To all whom it may concern:

Be it known that I, William Buhl, a citizen of the United States, and a resident of Flushing, in the county of Queens and State of New York, have invented an Improvement in Power-Transmitting Means, of which the following is a specification.

My invention relates to means for transmitting power, and it has for its object generally to provide a simplified and improved construction of such means whereby rotary motion may be converted into reciprocatory motion and the power incident to such rotary motion applied rectilinearly. The principle of my invention is also applicable to a construction in which rectilinear motion is converted into a rotary motion and the power applied as a result of the latter movement instead of directly from a rectilinearly moving part.

In the drawing I have illustrated and shall describe herein my invention as employed in a riveting machine, but it will be understood that it may be employed in machines of other kinds and for other purposes.

My invention is an improvement of the construction shown in United States Patent No. 878,152, issued February 14, 1908, and its object more specifically stated is to provide a simplified construction of machine of the character illustrated in the said patent.

One of the objects of my invention is to provide a construction in which the hammer which operates upon the tool, whether it be a riveting tool, a rock drill or other tool, is integral with the yoke,—the tool, however, being a separate, non-integral part.

A further object is to provide a construction in which and whereby the stroke of the hammer may be varied within certain limits without interfering with the operation of the device or machine and without in any way injuring the same; and also in which at the moment of percussion of the hammer or other member it is free or in released position with respect to the means by which it is operated and driven.

Other objects and advantages of my invention will be pointed out in the detailed description thereof which follows or will be apparent from such description.

In order that my invention may be fully understood and its practical advantages appreciated, reference should be had to the accompanying drawing in which I have illustrated a construction embodying one form of a convenient embodiment of my invention.

In the drawing:

Figure 1 is a view partly in front elevation and partly in longitudinal section, the section being taken on the line 1—1 of Fig. 3;

Fig. 2 is a view in front elevation of the machine shown in Figs. 1 and 3;

Fig. 3 is a view in side elevation of the same;

Fig. 4 is a view in front elevation of the yoke member and the crank pin and crank disk shown in Fig. 1 and indicates by dotted lines the different positions of the cam slot in the yoke member; and

Fig. 5 is an enlarged view in front elevation of a portion of the yoke, showing more clearly a detail of the construction;

Fig. 6 is a horizontal, transverse, sectional view of the machine; and

Fig. 7 is a view taken on the line 7—7 of Fig. 6 and being partly in vertical longitudinal section and partly in side elevation.

Referring to the drawing,—1 designates the main or body portion of a casing in which is situated the yoke or cam member 2 and the crank disk 3, the latter being mounted upon and being integral with the inner end of a shaft 4 supported in a bearing formed in a cover member 5 for filling and closing the opening 6 formed in the casing 1. The crank disk may be otherwise than integrally connected with the shaft 4. The casing 1 is provided with perforated lugs 7 adjacent the edges of the opening 6 therein, while the cover 5 is provided with similar lugs 8, one pair of which is shown. These lugs, when the cover is placed in position, are adapted to contact with each other as shown in Fig. 3. The lugs 7 and 8 are provided with holes or perforations through which headed bolts 9 extend for the purpose of firmly and tightly securing the cover 5 in the opening 6.

The casing 1 is provided at its upper end with flange portions 10 forming a seat for a motor 11. The cover 5 is provided with a
casing 12 within which is inclosed the gear mechanism by means of which the shaft 4 is driven from the shaft of the motor 11.

The opposite edges of the yoke 2 are situated in guide grooves 15 oppositely disposed in the casing 1. The yoke is provided with an integral stem or connecting bar portion 20 to the lower end of which is connected, preferably integrally, a hammer or other tool 21 provided with a number of longitudinal grooves 22 in its surface. The hammer is adapted to operate reciprocally in a guiding tubular portion 23 which preferably is integral with and projects from the casing 1. As shown in the drawing, the portion 23 is of considerably less diameter than the casing in which the yoke 2 operates.

The yoke 2 is provided with a quadrantal shaped cam slot 25 into which extends a crank pin 27 rigidly secured to the crank disk 3 which revolves with uniform speed. A cylindrical sleeve 26 is rotatably mounted upon the crank pin 27 and adapted to contact with the sides of the cam slot 25.

It will, of course, be understood that the shape or form and direction of the cam slot 25 in and with respect to the yoke 2 may be varied without departing from the principle of my invention.

Movement of the crank pin 27 in a circle as indicated in Fig. 4 of the drawing causes said pin to assume different positions in the cam slot 25 to effect reciprocatory movement of the yoke 2 and the hammer 21 having rigid connection therewith.

In order that access may be had readily to the interior of the casing for the purpose of changing or renewing the bearing sleeve 26, if occasion to do so should arise, and also in order to provide means for retaining the said sleeve in position upon the crank pin 27, I have provided a relatively large opening 30 in the front side of the casing which is adapted to be closed by a hollow plug 31.

In order to retain the plug in position within the opening, I have provided oppositely disposed pins 32 which project through the walls thereof and which are held in projecting position normally by an intermediate coiled spring 33. The outer ends of these pins 32 contact with inclined surfaces 34 upon the inner side of the casing 1 adjacent the edge of the opening 30.

It will be seen that the contact of the outer ends of the yielding pins 32 with the inclined surfaces 34 retains the closing plug 31 in position but that it may be readily removed by an outward pull thereupon. The inner annular edge of the plug 31 occupies a position such that at all times some portion thereof contacts with the sleeve 26 so as to hold the same in position in the cam slot 25.

In order to assure that the sleeve 26 and the surfaces of the cam slot are at all times lubricated, it is not only desirable that the casing formed by the parts 1 and 5 contain a lubricant, but also such lubricant should fill the hollow plug 31 so as to apply the lubricant directly to the front face of the sleeve 26.

Rotation of the crank disk, as above stated, causes reciprocatory movement of the yoke 2 and the hammer 21. The hammer 21 is adapted to strike the upper end of a reduced stem portion 40 of a tool 41, which may be a riveting tool, a rock drill or other tool. The stem 40 extends through a bushing 42 which is fitted in a reduced opening 43 formed in the lower end of the guiding tubular portion 23. The upper end of the said bushing is provided with a flange 45 seated upon a shoulder 46 intermediate the reduced opening 43 and the larger opening in the tubular portion 23.

It will be noted that the upper end of the stem 40 of the tool 41 projects above the upper end of the bushing 42. The presence of the bushing 42 is to protect the tubular extended portion 23 in case the machine should be operated without the presence of the stem 40, or in case the said stem should be too short to prevent the hammer from striking against the shoulder 46.

It is noted that the hammer 21 fits somewhat closely the opening in the tubular projection 23 in which it operates. It has been found that without the presence of the grooves 22 in the hammer or some means whereby constant communication is maintained between the interior of the casing 1 and the interior of the tubular portion 23 the apparatus will not operate satisfactorily. One reason for this is that upon the down stroke of the hammer the air between the bottom of the hammer and the bottom of the chamber or opening of the tube, and the top of the tool stem 40 is compressed and retards the downward stroke of the same or may prevent it altogether. The presence of the grooves 22, however, prevents the retention and compression of air or other fluid in the space underneath the hammer and therefore obviates the difficulty mentioned. It will be understood that the same result may be obtained by providing grooves in the inner side of the wall of the reduced tubular part 23.

It is apparent that the lengths of the stems 40 of different tools may vary somewhat so that the positions of the upper ends thereof with respect to the yoke 2 or with respect to the shoulder or abutment 46 may be varied somewhat.

In other words, if the stem 40 of one tool should be somewhat longer than a corresponding stem of another tool, it is apparent that the upper end thereof would occupy a position somewhat nearer to the yoke 2; or
if such stem should be shorter, it is apparent that the upper end would occupy a position farther away from the said yoke. It is apparent, therefore, that means should be provided whereby the descending or striking movement of the yoke and the hammer connected therewith may be interrupted at different points nearer to or farther away from the axis or center of movement of the crank pin 27 and block 26 carried thereby without interfering with the operation of the device. The means employed by me for that purpose consists in the straightening out or flattening of the upper portion of the outer wall or side of the cam slot 25 as indicated by the letter a. When thus flattened out, instead of continuing curved and in parallel relation to the inner wall of the said slot, a certain amount of play of the block 26 or its equivalent and relative sliding movement between the same and the yoke 2 is permitted when the said block is in the upper end portion of the said slot. Such play also is permitted by the enlargement of the upper end of the slot as indicated at 50. The inner or lower end of the slot is also enlarged as indicated at 51.

Assuming that the stem 40 of a tool is shorter than usual or that it should have been partially removed from the lower end of the tubular member 23 so that in making its stroke the hammer 21 and yoke 2 move through a greater distance than normal or usual,—The said yoke is permitted to move under the inertia of its momentum beyond the position to which it is actually forced by the crank pin 27, so that the said yoke actually has a sliding movement or a bodily relative movement with respect to the said sleeve. At such time if the upper end portion of the outer side wall of the slot 25 were not flattened out as indicated so as to permit a certain amount of play of the sleeve 26 therein, a binding action would take place and in all likelihood would cause some injury to the machine. On the other hand, assuming that the stem is slightly longer than normal or usual so that the downward or striking movements of the hammer 21 and yoke 2 are interrupted before they have reached the point to which they are normally, positively driven by action of the sleeve 26 in the cam slot 25, it is apparent that there must be a certain amount of play or relative sliding movement between the sleeve 26 and the walls of the said slot, otherwise a binding action would take place which would interfere with the smooth, satisfactory working of the device.

At the moment of percussion or striking of the hammer 21 or other member having connection with the yoke 2, the crank pin 27 and its bearing sleeve 26 are situated in the portion of the cam slot 25, one side of which is bounded and formed by the straight portion a so that at such moment the said crank pin is in released relation with respect to the yoke 2, and consequently with respect to the hammer 21 or other member operated thereby. By reason of the fact that at the moment of percussion or striking of the hammer 21 or other member having connection with and being operated by the yoke 2, the crank pin 27 is situated adjacent the lower end of that portion of the cam slot 25 having the straight outer side portion a in tangential relation to the adjoining part of the quadrant portion of the cam contour, the said crank pin is wholly free from the shock of the hammer blow or the blow of any other member which may be substituted therefor. The crank pin thus being at the moment of percussion released from the yoke 2 and being free to move independently thereof, and being thereby free from the re-action effect of the blow or striking of the hammer or other member, the operator of the device or tool is not subjected to the severe jolting which is characteristic of the operation of pneumatic hammers.

By the provision of the flattened upper end portion of the outer wall of the cam slot 25, I am enabled to rigidly and firmly secure the crank pin 27 to the crank disk 3 and still operate the device successfully and efficiently with the advantages above pointed out.

It will be understood and observed that the yoke 2 and parts connected with and operated thereby are lifted relatively slowly, the lifting movement taking place during practically two-thirds of a revolution of the crank pin 27, while the striking movement of the cam member 2 is effected during substantially a movement of one-third of a revolution of the said crank pin. Referring to Fig. 4 of the drawing, it will be noted that the striking movement of the cam member 2 is effected by the movement of the crank pin 27 from substantially the full line position shown in that figure to the first dotted line position thereof shown to the right in said figure. The return or lifting movement of the cam member 2 occurs as the result of movement of the crank pin 27 toward the left from the last mentioned dotted line position to the full line position.

I claim:

1. In combination, a yoke having a curved cam slot therein, a hammer having connection with said yoke, a crank pin extending into said cam slot, the said crank pin and said slot having relative reciprocatory motion with respect to each other, the outer wall of said slot at the region thereof corresponding to the uppermost portion which is reached by the said pin being flattened as described, and a revoluble crank for supporting the said crank pin.
2. In combination, a yoke having a curved cam slot therein, the curvature of the outer wall discontinuing at its upper end prior to the discontinuance of the curvature of the corresponding portion of the inner wall, a crank pin projecting into the said cam slot and provided with a pivoted bearing member for engaging the walls of said slot, and a revolvable support for said crank pin.

3. In a power transmitting device, the combination of a casing, a yoke situated in and guided in its reciprocatory movements by said casing, said yoke having a quadrantal shaped cam slot therein, the curvature of the upper end portion of the outer wall of said slot terminating at a point below the termination of the curvature of the upper end portion of the inner wall of said slot, a crank pin extending into the said slot, and means for causing revolvable movement of said crank pin to effect reciprocatory movement of the said yoke, substantially as described.

4. In a device of the character described, the combination of a power driven crank, a percussion tool, and a cam member for actuating said tool, said member having a cam contour in engagement with the said crank, the said cam contour being made up of a curved part which converts the uniform rotary crank motion into a quick-return percussive motion and a part having a straight side whereby the said crank is released from percussive re-action.

5. In a device of the character described, the combination of a power driven crank, a cam member operated thereby, a device actuated by the said cam member, the said cam member being provided with a cam contour proportioned to translate the rotary motion of the crank into a reciprocating quick-return motion on the part of the said cam member and the said cam contour from the point at which the said crank is situated at the moment of impact of the device being continued in a path parallel to the path of movement of said device.

6. In a device of the character described, the combination of a power driven crank, a tool, a cam member interposed between the said crank and said tool and having operative connection with each and the said cam member having a quadrantal shaped cam contour proportioned to translate the rotary motion of the said crank into a reciprocating quick-return motion of the said tool, and the outer side of the said cam contour being continued in a straight line whereby the said crank is released from percussive re-action at the impact end of the stroke of the said tool.

7. In a device of the character described, the combination of a motor driven crank, a tool, a cam actuated by the said crank to operate the said tool, said cam having a quadrantal cam slot proportioned to translate the rotary motion of the said crank into a reciprocating quick-return movement of the said cam member and the said cam contour having a part which is parallel to the path of motion of said tool whereby at the moment of impact of said tool the said crank is in released relation with respect to the said cam member, substantially as described.

8. In a device of the character described, the combination of a motor driven crank, a tool, a cam member interposed between the said crank and the said tool, said member being provided with a curved cam contour proportioned to convert the rotary motion of the crank into a reciprocating quick-return movement of the said cam member and the tool having connection therewith and which is provided with a straight cam path within which the crank is situated when the said tool reaches the end of its striking movement, said straight path permitting variation in the length of the tool stroke.

9. In a device of the character described, the combination of a cam member provided with a curved cam contour, a crank pin in engagement with said cam contour, means for supporting and revolving said crank pin to effect reciprocatory movement of said cam member, a tool having connection with and being actuated by said cam member, and the said cam member being provided with means whereby said crank pin is in released relation with respect thereto at the moment of impact of the said tool.

10. In combination, a cam member having a curved cam slot therein, a crank pin projecting into the said cam slot, and means for causing revolution of the said crank pin to effect reciprocatory motion of the said cam member, and the upper portion of the said cam slot being enlarged to permit relative sliding movement between the said crank pin and the said cam member whereby the length of stroke of the latter may be varied without interfering with the movements of the said crank pin.

In testimony that I claim the foregoing as my invention, I have hereunto set my hand this 25th day of November, A. D. 1918.

WILLIAM BUHL.