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Improved Boring and Mortising Machine.

These engravings represent two views of a single machine intended for sawing and mortising fence rails, but which can be readily used for any work requiring similar manipulation, such as the framing of a house or other timbers. By the use of the machine the holes are mortised of a fixed length in the right places, sawed to a given length, and the rails pointed; picket tops can also be worked on slats or boards by this machine when so desired. This latter operation is performed by a separate detail attached to the back of the machine. This appliance is merely a bracket to support the rail and a guide set diagonally to carry the stuff to the saw at the proper angle. The saw bench is also provided with a gage (not shown) by which timber can be split to any given width. The peculiar feature of this machine is the means by which the length of the slot or mortise in the fence post is governed. By means of a lever, A, and the pins, B, the bench is moved forward a certain distance, when the lever, A, is acted on.

The boring mechanism seen protruding through one of the mortises then cuts away the timber fast. The pins govern the length and distance apart of the mortises, and the lever is brought close to the stationary pin, C, each time, so that it forms a stopping and starting point. The auger is worked up and down to enter or leave the timber, D, by the hand lever, E. Figure 2 shows the saw and the ingenious device by which, when the boring apparatus is at work, it is dropped out of the way. This device consists in placing the saw mandrel in bearings on an arm, F. This arm is fast at G, and swings on a pivot there, so that by taking hold of the bearing box the saw mandrel runs in, and, depressing it, the saw is carried down through the table out of the way. When wanted for use it is easily set up tight by the screw in the supporting arm, H, which bears against the slotted arm. The gage for governing the width of the stuff split is here shown at I.

These are the principal features of this machine, and combined with others spoken of previously, it is a very useful one. It was patented through the Scientific American Patent Agency, on Jan. 31, 1865, by Benjamin Klahr, of Bernville, Pa., whom address for further information.

Fig. 1.

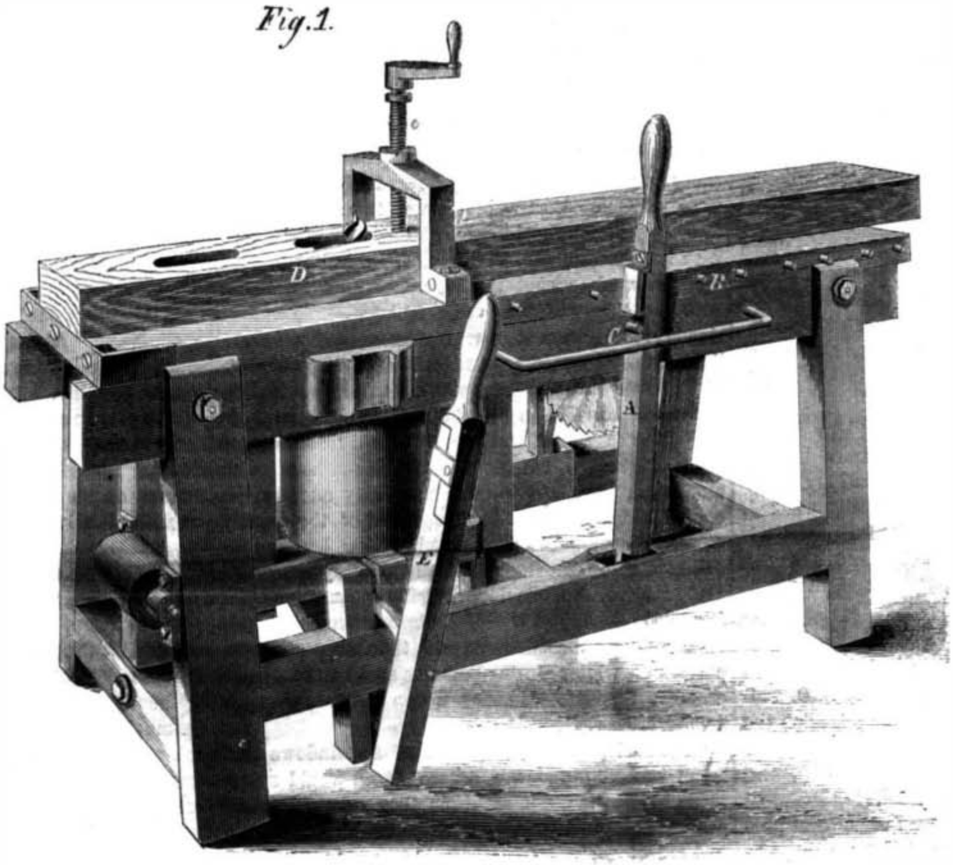
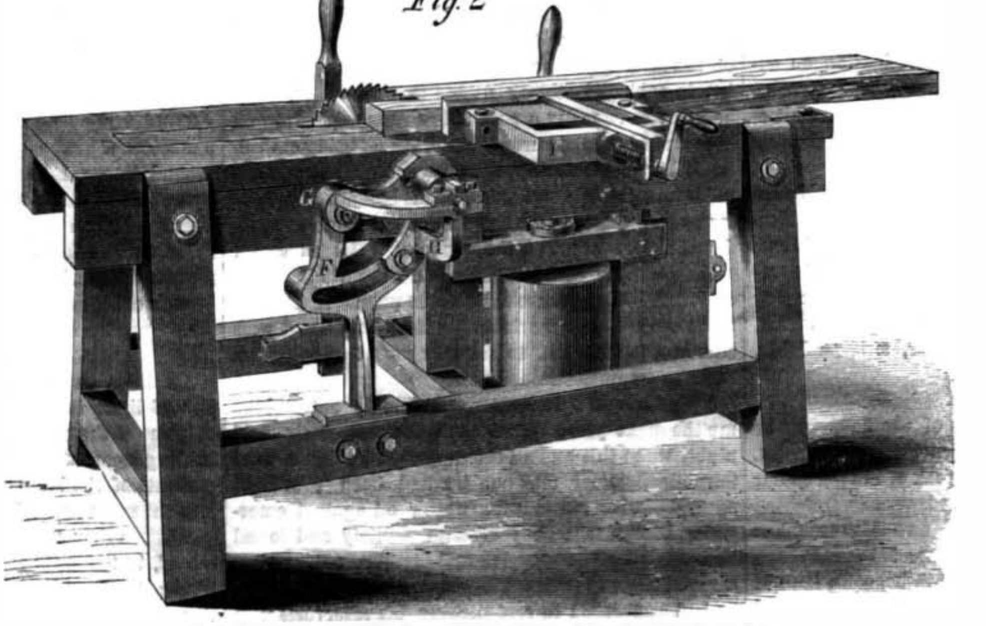


Fig. 2



KLAHR'S BORING AND MORTISING MACHINE.

Plaster of Paris.

Dr. Ure, in the supplement to his dictionary gives these facts in relation to gypsum, or plaster of Paris:—

"Gypsum is a sulphate of lime. When massive it is called indifferently alabaster or gypsum; and when in distinct and separate crystals, it is termed selenite. Massive alabaster occurs in Britain in the new red or keuper marl; in Glamorganshire, on the Bristol channel; in Leicestershire, at Syston; at Tutbury and near Burton-on-Trent, in Staffordshire; at Chellaston, in Derbyshire; near Droitwich it is associated in the marl with rock salt, in strata respectively 40 and 75 feet in thickness; and at Northwich and elsewhere the red marl is intersected with frequent veins of gypsum. At Tutbury it is quarried in the open air, and at Chellaston in caverns, where it is blasted by gunpowder; at both places it is burned in kilns and otherwise prepared for the market. It lies in irregular beds in the marl, that at Chellaston being about 30 feet thick. There is, however, reason to suppose that it was not originally deposited along with the marl as sulphate of lime, but rather that calcareous strata, by the access of sulphuric acid and water, have been converted into sulphate of lime—a circumstance quite consistent with the bulging of the beds of marl with which the gypsum is associated; the lime, as a sulphate, occupying more space than it did in its original state as a carbonate. At Tutbury and elsewhere, though it lies on a given general horizon, yet it can scarcely be said to be truly bedded, but ramifies among the beds and joints of the marl in numerous films, veins and layers of fibrous gypsum. A snow-white alabaster occurs at Volterra, in Tuscany, much used in works of art in Florence and Leghorn. In the Paris basin it occurs as a granular crystalline rock, in the lower tertiary rocks, known to geologists as the upper part of the middle eocene fresh-water strata. It is associated with beds of white and green marls; but in the Thuringewald there is a great mass of sulphate of lime in the Permian strata. It has been sunk through to a depth of 70 feet, and is believed to be metamorphosed magnesian limestone or Zechstein. In the United States this calcareous salt occurs in numerous lenticular masses in marly and sand strata, of that part of the upper silurian strata known as the Onondaga salt group. It is excavated for agricultural purposes.

"The gypsum of our own country is found, in apparently inexhaustible quantities, in the red marl formation in the neighborhood of Derby, and has been worked for many centuries. The great bulk of it is used for making plaster of Paris, and as a manure; and it is the basis of many kinds of cements, patented —as Keene's, Martin's, and others.

"To get it for these purposes, it is worked by mining underground, and the stone is blasted by gunpowder; but this shakes it so much as to be unfit for working into ornaments, etc.; to procure blocks for which it is necessary to have an open quarry. By removing the superincumbent marl, and laying bare a large surface of the rock—the alabaster being very irregular in form—and jutting out in several parts, allows of its being sawed out in blocks of considerable size, and comparatively sound (as is illustrated by the large tazza in the Museum of Practical Geology). This stone, when protected from the action of water, is extremely durable, as may be seen in churches all over the country, where monumental effigies, many centuries old, are now as perfect as the day they were made, excepting, of course, willful injuries; but exposure to rain soon decomposes the stone, and it must be borne in mind that it is perfectly unsuited for garden vases or other out-door work in this country.

"In working, it can be sawed up into slabs with toothed saws, and for working moldings and sculptures, fine chisels, rasps and files are the implements used; the polishing is performed by rubbing it with pieces of sandstone, of various degrees of fineness, and water, until it is quite free from scratches, and then giving a gloss by means of polishing powder (oxide of tin) applied on a piece of cloth, and rubbed with a considerable degree of friction on the stone. This material gives employment in Derby to a good many hands in forming it into useful and ornamental articles, and is commonly called Derbyshire spar; most of the articles are turned in the lathe, and it works something like very hard wood.

"Another kind of gypsum also found in Derbyshire is the fibrous or silky kind; it occurs in thin beds, from one to six inches in depth, and is crystallized in long needle-like fibers; being easily worked, susceptible of a high polish, and quite lustrous, it is used for making necklaces, bracelets, brooches, and such like small articles."

CLYDONICS.

At the last meeting of the Polytechnic Association the following paper was read by Professor S. D. Tillman, the President, in conclusion of the paper on the same subject which was published on page 225 of our current volume:—

The celebrated historian, Buckle, believed the most effective way of turning observations of natural phenomena to account, would be to give more scope to the imagination and incorporate the spirit of poetry with the spirit of science. By this means our philosophers would double their resources, instead of working, as now, maimed and with only one half of their nature. They fear the imagination on account of the tendency to form hasty theories. But surely all our faculties are needed in the pursuit of truth, and we cannot be justified in discrediting any part of the human mind.

These views, if not applicable to methods of original research, are certainly of great moment in considering the best means of diffusing scientific knowledge; and if there is any branch of philosophy which is pre-eminently entitled to bring to its service the free play of fancy, it is that treating of the force of waves, whether propagated through liquids, aeriform fluids, or more attenuated media.

THE PHAROS.

A discourse on the structure of the flame of the ordinary lamp might not gain general attention, yet how intense the interest as we speak of the particular light which a captain seeks when his vessels, freighted with human beings, midst storm and darkness, has nearly reached its haven. There are scattered along our vast boundary five hundred such beacons, kept in operation at an annual expense to the United States' Government of more than a million of dollars.

A description of one of these is given in the posthumous papers of the gifted Thoreau, just published under the title of "Cape Cod;" and although since the time of his visit a more imposing structure has arisen in the place of the old lighthouse, the account is so graphic, one feels, after its perusal, the satisfaction which he would probably have experienced by a personal inspection of the premises.

THE CAPE COD LIGHT.

"The Highland Lighthouse, where we were staying, is a substantial-looking building of brick, painted white and surmounted by an iron cap. Attached to it is the dwelling of the keeper, one story high, also of brick, and built by Government. As we were going to spend the night in a lighthouse we wished to make the most of so novel an experience, and therefore told our host that we would like to accompany him when he went to light up. At rather early candle-light he lighted a small Japan lamp, allowing it to smoke rather more than we like on ordinary occasions, and told us to follow him. He led the way first through his bedroom, which was placed nearest to the lighthouse, and then through a long, narrow, covered passage way, between whitewashed walls like a prison entry, into the lower part of the lighthouse, where many great butts of oil were arranged around; a winding and open iron stairway, with a steadily increasing scent of oil and lamp smoke, to a trap-door in an iron floor, and through this into the lantern. It was a neat building, with everything in apple-pie order, and no danger of anything rusting there for want of oil. The light consisted of fifteen argand lamps, placed within smooth concave reflectors twenty-one inches in diameter, and arranged in two horizontal circles, one above the other, facing every way excepting directly down the Cape. These were surrounded, at a distance of two or three feet, by large plate-glass windows, which defied the storms, with iron sashes, on which rested the iron cap. All the iron work, except the floor, was painted white. And thus the lighthouse was completed. We walked slowly round in that narrow space as the keeper lighted each lamp in succession, conversing with him at the same moment that many a sailor on the deep witnessed the lighting of the Highland light. His duty was to fill and trim and light his lamps, and keep bright the reflectors. He filled them every morning, and trimmed them commonly once in the course of the night. He complained of the quality of the oil which was furnished. This house consumes about eight hundred gallons in a year, which cost not far from one dollar a gallon; but perhaps a few lives would be saved if better oil were provided. Another lighthouse-keeper said that the same proportion of winter-strained oil was sent to the southernmost lighthouse in the Union as to the most northern.

"Formerly, when this lighthouse had windows with small and thin panes, a severe storm would sometimes break the glass, and then they were obliged to put up a wooden shutter in haste to save their lights and reflectors; and sometimes in tempests, when the mariner stood most in need of their guidance, they had thus nearly converted the lighthouse into a dark lantern, which emitted only a few feeble rays, and those commonly on the land or lee side. He spoke of the anxiety and sense of responsibility which he felt in cold and stormy nights in the winter, when he knew that many a poor fellow was depending on him, and his lamps burned dimly, the oil being chilled. Sometimes he was obliged to warm the oil in a kettle in his house at midnight, and fill his lamps over again; for he could not have a fire in the lighthouse, it produced such a sweat on the windows. His successor told me that he could not keep too hot a fire in such a case. All this because the oil was poor. A Government lighting the mariners on its wintry coast with summer-strained oil, to save expense! That were surely a summer-strained mercy

"This keeper's successor, who kindly entertained me the next year, stated that, one extremely cold night, when this and all the neighboring lights were burning Summer oil, but he had been provident enough to reserve a little winter oil against emergencies, he was waked up with anxiety and found that his oil was congealed and his lights almost extinguished; and when, after many hours' exertion, he had succeeded in replenishing his reservoirs with winter oil at the wick end, and with difficulty had made them burn, he looked out and found that the other lights in the neighborhood which were usually visible to him, had gone out, and he heard afterward that the Pamet River and Billingsgate Lights also had been extinguished.

"Our host said that the frost, too, on the windows caused him much trouble, and in sultry summer nights the moths covered them and dimmed his lights; sometimes even small birds flew against the thick plate glass, and were found on the ground in the morning with their necks broken. In the spring of 1855 he found nineteen small yellow birds, perhaps goldfinches or myrtle birds, thus lying dead around the lighthouse; and sometimes in the fall he had seen where a golden plover had struck the glass in the night, and left the down and the fatty part of its breast on it.

"Thus he struggled by every method to keep his light shining before men. Surely the lighthouse keeper has a responsible, if an easy, office. When his lamp goes out, *he* goes out; or, at most, only one such accident is pardoned.

"I thought it a pity that some poor student did not live there, to profit by all that light, since he would not rob the mariner. 'Well,' he said, 'I do sometimes come up here and read the newspaper when they are noisy down below.' Think of fifteen Argand lamps to read the newspaper by! Government oil! light enough, perchance, to read the Constitution by! I thought that he should read nothing less than his Bible by that light. I had a classmate who fitted for college by the lamps of a lighthouse, which was more light, we think, than the University afforded."

WAVE-MOTIONS.

Let us in imagination stand with Thoreau on the luminous tower and amid the agitations of ocean, air and æth, consider the laws by which The Presiding Power controls these elements. The restless sea through all its movements, from ripple to billow, obeys the same mandate; the time of each oscillation is proportional to the square root of the length of the wave. At great depths the motion of the fluid is wholly insignificant, because at a distance below, equal to the length of a wave, the motion is only $\frac{1}{535}$ of that at the surface.

The size of the wave depends, therefore, upon the force of the wind and the depth of the sea. The largest on the Atlantic observed by Capt. Scoresby were 550 feet long and 30 feet high.

AIR-WAVES.

The air, however, is not confined like the sea, which has only an upward and downward motion, except near the shore, where the force it contains would escape. But the whole mass of air, moving as wind, has also a vibratory or wave-motion producing sound. If the distant bell we hear is tuned to middle C of the musical scale, according to the new French standard, and the temperature is at 16° centigrade, its sound is produced by air-waves vibrating—not undulating—at the rate of 522 per second, each of which is about 2·15 feet in length. The lowest octave of this note which could be heard would, according to Savart, be the result of 16·31 waves per second, each about 68·8 feet long, and the highest octave by waves moving at the rate of 33,408 per second, each ·0492 of a foot in length.

ÆTH-WAVES.

Turning now to the light produced by the fifteen Argand lamps, we behold still more wonderful wave phenomena. The all-pervading æth is, for miles around, thrown into undulations moving at an average rate of 582 million of million per second, having an average length slightly exceeding twenty-one millionths of an inch. These numbers, determined by repeated experiment, appall us, and we turn to that branch of the subject where results are more palpable.

THE CHEMISTRY OF FLAME.

All the phenomena attending the artificial production of light is not yet fully understood. Light is only one of the effects of the burning of hydro-carbons in the gaseous state. The solid candle and the liquid contents of the lamp must be volatilized, and brought into the same expanded state as ordinary illuminating gas before they can be burned. This conditon is attained, in the case of the candle, by the heat of the flame; the liquid wax or tallow, by capillary attraction, is carried along the wick to the point where it is turned to gas. Yet light does not emanate from gases. Draper found that while gases heated to over 1100° centigrade do not give light, all the solids subjected began to be luminous at about 510° C, and they display the several colors of the prism, and finally emit white light.

In the process of burning illuminating gas, the