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2,767,588

VARIABLE STROKE MECHANISM

Filed Sept. 15, 1954

3 Sheets-Sheet 1

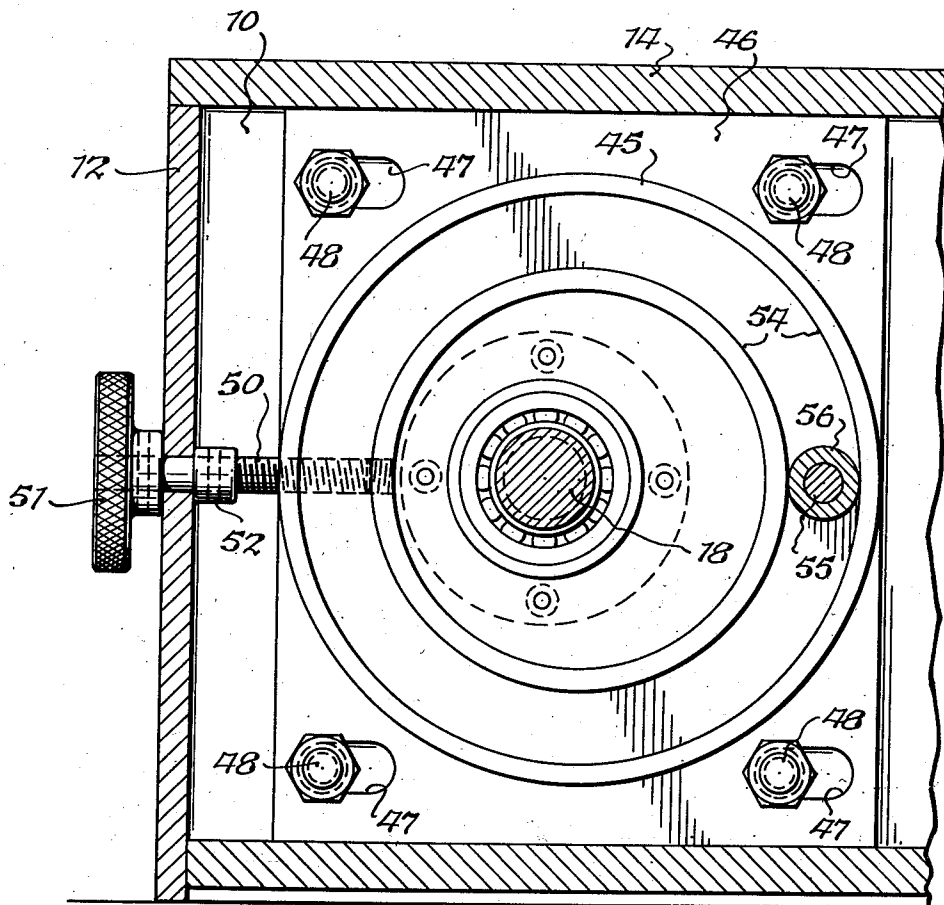
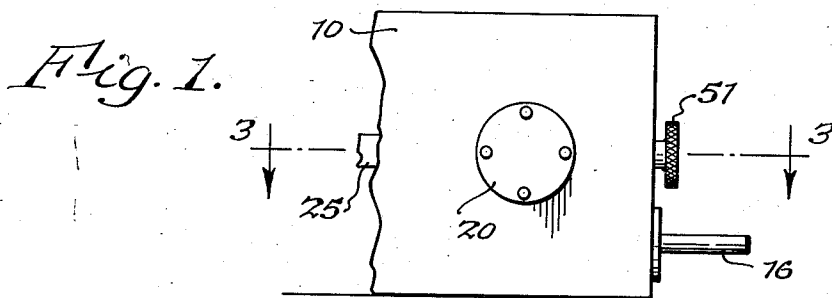


Fig. 2.

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Fig. 3.

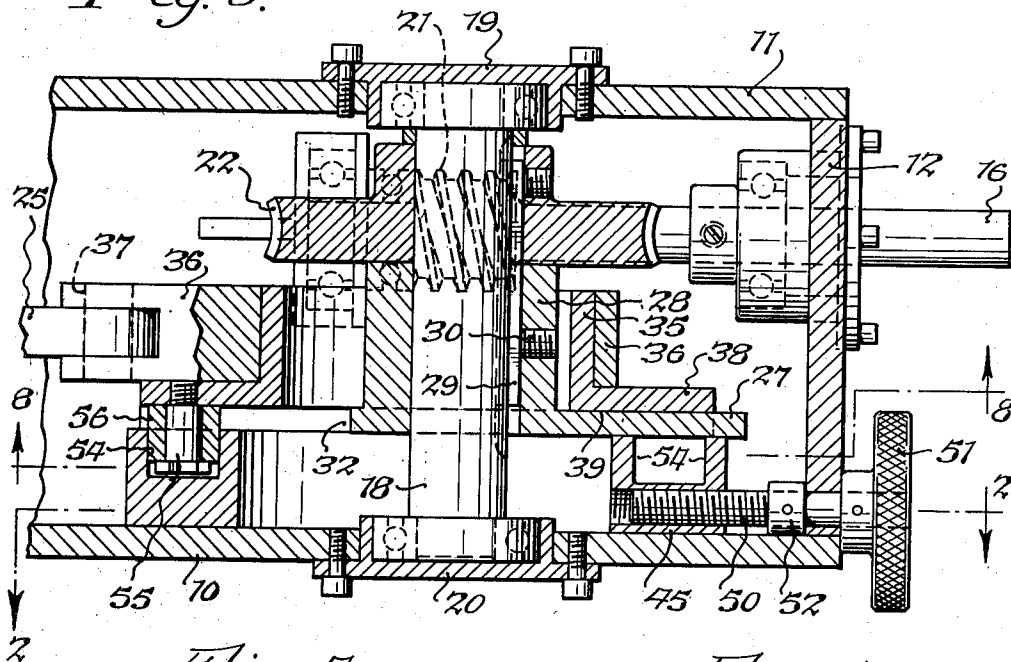


Fig. 4.

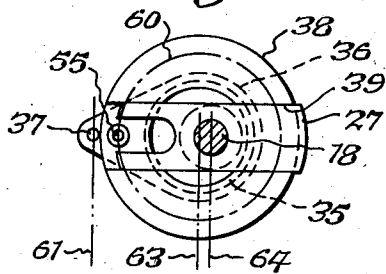


Fig. 5.

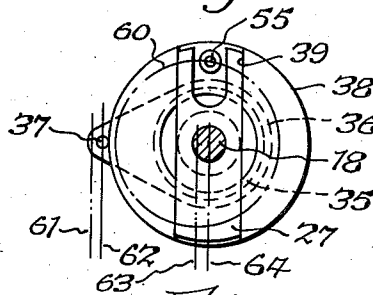


Fig. 7.

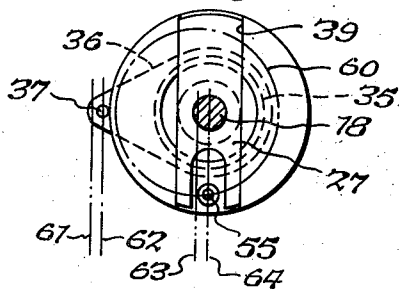
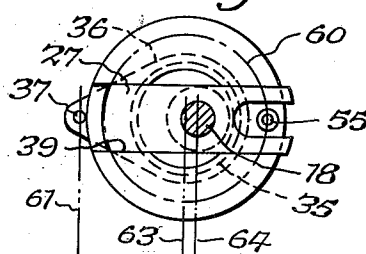


Fig. 6.



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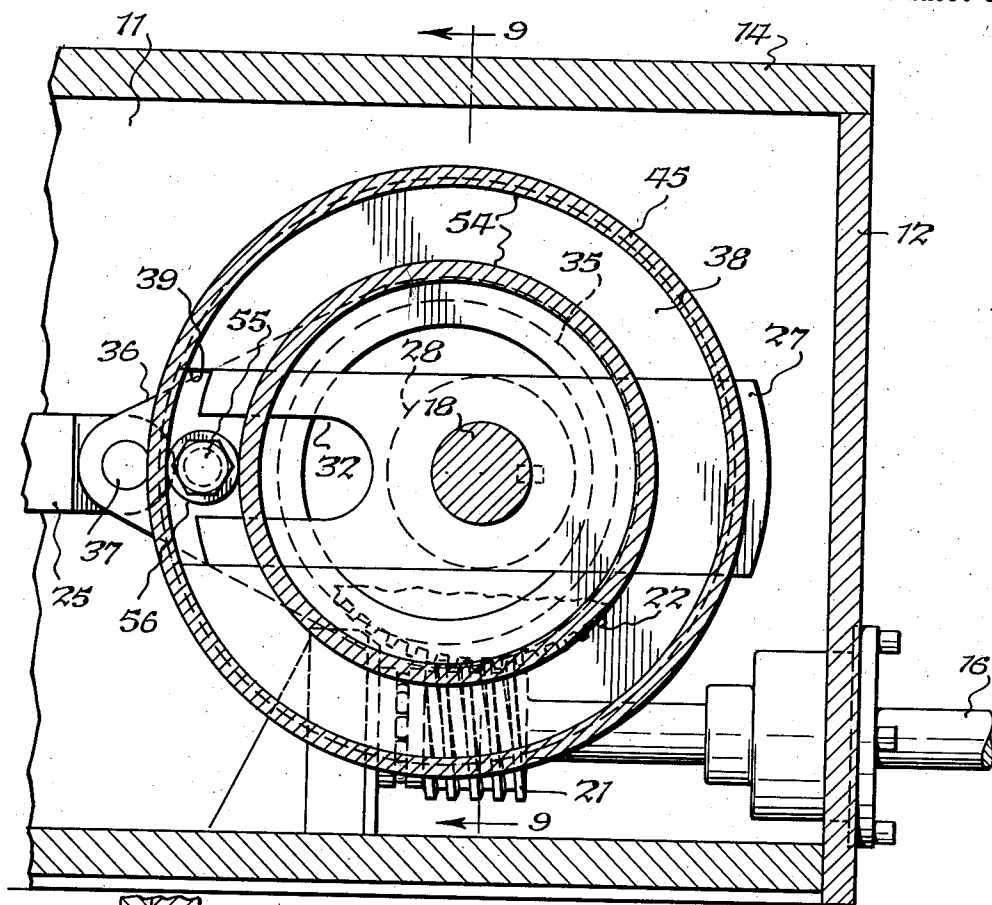


Fig. 8.

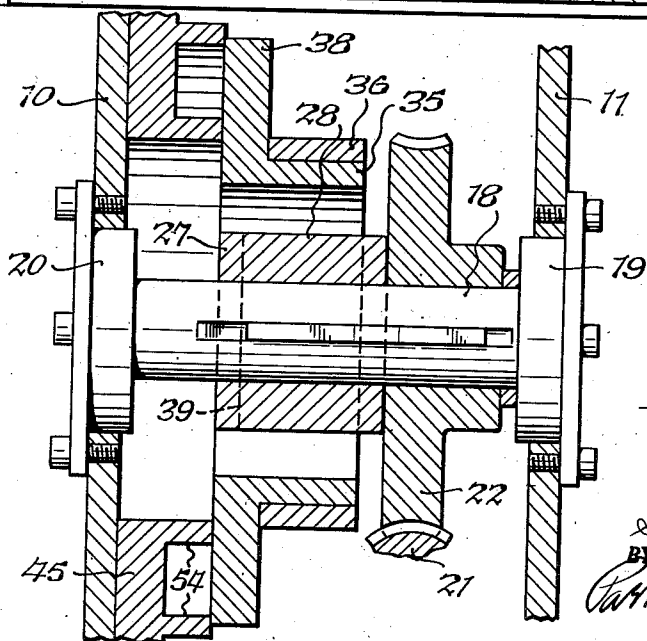


Fig. 9.

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VARIABLE STROKE MECHANISM

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9 Claims. (Cl. 74-44)

This invention relates to mechanisms for varying the stroke imparted to a reciprocatory member from a rotary member. It is frequently necessary for various purposes to vary the stroke of a reciprocating member without stopping the operation of the mechanism. For example, it may be desirable to vary the stroke of a piston in a cylinder or of a diaphragm of a pumping mechanism for accurately and instantaneously varying the feed of material by such piston or diaphragm.

Consequently, it is one of the objects of this invention to provide mechanism of this type by means of which power obtained from a rotary shaft may be converted into reciprocatory motion by means of mechanism which can be adjusted while the same is in operation to easily and quickly vary the stroke of a reciprocable member.

Another object is to provide a mechanism of this type which is efficient in operation and economical to construct.

A further object is to provide a mechanism by means of which two reciprocations are produced for each revolution of the actuating shaft.

Other objects and advantages will be apparent from the following description of one embodiment of the invention and the novel features will be particularly pointed out hereinafter in connection with the appended claims.

In the accompanying drawings:

Fig. 1 is a fragmentary side elevation of an apparatus embodying this invention.

Fig. 2 is a fragmentary, sectional elevation thereof, on line 2-2 of Fig. 3.

Fig. 3 is a central sectional plan view thereof, on line 3-3, Fig. 1.

Figs. 4 to 7 are fragmentary elevations thereof, on a reduced scale and showing more or less diagrammatically different positions of the parts.

Fig. 8 is a sectional elevation thereof, on line 8-8, Fig. 3.

Fig. 9 is a fragmentary sectional elevation thereof, on line 9-9, Fig. 8.

The particular mechanism shown in the drawings by way of example to illustrate one form of my invention includes a housing or container for the mechanism having upright side walls 10 and 11 connected by means of an end wall 12, a bottom wall 13 and a lid or top wall 14. These walls may be removably connected with each other to allow easy access to the mechanism in the interior of the housing. The same walls may also confine a pump or other device operated by the mechanism, which is not shown, since by itself it constitutes no part of this invention. Other supporting means for the mechanism may be employed.

Rotary motion is imparted to the mechanism through a drive shaft 16 rotated in any suitable or desired manner and which, in turn, imparts rotation at a greatly reduced speed to the main shaft 18 of the mechanism, which is rotatably mounted in suitable bearing supports 19 and 20 secured to the side walls 10 and 11 of the frame. Gearing of any suitable type may be interposed between the drive shaft 16 and the main shaft 18, these gears in the

construction shown including a worm 21 on the drive shaft which meshes with a worm wheel 22 secured on the main shaft. Any other means for rotating the shaft 18 may be provided. 25 represents a reciprocatory connecting rod which is connected with the part (not shown) which is to be reciprocated.

The shaft 18 has a driving member 27 rigidly mounted thereon. This driving member may be formed integral with a sleeve 28 which is rigidly secured to the shaft 18, for example, by means of a key 29 extending into keyways and held in place by means of set screws 30. This driving member, as shown by way of example, is of approximately rectangular shape and is provided in one end thereof with a slot 32 which extends inwardly from one end thereof and extends radially with reference to the sleeve 28 and terminates at its inner end in spaced relation to this sleeve.

The reciprocatory member 25 is actuated by means of a driven member which, in the particular construction illustrated, is in the form of a sleeve or collar 35 which floats about the shaft 18. The collar of the driven member 35 cooperates with an eccentric strap 36 which is pivotally connected with the pitman or reciprocable member 25 by means of a pin 37. The floating collar 35 of the driven member is provided with an outwardly extending flange 38, having a diametrically extending groove 39 in which the driving member 27 has a sliding fit. Consequently, rotation is imparted from the driving member 27, which rotates with the shaft 18, to the driven member 35.

The axis about which the driven collar 35 rotates is adjustable with reference to the axis of the main shaft 18. Obviously if the floating collar or sleeve 35 is concentric with the main shaft 18, then the rotation of the sleeve or collar 35 will be concentric with the drive shaft 18 and no motion will be imparted to the pitman 25. If, however, the sleeve or collar 35 is moved away from the axis of the main shaft 18, the rotation of the floating collar 35 will be eccentric with relation to the main shaft 18 and movement will be imparted to the pitman, proportional to the distance between the center of rotation of the sleeve and the axis of the shaft.

The shifting of the floating collar or sleeve 35 relative to the main shaft 18 may be effected in any suitable or desired manner, and in the particular construction illustrated by way of example, I have provided an endless control track or guide ring 45, which in the construction shown by way of example, extends outwardly from and is formed integral with a plate 46. This plate may be of rectangular form and is guided for movement lengthwise of the housing by having the inner face thereof slidable along the side wall 10 of the housing. The edges of the plate 46 may, consequently, be guided by the upper and lower walls of the housing as shown in Fig. 2. The rectangular base plate 46 is further guided for movement on the side wall 10 of the housing and held in correct relation thereto by means of slots 47 in the plate 46 through which guide screws 48 secured to the side wall 10 extend. The plate 46 and the ring 45 may be adjusted lengthwise of the side wall 10 and the screws 48 in any suitable or desired manner, for example, the ring may be provided in a side thereof with a threaded hole in which an adjusting screw 50 engages. The screw extends out through a hole in the end wall 12 of the housing and is rotatable in and held against lengthwise movement in this hole, for example, by means of a collar 52 and the hub of a hand wheel 51 which is secured on the outer end of the adjusting screw and by means of which the screw can be turned for moving the guide ring and plate 46. It will be noted that this ring is hollow and extends about the main shaft 18, the opening within the ring and plate 46 being sufficiently large to permit the ring to be moved

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into a position approximately concentric with the axis of the shaft 18 and into various eccentric relation to this shaft by turning the adjusting screw 50. The guide ring is preferably circular, but may be of other form, if desired.

The guide ring 45 serves the purpose of determining the eccentricity of the floating sleeve or collar 35 with reference to the main shaft 18 and any suitable means may be provided for establishing a connection between the guide ring 45 and the floating collar 35. In the construction shown, the guide ring is provided with a groove 54 and the floating collar 35 has a guide pin 55 secured to the flange 38 thereof and extending into the annular groove 54. An anti-friction roller 56 is preferably interposed between this guide pin 55 and the walls of the groove 54. Consequently, as the rectangular driving member 27 imparts rotation to the floating collar 35 and its flange 38, the pin 55 and the guide ring 45 determine the nature of the rotation of the floating collar, this being determined by adjustment of the plate 46 by means of the screw 50. During rotation of this collar eccentrically with reference to the main shaft 18, the driving member 27 will, of course, slide back and forth in the groove formed in the flange 38 of the floating driven member and the connecting pin 55 may move lengthwise of the slot 39 in the driving member without, however, contacting the walls of the slot.

The operation of my mechanism may be better understood by means of the diagrammatic views in Figs. 4 to 7. In these diagrams, a circle 60 is broken lines represents the groove 54 in the guide ring 45. Assuming that this guide ring has been set into the desired relation to the main shaft 18, the center of the connecting pin 37 will lie in the broken line 61. As the main shaft 18 turns the rectangular drive member 27 through 90 degrees clockwise into the position shown in Fig. 5, it will be noted that the pin 37 has been moved from the line 61 into a new position indicated by the line 62 and the pin 37 is then at its extreme right position. Upon a farther turning of the main shaft through another 90 degrees in the same direction, as shown in Fig. 6, the pin 37 has again moved to the left to the line 61 and upon a farther rotation through another 90 degrees as shown in Fig. 7, the pin 37 will be moved from the line 61 back to the line 62. A further 90 degrees turn will return the parts into the positions shown in Fig. 4. It will thus be seen that for each revolution of the main shaft 18, the connecting pin 37 moves through two reciprocations.

63 is a line passing through the center of the guide ring 45 and 64 represents a line passing through the axis of the main shaft 18 and these two lines indicate the extent to which the guide ring has been adjusted relatively to the axis of the shaft 18. The distance between these two lines is equivalent to the stroke or reciprocatory movement which will be imparted to a crosshead of a pump to a diaphragm.

It will also be noted that during the adjusting of the apparatus for a different throw of the reciprocating member 25, this member together with the floating collar 35 will be moved either toward or from the axis of the main shaft 18. When the reciprocatory member 25 is connected with the piston of a pump or with the diaphragm of a pump, it will be obvious that the position of the reciprocating member will not affect the operation of the pump, but will merely mean that the piston moves through a different distance within its cylinder or that the diaphragm of the pump is differently positioned with relation to the chamber for the liquid which is being pumped.

It will be understood that various changes in the details, materials, and arrangements of parts which have been herein described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention, as expressed in the appended claims.

I claim as my invention:

1. A mechanism for imparting a variable stroke to a reciprocatory member, including a rotary driving member, an eccentric strap, a driven member rotatably connected with said eccentric strap and also having a sliding connection with said driving member, an endless guide member extending about the axis of rotation of said driving member and connected with said driven member to direct the path of movement of said driven member about the axis of rotation of said driving member while said driven member is rotated by said driving member, and means for adjusting the position of said guide member relatively to the axis of rotation of said driving member.

2. A mechanism for imparting a variable stroke to a reciprocatory member, including a rotary driving member, an eccentric strap, a driven member rotatably connected with said eccentric strap and also having a sliding connection with said driving member, an endless guide member extending about the axis of rotation of said driving member, and a pin mounted on said driven member and extending into operative relation to said guide member to guide the rotation of said driven member in eccentric relation to said driving member, and means for adjusting the position of said guide member relatively to the axis of rotation of said driving member.

3. A mechanism for imparting a variable stroke to a reciprocatory member, including a rotary driving member, a driven member having an annular peripheral part, an eccentric strap extending about said annular part and connected with said reciprocatory member, a sliding connection between said driving and driven members for imparting rotation to said driven member, an endless guide member extending about the axis of rotation of said driving member, and a pin on said driven member extending into engagement with said guide member for controlling the rotation of said driven member, and means for adjusting the position of said guide member relatively to the axis of rotation of said driving member.

4. A mechanism according to claim 3, in which said guide member comprises an annular groove into which said pin extends, and an anti-friction roller pivoted on said pin and also extending into said groove.

5. A mechanism according to claim 3, in which said driven member has a substantially diametrically extending slot and in which said driving member includes a rectangular part slidably arranged in said slot to impart rotation to said driven member when said driven member rotates about an axis eccentric with relation to the axis of said driving member.

6. A mechanism according to claim 3 in which said sliding connection includes a slot on one of said members, and a part on the other of said members which extends into and is slidable in said slot.

7. A mechanism according to claim 3 and including a housing in which said mechanism is contained, means for slidably mounting said guide means on said housing for movement relatively to the axis of rotation of said driving member, and adjusting means on the exterior of said housing and engaging said guide means for holding the same in various relations to said axis of rotation of said driving member.

8. A mechanism for imparting a variable stroke to a reciprocatory member including a rotary shaft having a substantially rectangular driving member secured thereto, a driven member including a disk extending about said shaft and provided with a recess into which said substantially rectangular driving member extends and in which it is slidable, a substantially annular guide member extending about said shaft, a pin secured to said driven member and extending into operative relation to said guide member for movement along the same, means for positioning said guide member in different relations to said shaft, and an eccentric strap extending about a peripheral portion of

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said driven member and connected with said reciprocatory member.

9. A mechanism for imparting a variable stroke to a reciprocatory member including a rotary driving member, a rotatable driven member, a slidable connection between said driving and driven members for transmitting rotation from said driving member to said driven member when the axes of rotation of said members are out of alinement, an annular guide track connected with said driven member and controlling the path of movement of said driven member, means for adjusting the position of said guide track

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relatively to said driving member to vary the eccentricity of rotation of said driven member relatively to said driving member, and means connecting said driven member with said reciprocatory member.

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