July 7, 1931. J. R. SANDAGE 1,813,087

IMPACT TOOL

Filed Jan. 28, 1926 2 Sheets-Sheet 1

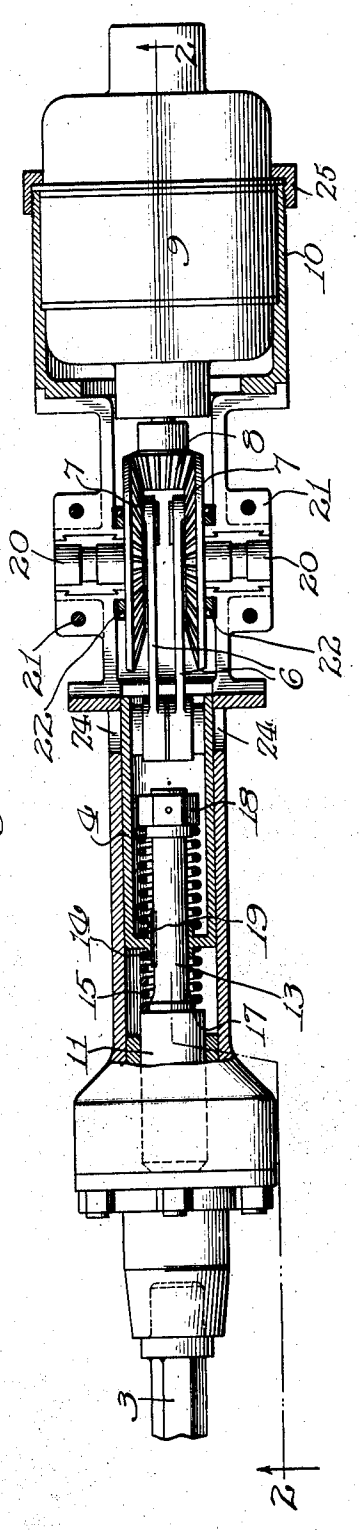


Fig. 1.

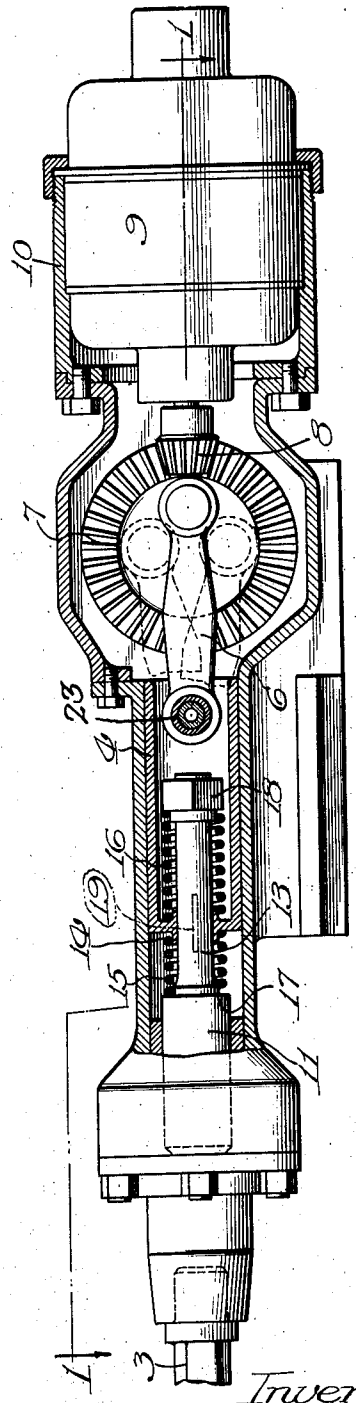


Fig. 2.

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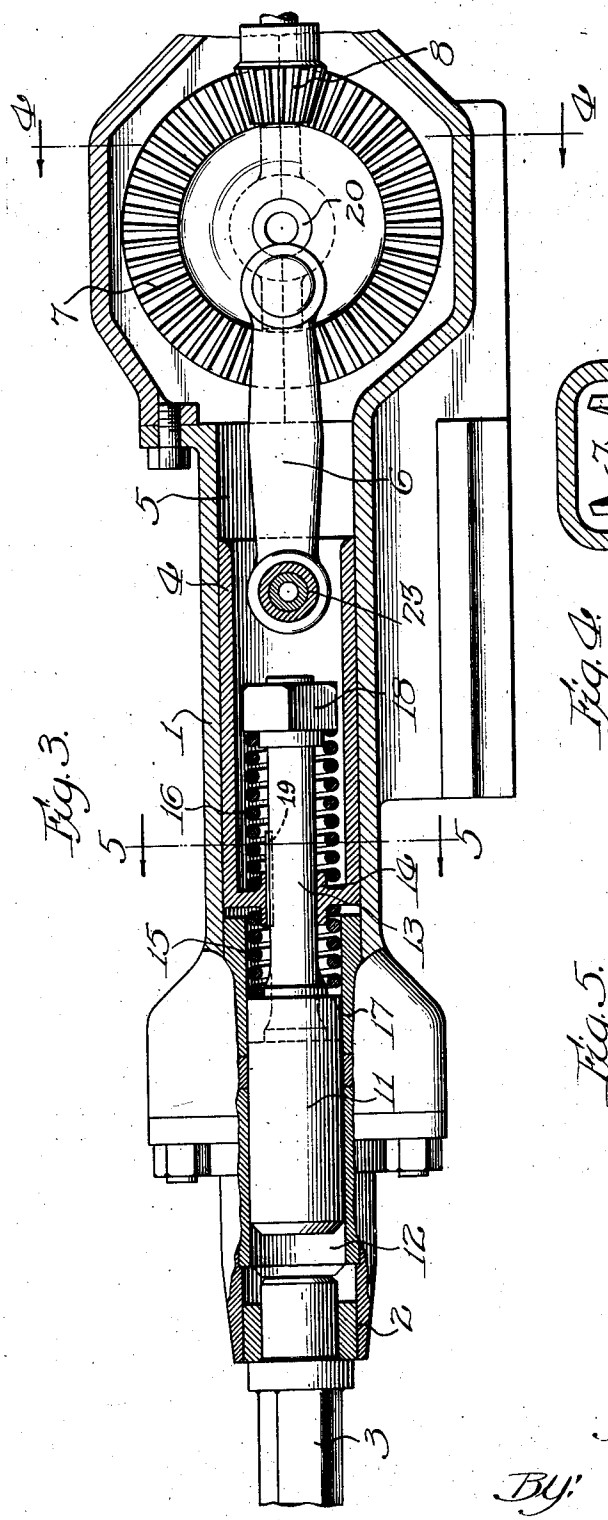


Fig. 3.

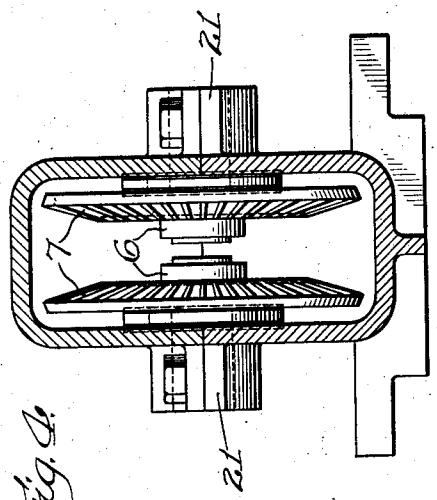


Fig. 4.

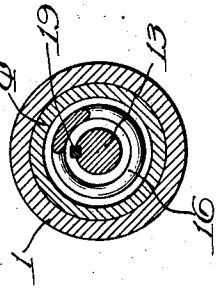


Fig. 5.

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UNITED STATES PATENT OFFICE

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IMPACT TOOL

Application filed January 28, 1926. Serial No. 84,425.

This invention relates to impact drills or similar tools, in which the drill or the tool is subjected to the impacts of a rapidly reciprocating plunger or hammer, thereby to cause the drill or other tool to perform the desired work.

Generally stated, the object of the invention is to provide a novel and improved means for delivering the impacts to the drill or other tool, in a rapid and satisfactory manner.

A special object is to provide a novel and improved construction and arrangement whereby the impact-producing instrumentalities are operated by electric power.

Another object is to provide a novel and improved construction and arrangement whereby the reaction from the impacts, in the hammer or plunger, is cushioned, and thus prevented from producing injurious or undesirable vibration of the apparatus.

It is also an object to provide certain details and features of construction and combinations tending to increase the general efficiency and the desirability of an impact tool apparatus of this particular character.

To these and other useful ends, the invention consists in the matters hereinafter set forth and claimed and shown in the accompanying drawings, in which:

Fig. 1 is a plan view of an impact tool apparatus embodying the principles of the invention, in partial and horizontal section, the section being taken on line 1—1 in Fig. 2 of the drawings.

Fig. 2 of the drawings is a vertical longitudinal section on line 2—2 in Fig. 1.

Fig. 3 is a view similar to Fig 2, on a larger scale, with certain portions broken away for convenience of illustration.

Fig. 4 is a transverse vertical section on line 4—4 in Fig. 3.

Fig. 5 is a transverse vertical section on line 5—5 in Fig. 3.

As thus illustrated, the invention comprises a hollow body 1 having a chuck 2 at one end to receive the drill or other tool 3 in position to be operated by the impact mechanism. Said mechanism comprises a reciprocating head 4, which reciprocates in the bore 5 of the body 1, and which is reciprocated by the two pitmen 6 connected to the bevel gears 7, whereby these bevel gears act as crank plates to actuate the pitmen and thereby reciprocate said head. These bevel gears are rotated in opposite directions by the interposed bevel pinion 8, and the latter is operated by an electric motor 9 of any suitable or desired character, mounted within the casing 10 which forms a part of the body of the apparatus. Thus when one pitman is up the other is down, as the bevel gears 7 rotate in opposite directions, and in this way the lateral thrust of one pitman, on the head 4, is counteracted by the lateral thrust of the other pitman, whereby the lateral thrust of the crank means thus provided is balanced, with the result that in effect the head 4 is always subject to a straight push or pull, and in effect is not subject to any lateral thrust.

The hammer or plunger 11 reciprocates in the bore 12 of the body, and delivers the impacts to the inner end of the drill or other tool 3, in a manner that can be readily understood. The stem portion 13 of said hammer or plunger extends through a guide portion 14 in the end of the head 4, this guide portion forming inner and outer shoulders for the coil springs 15 and 16 on said stem. The spring 15, it will be seen, is interposed between the end of the head 4 and the shoulder 17 on the hammer or plunger, while the spring 16 is interposed between the guide 14 and the nut 18 screwed on to the end of the stem 13, as shown. Preferably, a spline 19 is provided on the stem 13, to engage a groove in the guide 14, thereby to prevent rotation of the hammer or plunger.

Thus, with the construction shown and described, which is illustrative of the invention, the rapid reciprocation of the head 4, by the electric motor, through the medium of the double crank mechanism, will cause the hammer or plunger 11 to reciprocate rapidly, but with a somewhat greater throw, of course, inasmuch as the momentum of the hammer or plunger will carry it on a distance beyond the end of the stroke of the

head 4, inasmuch as the spring 16 will be compressed, thus permitting the hammer or plunger to travel far enough forward to deliver the desired impact upon the inner end of the drill or other tool. Of course, when the head 4 reaches the end of its stroke toward the crank plates, the momentum of the plunger or hammer 11 will then carry it on a slight distance, compressing spring 15, whereby the plunger or hammer travels a distance farther at each end of its stroke than does the reciprocating head. It is desirable, as shown, to have the spring 16 somewhat longer than the spring 15, as a greater overthrow of the hammer or plunger is desired at the end of its stroke toward the drill or other tool. Therefore, when the hammer or plunger actually delivers the blow or impact upon the inner end of the drill or other tool, the spring 16 is under compression, and the spring 15 is expanded and the reaction from the blow in the hammer iself is practically not communicated to any extent to the actuating mechanism. In other words, it is very much as though the hammer or plunger was disconnected and thrown forward a distance, after the head 4 stops moving forward, and hence the reciprocating head 4 and the crank mechanism are not subject to the reaction from impacts delivered by the hammer or plunger upon the inner end of the drill or other tool.

In addition, as shown, the impact tool apparatus is conveniently operated by electric power through the medium of an ordinary rotary electric motor, the rotation of the motor being ultimately converted or translated into rapid reciprocation of the hammer or plunger to deliver the desired impacts upon the inner end of the drill or other tool.

It will be understood, of course, that the body of the apparatus can be constructed in any suitable or desired way. It will be observed that the bevel gears 7 have their journals 20 mounted in suitable bearings 21 formed on the casing or body of the apparatus, and bearings 22 may be interposed, if desired, between the bevel gears 7 and the inner side of the casing, thereby to take the axial thrust of these two gears, produced by the pinion 8, and thus insure smooth and easy running of the crank mechanism. The ball bearings 22 may be of any suitable character.

Thus the hammer delivers the impact by momentum alone, for as soon as the member 4 stops moving forward, after reaching the end of its stroke, it is then merely the momentum of the hammer 11 which carries it forward to an extent sufficient to deliver the required impact upon the inner end of the tool. The momentum of the hammer 11 compresses the spring 16, but the momentum is greater than the resistance of the spring, and hence the spring does not expand and return the hammer to its normal position, relative to the member 4, until after the latter has reversed its motion and has traveled backward a distance. Thus, the reaction from the impacts is prevented from extending back into the operating mechanism, and cannot reach the motor, which latter is axially aligned with the tool, the said motor and the pinion 8 and the hammer 11 and the tool 3, and also the springs 15 and 16, and the member 4, being all axially aligned in the manner shown.

Any suitable means (not shown) can be employed for gradually rotating the tool 3, about its longitudinal axis, which axis is also the axis of the motor, as explained, if such is necessary or desirable. Means for gradually rotating the tool, during the impacts, and while the tool is in use, are well known and need no description or illustration thereof.

It will be seen that the transverse pivot formed at 23, where the two pitman 6 connect to the member 4, is between the spring 16 and the crank plate mechanism, so that the said spring is entirely in front of said axis. Furthermore, and by actuating the bevel pinion 8, power is communicated directly to each crank plate, and no power is communicated from one crank plate 7 to the other crank plate 7, each crank plate operating independently of the other to transmit power through its allotted pitman 6 to reciprocate the member 4 in the manner explained. The pivot 23 is removable through the openings 24 in the sides of the casing, and the motor 9 and the pinion 8 are removable as a unit by merely unscrewing the ring 25 which is screwed on to the end of the casing section 10 in the manner shown. The rear end of the member 4 must be open, of course, as shown, as the spring 10 is inserted in place through this open end, and also the nut 18, and thus there is access through this open end to permit both assembling and removal of the parts. When the pivot 23 is pulled out, and the nut 18 is removed, the hammer can then be removed from the front end of the member 4, and the spring 16 can then be pulled out of said open rear end. It will be seen that the casing, to permit such assembling and taking apart of the apparatus, is composed of three sections, detachably bolted together, the middle split or divided section removably enclosing the crank plate mechanism, one end section enclosing the motor, and the other end section enclosing the reciprocating hammer mechanism.

Without disclaiming anything, and without prejudice to any novelty disclosed, what I claim as my invention is:

1. In an impact tool apparatus, the com-

bination of means for holding the tool loosely in position at the front end of the apparatus, and power instrumentalities including a hammer to deliver the impacts to said tool, whereby the hammer reciprocates relatively to said tool, a hollow reciprocating and externally supported and guided member open at its rear end and formed at its front end with a bearing for said hammer, in which bearing the hammer reciprocates endwise, spring means engaging said hammer and said bearing to cause the hammer to reciprocate and have a longer stroke than said member, causing the hammer to continue moving forward by momentum alone after said member reaches the end of its forward stroke, operative to return the hammer to normal position on said member after the impact, said open end permitting access to one end of said spring means and to the rear end of said hammer in assembling the parts, said bearing precluding such insertion and access through the front end of said member, and means for actuating said member and forming a transverse pivot in said open end thereof, said spring means being disposed entirely in front of said pivot.

2. A structure as specified in claim 1, said spring means comprising a coil spring enclosed in said member, and said hammer having a stem extending through said bearing and through said coil spring, with means on said stem to form a shoulder to engage one end of the spring, whereby said spring reciprocates relatively to said tool and is compressed by the momentum of the hammer.

3. A structure as specified in claim 1, said spring means comprising two coil springs, a portion of said member forming said bearing being interposed between said springs, and said hammer having a stem extending through both springs and through said bearing, whereby one spring is compressed by the momentum of the hammer at the end of the stroke in one direction, and the other spring is likewise compressed at the end of the stroke in the opposite direction, whereby both springs reciprocate relatively to said tool.

4. A structure as specified in claim 1, said instrumentalities comprising an electric motor the axis of which is coincident with the longitudinal axis of said bearing and said spring means, and comprising power transmitting means between said motor and said hollow member, said power transmitting means having an axis transverse to said longitudinal axis, communicating power through said spring means to the hammer.

5. A structure as specified in claim 1, said instrumentalities comprising a double crank mechanism, with pitmen disposed side by side between the cranks and connecting the cranks to said pivot, whereby the cranks actuate said member, and comprising means for rotating said cranks in opposite directions, by power communicated directly to each crank, so that each crank receives power independently of the other, preventing the transmission of power through one crank to the other, thereby to balance the lateral thrust of the pitmen on said member, and whereby the thrust of said spring means on said bearing is sustained equally by both cranks, and a casing having provisions whereby said instrumentalities except rotating means are removable intact independently of said tool, said cranks being disposed between said rotating means and said hollow member, communicating power through said spring means to the hammer.

6. A structure as specified in claim 1, said instrumentalities comprising two bevel gears serving as crank plates, pitmen disposed side by side between the gears and connecting the cranks to said pivot, the pitmen extending into said member, so that said gears actuate said member, a bevel pinion interposed between said bevel gears, spacing the gears far enough apart to accommodate the pitmen between them, and means to rotate said pinion and thereby rotate said gears in opposite directions, thereby to balance the lateral thrust of said pitmen on said member, and whereby the thrust of said spring means on said bearing is sustained equally by both bevel gears, in combination with a casing having sections forming transverse opposite split bearings for said gears, said casing having provisions whereby said instrumentalities except said pinion are removable intact independently of said tool, said cranks being disposed between said rotating means and said hollow member, communicating power through said spring means to the hammer.

7. A structure as specified in claim 1, said instrumentalities comprising two bevel gears serving as crank plates, pitmen disposed side by side between the gears and connecting the cranks to said member, the pitmen extending into said member, so that said gears actuate said member, a bevel pinion interposed between said bevel gears, spacing the gears far enough apart to accommodate the pitmen between them, and comprising also means to rotate said pinion and thereby rotate said gears in opposite directions, thereby to balance the lateral thrust of said pitmen on said member, and whereby the thrust of said spring means on said bearing is sustained equally by both bevel gears, and an electric motor for rotating said bevel pinion, together with a sectional body forming a casing for removably enclosing all of said specified elements, forming split bearings for said gears, and a casing having provisions whereby said instrumentalities except said pinion are removable intact inde-

pendently of said tool, said cranks being disposed between said rotating means and said hollow member, communicating power through said spring means to the hammer.

8. A structure as specified in claim 1, in combination with a body forming a sectional casing for enclosing all of said specified elements, said casing having three connected separable sections, said sections disposed end to end, and the middle section being divided centrally and longitudinally thereof in a plane coincident with the longitudinal axis of said apparatus and thereby removably enclosing said instrumentalities, forming transverse opposite split bearings for parts of said instrumentalities.

Specification signed this 26th day of January, 1926.

JACOB R. SANDAGE.