

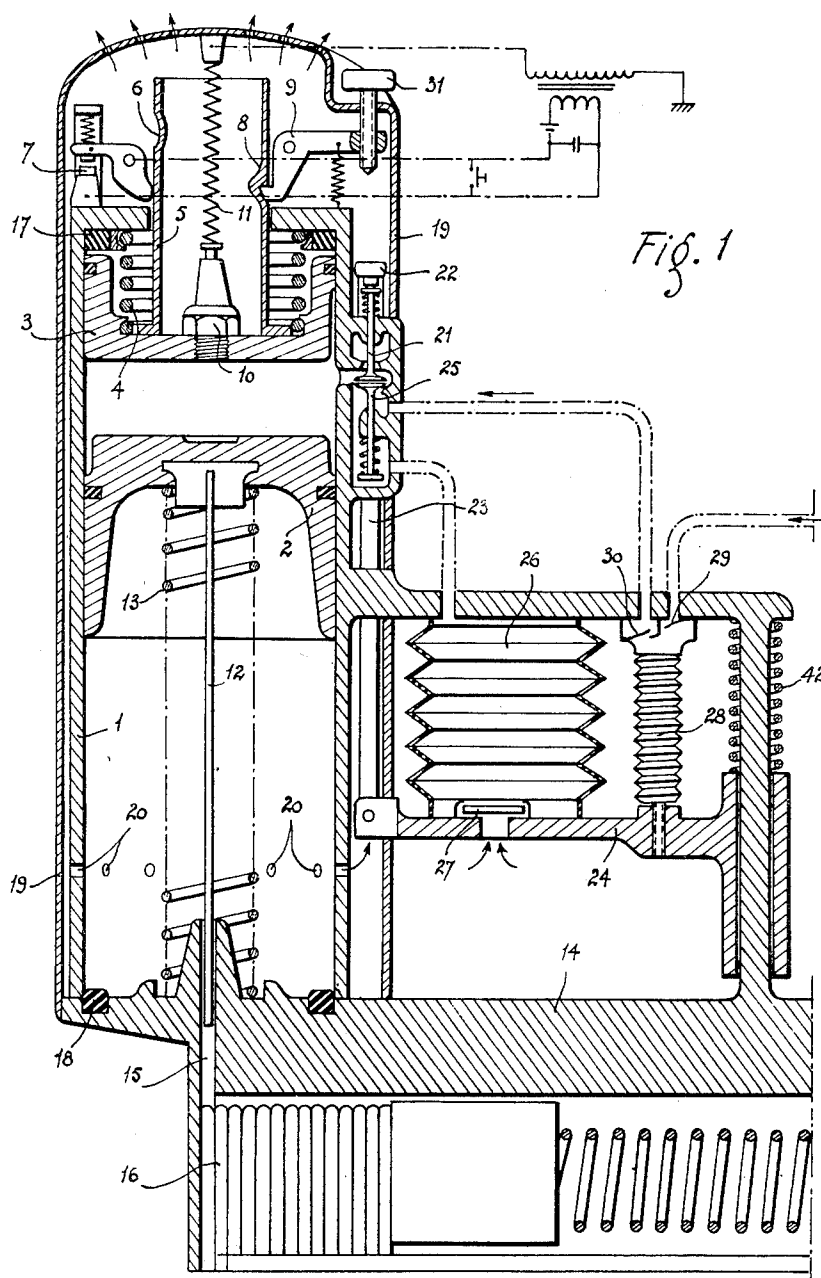
July 3, 1962

M. LIESSE
STRIKING MACHINE, CHIEFLY NAILING, CLAMPING
AND THE LIKE PERCUSSION MACHINES

3,042,008

Filed Oct. 26, 1959

2 Sheets-Sheet 1



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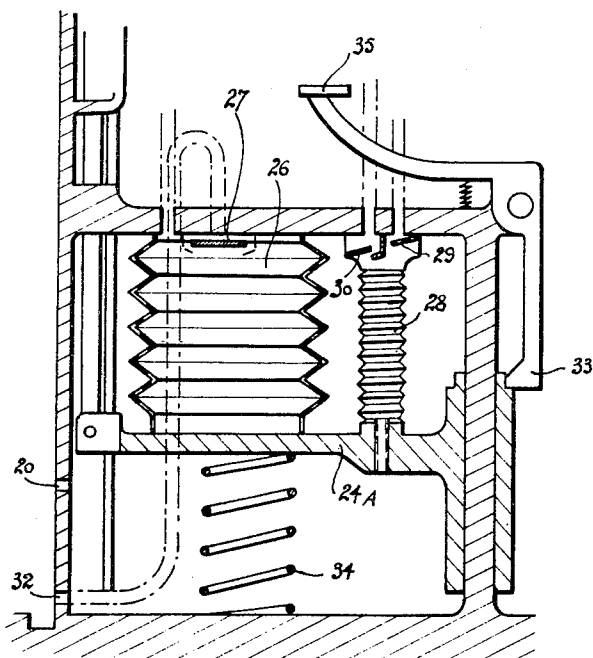


Fig. 2

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3,042,008 STRIKING MACHINE, CHIEFLY NAILING, CLAMPING AND THE LIKE PERCUSSION MACHINES

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The invention disclosed herein relates to striking machines used for industrial purposes, chiefly those the impulses of which are to be individually manually controlled. Such nailing, clamping, marking, punching, chiselling and the like generally hand-controlled machines depend on an external supply of power and on an apparatus transforming said power so as to produce the abrupt impulses required by striking machines.

The use of such machines is presently limited by their lack of easy operation, the necessity of using power-converting means and the high cost price and bulk of the complete machine.

In order to eliminate such drawbacks, my invention has for its object means for feeding energy into striking machines through the novel application of the energy released by the explosion of an explosive mixture, the impulses produced being strictly controlled by a hand-operated member. My invention covers more particularly the release under complete control of a large energy, at the exact moment required while the weight and bulk of the machine are reduced to a minimum.

My improved machine includes a striking tool associated with a driving piston adapted to move inside a cylinder against the action of a return spring and adapted to transmit to the tool the thrust produced by the ignition inside the cylinder of an explosive mixture. According to my invention, each introduction of the explosive mixture into the cylinder takes place under manual control, while locking means are provided for preventing operation of the machine, after each operative cycle.

I will now describe with further detail an embodiment of my invention, reference being made to the accompanying diagrammatic drawings given by way of example and by no means in a limiting sense. In said drawings:

FIG. 1 is a sectional diagrammatic view of a nailing machine according to my invention.

FIG. 2 is a partial view of a slightly modified machine.

Turning to FIG. 1, the cylinder 1 is provided with a striking or driving piston 2 and an auxiliary piston 3, which latter is associated with a spring 4. A guiding member 5 rigid with the piston 3 is provided, on the one hand with a cam surface 6 actuating a circuit-breaker 7 and, on the other hand with a notch 8 which can be engaged by the catch 9. A spark plug 10 carried by the piston 4 is connected with a high voltage terminal through a helically wound wire 11 adapted to be stretched. The striking piston 2 carries the punch 12 forming the operative tool and is urged against the piston 3 by a spring 13. A frame 14 carrying the whole arrangement includes a guide 15 inside which the punch 12 slides, so as to strike the nails or staples such as 16. The cylinder 1 is provided at its opposite ends with resilient stops 17 and 18. A double wall 19 rigid with the frame 14 forms an annular passage through which the air driven out of the cylinder through the ports 20 may flow. A valve 21 controlling the opening of the exhaust port is operated by a stud 22 rigid with the valve stem 23. Said stem follows the movements of the longitudinally shiftable handle 24. A valve 25 automatically closes the admission port, the valve being returned to the closed position by its spring when the handle is in the position of rest. Two bellows are provided, the bellows 26 being provided at its lower end with a flap valve 27 and the other,

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28, being provided at its upper end with an inlet valve 29 and with an outlet valve 30. The bellows 26 is connected to the atmosphere through said valve 27 to feed the cylinder with air through a pipe at its upper end, while a gaseous fuel such as butane, for instance, enters the bellows 28 at 29 and is delivered through the outlet valve 30 into the cylinder 1. The supply of gas may be constituted by a portable bottle or cylinder provided with a pressure reducer; an adjusting screw 31 having its threaded shank engaged in the catch 9 is provided to adjust the stroke of the stud 22.

The operation is as follows: when the apparatus is inoperative, the two pistons 2 and 3 are in contact with each other and the exhaust valve 21 remains open under the action of the stud 22 on its rod 23. Said rod, which is slidable axially, follows the sliding movements of the handle 24. Assuming the catch 9 has been raised and no explosion has occurred, the setting of the apparatus is obtained readily by one or two operations of the movable handle 24, whereby an explosive mixture is fed into the cylinder 1, the machine operating idly upon actuation by hand of the circuit-breaker 7, or else of a switch in parallel with said circuit-breaker. At such a moment, a spark produced by a conventional ignition circuit, illustrated in dot-and-dash lines, jumps across the terminals of the spark plug 10 and the explosion, obtained without any preliminary combustion, is sufficient for the resetting of the piston 3 through engagement with the catch 9.

The apparatus is now ready to operate: actuation of the movable handle 24 sends through the bellows 26 a corresponding volume of gaseous fuel, the proportion between said volumes of air and fuel being equal to the proportion between the volumes of the two bellows. In the valve pocket the valve 25 rises so that the cylinder is filled with an explosive mixture. When the handle 24 reaches the end of its travel, the stud 22 on the stem 23 strikes against the screw 31. The latter releases the catch 9 and the spring 4 produces a sudden downward movement of the piston 3. At the moment when the compression is maximum, by reason of the inertia of the piston 3, the cam 6 actuates the circuit-breaker 7 and makes a spark jump across the terminals of the spark plug. The explosion then obtained drives the piston 2 downwardly in a very sudden manner and gives a sharp blow on a nail 16 through the agency of the punch 12, while the counter-pressure exerted on the piston 3 returns the latter into its starting position in which the catch 9 is reengaged by said piston 3. The volume of air enclosed at the lower end of the piston 2 is driven out through the ports 20 and serves to cool the cylinder as it passes through the annular space in the double wall 19.

When the handle 24 is released, the valve 21 opens and the comparatively weak spring 13 raises the piston 2 and drives out the burnt gases, the opening of the exhaust valve 21 being ensured by the return of the handle 24 into its starting position through the agency of the elasticity of the bellows 26, 28 and the spring 42, acting on the handle guide-member.

In the modification illustrated in FIG. 2, when the ports 20 have been closed during the downward motion of the driving piston, the remaining mass of air at the bottom of the cylinder is urged through the port 32 into the air bellows 26, so as to inflate the latter and thereby return the handle 24A into its inoperative position in which it is held fast, in the case illustrated, by a catch 33. The shifting of the handle 24A into its operative condition is ensured, in the embodiment of FIG. 2, by a spring 34 upon release of the catch 33 obtained through depression of a key 35 rigid with said catch.

My invention is of course not limited to the details of the description given hereinabove by way of a mere ex-

emplification. It is in particular possible to consider for certain applications an automatic repetition of the operative cycle, for instance for incorporation with a scaling hammer, a riveting machine and the like as provided through a mechanical connection to be established for instance between the upward return movement of the driving piston and a flap valve starting the next operative cycle.

What I claim is:

1. A striking machine, chiefly a nailing, clamping or punching machine, comprising a cylinder, a driving piston moving inside said cylinder, proportioning means for simultaneously feeding a combustible gas and a combustion-supporting gas individually and in positively determined volumetric quantities into said cylinder; means for igniting the explosive mixture in said cylinder to produce driving impulses of the piston, a tool subjected to the impulses of said driving piston, a spring urging said piston back into its inoperative position, releasable locking means preventing the machine from operating after each operative cycle, and a member adapted to control conjointly the operation of said proportioning means and the release of the locking means.

2. A striking machine, chiefly a nailing, clamping or punching machine, comprising a cylinder, a driving piston moving inside said cylinder, proportioning means for simultaneously feeding a combustible gas and a combustion-supporting gas individually and in positively determined volumetric quantities into the cylinder to produce driving impulses of the piston, a tool subjected to the impulses of said driving piston, a spring urging said piston back into its inoperative position, an auxiliary piston moving in the cylinder in front of the first-mentioned piston between an inoperative position further from the first piston and an operative position nearer the first-mentioned piston, a spring urging said auxiliary piston towards its operative position, means for locking the auxiliary piston in its inoperative position, an ignition circuit for the mixture in the cylinder adapted to be closed under control of the auxiliary piston in its operative position and hand-operable means controlling conjointly the operation of said proportioning means and the release of the locking means.

3. A striking machine, chiefly a nailing, clamping or punching machine, comprising a cylinder, a driving piston moving inside said cylinder, two compressible elastic containers adapted to feed simultaneously a gaseous fuel and air mixture respectively in positively-determined volumetric quantities into said cylinder to produce driving impulses of the piston, a tool subjected to the impulses of said driving piston, a spring urging said piston back into its inoperative position, an auxiliary piston moving in the cylinder in front of the first-mentioned piston between an inoperative position further from the first piston and an operative position nearer the first-mentioned piston, a spring urging said auxiliary piston towards its operative position, means for locking the auxiliary piston in its inoperative position, an ignition circuit for igniting the mixture in the cylinder adapted to be closed under control of the auxiliary piston in its operative position, an automatically opening inlet valve for said cylinder between the two pistons, an exhaust valve for the cylinder, and control means adapted to be shifted from an inoperative into an operative position to simultaneously compress said containers, ensure closing of the exhaust valve and release the locking means for the auxiliary piston.

4. A striking machine, chiefly a nailing, clamping or punching machine, comprising a cylinder, a driving piston moving inside said cylinder, two compressible elastic containers adapted to feed simultaneously a gaseous fuel and air mixture respectively in positively-determined volumetric quantities into the cylinder to produce driving impulses of the piston, a tool subjected to the impulses of said driving piston, a spring urging said piston back into

its inoperative position, an auxiliary piston moving in the cylinder in front of the first-mentioned piston between an inoperative position further from the first piston and an operative position nearer the first-mentioned piston, a spring urging said auxiliary piston towards its operative position, means for locking the auxiliary piston in its inoperative position, an ignition circuit for igniting the mixture in the cylinder adapted to be closed under control of the auxiliary piston in its operative position, an automatically opening inlet valve for said cylinder between the two pistons, an exhaust valve for the cylinder, hand-operable control means adapted to be shifted from an inoperative to an operative position to simultaneously compress said containers, ensure closing of the exhaust valve and release the locking means for the auxiliary piston, and a spring urging the control means back into an inoperative position to effect reengagement of the locking means, opening of the exhaust valve and return of said containers to their initial extended position.

5. A striking machine, chiefly a nailing, clamping or punching machine, comprising a cylinder, a driving piston moving inside said cylinder, two compressible elastic containers adapted to feed simultaneously a gaseous fuel and air mixture respectively in positively-determined volumetric quantities into the cylinder to produce driving impulses of the piston, a spring urging said piston back into its inoperative position, an auxiliary piston moving in the cylinder in front of the first-mentioned piston between an inoperative position further from the first piston and an operative position nearer the first-mentioned piston, a spring urging said auxiliary piston towards its operative position, means for locking the auxiliary piston in its inoperative position, an ignition circuit for igniting the mixture in the cylinder adapted to be closed under control of the auxiliary piston in its operative position, an automatically opening inlet valve inserted between the two containers and the cylinder, an exhaust valve for the cylinder, hand-operable means adapted to be shifted from an inoperative to an operative position to simultaneously compress said containers and ensure closing of the exhaust valve, said hand-operable means releasing the locking means for the auxiliary piston when the exhaust valve is closed.

6. A striking machine, chiefly a nailing, clamping or punching machine, comprising a cylinder, a driving piston moving inside said cylinder, two compressible elastic containers adapted to feed simultaneously a gaseous fuel and air mixture respectively in positively-determined volumetric quantities into the cylinder to produce driving impulses of the piston, a tool subjected to the impulses of said driving piston, a spring urging said piston back into its inoperative position, an auxiliary piston moving in the cylinder in front of the first-mentioned piston between an inoperative position further from the first piston and an operative position nearer the first-mentioned piston, a spring urging said auxiliary piston into its operative position, means for locking the auxiliary piston in its inoperative position, an ignition circuit for igniting the mixture in the cylinder adapted to be closed under control of the auxiliary piston in its operative position, spring means for compressing said containers simultaneously, a hand-releasable member locking the container-compressing means in their inoperative position, said container-compressing means in their operative position releasing the locking means for the auxiliary piston, and means connecting the section of the cylinder behind the driving-piston with the air-feeding container to return into the latter the air compressed inside the cylinder by said driving piston during the driving stroke.

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