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RECIPROCATING TOOL

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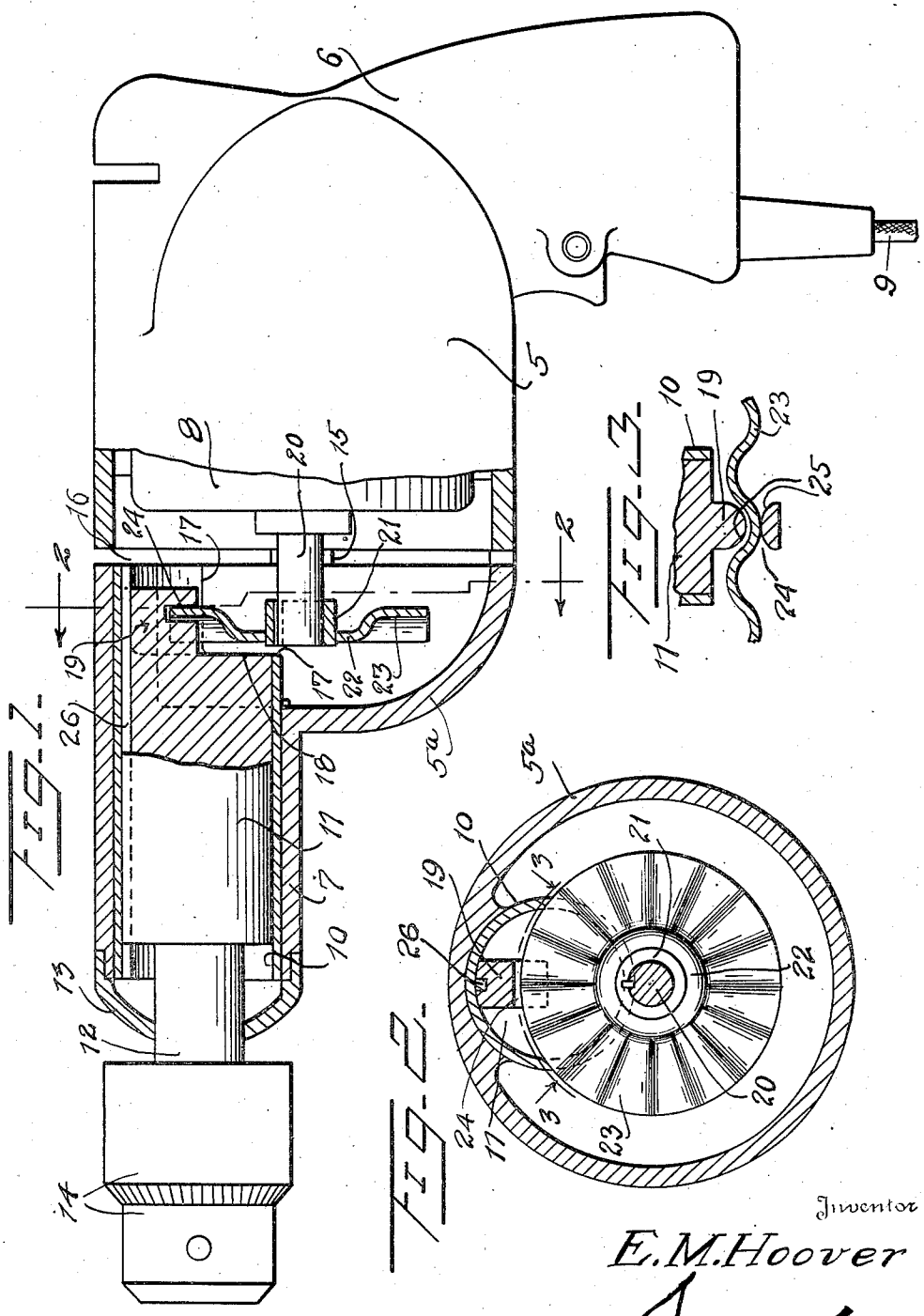


Fig. 1.

Fig. 3.

Fig. 2.

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RECIPROCATING TOOL

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1 Claim. (Cl. 74—56)

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This invention relates to certain new and useful improvements in reciprocating tools.

The primary object of the invention is to provide a reciprocating tool of the portable motor-driven type and especially designed for use as a riveter, although the device may be used in various other arts in which it is desired to effect reciprocatory movements of a tool, such as a punch or the like.

A further object of the invention is to provide a reciprocating tool of the foregoing character wherein a motor driven disk member has a crenellated or wavy peripheral edge for cooperation with a tool-carrying reciprocating piston for effecting reciprocatory movements of the piston.

With the above and other objects in view that will become apparent as the nature of the invention is better understood, the same consists in the novel form, combination and arrangement of parts hereinafter more fully described, shown in the accompanying drawing and claimed.

In the accompanying drawing:

Figure 1 is a side elevational view, partly broken away and shown in section, of a reciprocating tool constructed in accordance with the present invention and illustrating the drive disk connection between the motor and reciprocating tool-carrying piston,

Figure 2 is a vertical cross-sectional view taken on line 2—2 of Figure 1, and

Figure 3 is a detail sectional view taken on line 3—3 of Figure 2.

Referring more in detail to the accompanying drawing, there is illustrated a portable reciprocating tool especially designed for use as a riveter and is of general pistol design comprising a body portion 5 carrying a handle or handgrip 6 at one end thereof, while the other end of the body 5 has a barrel 7 projecting therefrom. An electric motor 8 is housed within the body 5 and is supplied with electric current by means of the conductor 9 in communication with a source of energy.

A bearing sleeve 10 is rigidly mounted in the barrel 7 while a reciprocating piston or plunger 11 is mounted in said sleeve, the plunger 11 carrying a projecting shaft 12 at the forward end thereof extending outwardly of the barrel 7 and sleeve 10 and through a central opening in an end closed cap 13 for the barrel 7. Chuck devices 14 of an appropriate character for the support of a tool are carried by the projecting end of the shaft 12 outwardly of the cap 13.

As illustrated in Figure 1, the body 5 includes a forward section 5a carrying the barrel 7 and

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spaced from the body portion 5 to be connected thereto by the members 15 to provide an air space 16 for the admission of air to cool the electric motor 8. The lower side of the inner end of the sleeve 10 is cut away at 17 and the inner end 18 of the plunger carries a rearwardly projecting block 19 at the upper side thereof overlying the space afforded by the cut-away portion 17 of the sleeve 10.

The motor 8 has a shaft 20 thereof extending into the body section 5a below the cut-away portion 17 and has keyed on the forward end thereof the hub 21 of a disk 22 that cooperates with the block extension 19 on the plunger 11 for reciprocating the latter. The disk 22 has the peripheral portion thereof crenellated or of wave-like formation as indicated by the reference character 23 with said wavy edge extending into a cross slot 24 formed in the lower side of the block 19, the walls of the slot 24 being oppositely curved as at 25 as clearly shown in Figure 3 to eliminate any binding action between the drive disk 22 and the grooved block 19 of the plunger. To prevent rotation of the plunger 11 within the bearing sleeve 10, there is a splined key connection 26 between the plunger and sleeve.

As will be seen in the drawing, the marginal zone of disk or member 22 has its contour symmetrically sinuate relative to a plane extending normal to the axis of such member; in other words, such contour is of sinusoidal characteristic relative to such plane. The indentations extend inwardly radially a distance beyond the limits of slot 24, the walls of which generally conform to the curvature of the inner wall of the indentations of the marginal zone. The width of the slot is somewhat greater than the thickness of the metal of such marginal zone, but is materially less than the overall distance between planes extending normal to the member axis and which correspond in position to the outer faces of the indentations. The opposing walls of the slot are thus oppositely curved.

As a result, rotation of the disk or member 22 in co-operation with the walls of the slot, presents a number of characteristics. Using Fig. 3 to illustrate, it will be understood that in the position shown, the plunger or blow-imparting element is at the end of its stroke away from the blow-imparting position; in this position the inner wall of slot 24 is out of contact with the active indentation. Since this occurs at the instant when the inward stroke of the element is approximate the end of the stroke and therefore under inertia of movement conditions, it can be under-

stood that the tendency of the element to continue its movement in such direction will cause the inner wall of the slot to advance toward the inner face of the succeeding active indentation and is momentarily freed from restraint. However, the length of such free movement is slightly less than the distance shown, since the disk is rotating and therefore carries the receding portion of the inner wall of the indentation into the path of movement of the slot wall; obviously, the greater the motor speed, the more rapid becomes the advance of the indentation wall, thus tending to reduce the length of such free movement; but this effect is less pronounced through the fact that the speed of the motor is also effective on the speed of advance of the element toward such position so that the speed of advance of the slot wall will increase with the speed increase of the motor, and thus tend to render the length of free movement approximately constant, although the time length may slightly decrease.

While this action is more or less immaterial at this particular end of the stroke of plunger or element 11, it is obvious that a precisely similar action takes place as the plunger is approaching the end of its stroke in the opposite direction, at which time the blow impact is taking place—a similar free advance of the plunger is provided by the combined action of the disk rotation and the impetus of the plunger. The time length is small as is the free length of movement, but both are sufficient to permit the plunger to impart the blow effect to the work, regardless of the motor speed.

This will be understood by considering the tool as a riveting implement. The riveting head is in contact with the work, held there by the operator, whereupon the plunger is moved in the direction of the work and as it approaches the end of the stroke, the above action takes place, during which the free movement referred to permits the plunger to deliver the blow, with the blow value responsive to the impetus value and the latter determined by the speed of the motor. Since the impact is completed instantaneously, and with the full value of impetus provided by motor speed, the time length of the free movement is not determinative, and is sufficient to complete the action even under high speed conditions of the motor.

In other words, the impetus values of the plunger are produced directly from the motor and through the camming action of the intermediate portions of the walls of the sinusoidal contour, with the maximum value present at the instant when the free advance is made possible. And since the blow value is responsive to the impetus

value, it is apparent that the blow value is determined by the speed of the motor. Hence, the motor speed not only determines the number of reciprocating cycles of the plunger—the number of blow-impacts made—per unit of time, but also determines the blow-impact values also.

With the disk or member having a plurality of the alternating indentations—eight are shown in the drawing—coupled with the fact that the disk is carried by the motor shaft and thus rotates at equal speed with the motor, it is apparent that even at medium motor speeds, the number of blow-impacts per unit of time is large, with the number increasing in synchronism with the increase in motor speed, thus making possible the development of a very large number of blow-impacts per unit of time; and since the blow-impact value also increases with the motor speed increase, it is apparent that the tool is capable of high-capacity operation without loss of efficiency.

While I have herein disclosed one form in which the invention may be embodied, it is apparent that changes and modifications therein may be found desirable or essential in meeting the exigencies of service or individual desires of users, and I therefore reserve the right to make any and all such changes as may be found desirable or essential insofar as the same may fall within the spirit and scope of the invention as expressed in the accompanying claim, when broadly construed.

I claim:

In a tool of the character described, a casing having a bearing at one end and an enlarged chamber at its other end, a hand grip carried by the chambered end of the casing, a tool-carrying plunger reciprocably mounted in the bearing end of the casing, a sleeve anchored in said bearing surrounding the plunger with one end projecting into the chambered end of the casing and having its lower portion cut-away, a motor in the enlarged chamber of the casing and a drive disk connection between the motor and plunger including a disk on the shaft of the motor, said disk having a sinuous peripheral edge, with the upper side thereof projecting into the cut-away portion of said sleeve, a block on the inner end of the plunger overlying the lower cut-away portion of said sleeve, the lower side of said block having a groove therein into which said sinuous peripheral edge of the disk extends and a splined key connection between said sleeve and said plunger whereby said plunger is free to reciprocate by driving connection with said motor and is restrained from rotation in said sleeve.

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