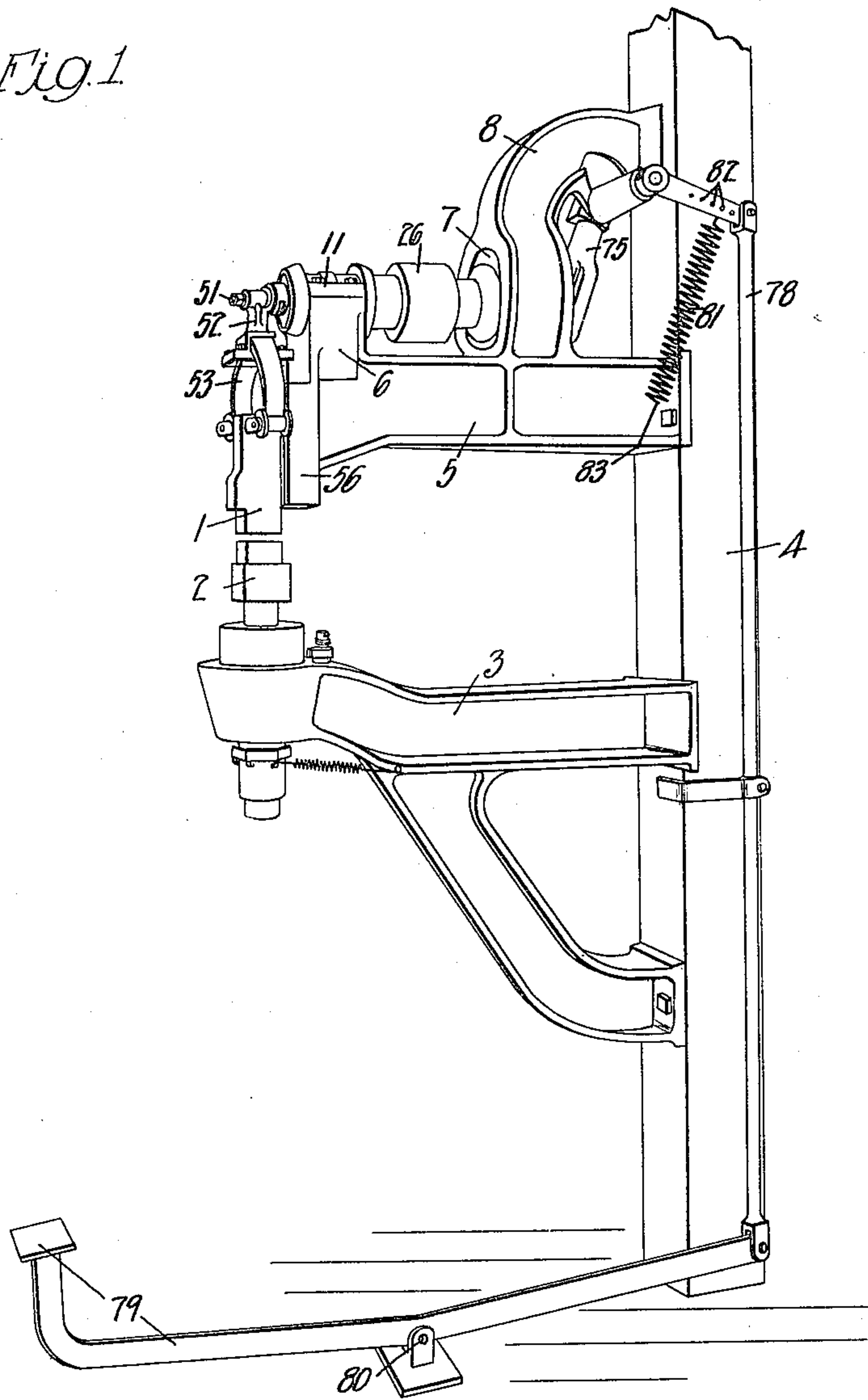


1,154,667.

H. C. SMITH.  
POWER HAMMER.  
APPLICATION FILED NOV. 20, 1914.

Patented Sept. 28, 1915.  
3 SHEETS—SHEET 1.

Fig. 1



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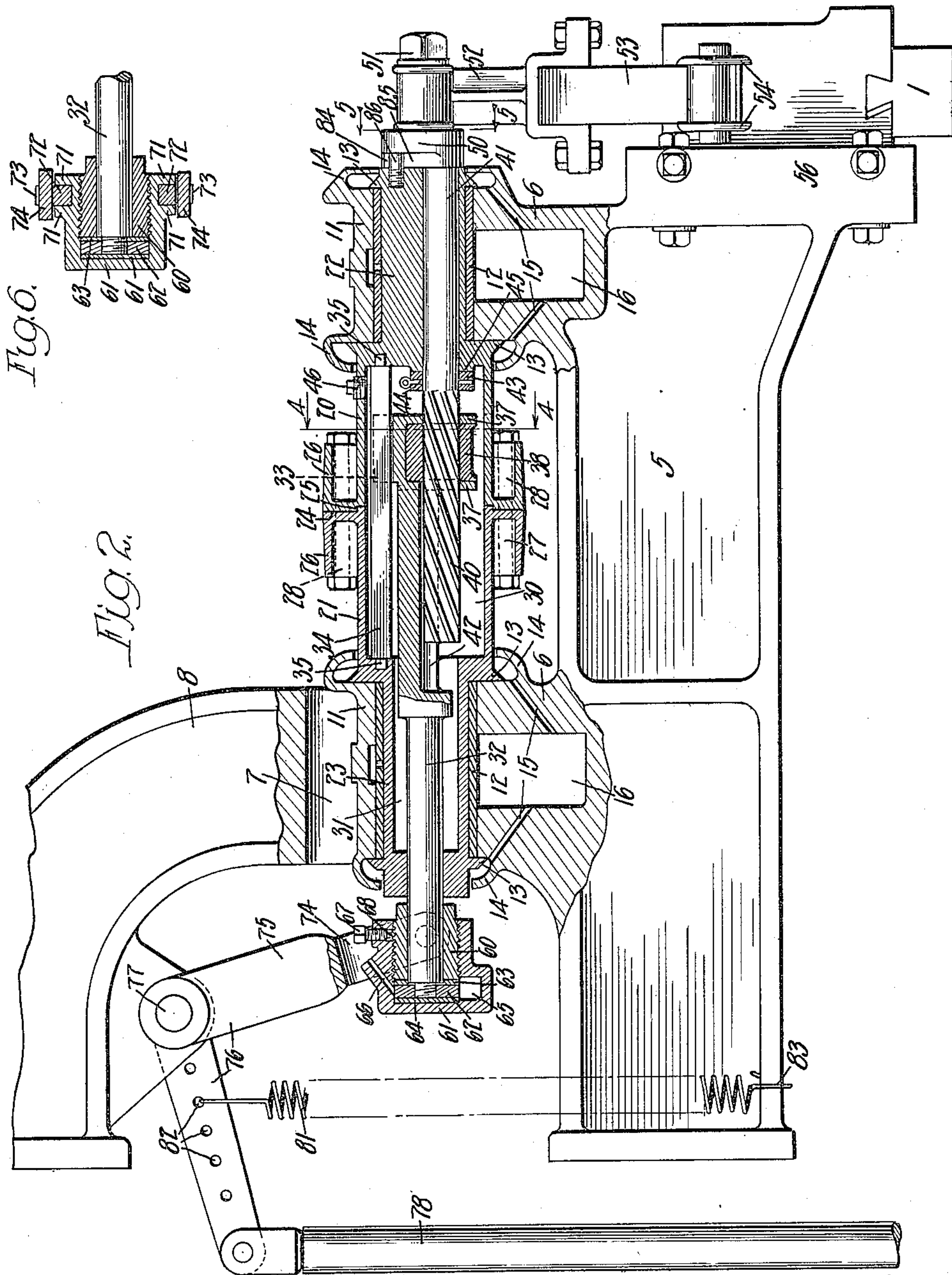
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3 SHEETS—SHEET 3.

Fig. 3.

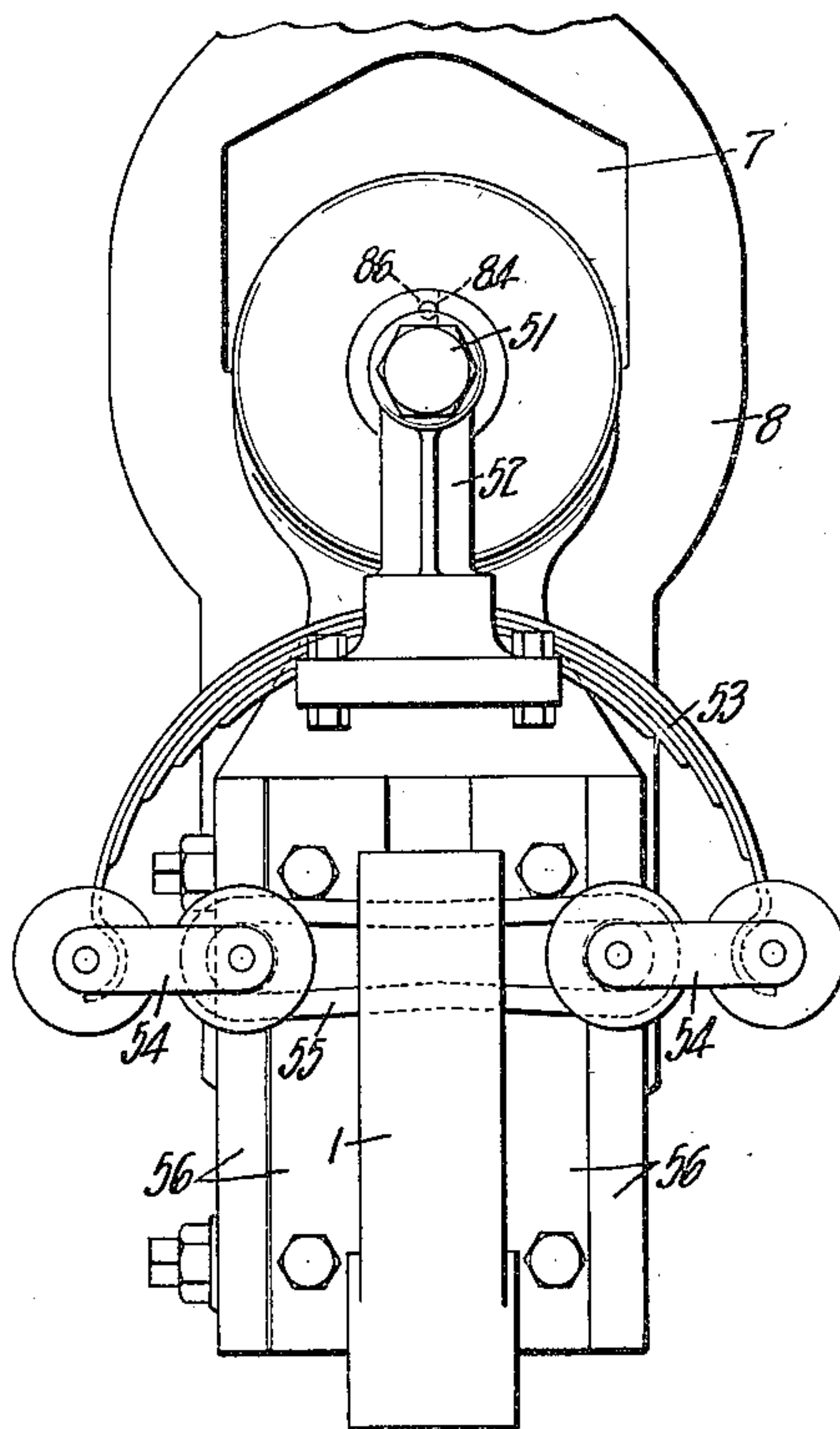


Fig. 4.

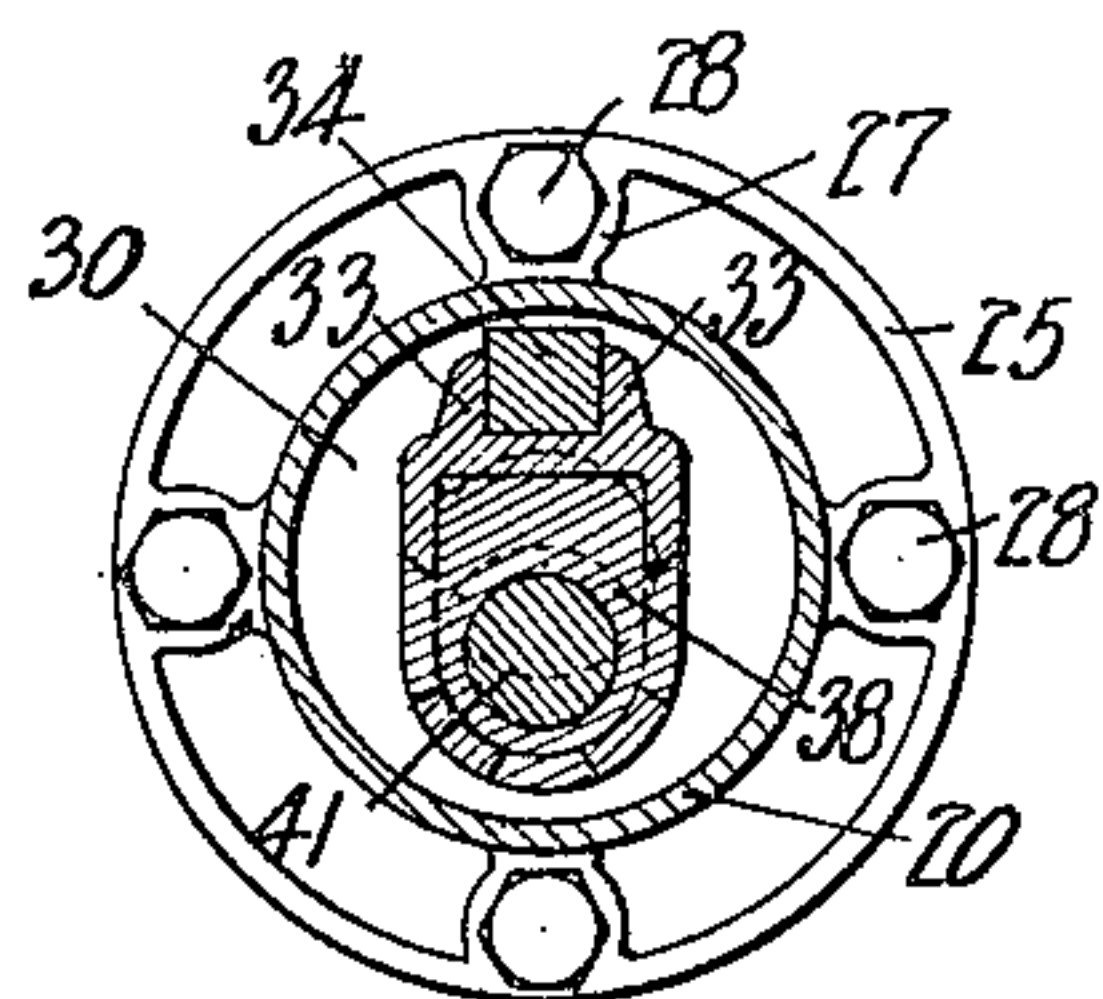
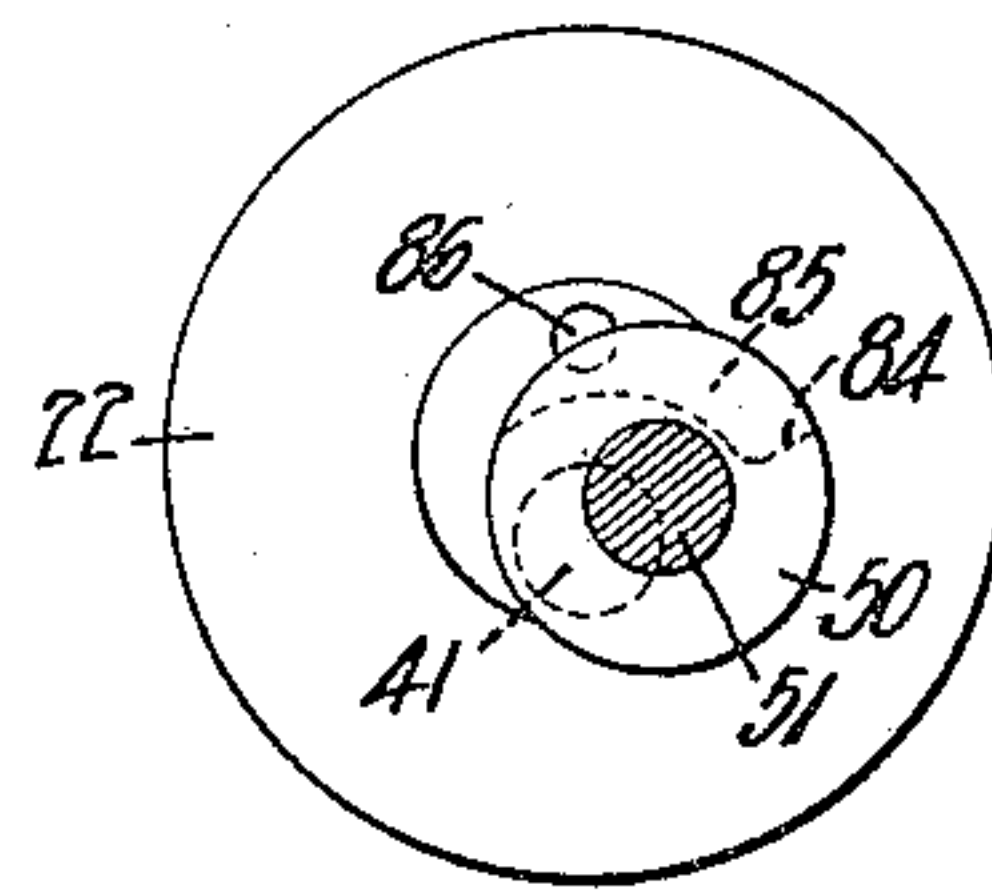


Fig. 5.



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# UNITED STATES PATENT OFFICE.

HENRY COLLIER SMITH, OF DETROIT, MICHIGAN.

## POWER-HAMMER.

1,154,667.

Specification of Letters Patent.

Patented Sept. 28, 1915.

Application filed November 20, 1914. Serial No. 873,114.

*To all whom it may concern:*

Be it known that I, HENRY COLLIER SMITH, a citizen of the United States, and a resident of Detroit, in the county of Wayne and State of Michigan, have invented a new and Improved Power-Hammer, of which the following is a specification.

This invention relates to power hammer and other blow-striking devices, and some of its objects are to provide means whereby the stroke of the hammer may be varied while the driving shaft is in motion; to provide means for automatically causing the stroke to become zero when the operator leaves the machine or ceases to control the hammer; and to improve the construction of the machine generally.

This invention consists in a hammer or other blow-striking device comprising a rotatable driving shaft, a crank shaft carried thereby and rotatable in respect thereto, the axis of the crank shaft being offset from that of the driving shaft, a crank pin carried by the crank shaft and arranged to drive a hammer, and a manually actuated member movable longitudinally of the crank shaft whereby the latter is caused to rotate and the stroke of the hammer to be varied.

It also consists in means for causing the axis of the crank pin to coincide with that of the driving shaft whenever the operator leaves the machine or ceases to operate the manually controlled means.

It further consists in the details of construction shown, described and particularly pointed out in the subjoined claims.

In the drawings, Figure 1 is a perspective view showing one embodiment of my invention. Fig. 2 is a vertical longitudinal section of the hammer actuating mechanism. Fig. 3 is a fragmentary front elevation of the hammer with the actuating mechanism in normal position; that is, in position such that no stroke is imparted to the hammer. Fig. 4 is a section on the line 4—4 of Fig. 2. Fig. 5 is a section on the line 5—5 of Fig. 2. Fig. 6 is a fragmentary horizontal section showing the manner of connecting the bell crank to the longitudinally slidable member in the driving shaft.

Similar reference characters refer to like parts throughout the several views.

In the present embodiment of my invention, the hammer 1 is shown in position to act upon an anvil 2 carried by a bracket 3, the construction of which is immaterial. Lo-

cated above the anvil bracket and secured to the post 4 or other support in any suitable manner is a hammer bracket 5, that includes the spaced bearing boxes 6, the inner of which may be adjacent an opening 7 in an upstanding arm 8 of the bracket. These boxes are supplied with caps 11 that serve to retain the bushings 12, in which a rotatable driving shaft, the details of which will be pointed out later, is mounted. The bearings may be of the ring-oiling type (the rings not being shown); and the pulley shaft is preferably provided with the circumferential flanges 13, the function of which is to direct lubricant that has passed through the bearings into the annular cups 14 at each end thereof. From the cups the lubricant flows through passages 15 back into the wells 16 of the bearing boxes.

The pulley shaft preferably comprises a front section 20 and a rear section 21 the opposite ends of which may be reduced to form the bearing portions 22 and 23, respectively, that rest in the bushings 12. The adjacent ends of the sections are faced at 24 and shouldered at 25, and may include the half pulley sections 26, spaced apart laterally from the main portion of the corresponding shaft-section and connected thereto at intervals by the perforated bosses 27. Through the latter the bolts 28, that secure the pulley sections rigidly together, pass. It will be understood that the pulley may be formed in various ways, that described being preferred since it results in a considerable saving of material. The adjacent ends of the pulley sections are hollowed out to form a chamber 30 that may be extended into the bearing portion 23 as indicated at 31.

Axially aligned with the pulley shaft and passing through the rear end thereof is a longitudinally shiftable rod 32, the front end of which may be provided with the guides 33 (Figs. 2 and 4) that embrace the key 34, the ends 35 of which are preferably supported in depressions in the wall of the chamber 30. The purpose of the guides and key is to prevent rotary movement of the rod 32 in respect to the pulley shaft. The rod is provided at its forward end with the spaced cross-walls 37, between which may be poured a Babbitt filling 38, having threads that engage with the threads 40 on the rotatable crank shaft 41, supported in a bearing formed in the portion 22 of the pulley shaft. One side of the rod 32 may



be hollowed out as indicated at 42 to allow the crank shaft to be nested therein. Forward longitudinal movement of the crank shaft through the bearing is prevented by the collar 43, that may be connected to it by the pin 44 and is in engagement with the face of a boss 45 formed on the wall of the chamber 30. In use the chamber 30-31 is preferably filled with lubricant which may be poured in through an opening provided with a plug 46 in alinement with the pin 44, this arrangement allowing a ready manipulation of the pin in assembling the parts.

It will be particularly noted that the axis of the crank shaft is offset somewhat from that of the pulley shaft. The outer end of the crank shaft has formed integrally therewith, or rigidly secured thereto, the crank arm 50 from which the crank pin 51 projects, the axis of the crank pin being offset from that of the crank shaft the same amount that the axis of the crank shaft is offset from the axis of the pulley shaft (Fig. 5). It will therefore be seen that at one point in the rotative movement of the crank shaft in respect to the pulley shaft the axis of the crank pin will be in coincidence with that of the pulley shaft, at which time the crank pin will be given no stroke; and that at all other points the crank pin will be given a stroke, the length of which depends on the angular displacement of the crank shaft in respect to the pulley shaft at the particular instant, and the maximum of which is equal to twice the amount the axis of the crank shaft is offset from that of the pulley shaft. The rotation of the crank shaft is, of course, caused by longitudinal movement of the rod 32. The crank pin 51 supports the connecting rod 52 bearing the leaf spring 53 from which may be suspended, by means of the loops 54 and strap 55, or in any other desired manner, the hammer 1, that may be guided in its reciprocatory movement by any suitable means 56.

The rod 32 may be moved longitudinally by mechanism, the particular construction of which will now be pointed out: The rear cylindrical end of the rod is received in the bore of a screw plug 60, threaded into a cavity formed in a housing 61; and the extreme rear end is preferably reduced and has threaded thereon the collar 62, between which and the plug and housing the hard washers 63 and 64, respectively, may be interposed. The housing may be provided with the oil well 65 and oil passage 66, and the plug 60 may have its outer end formed to allow the application of a wrench whereby it may be adjusted in the housing. A set screw 67 may be threaded into the housing and preferably bears against a soft metallic filler 68 whereby the plug is secured in any position of angular adjustment. Upon opposite sides of the housing are

formed the guides 71 (Fig. 6) between which the vertically slidable members 72 bearing the pins 73 are guided. These pins are received in openings formed in the divided end 74 of the arm 75 of a bell-crank 76 that may swing about the pivot 77. The other arm of the bell-crank is preferably pivotally connected to the link 78, the lower end of which is in turn pivoted to the treadle 79 mounted on the fulcrum 80. It will be noticed that when pressure is applied to the foot-piece of the treadle the rod 32 is pulled outwardly whereby the crank arm 50 will be swung in clockwise direction (Fig. 5) to carry the crank pin 51 away from the axis of the pulley shaft. Should the foot of the operator be removed from the treadle, the rod 32 is immediately thrust forwardly by the tension spring 81, one end of which may pass through any one of the holes 82 in the bell crank, the other being preferably anchored to the bracket at 83. The forward movement of the rod causes the crank arm to turn in counterclockwise direction (Fig. 5), the amount of which is limited by the wall 84 of a groove 85 therein coming into contact with a pin 86 threaded or otherwise rigidly connected to the end of the pulley shaft. These parts are preferably so arranged as to come into mutual engagement only when the crank pin is in alinement with the axis of the pulley shaft, or when the stroke of the crank pin is zero. It will therefore be seen that when no pressure is applied to the treadle, the crank pin is automatically held in position such that no stroke is imparted to the hammer, and that the length of the stroke may be varied at will while the driving shaft is rotating.

It is clear that many changes may be made in the details of construction without departing from the spirit of my invention. For example, the nut may be arranged on the crank shaft instead of on the longitudinally movable rod. It is also clear that the invention is applicable to blow-striking machines other than those usually known as hammers, for instance, to percussion drills. I do not, therefore, wish to be limited otherwise than as indicated in the subjoined claims.

I claim:—

1. A device for striking blows comprising a rotatable driving shaft, means for applying force to the driving shaft to cause it to rotate, a crank shaft supported thereby and rotatable in respect thereto, the axis of said crank shaft being parallel to and offset from that of said driving shaft, a member movable longitudinally of the driving shaft, said member and said crank shaft being so arranged that longitudinal movement of the member causes rotative movement of the crank shaft, a crank pin carried by said crank shaft, the axis of said pin being offset



from the axis of the crank shaft, a blow-striking member operatively connected to said crank pin, and manually operable means for moving the longitudinally movable member while the driving shaft is rotating whereby the axis of the crank pin is caused to recede from that of the driving shaft to increase the stroke of the blow-striking member.

2. A device for striking blows comprising a rotatable driving shaft, means for applying force to the driving shaft to cause it to rotate, a crank shaft supported thereby and rotatable in respect thereto, the axis of said crank shaft being parallel to and offset from that of said driving shaft, a member movable longitudinally of the driving shaft, said member and said crank shaft being so arranged that longitudinal movement of the member causes rotative movement of the crank shaft, a crank pin carried by said crank shaft, the axis of said pin being offset from the axis of the crank shaft, a blow-striking member operatively connected to said crank pin, manually operable means for moving the longitudinally movable member while the driving shaft is rotating whereby the axis of the crank pin is caused to recede from that of the driving shaft to increase the stroke of the blow-striking member, and means for normally holding the crank pin in position such that its axis is aligned with that of the driving shaft.

3. A device for striking blows comprising a rotatable driving shaft, means for applying force to the driving shaft to cause it to rotate, a crank shaft supported thereby and rotatable in respect thereto, the axis of said crank shaft being parallel to and offset from that of said driving shaft, a member movable longitudinally of said driving shaft and rotatable therewith, said member and said crank shaft being so arranged that longitudinal movement of the member causes rotative movement of the crank shaft, a crank pin carried by said crank shaft, the axis of said pin being parallel to the axis of said crank shaft and offset therefrom the same distance the axis of the crank shaft is offset from the axis of the driving shaft, a blow-striking member operably connected to the crank pin, means tending to move the longitudinal movable member in one direction to cause the axis of the crank pin to approach that of the driving shaft, means for limiting the movement of the crank pin in the direction stated, and manually operable means for moving the longitudinally movable member in the opposite direction while the driving shaft is rotating whereby the axis of the crank pin is caused to recede from that of the driving shaft and the stroke of the blow-striking member is increased.

4. A device for striking blows compris-

ing a rotatable driving shaft having a chamber formed therein, means for applying force to the driving shaft to cause it to rotate, a crank shaft supported thereby and rotatable in respect thereto, the axis of said crank shaft being parallel to and offset from that of said driving shaft, a rod movable longitudinally of said driving shaft and rotatable therewith, the rod and crank shaft including inter-engaging surfaces located in the chamber and so arranged that longitudinal movement of the rod causes rotative movement of the crank shaft, a crank pin carried by the crank shaft, the axis of said pin being parallel to the axis of said crank shaft and offset therefrom the same distance the axis of the crank shaft is offset from the axis of the driving shaft, a blow-striking member operably connected to the crank pin, means tending to move the rod in one direction to cause the axis of the crank pin to approach that of the driving shaft, means for limiting the movement of the crank pin in the direction stated, and manually operable means for moving the rod in the opposite direction while the driving shaft is in rotation whereby the axis of the crank pin is caused to recede from that of the driving shaft and the stroke of the blow-striking member is increased.

5. A device for striking blows comprising a rotatable driving shaft having a chamber formed therein, means for applying force to the driving shaft to cause it to rotate, a crank shaft supported thereby and rotatable in respect thereto, the axis of said crank shaft being parallel to and offset from that of said driving shaft, a rod movable longitudinally of said driving shaft and rotatable therewith, the rod and crank shaft including interengaging surfaces located in the chamber and so arranged that longitudinal movement of the rod causes rotative movement of the crank shaft, a crank pin carried by the crank shaft, the axis of said pin being parallel to the axis of said crank shaft and offset therefrom the same distance the axis of the crank shaft is offset from the axis of the driving shaft, a blow-striking member operably connected to the crank-pin, means connected to the rear end of said rod, in respect to which the rod is rotatable, for imparting longitudinal movement to the rod, means tending to move the last mentioned means in one direction whereby the axis of the crank-pin is caused to approach that of the driving shaft, means for limiting the movement of the crank-pin in the direction stated, and manually operable means for moving the rod in the opposite direction while the driving shaft is in rotation, whereby the axis of the crank-pin is caused to recede from that of the driving shaft and the stroke of the blow-striking member is increased.



6. A device for striking blows comprising a rotatable driving shaft having a chamber formed therein, means for applying force to the driving shaft to cause it to rotate, a crank shaft supported thereby and rotatable in respect thereto, the axis of said crank shaft being parallel to and offset from that of said driving shaft, a rod movable longitudinally of said driving shaft and rotatable therewith, the rod and crank shaft including interengaging surfaces located in the chamber and so arranged that longitudinal movement of the rod causes rotative movement of the crank-shaft, a crank-pin carried by the crank shaft, the axis of said pin being parallel to the axis of said crank shaft and offset therefrom the same distance the axis of the crank shaft is offset from the axis of the driving shaft, a blow-striking member operably connected to the crank-pin, a housing in which the rear end of the rod is received and in respect to which the rod is rotatable, a collar on the rod and inclosed by the housing, an adjustable plug in the housing and adapted to exert pressure on the collar to take up longitudinal movement of the rod in the housing, means tending to move the housing in one direction whereby the axis of the crank-pin is caused to approach that of the driving shaft, means for limiting the movement of the crank-pin in the direction stated, and manually operable means for moving the housing in the opposite direction while the driving shaft is in rotation, whereby the axis of the crank-pin is caused to recede from that of the driving shaft and the stroke of the blow-striking member is increased.

7. A device for striking blows comprising a rotatable driving shaft having a chamber formed therein, means for applying force to the driving shaft to cause it to rotate, a crank shaft supported thereby and rotatable in respect thereto, the axis of said crank shaft being parallel to and offset from that of said driving shaft, a rod movable longitudinally of said driving shaft, a key contacting with the rod and serving to prevent the rod from rotating in respect to the driving shaft, the rod and the crank shaft including inter-engaging threads located in the chamber and so arranged that longitudinal movement of the rod causes rotative movement of the crank shaft, a crank-pin carried by the crank shaft, the axis of said pin being parallel to the axis of said crank shaft and offset therefrom the same distance the axis of the crank shaft is offset from the axis of the driving shaft, a blow-striking member operably connected to the crank-pin, means tending to move the rod in one direction to cause the axis of the crank-pin to approach that of the driving shaft, means for limiting the movement of the crank-pin in the direction stated, and manually operable means for moving the rod in the opposite direction while the driving shaft is in rotation whereby the axis of the crank-pin is caused to recede from that of the driving shaft and the stroke of the blow-striking member is increased.

erale means for moving the rod in the opposite direction while the driving shaft is in rotation whereby the axis of the crank-pin is caused to recede from that of the driving shaft and the stroke of the blow-striking member is increased.

8. A device for striking blows comprising a rotatable driving shaft having a chamber formed therein, means for applying force to the driving shaft to cause it to rotate, a crank shaft supported thereby and rotatable in respect thereto, the axis of said crank shaft being parallel to and offset from that of said driving shaft, means for preventing longitudinal movement of the crank shaft in the driving shaft, a rod movable longitudinally of said driving shaft and rotatable therewith, the rod and crank shaft including inter-engaging surfaces located in the chamber and so arranged that longitudinal movement of the rod causes rotative movement of the crank shaft, a crank-pin carried by the crank shaft, the axis of said pin being parallel to the axis of said crank shaft and offset therefrom the same distance the axis of the crank shaft is offset from the axis of the driving shaft, a blow-striking member operably connected to the crank-pin, means tending to move the rod in one direction to cause the axis of the crank-pin to approach that of the driving shaft, means for limiting the movement of the crank-pin in the direction stated, and manually operable means for moving the rod in the opposite direction while the driving shaft is in rotation whereby the axis of the crank-pin is caused to recede from that of the driving shaft and the stroke of the blow-striking member is increased.

9. A device for striking blows comprising a rotatable driving shaft having a chamber formed therein, means for applying force to the driving shaft to cause it to rotate, a crank shaft supported thereby and rotatable in respect thereto, the axis of said crank shaft being parallel to and offset from that of said driving shaft, means for preventing longitudinal movement of the crank shaft in the driving shaft, a rod movable longitudinally of said driving shaft, means for preventing the rod from rotating in respect to the driving shaft, the rod and crank shaft including inter-engaging surfaces located in the chamber and so arranged that longitudinal movement of the rod causes rotative movement of the crank shaft, a crank-pin carried by the crank shaft, the axis of said pin being parallel to the axis of said crank shaft and offset therefrom the same distance the axis of the crank shaft is offset from the axis of the driving shaft, a blow-striking member operably connected to the crank pin, means tending to move the rod in one direction to cause the axis of the crank-pin to approach that of the driving shaft, means



for limiting the movement of the crank-pin in the direction stated, and manually operable means for moving the rod in the opposite direction while the driving shaft is in rotation whereby the axis of the crank-pin is caused to recede from that of the driving shaft and the stroke of the blow-striking member is increased.

10. A device for striking blows comprising a rotatable driving shaft having a chamber formed therein, means for applying force to the driving shaft to cause it to rotate, a crank shaft supported thereby and rotatable in respect thereto, the axis of said crank shaft being parallel to and offset from that of said driving shaft, a rod movable longitudinally of said driving shaft and rotatable therewith, the rod and crank shaft including inter-engaging surfaces located in the chamber and so arranged that longitudinal movement of the rod causes rotative movement of the crank shaft, a crank arm and crank pin carried by the crank shaft, the axis of said pin being parallel to the axis of said crank shaft and offset therefrom the same distance the axis of the crank shaft is offset from the axis of the driving shaft, a blow-striking member operably connected to the crank pin, means tending to move the rod in one direction to cause the axis of the crank pin to approach that of the driving shaft, said crank arm and driving shaft constituting two members, a projection on one of the members arranged to contact with a surface on the other member for limiting the movement of the crank pin in the direction stated, and manually operable means for moving the rod in the opposite direction while the driving shaft is in rotation whereby the axis of the crank pin is caused to recede from that of the driving shaft and the stroke of the blow-striking member is increased.

11. A device for striking blows comprising a rotatable driving shaft having an inclosed chamber formed therein, means for applying force to the driving shaft to cause it to rotate, a crank shaft supported thereby and rotatable in respect thereto, the axis of said crank shaft being parallel to and offset from that of said driving shaft, a rod movable longitudinally of said driving shaft and rotatable therewith, the rod and crank shaft including inter-engaging surfaces located in the chamber and so arranged that longitudinal movement of the rod causes rotative movement of the crank shaft, a crank pin carried by the crank shaft, the axis of said pin being parallel to the axis of said crank shaft and offset therefrom the same distance the axis of the crank shaft is offset from the axis of the driving shaft, a blow-striking member operably connected to the crank pin, means tending to move the rod in one direction to cause the axis of the

crank pin to approach that of the driving shaft, means for limiting the movement of the crank pin in the direction stated, manually operable means for moving the rod in the opposite direction while the driving shaft is in rotation whereby the axis of the crank pin is caused to recede from that of the driving shaft and the stroke of the blow-striking member is increased, said driving shaft having an opening leading to the chamber therein through which lubricant may be supplied, and a removable plug for said opening.

12. A device for striking blows comprising a rotatable driving shaft having a chamber formed therein, means for applying force to the driving shaft to cause it to rotate, a crank shaft supported thereby and rotatable in respect thereto, the axis of said crank shaft being parallel to and offset from that of said driving shaft, a rod movable longitudinally of said driving shaft and rotatable therewith, the rod and crank shaft including inter-engaging surfaces located in the chamber and so arranged that longitudinal movement of the rod causes rotative movement of the crank shaft, a crank pin carried by the crank shaft, the axis of said pin being parallel to the axis of said crank shaft and offset therefrom the same distance the axis of the crank shaft is offset from the axis of the driving shaft, a blow-striking member operably connected to the crank-pin, a housing connected to the rear end of said rod, in respect to which the rod is rotatable, for imparting longitudinal movement to the rod, a guide arranged transversely of the housing, a member slidable in the guide, a lever having one arm in proximity to the slidable member, said member and said arm being pivotally connected, means tending to move the lever in one direction whereby the axis of the crank pin is caused to approach that of the driving shaft, means for limiting the movement of the crank pin in the direction stated, and manually operable means for moving the lever in the opposite direction while the driving shaft is in rotation, whereby the axis of the crank pin is caused to recede from that of the driving shaft and the stroke of the blow-striking member is increased.

13. A device for striking blows comprising a rotatable driving shaft, means for applying force to the driving shaft to cause it to rotate, a crank shaft supported thereby and rotatable in respect thereto, the axis of said crank shaft being parallel to and offset from that of said driving shaft, a member movable longitudinally of the driving shaft, said member and said crank shaft being so arranged that longitudinal movement of the member causes rotative movement of the crank shaft, a crank pin carried by said crank shaft, the axis of said pin being off-



set from the axis of the crank shaft, a blow-  
striking member operatively connected to  
said crank pin, and arranged to reciprocate  
in a radial plane passing through the axis of  
5 the driving shaft, means for guiding the  
blow-striking member in its reciprocation,  
and manually operable means for moving  
the longitudinally movable member while  
the driving shaft is rotating whereby the  
10 axis of the crank pin is caused to recede  
from that of the driving shaft to increase  
the stroke of the blow-striking member.

14. A device for striking blows compris-  
ing a rotatable driving shaft, means for ap-  
15 plying force to the driving shaft to cause it  
to rotate, a crank shaft supported thereby  
and rotatable in respect thereto, the axis of  
said crank shaft being parallel to and offset  
from that of said driving shaft, a member  
20 movable longitudinally of the driving shaft,  
said member and said crank shaft being so  
arranged that longitudinal movement of the  
member causes rotative movement of the  
crank shaft, a crank pin carried by said  
25 crank shaft, the axis of said pin being offset  
from the axis of the crank shaft, a blow-  
striking member operatively connected to  
said crank pin and arranged to reciprocate  
in a radial plane passing through the axis of  
30 the driving shaft, means for guiding the  
blow-striking member in its reciprocation,  
manually operable means for moving the  
longitudinally movable member while the  
driving shaft is rotating whereby the axis of  
35 the crank pin is caused to recede from that  
of the driving shaft to increase the stroke  
of the blow-striking member, and means for  
normally holding the crank pin in position  
such that its axis is alined with that of the  
40 driving shaft.

15. In combination, a rotatable driving  
shaft, means for applying force to the driv-  
ing shaft to cause it to rotate, a crank shaft  
supported thereby and rotatable in respect  
45 thereto, the axis of said crank shaft being  
parallel to and offset from that of said driv-  
ing shaft, a member movable longitudinally  
of the driving shaft, said member and said  
crank shaft being so arranged that longi-  
50 tudinal movement of the member causes ro-  
tative movement of the crank shaft, a crank  
pin carried by said crank shaft, the axis of  
said pin being offset from the axis of the  
crank shaft, a reciprocable member opera-  
55 tively connected to said crank pin, and  
manually operable means for moving the  
longitudinally movable member while the  
driving shaft is rotating whereby the axis of  
the crank pin is caused to recede from that  
60 of the driving shaft to increase the stroke  
of the reciprocable member.

16. In combination, a rotatable driving  
shaft, means for applying force to the driv-  
ing shaft to cause it to rotate, a crank shaft  
65 supported thereby and rotatable in respect

thereto, the axis of said crank shaft being  
parallel to and offset from that of said driv-  
ing shaft, a member movable longitudinally  
of the driving shaft, said member and said  
crank shaft being so arranged that longi- 70  
tudinal movement of the member causes ro-  
tative movement of the crank shaft, a crank  
pin carried by said crank shaft, the axis of  
said pin being offset from the axis of the  
crank shaft, a reciprocable member opera- 75  
tively connected to said crank pin and ar-  
ranged to reciprocate in a radial plane pass-  
ing through the axis of the driving shaft,  
means for guiding the reciprocable member  
in its reciprocation, and manually operable 80  
means for moving the longitudinally mov-  
able member while the driving shaft is ro-  
tating whereby the axis of the crank pin is  
caused to recede from that of the driving  
shaft to increase the stroke of the recip- 85  
rocable member.

17. In combination, a rotatable driving  
shaft having a chamber formed therein,  
means for applying force to the driving  
shaft to cause it to rotate, a crank shaft sup- 90  
ported thereby and rotatable in respect  
thereto, the axis of said crank shaft being  
parallel to and offset from that of said driv-  
ing shaft, a rod movable longitudinally of  
said driving shaft and rotatable therewith, 95  
the rod and crank shaft including inter-en-  
gaging surfaces located in the chamber and  
so arranged that longitudinal movement of  
the rod causes rotative movement of the  
crank shaft, a crank pin carried by the 100  
crank shaft, the axis of said pin being par-  
allel to the axis of said crank shaft and off-  
set therefrom the same distance the axis of  
the crank shaft is offset from the axis of the  
driving shaft, a reciprocable member opera- 105  
tively connected to said crank pin and ar-  
ranged to reciprocate in a radial plane pass-  
ing through the axis of the driving shaft,  
means for guiding the reciprocable member  
in its reciprocation, means tending to move 110  
the rod in one direction to cause the axis of  
the crank pin to approach that of the driv-  
ing shaft, means for limiting the movement  
of the crank pin in the direction stated, and  
manually operable means for moving the 115  
rod in the opposite direction while the driv-  
ing shaft is in rotation whereby the axis of  
the crank pin is caused to recede from that  
of the driving shaft and the stroke of the  
reciprocable member is increased. 120

18. In combination, a rotatable driving  
shaft having a chamber formed therein,  
means for applying force to the driving  
shaft to cause it to rotate, a crank shaft sup- 125  
ported thereby and rotatable in respect  
thereto, the axis of said crank shaft being  
parallel to and offset from that of said driv-  
ing shaft, a rod movable longitudinally of  
said driving shaft and rotatable therewith,  
the rod and crank shaft including inter-en- 130



gaging surfaces located in the chamber and so arranged that longitudinal movement of the rod causes rotative movement of the crank-shaft, a crank-pin carried by the crank shaft, the axis of said pin being parallel to the axis of said crank shaft and offset there from the same distance the axis of the crank shaft is offset from the axis of the driving shaft, a reciprocable member operably connected to the crank-pin, a housing in which the rear end of the rod is received and in respect to which the rod is rotatable, a collar on the rod and inclosed by the housing, an adjustable plug in the housing and adapted to exert pressure on the collar to take up longitudinal movement of the rod in the housing, means tending to move the housing in one direction whereby the axis of the crank-pin is caused to approach that of the driving shaft, means for limiting the movement of the crank-pin in the direction stated, and manually operable means for moving the housing in the opposite direction while the driving shaft is in rotation, whereby the axis of the crank-pin is caused to recede from that of the driving shaft and the stroke of the reciprocable member is increased.

19. In combination, a rotatable driving shaft having a chamber formed therein, means for applying force to the driving shaft to cause it to rotate, a crank shaft supported thereby and rotatable in respect thereto, the axis of said crank shaft being parallel to and offset from that of said driving shaft, a rod movable longitudinally of said driving shaft, a key contacting with the rod and serving to prevent the rod from rotating in respect to the driving shaft, the rod and the crank shaft including inter-engaging threads located in the chamber and so arranged that longitudinal movement of the rod causes rotative movement of the crank shaft, a crank-pin carried by the crank shaft, the axis of said pin being parallel to the axis of said crank shaft and offset therefrom the same distance the axis of the crank shaft is offset from the axis of the driving shaft, a reciprocable member operably connected to the crank-pin, means tending to move the rod in one direction to cause the axis of the crank-pin to approach that of the driving shaft, means for limiting the movement of the crank-pin in the direction stated, and manually operable means for moving the rod in the opposite direction while the driving shaft is in rotation whereby the axis of the crank-pin is caused to recede from that of the driving shaft and the stroke of the reciprocable member is increased.

20. In combination, a rotatable driving shaft having a chamber formed therein, means for applying force to the driving shaft to cause it to rotate, a crank shaft

supported thereby and rotatable in respect thereto, the axis of said crank shaft being parallel to and offset from that of said driving shaft, means for preventing longitudinal movement of the crank shaft in the driving shaft, a rod movable longitudinally of said driving shaft and rotatable therewith, the rod and crank shaft including inter-engaging surfaces located in the chamber and so arranged that longitudinal movement of the rod causes rotative movement of the crank shaft, a crank-pin carried by the crank shaft, the axis of said pin being parallel to the axis of said crank shaft and offset therefrom the same distance the axis of the crank shaft is offset from the axis of the driving shaft, a reciprocable member operably connected to the crank-pin, means tending to move the rod in one direction to cause the axis of the crank-pin to approach that of the driving shaft, means for limiting the movement of the crank-pin in the direction stated, and manually operable means for moving the rod in the opposite direction while the driving shaft is in rotation whereby the axis of the crank-pin is caused to recede from that of the driving shaft and the stroke of the reciprocable member is increased.

21. In combination, a rotatable driving shaft having a chamber formed therein, means for applying force to the driving shaft to cause it to rotate, a crank shaft supported thereby and rotatable in respect thereto, the axis of said crank shaft being parallel to and offset from that of said driving shaft, means for preventing longitudinal movement of the crank shaft in the driving shaft, a rod movable longitudinally of said driving shaft, means for preventing the rod from rotating in respect to the driving shaft, the rod and crank shaft including inter-engaging surfaces located in the chamber and so arranged that longitudinal movement of the rod causes rotative movement of the crank shaft, a crank-pin carried by the crank shaft, the axis of said pin being parallel to the axis of said crank shaft and offset therefrom the same distance the axis of the crank shaft is offset from the axis of the driving shaft, a reciprocable member operably connected to the crank pin, means tending to move the rod in one direction to cause the axis of the crank-pin to approach that of the driving shaft, means for limiting the movement of the crank-pin in the direction stated, and manually operable means for moving the rod in the opposite direction while the driving shaft is in rotation whereby the axis of the crank-pin is caused to recede from that of the driving shaft and the stroke of the reciprocable member is increased.

22. In combination, a rotatable driving shaft having a chamber formed therein,



means for applying force to the driving shaft to cause it to rotate, a crank shaft supported thereby and rotatable in respect thereto, the axis of said crank shaft being  
 5 parallel to and offset from that of said driving shaft, a rod movable longitudinally of said driving shaft and rotatable therewith, the rod and crank shaft including inter-engaging surfaces located in the chamber  
 10 and so arranged that longitudinal movement of the rod causes rotative movement of the crank shaft, a crank arm and crank pin carried by the crank shaft, the axis of said pin being parallel to the axis of said crank  
 15 shaft and offset therefrom the same distance the axis of the crank shaft is offset from the axis of the driving shaft, a reciprocable member operably connected to the crank pin, means tending to move the rod in one di-  
 20 rection to cause the axis of the crank pin to approach that of the driving shaft, said crank arm and driving shaft constituting two members, a projection on one of the members arranged to contact with a surface  
 25 on the other member for limiting the movement of the crank pin in the direction stated, and manually operable means for moving the rod in the opposite direction while the driving shaft is in rotation whereby the axis  
 30 of the crank pin is caused to recede from that of the driving shaft and the stroke of the reciprocable member is increased.

23. In combination, a rotatable driving shaft having an inclosed chamber formed  
 35 therein, means for applying force to the driving shaft to cause it to rotate, a crank shaft supported thereby and rotatable in respect thereto, the axis of said crank shaft being parallel to and offset from that of the  
 40 driving shaft, a rod movable longitudinally of said driving shaft and rotatable therewith, the rod and crank shaft including inter-engaging surfaces located in the chamber and so arranged that longitudinal movement  
 45 of the rod causes rotative movement of the crank shaft, a crank pin carried by the crank shaft, the axis of said pin being parallel to the axis of said crank shaft and offset therefrom the same distance the axis of  
 50 the crank shaft is offset from the axis of the driving shaft, a reciprocable member operably connected to the crank pin, means tending to move the rod in one direction to cause the axis of the crank pin to approach that  
 55 of the driving shaft, means for limiting the movement of the crank pin in the direction

stated, manually operable means for moving the rod in the opposite direction while the driving shaft is in rotation whereby the axis of the crank pin is caused to recede from  
 60 that of the driving shaft and the stroke of the reciprocable member is increased, said driving shaft having an opening leading to the chamber therein through which lubricant may be supplied, and a removable  
 65 plug for said opening.

24. In combination, a rotatable driving shaft having a chamber formed therein, means for applying force to the driving  
 70 shaft to cause it to rotate, a crank shaft supported thereby and rotatable in respect thereto, the axis of said crank shaft being parallel to and offset from that of said driving shaft, a rod movable longitudinally of  
 75 said driving shaft and rotatable therewith, the rod and crank shaft including inter-engaging surfaces located in the chamber and so arranged that longitudinal movement of the rod causes rotative movement of the  
 80 crank shaft, a crank pin carried by the crank shaft, the axis of said pin being parallel to the axis of said crank shaft and offset therefrom the same distance the axis of the crank shaft is offset from the axis of  
 85 the driving shaft, a reciprocable member operably connected to the crank-pin, a housing connected to the rear end of said rod, in respect to which the rod is rotatable, for imparting longitudinal movement to the rod,  
 90 a guide arranged transversely of the housing, a member slidable in the guide, a lever having one arm in proximity to the slidable member, said member and said arm being pivotally connected, means tending to move  
 95 the lever in one direction whereby the axis of the crank pin is caused to approach that of the driving shaft, means for limiting the movement of the crank pin in the direction stated, and manually operable means for  
 100 moving the lever in the opposite direction while the driving shaft is in rotation, whereby the axis of the crank pin is caused to recede from that of the driving shaft and the stroke of the reciprocable member is in-  
 105 creased.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

HENRY COLLIER SMITH.

Witnesses:

L. M. SPENCER,

HUGO W. KREINBRING.