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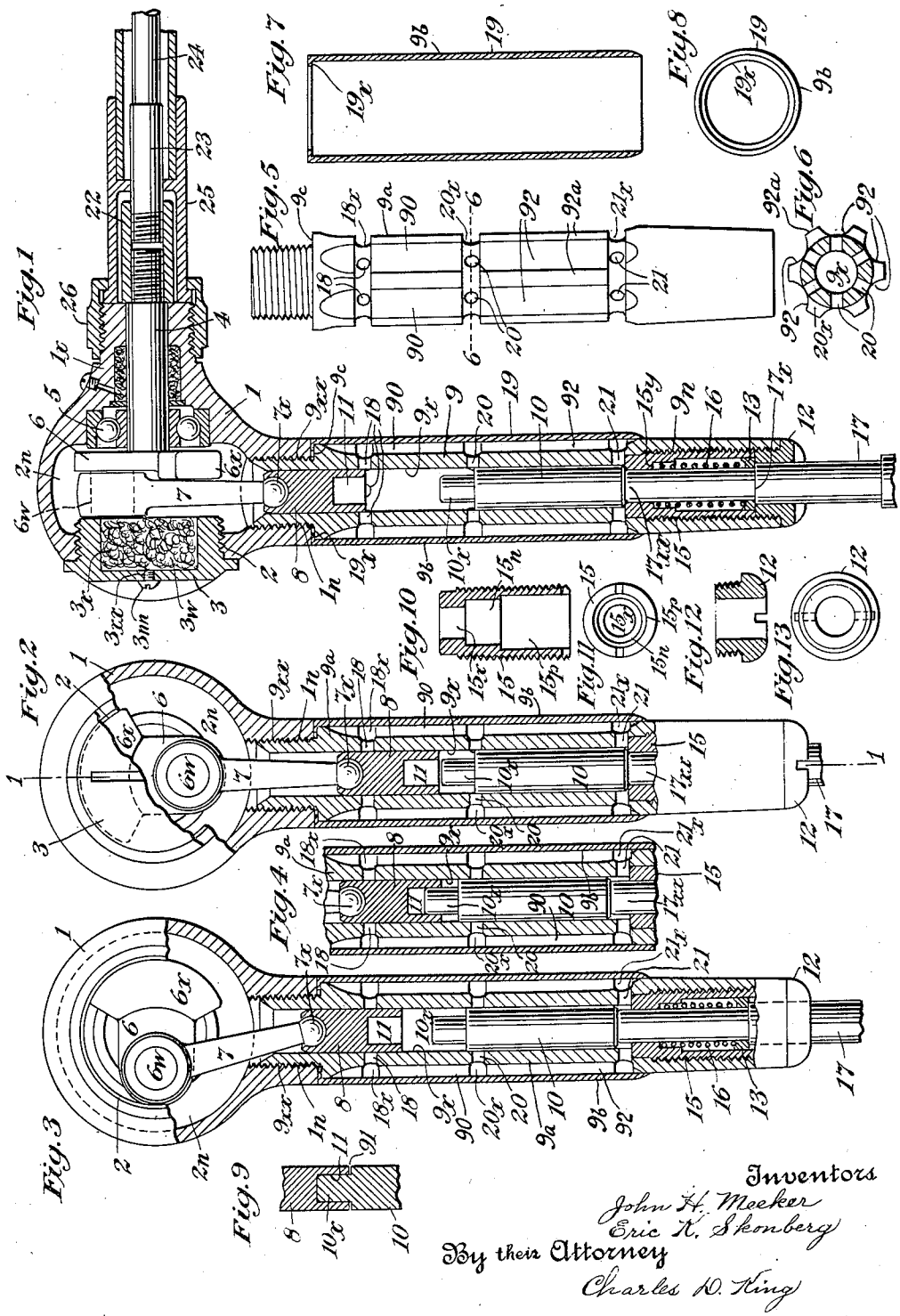

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POWER HAMMER

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This invention relates to improvements in power hamers and more particularly to power hammers employing air under compression or vacuum and especially to portable implements of such type. It relates particularly to the class of such implements disclosed in our co-pending application Serial No. 223,950, filed Oct. 4, 1927 to which reference may be had.

Certain power hammers have been devised of the portable type which have serious faults of operation, or are of complicated or intricate construction, particularly in hammers employing vacuum principles of operation. Among the faults of operation are those due to objectionable rattling of the parts, especially the reciprocating parts, caused by lack of proper cushioning and in some forms to the increase in the number of parts employed in effecting variation of the vacuum during the strokes of the active parts. Also there are faults involving danger of injury to the hands of the operator by improper arrangement of parts. And there are other faults of construction due to increase of the number of parts to secure greater facility of manufacture of certain parts.

The main object of the present invention is to provide a power hammer embodying air influenced devices in which the parts are few and simple to manufacture. Another object is to provide an improved article of this class which employs pneumatic means to modify the operation of certain reciprocating parts and to minimize the rattle of moving parts, and a further object is to improve the means for giving working strokes of varying force from light cushioned blows to sharper blows of greater force and without undue heating of parts. Another object is to provide an improved implement which tends to prevent injuries to the hands of the operator.

Among the faulty implements above-mentioned are certain power hammers having barrels provided with thin tubular linings forced into the main barrels. In our improved construction we avoid such thin tubular linings and provide a barrel in which the integral central bore can be finished with great accuracy by grinding. Also certain hammers have internal flanges in the barrels which necessitate the use of the tubular linings above referred to or to very expensive grinding operations. Among the faulty structures likely to injure the hands of the operators are those having sliding inner sleeve construction in which the lower parts have recipricating shoulders or collars which move toward and from shoulders or collars on the outer parts of the barrels. It is obvious that such construction will sooner or later result in bruising the hands of the operators. In regard to the hammers employing vacuum principles, some parts of either the working or retracting strokes are found to develop a rattle in such implements on account of the rapid change in the application of power as will be clear on study of such hammers. Also certain vacuum hammers have a discharge of air through ports in the casing which discharge frequently becomes mixed with oil both of which features are highly objectionable.

In our improved implement we have overcome the above objectionable features and have produced a safe and quiet running article, that is simple and economical to manufacture. Such being the case we are able to make the parts of better quality than could be done at the same price for the more complicated articles. And also for the reason that we are able to provide hardened and ground steel parts in place of parts not hardened and ground, or which are merely ground and not hardened.

The means we prefer to employ for accomplishing the above-named objects together with other novel and advantageous features which will appear hereinafter, are illustrated in the drawings accompanying and forming part of this specification, and in which,—

Figure 1 is a longitudinal section of one form of our improved power hammer taken on the line 1—1 of Fig. 2.

Fig. 2 is a view taken partly in side elevation and partly in longitudinal section along the center line of the barrel and at right angles to the section in Fig. 1, certain parts being in opposite positions to those of Fig. 1.

Fig. 3 is a view similar to Fig. 2 but with certain parts in another position.

Fig. 4 is a longitudinal section of a portion of the barrel with certain parts in still another position.

Fig. 5 is a detail side elevation of the body of the barrel.

Fig. 6 is a transverse section of the same taken on the line 6—6 of Fig. 5.

Fig. 7 is a longitudinal section of the barrel casing.

Fig. 8 is a plan of the same.

Fig. 9 is a detail longitudinal section of the piston and plunger in their nearest position.

Fig. 10 is a detail longitudinal section of the upper barrel bushing.

Fig. 11 is a plan of the same.

Fig. 12 is a detail longitudinal section of the plug or lower barrel bushing, and

Fig. 13 is a plan of the same.

Like characters of reference refer to like parts in all the figures of the drawings.

Referring to the drawings, the numeral 1 designates the housing or head of the implement and which is provided with an opening 2 which is preferably screw-threaded and is adapted to receive an annular member 3. There is a projection or hub $1x$ formed opposite the opening 2 substantially on the same axis and has an opening through which the drive shaft 4 is placed and journaled preferably in a ball bearing 5.

The housing 1 has also a crank chamber $2n$ in which is placed the rotary member or drive plate 6 having a weighted balance $6x$ at one side and at the other is an eccentric or crank pin $6w$ off center of said shaft 4. There is a connecting rod 7 pivoted on the eccentric pin at one end and at the other end is connected to the piston 8 by the ball joint $7x$. The said piston 8 is fitted to the bore $9x$ of the barrel 9 which at its upper end is externally-screw-threaded at $9xx$ and secured in the internally screw-threaded opening $1n$ of the housing 1. The annular member 3 is provided with an annular recess $3x$ in which is placed a body $3w$ of fibrous material such as felt, the inner face of which is disposed in juxtaposition to the end of the pin $6w$. The fibrous material is adapted to be saturated with oil which can be replenished through the oil hole $3xx$, closed by the screw $3nn$ so that the crank pin $6w$ is adapted to take on oil from the fibrous portion $3w$ when the oil supply in the crank pin chamber becomes low.

Also in the bore $9x$ of the barrel 9 is a floating plunger 10 which has a reduced portion $10x$ at its upper part which is adapted to enter the recess 11 formed in the lower end of the piston 8. The lower end of the barrel 9 is internally screw-threaded at $9n$ and adapted to receive two bushings, the upper one 15 of which has a central opening $15x$, a spring recess $15n$ in which a coiled spring 16 is placed, and a lower recess $15p$ in which a washer or collar 13 is located and on which the lower end of the spring 16 rests, while its upper end bears against the shoulder $15y$.

The spring 16 acts through the washer 13 upon the shoulder $17x$ of a tool or tool holder 17, the reduced upper end $17xx$ of which is adapted to make contact with the lower end of the plunger 10. The barrel 9 is in two parts, the first or main part $9a$ is formed with a chamber indicated by 90, exterior to the bore $9x$ and extending along the same. Preferably there are upper air ports 18, intermediate air ports 20, and lower air ports 21 connecting the bore $9x$ with said chamber 90. In the form herein shown said chamber 90 has annular passages or grooves $18x$ and $21x$ near or at the ends of the chamber and with a third groove or passage $20x$ between them. The annular grooves are also shown as connected by longitudinal passages such as the longitudinal grooves 92, with ribs $92a$ between said passages forming the periphery of the barrel part $9a$. The air ports 18, 20 and 21 lie in or are connected with said annular grooves or passages $18x$, $20x$ and $21x$ respectively. The first or main barrel part $9a$ and the chamber 90 therein are covered by the second barrel part or sleeve $9b$, which in effect forms the outer walls of said chamber 90 and its grooves or passages. The sleeve $9b$ is secured in position by means of the interior flange $19x$ in its upper part, said flange being clamped between the shoulder $9c$ on the upper part of the barrel and the lower face of the housing opening $1n$. The chamber 90 or system formed by the passages 90, $18x$, $20x$ and $21x$, and ports 18, 20 and 21 is closed to the flow of air except at said ports 18, 20 and 21.

All the ports 18 are in alinement with each other horizontally at the groove or passage $18x$, all the ports 20 are alined horizontally at the passage $20x$, and the ports 21 are similarly alined at the passage $21x$ so that the piston 8 and plunger 10 will be influenced in a balanced manner by the pneumatic pressure through said ports. The air pressure in said passages and ports will normally be uniform throughout the system except as modified by the entrance or egress of air through said ports.

The shaft 4 at its right hand end is screw-threaded to be received within a sleeve 22 which also receives the screw-threaded end of the connection 23 for the flexible shaft 24,

these members being enclosed within a cover sleeve 25 shouldered and held in position by the coupling nut 26 which is screw-threaded onto the extension 1x of the head or housing 1. Preferably there is a portion of felt 26x to prevent the escape of oil from the interior of the housing 1 into the flexible shaft casing.

To properly oil the hammer, the housing or head 1 is supplied with a quantity of oil through the oil hole 3xx, and the hammer is then turned upside down while running and oil is dropped into the barrel between the tool holder 17 and the hole in the bushing 12 so that it will run into the bore 9x and through the air ports into the chamber 90. The chamber 90 should have a good supply of oil but not by any means should it be more than partly filled with oil, so that plenty of air can pass into it, and then as the air passes out through the ports, particularly the ports 18, some oil will also pass through into the bore 9x. Thus the bore, piston and plunger will have some oil supplied at each stroke of the piston in addition to that coming from the housing 1. Hence friction and heating will be reduced to a minimum.

Fig. 1 illustrates the positions of the various parts at the commencement of a down stroke of the piston but in which no work is being done by the tool or holder 17. Fig. 2 illustrates the positions of the parts at the end of such a down stroke. Fig. 3 illustrates an intermediate position of the piston and a position of the plunger suitable for performing working strokes on the tool or holder 17. Fig. 4 represents a similar position of the plunger but with the piston in its lowermost position. Fig. 9 represents the positions of the lower end of the piston and the upper end of the plunger when strokes of the greatest force are being given.

The operation of our improved power hammer is a follows:—

The positions of parts in Figs. 1 and 2 are taken during the time when the implement is doing no work but show the piston, connecting rod and eccentric or crank pin in two different positions, Fig. 1 showing the uppermost position of said parts and Fig. 2 the lowermost position of the same. When the piston 8 moves downward past the ports 18 and closes the same, it compresses the air in the bore 9x between the piston and the plunger 10. However, by reason of such compression some of the air passes out through the ports 20 into the passages or grooves 20x and 90 and also into the ports 18 and 21. Thus the pressure is increased in said ports and passages, all the parts fitting closely enough and there also being oil films between surfaces of the parts so that practically no air leakage occurs.

During all this time the plunger 10 is in its lowest position relatively to the barrel and together with the shank of the tool or tool holder 17 is in the position indicated in Fig. 1. In order to do work on the tool 17 the operator presses down on the implement, so that relative movement takes place between the barrel 9 and the plunger 10 and tool shank 17 as represented in Figs. 3 and 4. The plunger 10 thus closes the ports 20, so that as the piston 8 descends it increases the pneumatic pressure on the end of said plunger sufficiently to produce a working stroke of the same which in turn is communicated to the tool shank 17. Fig. 4 illustrates the positions of the piston, plunger and tool shank at the lower end of the piston stroke when the implement has been moved down an amount equal to about twice the diameter of one of the ports 21.

When the tool shank 17 and plunger 10 are in their highest position in the bore 9x, at the lower end of the piston stroke, the piston and plunger will come together substantially as illustrated in Fig. 9 and the air contained in the bore 9x between the piston and plunger will be compressed into the small space 91 between the end of the piston and the shoulder on the plunger and also an infinitesimal amount in the recess 11 between the end of the plunger and the end of said recess. During this time the air in the port system formed by the passages grooves or passages 18x, 20x, 21x, 90 and ports 18, 20 and 21 remains slightly above atmospheric pressure or substantially at the pressure existing in the bore 9x at the instant the ports 20 were closed by the relative movement between the same and the plunger 10.

In the positions of the piston and plunger shown in Fig. 9 the implement is delivering its sharpest and most forceful blows, while with the plunger in the position of Fig. 3 it delivers its lightest blows. The intermediate positions between these two will permit variations in intensity all the way from the lightest blows to those of greatest force, the relative cushioning effect due to the trapped compressed air being less and less as the maximum force blows are approached.

When the piston 8 and floating plunger 10 are in their highest position, they tend to separate from each other because the compressed air in the recess 11 tends to force them apart, and part of such air then flows through the port or ports 18 into the chamber 90. The bottom of the plunger 10 is under substantially the same pressure as that of the chamber 90, which pressure assists in raising the plunger. The pressure on the top of the plunger in Fig. 1 is substantially the same as that on the bottom and whenever the motor or other power for driving the device is stopped the plunger finally assumes the position of Fig. 1. When the parts are ascending in the relations shown in Fig. 4, friction between the plunger 10 and the bore 9x, together with the expansion of the compressed

air in the recess 11 tend to separate the two members. This will not take place completely without the use of the upper port or ports 18, which permits the air from the chamber 90, this being somewhat above atmospheric pressure, to assist in forcing down the plunger 10 so that the piston and plunger then separate. When air comes through the port or ports 18 from the chamber 90 into the bore 9x, some oil will also pass into said bore, thus insuring more thorough oiling of the piston 8 and bore 9x under the same and then passing down to oil the plunger 10 and the bore around the same.

By reason of the closed arrangement of the passage and port system the air therein is prevented from falling below atmospheric pressure so that suction effects in the up strokes are reduced to a minimum. This tends to keep down the shocks and noise of operating parts as these parts are cushioned to the maximum amount for the type of implement. The closed arrangement of said system also tends to prevent the undue escape of oil from the implement so that the various parts thus have better lubrication and do not become excessively heated by friction with each other.

The interior of the housing is partly or wholly filled with oil at the commencement of operation and is practically closed to the outside atmosphere and it has no direct communication with the air in the bore 9x or in the passage and port system. Lubrication of the piston 8 and plunger 10 is effected by the slow downward flow of oil from the housing 1. The shank 17x of the tool or holder 17 and the washer 13 together with the bushing 15 and nut 12 are lubricated by the further downward movement of oil.

The spring 16 normally presses down the shank 17x of the tool 17 by reason of the washer 13 bearing on the shoulder 17x so that on release of the downward pressure on the implement by the operator, the tool 17 is brought back to its idle position.

The heat generated in compressing the air in the bore 9x is communicated partly to the air in the passage system and partly carried away by radiation. The said passages 90 18x, 20x and 21x are made sufficiently large so that the heat of the air therein will not be unduly increased by air flow therethrough and the total heat due to friction of metal parts and compressed air is such that the casing 19 does not become uncomfortably warm to the hands of the operator.

It will be clear from the foregoing that the implement has a minimum number of parts for the effect obtained, that undue heating of the implement is prevented and by reason of the exterior barrel construction the implement does not tend to injure the hands of the operator.

What we claim is:—

1. A power hammer comprising a cylinder, a piston reciprocal within the inner end portion of said cylinder, means for reciprocating said piston, a reciprocal tool element, and a plunger slidable within said cylinder between said piston and said tool element and adapted to be forced outward by outward movement of said piston for impact with said tool element, said cylinder having a pair of ports one of which is disposed to relieve the air pressure between said piston and said plunger when the plunger is substantially at its limit of outward movement, and the other of which is disposed to admit air between said piston and said plunger when the piston is substantially at the extreme end of its inward stroke.

2. A power hammer comprising a cylinder, a piston reciprocal within the inner end portion of said cylinder, means for reciprocating said piston, a reciprocal tool element, a plunger slidable within said cylinder between said piston and said tool element and adapted to be forced outward by outward movement of said piston for impact with said tool element, said cylinder having a pair of ports one of which is disposed to relieve the air pressure between said piston and said plunger when the plunger is substantially at its limit of outward movement, and the other of which is disposed to admit air between said piston and said plunger when the piston is substantially at the extreme end of its inward stroke, and means providing a closed chamber connecting said ports with one another.

3. A power hammer comprising a cylinder, a piston reciprocal within said cylinder, a drive shaft, a crank and pitman drive connection between said shaft and said piston, a reciprocal tool element, and a plunger slidable within said cylinder between said piston and said tool element adapted to be forced outward by outward movement of said piston for impact with said tool element, said cylinder having a pair of ports one of which is disposed to relieve the air pressure between said piston and said plunger when the plunger is substantially at its limit of outward movement, and the other of which is disposed in the plane of the outer end of the piston when the latter is substantially at its limit of inward movement with the operating crank thereof substantially on dead center.

4. A power hammer comprising a cylinder, a piston reciprocal within said cylinder, a drive shaft, a crank and pitman drive connection between said shaft and said piston, a reciprocal tool element, a plunger slidable within said cylinder between said piston and said tool element adapted to be forced outward by outward movement of said piston for impact with said tool element, said cylinder having a pair of ports one of which is

disposed to relieve the air pressure between said piston and said plunger when the plunger is substantially at its limit of outward movement, and the other of which is disposed in the plane of the outer end of the piston when the latter is substantially at its limit of inward movement with the operating crank thereof substantially on dead center, and means providing a closed chamber connecting said ports with one another.

Signed at New York, in the county of New York and State of New York, this 28th day of February, 1929.

JOHN H. MEEKER.
ERIC K. SKONBERG.