

May 5, 1942.

F. TOOP

2,281,641

MECHANISM FOR CONVERTING ROTARY MOTION TO RECIPROCATORY MOTION

Filed Dec. 27, 1940

3 Sheets-Sheet 1

Fig. 1

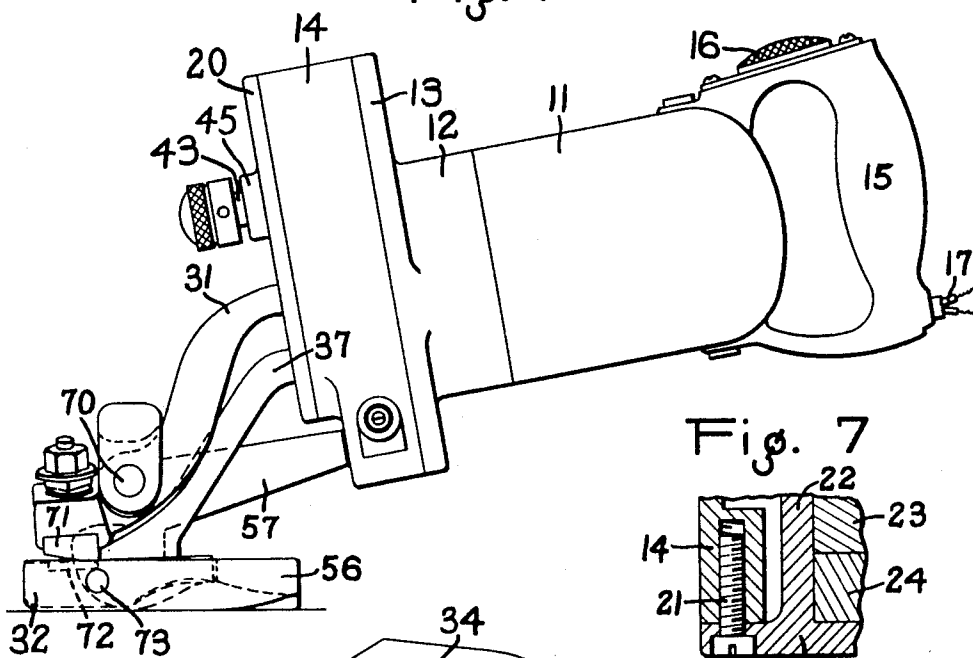


Fig. 7

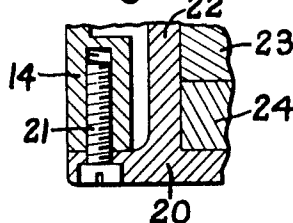


Fig. 8

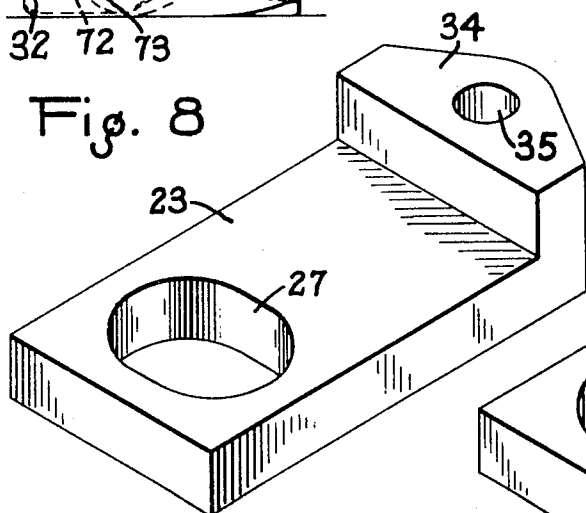


Fig. 9

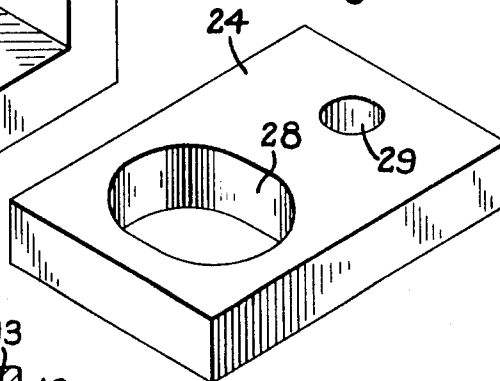
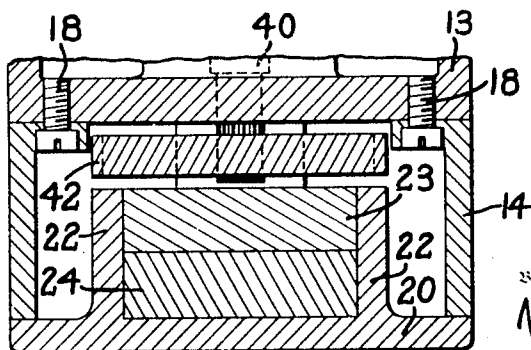


Fig. 6



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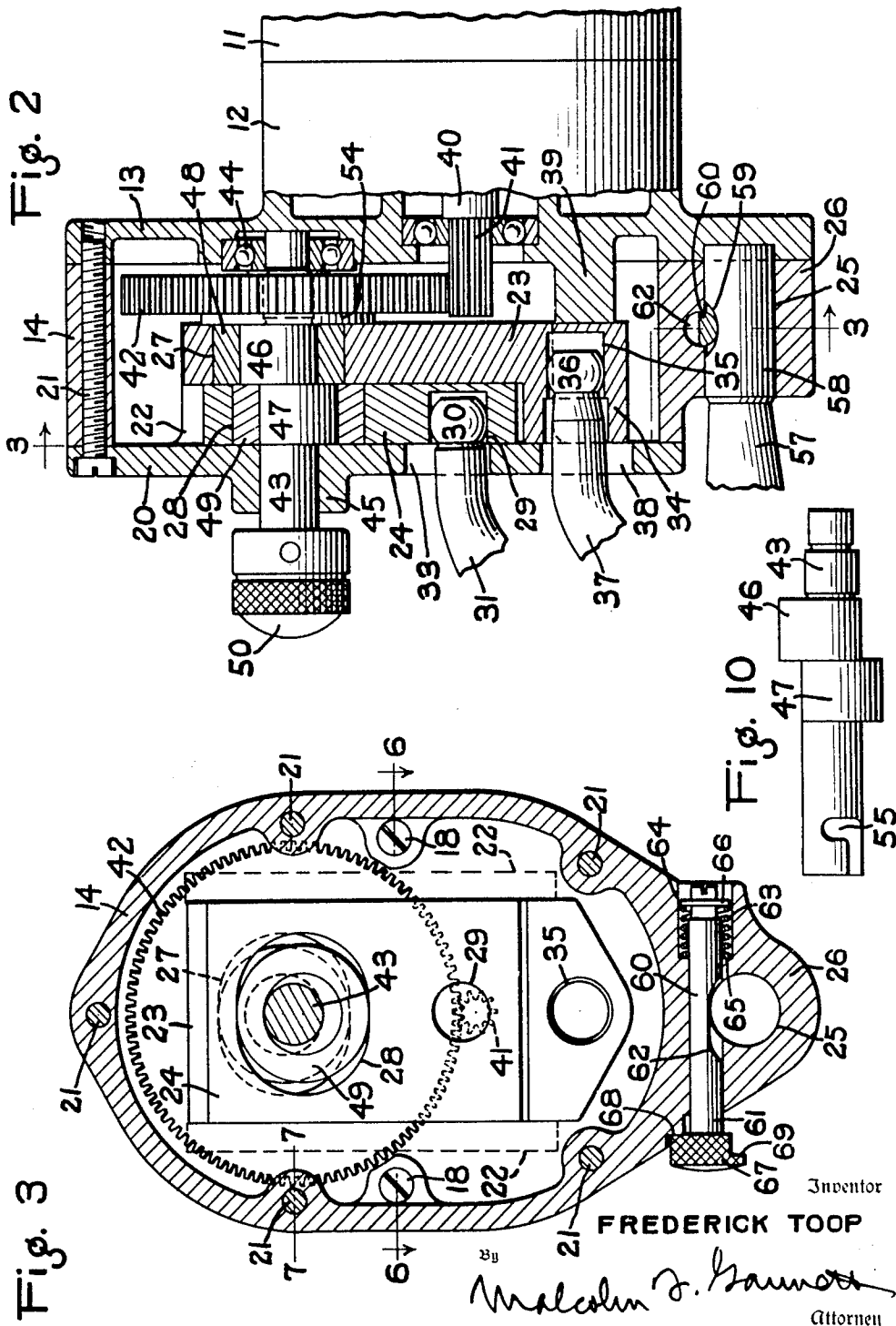
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3 Sheets-Sheet 2



May 5, 1942.

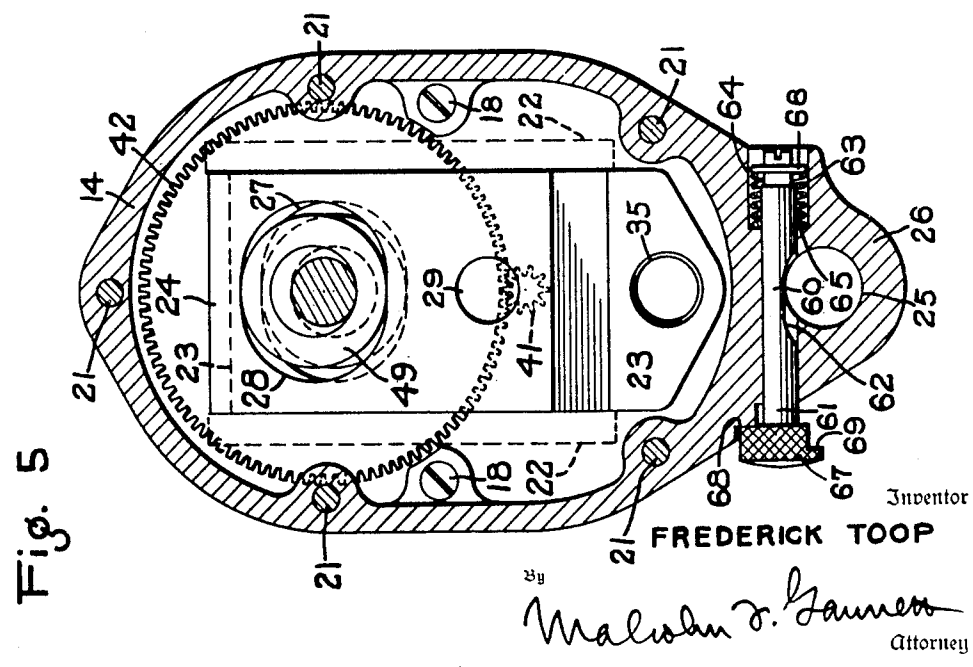
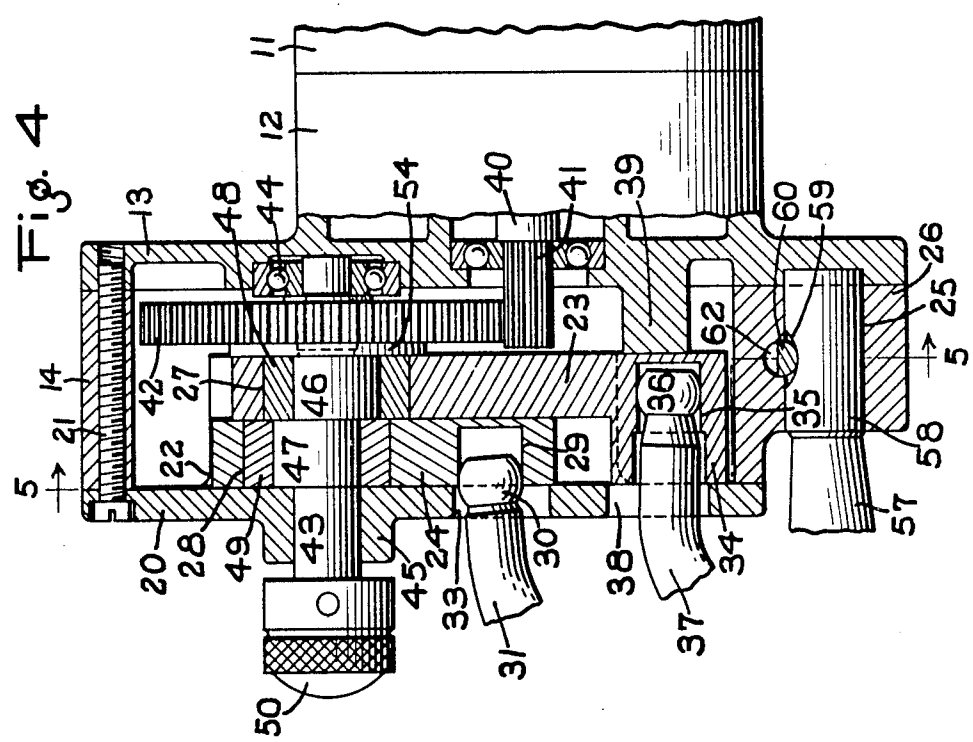
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MECHANISM FOR CONVERTING ROTARY MOTION TO RECIPROCATORY MOTION

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3 Sheets-Sheet 3



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MECHANISM FOR CONVERTING ROTARY MOTION TO RECIPROCATORY MOTION

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Application December 27, 1940, Serial No. 371,874

4 Claims. (Cl. 74-49)

This invention relates to mechanism for converting rotary motion to reciprocatory motion, and more particularly to portable power producing and transmitting machines of the type shown and described in my United States Letters Patent Numbered 2,220,871 and 2,220,872, granted November 5, 1940.

Some tools are so delicate in their operation that when used with power operating machines of the type shown in the above referred to patents, the single actuating members of the machines cause shocks at each end of their reciprocative movements which prevent precision work and smooth operation of the tools.

Also, it has been found that the machines of the type shown in the above referred to patents are not adapted for use with many types of tools in the desired manner, on account of the single reciprocative movements of the actuating members.

An object of the present invention is to provide an improved mechanism for converting rotary motion to reciprocatory motion, in which the reciprocatory motion is produced by a pair of reciprocative members operatively connected to the shaft of a motor in such a manner as to be simultaneously reciprocated in opposite directions.

Another object of the invention is to provide an improved mechanism for converting rotary motion to reciprocatory motion, in which a pair of tool actuating members are reciprocated by a motor driven shaft having means thereon to effect simultaneous reciprocative motion of the actuating members in opposite directions.

Another object of the invention is to provide an improved mechanism for converting rotary motion to reciprocatory motion in which reciprocatory movements in opposite directions are simultaneously produced by a pair of members which are operated by a shaft having a pair of eccentrically positioned elements mounted within openings formed in the reciprocative members.

Another object of the invention is to provide an improved machine of the above type in which a plurality of reciprocative movements are simultaneously produced by members operatively connected to the shaft of a motor in such a manner that shocks occurring at the ends of the movements of the members are neutralized.

With these and other objects in view, the invention comprises novel features of construction and combinations of elements which will be hereinafter described and claimed.

In the accompanying drawings:

Figure 1 is a side elevation of a portable machine embodying the present invention and having one type of tool attached in its operative relation;

Fig. 2 is an enlarged elevation, partly in section, of a portion of the machine shown in Fig. 1, the reciprocative members being shown at their innermost reciprocative position;

Fig. 3 is a vertical section taken on the line 3-3 of Fig. 2, the elements of the tool being omitted;

Fig. 4 is a view similar to Fig. 2 showing the reciprocative members of the machine at their extreme outermost reciprocative position;

Fig. 5 is a view similar to Fig. 3 showing the reciprocative members at their extreme outermost reciprocative position;

Fig. 6 is a transverse section taken on the line 6-6 of Fig. 3;

Fig. 7 is a transverse section taken on the line 7-7 of Fig. 3;

Fig. 8 is a perspective view of one of the reciprocative members;

Fig. 9 is a perspective view of the other reciprocative member, and

Fig. 10 is a side elevation of the operating shaft for the reciprocative members.

Referring to the drawings, an electric motor of any appropriate type or kind (not shown), with the exception of the front end portion of the motor shaft, is mounted within a casing having a main part 11 and an end portion 12 formed with an enlarged portion 13 to receive a housing 14 for the operating mechanism of the present invention.

The end of the casing 11 opposite to the end having the portion 12 carries a handle 15 with its controlling switch 16 and power connecting terminals 17 for the electric motor.

The housing 14 is removably secured to the portion 13 of the casing by screws 18 (Fig. 6), or by any other appropriate means, and the portion 12 of the casing may be removably secured to the portion 11 by any appropriate means (not shown).

The housing 14 has a closure 20 removably secured to the front end thereof by screws 21 (Fig. 7).

The closure 20 is formed on its inner or rear side with parallel guides 22 (Fig. 6), between which are disposed two reciprocative members 23 and 24.

The parallel guides 22 engage the side edges of the members 23 and 24 and thereby prevent relative movement of these members except in a straight line, normally upward and downward or

towards and from a tool supporting element or socket 25 formed in a boss 26 or extension of the housing 14, as shown in Figs. 2, 3, 4 and 5.

The reciprocative member 23 is formed with an opening 27 which is made elongated transversely of the longitudinal center line of said member, as shown best in Fig. 8.

An opening 28, similar to the opening 27, is formed in the reciprocative member 24, as shown best in Fig. 9.

The member 24 is slidably mounted on the member 23, as shown in Figs. 2, 3, 4 and 5, and said member 24 is formed with a socket or element 29 adapted to receive a spherical end portion 30 of an arm 31 of a tool 32, for operation of the latter as hereinafter described. The arm 31 is adapted to extend through an opening 33 formed in the closure 20.

The reciprocative member 23 is constructed somewhat longer than the reciprocative member 24 and the end of the member 23 nearest the socket 25 is formed with a lateral extension or offset portion 34.

The portion 34 is formed with a socket or element 35 adapted to receive a spherical end portion 36 of an arm 37 of the tool 32, said arm 37 extending through an opening 38 formed in the closure 20.

The member 23 is slidably mounted on a supporting member 39 preferably made integral with the portion 12 of the casing and extending from the inner portion of said casing, as shown in Figs. 2 and 4, towards the closure 20.

As shown in Fig. 8, the portion 34 of the member 23 provides a broad bearing surface adapted to engage the inner face of the closure 20 to thereby constitute a sliding guide for the member 23. In other words, the member 23 is slidably mounted between the closure 20 and the supporting member 39 and is thus held from lateral shifting movement therebetween. The member 34 also has another purpose, in that it functions as means for closing the exposed portion of the opening 38 in the closure 20 (see Figs. 2 and 4).

Formed on the extremity of the motor shaft 40 is a gear 41 which has teeth in meshing relationship with the teeth of a gear 42.

The gear 42 is fixed to a shaft 43, journaled at one end in a bearing 44 mounted in the casing 13, as shown in Fig. 2.

The shaft 43 extends through the openings 27 and 28 of the reciprocative members 23 and 24, respectively, and also through a journal or bearing 45 formed in the closure 20.

A washer 54 is mounted on the shaft 43, and said washer is interposed between the reciprocative member 23 and the gear 42 so as to support the end of the member 23 opposite to the end supported by the member 39.

Formed on the shaft 43 is a pair of eccentrically positioned elements 46 and 47 adapted to move in the openings 27 and 28, respectively, of the reciprocative members 23 and 24.

In order to prevent undue wear of the eccentrics 46 and 47, said eccentrics are fitted with bearings or bushings 48 and 49, respectively, said bushings being preferably arranged concentric of said eccentrics, as shown. In Figs. 2 and 4 the bushings are shown on their respective eccentrics, and in Fig. 10 the bushings have been omitted from the eccentrics.

The eccentrics 46 and 47 are diametrically disposed with respect to the longitudinal center line of the shaft 43, the eccentric 46 extending laterally in one direction from the center of said shaft

and the eccentric 47 extending laterally from the center of the shaft in the direction opposite to said eccentric 46. Both eccentrics and their respective bushings are circular in outline and the maximum diameter of the bushings is substantially equal to the minimum width of the openings 27 and 28, as shown in Fig. 3.

The contours of the openings 27 and 28 and the arrangement of the eccentrics 46 and 47 are such that the reciprocative members 23 and 24, which are disposed between the guides 22, move in a straight line across the axis of the shaft 43.

The extremity of the shaft 43 may be provided with a knob 50, and if so desired said knob may be detachably connected to said shaft in any convenient manner, such as by a bayonet-slot 55, as shown in Fig. 10.

In order to show one use for which the power producing mechanism has been designed, I have chosen the tool 32. This tool has a base member 56, from which projects an arm 57.

The arm 57 is made rigid with the base 56 and the outer portion 58 of said arm is adapted to be mounted in the socket 25 so that the tool will be rigidly connected with the casing 11.

In order to detachably connect the tool 32 to the power device, the portion 58 of the arm 57 is formed with a transverse slot or groove 59 adapted to receive the shank 60 of a spring pressed locking-pin 61.

The locking-pin 61 is mounted in the boss 26 and arranged transversely of the device so as to extend across a portion of the socket 25.

In order to permit the insertion of the end 58 into the socket 25 and the withdrawal of the arm from said socket without the necessity of removing the locking pin 61 from the device, said pin has a notch 62 formed in the portion of its shank 60 which normally extends across the socket opening 25. The contour of the notch 62 is such that when the pin 61 is turned to the position shown in Fig. 3, the full area of the socket opening 25 will be provided for the insertion or the withdrawal of the arm portion 58. After the arm is mounted in the socket 25, as shown in Fig. 2, the pin 61 is adapted to be rotated to the position in which the notch 62 is moved out of registration with the opening of the socket 25. In such position, the main shank portion 60 of the pin 61 will be disposed in the groove 59, thereby preventing movement of the arm 58 relative to the housing 14. In this way the tool 32 will be rigidly connected to the power device.

The pin 61 is held in either of the two positions referred to above by a coil spring 63 mounted in a recess 64 and encircling an end of the pin, said spring bearing at one end against a shoulder 65 and at the other end against a washer or disk 66 mounted on the extremity of said pin. The action of the spring 63 normally retains the operating head 67 of the pin 61 in engagement with a shoulder 68. The head 67 is formed with a lug 69 adapted to engage the shoulder 68 when the pin 61 is in the position shown in Fig. 2.

The arm 31 is pivotally mounted on the tool 32, as indicated at 70, and said arm carries a cutting element 71 adapted to cooperate with a cutting element 72 carried by the arm 37 to produce a shearing action. The arm 37 is also pivotally mounted on the tool 32, as indicated at 73.

The disposition of the eccentrics 46 and 47 with respect to the axis of rotation of the shaft 43 and the manner in which said eccentrics are

49

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arranged in the reciprocative members 23 and 24, is such that said members will be moved simultaneously in opposite directions when the shaft 43 is rotated. The reciprocating movement of the members 23 and 24 in opposite directions imparts a similar movement to the arms 31 and 37, so that said arms will be alternately moved toward and away from each other. In this way the cutting elements 71 and 72 will be operated to produce the desired shearing action.

By providing means, such as the element 25, for retaining the tool rigid with the motor casing, and by providing means, such as the reciprocative members 23 and 24, for simultaneously operating the tool arms 31 and 37, the shock which occurs at the end of each reciprocative movement of the tool arms is neutralized, with the result that the tool is operated more smoothly than when a single reciprocative member is employed, such as the reciprocative members of my two above referred to patents.

It will be understood that in the case of a single reciprocative member operated at considerable speed, first in one direction, and then in the opposite direction, the suddenness which the single reciprocative member changes its direction of movement causes a pronounced shock in the operating mechanism, and also in the mechanism operated thereby. On the other hand, since both of the reciprocative members 23 and 24 reverse their direction of movement simultaneously, the shock at one end balances the shock at the opposite end resulting from the change in direction of movement, so that little or no vibration or shock is produced in the operating mechanism and the mechanism operated thereby. Thus, the simultaneous double reciprocative action in opposite directions of the members 23 and 24 produces a mechanical movement simulating somewhat the smooth motion produced by a balanced wheel. For instance, after the members 23 and 24 have attained their normal operating speed, the reciprocative movements of said members continue for a considerable period of time after the current supplied to the driving motor has been cut off. That is to say, the arms 31 and 37 are actuated approximately three times longer than is the case where a single reciprocative member is employed as referred to in my prior patents. Another feature of the present invention is that the double action of the two members 23 and 24 is obtained by the use of a single operating shaft and gear drive therefor.

The amount of reciprocatory motion imparted to the members 23 and 24 by the shaft 43 can be observed by comparing the position of the parts shown in Figs. 2 and 3, with the position of the same parts in Figs. 4 and 5, respectively.

Having thus described my invention, what I claim is:

1. In a mechanism for converting rotary motion to reciprocatory motion, the combination of a motor including a motor shaft and also including a casing which has a tool attaching element at its front end, said tool attaching element being adapted to engage with and support a rigid member of a tool that comprises a pair of movable members pivotally connected to the rigid member for cooperation in performing the tool's function, a pair of members mounted in said casing for reciprocative strokes, each reciprocative member having means for operatively connecting a movable member of said tool thereto, an opening formed in each reciprocative member, and a shaft operatively connected with said motor shaft

and having two eccentrics thereon mounted respectively within the openings of said reciprocative members, said eccentrics being located at diametric points with respect to the longitudinal center line of said shaft so that said members will be simultaneously operated to move the movable tool members in opposite directions with respect to said rigid tool member.

2. In a machine of the type described, the combination of a motor including a motor shaft and also including a casing which has a tool attaching element at its front end, said tool attaching element being adapted to engage with and support a rigid member of a tool that comprises a pair of movable members pivotally connected to the rigid member for cooperation in performing the tool's function, a separate actuating member for each of said movable members, each actuating member having means for operatively connecting a movable member of said tool thereto, and power transmitting means operatively connected to each of said actuating members and to said motor shaft so as to effect simultaneous reciprocative movements of said actuating members in opposite directions to thereby effect operation and function of said tool by the operation of said motor, said front end of the casing being inclusive of a removable closure that is provided with parallel guides, said actuating members being slidably seated between said guides in a proper relation for having reciprocative motion towards and from said rigid tool attaching element, said power transmitting means being inclusive of a shaft that has means thereon to effect said simultaneous reciprocative motion of said actuating members in opposite directions.

3. In a machine of the type described, the combination of a motor including a motor shaft and also including a casing which has a tool attaching element at its front end, said tool attaching element being adapted to engage with and support a rigid member of a tool that comprises two movable members pivotally connected to the tool for cooperation in performing the tool's function, a separate actuating member for each of said movable tool members, each actuating member having means for operatively connecting a movable member of said tool thereto, and power transmitting means operatively connected to each of said actuating members and to said motor shaft so as to effect simultaneous reciprocative movements of said actuating members in opposite directions to thereby effect operation and function of said tool by the operation of said motor.

4. In a machine of the type described, the combination of a motor including a motor shaft and also including a casing which has a tool attaching element at its front end, said tool attaching element being adapted to engage with and support a rigid member of a tool that comprises two movable members pivotally connected to the tool for cooperation in performing the tool's function, a separate actuating member for each of said movable tool members, each actuating member having means for operatively connecting a movable member of said tool thereto, a shaft operatively connected to said motor shaft, and means carried by said shaft and operatively connected to each of said actuating members so as to effect simultaneous reciprocative movements of said actuating members in opposite directions to thereby effect operation and function of said tool by the operation of said motor.

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