

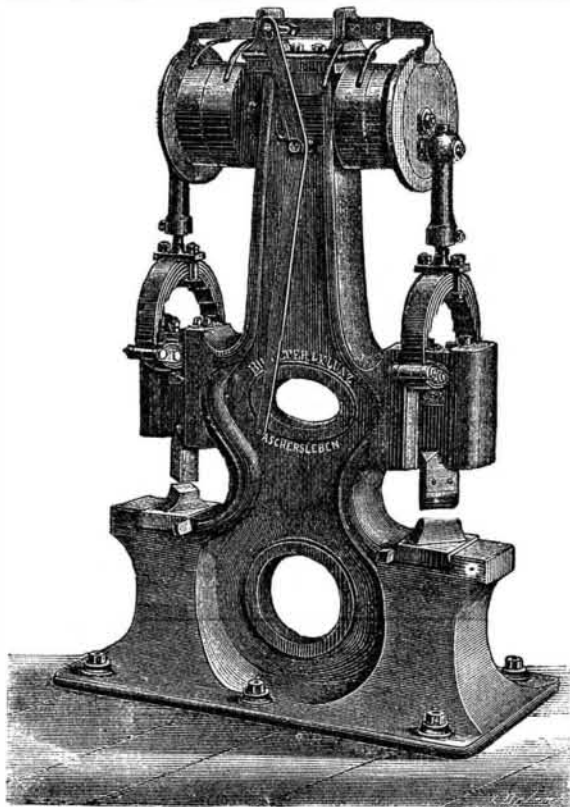
pipes, and to prevent the interruption of the working of the pipes.

Fig. 4 shows the combination of centrifugal pump and water-elevating pipes, in which the ejector is kept continuously at work so that the working of the pump is facilitated, as it is not required to pump higher than the absolute difference by the upper and lower water-level.

#### DOUBLE-SPRING STEAM-HAMMER.

FOR some years past steam and spring hammers of American origin have been introduced into Europe and used with satisfaction.

An example is shown in our engraving, made by Billeter & Klunz. It is a double hammer, which serves at once for



DOUBLE-SPRING STEAM-HAMMER.

drawing out and smoothing. With a weight of about 66 lbs. and a range of 8.89 in., each hammer gives about 180 blows a minute, and requires scarcely half a horse-power of moving force. The two hammers are independent of each other. There is a saving of manual labor to the extent of 50 per cent.

#### ROTARY PUMP.

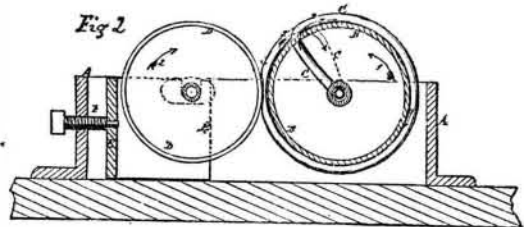
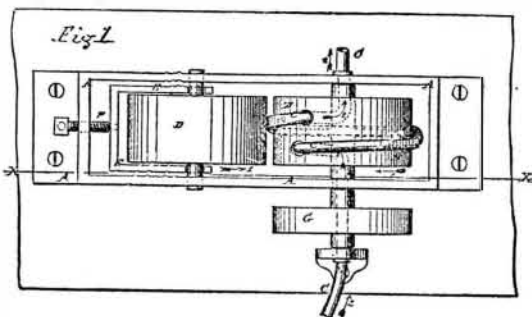
By W. T. DOREMUS, New-York.

THE fluid is forced through a flexible tube coiled around the face of a cylinder, the tube receiving and discharging its fluid through the hollow journals of said cylinder by the pressure upon said tube of a second cylinder.

A, frame in which revolves a cylinder, B; its journals are hollow to receive a flexible tube, C, made of rubber, which passes in through one journal, passes out through a hole or notch in the shell of cylinder B, makes a little more than one turn around it, passes in through a hole or notch in its shell, in through a hole in its hub, and out through its other journal.

The tube C should be swivelled at the ends of the journals of the cylinder B, to prevent it from being twisted by the revolution of said cylinder, and should have a check-valve in its discharge end, to prevent any back flow of the fluid.

The part of the tube C that passes around the cylinder B may be round or flattened, or of any form not liable to be injured by compression.



ROTARY PUMP.

The flexible tube need not pass through the journals of the cylinder B, but may be connected with the hub of said cylinder, and the fluid received and discharged through its journals, with the outer ends of which the inlet and discharge pipes may be connected by swivelled joint or otherwise.

D, a cylinder, revolving in a frame, E, that slides in the frame A, and has a swivelled screw, F, connected with it, so that it may be adjusted to press the tube C against the face of the cylinder B with any desired pressure.

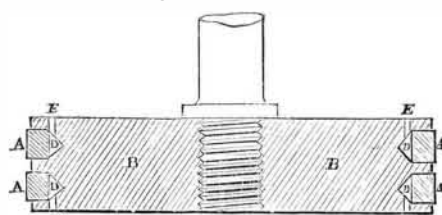
As the cylinders B D are revolved the tube C is compressed between their faces, which forces the fluid in front of the point of contact out through the discharge end of the tube C, and forms a vacuum in the rear of said point of contact, into which the fluid is forced by atmospheric pressure, so that there will be a continuous discharge of the fluid from the discharge end of said tube C.

#### NEW PISTON-PACKING.

By M. PAUL GIFFARD, Paris, France.

CONSISTS of a circumferential groove cut into the piston, into which a band of leather or caoutchouc is made to fit tightly. The bottom of the circumferential groove is V-shaped, and thus forms a hollow behind the packing-band. Into this hollow steam enters and drives the packing-ring against the surface of the cylinder, securing perfect tightness of the piston without thereby increasing the friction to an excessive degree. The holes for the admission of the steam to the back of the piston-ring are drilled from the upper and under surface of the piston. The band of leather or caoutchouc is so fitted into the groove that it is without play—with the greatest possible tightness, and the ends overlap each other by gradually thinned surfaces.

The annexed diagram illustrates a piston of double effect, as M. Giffard describes it: A is the packing-ring, D the hollow behind, and E the passage for the steam. In this case, as will be seen, there are two rings, the piston thus being automatically fitted in both up and down strokes. For use in steam-engines a metallic band, or ring, and an elastic band are placed in the groove, the metal and rubber being in close contact. Other packings may, however, be used, such as

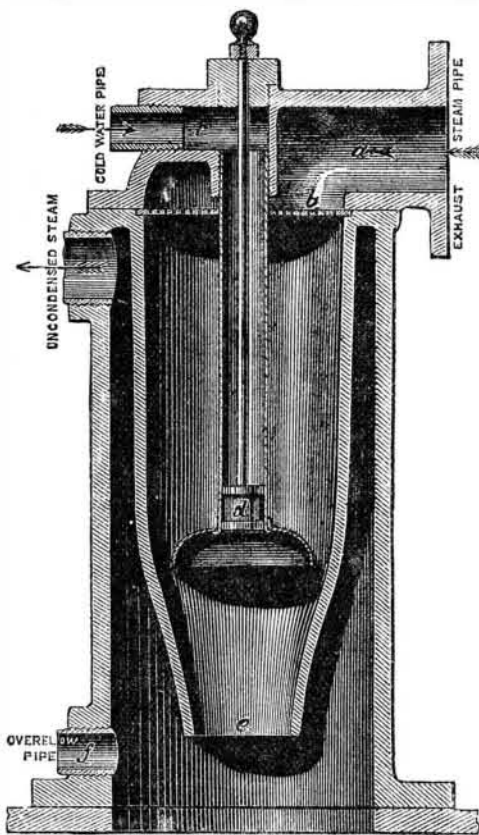


NEW PISTON-PACKING.

leather, rubber in one thick or several thin bands, hemp, gasket, wood, compressed paper, and other suitable materials; but it is important to keep the channel or groove D as small as possible, and to make the holes E for the admission of steam, in no greater number and no larger than is required to allow the steam to exercise the desired effect as soon as possible. That this system of packing-pistons is a good one can not be doubted, but it may be questioned whether it is of such excellence as to cause any great demand for it. M. Giffard says that "the mode of construction is entirely new, extremely economical, easily adapted, and the wear compensated. It is also infallible in its working, lasts a long time, can be easily and quickly renewed, enables a cheap piston to be obtained, having the minimum amount of friction, and such an absolute hermeticity, or proper tightness, as to enable cent per cent of the volume of gases, fluids, or steam to be utilized."

#### NORTHCOTT'S NEW FEED-WATER HEATER.

THE arrangement will be readily understood from our engraving. The exhaust steam enters at the branch a and passes through a horizontal perforated plate b, below which it comes into contact with the feed-water to be heated, this water entering through the branch c, and being discharged in a number of fine streams through holes formed in the central pipe shown. This pipe is fitted with the piston d, which piston can, by means of the rod shown, be slid up and down so as to adjust the supply of feed-water. The feed-water in contact with the exhaust steam has to pass through the small annular space



NEW FEED-WATER HEATER.

around the bell at the lower end of the central tube, and falls through the nozzle e into the tank in which the heater is placed. This tank serves to contain a supply of heated water, and it is placed slightly above the level of the feed-pump. In it, too, the heated feed-water deposits some of its impurities, these settling down and being cleaned out at convenient intervals. It is recommended that the supply of feed-water should be so adjusted that there is always a small escape at the overflow pipe f, this overflow thus carrying off any oil or tallow which may rise to the surface. This heater is capable of raising the temperature of the feed to 210 deg. or 212 deg. and it is altogether a very neat and compact arrangement.

#### BOILER-COVERING.

THE invention of Messrs. Beamish and Mason, of Liverpool, consists essentially of a combination of lagging and cement, so as to obtain the advantages of both. The laths are placed a few inches apart on a surface of cement, the laths being pressed into the cement till the surfaces of the two materials are flush with each other.

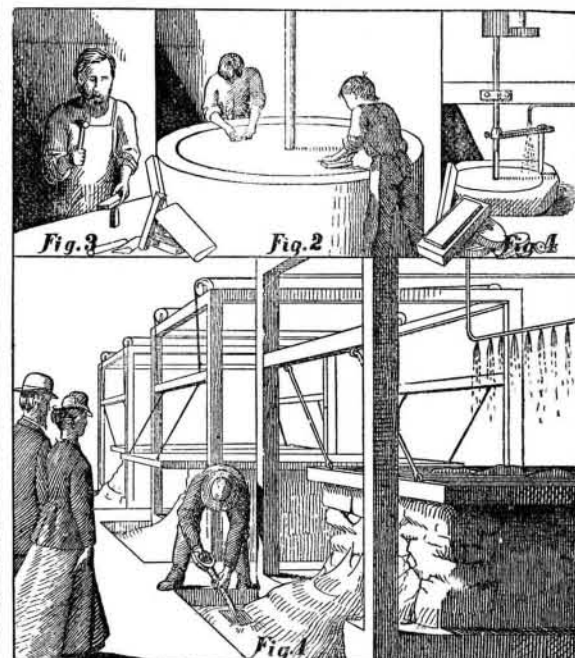
#### THE MANUFACTURE OF OIL-STONES.

By H. Y. BEACH.

UNTIL recently the principal supply of oil-stones was brought from Turkey, though the Hindostan stone, the Norway rag-stone, the Welsh stones, and others were to some extent used. A specimen of Turkey stone of uniform texture is rare. The Hindostan stone when in use quickly fills with metal, and nearly all the kinds enumerated have some serious defect. The European varieties are now superseded by the "Whetstone Rock" from Arkansas, which fulfills better than any other the difficult requirements of an oil-stone. It is of uniform hardness. It is somewhat porous, yet the pores do not retain metallic particles. Its surface does not wear concave, and it possesses extraordinary resisting properties, the sharpest point of the file instantly wearing flat upon it, without causing a scratch. According to Professor David Dale Owen, the chemical analysis of the Novaculite Rock (Washita or Arkansas stone) shows the composition to be as follows:

Silica.....	98.00
Alumina.....	.80
Potash.....	.60
Soda.....	.50
Lime.....	
Magnesia.....	
Hydric Fluoride.....	.10
Water.....	
	100.00

Messrs. Boyd and Chase of New-York are the most extensive manufacturers of this stone. They obtain their supply from Hot Springs, Arkansas, the only locality known that contains this peculiar variety. The finer quality is called Arkansas stone; the coarser, Washita. Arkansas stone is the harder, and resembles white marble. Lumps of Arkansas stone without flaw are seldom found more than eight inches long, and they are often traversed by thin quartz veins. Where these veins occur, the stones must be cut to avoid them, for the surrounding stone, being softer than the quartz, is worn away by the polishing process more rapidly, leaving the quartz projecting above the surface, and liable to destroy any cutting edge which may strike it.



THE MANUFACTURE OF OIL-STONES.

Washita stone is softer and more porous than the Arkansas. It is found in larger masses, is cheaper, and seldom contains quartz.

The accompanying diagrams illustrate the process employed by Boyd & Chase for cutting and polishing oil-stones. Fig. 1 shows the gangs of saws, each gang requiring a four-horse steam power, and cutting about one thousand pounds of Washita stone per day, and about sixty pounds of Arkansas stone. The fragments of rock are packed upon the bed of the saw-frame. The saws have a reciprocating motion, and rise at the end of every stroke. The sand and water which are thrown upon the saws then flow down between the saw-edges and the stone beneath. The saws are of soft iron, and when they descend at the beginning of the next stroke, the sand is imbedded in the metal and cuts the stone as the saws move.

After being sawed into slabs, the stones are piled under another gang of saws, by which they are cut into proper widths. Their ends are then squared in such a manner as to avoid flaws and quartz veins (Fig. 3). To cut beveled surfaces the slab is held in an inclined position under the saw by means of plaster-of-Paris.

Lastly, the stones are finished on a large horizontal cast-iron wheel or revolving table, covered with sand and water (Fig. 2). The workman presses the stone upon the wheel, which revolves with great velocity, and polishes the stone by means of the sand.

Fig. 4 represents the machine employed to cut wheel-stones. The lower end of the shaft is shaped like a gouge chisel, and cuts the core. The periphery of the wheel is cut by a soft iron, bent to form an arc of the circle it describes, and its corner rounded to permit the sand to flow under. The wheel-stones usually range from one inch to three inches in diameter. So rare is a large piece of Arkansas rock without flaw that the cost of a wheel nine inches in diameter would reach several hundred dollars.

Mr. Chase has employed several methods of sawing with diamonds, but he eventually found their use inexpedient. The diamond cuts as much in twenty minutes as the sand can in a day, but so wonderful is the abrading property of this stone, that even diamond points are worn smooth after a few minutes' use. So great is the necessary strain that the strongest saws set with diamonds double up, and the diamonds are frequently forced from their settings or broken.

The excellence of the Arkansas and Washita stones is attested by the number exported to all parts of Europe. Their shapes and uses are quite varied. Stone files are made pointed, knife-shaped, cylindrical, and in the shape of triangular prisms, for dentists, jewelers, and watchmakers; also, stones to sharpen surgical, mathematical, and engravers' instruments, and for penknives, needles, and all kinds of wood-working tools.