April 22, 1941. L. T. EVERETT 2,239,090

PORTABLE POWER HAMMER

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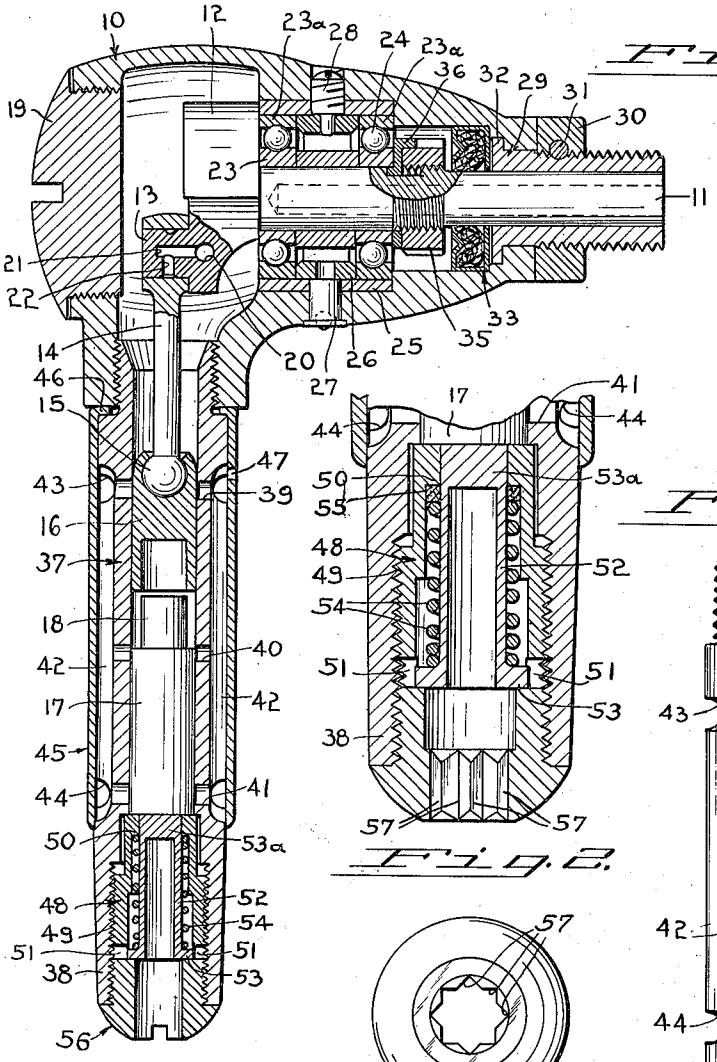


Fig. 1.

Fig. 2.

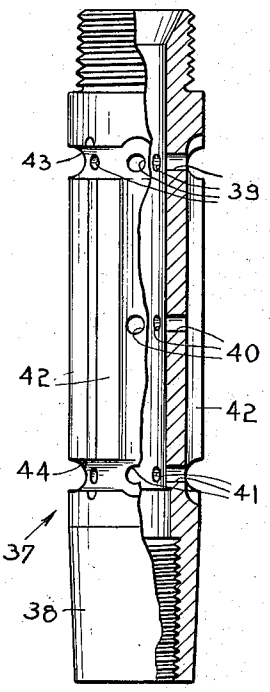


Fig. 3.

Fig. 5.

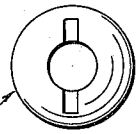


Fig. 4.

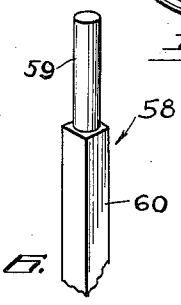


Fig. 6.

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PORTABLE POWER HAMMER

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Application April 23, 1940, Serial No. 331,225

5 Claims. (Cl. 125—34)

This invention relates to improvements in portable power hammers of that type in which the percussive force is determined by the pressure exerted by the operator in holding the hammer to the work.

An example of such a power hammer is given hereinafter in connection with the description of the improvements constituting the present invention.

Such portable power hammers have gone into extensive use in many arts including marble working and sculpturing. However, the prior apparatus has been open to the objection that dust and dirt enters through the nose-end of the apparatus around the tool shank and in time interferes with the operation of the apparatus, so that at intervals it is necessary to dismantle the apparatus and clean it.

Sometimes, instead of disassembling the apparatus it is the practice to immerse the nose-end in kerosene and then wash out as much as possible of the accumulated dirt by draining off the kerosene, this treatment sometimes being repeated several times. In stone working or sculpture work where much dust arises from the material worked on and particularly in cases where the apparatus is working with the chisel pointing generally upward, there is an undesirable accumulation of the dust and dirt within the lower end of the apparatus around and up inside the tool which is very objectionable because requiring such frequent attention to the removal of it.

A further objection has been that there is an appreciable leakage of oil from the apparatus around the tool. This is somewhat aggravated by the fact that as these power hammers are fast-working machines they must be well lubricated and hence carry a relatively considerable amount of oil in the housing. As the operator heretofore has been compelled to keep one hand on the tool itself in order to prevent it from rotating about its own axis and to guide it at its work, such hand soon becomes smeared with oil while also oil seeps down the chisel and might reach the work. In ordinary work the slight leakage of oil is unimportant though perhaps somewhat disagreeable. But with statuary work, such as work done on marble or other light colored stone, or plaster, the results of the oil leakage might be very serious, because the oil, usually blackened somewhat, is absorbed by the work and blemishes it. It is difficult to remove such blemishes by chemical means because of the depth to which the oil sinks in the stone, marble or other similar material worked upon. Therefore, the operators must use care in handling the apparatus to avoid blemishes on the work material, such care generally involving a frequent wiping of the tool.

A further objection to comparable power hammers of the prior art has been the practice of making the chisel or other tool with a cylindrical shank to fit into the nose-end of the power hammer with its end arranged to make direct contact with the tappet. In such a case, the shank must be carefully machined to quite exact dimensions, as leakage of oil and entrance of dust are greatly increased by a loose fit of the shank. As it is a common practice with some users of power hammers of the type under consideration to make their own chisels, it frequently occurred that these were not all that they should be as to dimensions, hardness and particularly length of the cylindrical shank portion. In most cases the shank is made too long, thereby moving the tappet too much toward the hammer, with the result that either the machine is stalled or in most cases breakage occurs, either of the pitman or of the crank pin. This is particularly serious where repair parts are not readily available, as with users located far from the maker of the hammer. Complaints sometimes were made as to the efficiency of a power hammer when the principal cause of the trouble was the imperfection of the shank of a chisel or other tool made by the user.

The object of the present invention is to overcome the above disadvantages and at the same time retain the simplicity and durability of the apparatus.

With these general objects in view and some others which will be obvious to those skilled in the art from the description hereinafter, the invention consists in the features, details of construction, and combination of parts which will first be described in connection with the accompanying drawing and then more particularly pointed out.

In the drawing,

Fig. 1 is a central longitudinal sectional view of a power hammer embodying the invention, some parts being shown in elevation.

Fig. 2 is a detail sectional view on a somewhat enlarged scale of a modification of the construction of the nose-end.

Fig. 3 is an elevation partly in section of the barrel.

Fig. 4 is an end view of one form of nose.

Fig. 5 is a similar view of another form of

nose embodying the most advantageous features of this particular invention.

Fig. 6 is a detail perspective of one form of tool, partly broken away.

Referring to the drawing, 10 is a housing in which is mounted a main driving shaft 11 to whose inner end is fixed a crank 12 provided with a crank-pin 13 arranged to receive a pitman or connecting rod 14 having a ball-shaped end 15 arranged to oscillate in a socket formed on the inner end of a plunger 16 arranged to coact with a tappet member 17, the tappet being provided with a projecting cylindrical end 18, of reduced diameter, arranged to enter a recess formed in the outer end of the plunger 16.

The housing has a threaded opening closed by a screw-threaded plug 19 to permit access to the interior of the housing. The crank 12 is provided with a transverse channel indicated at 20 for the admission of oil, and the crank-pin 13 has channels for the delivery of the oil from the transverse channel 20 to the pitman bearing, the channels in the crank-pin being indicated at 21 and 22, respectively.

The main shaft 11, as shown, is tubular for nearly its whole length and is stepped down in diameter from near the crank outward. Its largest diameter carries the inner guide-rings 23, of ball-bearings, the balls being indicated at 24, the corresponding outer guide-rings 23*a*, of said ball-bearings being securely mounted within a bearing-sleeve 25 arranged to fit in a recess in the housing. The space between the ball-bearings is filled by an annular spacing ring 26 having longitudinal oil channels communicating with a radial oil hole closed by a plug 27, as will be clear from Fig. 1. The spacing ring is held by a set screw 28.

Around the outer end of the shaft which has the smallest diameter is arranged a coupling-sleeve 29 held in the housing by an external screw-threaded collar 30, pinned to sleeve 29 by a transverse pin 31, and also held by a flanged end 32 recessed in the housing as shown.

Immediately inside the flanged end 32 of the bearing sleeve there may be provided an annular oil-sealing device 33 comprising a metal case within which is held a ring of any suitable oil-proof elastic material such as synthetic rubber-like material.

The intermediate portion of the main shaft is of a diameter intermediate the diameters of two ends, and is provided with a collar 35 threaded onto the shaft and provided with a lock-washer 36. The collar and washer serve to prevent axial movement of the shaft outward, and the face of the crank 12 prevents movement axially in the opposite direction.

The main shaft 11 is intended to be connected at its outer end to a flexible shaft driven by any suitable motive power, such shaft (not shown) usually comprising a socket end which may be threaded onto the coupling sleeve 29.

The plunger and tappet fit snugly and are capable of reciprocating in a suitable barrel or cylinder 37, having a reduced end threaded into the housing 10 and also having a nose-end indicated at 38 whose bore has two diameters each larger than the internal diameter of the main portion of the cylinder or barrel, the largest internal diameter of the bore being at the outer end and threaded.

The cylinder or barrel is provided with a plurality of channels on the outside which are connected, by three sets of ports, with the interior of the said cylinder or barrel, some of the ports being indicated at 39, 40 and 41, respectively.

The channels on the outside of the barrel are separated by ribs 42, Fig. 3, and these are notched at each end as indicated at 43 and 44, Fig. 3, respectively, to put all the channels in communication with each other.

Outside the barrel is a jacket 45, which is provided at one end with an inturned flange 46, clamped between the housing and the barrel by a shoulder formed on the barrel. A suitable air hole 47 may be provided in the jacket, which puts all the channels of the barrel in communication with the outside air, near the upper end of the barrel.

Within the nose-end 38 of the barrel there is a nose-bushing 48 having at its outer end an enlarged external diameter which is screw-threaded as indicated at 49, this part of said bushing also having an enlarged central compartment of any suitable cross-section, but generally circular.

The inner end of said bushing, whose external diameter is less than that of the threaded outer end of the bushing, is smooth to fit snugly in the bore of the nose-end of the barrel. The extreme inner end of the nose-bushing is flanged interiorly as indicated at 50. The flange has a relatively considerable thickness for a reason which will be clear from the description hereinafter, and has a central opening, of any suitable cross-section, but usually circular. In order to permit the nose-bushing to be screwed into and out of the nose-end of the barrel, its extreme outer end may have a transverse slot for a screw driver device, as indicated at 51, Fig. 1.

Within the nose-bushing 48 there is an axially movable tool-holding device 52 having at its outer end an external flange 53, Fig. 1, of appreciable thickness, to fit snugly in the large diameter compartment or nose-bushing and to slide longitudinally of said compartment in the manner of a well-fitted piston. While the tool-holding device may have various external cross-sectional configurations, it is usually circular, as shown in the drawing. The said tool-holding device is chambered at its outer end to receive the shank of a chisel or other tool but at its inner end is solid for a relatively considerable axial distance. For example, in a certain size of power hammer the said solid end, 53*a*, has a longitudinal axial dimension of one-fourth inch where the external diameter of the tool-holding device is five-sixteenths of an inch. That is to say, the thickness of the solid end is substantially equal to four-fifths of the exterior diameter of the solid end, thereby insuring that there will be sufficient resistance to spreading or increase of external diameter at the inner end of the tool-holding device under the stresses due to operation, and at the same time serving to transmit such stresses to the wall of the chambered portion of the tube-holding device in case that becomes necessary.

The said solid end fits piston-like in the central opening of the flanged inner end 50 of the nose-bushing and because of the relatively considerable length of this opening, namely, about one-half the thickness of the solid end of the tool-holding device, there is sufficient capillary action between the inner wall of the flange 50 of the nose-bushing and the outer face of the solid end of the tool-holding device to draw in a mere film of oil at the beginning of operations, but thereafter tending to hold said film against

movement outward from the barrel. In other words, the capillary force or surface adhesion is sufficient to counteract to a large extent the usual hydrostatic head of the oil in the lower or outer part of the barrel **37** when the power hammer is in use with the tool or chisel extending downward. By this proper proportioning of the adhesive surfaces and careful fitting of the parts to reduce the clearance as much as is permissible for perfect sliding action of the tool-holding device in the nose-bushing, the seepage of oil down to the tool is reduced to a minimum, and, also, the entrance of dust to the interior of the barrel at the nose-end is prevented.

In the annular space between the inner face of the nose-bushing and the outer surface of the tool-holding device, a helical spring **54** is located, this spring resting at one end against the inner face of the flange **53** of the tool-holding device and abutting at its other end either directly against the outer face of the flange **50** of the nose-bushing, as shown in Fig. 1, or against a packing washer, such as leather, rubber, or other suitable material, which bears against said flange **50**, this modification being shown in Fig. 2 and being particularly important in machines intended for statuary work. The packing washer indicated at **55**, Fig. 2, is crowded radially by the pressure of the spring **54** so as to make a tight joint and thereby aid in excluding dust and also in preventing leakage of oil, while at the same time not unduly hampering the movement of the tool-holding device in a longitudinally axial direction within the nose-bushing.

To retain the tool-holding device in place, a nose **56** is provided. This nose is threaded to engage the internal screw threads of the nose-end of the barrel or cylinder. It is provided with a flanged head and an opening arranged to admit the end of the tool so that the latter may enter the tool-holding device. In one form of the device the nose has a central cylindrical bore of larger diameter than the chamber in the tool-holding device and is provided with a transverse slot to receive a screw driver device. This form of nose is illustrated in Fig. 4.

In the best embodiment of the invention, the nose is relied upon to hold the tool against rotary motion about its longitudinal axis. Such a construction is illustrated in Fig. 5. In this case the nose has a central passage of such diameter as to admit the shank of the tool, this passage in the present example being circular in cross-section, and from this central passage extend a series of radial notches as indicated at **57**, Fig. 5, which receive the edges of a tool having a polygonal cross-section at the part which engages the nose, thereby allowing the use of metal of polygonal cross-section rather than cylindrical, in making the chisels or other similar tools and also preventing any accidental rotation of the tool, about its longitudinal axis, relative to the power hammer. This gives the operator control of the tool by mere manipulation of the power hammer itself, thereby avoiding the necessity of keeping a firm hand on the chisel during working operations to prevent it rotating and making an unwanted cut. At the same time, the tool is not secured to the power hammer, but may be removed and replaced quickly with another tool, which is a necessary feature of such a type of power hammer, particularly for sculptors.

The chisel **58**, Fig. 5, or other tool, is made from suitable bar material of a polygonal cross-section, usually square. A cylindrical shank **59** of reduced diameter is formed on its inner end, this shank being arranged to fit fairly snugly in the chamber of the tool-holding device. The shank has a length substantially equal to the depth of the chamber in the tool-holding device. The shank is, of course, of less diameter than the transverse size of the square or polygonal portion **60** of the chisel or other tool, whereby a shoulder is formed which is intended to come into contact with the outer face of the flange **53**, on the outer end of the tool-holding device, while the extreme inner end of the tool shank is intended to make contact with the solid wall **53***a* of the inner end of the tool-holding device. As this requires great accuracy of machine work, it is better to have the shank **59** make contact with the face of said solid wall even if the shoulder on the tool does not quite fit against the flange **53** of the tool-holding device, because the shank is so well supported by the inner walls of the bore in the tool-holding device that spreading of the shank, due to the blows transmitted, is entirely avoided if there is only a direct transmission of a thrust from the solid wall **53***a* to the inner end of the tool shank **59**, and no hammer action can take place between the said wall and said shank such as would occur if there were a clearance between the two. If, however, in a home-made chisel, there were such a clearance, such that the shoulder of the tool makes contact with the flange **53** on the outer end of the tool-holder, the thickened solid wall **53***a* acts to distribute the stress of the blow down the tubular wall in a fairly uniform manner to the tool shoulder. In this embodiment of the invention, the inner end of the nose is counterbored so that the tool does not contact with the wall of the counterbored portion. In this way the friction of the tool as it reciprocates in the nose is greatly reduced. Furthermore, the outer end of the orifice which is to receive the tool may be chamfered, thereby assisting in guiding the tool-shank into place in the chamber of the tool-holding device, which aids in the quick replacement of a tool.

The operation of the power hammer embodying the improvements of the present invention is substantially the same as with prior art power hammers of the same general type, with the exception that with the present device it is not necessary for the operator to control the tool itself with one hand directly applied to it, in order to prevent its unwanted and accidental rotation, because as a result of the polygonal cross-section of the tool at one part at least, and the radial notches in the nose, the operator may rotate the tool when desired by turning the power hammer itself in an angular manner, or when desired may hold the tool against rotation by retaining the power hammer in the desired fixed position.

By the construction disclosed, the leakage of oil is overcome to such an extent that it is only at long intervals that the tool and nose-end need be wiped. Thus the danger of smearing with oil the material to be worked on is almost entirely eliminated. At the same time, the control of the tool by the hand holding the power hammer is so complete that the tool, such as a chisel, may be used along fillets in castings and in other angular places without danger of the accidental formation of gashes in the material worked upon, such as occurred heretofore with power hammers of this type and made them so unsatisfactory for sculptors working on stone or marble where tools

were changed even after a few strokes, and where each cut had to be carefully controlled, and where, furthermore, serious injury could be done to the material worked upon by smears of oil from the power hammer.

In addition, the entrance of dust to the interior of the power hammer at the nose-end is so substantially avoided that it may be said to be practically eliminated, power hammers embodying the present inventions having run for months without the necessity of cleaning.

It is to be understood that the power hammer is driven by a flexible shaft from a high speed motor such as an electric motor, and that the nature of the blow, whether hard or light is determined by the extent to which the operator presses down on the power hammer, which controls the extent to which the tool pushes back the tool-holder and the tappet 17 into the cylinder. In the present case, however, the tappet does not fit air-tight at its lower end in the barrel, so that there is practically no suction between the plunger 16 and the tappet tending to suck the tappet toward the plunger as the latter moves away from the tappet, and furthermore there is no compression of air under the tappet, which tends to minimize oil leakage around the tool-holding device. Consequently the tappet always tends to maintain a substantially continuous contact with the head of the tool-holding device, and the latter with the tool shank head. Therefore, the tappet is not strictly a hammer to pound on the inner end of the tool-holding device but is more in the nature of an anvil which takes the cushioned blow of the plunger and transmits it as a thrust direct to the tool. Of course, owing to the elasticity of the metals there may be a slight rebound of the tappet from the solid head of the tool-holding device, but practice has shown that this is is trivial as to be substantially negligible. By applicant's construction the usual battering of the shank of the tool is avoided.

It is to be noted that if a user makes his own tools and gets the shank too long, no especial damage can be done when using applicant's device because in all cases a given downward pressure exerted by the operator moves the tappet back a definite amount, whether the shank of the tool be long or short, whereas in prior constructions, a long shank on the tool, with even a very slight pressure, lifted the tappet closer to the plunger, dependent upon the excess length of the shank, and thereby caused breakage of the mechanism. All of this is avoided by the present invention in which the spring-pressed member which determines the extent to which the tappet is pushed toward the plunger is a part of the power hammer itself and hence is certain in determining the force of the blow given to the tool, and positively prevents any breakage.

What is claimed is:

1. In a power hammer of the type whose percussive force is determinable by the pressure exerted by the operator in holding the hammer to the work, said power hammer comprising a reciprocable plunger and a tappet to which the plunger imparts its blow, a nose-construction for said hammer comprising a tubular nose-end on the power hammer, a nose-bushing within the nose-end and having an enlarged compartment at its outer end and a radially inward extending relatively thick flange at its inner end provided with a central opening, a tool-holding device arranged to fit closely and yet be movable longitudinally in said central openings of the flange, said tool-holding device being provided with a flange arranged to travel in the enlarged compartment of the nose-bushing and being tubular part of the way from its flanged end to receive a tool shank and having its other end closed by a relatively thick solid wall, arranged to receive and transmit thrust from the tappet, a helical compression spring located in the space between the tool-holding device and the inner wall of the nose-bushing, said spring being restrained at one end by the flange of the nose-bushing and at the other end by the flange of the tool-holding device, and a nose having a central opening to admit a tool and threaded into the nose-end of the power hammer, said nose being arranged to limit the outward movement of the tool-holding device.

2. In a power hammer of the type whose percussive force is determinable by the pressure exerted by the operator in holding the hammer to the work, said power hammer comprising a reciprocable plunger and a tappet to which the plunger imparts its blow, a nose-construction for said hammer comprising a tubular nose-end on the power hammer, a nose-bushing within the nose-end and having an enlarged compartment at its outer end and a radially inward extending relatively thick flange at its inner end provided with a central opening, a tool-holding device arranged to fit closely and yet be movable longitudinally in said central opening of the flange, said tool-holding device being provided with a flange arranged to travel in the enlarged compartment of the nose-bushing and being tubular part of the way from its flanged end to receive a tool shank and having its other end closed by a relatively thick solid wall, arranged to receive and transmit thrust from the tappet, a helical compression spring located in the space between the tool-holding device and the inner wall of the nose-bushing, said spring being restrained at one end by the flange of the nose-bushing and at the other end by the flange of the tool-holding device, and a nose having a central opening to admit a tool and threaded into the nose-end of the power hammer, said nose being arranged to limit the outward movement of the tool-holding device, said nose being counterbored at its inner end and chamfered at the outer end of its central opening.

3. In a power hammer of the type whose percussive force is determinable by the pressure exerted by the operator in holding the hammer to the work, said power hammer comprising a reciprocable plunger and a tappet to which the plunger imparts its blow, a nose-construction for said hammer comprising a tubular nose-end on the power hammer, a nose-bushing within the nose-end and having an enlarged circular bore at its outer end and a radially inward extending relatively thick flange at its inner end provided with a circular opening, a cylindrical tool-holding device arranged to fit closely and yet be movable longitudinally in said circular opening of the flange, said tool-holding device being provided with a circular flange arranged to travel in the enlarged circular bore of the nose-bushing and being tubular part of the way from its flanged end to receive a tool shank and having its other end closed by a relatively thick solid wall, arranged to receive and transmit thrust from the tappet, a helical compression spring located in the space between the tool-holding device and the inner wall of the nose-bushing, said spring being restrained at one end by the flange

of the nose-bushing and at the other end by the flange of the tool-holding device, and a nose having a central bore to admit a tool and threaded into said enlarged circular bore of the nose-end of the power hammer, said nose being arranged to limit the outward movement of the tool-holding device.

4. In a power hammer of the type whose percussive force is determinable by the pressure exerted by the operator in holding the hammer to the work, said power hammer comprising a reciprocable plunger and a tappet to which the plunger imparts its blow, a nose-construction for said hammer comprising a tubular nose-end on the power hammer, a nose-bushing within the nose-end and having an enlarged circular bore at its outer end and a radially inward extending relatively thick flange at its inner end provided with a circular opening, a cylindrical tool-holding device arranged to fit closely and yet be movable longitudinally in said circular opening of the flange, said tool-holding device being provided with a circular flange arranged to travel in the enlarged circular bore of the nose-bushing and being tubular part of the way from its flanged end to receive a tool shank and having its other end closed by a relatively thick solid wall, arranged to receive and transmit thrust from the tappet, a helical compression spring located in the space between the tool-holding device and the inner wall of the nose-bushing, said spring being restrained at one end by the flange of the nose-bushing and at the other end by the flange of the tool-holding device, and a nose threaded into said enlarged circular bore of the nose-end and arranged to limit the outward movement of the tool-holding device, said nose having a central bore in axial alignment with and of greater diameter than the bore of the tubular portion of the tool-holding device, and having a plurality of radial grooves extending outward from its central bore and dimensioned to receive and retain the corners of a polygonal portion of a tool in a plurality of angularly adjustable positions of such tool.

5. In a portable power hammer of the type whose percussive force is determined by the operator in holding the hammer to the work, the combination with a plunger, means for reciprocating it, and a tappet arranged to transmit the force of the plunger to the work, of a member arranged to adjust the tappet with relation to the plunger, and a spring continuously acting on said member in a direction to allow the tappet to remain out of contact with the plunger, said member having a tubular bore to receive the shank of a tool and having a closed end to prevent contact of the tool-shank with the tappet and to transmit stress, due to a blow of the plunger on the tappet, to the tool.

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