cylinder, and annular valves work, between the cylinder and the steam chest, on ports at each end of the cylinder, admitting the steam from the space between the rings or valves, and exhausting into the jacket behind the rings or between the rings and the end of the jacket.

The outer surface of the steam cylinder and the inner surface of the steam chest are turned up truly for the pistons to fit between them steam tight, and the pistons are fitted with metal packing rings. The pistons are composed of a solid ring, preferably made in two parts, and bolted together tightly, so that steam cannot pass from one face to another, both the outer and the inner faces being recessed to provide space for the packing rings. As the steam might force the packing rings in the inner face of the piston backward to the bottom of the recess when passing over the ports, at which time there is a direct pressure on the rings, holes are made in the rings to admit steam behind them and balance their pressure. This arrangement of the engine admits of the application of a jacket more easily and better than when a square steam jacket is arranged on the side of the cylinder, which greatly interferes with the fitting of the jacket. The steam chest cylinder and the steam cylinder may be formed in one casting, proper stays being formed to connect them together between the parts where the valves work; or they may be cast separately and connected by the heads, if preferred.

But little steam is lost by the amount contained in the ports so as not be effective, for the steam cylinder ports are very short, being only equal to the thickness of the cylinder, which need not be thick, as it is constantly exposed to steam pressure at the outside.

Arden A. Heath, of Mercer, Pa., is the inventor of this improvement.

Ice Houses.

This being the season for storing ice, we would call attention to what is known as the "Stevens plan" for erecting a cheap house and storing ice, from *Hall's Journal of Health* for December:

"For one family, make a house twelve feet each way, by setting twelve posts in the ground, three on a side; board it up, eight feet high, on the inside, so that the weight of the ice shall not press the boards outward; dig out the dirt inside, six inches deep, and lay down twelve inches of sawdust; pack the ice in a pile nine feet each way, filling the space of eighteen inches between the ice and the boards with sawdust or tan bark, with the same thickness on top; make an old fashioned board roof, leaving the space above the ice open for ventilation. Have a small entrance on the north side of the roof.

"If the ice house can be located on the north side of a hill, and a small stream of water introduced slowly through the roof, on a very cold day, so as to make its way between the pieces of ice, the whole mass will freeze solid; or a pile of snow could thus be made into solid ice, and would last from one winter to another."

The Effect of a Grain of Strychnine.

A man in Harrisburgh recently attempted to commit suicide by taking a grain of strychnine. The skill of his physician having saved his life, he narrates his experience for the benefit of science. He says:

"In the course of five minutes I began to feel slight cramps in the calves of my legs. The cramps increased in intensity and extended to the feet and thighs, causing the most intense pain. I attempted to rise from the chair, but fell to the floor with convulsions in the lower extremities. Unsuccessful attempts were made to bathe my feet in hot water, each effort to raise me bringing on violent paroxysms, in the last one of which I thought my jaws had become unhinged. I was now perfectly paralyzed from the hips down, and suffering the most excruciating pains, which began to extend upwards; the muscles of the shoulders and neck were soon considerably convulsed, the forearms still being free from pain.

"I now prepared for the final struggle, which I knew must be near at hand, as I had become rigid from the neck down, save the forearms. The convulsions of the muscles were becoming fearful, and the torture awful to endure. My hands were drawn in to my sides, with the fingers drawn apart, and slightly bowed, and the jaws became rigid. I felt myself raised as if by some mighty power, and fixed immovably, with only my feet and head touching anything. I became unconscious of everything except my own agony, which was now beyond all description. I could feel my heart fluttering, and my brain beating and throbbing with an irregular motion, as though at every beat it would burst from its confinement. Every joint was locked, and every drop of blood seemed stagnated. I remember thinking it could not long be thus, when I must have lost consciousness.

"I remember nothing more until I felt a sensation of relief, as though the garments of death, which had been drawn over me, were being drawn back. Those terrible cramps seemed to be descending towards my lower limbs. A feeling of relief stole over me, and I began to be again conscious.

"From that time I resumed consciousness, when I was entirely free from cramps, with the exception of a little in the feet. I had but one attack of cramps afterwards, which was immediately relieved by a dose administered by my wife—the doctor having left for a short time—and when he returned, I felt that the poison was completely neutralized."

Snakes and Tigers in India.

We need not wonder at the eagerness, says the *Chemist and Druggist*, with which physicians and authorities in India examine every new remedy put forth as an antidote to the poison of a snake bite, when we learn that in British India, including British Burmah, the deaths from snake bite during the past three years amount to 25,664. This statement appears in an official report published in the *Gazette of India*. From that report, we also learn that during the same period the deaths resulting from the attacks of all kinds of wild beasts in the same area numbered 12,554. The snakes killed more than twice as many as were slain by the tigers and all the other fierce forest rangers put together. Truly the serpent is still "more subtle than the beasts of the field."

WHAT sunshine is to flowers, smiles are to humanity. They are but trifles, to be sure, but, scattered along life's pathway, the good they do is inconceivable. A smile, accompanied by a kind word, has been known to reclaim a poor outcast, and change the whole current of a human life. Of all life's blessings none are cheaper, or more easily dispensed, than smiles. Then let us not be too chary of them, but scatter them freely as we go; for life is too short to be frowned away.

Improved Steam Heating Apparatus.

The accompanying engraving represents the steam heating apparatus, patented July 18, 1871, by F. H. Pulsifer and Wm. C. Wheeler, of Baltimore, Md.

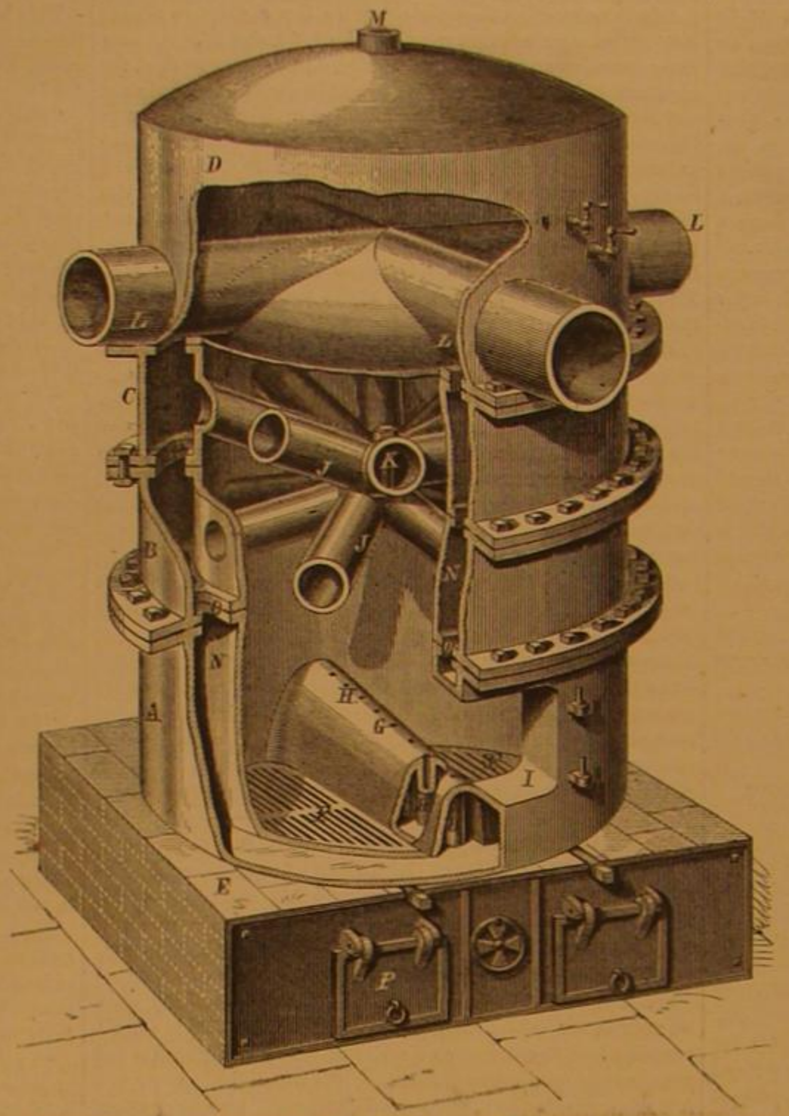
A B C D represents the outer shell, made in four sections and bolted together. The lower section, A, rests upon the brick ash pit, E, and is provided with a grate, F, separated by the hollow partition, G, inclined as shown. Through this partition is cast a number of tubes, H, for the passage of air to the fires, thereby producing a more perfect combustion of the fuel. By means of this partition two separate fires may be made, and, if preferred, only one grate or side may be used, thereby saving one half the amount of fuel. In this section is arranged the furnace door, I, which is of the ordinary construction. The sections, B and C, are provided with eight pipes or tubes, J (through which the water circulates), inclining and joining in the center, and bolted together through the center by the bolt, K. A water space is thus left all around the tubes.

In the engraving two of the sections, with flues or tubes, are shown; but for a larger boiler, as many sections as desired can be used. The pipes, J, in each section, may be set around or advanced, as shown in the engraving, thereby obtaining a greater heating surface.

In the top section, D, forming the dome or steam drum, are arranged four flues or pipes, L, running at right angles to each other, thereby obviating the necessity of elbows as heretofore used. M is the steam pipe connection. The sections are all connected between the inner and outer shell, forming the water space, N, by the openings, O. The front of the ash pit is of cast iron, and is fitted with ash pit doors, P. The advantages claimed for this apparatus over others heretofore used are, that a better circulation of the water is obtained, as well as a greater amount of heating surface; the water, being in the hollow partition in close proximity with the fire, is sooner heated, and, if desired, only one of the fires may be lighted, thereby saving one half of the fuel. A more perfect combustion of the fuel is also claimed; the outlets or escape flues having no elbows, the smoke is sooner got rid of; by bolting the pipes together in the center, greater strength is given the boiler. And it is claimed that, by including the tubes, they are not so liable to be cracked or broken in contraction or expansion, nor to hold the sediment contained in the water. And by arranging the tubes or pipes, as shown in the engraving, all the heat passing from the furnace or fire must come in contact with some portion of the heating surface, before passing out to the chimney.

The boiler is designed not only for heating but for other purposes.

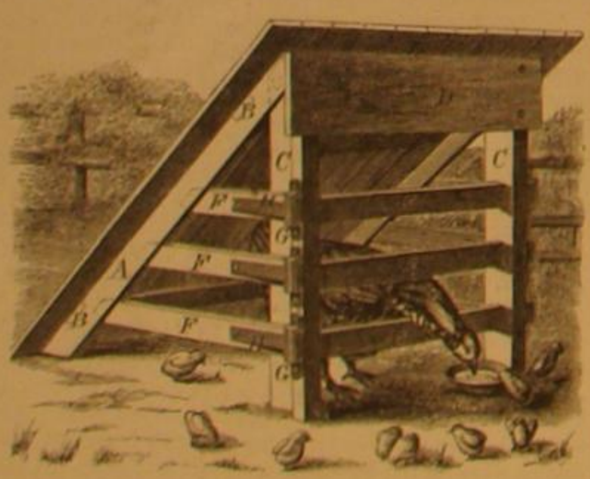
For further information or for purchase of State rights, address Frank H. Pulsifer, Milwaukee, Wis., or Wm. C. Wheeler, 679 Lexington street, Baltimore, Md.



PULSIFER & WHEELER'S STEAM HEATING APPARATUS.

WILCOX'S FOLDING HENCOOP.

To raisers of poultry and farmers in general, the invention we herewith illustrate will possess interest. It is a folding chicken coop, which may be closed together in small space for storage or transportation, and is constructed as follows:



The inclined bars, A, are held parallel to each other by crossbars, B, which, with the inclined bars, support the roof. To the upper ends of the bars, A, are pivoted the uprights, C. The latter are rabbeted on the outside, so that when the coop is folded they partly overlap the bars, A, as shown in detail at the bottom of the engraving. To the outer sides of the upper ends of the bars, C, is attached a board, D, the ends of which project and rest against the ends of the bars, A, as shown.

The edge of the board, E, and the ends of the bars, C, as also the edges of the shoulders of the bars, C, are beveled off so that the coop may stand firmly when set up.

To the bars, C, and at a proper distance from each other, are attached crossbars, E. The side bars, F, are slid in through keepers, G, and are held in place by spring catches, I, which engage the keepers, as shown. The inner ends of the bars, G, enter mortices in A, as shown in dotted outline.

When taken down and folded, the parts assume the position shown in detail at the bottom of the engraving.

The invention was patented through the Scientific American Patent Agency, Nov. 14, 1871, by Edward J. Wilcox, of Ivy Mills, Pa., who may be addressed for further information.

ANTS AS ENGINEERS.—It appears that the ants in Panama are not merely mining engineers—they build tubular bridges. A corresponding member of the Glasgow Natural History Society, who has been lately in that country, describes the curious covered ways constructed by these ingenious insects. In tracing one of these covered ways, he found it led over a pretty wide fracture in the rocks and was carried across in the air in the form of a tubular bridge of half an inch in diameter. It was a scene of busy traffic. There was nearly a foot of unsupported tube from one edge of the cliff to the other.

Toothache, Earache, Etc.

The little work noticed in another column, entitled "First Help in Accidents," speaks of these complaints, so prevalent at this season of the year, as follows:

"It is a bad practice to put cotton wool, soaked in laudanum or chloroform, into the ear for the relief of toothache. It is true that it may sometimes prove effectual, and procure a night's rest, for the connection between the teeth and the ear is very close. But let it be borne in mind that the ear is far too delicate and valuable an organ to be used as a medium for the application of strong remedies for disorders of the teeth, and that both laudanum and chloroform, more especially the latter, are powerful irritants, and that such applications are always accompanied with risk. The teeth should be looked after for themselves, by some competent dentist; and if toothache spreads to the ear, this is another reason why they should be attended to at once; for prolonged pain in the head, arising from the teeth, may itself injure the hearing. In earache everything should be done to soothe it, and all strong irritating applications should be avoided. Pieces of hot fig or onion should on no account be put in; but warm flannels should be applied, with poppy fomentation externally, if the pain does not soon subside."

Clark's Locomotive Engine.

John Clark, M. E., of 44 Finsbury Circus, in the city of London, England, has recently patented, through the Scientific American Patent Agency, an improvement in locomotive engines, the object of which is to radiate the leading and trailing axles of locomotive engines, or of engine and tender comb'ned, to enable them to pass round sharp curves more freely.

He constructs the leading and trailing axles hollow, inside of which he fits a central spindle, to which are fitted, at each end, cranks in connection with the driving gear. The hollow axles may be called the carrying axles, and the central spindles, the driving axles. The centre part of the spindles may be square or hexagonal, to fit freely a bush fixed at the center of the hollow axle, so that it may slide therein. Thus, when the spindle is driven, the carrying or hollow axle will be driven with it.

The radial movement of the hollow axles is effected by links fixed to the framing. The spindles are carried in bearings in the framing, and are held in a parallel plane with the other axles of the engine by horizontal rocking shafts. The engine may have eight, ten, or even twelve wheels coupled and propelled by one pair of cylinders, either outside or inside.

One purpose effected in the design is to make the load moderate on all the wheels—say not to exceed nine tons per pair—and to include all the weight for adhesion. In the eight wheeled engine, the four wheels in the centre form a fixed or parallel wheel base from seven to ten feet centers.

The leading and trailing axles radiate freely to pass curves of three chains radius. In the ten wheeled engine the six wheels in the centre form a fixed or parallel wheel base, the middle pair being without the flange. In the twelve wheeled engine the six wheels, situated immediately behind the leading axle, form a fixed or parallel wheel base from nine to twelve feet centres, and the leading and two trailing axles are fitted with the radial arrangement.

The load carried by the radial axle is entirely borne by a transverse spring or springs from a pin in the center buckle, supporting slings from a bracket fixed to the framing or boiler. Either wheel of the leading and trailing axles is free to rise or fall about an inch and a half, to suit the "cant" or inequalities of the rail, without imparting any cross twist to the framing, thereby securing the advantages of the American bogie as applied to engines. The said supporting slings have a double fulcrum pin, where they are joined to the supporting brackets, to secure a certain amount of righting to make the engine run smooth and steady on a straight road.

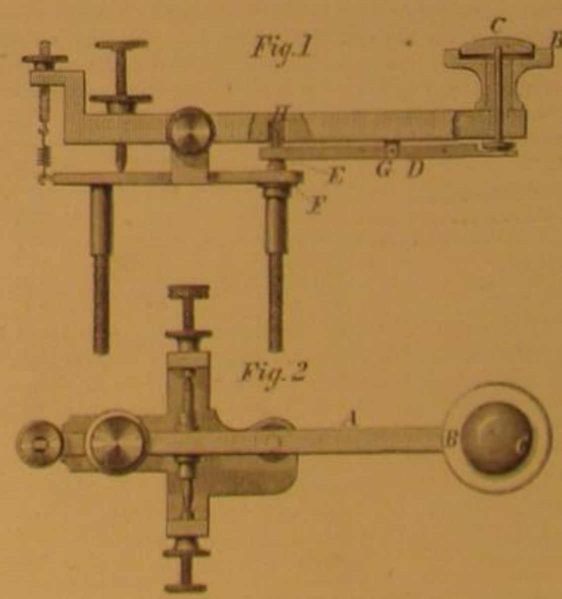
The details of Mr. Clark's invention cannot well be explained without drawings, but the general description given will enable engineers to comprehend in some measure the nature of the improvement.

SELF-CLOSING TELEGRAPH KEY.

This telegraph key, which was patented through the Scientific American Patent Agency, Nov. 7, 1871, by Jeremiah F. O'Sullivan and Philip W. O'Sullivan, of Jackson, Miss., is so constructed as to hold the circuit constantly closed, in order that it may not be accidentally left open by careless and inexperienced operators.

To this end there is applied to the ordinary key bar, A (see engraving), a secondary button, C, in addition to the ordinary one, B, in connection with the lever, D, and spring, H, the latter holding the lever in constant contact with the conductor, unless it is lifted off by pressure on the secondary button.

The second button, C, is fitted upon a pin or shank, which passes through the button, B. The lever, D, is pivoted to the under side of the bar, A, at G. The spiral spring, H, holds the pin or hammer, E, in contact with the anvil, F, thereby closing the circuit.



The instrument can be worked perfectly, without grasping the button with thumb and fingers, by operators who do not use the thumb in writing. The improvement can be adapted to all keys at very little expense, and new keys can be made as cheap as the old.

The key is very convenient to inexperienced operators. Accidents that would open a common key will have no effect on this. The spring, so sensitive to the touch which closes the circuit, would require a nicely balanced weight to keep it open without bearing down the key bar and connecting the platina points on the hammer and anvil.

For further particulars, address O'Sullivan & Brother, Jackson, Miss.

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NEW YORK, SATURDAY, DECEMBER 16, 1871.

Contents:

(Illustrated articles are marked with an asterisk.)

THE NEW YORK GAS MONOPOLIES.

New York has, like most large cities in the United States, suffered from the extortions of gas companies until the public at last revolts against their impositions. The chartered privileges of these companies, the large capital necessary to the establishment of an extensive system of illumination by gas, and the enormous profits realized in a few years, have made the monopolies so powerful that they have, as yet, defied competition. And although numerous companies have been projected, and some have been organized, the wealth of the older companies has been able to buy them up, or to effect coalitions, so that the monopolists have had their own way so far.

These companies have sustained prices far above that for which good gas can be made and furnished; but not content with this extortion, they have persistently furnished inferior gas without decreasing the price. They have been exceedingly arbitrary in their treatment of complaints, have treated with indifference those who questioned the accuracy of their bills, and have altogether made themselves so obnoxious to the public at large that every gas consumer will hail with delight any attempt to break their power.

For a period of about fifteen years, inventors have grappled with the problem of how to make illuminating gas from the light products of petroleum distillation. The task was not an easy one, and only through many failures has a fair measure of success been reached. There are now portable machines, for this purpose, in market that work very satisfactorily.

In Memphis, Tenn., there have been put into operation, on a large scale, works which manufacture gas from naphtha, and which are, according to the accounts that reach us, furnishing gas of far better quality than the ordinary coal gas, at a cheaper rate than the latter has yet been furnished to American consumers. We published last week an article referring to the quality of New York City gas, and need not enlarge further upon this head.

We are glad to learn that an organized effort to introduce here the system in use at Memphis is in progress, and that a company, composed of citizens among our heaviest capitalists, has purchased a site, and is erecting works on Avenue D, between 11th and 12th streets.

The company have a charter, granted at the last session of the State Legislature, which permits them to lay mains, to open streets, etc., and they are now vigorously engaged laying their main pipes in various parts of the city. It is further stated that at the ending session of the Legislature, strenuous attempts will be made to annul the charters of the old gas companies; but of this result we have not much hope.

The process used at Memphis, and which is to be adopted by the new mutual company here, is, so far as we have been able to ascertain its character, extremely simple, consisting in the conversion of the naphtha into gas by heat in retorts, and diluting it with atmospheric air to the proper degree for burning without smoking. Were it not that the process is stated to be a practical success, we should anticipate trouble in the distribution of such gas from condensation in pipes, which has been a difficulty experienced in the previous use of this material; but as a committee sent from this city to examine the process reports no such difficulty, we are constrained to hope it is in some way obviated. The committee report that the process is simple and safe; that the gas had a high illuminating power in all parts of the city, and that consumers state this power to average three times that of coal gas. It is expected that the new Mutual Company will have their works finished, and pipes laid so as to supply consumers early next season.

THE REPETITION OF EXPERIMENTS.

The importance of experimental investigation, so strongly insisted upon by Bacon and practiced since by scientists as the basis of the true scientific method in physical researches, is now so generally admitted as to need no argument. The importance, of not accepting results as final determinations of physical laws until repeated experiments leave no room to doubt their accuracy, is not so generally appreciated. The really scientific investigator always retains some reservation in his acceptance of results attained by others, unless, through the most careful scrutiny, he can find no error in their method of experimentation, and can devise nothing which appears a more sure way of arriving at truth.

The prestige of name and attainments goes far to influence belief, but those who think for themselves need a surer foundation than this in matters where accuracy is essential.

Libraries of reference contain tables which are relied upon by engineers and constructors in making their computations, and in the use of which they cannot go far astray; yet many of them have been found in practice to be inaccurate. At least, recent experiments have given results differing more or less from those formerly obtained, and from which the tables were framed. As long as differences exist greater than may be accounted for by inaccuracies in manipulation, there must remain doubt as to the correctness of our knowledge. Experiments upon any subject should then never cease until a certain degree of uniformity is attained through the employment of different methods.

There are not wanting recent illustrations of the truth of this proposition. Among these may be cited the remarkable experiments, of Professor Ogden W. Rood, of Columbia College, New York, on the amount of time necessary for vision, in which Wheatstone's conclusions from his experiments on the duration of the discharge of a Leyden jar, are found to be immensely far from the truth. He affirmed that the time necessary to produce distinct vision was within one millionth of a second. Prof. Rood now shows, by a most ingenious method, that in a space of time less than forty billionths of a second, the retina can receive and combine a whole series of impressions; and he feels confident that the eye could distinctly see an object illuminated during a period so inconceivably minute as four billionths of a second. In the conclusion of his paper on this subject, published in the *American Journal of Science* for September, 1871, he quietly remarks: "All this is not so wonderful, if we accept the doctrine of undulatory light, for according to it, in four billionths of a second, nearly two and one half millions of the mean undulations of light reach and act on the eye."

Professor Rood also has determined the possible duration, of the discharge from a Leyden jar, to be as short as nineteen hundred-millionths of a second.

Even the experiments of Regnault have been recently revised by Mr. Alexander Morton, with results from which he deduces formulae that show the relation between the temperature, pressure, and density of steam.

Recent experiments have shown room for doubt as to the full reliability of the tables in common use for computing the strength of beams and girders.

Boiler explosions are now being brought under systematic experiment, at Sandy Hook, which will doubtless throw much light on this important subject.

In short, there yet remain many things in science and mechanics to be definitely determined. The experiments of General Morin on friction might be revised, we think, with profit, and carried further than he went with them, to show how the compounding of motion on cylindrical surfaces modifies friction, and what part of the power is absorbed by friction in each of the components of the resultant.

The use of air compressors has shown that we are far from knowing the real laws of the friction of gases in tubes; and herein is a most important and profitable field of investigation, as the use of air as a motive power in mines and tunnels is only in its infancy. But we have said enough to show that, notwithstanding the labors of those that have gone before, there is yet enough scientific work to be done.

THE CONDEMNATION OF THE HALL OF PUBLIC RECORDS FOR THE CITY AND COUNTY OF NEW YORK.

In the Court of General Sessions, December 5th, Judge Bedford presiding, the Grand Jury made a formal presentment relating to the unsafe and filthy condition of the above building, a condition which, we believe, we were the first of the New York press to notice publicly.

In view of this decided action, it will probably interest our readers to know in what way important records of untold millions are kept (or rather not kept), as ascertained by a personal inspection of all parts of the building.

The building stands by itself in the northeast part of the City Hall Park, but not so far removed from other buildings as to be protected from fire by its isolation, unless it were thoroughly fireproof. Sparks would find easy access through numerous broken panes, only a portion of which were, at the time of our visit, stopped with books labeled "conveyances," newspapers, or whatever other makeshift could be extemporized by the clerks to keep out wind and rain.

Entering thus, the sparks would find sport ready to hand in loosely folded and dusty, cobwebby papers, which crowned the tops of nearly all of the cases, and in bundles of paper, loose shavings, small pieces of lath, etc., etc., which, dried by long protection from weather, are profusely scattered in the upper unoccupied rooms left in an unfinished state by the carpenters and masons.

The cases for containing the books of conveyance and records of mortgages are most perfectly designed fire traps. They are double, so that books are placed in them from both sides, the partitions which separate the books being boarded on their inner edges, leaving a wooden flue the whole length of each case, and about six inches wide, running from bottom to top, and open above and below.

No walls of any railway round house can exceed in grimy squalor the walls and ceilings of the Hall of Records. They look like chimney flues. One of the clerks told us that, during a term of fourteen years service, he had never seen a whitewash brush in the building. Leaky soil pipes and fetid sinks lend odors to the air, which is so sickening in some parts of the building that, we were told, some of the clerks have been made ill by it.

The numerous paper stuffed holes and crannies form a favorite haunt for troops of mice that, in the absence of other food, gnaw at the leather of the bindings to get at the paste and gum, and destroy the papers and maps without let or hindrance. We did see one or two tin boxes designed to spoil the literary recreations of these rodents, but the great mass of documents are entirely open to their ravages. In one place we were shown a great pile of what once were maps, thrown in a confused heap together, the mice having so disfigured and torn them that they are rendered illegible. In other places ledgers were reduced to mere bundles of unbound and displaced pages by the same destructive vermin. Everything spoke of ruin and rottenness. But sadder than all, the destruction and decay visible in the records and in the building were the evidences of the moral decay and the misrule which has so long corrupted our city government, and which has thus carelessly and criminally neglected public interests, and failed to provide for the security of the public records. We trust that, as we are now emancipated from this reign of disorder, the action of the grand jury will lead to measures that will so place public documents that they will no longer be food for mice, nor remain likely to become a prey to the first severe fire that shall take place within a hundred yards of the building where they are kept.

A MARE'S NEST—MORE ABOUT THE GAS QUESTION.

In another column will be found an editorial containing the announcement that gas works are in process of erection on Avenue D, between 11th and 12th streets, by the Mutual Gas Light Company, to supply gas made from naphtha. A correspondent in the New York *Herald*, of Dec. 4, states that the gas to be supplied will be compounded of naphtha vapor, common illuminating gas, and atmospheric air. He sounds, (to the uninitiated), a fearful warning that a gas thus composed is "as explosive as gunpowder or nitro-glycerin, and far more terrible in its effects." He further says:

The dreadful disaster of the *Westfield* excited the just indignation of the public, but this calamity was only a faint intimation of what may be expected if this compound is allowed to be made. The oxygen necessary for its combustion is mingled with the gas not only in the holders, but also in the supply pipes; and if an explosion should occur it would take place instantaneously, throughout the entire body of the gas not only in the holders but also in the pipes in all parts of the city wherever they are laid, and every building in the vicinity of these pipes would be blown into atoms instantly, and every human being therein or near by would suddenly perish.

The destruction would be more terrible than an earthquake or the explosion of a powder magazine.

Now, mark, it will be claimed by those interested in this death process that it has been in successful operation in Saratoga and other places, and that no accidents have occurred from its use. Well, the Saratogians have been truly fortunate in escaping a terrible calamity, but let this compound be ignited by the breakage of a street main, or in any other of the thousand ways that may happen any moment, and if the result is not more terrible than here indicated, then it will be because Providence interposes a miracle to save the people.

A year or two since a new gas burner was invented for burning a mixture of coal gas and oxygen gas. This burner was denominated the "safety burner." It was tried and worked well for months. No accident occurred until a defective burner was used, when an explosion took place. There was not more than one cubic foot of the mixed gases in a small holder, when the accident occurred which sent part of the holder down through two ceilings and the other part upwards through one ceiling and the roof of a building in Broadway, producing a frightful noise and great consternation among the people in the block. Thousands were attracted to the scene of the accident in a few moments. Now, this mixture, so far as its explosive properties are concerned, was precisely the same as that proposed to be made by the Mutual Gaslight Company and supplied to consumers.

All of this terribly sensational statement is pure, unmitigated bosh, having no more foundation in fact than the stories of Munchausen or Gulliver. It is calculated to frighten those ignorant of the subject, and to injure the Mutual Gas Light Company. The statement, that the naphtha gas is the same mixture as that which exploded on Broadway, is without truth. Any kind of combustible gas will explode when mixed with enough air or oxygen to entirely consume it. The explosion, cited by the *Herald* correspondent, was with coal gas and oxygen so mixed, as is always the case when coal gas and oxygen are used in the so called magnesia, or lime light. The mixture is ordinarily made with minute quantities of the gases, just before they reach the pencil of lime, or magnesia, which in their combustion they heat, and render luminous. It has long been known that common illuminating gas, mixed with common air in the proper proportions, will explode, yet when conveyed in pipes it is so impossible that such a mixture can occur in the conduits, that gas is acknowledged the safest illuminating agent in use. The explosions that have occurred with it have been caused by its escape into closed apartments where, after a time, the proper proportions of gas and air have been mingled, and subsequently ignited by contact with flame, through carelessness.

When any illuminating gas is mixed with air in sufficient quantity to render the mixture explosive, it loses its illuminating power, and burns with a pale blue flame. A gas, that will give a light from any ordinary sized burner sufficient to read by, is never explosive. The Mutual Gas Light Company propose to furnish *illuminating gas*, and if they do this, they will furnish a material as safe as any ever employed for lighting; for the same general principles apply to all kinds of gas from which light is obtained.

But it may be asked, why has the SCIENTIFIC AMERICAN made such a persistent protest against the use of naphtha in naphtha stoves and in lamps, if the material can be used as is proposed by the Mutual Gas Light Company? We answer that naphtha, so long as it is in a liquid state, can never explode. So long as it is confined in close pipes, it can never burn, whether it be in a liquid state or in a gaseous form. When not controlled as it can be in metal pipes, it may and does often generate vapors that, mixed with air, are explosive. When lamps are broken or overturned, a highly inflammable liquid is scattered about, which endangers life and property. The dangers arise from the careless and wrong methods of using this material. A lamp is no more a fit instrument for burning naphtha than is a man's watch pocket for the burning of gunpowder. Experience has shown that inflammable gases may be conveyed in pipes with very great economy and safety; and when the false prophet of the *Herald* cites, as an example of danger, an instance where coal gas exploded when mixed with oxygen, he, like other over eager witnesses, proves too much. He proves that gas, (which, rightly mixed with a supporter of combustion, will explode), can be and has been used for years with less damage than has arisen from any other mode of illumination. The same can be done with the naphtha gas, the safety arising in both cases from the manner of distribution through pipes.

The article in the *Herald* is evidently written by a person not ignorant of the facts and principles we have stated, but one who, out of his knowledge of the subject and his acquaintance with the general ignorance of the public in such matters, has seen his opportunity to frighten the people, and retard the new enterprise which is likely to become a strong competitor with the old gas companies.

EDUCATION OF THE EYE.

How few there are that appreciate that optical marvel, the eye! How few understand its mechanism, the principles on which it acts, and the wonders it accomplishes! As an avenue by which external impressions find their way to the mind, it is worth all the others man possesses. So gradually is its skill acquired, that we hardly recognize it as acquired skill. We educate, through long and systematic practice, hands, feet, and muscles; but in the main the eye is left to itself, to acquire as it may its power of estimating distance and size, color and the definition of form.

In this desultory way it acquires a skill beyond expression wonderful, yet we believe that with most the power of vision is only imperfectly developed. What is to hinder systematic discipline of the eye any more than that of any other organ? To be able to see correctly is of as much importance to the mechanic as to the artist. Mr. Ruskin in his admirable treatise on the "Elements of Drawing" lays particular stress upon teaching the eye to see correctly, and shows that the hand will have but little difficulty in learning to represent what is accurately seen.

The mechanic is often called upon to make forms for which his unaided eye must be the principal guide. The wagon maker may lay out his work by patterns, but the ornamental finish principally depends upon the nicety with which his eye can trace lines of grace and beauty. Even in shaping a boot sole there is required great skill of eye. If any one doubts this, let him try to shape a sole to the outlines of his own foot, and see what an uncouth, ungainly form he will make. None but novices will try the experiment, for any one who has tried it, knows the difficulty of combining comfort and beauty in a boot sole. Shoemakers have been much denounced for their failures in this respect, but the reader may rest assured that their art is a difficult one. They can not go by plumb line, square, and level, like the mason or the carpenter, and no one who has never tried to draw a sole pattern knows how slight variations will affect, favorably or unfavorably, its appearance. The cabinet maker, the carver, the sign painter, the decorator, all of these attain skill principally through the education of the eye.

An analysis of what the eye can perceive will give a clue to the proper method of educating it. The impressions gained through this organ may be classed under the categories of distance, size, light and shade, form, and color. It appears to us that, in the order in which these categories are named, the education of the eye should proceed, since that is probably the order in which we first learn to perceive. It is through the power to appreciate distance that we form our first estimates of size; then we begin to distinguish light and shade, and thus to gain power to define form, and lastly we distinguish, more or less perfectly, colors and tints.

We think a most profitable system of exercises might be devised by an ingenious teacher, calculated to train the eye in the exercise of its various functions in early youth, and to form correct habits of vision; for he who supposes the eye is not influenced by habit as well as any other organ makes a serious mistake.

The worst habit of all is the habit of partial sight. Instead of closely scrutinizing everything they see, the majority of men only superficially look at objects as they pass before them. They thus become inaccurate witnesses in courts, inaccurate in their impressions of material objects in general, and fail when they attempt to imitate, because the images they strive to reproduce are imperfect.

If in early youth, children were taught to look carefully at everything, and to constantly test the accuracy of the perceptions thus obtained, we believe the habits of close observation thus acquired would be of greater advantage than the result of any other mode of discipline now practiced in elementary schools.

THE ST. GOTHARD TUNNEL---ANOTHER GRAND ENGINEERING WORK.

The pass of St. Gothard was the most frequented of all the routes across the Alps until the commencement of the present century; but as it was not practicable for vehicles, it was gradually deserted after the construction, by Napoleon I., of the road over the Simplon. The loss of traffic induced the cantons through which the route passed to construct a carriage road quite as good as that on the Simplon. The work was commenced in 1820, and finished in 1832, and it is one of the greatest monuments of engineering skill to be found in Europe. In magnificence of scenery, the St. Gothard is superior to all of the passes, unless we except the Stelvio. To the mere pleasure seeker, it will, therefore, be a matter of regret to see this superb road deserted for a hole through the mountain. Ever since the Mont Cenis tunnel was projected, the Swiss and Germans have felt that a large share of traffic would be diverted to France. For military and strategic reasons, it was, also, felt that equally good facilities ought to be provided on the other side of Switzerland, and all of the necessary surveys were made many years since; but the jealousy of the French, and the fear of that nation, has prevented the commencement of the work. The moment, however, that France was powerless to prevent, the project was revived, and we now hear that a contract for the construction of the tunnel has been concluded between the Swiss government and a syndicate of German bankers under the protection of the imperial government of Germany. The work will be abo t twice as long as the Mont Cenis tunnel, and it will be considerably more difficult, as it must pass under several rivers and lakes, and encounter the hardest rocks of the Alps. The summit of the present carriage road is 6,507 feet, but the railroad will pass under peaks varying from 8,750 to 10,900 feet. There is no distinct peak of St. Gothard, but an extensive ridge of elevated ground which bears that name.

Geologists will be greatly interested in the work, as this part of Switzerland abounds in a large variety of choice minerals, and some important questions may be solved by the projected work. The total cost is estimated at $37,000,000. Of this amount, the company will raise $20,000,000, leaving the balance to be raised by assessment upon the cantons and countries immediately interested in the project. There is a general belief among engineers that the work will cost much more money than the above estimate, but, as rich governments stand as security, there seems to be little doubt that the undertaking will be pushed to final completion. The new road will bring Germany and Italy into closer political union, and, in the event of war, give these powers a decided military advantage; but this feature of the undertaking is of small importance in comparison with the enormous traffic that will flow through the tunnel between the nations of the North and the remote inhabitants of Asia. Its principal utility will consist in facilitating trade and travel between Europe and Asia, by way of Italy. The extreme Eastern points within its circle of traffic will touch the outstretched hand of our Pacific railroad, and the commerce of the whole world will be benefitted by the completion of the gigantic scheme. It is not many years since the river Danube was the highway for the commerce of the world. The boats, moored at the bridge of Ratisbon, far up in the interior of the Continent, were manned by sailors who were the boast of that period, when suddenly, by the discovery of the passage around the Cape of Good Hope, commerce was diverted to new routes, and we have nothing but the ancient bridge and the quaint old storehouses to tell us of the magnificence of the past. The completion of such works as the Suez Canal and the tunnels through the Alps are great illustrations of the triumph of science over all obstacles.

The trade, which, for a time, was diverted to new routes, appears likely to return to its former channels. The Austrian government already have a railroad over the lower Alps, connecting with Trieste and Venice, so that they will profit by the revival of trade in this direction.

It is difficult to anticipate how long it will require to complete the St. Gothard tunnel, but, with improved machinery and aided by the experience of Mont Cenis, it can hardly endure twice as long as the last famous undertaking. It is a bold enterprise, well worthy of the age in which we live.

A MOST INGENIOUS MACHINE.

There is on exhibition at the Progress Iron Works, 59 Lewis St., this city, a machine, for bunching, wiring and inserting and fastening bristles in brush backs, that is a marvel of ingenuity. In the accuracy, beauty and rapidity of its operation, it has scarcely been excelled in the history of invention. The machine was entered at the Fair of the American Institute only just before the closing, and it escaped notice from us at the time on that account. We shall, however, shortly give an illustrated description, which will be more satisfactory to our readers. The machine is, we believe, the joint invention of Messrs. O. D. and D. C. Woodbury, of the above named works. To any who like to see what mechanical skill of the highest order can accomplish, it offers one of the most profitable studies that has been brought before the public in a long time, and it must, we think, revolutionize the present system of brush making.

MECHANICAL BIGOTS.

Bigotry is by no means confined to religionists, any more than pedantry is limited to schoolmasters. The good old way, whether it be in science, art or mechanics, is *so good*, in many men's eyes, that to them there can be nothing better. To them, innovations and innovators are abominations. Because unwilling to adapt themselves to a new order of things, and reluctant to make the effort, they are sure to be left behind in the race. Instead of "trying all things and holding fast to that which is good," they hold fast to that which they have, and try nothing.

The other day we carried a lock to four different locksmiths, for repairs. In itself peculiar (we believe it was imported from France) and being attached to an article in such a way that it was impracticable to substitute for it another lock, it proved too much for the ingenuity of the mechanics who were solicited to mend it. "*It can't be done,*" was the unanimous verdict. In each case, we delicately suggested a method whereby the repairs could, we thought, be easily effected, and in each case we were met with an impatient assertion that the suggestion could not be put into practice. At the fourth shop we lost patience and offered, with the aid of a few simple tools, to convince our mechanical bigot that "some things could be done as well as others." It took us about a quarter of an hour to prove our position correct, and put the lock into good working order. We silenced this bigot, but did not reform him. The next time he is asked to do something out of the usual way, he will be just as pigheaded as before.

We once had a similar experience with a pattern maker, who declared patterns could not be made to cast a certain article, which could be drawn from the sand; yet that same impossible feat was accomplished by the bigot himself, finally induced, by some stinging remarks, to get out of his rut.

This sort of wilful blindness, is quite a different thing from that intelligent conservatism that, after carefully examining new things, refuses to adopt them, because they are no improvement on those already in use. Heaven only knows what the world would come to, were there not such a thing as intelligent conservatism. But the latter never says things are impossible; it simply says of that which it rejects, "it is unprofitable or impolitic." It places a wholesome restraint on that class of mind which believes that everything new must be useful, and is always eager to embrace that which has the charm of novelty. It calmly sifts the chaff from the wheat, and gives the former to the winds, whether it be old or new, while the wheat is saved; if old, valued neither less nor more than the new, on that account. Whatever is valuable is retained on account of its value, not on account of its ancient prestige, nor the brilliant *debût* it may have made into the world of letters, science or art.

The bigot, on the contrary, refuses to examine, and prejudges everything which has not the stamp of custom to commend it. To merit his disapproval, any proposition or process needs only to be different from that to which he is accustomed. He refuses to acknowledge proof, and turns himself away from attempted demonstration. He does not see, because he does not want to see, and hence his blindness is total.

We find plenty of just such bigots among mechanics and engineers, although the tendency of these occupations is to correct such a state of mind; but prejudice is so strong, and reasoning so difficult, that the world will probably never be rid of those who prefer to shut their eyes, rather than hurt them by looking at the light.

IMPORTANT IMPROVEMENT IN GLASS AND PLATE ENGRAVING.

We have heretofore chronicled the invention of Tilghman, who, by means of a powerful blast of steam or air, impels a jet of sand with such tremendous force against the surfaces of glass, stone, or other materials, that they are cut, engraved, or dressed, as may be desired. In fact, stone may be bored by this process.

We have now to record another improvement in an analogous direction, although the means employed are far simpler, while the results produced are very remarkable. We allude to the invention of George F. Morse, 287 West Twelfth street, New York, for which a patent has been recently granted.

The inventor provides a simple box or hopper, from which depends a small tube about eight feet long. No machinery whatever is used. A mixture of corundum and emery, in the form of powder, is placed in the hopper and allowed to descend through the tube. The article to be engraved, which may be a silver cup, a watch case, a sheet of glass, a goblet, or other object, is held under the extremity of the tube, so that the engraving powder will fall upon it, and in a few minutes' time the most splendid ornamental designs are cut, with marvelous exactitude and surprising beauty. We have seen engraved effects, produced by this process, upon glass and silver ware, that altogether surpass anything that has ever been attempted by the most skilled hand labor.

As fast as the supply of the engraving powder runs down through the tube, it is replaced in the hopper; and girls may do all the work. That portion of the surface of the articles that is not to be engraved, is protected by paper or other substance. The engraving, therefore, is done by cutting out the desired pattern in paper, which is then applied to the surface of the article. The powder only acts between the interstices of the pattern.

This simple and beautiful invention promises to revolutionize the art of plate and glass engraving. By its use the adornment of all kinds of wares, in the most superb manner, may be quickly accomplished, at a tithe of the cost of the ordinary methods. The invention is now in successful practical operation in this city.

SCIENCE RECORD FOR 1872.

We have in press, to be issued January 1st, a new and valuable book of 350 pages octavo, entitled as above, which, we think, will be read everywhere with interest. It will be a compendium of scientific progress of the present year, and is to be profusely illustrated with steel plate and wood engravings.

The following is a partial outline of the general contents of the *Science Record:*

Notices and descriptions of the leading discoveries and improvements invented or introduced during the present year, pertaining to Engineering, Mechanics, Chemistry, Philosophy, Natural History, Agriculture, Architecture, Domestic Economy, and the various Arts and Sciences, with many engravings.

Biographical notices of prominent men of science, with portraits.

Descriptions of the most important public works, began or completed during the year, with illustrations.

Notes of the progress and extension of railways, telegraphs, and other means of communication.

Descriptions of the new applications of steam, electricity, and other motive powers, with engravings.

Almanac for the year, and a chronological table of notable scientific events and phenomena.

Reports of Patent Office proceedings. Classification of inventions at the Patent Office, with the names of all examiners, officials and employees.

Portrait and biographical sketch of the Hon. M. D. Leggett, Commissioner of Patents.

Description of that great engineering work, the Mount Cenis Tunnel through the Alps, with engravings of the tunneling machinery, portraits of the chief engineers of the work, and other illustrations.

Description of the great Government works at Hell Gate, New York, with many illustrations, showing the wonderful galleries now being cut in the rocks under the bed of the East River, preparatory to removal of these obstructions by explosion, the drilling machinery, the electric apparatus, and other interesting objects.

Description of the great Suspension Bridge between New York and Brooklyn, now in process of erection, with interesting engravings.

Steel plate engravings of the celebrated Gatling Gun or Mitrailleur, showing its construction and use in various forms, upon wheels, horseback, camels, boats, etc.

Illustrations of recent improvements in cannon, fire arms, etc.

Recent applications of science to the construction of steam and sailing vessels, with illustrations.

Reports of the important law trials, and decisions pertaining to inventions and scientific matters.

Proceedings of scientific bodies, with notes of interesting papers.

Illustrations of late improvements in all the leading bepartments of mechanics and science.

Useful tables and practical recipes pertaining to the principal branches of industry.

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University of the City of New York---Free Lectures.

We have received the prospectus of a course of lectures, to be delivered in the University Chapel, Washington Square, New York city. The admission to the lectures is free, and the reputation of the distinguished lecturers should attract a full attendance. The following gentlemen will lecture as follows.

December 14th. Professor John W. Draper, M.D., LL.D., on Spectrum Analysis.

December 21st. Professor George W. Coakley, LL.D, on The Physical Constitution of the Sun.

January 4th., 1872. Professor Benjamin N. Martin, D.D., L. H.D., on The Natural Theology of the Doctrine of the Forces.

January 11th. Professor Henry Draper, M.D., on Respiration.

January 18th. Professor Henry Draper, M.D., on Respiration. (Continued.)

February 1st. Professor George W. Coakley, LL.D., on Comets.

February 8th. Professor E. H. Gillett, D.D., on The Future of Society.

February 15th. Professor Henry M. Baird, Ph. D., on Homer and his English Translators.

February 29th. Professor Charles Carroll, A.M., on Robert Browning.

March 7th. Professor E. A. Johnson, LL. D., on The Industries of the Romans.

March 14th. Professor F. D. Weisse, M.D., on Sensation and Thought, (illustrated.)

March 21st. Professor John J. Stevenson, Ph. D., on American Geology.

March 28th. Professor T. Addison Richards, N.A., on The History and Criticism of Art.

April 4th. Whitelaw Reid, Esq., on Journalism.

THE British Museum has an anvil which, it is said, belonged to one of the Pharaohs.

SCIENTIFIC INTELLIGENCE.

DETECTING OZONE.

A Russian chemist has devised a simple method for detecting ozone. He inverts a Hoffmann eudiometer, and, after connecting the platinum wires with an induction apparatus, passes oxygen gas slowly through the tube, and afterwards through Liebig's potassa bulbs, in which is a solution of iodide of potassium and starch. The presence of ozone will presently be shown by the liberation of the iodine and the consequent blueing of the starch.

BROMIDE OF SULPHUR AND AMMONIA.

If bromine be left for some time in contact with an excess of flowers of sulphur in a well stoppered bottle, and afterwards filtered through asbestos, a liquid is obtained which is composed of 83·33 per cent of bromine and 16·77 per cent sulphur. When this compound is brought into contact with aqua ammonia, the action is so energetic that the liquid begins to boil; and presently the liberated gases burst into flame. Chlorine and sulphur afford similar reactions, and it is a question whether this phenomenon could not be used for the production of explosive mixtures and also for signals. If the action could be moderated, as is the case with chlorine, it is possible that use, in medicine and in bleaching, could be made of the compound. At any rate, it affords a beautiful lecture room experiment, if performed with due caution.

OXIDATION OF CARBON AND ARTIFICIAL PRODUCTION OF ANILINE.

At the meeting of the chemical section of the German Association for the Advancement of Science, at Rostock, on the 18th of September, 1871, the President, Professor Schulze, read a paper, on the direct oxidation of carbon by means of permanganate of potash in an alkaline solution, which excited lively debate, and was justly regarded as one of the most important chemical discoveries of the year. In addition to copious quantities of oxalic acid and of other products not yet determined, the author obtained an acid to which he has given the name of anthraconic, and which he found to closely resemble mellitic acid in its properties. The experiment was repeated with charcoal purified in a stream of chlorine gas, also by calcining cream of tartar, by the reduction of carbonic acid with phosphorus, and from graphite. All of these varieties of carbon yielded analogous results. So great was the interest manifested in the announcement, that the leading chemists adjourned to the Professor's laboratory, there to repeat the tests and to examine into the nature of the incidental products. They soon came to the conclusion that the new body was identical with mellitic acid. By treating the anthraconic acid with caustic soda, benzole was produced, which was converted into nitrobenzole in the usual manner, and from this product aniline was manufactured. We have in this way the artificial production of aniline from charcoal, and are brought nearer to an explanation, of the chemical properties of carbon and of important practical applications likely to grow out of such knowledge. It is another step in the distinguishing characteristic of modern research, namely, the synthetical method, or the building up of compounds from their constituent elements. It is easy to rend asunder and destroy, but to rebuild requires the application of the highest genius. The discovery of Professor Schulze is likely to prove of great importance, as soon as it is thoroughly understood and applied.

TO GROW LARGE CRYSTALS.

In order to grow large crystals of such substances as sugar, borax, alum, and the like, Professor Schulze recommends the use of gelatinous solutions, such as pectin and gelatin. The crystals separate, suspended in the mass, and go on growing uniformly on all sides. In this way, irregularities and distortions are avoided. The determination of the amount of gelatinous matter to be added must be the result of experiment. The chief advantage appears to be to make the liquid of such a specific gravity as will hold the crystals in suspension.

CONSUMPTION OF GAS IN LONDON, 1870.

According to official reports of the thirteen gas companies of London for the year 1870, the following were the

RECEIPTS.

For gas	£2,045,313	0	6
Rent of meters	31,558	2	4
Sale of old materials	5,766	5	4
Products	424,952	5	11
Miscellaneous	11,649	15	11
Total	£2,519,239	10	0

EXPENSES.

Coal	£1,004,300	9	7
Purifying materials	22,235	16	7
Wages of workmen	224,432	3	10
Repairs	185,431	6	7
Taxes	63,172	2	1
Salaries	24,808	3	0
Commission of collectors	27,035	18	9
Office expenses	17,608	19	10
Directors	22,565	14	9
Auditors	1,314	10	0
Gas pipes	127,249	8	1
Gas meters	32,874	15	11
Lawyers' fees	3,643	16	9
Miscellaneous	29,736	11	2
Total	£1,786,409	16	9

Excess of receipts over expenditures, £722,829·13·3. The active capital and loan of the thirteen companies is £8,272,816; the receipts therefore exhibit an interest of 8·86 per cent on the capital stock. The private consumption of gas was 9,122,113,853 cubic feet; for the street lamps it was 1,500,000,000 cubic feet; the total consumption of gas in London for 1870 was therefore 10,622,000,000 cubic feet, which is double the consumption of Paris. Total quantity of coal used in making gas 1,225,839 tuns, and the average cost, including cannel, was 16s. 4¼d. per tun. In New York the annual consumption of coal by three gas companies is 200,000 tuns.

PREPARATION OF SULPHUROUS ACID.

In order to prepare sulphurous acid from sulphuric acid and charcoal, it is better to employ an acid of 74 per cent, or 1·825 specific gravity. If we take a stronger acid, a part of it is entirely deoxidized to sulphur, and if weaker acid be employed, sulphuretted hydrogen is evolved. To obtain absolutely pure sulphurous acid, it is well to put sulphite of lead and coarse charcoal in the wash bottle. With these precautions, it is possible to obtain pure sulphurous acid from sulphuric acid and charcoal.

REPERTORY OF TECHNICAL LITERATURE.

Many of our readers may not be aware that a continuation of Schubarth's famous repertory of technical literature is now going through the press in Leipsic, under the editorial management of Professor Bruno Kerl. The first volume of 696 octavo pages, from A to K, is now complete, bringing down the literature to 1868. By reference to Schubarth's and Kerl's *repertorium*, it is possible to obtain a complete history of the leading papers and researches, published upon any given subject, in the technological journals of the world since 1823. The work is a dictionary of reference, and is the richest mine of information to be found in any language; and it is only possible to get up such a book in a country where the compiler has access to complete series of journals in all languages. For an inventor who wishes to make an exhaustive examination of what others have done before him, such a book of reference is indispensable; and it also follows that our libraries ought to contain all of the journals, in which the original publications first make their appearance, to which reference is made in this work.

TO CITY SUBSCRIBERS.

The SCIENTIFIC AMERICAN will hereafter be served to our city subscribers, either at their residences or places of business, at $3·50 a year, through the post office by mail carriers. The newsdealers throughout this city, Brooklyn, Jersey City, and Hoboken keep the SCIENTIFIC AMERICAN on sale, and supply subscribers regularly. Many prefer to receive their papers of dealers in their neighborhood. We recommend persons to patronize the local dealers if they wish the SCIENTIFIC AMERICAN or any other paper or magazine.

TIMELY SUGGESTIONS.

Every Employer should present his workmen and apprentices with a subscription to the SCIENTIFIC AMERICAN for the coming year.

Every Mechanic and Artisan whose employer does not take the SCIENTIFIC AMERICAN should solicit him to subscribe for 1872.

Now is the Time for old subscribers, whose subscriptions expire with the year, to renew.

Now is the Time for new subscribers to send $3 and commence with the new year.

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It will pay any one to invest $3 for himself, his sons, or his workmen, for one year's subscription to the SCIENTIFIC AMERICAN.

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It is easy for any old subscriber to get a new one to join in taking the paper. Those who do will receive a bound volume of the "Science Record" for 1872. See description of this work on page 353, SCIENTIFIC AMERICAN, issue of December 2d.

It is no more trouble to remit $6 for two subscribers than $3 for one.

If any mechanic whom you ask to subscribe says he cannot afford it, tell him he cannot afford not to.

If any one wishes specimens of the paper to examine before subscribing, tell him to write to the publishers and they will cheerfully mail them.

If any one wishes an illuminated Calendar for 1872, to hang in his office or shop, he can have it sent free on sending a request to this office.

If handsome illustrated posters and prospectuses are wanted to assist in obtaining subscribers, send to the publishers of this paper.

It is the intention of the publishers of the SCIENTIFIC AMERICAN to make the paper next year better and handsomer than any previous year during the last quarter century it has been published.

It is the intention of the publishers to illustrate, by superb engravings, all new and practical inventions and discoveries that may be developed during the year.

For Prospectus and terms to Clubs see last page.

Examples for the Ladies.

Mrs. E. J. Stout, Elkader, Iowa, besides doing all the housework for a amily of four persons, made last year, with a Wheeler & Wilson Machine, one hundred and fifty fashionable dresses, hemmed over 2900 yards of biased ruffling, and made quite a number of under-garments. This is about her average work a year in all kinds of general sewing for seven years, with no repairs to her machine.

Burnett's Cocoaine is not greasy or sticky. As a hair dressing, it stands peerless and alone.

NEW BOOKS AND PUBLICATIONS.

A COMPENDIOUS GRAMMAR OF THE GREEK LANGUAGE. By Alpheus Crosby, Professor Emeritus of the Greek Language and Literature in Dartmouth College. Woolworth, Ainsworth & Co., 51, 53, and 55 John Street, New York; 111 State Street, Chicago.

This is an abridgement of the well known and long highly appreciated Greek Grammar by the same author, which has now reached its forty-fourth edition. The abridgement is, however, a sufficient *vade mecum* for the student in his progress through school and college. The intention has been to compress, as much as possible, the larger work, to form a portable simple grammar for the beginner, yet sufficiently comprehensive to accompany him throughout a whole course of Greek study as ordinarily pursued.

MAGNETISM AND ELECTRICITY. By William Allen Miller, M.D., LL.D., Professor of Chemistry in King's College, London, etc. Corrected from the Fourth London Edition. New York: John Wiley & Son, 15 Astor Place.

This work is identical with the portion of Miller's excellent work on Chemical Physics," from page 313 onward to the end of the book. Some tables, scarcely germane to the subject matter of the reprint, are added. The book forms a good manual of magnetism and electricity up to the date (1864) of the third edition of "Miller's Chemical Physics."

ÆSTHETICS, OR THE SCIENCE OF BEAUTY. By John Bascom, Professor in Williams College. New York and Chicago: Woolworth, Ainsworth & Co.

The pressure, upon our time, of other duties has precluded such a perusal of this work as a fair criticism demands. A cursory examination, however, leads us to pronounce it a very useful and entertaining volume. We discern, however, that the author does not abstract the conception of beauty from the conventionalities, religious belief, and even superstitions of mankind, since, in establishing his standards of beauty in literature and art, he defers to all these, deprecating that which violates the "proprieties" of society as below the true standard. Now, we respectfully suggest this is not a "science of beauty," as the author styles it in his preface, but a dissertation thereon, having reference, at least in part, to the moral and religious effect of certain things which, scientifically judged, are beautiful in the extreme, but which our author denounces as inconsistent with a taste for the beautiful, because, to the prurient mind, they suggest immoral ideas. To such an argument as this, the most fitting reply is that art "labors not for prurient minds."

SPEECHES, ADDRESSES, AND LETTERS on Industrial and Financial Questions, to which is added an Introduction, together with Copious Notes and an Index. By William D. Kelley, M. C. Philadelphia: Henry Carey Baird, Industrial Publisher, 406 Walnut Street. Price, $3.00.

To review this book adequately would require a column of our paper. It is a large octavo, filled with the views of a strong protective tariff advocate on questions, as its title indicates, intimately connected with production and labor. Such a book cannot fail to be interesting and profitable reading, when it is, as in the present case, the work of a strong mind devoted to the consideration of such topics through a life of public service. The social questions hinging upon the solution of the labor question are various and important. The book deserves, and will secure, a large sale, though many will doubtless take issue with the author in some of his views. But such a book, whether it agrees or disagrees with opinions already formed, arouses public attention to vitally important questions, the discussion and settlement of which cannot be delayed without danger. In this way the work before us will do good, and we cordially commend it to our readers.

FIRST HELP IN ACCIDENTS AND SICKNESS. A Guide in the Absence, or Before the Arrival of Medical Assistance. Published with the Recommendation of the Highest Medical Authority. Boston: Alexander Moore.

This appears to be a safe and comprehensive manual for the purpose set orth in its title.

THE AMERICAN JOURNAL OF MICROSCOPY, which was among the journals burned out in the recent Chicago fire, will hereafter be published at Racine, Wisconsin. By those interested in microscopic science, this publication will be cordially welcomed on its reappearance. Mr. George Mead is the editor and publisher. An advertisement appears on another page.

APPLICATIONS FOR EXTENSION OF PATENTS.

MACHINE FOR FORMING SHEET METAL PANS.—E. A. Smead, Corning, N. Y., has petitioned for an extension of the above patent. Day of hearing, February 14, 1872.

HARVESTER.—Joseph B. Butterfield, Philadelphia, Pa., administrator of Jesse S. Butterfield, deceased, has petitioned for an extension of the above patent. Day of hearing, February 14, 1872.

MACHINE FOR PACKING FLOUR.—J. Mattison, Oswego, N. Y., has petitioned for an extension of the above patent. Day of hearing, Feb. 21, 1872.

Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of the former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension, except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing

MUNN & CO., 37 Park Row,

Inventions Patented in England by Americans.

From November 9 to November 11, 1871, inclusive.

[Compiled from the Commissioners of Patents' Journal.]

CANAL BOAT.—W. F. Goodwin, Metuchen, N. J.

HEATING BOLT RODS.—G. C. Bell, Buffalo, N. Y.

UTILIZATION OF TIN PICKLE.—G. Lander, New York city.

WATER METER.—G. W. Copeland, Malden, Mass.

Foreign Patents.

The population of Great Britain is 31,000,000; of France, 37,000,000 Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000; and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Now is the time, while business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured n foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, $4 00 a year. Advertisements 17c. a line.

Francis Schleicher, Consulting, Analytical and Man'fg Chemist. Laboratory, Newark St., bet. Jackson and Harrison St., Box 172, Hoboken.

Information wanted of where could be purchased, by the quantity, L. A. M. Pascol's patent Burglar Alarm—patentee, George W. Biglow, New Haven, Conn. Please address M. K., Box 313, Shreveport.

I will send, to any address, a plan and specification of my improvements in setting Steam Boilers, together with a shop license, for $25. Address, for particulars O. Ranney, Corry, Pa., Box 264.

Basket Splint Machine Makers, address B. B. Eastman, Huntington, Mass.

Wanted, a Second Hand Boring Mill—6 ft. to 7 ft. Table—Bement or Sellers make preferred. Address P. O. Box 2459, Phila., Pa.

For Hydraulic Jacks and Presses, New or Second Hand, send for circular to E. Lyon, 470 Grand Street, New York.

The Valley of the Upper Missouri wants 1000 Traction Engines for agricultural purposes, for which it is peculiarly adapted, in surface and in soil. Send descriptive circulars and price list. J. Armstrong, Onawa City, Iowa.

Wanted, a Machinist thoroughly experienced in Milling up Gun Work, making Holders, Jigs, Gauges, and other Gun Tools. A. S. Babbit & Co., Plattsburgh, N. Y.

Williamson's Road Steamer and Steam Plow, with Thomson's Tires. Address D. D. Williamson, 32 Broadway, N. Y., or Box 1809.

Boynton's Lightning Saws. The genuine $500 challenge. Will cut five times as fast as an ax. A 6 foot cross cut and buck saw, $6. E. M. Boynton, 80 Beekman Street, New York, Sole Proprietor.

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Scale in Steam Boilers—To remove or prevent scale, use Allen's Patent Anti Lamina. In use over Five Years. J. J. Allen, 4 South Delaware Avenue, Philadelphia, Pa.

Photographs.—Rockwood, 845 Broadway, will make 8x10 negative and six photographs of machinery, in any part of the city, for $10.

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Wanted, by an experienced Machinist, a situation to superintend, construct, or Book-keeping. Commands the best references as to ability. D. L. W., Station A., New York.

Improved Mode of Graining Wood, pat. July 5, '70, by J. J. Callow, of Cleveland, O., enabling inexperienced grainers ("without the long required study and practice of heretofore") to produce the most beautiful and Natural Graining with speed and facility. Send stamp for circular.

3 Hydraulic Presses for sale on reasonable terms. Apply to Whitneyville Armory, Conn.

Metallic Molding Letters, for Pattern Makers to put on patterns of Castings, all sizes, etc. H. W. Knight, Seneca Falls, N.Y.

Use Soluble Glass for fireproofing Wooden Pavements, Shanties, R. R. Bridges—also as common hardening Mortar and Cements, makes most durable Stove and Foundry Putty, Iron Cement. Apply to L. & J. W. Feuchtwanger, Chemists, 55 Cedar street, New York.

Portable Farm Engines, new and beautiful design, mounted on Springs. Compact, light, and efficient. Send for descriptive circular, Mansfield Machine Works, Mansfield, Ohio.

Stencil Tools & Steel Letters. J.C.Hilton, 66 W. Lake st. Chicago,

Taft's Portable Hot Air Vapor and Shower Bathing Apparatus Address Portable Bath Co., Sag Harbor, N.Y. Send for Circular.

Shoe Peg Machinery. Address A. Gauntt, Chagrin Fall, Ohio

Builder's Scaffold—Patent for Sale—For further particulars, address Redick & Kunkle, Butler, O.

For Steam Fire Engines, address R. J. Gould, Newark, N. J.

Turkey Boxwood pieces for Sale, suitable for engravers and fancy turners' use. Address Stephens & Co., Riverton, Conn.

All kinds of Presses and Dies. Bliss & Williams, successors to Mays & Bliss, 118 to 122 Plymouth St., Brooklyn. Send for Catalogue.

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Brown's Coalyard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable. W.D. Andrews & Bro, 414 Water st., N.Y

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

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement, Andrew's Patent, inside page.

Improved Foot Lathes, Hand Planers, etc. Many a reader of this paper has one of them. Selling in all parts of the country, Canada, Europe, etc. Catalogue free. N. H. Baldwin, Laconia, N. H.

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Boiler and Pipe Covering manufactured by the Chalmers Spence Non-Conductor Co. In use in the principal mills and factories Claims—Economy, Safety, and Durability. Offices and Manufactories, foo E. 9th street, New York, and 1202 N. 2d street, St. Louis, Mo.

Dickinson's Patent Shaped Diamond Carbon Points and Adjustable Holder for dressing emery wheels, grindstones, etc. See Scientific American, July 24 and Nov. 20, 1869. 64 Nassau st., New York.

Railway Turn Tables—Greenleaf's Patent. Drawings sent on application. Greenleaf Machine Works, Indianapolis, Ind.

Peck's Patent Drop Press. For circulars address the sole manufacturers, Milo, Peck & Co., New Haven, Ct.

To Ascertain where there will be a demand for new Machinery, mechanics, or manufacturers' supplies, see Manufacturing News of United States in Boston Commercial Bulletin. Terms $4.00 a year

Answers to Correspondents.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however when paid for as advertisements at 1·00 a line, under the head of "Business and Personal."

ALL reference to back numbers must be by volume and page.

C. L., of Pa.—We cannot detect any silver in the mineral you send.

PREVENTION OF FERMENTATION.—Cider can be prevented from becoming fermented by passing ozone through it.—C. F. D.

INCRUSTATION IN BOILERS.—E. S. F. should put clean oyster shells in his boiler. These will keep it clean by attracting all the particles of carbonate of lime.—F. W. A. S., of Cal.

CANKER IN THE MOUTH.—In answer to F. S. C., November 18th, I will say: Take a piece of common blue vitriol, and either make a wash by diluting in water, or simply rub the vitriol over the affected part, taking care not to swallow any of the vitriol. I have used it a great many many times, and never knew it to fail.—J. C. C., of N. J.

S. H., of ——.—A perpetual motion, in the sense in which the term is used in mechanics, must supply its own power.

H. A. S., of N. Y.—A siphon cannot conduct water over a hight greater than that to which water can be raised by the pressure of the air at the point where the siphon is placed, less the hight of a column whose pressure would overcome the friction of the water in the short leg of the tube. It is atmospheric pressure alone that causes the water to rise in the short leg of the siphon. Your query relative to the motion of a rolling wheel has been repeatedly answered in this column.

W. M., of Pa.—The pressure of the atmosphere is all that raises water in an atmospheric pump. Such pumps are called suction pumps only by those unfamiliar with hydraulics.

WORMS IN HICKORY.—Cut the hickory at a time when the bark will peel off. That is generally from June to September. We, in the West, find this to be the right time.—G., of O.

SQUEAKING BOOTS.—In your issue of November 25, I noticed a remedy for squeaking boots, namely, to saturate the soles with kerosene oil. A much pleasanter way is to have your boots made to order, and, between each layer of leather in the sole, have apiece of oiled silk inserted. This is a sure preventive. Let Jones try it.—G. L. F., of N. Y.

CUTTING BEVELS.—In reply to C. H. S.: The surest, quickest, and best way to cut a bevel is to cut it in a box. To cut a miter on beveled work, place it in a miter box, giving it the same bevel in the box that it is to have in the work, and cut it with a saw, in the manner of cutting any other miter.—C. T., of Vt.

INCREASING POWER.—In answer to E. K., Nov. 4, I would like to say, it will be a disadvantage to put a fly wheel on his saw arbor. If his saw runs at a high speed, as it ought to, it will take a certain amount of power to run the fly wheel; this is always a dead loss. In sawing short work, it might serve to equalize the speed, but no one can gain power by its use.—F. C. S., of Conn.

BLAST FOR WASTE SHAFT.—J. H. B., of Ohio, writes: "I am producing an exhaust or suction in pipes with a blast from a fan, which draws up and discharges, with great force, dust, shavings, sticks, blocks, shelled corn, and all kinds of grain. This I do without anything going through the fan or blower. But, sir, do you know of anything in use that does this?" Answer—Machines for removing sawdust and small rubbish from shops have been constructed on this principle.

LAYING OUT HOPPERS, ETC.—C. H. S. asks for a rule for laying out the miter of hoppers, wagon seats, etc. I give the following simple and accurate rule: Bevel the top or bottom edge of the sides of the hopper to the same angle that the sides stand at; then lay a bevel set at a true miter on the beveled edge, and that will lay off the joint. When the sides stand at different angles, bevel the edge of each side to correspond with the angle of that side. If the corners are to be a square joint, lay a T square on the beveled edge instead of a true miter.—G. S. N.

SETTING SAW.—A circular saw that is filed and set right for splitting is not right for cross cutting, and *vice versa*. If J. H. M. wants a saw for doing both kinds of work, let him file the front edge of the teeth in a line with the center of the saw, giving the teeth a slight bevel top and front. In setting the saw, use a hammer, holding a piece of iron against the saw on the opposite side. Do not set the teeth at the points, but as near the base as possible. I think this will give him a saw that will cut smoothly, and as near right for both kinds of work as he can get.—F. C. S., of Conn.

SPRING IN SHAFTING.—Answer to query 5, No. 22, current volume. Ten years since, our factory, in the basement of which was shafting of cast iron, from three to four inches diameter, in sections about ten feet long, was burned down. These were entire, but crooked as snakes, six to ten inches out of line. When we rebuilt, they were utilized, by being heated (by wood fires, made on the ground) to a red heat at the point to be straightened. At those points a steady pressure was applied; the shafts were forced into line, fitted, and are now in use, "as good as new."—R. L. B.

EXTERMINATING RATS.—In your paper No. 14, Sept. 30, 1871, query 21, T. C. H. wishes to know some means of expelling rats from a building. Let him catch, by any ordinary trap, three rats, put them in a cage constructed of wire, in any place which is plagued by this animal, and give them no food whatever. On the third day he will find only two rats, one being eaten up by the two others, and on the sixth day, only a single rat in the cage. Let him give the survivor his liberty on the seventh day, and he will be, in the course of one week, rid of all the rats, except the one monster which ate up his two brothers, and which he may feed for sympathy's sake. This mode was adopted with great success in a building in the former Thiergarten, at Vienna, where all other means to expel these animals were useless.—L. S., of Vienna, Austria.

L. B. S., of Mass.—The compound engine is an engine having two cylinders, one a high pressure and the other a low pressure. In the high pressure cylinder the steam is used non-expansively, and it exhausts from this cylinder into the low pressure cylinder, where it is expanded as much as practicable, and then exhausted into a condenser. The method admits of more convenient application in marine engines, where, to obtain the same amount of expansion, a long cylinder would be needed. With the general adoption of surface condensers, marine boilers are not now liable to scale, and they carry a much higher pressure of steam than formerly, rendering the expansion of steam much more important than was the case when low pressures were the rule. For details of construction of various engines, made on the compound principle, you will find it necessary to read such works and publications as make marine engineering a specialty.

CURIOUS FREAK OF TWIN STEAM BOILERS.—Will you allow me to say, for the benefit of H. P. S., of Kansas City, Mo., that the difficulty lies only in his not having steam pipes large enough to allow the steam to pass freely from one boiler to the other, so as to equalize the pressure, attendant upon a larger amount of steam being generated in one boiler than the other and *vice versa?* No one can keep a fire perfectly regular, and therefore boilers set in the manner he states should be connected by a pipe of ample size to allow the pressure to equalize itself; when that is done there will be no trouble. The only curious freak about the boilers lies in the use of so small a pipe to connect them at the top. A six inch pipe wuold answer the purpose very well; then, if he chooses to use a two inch one to lead from that to the engine, good; but a four inch one would be better, as the friction of the steam in the pipe would be sufficiently less to compensate for the loss of heat by radiation, etc., by the saving in fuel, if it costs as much as it does generally. A quarter of a pound friction in a pipe amounts to considerable in time, as it is constant; for instance, a cent per minute for ten hours will amount to six dollars. The greatest trouble with engineers in general is that they overlook these seemingly trifling matters for the sake of saving in cost; while, if they were attended to, a vast amount of money might be saved.—A. L., of Mass.

CUTTING BEVELS.—C. H. S. asks for a rule for mitering bevels or "flaring boxes." I submit two methods, original as far as I know. 1st. Draw a rectangular parallelogram, the shortest side corresponding with the thickness of the board to be mitered, the other side with a line cutting the board horizontally when set at the required flare. Draw the diagonal line and the angle formed by the diagonal, and the shortest side is the required miter. If different sides of the box or seat flare unequally, each side must be treated by the same rule separately. 2d. Add half as many degrees to the miter angle (forty-five degrees) as the side of the box deflects from the perpendicular. For instance, if the side of the box flares at an angle of forty-five degrees, an angle of sixty-seven and a half degrees will miter the corner.—J. S. O., of N. J.

CASE HARDENING.—If E. N. G. will make a paste of prussiate of potash, and cover his screws and nuts with it, and then heat until red hot, he will have them case hardened. Any quantity can be heated at a time provided he has a furnace large enough.—E. O. McC., of S. C.

Queries.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.]

1.—LIQUID GLUE.—M. M., Havana, Cuba, asks:—Can any of your correspondents inform me through your scientific paper, how to prepare a good liquid glue for banks, commercial offices and general use?

2.—MARKING FLUID.—Will some of your many readers inform me how to make a good marking fluid, for marking boxes, barrels, etc?—R. W. R.

3.—VENTILATING ICE HOUSES.—Can any of your correspondents tell me the best way to ventilate ice houses?—J. M. D.

4.—BINIODIDE OF MERCURY IN SOLUTION.—I often have prescriptions calling for bichloride of mercury with potass iodide, combining which I have the biniodide of mercury ($Hg\,I\,2$) as a precipitate. I wish to inquire through your columns how to retain the salts in solution.—H. G. I.

5.—SOLDERING CAST IRON.—Will you inform us what preparation has been most successfully used for putting solder on to cast iron?—G. D. & S.

6.—DECAY OF INDIA RUBBER BANDS.—Is there any manner of rendering elastic rubber bands proof against decay? Those now in use in business houses are useless after a year or two.—W. H. S.

7.—DEOXIDISING ZINC.—Can any one inform me of any method by which I can restore oxidized zinc or spelter? I use it in a liquid state, but have a great deal of waste by over heating.—G. A.

8.—FIREPROOFING TIMBER.—Can any one inform us of any wash that can be applied to wood to make it fireproof? We have a building of easily fired timber, and would like to avert the danger.—K. K. & W.

9.—COMPOUND GEARING ON SCREW CUTTING LATHE.—I wish a simple and reliable rule for compounding gearing on screw cutting lathes, the traverse screw having four threads to the inch.—R. F. S.

10.—BATTERY POWER.—How many cups of Daniell's battery would be required to work a telegraph line 650 feet long with common sounders at each end? The wire is copper, No. 16.—E. M. D.

11.—SALT AND ICE.—Why is salt mixed with ice to freeze ice cream, while, in winter, we put salt in our pumps to keep them from freezing?—M. A.

12.—CARBON BATTERY PLATES.—I wish to know how to make carbon battery plates for voltaic batteries.—A. N.

13.—DRESSING FOR SHOES.—Can any one give me a receipt for making the best dressing for ladies' and children's shoes, waterproof, and that will not injure the leather?—M. L. K.

14.—FREEZING OF MORTAR.—Does lime mortar undergo any chemical change by freezing when in a soft state? I am informed that it is customary, upon the continent of Europe and in England, for all lime mortar which is to be used in the masonry of buildings of importance to be made up months, or perhaps longer, before it is used. Is it ever allowed to freeze, or does it injure the setting of it, or the durability after it has set, by freezing in a mass when wet?—H. D. C.

15.—RESULTANT POWER.—Does the resultant equal the power applied, in that class of machinery where the power is applied at the axle (as in reapers), no account being taken of friction or the power required to draw the weight of the machine? If any power is lost, how can it be accounted for, or, in other words, what becomes of it?—C. A. B. of Ill.

16.—LAND AND SEA BREEZES.—I would like to inquire what causes the wind to moderate at sun setting, and then a breeze to get up after dark? I have often noticed the same at sea, and on land in heavy gales.—B. R., Jr.

17.—JEWELLER'S LAP.—Can any one give me directions for making a lap, such as is used generally by jewellers in polishing? I want to know what the different kinds of metals are, and their proportions, so that I may cast one.—O. B. F.

18.—REVOLUTION OF BODIES.—The following question has given rise to a good deal of discussion in this place, and both parties have agreed to leave the matter for your readers to decide: A man starts to go around a squirrel that is on the trunk of a tree, and, as the man goes round, the squirrel travels around the tree, and remains in the same position to the man until both arrive at the point whence they started. Does the man go round the squirrel?—R. O. H.

19.—HYGROMETER.—I wish to know what to do with my hygrometer, that is, the wet bulb thermometer, when it is so cold that water freezes, so that I can find the relative humidity of the air? Is there an instrument made called a hygrodeik?—T. M., Jr.

20.—ANNEALING LAMP CHIMNEY.—Every person who has used a "German Study Lamp" one season, knows that the glass chimneys of the kerosene lamps in common use are an imposition on the public. Can any of your readers give a simple process to anneal or temper them, so that they, with judicious care and careful usage, will not be broken by the heat of its burning wick?—R. L. B.

21.—MARKING INK.—How can I make a good marking ink, suitable for marking boxes and barrels, etc?—T. L. S.

22.—RESTORING BUFFALO ROBES.—What can be applied to buffalo robes to make them soft and pliable after having been wet?—T. L. S.

23.—SOFTENING LEAD.—Will some one please give me, through your paper, a receipt for softening lead, that has become hard by repeated melting and using?—C. W. L.

24.—BRONZING.—Can any one give me some information about bronzing? And where can I obtain a work on bronzing, and which is the best work to get?—C. R.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

CUTTING AND ASSORTING PLAYING CARDS AND STRIPS.—Victor E. Mauger, of New York city.—This invention has for its object to produce simple and effective means for assorting—that is to say, putting upon one another in regular order—the several strips or pieces cut from strips. The invention is to be more particularly applicable in the manufacture of playing cards, but may also be advantageously used for other work. Playing cards are by rotary knives, cut from large sheets, each sheet containing about thirty or more cards. Every sheet is first printed, and then, by parallel incisions cut into strips, each strip being subsequently cut up into as many cards as it contains. When thus cut rapidly, the cards of several sheets are apt to become mixed, and those of each sheet are liable to be indiscriminately arranged, making it difficult and laborious to assort them into "packs;" but by this invention the cards of each sheet are regularly arranged and placed one upon another in desired succession, so that the entire labor of subsequent assorting is dispensed with. The invention consists chiefly in the use of a graduated plate, upon which the strips cut from sheets or the cards cut from strips are deposited, and in the use thereon of a sliding carriage or belt, which conveys each higher strip or card to the one next below it and places it on top, so that finally all pieces will be one above another in regular succession. The invention also consists in the combination, with the graduated plate, of guide chutes, which convey the several pieces, respectively, to the several steps of the plate.

WATCH ESCAPEMENT.—Don J. Mozart, of New York city.—The ordinary escapement has a projecting pin or ruby on the staff, which receives an impulse from the double pronged anchor alternately in opposite directions. The impulse for either movement is given when the ruby pin is in one—the central—position, and exerts its influence to the very end of its extent—or, in other words, until the power of the hair spring exceeds that of the impulse. The hair spring will then, in attempting to adjust itself, carry the staff back until the ruby pin is again in the central position, where it receives an impulse in the opposite direction, and so forth, every stroke using the entire force of the impulse as against that of the hair spring. This arrangement although satisfactory in a limited degree, is nevertheless unreliable as to exactness, since too much reliance is placed upon the slender hair spring, whose slight power varies under the least change of temperature and atmosphere. The division of the movements of the second hand, which is, more than any other part of the watch, dependent upon the exactitude of escapement, becomes difficult by the use of the old mechanism, and has, whenever effected, added greatly to the complication and expense of the watch. By a double regulating and impelling mechanism the inventor is enabled to give the impulse at the end of each swing of the balance wheel between certain definite limits. A beautiful precision is thus produced by simple means, and the subdivision of the second movement made easy by the mere application of detent arms to the arbor.

BORING MACHINE.—Frank S. Allen and Charles F. Ritchel, of New York city.—This improved boring machine is designed more especially for use in boring holes upon a flare and at different inclinations, and is so constructed and arranged that all the holes, whatever or however different their inclination, may be bored at the same time and at one operation; and it consists in the construction and combination of various parts, which can not well be described in such a notice as the present, but which constitute a very ingenious invention.

KEY FOR SEWING MACHINE LOCK.—Edward L. Gaylord, of Bridgeport, Conn.—This invention has for its object to furnish an improved key for locks to be attached to sewing machine covers and other articles that are turned up or over so that the key is liable to fall out and be lost, and which shall be so constructed as to retain its place in the key hole however much the article to which the lock is attached may be turned up. The key is made in two parts, secured to each other at the handle end by rivets. The forward ends of the parts or pieces of the key are made square, and are beveled or slightly bent inward at their extreme ends, to enable them to be conveniently inserted in the square key hole of the lock. The parts of the key are made elastic and their forward parts are set out, so as to be pressed inward or toward each other when the key is pressed into the key hole, where the key will be retained by the elasticity of said parts.

ASH PANS FOR STEAM BOILERS.—John Gates, of Portland, Oregon.—This invention consists in certain improvements in connection with the ash pans of steam boilers. A surrounding pan, within which the ash pan is placed, is so adjusted that a water space will be formed between the two. Stays of proper strength are interposed for holding them the requisite distance apart and supporting the ash pan. A water supply leads to the water space. An adjusted pipe extending from the side of the outer pan is bent upward, and its upper end is bent down to discharge water into a funnel held on a discharge pipe. The water entering the space through the supply pipe circulates around the ash pan and escapes through the discharge pipe. The engineer can, at the end of the latter, always observe whether the circulation of water is interrupted or not. Air is admitted to the ash pan in front through an opening. A hinged door or damper is applied to the front of the boiler for the purpose of more or less closing the opening, and thereby regulating the draught. A rope or chain is connected with the damper, and extends thence to the engineer's room, passing over friction rollers. Its other end is, or may be, weighted to balance the door in any desired position, or is otherwise secured or connected in such manner that the engineer can readily control the position of the damper, and increase, reduce, or extinguish the fire.

ROCK DRILLING APPARATUS.—Lycurgus Nelson, of Smyrna, Tenn.—This invention has for its object to so combine the necessary shafts and devices of a power drill that either of the processes of drilling, extracting tools, and sand pumping may be carried on without much preparation or difficult change or gearing. The arrangement consists in a general new arrangement of parts, which appears to be admirably adapted to the purpose intended, but the nature of which cannot be well described without engravings.

COMBINED WASHER AND BOILER.—George C. Taylor and John B. Chrisman, Port Jervis, N. Y.—This invention furnishes an improved washing machine, claimed to be very effective in operation, washing the clothes quickly, thoroughly, and without injuring them, and, at the same time, so constructed that the water may be heated and the clothes boiled in the machine. A heater is placed below the water chamber, in which the clothes are agitated by suitable mechanism, and provision is made for the circulation of the water to and from the chamber or heater through pipes.

SKATE FASTENINGS.—Edward Lawson Fenerty, Halifax, Canada.—This invention has for its object to furnish an improved skate fastening which shall be light, strong, simple, and inexpensive, and so constructed that it may be firmly secured to the boot by a single motion. When the fastenings have been adjusted to the boot, the skate is placed upon the boot-sole with the rear side of the boot heel resting against the fixed jaws. A lever is then brought up to its catch. This forces a jaw back against the forward side of the boot heel, and draws the forward fastening back from a narrower to a wider part of the boot sole, so as to clamp the edges of the sole and hold it firmly.

APPARATUS FOR TESTING CANS, BARRELS, ETC.—William D. Brooks, Baltimore, Md.—In this case, an apparatus is constructed for testing cans, barrels, and other vessels, by forcing air into the same, so that, if the vessel is not perfectly tight, the condensed air therein will leak out and indicate the spot where the hole is, the fact of leakage being revealed by the backward rotation of the index of a pressure gage that is connected with the force pump.

FIRE PLACE FENDERS.—Charles C. Algeo, Pittsburgh, Pa.—This invention consists in having an inwardly projecting flange at the base of the fender with the spindle or pivot of the caster passing through said flange up to the under side of the top of the fender, where a cavity is made for the reception of the top of the spindle, and the latter is confined against falling out by a pin passing through it above the aforesaid flange. This plan is very simple in construction, and is claimed to afford a more durable arrangement than any other in use.

FLUTING SAD IRONS.—Edward A. Franklin, of Brenham, Texas.—This invention relates to a new combination of fluting and sad iron, of such kind that the upper fluting roller will serve as handle for the sad iron, there being thus no loose or separate parts required for the two functions. The body of the sad iron has a projecting stem. The lower roller hangs in a cavity which is provided in the top of the iron, while the projecting axle of the upper roller is fitted through a hole in the stem which thus constitutes the support for said roller. The operating crank is screwed to a left-handed thread of the axle of the lower roller, and will thus, when used for fluting, so turn the rollers that they take the cloth from the operator when the crank is turned When not used for fluting, the crank is unscrewed and the roller transferred to the upper part of the stem where there is a hole for the reception of the axle. After the crank is re-applied, the roller is in position to constitute the handle of the sad iron.

LIFTING JACKS.—Walter S. Burgin, of Washington, Vt.—This invention relates to a new arrangement of parts constituting a lifting mechanism for a wagon jack. The case or main frame of the jack is made in form of a rectangular narrow box, standing on a stout base or board, and open on top for the reception of a lifting slide. The slide has its upper edge made in the form of steps, to be originally applicable to articles of different hights. The lower end of the slide rests, with a small rounded point which is formed on it, upon a lever pivoted to the case. The free end of the lever projects through a slot in the case, and is, by a link, connected with the short arm of a lever handle, which is pivoted to ears projecting from the side of the case. By swinging the handle down, the lever will be swung up and the slide elevated, the connecting hinge or pivot between the link and handle being carried beyond the line drawn through the lower hinge or pivot of the link and the pivot of the handle, so as thereby to lock the parts and prevent the weight on the slide from crowding it down. By swinging the handle up the slide will be let down. The combined leverage gives great power and facilitates the raising of heavy weights.

SASH HOLDERS.—Charles T. Tessier, of New York city.—This invention consists of a T headed lever, a sliding locking bolt with a retracting spring, a flexible locking roller, and a shifting inclined plate in connection with said roller, all arranged in a case adapted to be applied to the stile of the sash, and to lock the sash by the bolt, and free it from the flexible roller by a down movement of the lever, the bolt being employed for locking the sash when down. By an upward movement of the lever the bolt is freed so as to be withdrawn by its spring, and the shifting inclined plate behind the flexible roller is actuated to press the roller against the window frame, so that it will jam between said plate and frame to hold the sash up.

STONE CRUSHER.—Peter Wood, Jersey City, N. J.—This is a powerful machine, the principle of which may be briefly described as follows: A fly wheel shaft receives power from a belt, and, through a crank of short radius and a stout pitman, actuates a powerful lever, which, through a bar, applies the force thus multiplied to toggle levers which actuate a pivoted jaw which, moving to and from a fixed jaw, crushes the stones as they are fed in between the jaws.

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121,447.—CUTTER.—E. Benjamin, Chicago, Ill.
121,448.—FENCE.—C. E. Brown, Pamelia, N. Y.
121,449.—MOLD.—G. Carnell, Philadelphia, Pa.
121,450.—BRICK MACHINE.—J. Cooke, Muncy, Pa.
121,451.—STEAM ENGINE.—C. P. Deane, Springfield, Mass.
121,452.—FASTENING.—J. C. Desumeur, C. & E. Dudin, L. Delscourt, Guise, France.
121,453.—CARRIAGE.—E. Falkingham, San Francisco, Cal.
121,454.—SAFE.—D. Fitzgerald, New York city.
121,455.—ORDNANCE.—D. Fitzgerald, New York city.
121,456.—LAMP POST.—S. W. France, Brooklyn, N.Y.
121,457.—ENGINE.—A. Goulding, Worcester, Mass.
121,458.—BRUSH, ETC.—S. G. Groff, Vogansville, Pa.
121,459.—WAGON.—A. Iske, Lancaster, Pa.
121,460.—SEWING MACHINE.—M. H. Kernaul, Berlin, Prussia
121,461.—WASHER.—C. Larrabee, Haywood, Cal.
121,462.—HUB.—J. Monk, Norwich, Conn.
121,463.—HOIST.—J. Nicholson, Monticello, Ind.
121,464.—DRAFT HOOK.—J. Nicholson, Monticello, Ind.
121,465.—EDGE PLANE.—A. J. Parker, Lynn, Mass.
121,466.—SAW MILL.—L. C. Pattee, Lebanon, N. H.
121,467.—COMPOUND.—P. Paul, Black Earth, Wis.
121,468.—TRAP.—H. Polley, San Francisco, Cal.
121,469.—BOAT.—W. E. Prall, J. D. Defrees, Washington, D.C.
121,470.—DESK, ETC.—J. S. Rankin, Minneapolis, Minn.
121,471.—DESK, ETC.—J. S. Rankin, Minneapolis, Minn.
121,472.—WATER WHEEL.—B. Redding, Kentville, Canada.
121,473.—BED BOTTOM.—R. A. Smith, East Weare, N. H.
121,474.—WATCH CASE.—C. L. Thiery, Boston, Mass.
121,475.—TINTING.—H. Vander Weyde, New York city.
121,476.—INDICATOR.—F. F. Warner, J. W. Benham, Chicago, Ill.
121,477.—SEWING MACHINE.—J. N. Wilkins, Chicago, Ill.
121,478.—PAINT.—D. R. Averill, New Centerville, N. Y.
121,479.—ENGINE.—J. S. Baldwin, Newark, N. J.
121,480.—ENGINE.—J. S. Baldwin, Newark, N. J.
121,481.—ENGINE.—J. S. Baldwin, Newark, N. J.
121,482.—FORCING LIQUIDS.—J. S. Baldwin, Newark, N. J.
121,483.—PIPE HOLDER.—V. A. Bond, Cotton Gin, Tex.
121,484.—CULTIVATOR.—D. W. Bowman, Tippecanoe, Ohio.
121,485.—SAFETY PIN.—W. H. Brock, Bridgeport, Conn.
121,486.—CAR SEAT.—G. Buntin, Boston, Mass.
121,487.—FAUCET.—M. Burnett, Boston, Mass.
121,488.—SEWING MACHINE.—R. G. Bush, Jamestown, N.Y.
121,489.—EARTH CLOSET.—D. B. Collins, Richmond, Va.
121,490.—CAN HEAD.—E. T. Covell, Brooklyn, N. Y.
121,491.—PIN PACKAGE.—C. O. Crosby, Milford, Conn.

121,492.—Pin Package.—C. O. Crosby, Milford, Conn.
121,493.—Sticking Pins.—C. O. Crosby, Milford, Conn.
121,494.—Chuck.—A. F. Cushman, Hartford, Conn.
121,495.—Eyelet.—A. Delkescamp, New York city.
121,496.—Mold.—A. J. Derrick, Sheridan, Nev.
121,497.—Burner.—T. B. Doane, New York city.
121,498.—Knuckle Protector.—G. W. Doty, Wooster, O.
121,499.—Fire Arm.—W. H. Elliot, New York city.
121,500.—Pitcher.—C. Englebert, J. S. Von Nieda, Phila., Pa.
121,501.—Broom.—T. R. Evans, Blacksburg, Va.
121,502.—Toy.—J. Fallows, Philadelphia, Pa.
121,503.—Safe.—D. Fitzgerald, New York city.
121,504.—Desk.—D. Fitzgerald, New York city.
121,505.—Finishing Silk.—C. L. Frink, Vernon, Conn.
121,506.—Stove.—J. H. Goodfellow, Troy, N. Y.
121,507.—Door Spring.—W. M. Gray, Brooklyn, N. Y.
121,508.—Door Spring.—W. M. Gray, Brooklyn, N. Y.
121,509.—Suspender.—H. C. Griggs, Waterbury, Conn.
121,510.—Gluing Table.—S. P. Groocock, Clifton, N. J., W. J. Brassington, Brooklyn, N. Y.
121,511.—Nail.—G. L. Hall, Boston, Mass.
121,512.—Swage Tool.—I. S. Hamilton, Hamilton, Ohio.
121,513.—Tool.—I. S. Hamilton, Hamilton, Ohio.
121,514.—Flue Expander.—I. S. Hamilton, Hamilton, O.
121,515.—Ejector.—J. T. Hancock, West Roxbury, Mass.
121,516.—Hemmer, etc.—M. Harris, Jamestown, N. Y.
121,517.—Spinning Machine.—G. H. Hathorn, Bangor, Me.
121,518.—Packing Sugar.—C. E. Haynes, Boston, Mass.
121,519.—Wagon Seat.—G. G. Heermance, Claverack, N.Y.
121,520.—Cutting Whalebone.—F. E. Hibbard, Boston, Mass.
121,521.—Lamp.—M. W. House, Cleveland, Ohio.
121,522.—Dental Plate.—J. W., Jr., I. S. Hyatt, Albany, N.Y.
121,523.—Compound.—C. L. Jones, Pedler, Va.
121,524.—Pavement.—J. S. Kelly, New York city.
121,525.—Foot Power.—G. B. Kirkham, New York city.
121,526.—Treating Ore.—S. R. Krom, New York city.
121,527.—Ammonia Engine.—E. Lamm, New Orleans, La.
121,528.—Blinder.—J. B. Low, Homerville, Ohio.
121,529.—Bag Holder, etc.—W. F. Lum, Waterloo, Wis.
121,530.—Refrigerating Car.—A. S. Lyman, New York city.
121,531.—Sash Holder.—W. W. Lyman, West Meriden, Ct.
121,532.—Motor.—J. A. Macauley, Wheeling, W. Va.
121,533.—Elevator.—P. W. Mackenzie, Blauveltville, N. Y.
121,534.—Compound.—N. McKelfresh, Elizabeth, Ind.
121,535.—Plow.—T. Meikle, Louisville, Ky.
121,536.—Compound.—A. Miles, Toledo, Ohio.
121,537.—Sewing Machine.—R. S. Morse, East Dixfield, Me.
121,538.—Railway.—J. B. Newbrough, New York city.
121,539.—Car.—J. B. Newbrough, New York city.
121,540.—Car Starter.—J. North, New York city.
121,541.—Plant Stand.—B. B. Nourse, Westborough, Mass.
121,542.—Valve.—S. J. Peet, J. W. Willis, Boston, Mass.
121,543.—Desk.—I. N. Peirce, Philadelphia, Pa.
121,544.—Pavement.—R. C. Phillips, Cincinnati, Ohio.
121,545.—Oil Can.—G. S. Prior, Boston, Mass.
121,546.—Nut Lock.—H. L. Purdie, Buffalo, N. Y.
121,547.—Nut Lock.—H. L. Purdie, Buffalo, N. Y.
121,548.—Nut Lock.—H. L. Purdie, Buffalo, N. Y.
121,549.—Nut Lock.—H. L. Purdie, Buffalo, N. Y.
121,550.—Burner.—F. S. Robinson, Boston, Mass.
121,551.—Mortise.—E. J. Rowe, Eureka, Cal.
121,552.—Wagon.—L. B. Snow, Cleveland, Ohio.
121,553.—Camera.—J. J. Stock, New York city.
121,554.—Treating Ore.—P. T. G. Stockman, Brooklyn, N.Y.
121,555.—Water Wheel.—J. S. Teed, Guilford, N. Y.
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REISSUES.

4,654.—Cork Machine.—M. F. Crocker, West Winsted, Conn. —Patent No. 13,714, dated October 30, 1855.
4,655.—Governor.—J. Judson, Rochester, N. Y.—Patent No. 33,743, dated November 19, 1861.
4,656.—Division A.—Revolving Caster.—C. H. Latham, J. S. Lugg, Lowell, Mass.—Patent No. 116,722, dated July 4, 1871
4,657.—Division B.—Revolving Caster.—C. H. Latham, J. S. Lugg, Lowell, Mass.—Patent No. 116,722, dated July 4, 1871.
4,658.—Lubricator.—J. B. Wickersham, Phila., Pa.—Patent No. 70,058, dated October 22, 1867.
4,659.—Making Cans.—E. W. Bliss, Brooklyn, N. Y.—Patent No. 82,4?1, dated September 29, 1868.
4,660.—Lamp.—H. Halvorson, Nashua, N. H.—Patent No. 25,506, dated September 20, 1859; reissue No. 4,413, dated June 6, 1871.
4,661.—Tender Frame.—B. W. Healey, Providence, R. I.—Patent No. 103,878, dated June 7, 1870.
4,662.—Finishing Beltings.—C. McBurney, Boston, Mass.—Patent No. 115,880, dated June 13 1871.
4,663.—Needle.—C. H. Wilcox, New York city—Patent dated March 19, 1861.

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