2 Sheets--Sheet 1.

A. L. S. CHENOT.

Power-Hammers.

No. 155,859. Patented Oct. 13, 1874.

FIG. 4.

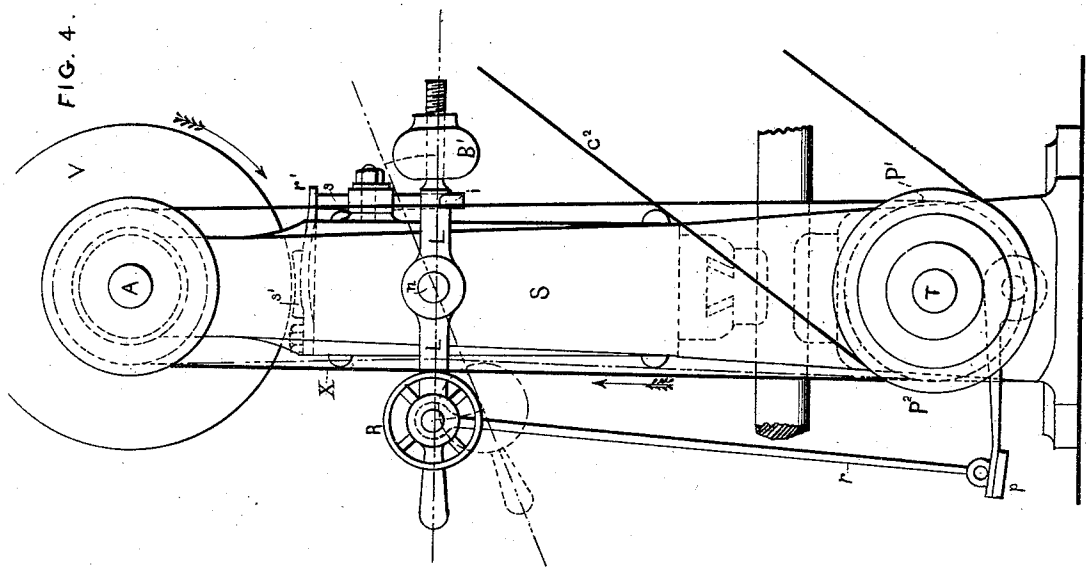
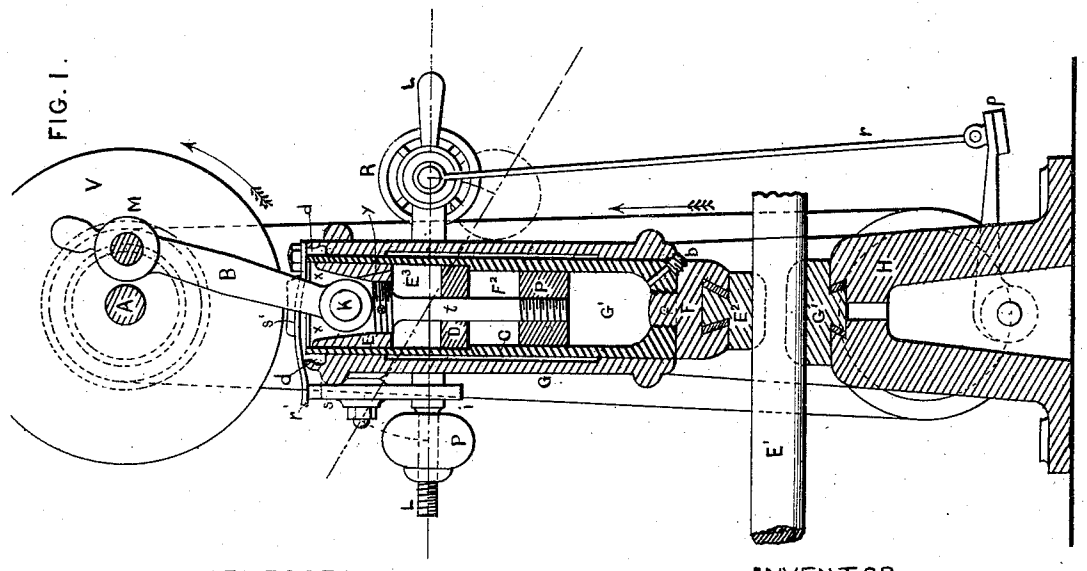


FIG. 1.



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THE GRAPHIC CO. PHOTO-LITH. 39 & 41 PARK PLACE, N.Y.

2 Sheets--Sheet 2.

A. L. S. CHENOT.

Power-Hammers.

No. 155,859. Patented Oct. 13, 1874.

FIG 2.

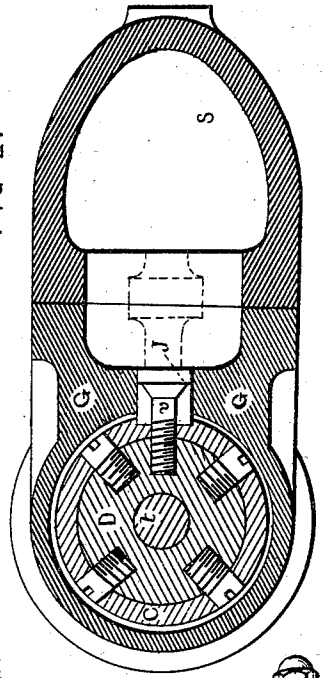
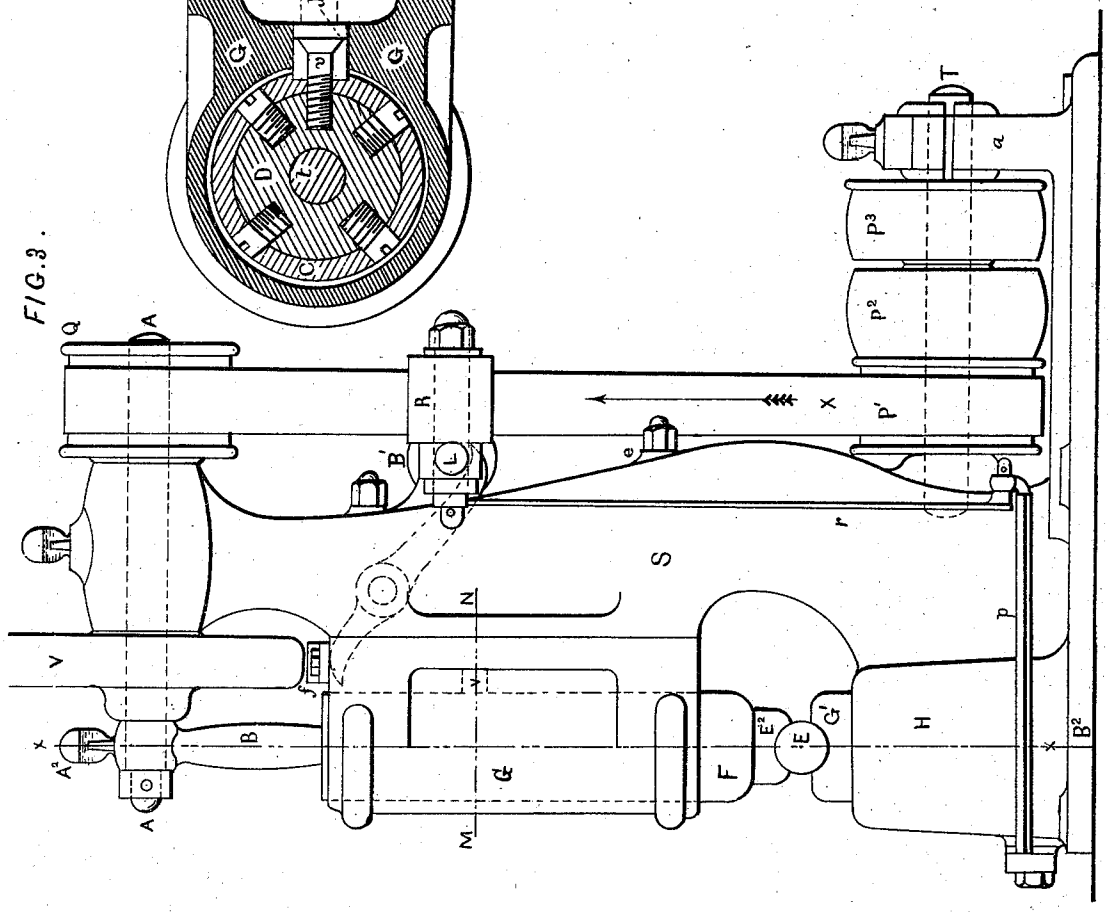


FIG. 3.



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UNITED STATES PATENT OFFICE.

ALFRED L. S. CHENOT, OF PARIS, FRANCE.

IMPROVEMENT IN POWER-HAMMERS.

Specification forming part of Letters Patent No. **155,859**, dated October 13, 1874; application filed July 18, 1874.

To all whom it may concern:

Be it known that I, ALFRED L. S. CHENOT, of Paris, France, have invented a new and Improved Triple-Acting Steam-Hammer; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing, forming a part of this specification, in which—

Figure 1 is a vertical section through line *x x* of Fig. 3; Fig. 2, a horizontal section through line M N of Fig. 3; Fig. 3, a side elevation; Fig. 4, a rear elevation, showing apparatus for controlling the motion of the hammer.

This invention relates to that class of machines known as steam-hammers; and is a new and improved arrangement, whereby the greatest attainable efficiency is secured, and the machinery adapted to the operations of boring or drilling rock, breaking stone, and road-making, as well as to the forging and planishing of metals. It consists in a percussion-cylinder bearing upon its lower end a hammer-block and hammer, and moving smoothly in an incasing-cylinder, which acts as a guide, and prevents any lateral motion of the percussion-cylinder resulting from the strokes of the same. Inside the said percussion-cylinder is a piston-rod bearing upon each end a piston, which moves freely in the cylinder, and between the two pistons, and permanently attached to the cylinder, a diaphragm, which, with the two pistons, divides the cylinder into three air-compartments. When the piston-rod is elevated by the connecting mechanism a vacuum is formed in the upper and lower compartments, a compressed plenum in the middle compartment, and the cylinder raised by the elasticity of the air. When the connecting mechanism drives the piston-rod down the force of the steam, gravity, and the elasticity of the air combine to give a heavy, quick, and elastic blow.

Combined with the above-mentioned mechanism are various attachments for regulating and controlling the action of the hammer, which will be hereinafter more fully described.

In the drawings, Fig. 1, A represents an actuating-shaft bearing a wheel, V, to which is attached a crank, M. B is a pitman-rod connecting crank M with pin K attached to piston E. Said piston E acts as a guide for rod B, and is formed with a cup-shaped cavity, *x*, to receive the end of same, said cavity serving as a receptacle for oil, for the purpose of lubricating the mechanism. Connecting piston E with piston P is the rod *t*, which passes through the packing of diaphragm D, forming therewith an air-tight joint. C is the percussion-cylinder bearing the hammer-block F and hammer E, and sliding freely in a vertical position. Said cylinder is carefully turned upon its periphery, and bored upon the inside, the lower portion being of a little smaller caliber than the upper, to form a seat, upon which the diaphragm D may rest. G represents the outer casing, which contains the cylinder, and is preferably made cylindrical on one side and flat on the other, so that it may present a plane surface to the wall or frame to which it is secured. Said case is bored out above and below, to fit the inside cylinder, the middle portion being cast a little larger, and is provided at the top with an annular trough, *d*, which contains oil for lubricating the contact of the case with the cylinder. In piston E and the bottom part of cylinder C are the oil-conduits *y* and *b*, of which *y* serves to conduct the oil from cup *x* to the inner side of the cylinder for lubricating the piston, and *b* to remove the waste, both being provided with appropriate cocks or plugs. G′, F^2, and E^3 represent the different air-chambers formed by the diaphragm, the two pistons, and the bottom of the cylinder. F is a hammer-block, containing hammer E^2; G′, the anvil, and H the block supporting the same, E^1 being a bar of metal which is being operated upon. J, Fig. 2, is a stud secured to cylinder C by screw *v*, which moves in a slot in outer casing G, and prevents the said cylinder from rotating. In Fig. 3, which shows a side elevation, S represents the frame-work to which the operating parts are attached. Said frame is preferably made as shown, but may be varied, according to circumstances. In the top part of said frame is the shaft A, carrying fly-wheel V and band-pulley Q, said pulley being connected with a second pulley, P^1, upon shaft T by a loose band, X. P^2 and P^3 are transmitting-pulleys upon the same axis T, through which motion is imparted to the ham-

mer from the engine. Connected with the apparatus, as thus described, is an attachment for regulating the operation of the hammer, which may be seen in Fig. 4. L is a lever pivoted at *n* to the frame S, having at one end the adjustable counter-weight B^1, and at the other the tension-roller R. This end of the lever L is made into a handle, and connects by rod *r* with a pedal, *p*. The other end of said lever rests upon the end *i* of a second lever moving upon a horizontal axis, but at right angles to L, and as this end of this second lever is depressed by L the other end, *s*, raises a spring, *r'*, and brings a cushioned brake, *s'*, in contact with the fly-wheel V, arresting its motion, said tension pulley R receding from the belt, and allowing the same to become slack whenever the above action takes place.

The operation of this machine is as follows: We will suppose the pulley P^1 to be revolving through belt C^2 and pulley P^2, the lever L is in a horizontal position, the tension-roller away from the belt X, the weight B' pressing upon arm *i*, and the brake *s'* against the wheel V, the hammer being at rest. The lever L is now drawn down, either by hand or by foot, through the pedal *p* and connecting-rod, which action simultaneously withdraws the brake *s'* from the fly-wheel V, and tightens the band X by pressing the tension-roller R against the same. Motion being now imparted to the wheel V, the pitman-rod B is moved accordingly, and a reciprocating motion communicated to the piston-rod *t* and two pistons, E and P. When rod *t* and pistons E and P rise, the cylinder C does not rise simultaneously, but waits until the force of the compression of the air in F^2 and the rarefication of same in G' and E^3 is equal to the weight of the cylinder and hammer. As soon as this takes place the cylinder rises with a spring, elevating the hammer also. Now, as the pistons are forced down by the actuating mechanism, to the impulsive force is added the influence of gravity and the elasticity of the compressed and rarefied air in the compartments, all combining to produce a heavy, sudden, and elastic blow. In the downward stroke, however, the conditions of the air in the compartments of the cylinder are reversed, the air being compressed in G' and E^3 and rarefied in F^2. This occurs by reason of the inertia of the cylinder and hammer when about to change from an upward to a downward course, the pistons moving rapidly and plunging down first, while the cylinder and hammer are, so to speak, balanced between gravity and the upward-impelling force.

It is evident that, in an arrangement like this, the greatest possible variation of stroke can be attained. The machine may be run so slowly as to strike with only a few pounds of its weight, the rest being balanced by the elasticity of the air; or it may be run so rapidly as to reverse the conditions of the air-chambers, and produce the heaviest, quickest, and most elastic stroke possible, the elasticity of the air acting in combination with the weight of the apparatus.

When it is desired to stop the hammer, all that is necessary is to restore the lever L to its former position, whereby the tension-roller is withdrawn from the belt and motion cut off from the machine, and the brake applied to the fly-wheel, by means of which its present motion is arrested.

In the use of the machine as thus described, I do not confine myself to a single diaphragm and two pistons, but may use two or more sets of diaphragms and pistons, when desirable, by making the cylinder longer, the principle and mode of application being the same.

As a modification, also, of my invention, the hammer may be actuated by a direct rectilinear motion, instead of a rotary one, by connecting the pistons to the piston-rod of a steam-cylinder operating in a right line with the hammer; and in this case the entire apparatus may be disposed horizontally upon a frame, as would be required in drilling or breaking rock.

Having thus described my invention, what I claim as new is—

1. The combination, with a reciprocating cylinder, of the rod *t*, pistons E and P, and permanent diaphragm D, for the purpose of forming a triple-acting hammer, operating substantially in the manner and for the purposes set forth.

2. The construction of the piston E, hollowed out at *x*, and having the conduit *y*, for the purpose of forming an oil-cup for lubricating the pistons, and of receiving the end of rod B and forming a guide for the same, substantially as and for the purpose specified.

3. The combination of lever L, tension-roller R, counter-weight B', pedal *p*, rod *r*, lever *s i*, and brake *r' s'*, for the purpose of breaking the communication with the actuating mechanism, and of arresting the motion already imparted to the machine, substantially as and for the purpose specified.

ALFRED LOUIS STANISLAS CHENOT.

Witnesses:
ROBT. M. HOOPER,
EMILE DUHAN.