IMPROVED PAPER-PULP ENGINE.

The new feature in the engine illustrated herewith consists in the female cone, provided with groups of radial knives and guide cavities in the spaces between said groups of knives.

Upon the bottom of the case, A, is formed a hollow column, B, to receive and serve as a bearing for the vertical shaft, C, and which rises a little above the top of the case, A, to prevent the pulp from coming in contact with the shaft, C, and clogging and wearing it. To the shaft, C, above the top of the hollow column, B, is attached the hub of an inverted frustum of a cone, D. The lower part of the hub of the cone, D, is recessed to receive the upper end of the hollow column, B, so that the face of the male cone, D, may coincide with the face of the female cone, E.

To the face of the cone, D, are attached radial knives, not shown in the drawings. To the face of the cone, E, are attached knives, G, which are arranged in groups, and are made with an angle or curve, as shown in Fig. 1, to prevent them from interlocking with the knives of the cone, D. In the face of the cone, E, between the groups of knives, G, are formed two concavities, H I. The concavity, H, leads up from the lower edge of the cone, E, to the front of the group of knives, to serve as a spout to conduct the pulp to said knives; and the concavity, I, leads from the rear of the group of knives, G, to the upper edge of the cone, E, to serve as a spout to conduct the pulp from the knives to the upper edge of the cone, E, so that it may pass freely back into the case or tank, A. To the lower edge of the cone, E, is attached the upper edge of a tube, J, which extends down nearly to the bottom of the case, A. With this construction, the centrifugal force engendered by the revolution of the cone, D, causes the pulp to pass up between the cones, D E, flow over the upper edge of the cone, E, and flow back into the tank, A, the pulp from the lower part of the said tank passing into the tube, J, and up between the cones, D E, so as to establish a circulation, and insure all the pulp being properly acted upon. This invention was patented through the Scientific American Patent Agency, April 17, 1877, by Mr. J. S. Warren, of Cumberland Mills, Westbrook, Me.

Fig.1.

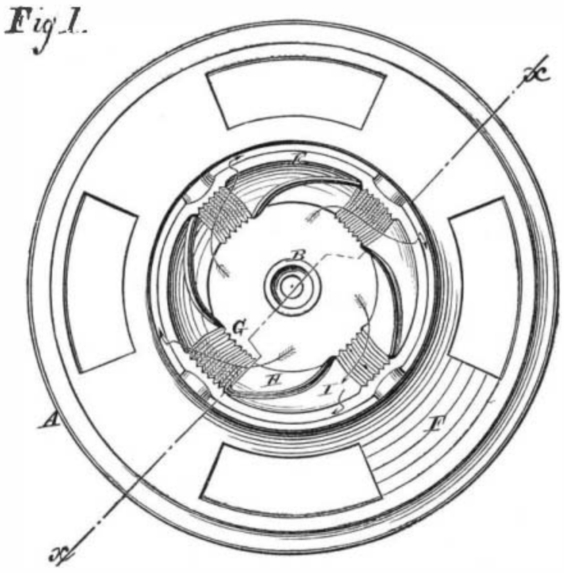
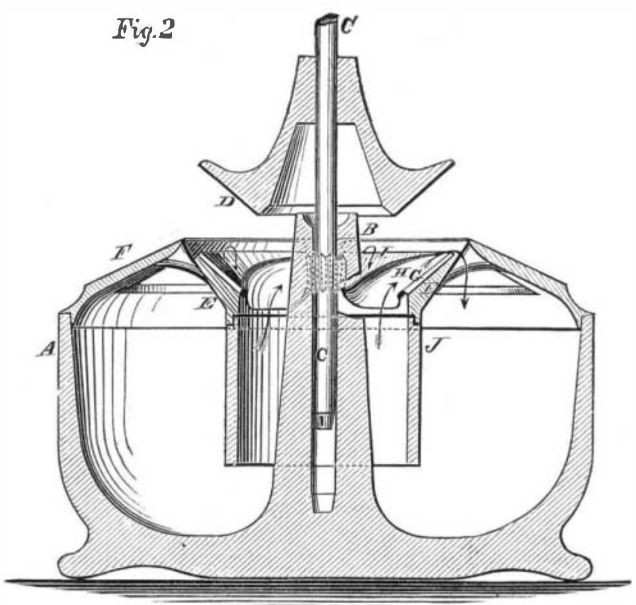


Fig.2



WARREN'S PAPER-PULP ENGINE.

PNEUMATIC ELEVATION IN MINES.

M. Blanchet has recently constructed, at Epinac, France, an atmospheric elevator which appears to be an important improvement in means of lifting the products of mines to the surface. The shaft of the mine is lined with an iron tube of about 1,920 feet in length, through which a load of 22,000 lbs. can be lifted. A vacuum is produced above the piston which supports the cage, which is thus carried up the tube by the normal atmospheric pressure acting from below. After the load is removed, the piston is allowed to descend slowly by its own gravity, sufficient air being admitted above it. Compressed air is not used to force the piston upward, on account of the heat necessarily developed by its compression being objectionable; and further, because pressure from within the tube tends to open any little fissures which may exist, while on the other hand pressure from without (which obtains when there is a vacuum within) serves to close them.

The charge to be elevated by M. Blanchet's apparatus is, as above stated, 22,000 lbs., and the piston has a diameter of 5·1 feet. The weight is therefore about 7·2 lbs. per square inch, so that but a partial vacuum is required above the piston. A manometer placed on the upper part of the tube indicates the condition of affairs within the shaft very clearly. In case the piston, in rising, encounters inequalities in the tube, so that its movement is stopped or delayed, the air pump, continuing its work, increases the vacuum, and allows a greater degree of atmospheric pressure to be exerted to push the piston past the obstacle. This change in the interior atmosphere is of course instantly shown by the manometer needle. The annexed engraving clearly exhibits the arrangement. At A are the various headings and galleries, which meet the shaft, and from which the filled receptacles are placed in the cage. At B are the openings above for removing the load. The doors at these upper apertures are kept closed during the ascension of the cage, and are not opened until the latter reaches the end of its upward journey. It will be observed that the cage contains nine tiers of receptacles, while there are only three receiving apertures above. The latter are, however, spaced apart a distance of about 10·5 feet, this being the height of three tiers of receptacles. Hence, after the cage has reached the summit, but three filled buckets or cars can be removed at a time, and three successive lowerings are necessary to bring the whole nine before the openings. The reception is accomplished as follows: The operator permits the cage to rise above the doors, and then closes the tube beneath them by a horizontal trap. The cage is thus prevented from falling, in case of any inopportune admission of air or accident to the machinery. Communication between the tube and the air pump is next closed, and a valve is opened, which allows air to enter very gradually above the cage. The latter then slowly descends. If the descent be too rapid, it is checked by closing the air valve or opening communication to the pump by means of a secondary small tube. By managing the two levers governing this apparatus, the cage is permitted to move down until tiers of buckets (Nos. 1, 4, and 7) are in front of the openings. Other levers are then manipulated, which cause wedges inside the tube to obstruct the further passage of the piston. In this way the cage is held motionless, so that no nice adjustment of difference of pressure need be looked to: although this is naturally so delicate that it is perfectly easy to stop and hold the cage anywhere in the tube without having recourse to the wedges. When the three filled receptacles above noted are removed, the operator withdraws the wedges, and permits the cage to sink until the second and then the third tier of receptacles comes in place. Then the trap is opened, and the cage without its load, now weighing some 11,000 lbs., is allowed to sink to the bottom of the tube. Just before it reaches this point, the air escape is cut off, so that the piston cushions on the slightly compressed air before it. The nine empty receptacles are then removed in the manner already described, three at a time.

M. Blanchet proposes soon to construct a second atmospheric tube, as shown in our illustration. The two cages will then travel in relatively opposite directions, and the work of the air pump will be diminished, the weight of one cage counterbalancing that of the other. The shaft is divided into two equal portions by a partition, one tube being in each compartment, while, in a third, an ordinary rope hoisting system may be arranged to serve as an auxiliary means of extraction. At D, in the illustration, is shown how the various sections of the tubes are connected. It will be noticed that the weight of the several portions is not borne by the parts directly underneath, else the weight of the immense column might cause its deflection. Each section is supported by eight rods, which are secured to horizontal timbers imbedded in the rocky sides of the shaft. Within the tube also are four longitudinal guides attached to its inner surface, which serve to prevent the rotation of the cage, so that the ore or coal receptacles are always brought in proper position before the doors.

BLANCHET'S PNEUMATIC ELEVATOR.

A New Resin--Kauri Gum.

We have recently met with a new vegetable product of peculiar origin and properties, the classification of which for some time was very puzzling until we made the acquaintance of a gentleman who was quite conversant with its appearance and sources. He at once pronounced it to be kauri gum, which is exported in some quantity from New Zealand. The physical properties of the gum were so different from those of most resins that we were led to try some experiments with it, which, though not entirely encouraging, may be here given to serve as a guide for those who choose to essay further trials of its usefulness from a photographic point of view. In appearance it is most like amber, which, also, in many other respects, it resembles. It is very similar to it in color, or one may say colors, for it is found in all the hues of amber, from the pale straw to light brown, and mingled also with cloudy-looking masses like clouded amber. It breaks with a lustrous fracture in the same manner as amber, but it is not so tough, and is consequently more fragile. Like amber, also, it is in a manner allied to fossil products; for, instead of being collected from growing trees, it is dug out of the ground on the site of old forests long laid low, and almost even with the ground—almost, but not quite, even; for to the little inequality on the surface of the broad, open ground, where the giant trees have fallen, does the gum hunter owe the power to find the hidden treasures of kauri gum. It is supposed that, possibly many centuries ago, conflagration of the *ti* tree scrub had destroyed the gum-bearing trees, which fell where they stood, half incrusted with the hardened sap, and according to their condition yielding small flakes or huge masses of sap, as the heated ground around them caused every particle of the resin to come to the surface. To find the gum, the heaps or mounds alluded to—which are covered with long grass and often scarcely discernible—are pierced by a steel-tipped spear which is carried for the purpose. A little practice soon enables the gum digger to discover if he has struck, not "ile," but gum. The experienced man then soon bares the spot, and finds pieces of the amber-looking material in blocks of various sizes, from a few ounces to half a hundredweight. This digging, which affords a means of livelihood to a large number of natives and colonists, known as "gum diggers," is also undertaken by the sheep breeder in his leisure moments, and to the small holder often, if luck favors him, forms a not unwelcome increase of income. It is collected and sent to market for shipment, and in England it appears to find purchasers who use it for the purpose of dressing calicoes with, for which object it is possibly dissolved by the aid of alkalies.

To return to the physical properties of the material. In its peculiarities of solution it acted more like copal; like that gum it is difficultly soluble, and further experiment may show still further likeness. One remarkable characteristic of copal is its power of becoming more soluble in alcohol after first melting it with as little heat as possible, when, upon resolidification, it is found much more easily soluble. We have not yet tried whether the kauri would act in a similar manner, but shall do so shortly. So far we have tried its solubility in alcohol, chloroform, benzole, and turpentine.

In alcohol it is quite insoluble after a week's digestion, a little coloring matter only being taken up. In chloroform it is soluble to a great extent—a small proportion, after repeated shakings during the course of a week's digestion, appearing to refuse to dissolve. In benzole it is partially soluble, though not nearly to the extent of the chloroform solution. In turpentine its solubility appears to lie between benzole and chloroform.

In all the three last cases a portion only of the gum dissolves, leading to the supposition that it may be composed of a series of different and distinct resins having preferential solubility in the various menstrua. Upon trying the varnishes thus produced upon negatives they all gave a beautiful glossy film, not easily scratched through so as to reach the glass, but very easily rubbed upon the surface, as though something of the nature of beeswax might be contained in the substance dissolved. The varnish with turpentine had a decided advantage over the others in tenacity.

Up to this point they are all, therefore, decidedly inferior to shellac as a photographic protective varnish; but further experiments are well worth trying, seeing this new substance can be bought at under one shilling a pound, while good shellac costs about three times the price. It is possible that treatment with an alkali may take from the kauri gum that principle which causes the surface gloss of the varnish to be so destructible. We may conclude our notice of this very interesting product by stating that all three of the varnishes give most excellent surfaces for retouching upon with black lead; indeed, we have met with no varnish superior to them for the purpose.—*British Journal of Photography.*

Communications.

Steam Economy Again.

To the Editor of the Scientific American:

Your correspondent, S. W. Robinson, in your issue of June 16, seems not to understand my language, in your issue of May 26, in regard to the loss due the clearance of an engine. In the process of calculation there referred to, and in all other processes in which the diagram is charged with the consumption indicated by its terminal pressure, and credited with the work performed as shown by its mean effective pressure, the loss occasioned by clearance through increased terminal pressure for a given load, or diminished mean effective pressure for a given consumption, is fully recognized, as the factors used in the calculation are the ones affected by clearance. It was the loss which is occasioned by "the expansion of the steam in the clearance space," when the exhaust or terminal pressure is greater than the return or counter pressure, which was referred to as restored when the compression pressure reached that of the exhaust.

I was not attempting to give the conditions necessary "for securing the highest percentage of useful effect from the steam used," but merely discussing a method of calculating the theoretical rate of water consumption indicated by any actual diagram, whether favorably or unfavorably conditioned. Hence there is no conflict between my statements and those of Rankine, either as given in his work or as ably illustrated by your correspondent; we are simply not talking about the same thing, as I am sure he will see if he gives my article a careful re-perusal.

Salem, Ohio. J. W. THOMPSON.

Casting of a Large Gun.

The heaviest gun ever cast in this country, with perhaps two exceptions, was successfully produced at the South Boston Iron Company's works, near the Broadway bridge, South Boston, May 30, in the presence of about 150 persons, several of whom were ladies. Colonel Crispin, Colonel Bayler, Captain Phipps, Captain Bryant, Lieutenant Smith, and Lieutenant Whipple, of the Ordnance Corps: Colonel Randall, Major Sanger, Captain White, Captain Andrews, Lieutenant Nichols, and Lieutenant Patterson of the First Artillery, were present. The material used was the ordinary charcoal iron. The gun, which will be a 12-inch rifled Rodman, carrying a 700 pound conical ball, when finished is expected to measure 263 inches, or about 22 feet in length. The diameter at the widest part will be 55 inches, and the casing will be 20 inches for a depth of 232 inches. At the muzzle the outside diameter will be about 29 inches. The weight when finished will be 89,530 lbs., and when cast was about 162,000 lbs. There was 90 tons of metal in the three furnaces. The gun is expected to be completed in November. It is estimated that the mass will cool in about 150 hours.

Three large furnaces were used for the melting. The flask, which was some 29 feet long, was sunk all but about six feet into the ground, muzzle up. From the furnaces were runners, a sort of iron trough or spout, lined with clay, about 8 inches wide at the top, 4 inches at the bottom, and 6 inches deep, and each about 18 or 20 feet long. These led to a sort of central tank or pool within 6 or 8 feet of the point where the flask or mould was placed. In this was an opening which led into two runners like those coming from the furnaces, and the runners carried the material from the pool to the mould. The pool was for the purpose of equalizing the consistency of the iron before it entered into the composition of the gun. At about 4:50 the visitors were requested to preserve quiet; the word was given, and the deep red stream of molten iron was soon seen rolling through the runners, with the accompaniment of great quantities of beautiful golden stars scintillating over the fiery mass. From the pool the liquid, after being thoroughly amalgamated, passed through the shorter runners and dropped to the bottom of the mould, the material rising gradually until the level of the troughs was reached. This occupied about 15 minutes, and then it became necessary to pour in from the top, which was several feet above the troughs. This was done by filling ladles (great tubs of iron lined with clay), each holding several tons of melted iron, and swinging them by three enormous derricks around to a runner raised higher than the others, and which led to the top of the mould. The portion filled up with ladles was in addition to the length of the gun, which must be cut off some six feet. This is necessary in order to have the end perfectly solid. The gun was cast upon the Rodman principle of having the core, which is hollow, filled with water during the process of casting by means of a pipe to convey cold water to the bottom of the core, and another to carry off the water from the top when it becomes heated. This causes the cooling inside and outside to be much more uniform, and adds greatly to the strength of the gun. The casting was finally finished about 5:30 o'clock, without accident of any kind. The gun when finished will be forwarded to Sandy Hook for experiments by the United States authorities.—*Boston Journal.*

Strength of Metals.

Some experiments have recently been made, in the mechanical technical laboratory of the Royal Polytechnical School at Munich, upon the strength of different alloys made by L. A. Riedinger at Augsburg. The results may be tabulated as follows:

Alloy	Strength in lbs. per square inch.	Contraction of section, per cent.	Stretching of 1⅓ inch, per cent.	Appearance of the fracture.
Phosphorus bronze..	27,122	2·4	2·25	Fracture blue-gray, darker than in bell-metal; contained an air-bubble of $\frac{1}{10}$ inch in diameter.
Ditto	28,400	3·7	2·50	Fracture as before, with many little bubbles.
Bell metal..........	24,424	1·4	1·50	Fracture uniform, bluish gray.
Ditto	23,288	0	1·00	Fracture rougher than before; color somewhat lighter.
Common brass......	20,448	14·2	4·50	Fracture dirty, yellow, dense, and quite fine.
Ditto	11,158	13·5	5·25	Fracture as before.
Fine brass..........	22,720	35·2	23·75	Fracture golden yellow, uniform, somewhat rougher than the other.
Ditto	20,306	34·5	15·25	Fracture as before, with orange yellow spots.
Common zinc	1,931	0	0	Fracture alternately bright and dull, coarsely crystalline.
Ditto	2,144	0	0	Fracture lighter, bright, and more uniform than before.
Belgian zinc........	4,288	0	0	Fracture brilliant white, with fewer large crystals than before.
Ditto	3,209	0	0	Fracture as before; crystals rather larger.

Unfortunately the composition of the alloys tested is not accurately given in percentage. Nevertheless, the table is of interest as showing the superior strength of phosphorus bronze. It is quite surprising that, with the number of excellent testing machines in use in this city and country, so few results have been published here, our figures being mostly limited to iron and steel.

Turkey in America.

The largest single contract ever taken in this country from a foreign nation is the $17,000,000 one given to the Providence Tool Company by the Turkish Government. The Tool Company were three years in preparing to begin the work upon the contract, and now employ 2,500 men, who turn out 200,000 guns per year, or 600 finished guns in a day. These guns are the Martini-Henry rifles. One of the side businesses of magnitude which has grown principally out of this contract is that of the Excelsior Box Company of Providence, of which James A. L. Amoreux of this city and South Hadley Falls is treasurer. The Excelsior Box Company are now busy making 20,000 boxes per year for the Tool Company in which to ship their guns to Turkey. Each box is made to hold twenty of the guns, and with such accuracy are the groove pieces for the interior of the boxes made that they do not allow a play of even one two-hundredth part of an inch of the arms, when packed with the muzzle tip and shoulder piece resting in the grooves. No other precaution is needed or used in packing the guns for shipment to Turkey. The machinery for the manufacture of these boxes was perfected in invention for the purpose. The company have still two years in which to complete the number of these boxes that they contracted to make; by which time, also, the Tool Company will have completed their immense contract with the Turkish Government.—*Springfield Union.*

A Remarkable Map.

About the first of January, 1876, Professor Hitchcock, of the Geological Survey, and his assistants began the construction of a raised map of New Hampshire, the design of which was to combine all the present knowledge of the geography of the State which had been obtained in the geological survey made by Professor Hitchcock, Professor Huntington, and others. This map has just been completed, and placed in the State House.

The map is fourteen feet ten inches long, representing one hundred and seventy-eight miles in length (being constructed on a scale of one mile to the inch) and ninety-three miles in width, from the mouth of the Piscataqua river to the northwest corner of Hinsdale, showing the entire surface of the State, nine thousand three hundred and thirty-six square miles. It also shows all the rivers and brooks, ponds and lakes, hills and mountains, and the town and county lines, railroads, etc. The names of all cities and towns, rivers, and principal brooks, lakes and ponds, mountains and high elevations, are given conspicuously, so that any one can find at a glance what they desire to look up. The height of the hills and mountains is given on a scale of one inch to one thousand feet, and actual measurements are given when known.

The map is constructed of pine and bass wood, and the process of the work was this: A map was first drawn on paper of the same size as the raised map, with all the outlines of towns, streams, ponds, etc., and contour lines for each five hundred feet were drawn. Tracings of the contour lines were made on inch layers of pine and bass boards, maintaining as accurately as possible the relative size and shape. These are fastened upon each other, and the valleys are beveled out with chisels.—*Concord (N. H.) Monitor.*

Torpedo Balloons.

A correspondent suggests that torpedo balloons might prove a formidable means of offence, and proposes a plan of sending up a balloon, with a torpedo attached, to windward of an enemy, and then dropping the torpedo by bursting the balloon. It seems to us that this is a good idea, and one which might find useful application in the bombardment of cities, camps, and fortified places. It is of course not practicable against an enemy capable of moving about quickly. It is not a difficult matter to construct a balloon capable of lifting sufficient nitroglycerin for the purpose. This might be inclosed in a shell and suspended as a car under the air ship. A simple mechanical device could easily be provided for dropping the load; and this device might be controlled by a light wire through which an electric current could be sent. The besiegers have only to wait for a fair wind, and then start their balloon from a point far beyond the range of the most powerful guns. It would be easy by the aid of instruments to tell just when the balloon had arrived over the desired point, and the pressure of the key would transmit the current and drop the mass of explosive. The effect of a quantity of nitroglycerin blowing up in a city or fort would be terrific. The balloon could be permitted to rise to a height beyond the reach of artillery, so that the besieged would be totally destitute of any means of directly preventing the dropping of the unwelcome visitor in their midst.

Some well meaning philanthropists in England are just now protesting against the use of the torpedo in modern warfare, as being too cruel a resort, and one which should be classed with poisoned wells and explosive bullets, which are proscribed among civilized belligerents. Probably the torpedo balloon will to them seem exceptionally barbarous. The fact is, however, that such philanthropy is a mistaken sentiment. War itself is a frightful calamity; and it is for the benefit of all that it should be as quickly ended as possible. This result can only be reached by making weapons so effective either that people will not face them, and thus fighting may be stopped in that way, or else that they will produce such wholesale destruction as to secure victory for one side or the other in the quickest possible period. The most destructive weapons are therefore the most merciful; and in this light the torpedo should be regarded.

Russian Gold and Silver Production.

The following statistics of the yield of the Russian gold fields for the year 1876 show that this source of wealth is considerable in that cold northern clime. The amount of gold mined in 1876 was 1,617 pouds, equal to 71,503 lbs. troy, having a value of 22,086,662 roubles = $17,669,329.60. The silver amounted to only 156 pouds, or 5,616 lbs. avoirdupois, worth 142,360 roubles = $113,888.

NICHOL'S RAILROAD JOINT AND NUT LOCK.—In our recent illustrated article on this subject, the statement that the joint would be safe without any bolts "on the same section of rail" should read "on some sections of rail." Also for "requires no spikes in the flange of the rail," read "slots or notches" for "spikes."