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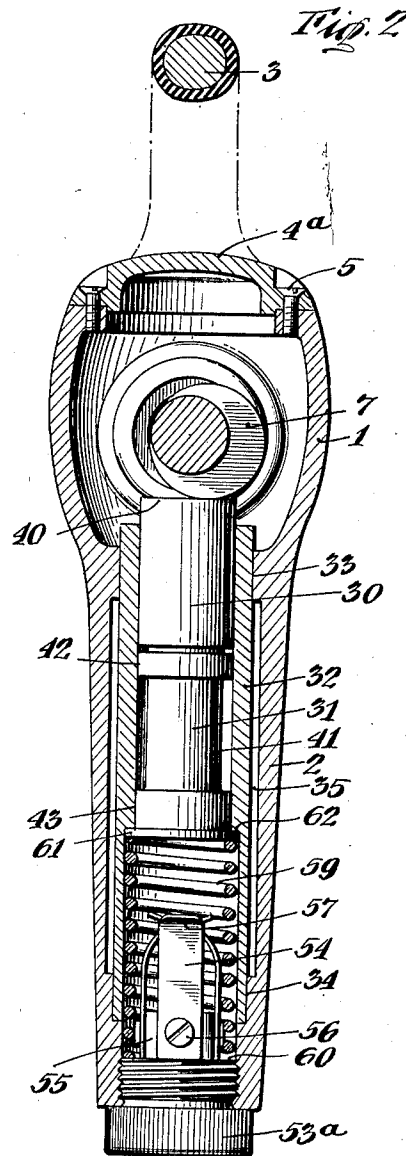
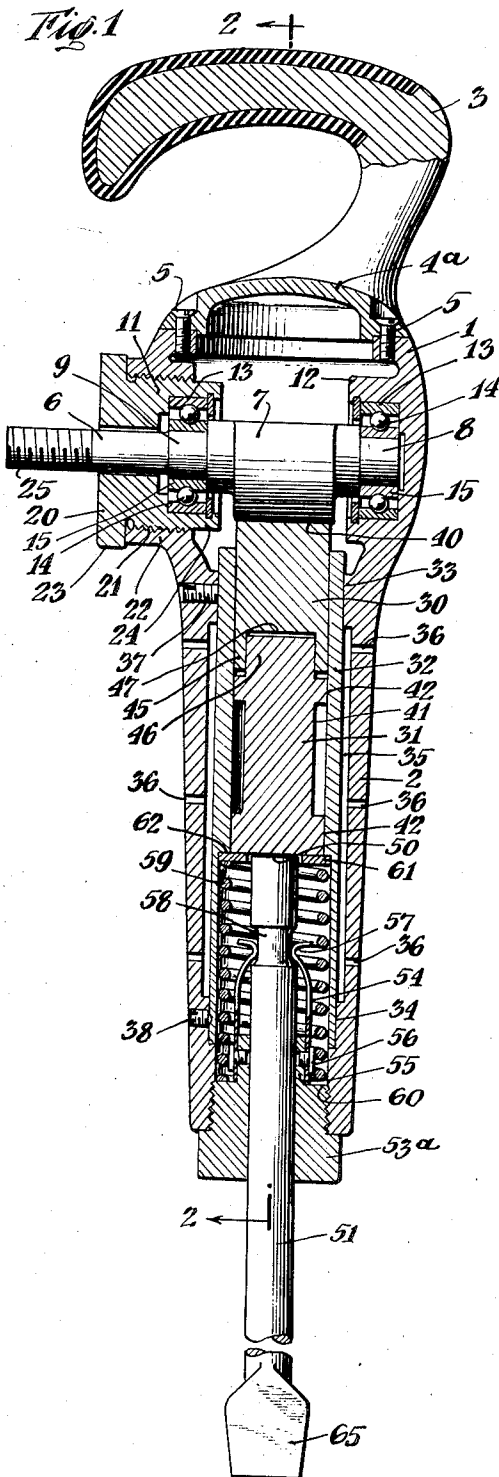
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2,226,559

MECHANICAL HAMMER

Filed Dec. 22, 1937

2 Sheets-Sheet 1



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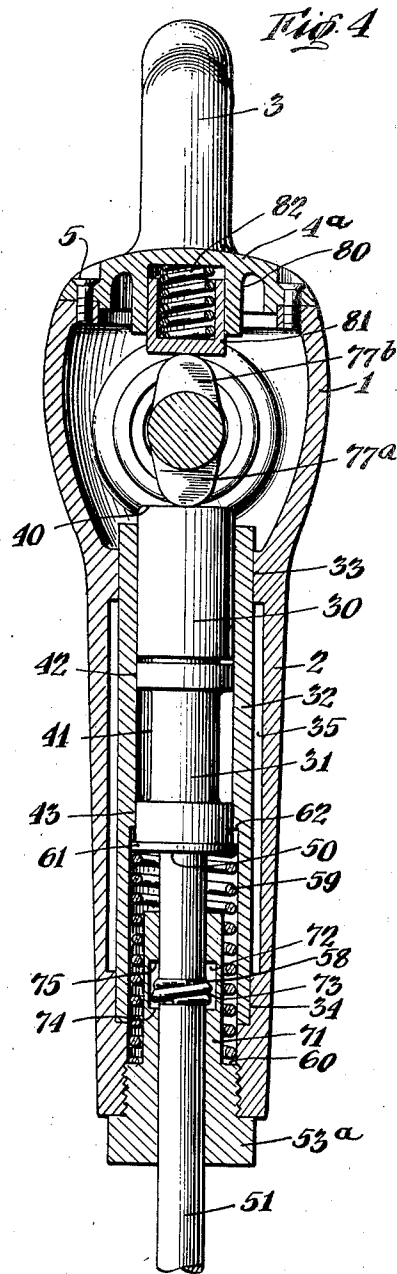
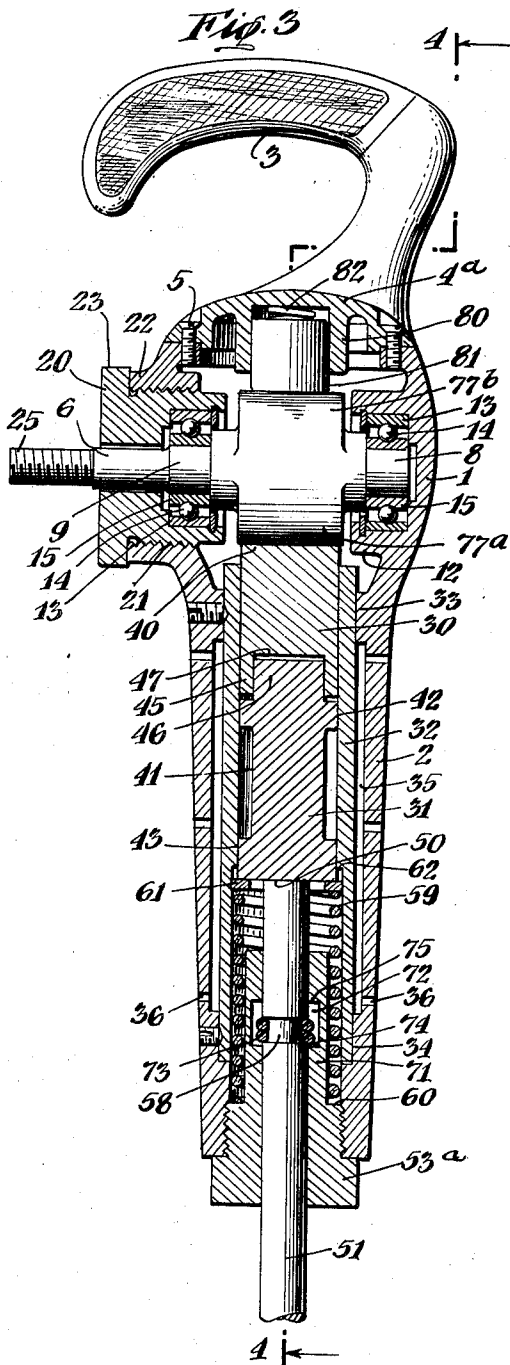
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MECHANICAL HAMMER

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2 Sheets-Sheet 2



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MECHANICAL HAMMER

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5 Claims. (Cl. 125—34)

This invention relates to a mechanical hammer and more particularly to a mechanical power driven hammer adapted to deliver a rapid succession of sharp blows or impacts against the material operated upon.

In accordance with this invention, a mechanical hammer is provided which may be easily manipulated by hand to perform such operations as cutting, chiseling, drilling, trimming, hammering, riveting metal, stone, concrete, and other hard and compact materials. It is especially adapted for performing the operations where pneumatic hammers are now generally used. My improved hammer possesses decided advantages over pneumatic hammers and other types of hammers now in use, in simplicity and cost of construction, durability, ease of manipulation, cost of operation and performance.

In accordance with this invention, a mechanical hammer is provided comprising a suitable casing including a head portion and a shank portion which may be formed as an integral casting of light metal. These parts are subjected to little strain in operation. A rotatable shaft is journaled within the housing portion, the rotatable shaft being connected to any suitable source of power, such as an electric motor or other driving mechanism, which may be directly connected to the shaft or indirectly to the shaft through a flexible drive or other power transmission means. The shank portion extending from the head portion is lined with a removable sleeve which receives a pair of reciprocating hammer members operating as a unit, which is arranged to impact or strike the head of the tool attached to the hammer. The rotatable shaft is provided with a cam which is adapted to strike the upper end of a reciprocable hammer when the shaft is rotated, causing the hammer to reciprocate so as to strike the tool head removably secured to the hammer. The reciprocating hammer members may be made of two parts so constructed as to provide an air pocket therebetween which serves to relieve the rotating cam from severe impact shocks.

An object of this invention is to provide a portable power hammer which is capable of delivering sharp hard blows in rapid succession against the tool head with a minimum of power consumption and with a high operating efficiency per unit of power consumed. With my improved hammer the power loss is relatively low and the amount of work which can be performed is substantially greater per unit of power consumed than is the case in the operation of so-called vacuum-pneu-

matic hammers or air-powered hammers used for a similar purpose. In vacuum-pneumatic or air-powered hammers, the air or vacuum flow cannot be accurately controlled, resulting in a considerable vacuum or air lag which greatly reduces their efficiency. In such hammers there is also a considerable loss in the transmission of the vacuum or air pressure to the hammer, resulting in impaired efficiency.

Another object of my invention is to provide a power hammer which is not dependent upon a convenient supply of vacuum or compressed air but which can be operated wherever motor power, electricity, gas, or water power is available. My improved power hammer can thus be conveniently used in locations where vacuum or compressed air power cannot be conveniently obtained.

Another object of my invention is to provide a power hammer of relatively few parts, which is simple and rugged in construction and will withstand severe use and abuse without damage to the operating parts thereof.

Another object of this invention is to provide a power hammer in which the friction losses are reduced to a minimum and which is so constructed as to remain cool under the most severe operating conditions.

Other objects of this invention will become apparent as the disclosure proceeds.

Various other features and advantages of the invention will be apparent from the following particular description and from an inspection of the accompanying drawings.

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the claims appended hereto, the invention itself, as to its objects and advantages, and the manner in which it may be carried out, may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part thereof, in which:

Fig. 1 is a cross-sectional view through my improved mechanical hammer taken longitudinally thereof, illustrating the construction and arrangement of the operating parts;

Fig. 2 is a cross-sectional view taken longitudinally of the hammer at right angles to the section shown in Fig. 1, this view being taken along line 2—2 of Fig. 1;

Fig. 3 is a cross-sectional view taken through a mechanical hammer of somewhat modified construction; and

Fig. 4 is a cross-sectional view taken longitudinally of the hammer at right angles to the

section shown in Fig. 3, this view being taken along line 4—4 of Fig. 3.

Similar reference characters refer to similar parts throughout the several views of the drawings and the specification.

The operated parts of my improved mechanical hammer are contained within a suitable hollow housing comprising a head portion 1 and a shank portion 2 which may be integrally formed as a one-piece casting of relatively light metal, such as aluminum. A handle 3, so shaped as to provide a convenient and comfortable hand grip, may be cast as an integral part of a cover 4 which closes the open top of the head 1, the cover 4 being suitably secured to the head 1, as by means of screws 5. Thus, in this construction the user is privileged to select the type of handle which he finds most convenient and desirable and at the same time the removable cover 4 gives ready and complete access to the interior operating parts for removal, replacement, adjustment or repair thereof.

The hammer is arranged and constructed to deliver a series of rapid sharp blows against the head 50 of the tool whose stem 51 extends into the shank portion 2 of the hammer and is removably held therein by clamping devices which will be presently described. The blows are delivered to the head 50 of the tool by a rapidly reciprocating hammer comprising a pair of interfitting cylindrical-shaped members 30 and 31, which reciprocate within the shank portion 2 and partially within the hollow head portion 1. As shown in Figs. 1 and 2, a cam member 7 cast as an integral part of the shaft 6 is positioned within the housing portion 1 and delivers a rapid succession of blows to the head 40 of the hammer member 30 upon rotation of the shaft 6. The shaft 6 is provided with spaced bearing sections 8 and 9 which rotate within a pair of ball or roller bearing assemblies. The bearing section 8 is enclosed within a ball or roller bearing assembly comprising a collar 15 fixed to the bearing section 8. The collar 15 is provided with a suitable track for the reception of ball or roller bearings 14. An outer stationary collar 13 is provided with a companion track within which the ball or roller bearings 14 move, the outer stationary collar 13 being fixedly held in position by means of a suitable inwardly extending boss 12 formed as an integral part of the head portion 1. The bearing section 9 likewise is enclosed by a similar bearing assembly comprising collar 15 secured to the bearing section 9, which collar is provided with a circumferentially extending track for the ball or roller bearings 14. The outer stationary collar 13 is also provided with a circumferentially extending track to guide the travel of the ball or roller bearings 14, the collar 13 being securely held in position within a cap closure 11 through which the shaft 6 projects. The cap closure 11 has a threaded body portion 21 which may be screwed into corresponding threads in an outwardly extending boss 22 formed on the housing 1. The cap closure is provided with a cap portion 20 which is adapted to seat against the outer extremity of the boss 22. The periphery 23 of the cap 20 may be knurled so as to facilitate manipulation of the cap closure. Thus, by removing the cap closure 11, the shaft 6 and associated cam 7 and bearing assemblies may be removed for inspection and repair. A strong and sturdy construction is thus provided which permits easy inspection, removal, repair and insertion of the

operating shaft 6, cam 7 and associated bearings. The shaft 6 is provided with an extension 25 which extends beyond the cap 20 to permit the attachment thereto of suitable driving mechanism.

To insure smooth sliding movement of the hammer members 30 and 31 within the shank 2, I preferably provide a sleeve member 32 having a smooth bore within which the cylindrical hammer members 30 and 31 are adapted to reciprocate. The sleeve member 32 at the upper end thereof is supported by an inwardly extending shoulder 33 formed as an integral part of the head portion 1 and by an inwardly extending shoulder 34 at the lower end of the shank portion 2 which supports the lower end of the sleeve member 32, providing an air chamber or space 35 between the shank portion 2 and the sleeve member 32. Three or more rows of circumferentially extending spaced pin holes or vents 36 puncture the shank portion 2. Thus, any heat developed by the sliding friction of the hammer members 30 and 31 in their sliding contact with the inside face of the sleeve member 32 is quickly dissipated through the air space 35 and the holes or vents 36. The hammer can thus be kept in cool condition at all times during operation. Friction between the hammer members 30 and 31 and the sleeve member 32 may be further reduced by limiting the area of contact between these parts. For example, hammer member 31 may have a circumferential portion 41 spaced from the sleeve member 32, as fully illustrated in the drawings, so that the guide shoulders 42 and 43 only are actually in contact with the inner surface of the sleeve member 32. Hammer member 30 can be similarly formed if desired. In such a construction the shoulders 42 and 43 serve to guide the hammer member in its sliding movement within the sleeve member 32 so that smooth sliding movement is assured, and also provides for adequate lubrication.

The stem 51 of the tool extends through a suitable bushing 53 which is screwed into the free end of the shank portion 2, the stem 51 of the tool being removably held in position therein. As shown more particularly in Figs. 1 and 2, the tool stem 51 may be removably held in operative position by a plurality of spring clips 54, shown in Figs. 1 and 2 as four in number. The spring clips may be fixedly secured to an inward extension 55 of the bushing 53, as by screws 56 or other means. The free ends of the spring clips 54 are provided with heads 57 which are adapted to resiliently and frictionally engage a reduced neck portion 58 of the tool stem. The reduced neck portion 58 is of sufficient length to permit a limited sliding movement of the tool stem 51 in the shank portion 2 of the hammer, so that the blows delivered to the inner end 50 of the tool stem 51 are transmitted with full force to the operating end 65 of the tool and are not transferred to the shank portion 2 or any of the mechanism fixed therein. A coil spring 59 of heavy coil wire, which is positioned within the lower end of the sleeve member 32, surrounds the upper end of the stem 51 of the tool and is compressibly held between a seating shoulder 60 formed on the bushing 53 at one end and a washer 61 at the other end. The washer 61 is arranged to rest against an inwardly extending seating shoulder 62 formed in the sleeve member 32 at a point adjacent the end of the normal down-stroke of the hammer

member 31. The coil spring 59 assists in giving the hammer members 30 and 31 snappy return movement but is so constructed and arranged as not to lessen or reduce the force of the blow delivered to the end 50 of the tool stem 51.

The operation of the hammer may be described as follows: The operating tool having a stem 51, as illustrated in Fig. 1, is inserted through the bushing 53 until the end 50 thereof strikes or abuts the lower end of the hammer member 31, in which position the heads 57 of the spring members 54 will snap into engagement against the reduced portion 58 of the tool stem. A suitable source of power, preferably an electric motor, is suitably connected to the attaching end 25 of the shaft 6. It will here be evident that the motor shaft may be directly connected to the connecting end 25 of the shaft 6 by a coupling or any suitable means or, if desired, the shaft 6 may form an integral part of the motor shaft. To obviate the necessity of lifting the motor with the tool when work is to be performed, it is generally desirable to operatively connect the motor shaft to the attaching end 25 of the shaft 6 by a suitable flexible drive connection of sufficient length to permit free and convenient manipulation of the hammer. The size of the motor required will depend entirely upon the size of the hammer used and the work to be performed, motors running from a small fraction of a horsepower to several horsepower being contemplated. Direct or alternating current motors of 1750 R. P. M. have been found highly practical for many uses, although the speed of the motor should to some extent be gauged by the particular work to be performed, as evident to those skilled in the art.

The motor, rotating the shaft 6, likewise rotates the eccentric cam 7 and at each rotation the cam 7 delivers a blow against the inner end 40 of the hammer member 30. This blow is transferred to the hammer member 31 which in turn transforms the blow to the end 50 of the tool stem 51. In order to reduce the wear on the parts it has been found desirable to make the hammer members 30 and 31 in two parts, as illustrated in the drawings. As shown, for example, in Fig. 1, the hammer member 30 is provided with a circular flange 45 within which snugly seats the neck portion 46 of the hammer member 31. A cushion of air becomes trapped between the end of the neck portion 46 and the bottom 47 of the recess defined by the circular flange 45. This cushion of air does not lessen the effectiveness of the blow delivered to the end 50 of the tool stem 51 but does to a certain extent reduce the strain and shock on the shaft 6 and cam 7. The shaft 6, cam 7 and hammer members 30 and 31 may be made of hardened tool steel, resistant to wear and impact shocks. The overall stroke of the hammer is measured by the depth or amount of offset of the cam 7 which, for most purposes, may measure from a small fraction of an inch to preferably not over two inches.

In operating the tool the handle 3 is held in one hand and the shank portion 2 is grasped by the other hand and the operating end 65 of the tool pressed into contact with the work. When the motor is thrown into operation the shaft is rotated, causing the cam 7 to deliver a series of rapid snappy blows against the end 40 of the hammer member 30, which blows are transferred to the hammer member 31 and thence transferred to the end 50 of the tool stem 51, so that the blow or shock is delivered to the operating

end 65 of the tool. While there is no mechanical connection between the cam 7 and the hammer members 30 and 31, it has been found in actual practice that after the blow has been delivered to the end 40 of the hammer member 30 by the cam 7, the end 40 of the hammer member 30 will move to a point adjacent the shortest radii of the cam when the cam 7 is rotated to a point to permit such movement. This return movement of both the hammer members 30 and 31 may be explained by the rebound force acting upon these parts after the hammer 31 has struck the end 50 of the tool stem, possibly due to the high coefficient of restitution present in the hammer members 30 and 31 and due to the fact that there is little or no friction lag or friction impairment of the free sliding movement of the hammer members 30 and 31 in the sleeve member 32. Whatever theory of operation may be given, it is a fact fully demonstrated by practical operation that with a tool as constructed as herein described, the hammer member 31 delivers a series of sharp, forceful, staccato-like blows to the end 50 of the tool stem 51, and due to the speed with which these blows are delivered, relatively low power consumption is required to effectively perform the most difficult hammering or cutting operation.

The tool is lubricated by packing a suitable machine lubricant within the head portion 1, and the moving parts quickly transfer the lubricant to all areas of the moving parts. There is no place through which the lubricant can leak out or be dissipated, and for this reason the tool need be only occasionally filled with lubricant.

The mechanical hammer is so made and constructed that it can be quickly and easily assembled and also taken down and repaired or parts replaced. It will be noted that in assembling, the sleeve member 32 can be inserted through the open head portion 1, the hammer members 30 and 31 having been first inserted into the sleeve member 32. The sleeve member 32 is held in locked position by the spaced set screws 37 and 38 screwed into the shank portion 2. The shaft 6, cam 7, and associated bearings may be inserted into position and locked in place by screwing the cap closure 11 into position. The washer 61, the coil spring 59 and bushing 53 carrying the spring clips 54 may be inserted into the open end of the shaft portion 2, and these parts held in place by screwing the bushing 53 in position in the threaded end of the shank portion 2. The handle 3 and associated cover 4 is secured in place by the securing screws 5. The tool stem 51 can be chucked or inserted into the bushing 53 until the heads 57 of the spring clips 54 frictionally engage the reduced neck portion 58 of the tool stem.

The mechanical hammer shown in Figs. 3 and 4 is similar to the mechanical hammer shown in Figs. 1 and 2 in general construction. Figs. 3 and 4 show as an alternative the operating shaft 6 provided with two cam lugs or surfaces 77a and 77b, so that with each rotation of the shaft 6 two impact blows are delivered to the end 40 of the hammer member 30. Thus twice the number of impact blows per unit of time may be delivered against the end 50 of the tool stem 51, as compared to the construction shown in Figs. 1 and 2, assuming that the shaft 6 in both instances is driven at the same speed of rotation. The construction shown in Figs. 3 and 4 may be desirable where the impact shocks to be delivered

against the work can be increased to advantage without requiring a greater speed to the shaft 6. Furthermore, the cams 77a and 77b, being spaced 180° apart, can serve to retain the shaft 6 in dynamic balance, reducing to some extent the wear on the operating parts. For certain types of work, therefore, the double cam construction, as illustrated in Figs. 3 and 4, may possess advantages.

There is also shown in Figs. 3 and 4 a modified means for retaining the tool stem 51 in chucked or operative position in the hammer. In the form here shown, the bushing 53a is provided with a neck portion 71 of substantial length, which extends into the sleeve member 33. The bushing 53a is, of course, provided with a suitable bore to receive the tool stem 51. An internal cavity 72 is cut within the neck portion 71 and contains an expansible spring element 73, which is free to expand within the chamber 72. In inserting the tool stem the end 50 of the stem will strike the expansible element 73 and with pressure applied thereto will cause the expansible element 73 to expand within the chamber 72 so as to permit the stem 51 to pass through it. When the reduced neck portion 58 of the stem is reached, however, the resiliently expansible element 73 will immediately contract to surround the reduced neck 58 of the stem, thus holding the stem in place. It will be noted that when the resilient expansible element 73 is seated within the reduced neck portion 58, it extends beyond the normal diameter of the stem 51, so as to provide a shoulder adapted to abut against the spaced walls 74 and 75 of the cavity 72. A small amount of play of the tool stem is, of course, desirable, so that the blows delivered to the end 50 of the stem 51 will not be transmitted to the bushing 53a, and also insures delivery of graduated blows, if desired. The distance between the walls 74 and 75 of the cavity 72 should approximately equal the hammer stroke or the longest radius of the cams 77a and 77b. The tool stem 51 can be removed by exerting an outward pull thereon, the rounded inner surface of the resilient expansible element 73 camming over the shoulder of the stem 51 adjacent the reduced neck portion 58 so as to cause the resilient expansible element to expand and permit the inner end of the stem 51 to be pulled there-through. While I have shown a resilient compact coil as one type of expansible element 73, it is understood that other forms of resilient expansible elements for this purpose may be used within the contemplation of this invention.

The strains on the shaft 6 and cams 77a and 77b may be to some extent relieved by providing a reaction element which may be associated with the handle cover 4. As shown more particularly in Figs. 3 and 4, a cylindrical sleeve 80 integrally formed with the cover 4a may be provided within which a tubular piston element 81 is adapted to slide. An expansion coil 82 is positioned within the piston element 81 and abuts the inside face of the cover 4a. The lower end of the piston element 80 is so positioned as to ride on the revolving cams 77a and 77b so as to counterbalance the impact action resulting when the cams strike the end 40 of the hammer member 33.

The mechanical hammer herein shown may be built to any desired size to best perform the work intended. It is highly adapted for any use where chiseling, drilling, riveting, cutting, or hammering operations are to be performed. As

a chiseling and cutting tool the operating end of the tool is so formed and ground as to best perform the particular job such as cutting bolts, nails, wire, composition material, stone and concrete, trimming irregularities, burrs and projections from castings, metals, stone, concrete and composition materials of all sorts. The hammer is highly serviceable with impact drills and star drills for cutting holes, recesses, grooves, or channels in soft metals, stone, concrete, wood, and other material. My improved mechanical hammer can also be used as a riveting tool by inserting a suitable tool having a riveting head into the hammer, and can thus be used for all sorts of riveting operations. It is also highly serviceable in the removal of paint, scale, rust, and other coatings from walls and surfaces of metal, stone, concrete, wood and other materials. Any desired type of tool chuck may be used, and since such chucks are so numerous and varied and generally known in the art, the shapes and types of such chucks, well within the knowledge of the mechanic, need not here be specifically set forth. The tool herein shown is a convenient and time-saving device, useful in the construction, foundry, steel, plumbing, machine shop, shipbuilding, servicing and repair industries, and for cutting, channelling, fitting, riveting, caulking, chipping, surface removal, shaping of parts, areas and surfaces, which must frequently be performed in the above industries.

My improved power hammer operates with very little power. For most chiseling, riveting and cutting operations, a one-quarter horsepower motor is all that is required to operate the device. For very heavy duty work, such as the breaking up of concrete surfaces, floors and pavements, a motor of one or two horsepower is in most instances sufficient to deliver ample power for the work to be accomplished. When this is compared with the heavy duty compressors and compressor lines required for the operation of pneumatic hammers used in this type of work, the immense saving in power consumption, cost of power equipment and wear and tear on machinery and parts, the great advantages of my improved power hammer become readily apparent. The moving parts used in my improved hammer are relatively few and are simply made. The design of the hammer permits sturdy construction. The shaft 6, cam 7 or cam lugs 77a and 77b, the cylindrical hammer elements 30 and 31, and the sleeve member 32 may be made of tool steel which is resistant to wear and shocks or strains. The casing itself comprising the housing portion 1 and the shank portion 2, as well as the handle 3, cover member 4, and cap closure 11, may be made of light metal such as aluminum, and since these parts receive little or no shock or strain, they may comprise relatively thin walled members.

For most work the entire hammer need not weigh more than six pounds, and can thus be lifted around and used by the workman with ease and facility. Little or no pressure need be exerted on the tool by the workman to effect the desired cutting, riveting, hammering, or impacting operation, and the jars incident to operation are no greater than encountered in the operation of a pneumatic hammer of equal weight. The flexible drive shaft attached to the connecting end 25 of the shaft 6 may be made relatively light and is less difficult to lift about than a pneumatic air line used in the pneumatic hammer. Furthermore, the flexible shaft may

be made much shorter than the air line used to operate pneumatic hammers, for the reason that a portable motor may be provided which itself may be moved close to the work. In most operations a flexible drive from six to twelve feet in length is generally sufficient. Furthermore, the motor may be easily fixed or suspended at the same or higher level than the work operated upon, so that the greater part of the weight of the flexible drive shaft need not be carried by the workman.

While certain novel features of the invention have been disclosed and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. A power hammer including, a casing comprising a head portion and a shank portion, a cam member journaled in said head portion, power means for rotating said cam member, an impact member adapted to reciprocate in said casing actuated by impacts delivered to one end thereof by said cam member, a tool head releasably held in said casing positioned to receive the impact blows delivered thereagainst by the other end of said impact member, said impact member including a pair of hammer elements, the adjacent ends of said hammer elements having interfitting portions operative to entrap a layer of air therebetween to reduce the shock on said rotating cam member resulting from the impact delivered to the adjacent end of said impact member.

2. A power hammer including, a casing comprising a head portion and a shank portion, an impact member slidable within said shank portion, a cam member rotatably mounted in said head portion positioned to deliver impact blows to one end of said impact member when said cam member is rotated, a tool having a portion extending into said shank portion arranged to receive the blows delivered by said reciprocating impact member, said impact member including a pair of hammer elements, the adjacent ends of said hammer elements having interfitting portions operative to entrap a layer of air therebetween to reduce the shock on said rotating cam member resulting from the impact delivered to the adjacent end of said impact member.

3. A power hammer including, a casing comprising a head portion and a shank portion, an

impact member slidable within said shank portion, a shaft member, a pair of bearings mounted in said head portion for supporting said shaft at two spaced points, a cam member fixed to said shaft between said bearings, said cam member being arranged to deliver successive impact blows to one end of said impact member to effect reciprocation thereof, a tool having a tool stem extending into said shank arranged to receive impacts from the other end of said impact member, said impact member including a pair of hammer elements, the adjacent ends of said hammer elements having interfitting portions operative to entrap a layer of air therebetween to reduce the shock on said rotating cam member resulting from the impact delivered to the adjacent end of said impact member.

4. A power hammer including, a casing comprising a head portion and a shank portion, a cam member rotatably mounted in said head portion, a tool having a tool stem extending into said shank portion, an impact member, said stem having a head portion positioned adjacent one end of said impact member, said cam member being arranged to deliver successive impact blows directly against the adjacent end of said impact member upon rotation of said cam member so as to effect rapid reciprocation of said impact member between the head of the tool stem and said cam member, said impact member including a pair of hammer elements, the adjacent ends of said hammer elements having interfitting portions operative to entrap a layer of air therebetween to reduce the shock on said rotating cam member resulting from the impact delivered to the adjacent end of said impact member.

5. A power hammer including, a casing comprising a head portion and a shank portion, an impact member slidable within said shank portion, a tool stem extending into said shank portion arranged to receive the blows delivered by said impact member, a rotatable cam journaled within said head portion arranged to directly deliver impact blows to one end of said impact member, said impact member comprising a pair of hammer elements, the adjacent ends of said hammer elements having interfitting male and female portions arranged to entrap a layer of air therebetween to reduce the shock on said rotating cam member resulting from the impacts delivered to the adjacent end of said impact member.

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