[For the Scientific American.]

SUCCESSFUL APPLICATION OF STEAM TO CANAL BOATS.

BY T. MAIN.

In the winter of 1867–8, the writer, after considering various methods for applying steam for towing on the canals, conceived the plan of locating an ordinary screw propeller in the center of the bow of the ordinary canal boat, in a cavity or opening (tapering in shape, and terminating about 20 feet from the bow) which is formed for that purpose, with the view of preventing any agitation of the water, of displacing it at the bow, and of replacing it at the stern of the boat; and, in order to show the indications with this method of propulsion, a working model of a boat, and a section of the canal, on a scale of ¼ inch to a foot, were constructed and tried in the spring of 1868.

Various models and experiments were tried until September, 1870, when the canal boat *Geo. Barnard* (a lake boat, 90 feet × 17 feet × 6 feet draft, and which carries 200 tuns) was procured, and steam power applied on this plan, at Nyack, for the purpose of making an actual trial on the Erie canal, to test the speed, the consumption of fuel, and to find whether there were any objections to its working when going through the locks, and running on the canal. Accordingly, on November 4th, after everything had been made ready, the *Geo. Barnard* left Nyack on a trial trip to Schenectady (on the Erie canal) and back, a distance of over three hundred miles, going with her own steam all the way.

The results of this trial prove that steam can be applied to ordinary canal boats to propel them three miles an hour, or twice the speed of the present loaded boats; without any injurious action on the canal banks whatever.

That the speed of the boat is the same on the canal as on the river.

That the boat can go through a lock in six minutes from the time the bow enters until the stern leaves it, or about one half the time a loaded horse boat takes; for, owing to the screw being in the bow, when going up the boat can be drawn against the upper gate, against the current, allowing the lower gate to be promptly closed.

That the boat will pass over the tow lines of other boats.

That it can be handled in the locks by three hands.

That a loaded boat can be run 72 miles per day, on one tun of coal, costing $5, while the towing for horse boats has cost 40 cents per mile this season, or $28·80 for 72 miles, and they take two days to go that distance, and have to pay the crew for two days instead of one.

That, if desired, this boat will tow one or more loaded boats at a moderate speed. (She towed a boat loaded with 135 tuns of cargo, at Rondout, at the rate of 2¾ miles an hour.)

That steam can be applied to any canal boat at a cost of about $600 for altering the boat, in addition to the cost of the machinery, and then she will be capable of doing twice as much business as before.

That such a boat can go on the canal, river, or lake, with her own steam, and so dispense with all charges for tunnage.

That steam can be advantageously applied to a canal boat or barge, with a smaller reduction of the carrying capacity, on this plan than on any other, as the boat can be built very full, and yet the water can flow to the screw, and go from it very readily.

That a boat carrying 200 tuns of cargo, on this plan, with a 16-horse power engine, and burning one tun of coal in twenty-four hours, will go three miles an hour, while the carrying capacity is only reduced ten tuns by the application of the machinery, and if a greater speed is desired it can be obtained by applying more power.

The steering qualities of the *Geo. Barnard*, when loaded on an even keel, are all that could be desired, and she behaved very well throughout the trip; the only thing found to be needed was a jet in the smoke pipe, so that the steam pressure could be maintained when cleaning the fire, or when the smoke pipe was lowered to go under the bridges.

The action of the engine and boiler was perfect, in fact the engine was never stopped until the destination of the boat was reached each day. The action of the screw on the trial has been found to draw a current into the opening at the bow, force it along under the bottom, and replace it at the stern, thus allowing the vessel to glide along without making any commotion in the water. The boat passed through forty-four locks on her way. She passed three loaded horse boats above Cohoes, and beat them three hours on a run of nine miles, thus showing that there is now no difficulty whatever in successfully applying steam to canal boats on the Erie, Champlain, or Hudson & Delaware canals.

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Alloys of Copper, Tin, Lead, Zinc, with Manganese.

In the year 1826 a spoon, made by Messrs. Zernecke, of Berlin, was analyzed, and the alloy was found to be composed of copper, 57·1 per cent; manganese, 19·7 per cent; zinc, 23·2 per cent. This analysis is included in a chapter on "Kuperf-mangan," by Mr. Johann Tenner, in his "Handbuch der Metall-legirungen," published at Quedlinburg. Berthier produced a large number of alloys of manganese with various metals, and has recorded their principal properties. Although there is no published account of such experiments, Dr. Percy some years ago thoroughly investigated the nature of manganese alloys. There are also specifications of patents, one in the name of Emil Stoehr, dated 1862, the other in the name of Oscar Prieger, dated 1864, both claiming the original discovery of this class of alloy. Whilst, therefore, the alloys of copper, zinc, and other metals with manganese, have been more or less known to the metallurgist for more than forty years; whilst their valuable physical properties have been fully described; whilst, moreover, manganese in its ores almost approaches iron in its abundance and in its value, and whilst for years being suffered to escape as a waste product from almost every large alkali works, we find the metallurgist has not succeeded in reducing it to serve widely except when yoked with iron. Attention was directed to this subject by the late Mr. John Keates. To produce metallic manganese was not from the first attempted; and it is with extreme difficulty that even small quantities of this metal can be prepared. From the first it was discovered that in using any of the ores of manganese the iron and the silicon completely destroyed the value of the product. Having obtained a comparatively pure oxide of manganese, recovered from the "still-liquors," and having mixed this with oxide of copper, not metallic copper, together with wood charcoal, all finely ground and intimately mixed, the charge was put into a plumbago crucible, then heated in an air furnace at an intense heat from three to four hours. It was found when the pot was taken out that, still suspended in the charcoal, and not run down to the bottom, were innumerable fine shots of a bright white metal; these being separated by washing and placed again in the crucible and heated, fused into a prill or button covered with a layer of green vitreous slag. The process was continued, until some small ingots were produced, and on these experiments were made as to their malleability and ductility. The alloy was found to be very hard and brittle when hot, but when cold, although still hard, it rolled with ease, and was highly elastic. The proportions of the alloy were about—copper, 75 per cent; manganese, 25 per cent. When the simple alloy had been produced in sufficient quantities, compound alloys with zinc were tried in various proportions, and these again rolled with complete success. Certain mixtures of copper, zinc, and manganese possess the advantage over both German silver and yellow metal that, whereas the one will only roll cold, and the other hot, the manganese alloy rolls from hot to cold. The laboratory experiments having been completed, an air furnace was built in which a 1 cwt. plumbago crucible was used. The results were precisely the same as those obtained in the laboratory, only it was found that by stirring the charge a few minutes before the crucible was taken out of the fire, by far the greater portion of the metal that before was in small fine shot, needing very careful washing, now settled to the bottom of the pot, and could be poured out as a bar or an ingot, the slag also melting, and the unconsumed charcoal floating on the top. This experiment was continued until several hundredweights of the alloy were produced, so that it might be subjected to various tests, and also that some approximate estimate of its cost and value might be formed. As a simple alloy, in which the proportions of manganese range from 5 per cent to 30 per cent, it is both malleable and ductile, with a tenacity considerably greater than that of copper. With zinc, a compound alloy, resembling in some of its qualities German silver, is obtained. The alloy of copper and manganese combines with tin, lead, and other metals, and from these castings are made, and applied as bearings for machinery and other similar purposes. It was not the nature of the metal itself that prevented its being widely used; it was its cost. The waste of manganese is very considerable, over 10 per cent remaining unreduced, and forming a silicate; the wear and tear of the plumbago pots and the furnace incurred a large expense, and in proportion to the quantity of metal produced the fuel consumed and the labor expended were great. The work was therefore for a time arrested by an obstacle which not unfrequently bars the path of the inventor. It was, however, now simply a question of cost. The waste of manganese in alloys rich in that metal will, it is feared, always be considerable, but the value of the raw material would permit some such loss, could the other points be obtained—and these, it is believed have now been achieved. The metal has been produced by heating a mixture of carbonate of manganese with oxide of copper and charcoal in a tolerably large reverberatory furnace, and not in a small and costly pot. The fuel used has been principally the common slack or small coal of the district, and not coke. The labor has been proportionately reduced, and a series of alloys are produced that ere long promise to play no unimportant part in the arts and manufactures. It is the excellent furnace arrangements of Mr. Siemens that have assisted in overcoming the difficulties at first encountered, by affording the intense heat needed, with a non-oxidizing flame, in a quiet atmosphere.

Specimens exhibited.—(1) Manganese and copper in various proportions, from 35 per cent to 5 per cent of manganese as ingot, sheet, and wire. (2) Copper, zinc, and manganese; also in different proportions, and in a variety of applications. (3) Copper, zinc, manganese, and tin; as ingots and as bearings. (4) Copper, manganese, and tin, in several different proportions; as bars. (5) Copper, manganese, and lead.—*J. F. Allen, Esq. F. C. S. Before the British Association.*

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There is an Under-Current.

It has long been known that a current is constantly flowing into the Mediterranean from the Black Sea, and from the Atlantic, besides the numerous rivers pouring in always abundantly, and the question has often been asked: How is it that the great Midland sea does not become over-full? The answer is: Because, while a surface-stream flows in through the Strait of Gibraltar, a stream deep down is constantly flowing out; and the existence of this under-current is said to have been proved by a captain, who sunk a basket of stones by a rope to a considerable depth, where, being acted upon by the strong stream, it towed the boat out against the surface-current. Nevertheless, the existence of the under-current has often been questioned. Dr. Carpenter, however, who has recently returned to England from a dredging-cruise in the Mediterrenean, states that he took much pains to investigate this question, and ascertained that the outflowing under-current does really exist.

EYESIGHT AND THE MICROSCOPE.

[Condensed from an article in "Good Health," by Professor John Phin, New York.]

In using the microscope, I have found that the best system is that recommended by Dr. Carpenter. It is to alternate the use of the eyes, always keeping the unemployed eye open. But I feel confident that it is of no use to keep the unemployed eye open if it be made to stare at a dead-black surface. It is the exclusion of light from one eye, and the consequent unequal action of the visual organs, that is thus produced, that causes the mischief that we dread; and it matters not whether this unequal action be produced by covering the eye with the eyelid, or by excluding the light from it by other means—the result is the same. In making observations with the microscope, all extraneous light should be excluded from the eyes. Hence the value of a properly arranged shade. Such a shade, however, should consist of more than a mere flat sheet of pasteboard covered with velvet. It should have a perpendicular portion, rising up in front of the face, and cutting off all light except that which comes through the microscope. And now, having provided a shield of this kind, which, by the way, is easily made of pasteboard, blackened on the inside with dead-black varnish (made of alcohol, lamp-black, and a very little shellac), if we punch an inch hole at such a point that the unoccupied eye can see it in the same way that the other eye looks through the instrument, we will find that the fatigue experienced by that eye is vastly less than when it is exposed to the dead-black surface. A few trials will set at rest all questions on this head, and the change from light to darkness is easily made by simply slipping a piece of blackened paper or card over the hole.

With few exceptions, we use altogether too much light with the microscope. Where a full flood of light is passed through a transparent object, the finer points are apt to be "drowned" out entirely; and it is only by modifying the amount of light by means of the diaphragm, that we are enabled to make out the more delicate details. Hence it will be found that the use of the bull's-eye condenser, for concentrating the light on the mirror, and consequently augmenting the amount of light passing through the object, is, in general, totally unnecessary. This arrangement of the illuminating apparatus is totally different in its effects from that of the achromatic condenser, and cannot be substituted for it, as some persons seem to think.

The first requisite in the light that we use is whiteness. Hence daylight, the light from a white cloud, the artificial white cloud illuminated by daylight, the light from the old-fashioned argand lamp burning sperm oil, the modern student lamp burning kerosene oil, and its various modifications, and the argand gas-burner are good—their excellence being about in the order here laid down. Common gas-light, candles, and kerosene lamps are inferior just about in the order we have named. White light is not nearly so fatiguing to the eyes as the reddish glare from a half-smothered combustion. Hence, in all cases we must seek to have the most perfect combustion and highest possible temperature of flame in our sources of artificial light. It is true that this gives rise to great heat, but this difficulty is easily obviated by the use of a proper screen or shade, and none will be found better than the one previously described. Indeed, when working by artificial light, it will be found that the heat is one of the most efficient causes of injury to the eyes, and the screen that we have mentioned is, perhaps, quite as useful, from the fact that it cuts off heat, as from its excluding unnecessary light.

The second requisite is steadiness. Nothing is more trying to the eyes than a flickering light. Of all sources of light, the naked gas-flame is the most unsteady; and yet we have seen young men working away with it for hours. The argand gas-lamp with glass chimney is much more steady, but it is not quite as white as a well-trimmed German student-lamp, burning good kerosene oil; and as this means of illumination is the most accessible in this country, it is probably to be preferred above all others.

There are certain conditions of nearly equal importance that ought to be found in the microscope itself, and that are found in the instruments of the best foreign makers, as well as those of this country. A very trifling want of correct adjustment on the part of the microscope produces a very injurious strain. Hence the necessity of a ready means of producing a delicate and accurate adjustment of the focus of the microscope. This is totally wanting in some instruments, and within a few days we saw, in an English scientific periodical, an advertisement of a microscope which claims superiority on the ground that it does not require focusing. Such a microscope must be essentially bad, except for a very limited class of objects. All good microscopes are furnished with arrangements for focusing. A second requisite is that the instrument should be so steady that the object shall be retained in view and in focus without change. Any tremor is injurious to the eyes, and especially is this the case when that tremor produce a continual change in the relation of the object to the focus. A single hour's work with a lens held in the hand or mounted on an unsteady stand will cause more injury to the eyes than weeks of work where a first-class instrument of far higher power is used. It has always seemed to us that watchmakers, engravers, and those who use lenses, do not sufficiently appreciate this fact. They in general mount their lenses on wire stands, which tremblingly respond to every footstep that falls upon the floor, and thus cause continual demands upon the eye for re-adjustment of focus. Wherever a microscope—single or compound—is used for more than a few seconds, it ought to be mounted upon a stand so firm that all vibration, and especially all disturbance of the focusing, will be avoided.

Shaw's Cotton Seed Huller.

The proper hulling of cotton seed is a matter of much importance, in a commercial point of view. Our readers having perused the valuable articles on Cotton Seed and Cotton Seed Oil, published in this journal during the past year, will stand in little need of any argument on this point. If the seed be much broken in the hulling process, so as to approximate the quality of meal, its spoiling during exportation is almost certain. We have been shown a letter, from a London firm, attesting that a lot of seed, hulled by the machine shown in our engraving, was shipped to London from this country, not only arriving in perfect condition, but yielding 42 lbs. of oil from 165 lbs.of seed,in the samples tested, the oil being of excellent quality, not inferior to that extracted from Egyptian seed.

In an agricultural point of view, the proper and economical hulling of the seed is also of importance, since the hulls which are worthless for industrial purposes, or for feeding contain nearly all the fertilizing elements of the seed.

We are informed that since the shipment of seed to London above referred to, other lots have been sent with equal success. If these are facts, as stated, they establish the possibility of shipping hulled seed, and will undoubtedly open the door to a large foreign traffic in this article.

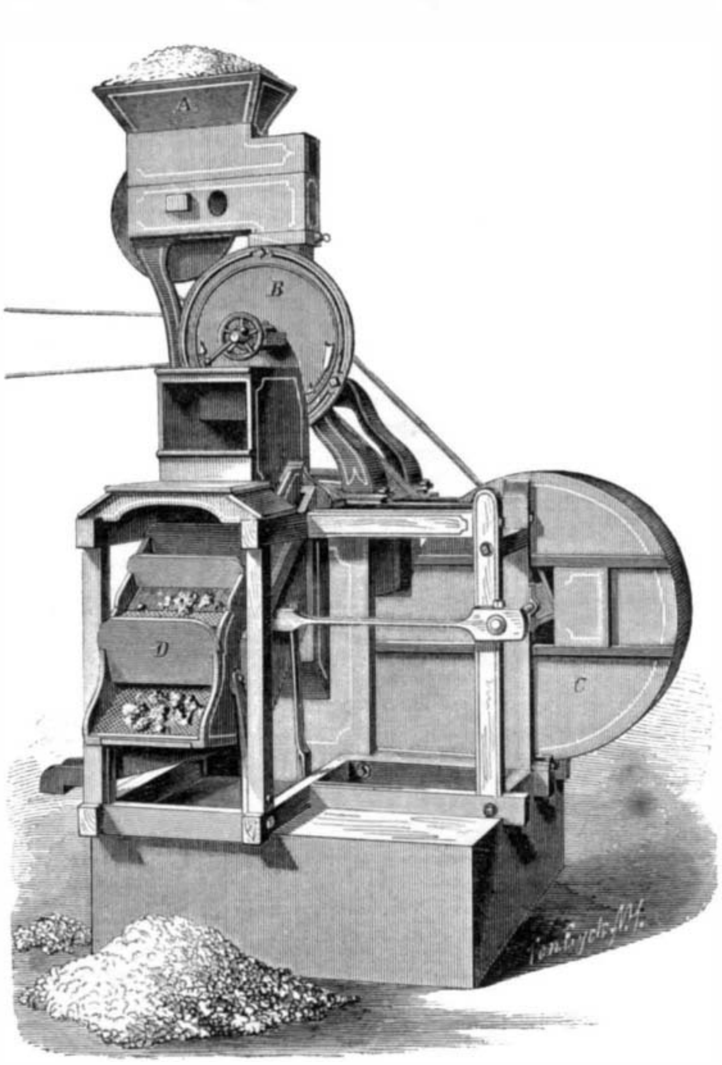
The operation of the machine is extremely simple, as is also its construction.

The seed is placed in the hopper, A. From this hopper it falls upon an endless apron, which carries it along and drops it into a vertical chute, from whence it is carried by a screw conveyer through the center openings of two revolving chilled iron plates, inclosed in the case, B, and passed through between their surfaces to be hulled. These hulling plates have a peculiar "dress," the action of which is to decorticate the kernels of the seed.

The seed, passing downward from the hulling plates, meets a blast, generated by the fan-blower, C, which blast carries up all such seed as is imperfectly hulled, together with the perfectly separated hulls, and deposits them upon the "separators," D. These separators are screens, upon which a series of fingers play, rubbing the imperfectly separated seeds and hulls, and completing the work of the hulling plates.

Very little of the seed is thus imperfectly hulled by the plates, and the passage of the same through the separators completely supplements the operation of the plates. At the same time the air blast removes all dust, and also acts to dry the hulled seed. A second separator in the opposite side of the machine from D separates the small portion of seed that may have been crushed in passing through the hulling plates, the crushed portion being used as food for cattle, while the sound and comparatively uncracked portions, constituting the greater bulk of the product, are reserved for exportation, or for home oil manufactories.

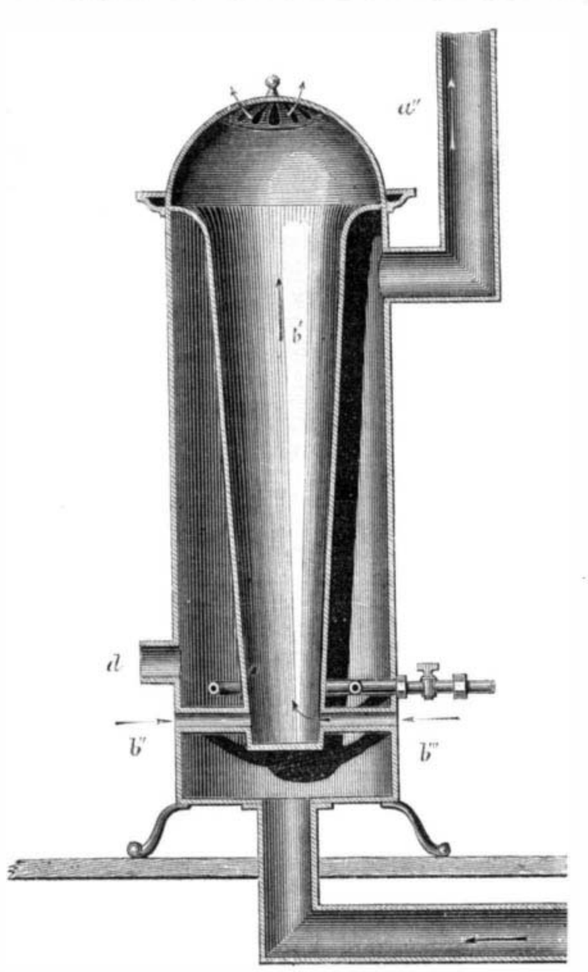
Patented Nov. 9, 1869, and June 7, 1870. For information concerning these machines address Jewell & Ehlen, 93 Liberty street, New York city.



SHAW'S COTTON SEED HULLER.

GAS STOVE.

A correspondent of the *Journal of Gas-Lighting* (London) gives a description of a gas stove, which is not open to the objections against such stoves as they are usually constructed. It may be easily made anywhere by ordinary sheet-iron workers, and as such a stove would be in many cases very desirable, we reproduce the engraving of it from the journal referred to.



a', the air-passage (2-inch tubing), passing underneath the floor to the outside of the building, and protected by an air-brick.

a'', the exit-flue. With a view to the economization of heat, this may be considered as part of the stove. As much of it as may be convenient should, therefore, be fixed in the room.

b', an air-chamber, through which the air circulates, entering below through the tubes, *b''*, *b'''*. *c*, the ring-burner.

d, a circular doorway for lighting the gas and examining the hight of the jets. This is closed by a disk of glass set in a tight-fitting ring, fastened by a bayonet-joint.

The exit-flue may extend horizontally a considerable distance—say 30 to 50 feet—if within such limits it can be conveyed into a constantly-used chimney, or, in any case, one with a good up-draft. If no chimney be available, the flue may be carried (horizontally) any reasonable distance to the outside of the building, the end being turned up in the usual manner. By a slight alteration in the fitting up—that is, by connecting the air-tubes, *b'*, *b''*—so as to receive air from outside the house, a constant flow of fresh (warmed) air would be admitted to the room.

Rapid Telegraphing.

There was great rivalry between the Western Union and the other telegraph companies having lines between this city and Washington, D. C., as to which should transmit most rapidly the annual message of the President, delivered to the Senate and House of Representatives on December 5th. The message contained about 9,000 words, and was transmitted over 10 wires by the Western Union Company, dropping copies at Baltimore and Philadelphia in 37½ minutes, or at the average rate of 25 words per minute on each wire.

The entire message was transmitted by the Bankers and Brokers' and Franklin Companies in 70 minutes, employing two wires each. This was at the rate of 33 words per minute.

The Franklin Company used two wires until the message was completed, and a third wire for 15 minutes, the average time being 70 minutes, and the average speed 28 words per minute.

The Bankers and Brokers' Company used two wires, the average time being 70 minutes, and the average speed 35 words per minute. One of these wires averaged 39 words per minute—Mr. Benjamin Johnson sending and Mr. I. S. Fitch receiving.

The result in the strike in January last drove from the Western Union to the opposition companies, greatly to the advantage of the latter, some of the best operators formerly employed by the former. The operators of the B. & B., and Franklin lines may justly feel proud of this achievement and their substantial demonstration of superiority.—*The Telegrapher*.

The Mode of Erecting a Railway Bridge across the Ganges.

Last month a party of engineers, headed by Sir John Rennie, visited the works of Messrs. Campbell, Johnstone & Co., at Silvertown, to witness the exhibition of a new method of launching girders or bridges without scaffolding. The structure which formed the subject of the experiment was two spans, each 110 feet in length, of a bridge which is to be erected across the Ganges at Cawnpore, and which will carry on the top surface the rails of the Oude and Rohilkund railway, and below, a good and substantial roadway for bullock trains or ordinary traffic. The bridge is to be formed of lattice tubular girders, the hight over all being ten feet eight inches, and the bullock road nine feet wide by eight high. The bridge, when complete, will consist of 23 spans each of 110 feet in length, resting upon cylindrical piers of brickwork, and the weight of materials in each will be about 75 tuns.

The method hitherto adopted for launching girders of these dimensions has been simple haulage by means of chains and pulleys, which has been attended with great loss of power, delay, and many other inconveniences. The mode adopted and devised by Messrs. Campbell, Johnstone & Co., avoids waste of power, has nothing to do with either chains or pulleys, and depends entirely upon direct propulsion. The span having been built up on the shore, rests at each end upon a series of ten wheels, which are propelled by ten hydraulic rams, five on each side; the number may of course be diminished or increased, according to the work to be performed —and to these wheels, which play upon a rail beneath the bridge, there is fitted a worm and worm-wheel moved by a ratchet brace, which is set in motion by five men on each side working handles up and down, who can propel 150 tuns at the rate of nine inches in the minute, a speed which, with a slight alteration of the machinery, will be increased to a foot. In this instance a bridge 2,530 feet in length, is to cross the Ganges in 23 spans of 110 feet each. Every section (each including two spans) will be launched from the same shore, and all will be driven across by the apparatus and moved from pier to pier as required. The bridge was designed by Mr. Heppel, C. E., and has been constructed by Messrs. Campbell, Johnstone & Co., to whom belong the entire credit of devising the apparatus for the fixture of the superstructure.—*Herapath's Journal.*

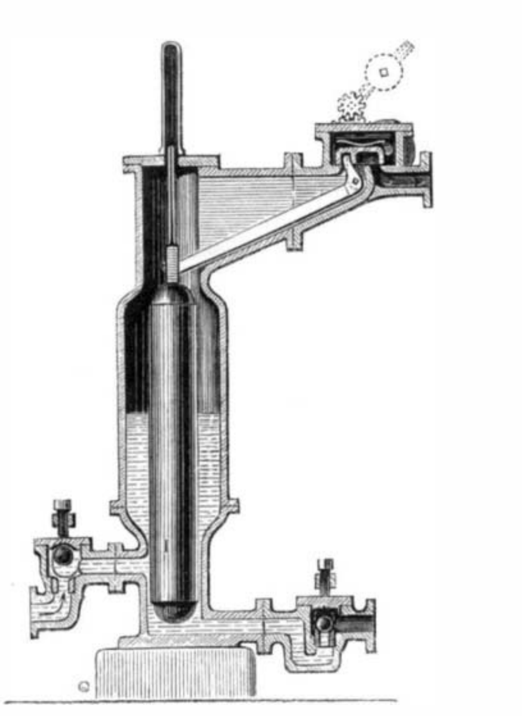
AUTOMATIC BOILER FEEDER.

This new feeder is the invention of the English enginee Mr. Macabies, and is designed to maintain a constant level in steam boilers. It is composed of a cylindrical receiver furnished with two spherical valves, one slide valve, and a floating water gage.

The receiver is put in communication first with the atmosphere and the hot water of a reservoir, and then with the steam and water of the generator.

It is in reality a supply cylinder of small capacity working automatically, and having no parts liable to derangement. The work of supplying the boiler is reduced to a simple surveillance of the apparatus.

According to the *English Mechanic*, when the float is down, as in the figure, the steam in the receiver can escape by the valve at the upper right hand corner, and hot water from the proper reservoir flows in by the valve at the lower left hand side. As the receiver fills, the float rises and closes the right hand upper valve; the steam, then acting upon the water of the receiver, closes the valve which admits the supply and opens the valve upon the opposite side, which communicates with the boiler. The water, being subjected to equal pressure above and below flows into the boiler by virtue of its weight. The float descending with the water shuts the steam valve and the water again flows in.



DYEING ARTICLES MADE OF HORN BLACK.—The objects made of horn, and ready for use, but not yet polished, are placed in a lye of caustic soda or potassa, and left therein until a portion of the surface has been dissolved, which may be readily detected by the somewhat fatty feeling the horn assumes when touched with the fingers. The objects are next washed in pure fresh water, and afterwards passed through Lucas' aniline black. After having been dried, the objects are washed, and, lastly, polished.