April 7, 1964 C. B. SIEBER 3,127,941

IMPACT TOOL

Filed Oct. 18, 1960 2 Sheets-Sheet 1

Fig. 1.

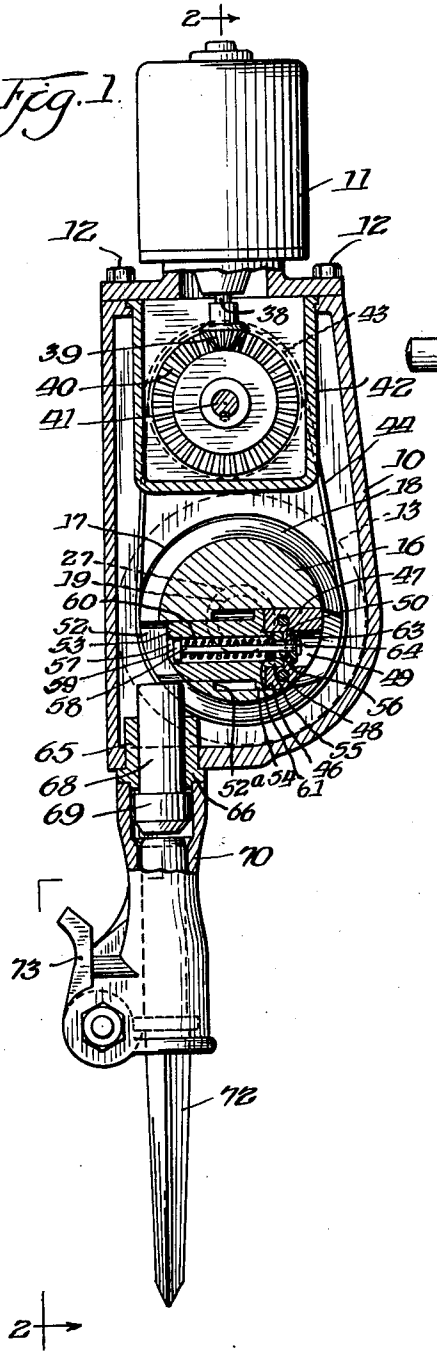
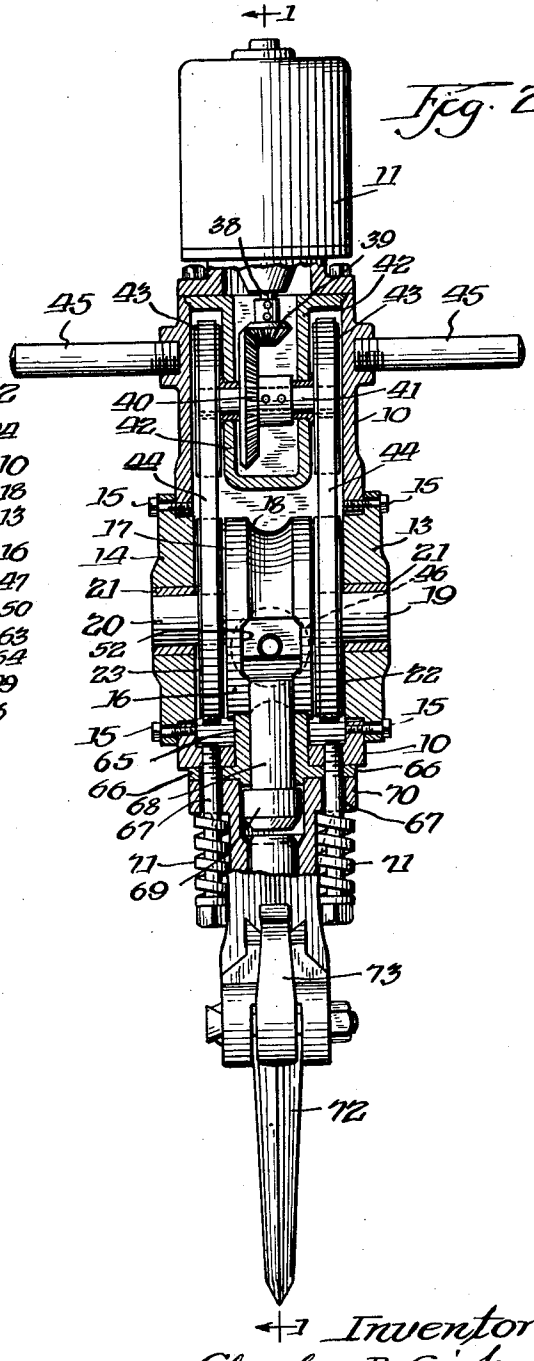


Fig. 2.



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Fig. 3.

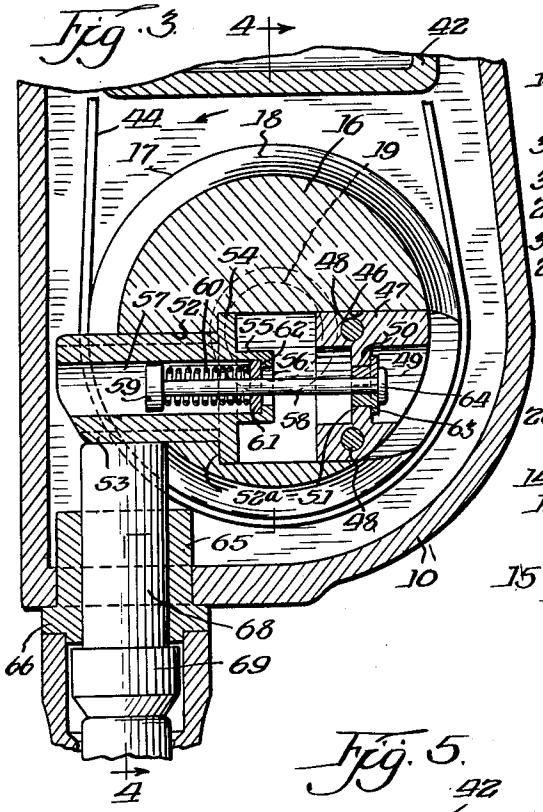


Fig. 4.

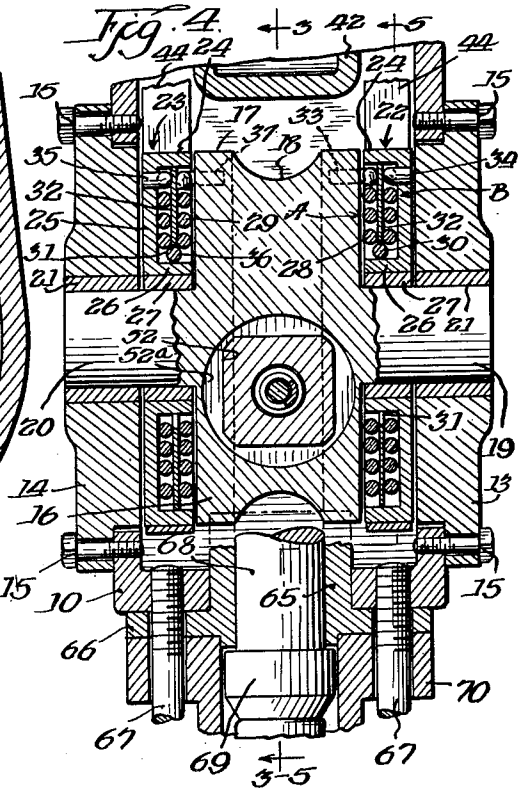


Fig. 5.

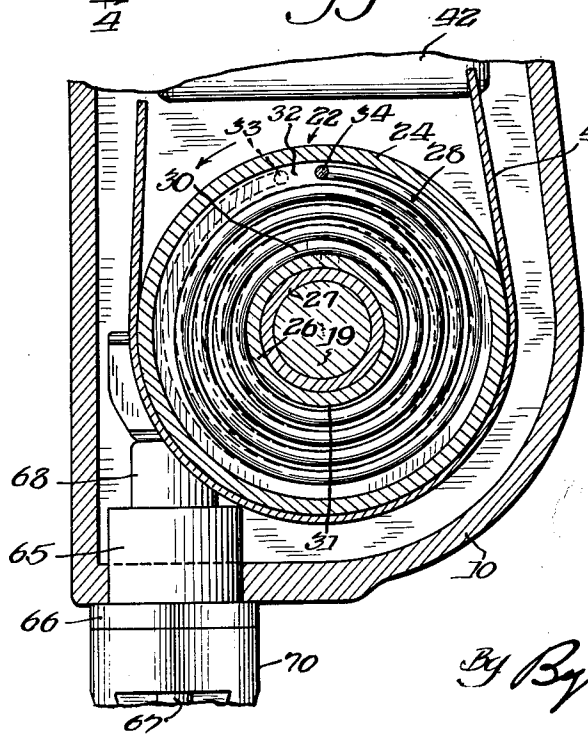
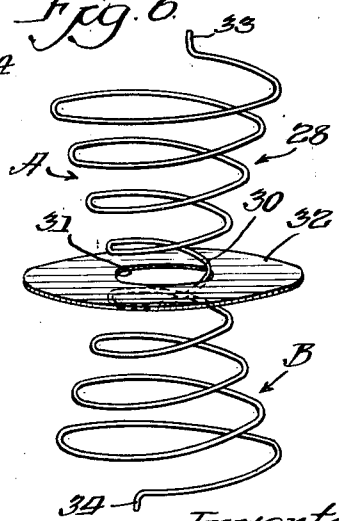


Fig. 6.



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3,127,941

IMPACT TOOL

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9 Claims. (Cl. 173—98)

My invention relates to an impact tool which may be used in various combinations for delivering a series of impact blows on a chisel such as is used in a demolition tool, a riveting tool, or may be embodied in a tool for removing dents in sheet metal such as automobile bodies, and the like.

Another object of my invention is the provision of an impact tool which is comparatively light in weight and can be easily moved and handled in use, and which can be easily actuated by an electric, air, hydraulic, or gasoline motor or from a power line or any other suitable source of power, making possible the use of the tool in any place where the usual electric current is available.

Another and further object of my invention is the provision of an impact tool which is easily handled and does not possess the vibration common in air operated demolition tools which is an objection to the use of such tools both in handling and operation because of the necessity of supplying air under pressure for the operation of the tools.

Another and further object of my invention is the provision of a tool in which a greater number of impact blows can be delivered than is normally possible in tools of this type and character and is an improvement upon the impact tool claimed and described in Patent No. 2,888,246 issued to me as of May 26, 1959.

These and other objects of my invention will be further and better understood by reference to the accompanying drawings in which—

FIG. 1 is a view partially in elevation and partially in section of my improved tool taken on line 1—1 of FIG. 2;

FIG. 2 is a view partially in section and partially in elevation on line 2—2 of FIG. 1;

FIG. 3 is a sectional view of a part of the tool taken on line 3—3 of FIG. 4;

FIG. 4 is a vertical sectional view showing a portion of the housing and operating mechanism taken on line 4—4 of FIG. 3;

FIG. 5 is a vertical sectional view showing a portion of the housing and operating parts taken on line 5—5 of FIG. 4;

FIG. 6 is an exploded view in perspective of one of the springs used in connection with the operation of the striking wheel in the tool.

Referring now specifically to the drawings in which like reference characters refer to like parts throughout, a main housing 10 is shown which has a motor casing 11 secured thereto by means of bolts 12, 12 with the housing 10 having openings at each of its sides which are closed by cheek plates 13 and 14, and which are secured to the main housing 10 by means of bolts 15, 15 which provide a complete housing mechanism for the main operating parts of the tool.

A striking wheel 16 is provided which is preferably machined from a single piece of metal and comprises a rim portion 17 with an arcuate channel 18 formed therein and having a central web portion with stub axles 19 and 20 extending outwardly therefrom and integrally formed therewith, which axles 19 and 20 are mounted in bearings 21, 21 fixed in the cheek plates 13 and 14 respectively, and within which the axles 19 and 20 forming a part of the striking wheel 16 rotates. A pair of belt wheels 22 and 23 are provided which belt wheels comprise rim portions 24, web portions 25, and hub portions 26, which have ring bearings 27, 27 mounted therein and through which the stub axles 19 and 20 extend so the belt wheels 23 and 24 rotate freely upon the axles 19 and 20. The rim portions 24 and hub portions 26 of the wheels 22 and 23 extend in the same direction to one side from their web portions 25 so that open recessed circular faces are provided for the wheels 22 and 23 adjacent each side of the striking wheel 16.

Spirally wound torsion springs 28 and 29 are mounted within the recessed circular faces of the wheels 22 and 23 respectively and are secured at one of their ends to the striking wheel 16 and at their other ends to the belt wheels 22 and 23 respectively, one of which springs 28, in exploded form, is shown in FIG. 6. The spring 28 comprises a single piece of tempered wire having an internal coil 30 wound about the hub 26 of the wheel 22 and extending through an opening 31 in a thin circular separator plate 32 with the end portions of the coil 30 merging into another coil adjacent thereto of a slightly greater radii and extending in a counter-clockwise direction and continuing outward in the form of other coils in a constant increasing radii to one end 33 of the spring 28, thereby producing a section A of the spring 28 with the end 33 being anchored in the rim portion 17 of the striking wheel 16 with all of the coils comprising the section A being in the same plane and compressed in the space between the plate 32 and the side of the striking wheel 16 to which the end 33 of the spring 28 is attached. The opposite end portion of the coil 30 merges into other coils which extend in a counter-clockwise direction with a constantly increasing radii forming a section B of the spring 28 with the end coil having an end 34 which is anchored in the side of the web 25 of the belt wheel 22 adjacent the rim portion 24 with all of the coils of section B being in the same plane and confined in the circular space between the plate 32 and the web 25 of the belt wheel 22. It will be thus understood that the spring 28 consists of two co-planar portions A and B of constantly increasing radii from the center coil 30, both portions A and B having their coils exending in a clockwise direction when seen in line 5—5 of FIG. 4.

The spring 29 is constructed like the spring 28 but in a reverse direction with co-planar sections, with an end 35 anchored in the web 25 of the wheel 23 adjacent the rim 24 and wound in a circular clockwise direction towards a constantly decreasing radii to a central coil 36 in the same plane, which central coil 36 is diagonally disposed merging into an adjacent coil in a different plane of an increased radii and continues outward therefrom in a constantly increasing radii terminating in an end 37 which is anchored in the side of the rim portion 17 of the striking wheel 16 so that rotary movement of the belt wheel 23 is transferred to the striking wheel 16. A plate 32 is placed between the co-planar sections of the spring 29 into the coil 36 extending through the central opening 31 in the plate 32. The spring 29 therefore occupies the space in the face of the belt wheel 23 and exerts force upon the striking wheel 16 in a counter-clockwise direction when looking at the wheel 16 in the direction of line 5—5 of FIG. 4.

A single spiral spring such as is shown in Patent No. 2,888,246 herein also referred to may be used instead of the double spring shown herein, in which case one end of the spring would be secured to the wheel 16 near the outer periphery thereof and the other end to the hub 26 of the belt wheel or to the web portions of the belt wheels, as may be preferred.

The motor casing 11 has an electric motor mounted therein having a motor shaft 38 extending therefrom upon which a bevel gear wheel 39 is mounted which is in mesh with a second bevel gear 40 fixed on a shaft 41

mounted in a sub frame 42 fixed to the housing 10 in any approved manner. Belt wheels 43, 43 are mounted on the outer ends of the shaft 41 and have endless belts 44, 44 thereon which operate on the belt wheels 43, 43 and their aligned belt wheels 22 and 23 rotatably mounted on the stub axles 19 and 20 forming a part of the striking wheel 16. Handles 45, 45 are secured to the housing 10 to provide means by which the tool is manipulated.

Extending into one side of the striking wheel 16, to one side of its center, is a cored opening 46 which is round in cross section and which has a round plug 47 mounted within the cored opening 46 and which is held in position by pins 48, 48 extending through the central web portion of the striking wheel 16 and having their ends upset to hold plug 47 in position. The plug 47 has a curved outer channelled end portion to conform to the curvature of the rim of the striking wheel 16 and has a central bore 49 therein into which an inwardly extending ring portion 50 projects having an opening 51 centrally therethrough for purposes hereinafter described.

From the opposite side of the wheel 16 a broached opening 52 is provided which is preferably square in cross section, is slightly lesser in width and height than is the diameter of the cored opening 46 whereby a circumferential shoulder 52^a is formed on the wheel for purposes hereinafter described, and extends into and is aligned with the cored opening 46, and in which a slidably mounted hammer block 53 is mounted, the hammer block 53 having a circular end portion 54 on its inner end, and is adapted to be fitted into and slidably mounted within the cored circular opening 46, with the squared hammer block 53 being slidably movable in the broached opening 52 into and out of impact position as more fully described hereinafter.

The slidably mounted hammer block has a trunnion portion 55 formed on its inner end with an opening 56 therein and a cored opening 57 extending longitudinally of the striking block 53 with a bolt 58 having a head 59 formed thereon which is slidably mounted in the cored opening 57 in the striking head 53 which bolt extends longitudinally of the cored opening 57 and has a compression spring 60 mounted thereon which abuts against the inner face of the head 59 at one of its ends and against a washer 61 at its opposite end. The washer 61 is held in position against an annular shoulder 62 formed internally of the inturned end of the trunnion 55 which bolt 58 extends through the opening 56 in the trunnion 55 and through a split bushing 63 which is mounted in the opening 51 in the annular portion 50. A head 64 is formed on the inner end of the bolt 58 to prevent its retraction because of the expansive force of the spring 60 which spring 60 normally holds the striking block 53 in position as shown in FIG. 1 of the drawings until thrown out into striking position by centrifugal force generated by the striking wheel 16 by the rotative force imparted to it through the springs 28 and 29, belt wheels 22 and 23 and the motor acting through the gears 39 and 40 and the belt wheels 43, 43 connected by the belts 44, 44 to the wheels 22 and 23. The outward travel of the hammer block 53 is limited by the engagement of the circular end portion 54 against the shoulder 52^a and the inward movement by engagement of the same circular end portion against the end of the plug 47.

The hammer block 53 is inserted into the broached opening 52 by inserting it through the cored opening 46, and the plug 47 is then placed in position in the cored opening 46 and secured in place to the striking wheel 16 by riveting or otherwise securing the pins 48, 48 in position. The bolt 58, the spring 60 and the washer 61, can then be assembled and the bolt 58 inserted through the opening 57 in the hammer block 53 and through the split bushing 63 which has been previously placed in position. The bolt 58 is pushed into position so that the end projects through the bushing 63, with the spring 60 being compressed, whereupon the end of the bolt 58 is upset thereby forming the head 64 thereon which prevents the bolt from being retracted by the expansive force of the spring 60. As this operation is performed the hammer block 53 is pushed inward by the spring 60 until the circular end portion 54 of the hammer block 53 is against the end of the plug 47 with the trunnion 55 extending into the inner end of the bore 49 in which position the spring 60 is compressed only a slight amount thereby holding the hammer block 53 in retracted position until forced outward into striking position by centrifugal force imparted to it by reason of the rapid rotation of the striking wheel 16.

An anvil guide 65 is provided having a rib 66 thereon which is secured to the housing 10 by means of bolts 67, 67 which pass through holes in the rib 66 on the guide 65 and within which an anvil 68 is mounted, the upper end of which extends into the peripheral channel 18 on the striking wheel 16, and has a head portion 69 thereon on which shoulders are formed which engage against the guide 65 which acts as a limit stop to the upward movement of the anvil 68 to insure that the anvil 68 is in proper striking position relative to the hammer block 53 as shown in FIG. 3 of the drawings. A tool holder 70 is provided which is secured to the lower end of the frame 10 by the bolts 68, 68 having springs 71, 71 thereon with a chisel 72 mounted therein with the upper end coming into normal contact with the lower end of the anvil 68 and resiliently held in contact therewith by the springs 71, 71. A latch 73 is provided whereby the chisel 72 is held in position against the anvil 68 if desired and which can be released to allow downward movement of the chisel 72 when the tool is placed in operation. This entire arrangement of the tool holder is common to the mounting of chisels and tools of like character in air hammers.

To operate the tool, power is applied to the motor mounted in the housing 11, which power rotates the gears 39 and 40 which in turn rotate the belt wheels 41 and 42 in a counter-clockwise direction as viewed in FIGS. 1 and 3 of the drawings, which belt wheels 41 and 42 cause the rotation of the wheels 22 and 23 on the axles 19 and 20 which rotative force of the wheels 22 and 23 is communicated to the striking wheel 16 through the springs 28 and 29 rotating this wheel in a counter-clockwise direction with the wheel being free to rotate because the hammer block 53 is held in the broached opening by the spring 60 within the periphery of the striking wheel 16 during the static condition of the device. As the speed of rotation of the striking wheel 16 increases, centrifugal force will cause the hammer block 53 to move outward overcoming the force of the spring 60 until its end portion 54 reaches the shoulder 52^a at the inner end of the cored opening 46 and far enough out of the rim of the wheel to squarely engage the anvil 68. As the blow is delivered to the anvil 68 there is a momentary interruption of the rotation of the striking wheel 16 with a slight rebounding of the striking wheel 16 in a reverse direction at which point the striking wheel is static and the spring 60 snaps the hammer block 53 back into the striking wheel 16 in the position shown in FIG. 1 of the drawings so that the outer end is free of the anvil and the portion 54 is in abutting engagement with the plug 47 which acts as a stop to the inward travel of the hammer block 53. In the meantime, the belt wheels 22 and 23 are continuing to rotate, thereby exerting a torsion force first to the outer coils of the springs 28 and 29 and in effect winding these springs about the hub portions 26, 26 of the belt wheels 22 and 23 and which springs, as soon as the hammer block is withdrawn, exert a torsion pull to such an extent that the striking wheel 16 commences to rotate by reason of the energy stored in the springs 28 and 29 and also because of the torsion pull which is exerted upon the striking wheel 16 through the springs 28 and 29 and which because of these combined forces causes the striking wheel

to accelerate its rotative speed very rapidly until by the time it has made a half to three quarters of a revolution its speed of travel equals the speed of travel of the belt wheels 22 and 23. As the speed of rotation of the striking wheel 16 accelerates, the centrifugal force created by the rapid rotation of the striking wheel 16 causes the hammer block to move outward to the limit of its travel or until its enlarged portion 54 engages against the wall of the wheel 16 at the end of the broached channel, in which position the block is out far enough so that it engages upon and delivers the blow to the entire face of the anvil 68. As the hammer strikes the anvil, centrifugal force is no longer present and the hammer block is withdrawn into the striking wheel 16.

As hereinabove described, the springs 28 and 29 are fashioned in two segments which enables the use of very long wire and which enables a great deal of tension to be placed into the spring which is distributed through the long wire section of the spring thereby distributing the tension to a greater extent than if the shorter length of spring were used and also prevents an excess of tension from being present in any area of the spring thereby adding to the long life of the springs and the prevention of metal fatigue arising in the springs resulting in breakage thereof in service.

It will be noted that the striking block is mounted to one side of the center of the striking wheel and toward the outer periphery of the striking wheel which position assists in the development of the necessary centrifugal force by the rotation of the striking wheel to quickly and effectively throw the hammer block outward in the periphery of the striking wheel to place the striking block into position to deliver a blow on the anvil and also, that the striking force of the striking block upon the anvil is wholly transmitted to the striking wheel because of the engagement of the rim portion of the striking wheel with the striking block so the striking block is not subject to the stresses of the hammer blows but is absorbed by the striking wheel.

While I have described more or less precisely the method employed and the apparatus used therewith, I do not wish to be understood as limiting myself thereto, as I contemplate changes in form and the proportion of parts and the substitution of equivalents as circumstances may suggest or render expedient without departing from the spirit or scope of my invention.

What is claimed is:

1. An impact tool comprising in combination a frame, a striking wheel mounted thereon having a peripheral opening therein, a hammer block having an opening longitudinally thereof slidably mounted in the opening in the said wheel, a plug fixed to the striking wheel at one end of the said peripheral opening, a bolt in the said plug extending into the longitudinal opening in the hammer block, a spring on the said bolt within the longitudinal opening in the hammer block normally biasing the said hammer block inwardly of the said wheel, a power driven wheel mounted upon a common axis with said striking wheel and a spring secured at one of its ends to the striking wheel adjacent its outer periphery and at its other end to the power driven wheel also adjacent its outer periphery.

2. An impact tool comprising in combination a frame, a striking wheel supported by an axle and having a peripheral opening therein, a power driven wheel mounted upon the axle and rotatable thereon, a spiral spring secured at one of its ends to the striking wheel adjacent its outer periphery and connected at its other end to the power driven wheel adjacent its outer periphery, a hammer block having an opening longitudinally thereof slidably mounted in the peripheral opening in the said wheel, a plug having an enlarged inner end portion in the said opening at one of its ends, a connecting member mounted in said plug and extending into the longitudinal opening in the hammer block having heads thereon at each of its ends and a compression spring on said connecting member in abutting engagement at one of its ends with the end wall of the hammer block and at its other end with the head of the said connecting member whereby the said hammer block is biased inwardly of the wheel.

3. An impact tool comprising in combination a frame, a striking wheel supported by an axle and having a peripheral opening therein extending through the wheel from edge to edge at one side of the center of the wheel, a power driven wheel mounted upon the axle and rotatable thereon, a spiral spring secured at one of its end to the striking wheel adjacent its outer periphery and connected at its other end to the power driven wheel adjacent its outer periphery, a hammer block having an opening longitudinally thereof slidably mounted in the peripheral opening in the said wheel, a plug having an enlarged inner end portion in the said opening at one of its ends, a connecting member mounted in said plug and extending into the longitudinal opening in the hammer block having heads thereon at each of its ends and a compression spring on said connecting member in abutting engagement at one of its ends with the end wall of the hammer block and at its other end with the head of the said connecting member whereby the hammer block is biased inwardly of the striking wheel.

4. An impact tool comprising in combination a frame, a striking wheel supported by stub axles mounted on the said frame having an opening therethrough from edge to edge, the said opening having different cross sectional areas whereby an abutment is formed in the said wheel, a power driven wheel rotatably mounted on one of said axles, a spiral spring nested between the said wheels, one end of which spring is secured to the power driven wheel near its outer edge and the other end of the spring secured to the striking wheel adjacent its outer edge, a plug in the larger sized opening secured to the said wheel terminating short of the said abutment, a slidably mounted hammer block mounted in the opening in the said wheel having an enlarged head portion extending into the larger sized portion of the opening, a bolt mounted in the said plug, and extending into the longitudinal opening in the hammer block, and a spring on the said bolt in abutting engagement at one of its ends with the end of the hammer block and the head of the bolt at its other end whereby the hammer block is normally biased inwardly of the striking wheel, the plug and the abutment forming limit stops to the inward and outward movement of the said hammer block.

5. An impact tool comprising in combination a frame, a striking wheel supported by stub axles thereon and having a peripheral opening therein extending from edge to edge of the wheel, one portion of the opening being larger in cross-sectional area than the other, whereby an annular shoulder is formed upon the wheel, a power driven wheel rotatably mounted on one of the stub axles, a spiral spring nested between the striking wheel and the power driven wheel having one of its ends secured to the power driven wheel adjacent its outer periphery and the other end secured to the said striking wheel adjacent its outer periphery, a hammer block having an opening longitudinally thereof slidably mounted in the said peripheral opening having an enlarged end portion mounted in the larger portion of the peripheral opening, a plug secured to the said wheel forming a closure member for the peripheral opening at one of its ends, a bolt in the said plug having head portions thereon and extending into the hammer block and a spring on said bolt in engagement with one of the heads on the said bolt and the hammer block normally biasing the hammer block inwardly of the said striking wheel, the shoulder on the wheel forming an outward limit stop to the movement of the hammer block and the plug forming a limit stop to the inward movement of the said hammer block.

6. An impact tool comprising in combination a frame, a striking wheel having a central web portion, a rim por-

tion, and stub axles integrally formed with the said web portion, mounted in the frame, a power wheel rotatably mounted upon one of said axles, a spiral spring nested between the striking wheel and the said power wheel having one of its ends connected to the said power wheel adjacent its rim and connected at its other end to the said striking wheel adjacent its rim portion, the said striking wheel having an opening thereacross at one side of its center the said opening at one end being larger than the other, the smaller portion being rectangular in shape and having a shoulder formed in the web of the wheel, a hammer block slidably mounted in the smaller portion of the said opening and having an inner end portion extending into the larger portion of the opening in the said wheel, a plug secured to the wheel forming a closure member for the larger portion of the said opening and spaced from the shoulder on the web adjacent the small portion of the opening in the web of the wheel whereby a chamber is formed in the web within which the inner end portion of the hammer block extends, a bolt in said plug extending into the opening in the hammer block and a spring on the said bolt in engagement with the head thereon and the end of the hammer block biasing the hammer block inwardly of the said striking wheel.

7. An impact tool comprising in combination a frame, a striking wheel having a peripheral opening therein at one side of its center and having a stub axle on each side thereof, power wheels rotatably mounted on each of the said axles, spiral springs nested between the striking wheel and the power wheel at each of its sides, one end of each of the said springs being secured to the power wheel adjacent its outer edge, the other end of each of said springs being secured to a power wheel adjacent its outer edge, a plug closing one end of the peripheral opening in its end opposite the plug, the hammer block having a central opening therein, a bolt having head portions at each of its ends mounted in the said plug and extending into the central opening in the hammer block and a spring on the said bolt in abutting engagement with the bolt head portions at one of its ends and with the said hammer block at its opposite end and biasing the hammer block inwardly of the said wheel.

8. An impact tool comprising in combination a frame, a striking wheel supported by an axle and having a peripheral opening therein, a power driven wheel mounted upon the axle and rotatable thereon, a spiral spring secured at one of its ends to the striking wheel adjacent its outer periphery and connected at its other end to the power driven wheel adjacent its outer periphery, a hammer block slidably mounted in the peripheral opening at one end thereof in the said wheel, a plug secured to the said wheel forming a closure member for the peripheral opening at its side opposite the hammer block and a spring connected with the hammer block and the plug whereby the said hammer block is withdrawn within the periphery of the wheel after delivery of its stroke.

9. An impact tool comprising in combination a frame, a striking wheel having a central web portion and having an opening thereacross at one side of its center, the said opening being of larger area at one of its ends than at the other, the smaller portion of the opening being rectangular in shape, and having a shoulder formed thereon intermediate its ends, a power wheel rotating upon the same axis as the striking wheel, a coiled spring nested between the striking and power wheels having one of its ends connected to the power wheel and its other end to the striking wheel, a hammer block having a rectangular portion slidably mounted in the larger area of the said opening and having an enlarged head portion in its inner end, a fixed plug secured to the said wheel as a closure member for the opening at one of its sides and a spring connected to the said plug and to the striking hammer normally tending to hold the striking member within the periphery of the wheel, the enlarged portion of the hammer block engaging the shoulder as a limit stop to its outward movement and engaging the plug as a limit stop to its inward movement.

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