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7 Sheets-Sheet 1



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March 13, 1956

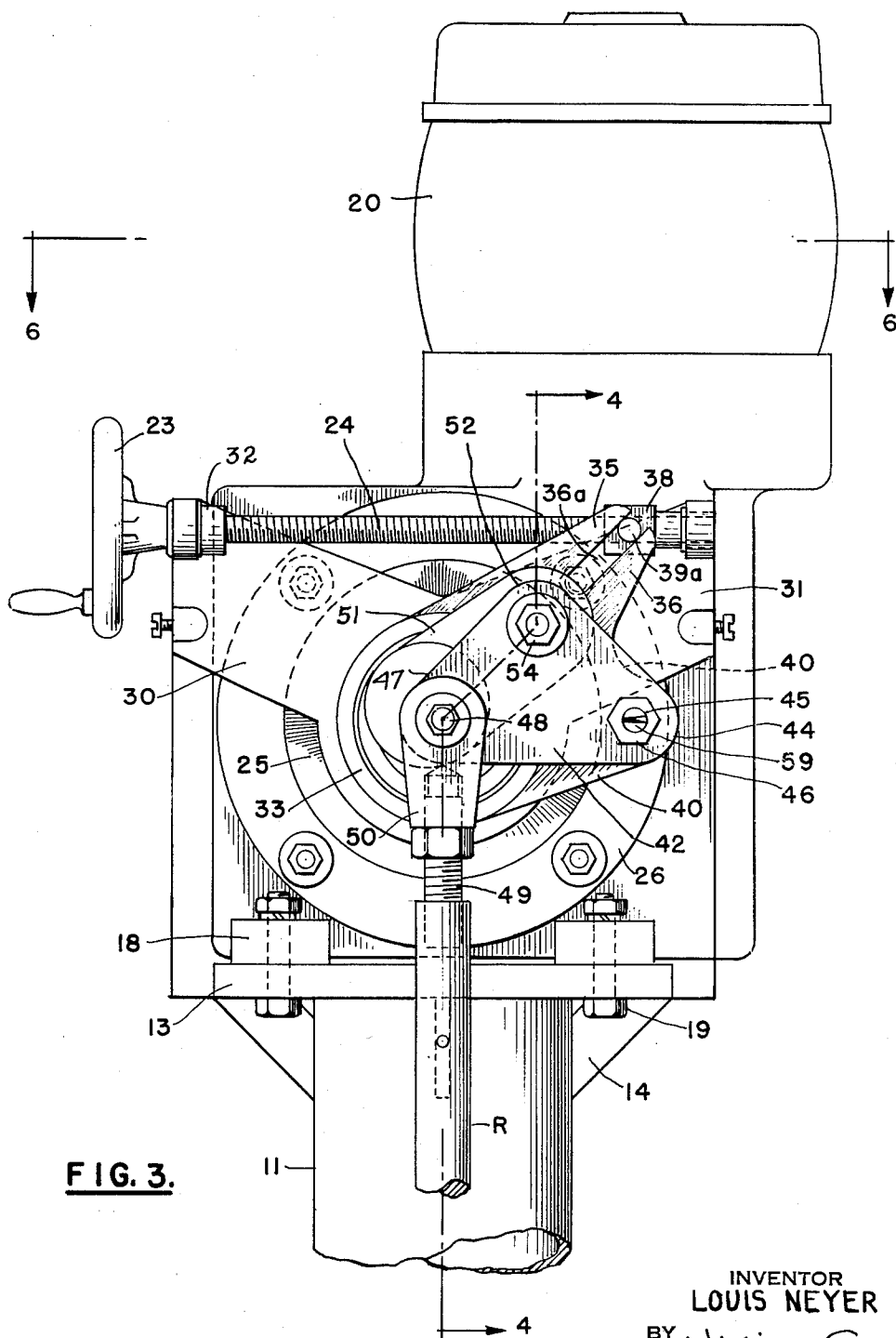
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DIAPHRAGM PUMP WITH STROKE ADJUSTING MECHANISM

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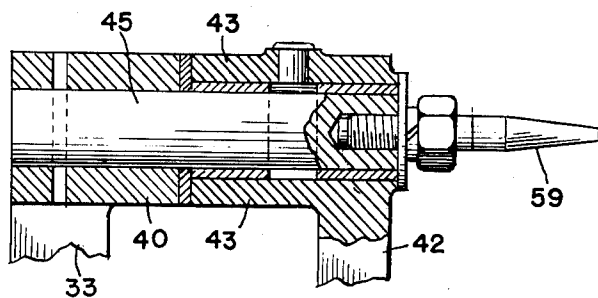
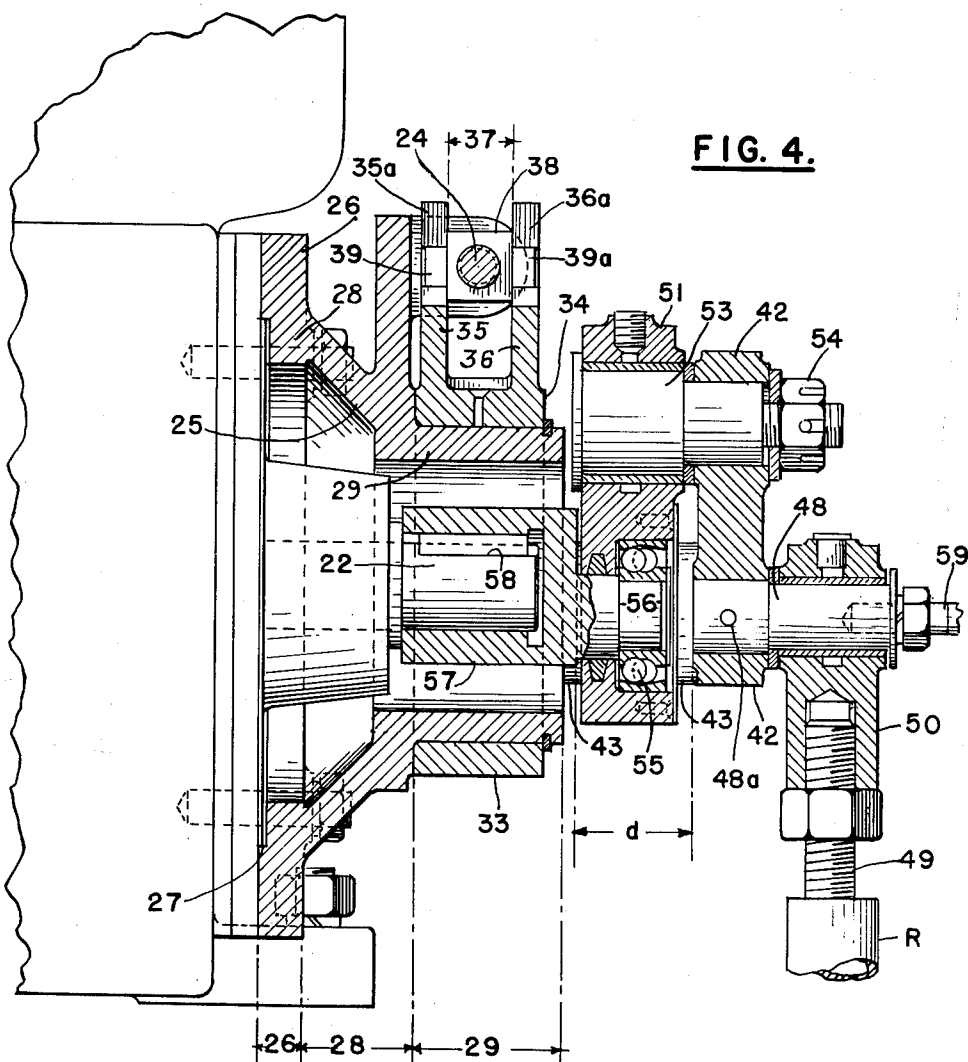


FIG. 5.

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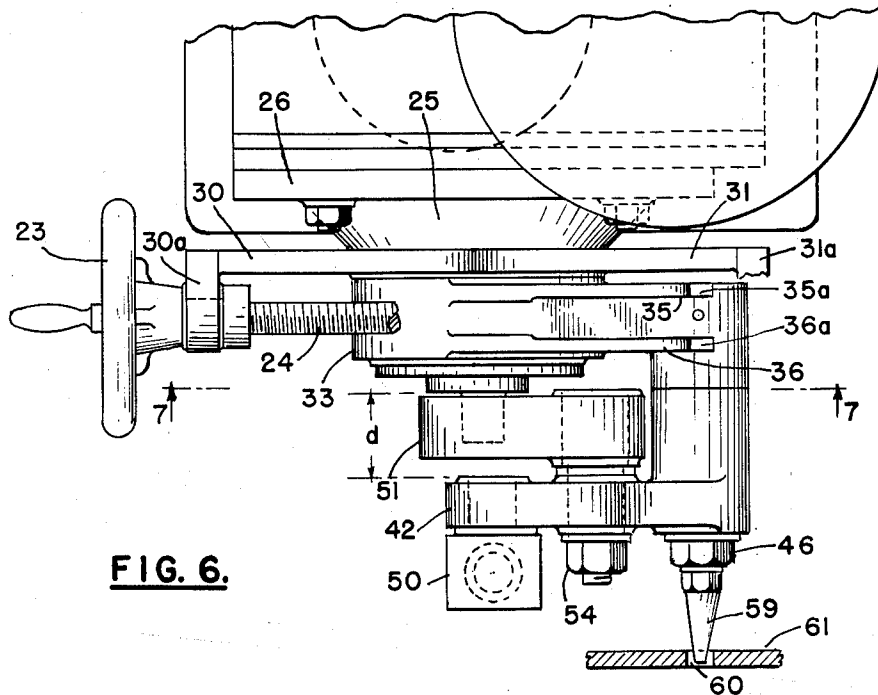


FIG. 6.

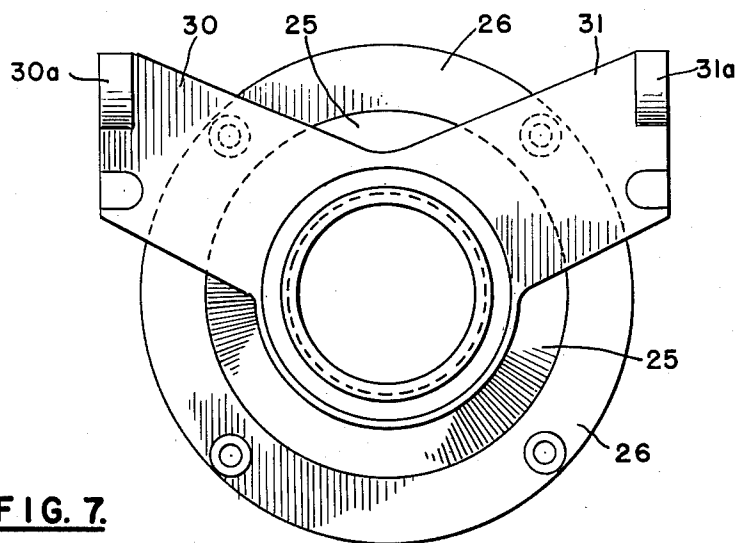


FIG. 7.

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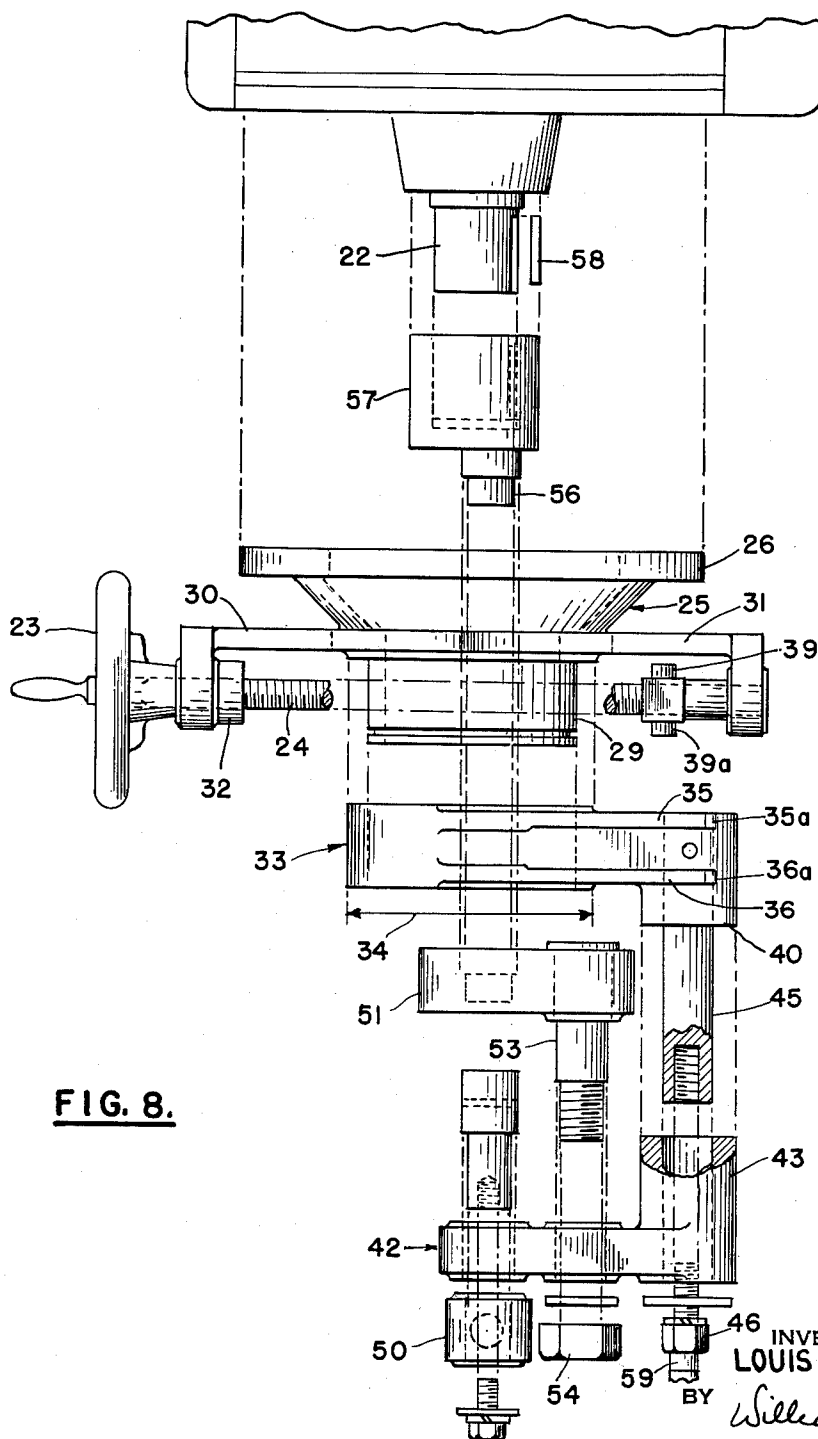
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DIAPHRAGM PUMP WITH STROKE ADJUSTING MECHANISM

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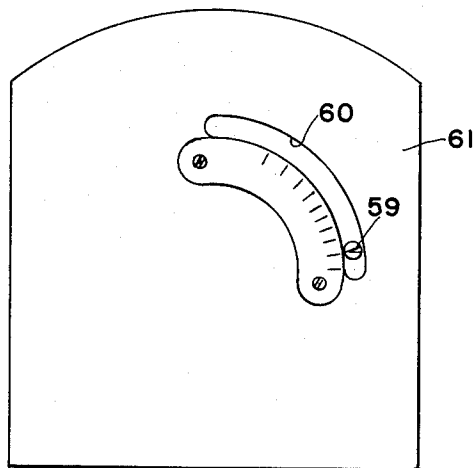
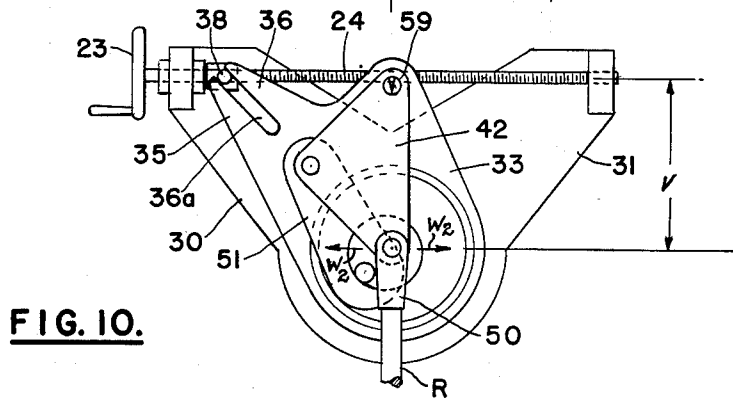
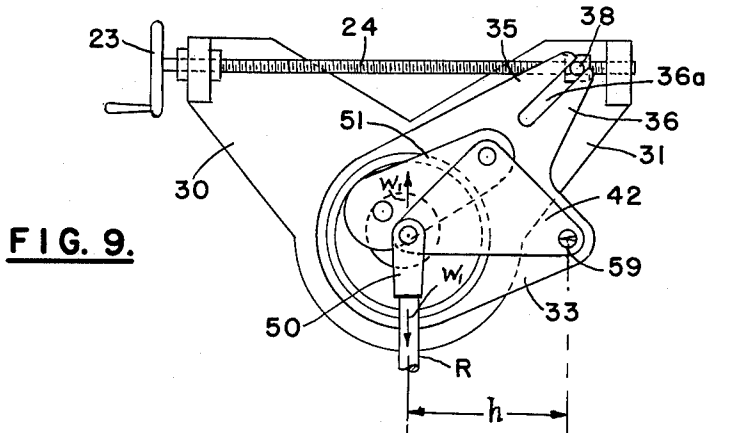
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DIAPHRAGM PUMP WITH STROKE ADJUSTING MECHANISM

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FIG. 12

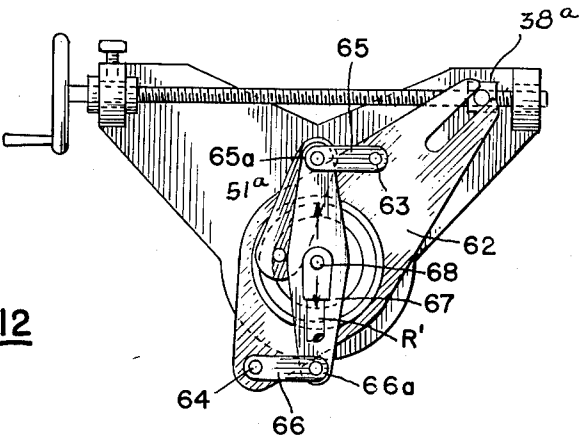
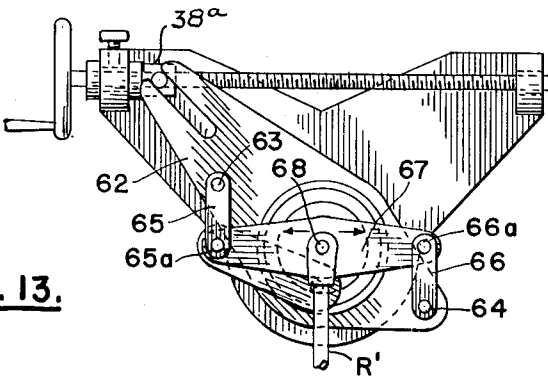


FIG. 13.



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DIAPHRAGM PUMP WITH STROKE ADJUSTING MECHANISM

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Claims priority, application France May 3, 1952

8 Claims. (Cl. 103—38)

This invention relates to a drive mechanism or drive-head for imparting reciprocating movement, for example, to the stem or pump rod of a diaphragm pump; more particularly, this relates to such a drive mechanism which comprises stroke adjusting means which are operable while the pump is running for example for varying the pumping stroke and thereby the delivery rate of the pump.

It is among the objects to provide such a drive-head that is self-contained, having embodied in it stroke adjusting means operable while running, which drive-head is to be highly compact yet simple and inexpensive to produce, and which is highly adaptable in lending itself to a variety of structural conditions and purposes.

Still another object is to provide in such a drive-head adapter means whereby a special oscillatory or reciprocatory section of the mechanism can be readily and compactly combined with or attached to the gear section of a gear-motor unit. This provision of such adapter means makes it possible to convert, for example, an existing gear-motor unit for use as a special drive-head for the present purpose.

Referring more particularly to the combination of such a drive-head with a diaphragm pump, other objects are to provide a diaphragm pump unit in the form of an upright or columnar unit in which an upright frame structure or column carries at its foot end the diaphragm pump housing and at its top end a drive mechanism including stroke-adjusting means, and which as a unit is highly compact as well as simple and inexpensive to produce; and furthermore to provide such a columnar pump unit in which a highly compact yet mechanically simple and efficient drive-head inclusive of its stroke-adjusting mechanism is attachable as a self-contained sub-assembly to and mountable upon the top end of the columnar frame structure.

To attain these objects, the invention provides at the top end of a columnar frame structure a drive-head which comprises a gear-motor unit in which the low-speed or output shaft has its outer free or exposed end extend horizontally from the gear housing. Importantly, there is provided a flanged hollow adaptor bracket which has a central hollow hub portion surrounding the free end portion of the horizontal shaft, which adaptor bracket is fastened shield-like to the adjacent vertical portion of the gear housing. The thus surrounded shaft end portion has fixed thereto and horizontally coextensive therewith an eccentric pin which is operatively connected with the pump rod for imparting thereto up-and-down reciprocating movement. That is to say, this eccentric pin through a drive link member imparts oscillations or reciprocations to a motion-transmitting member which is movable along a predetermined path relative to the adaptor bracket, which member in turn has a pivotal connection with the top end of the pump rod so as to impart its reciprocations thereto.

A stroke adjusting means embodied in this drive-head comprises an auxiliary bracket member which is carried by and turnably adjustable about the aforementioned cen-

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tral hub portion of the hollow adaptor bracket. The auxiliary bracket member is adjustable rotationally upon the hub portion through a suitable range, say 90°, and is held fixedly in any adjusted position within that range.

5 The aforementioned reciprocatory or oscillatory motion-transmitting member is operatively mounted upon this auxiliary bracket member, so that any rotational adjustment of the auxiliary bracket member will accordingly vary the direction of movement of the reciprocatory member and thereby vary the ratio of vertical to horizontal component movements thereof, and hence vary the delivery rate of the pump.

According to one feature, the motion-transmitting member is an oscillatory member which may be of triangular shape with one base corner portion of the triangle pivotally mounted upon a laterally outlying portion of the auxiliary bracket member, the other base corner portion having pivotal connection with the pump rod, while the top corner portion or intermediate portion of the oscillatory member has pivotal connection with a driving link actuated by the eccentric.

According to another feature, the motion-transmitting member is a floating link member operatively mounted upon the adjustable auxiliary bracket member by means of a pair of parallel links one at each end of the floating link member with the pump rod pivotally connected to an intermediate portion thereof.

According to one feature the eccentric at the outer end of the gear shaft is in the form of an attachment thereto. That is, the eccentric itself has a cup-shaped hollow cylindrical adaptor portion that fits cap-like over and onto the outer end of the gear shaft to be fixed thereon. Thus, by employing the aforementioned adaptor bracket together with the adaptor shaped eccentric, a gear motor is convertible into a drive-head having the characteristics set forth above in accordance with this invention.

In the drawings,

Fig. 1 is a front view of one embodiment of the pump equipped with the drive-head according to this invention.

Fig. 2 is a side view on the line 2—2 of the pump shown in Fig. 1.

Fig. 3 is an enlarged view of the drive-head shown in Fig. 1.

Fig. 4 is a vertical section taken on line 4—4 through the drive-head of Fig. 3, showing more particularly the adaptor bracket carrying the oscillatory mechanism as well as the pump stroke adjusting means.

Fig. 5 is a large detail view of the upper end of the pump rod as shown in Fig. 4, although with indicating pointer added thereto.

Fig. 6 is a top view taken on line 6—6 of the drive-head as shown in Fig. 3.

Fig. 7 is a transverse view taken on line 7—7 of Fig. 6 to show more clearly the adaptor bracket with other parts of the mechanism omitted.

Fig. 8 is an exploded top view of the mechanism as shown in Fig. 6.

Figs. 9 and 10 are diagrammatic front views of the drive-head showing the two extreme limits of operational adjustment, namely Fig. 9 showing the mechanism adjusted for maximum pump stroke and maximum delivery rate, and Fig. 10 showing the mechanism adjusted for minimum pump stroke and minimum delivery rate.

Fig. 11 is the diagrammatic front view of a casing for the oscillatory mechanism provided with means for the observation of any changes made with respect to adjusting the pump stroke.

Figs. 12 and 13 are diagrammatic views similar to Figs. 9 and 10 although showing a modification of the reciprocatory mechanism.

In the drawings there is shown by way of example a self contained drive-head D mounted atop a base column.

C, while a diaphragm pump P is mounted upon the foot end of column C with a pump rod R connecting the pump diaphragm (not visible) with the drive head D.

The column C is shown to comprise a base plate 10 from which rises a columnar element or pipe section 11 having its bottom end welded to the base plate 10 with stiffened ribs 12 provided to rigidify and reinforce that connection. The upper end of pipe section 11 has a top plate or platform 13 welded thereto and reinforced as by ribs 14.

The diaphragm pump P has a housing 14' which in turn has laterally extending therefrom a bracket portion 15 having a mating clamping member 16 whereby the pump housing is clamped and fastened to the pipe section 11 as indicated by screw bolts 17.

The drive-head D has a bottom flange or footings 18 whereby it is fastened upon the top plate or platform 13 as is indicated by bolts 19. The drive-head D constitutes a self-contained assembly unit which comprises a gear-motor section S₁ and an oscillatory section or mechanism S₂. The gear-motor section S₁ comprises a vertically disposed motor 20 connected with a box structure containing speed reducing mechanism as in the form of gear box 21 containing reduction gearing with a horizontal low-speed or output shaft 22. The oscillatory section S₂ comprises mechanism attached to the gear box 21 and driven by the output shaft 22.

The oscillatory mechanism S₂ imparts up-and-down movements to the pump rod R, and comprises certain stroke adjusting means whereby the pump stroke can be varied without stopping the drive, as by turning a hand wheel 23 and thereby a spindle 24.

The oscillatory mechanism S₂ will not be described in greater detail by reference to Figs. 3, 4, 6, 7, 8. A hollow adaptor bracket 25 (see Figs. 4 and 7) presents itself as the back-bone of this mechanism, in that it has a vertical flange portion 26 whereby it is fastened to the gear box 21, the parts being centered and positioned with respect to each other as by a circular shoulder 27. The body portion of the adaptor bracket 25 comprises said flange portion 26, a frusto-conical hollow portion 28 herein briefly termed conical portion extending horizontally outwardly from and concentric with the flange portion, and a hollow cylindrical portion or hub portion 29 extending horizontally outwardly from the frusto-conical portion 28. At the juncture of the conical portion 28 with the cylindrical portion there extend in a transverse vertical plane a pair of bracket extensions or wings 30 and 31 provided at their extreme outer ends with lugs 30^a and 31^a respectively in which is turnable a screw spindle 24 secured against axial displacement as by a collar 32 and having fixed upon one free outer end thereof the hand wheel 23 for varying the length of stroke of the pump.

An auxiliary bracket 33 is slidably fitted and rotationally adjustable upon the hub portion 29, and comprises a central annular body portion 34 formed with a pair of bifurcated or slotted parallel arms 35 and 36 having between them a space 37, which arms extend laterally and upwardly from the body portion so as to straddle the screw spindle 24 from underneath, with arms 35 and 36 providing slots at 35^a and 36^a. The screw spindle 24 has upon it a square nut 38 formed with a pair of pintles 39 and 39^a extending laterally from the nut in opposite directions so as to lodge in the slots 35^a and 36^a respectively.

In this way, by turning the hand wheel 23 and rotating the spindle 24 the square nut 38 can be moved horizontally back and forth upon the spindle 24, so that thereby the auxiliary bracket 33 can be rotationally adjusted to any desired angular position within a range defined by the respective end positions of the nut upon the screw spindle 24.

The adjustable auxiliary bracket 33 has another lateral extension or wing portion 40 upon which is pivotally

mounted a motion-transmitting oscillatable member or swingable plate 42 of substantially triangular shape and formed with a hub portion 43 at the outer base corner 44 of the triangular shape and thereby rotatable upon a pin or stud 45 fixed upon the wing portion 40 and held in place upon the stud as is indicated by a nut 46. The opposite or inner base corner 47 has pivotally connected therewith as at 48 the pump rod R, which latter is adjustable as to its own length by reason of the threaded end portion 49 thereof being screwed into a head portion 50, which latter has the pivotal connection 48 with the oscillatable member 42. The pivotal connection 48 comprises a pin which is fixed in and to the oscillatory member 42 as by cotter pin 48^a.

It will now be noted that the oscillatory member 42, because of the hub portion 43 thereof, is spaced a distance "d" (see Figs. 4 and 6) from the extreme outer end of the adaptor bracket 25 thereby defining a space in which lodges and extends a drive link member 51. The outer or upper end of link member 51 has pivotal connections with the intermediate portion of the oscillatable triangular member 42, namely with the upper corner portion 52 thereof, such pivotal connection being indicated by a pivot or stud 53 fixed in the oscillatory member 42 and a securing nut 54.

The lower end of the drive link member 51 has a ball bearing 55 whereby it is rotatable upon an eccentric pin 56 extending from the horizontal output shaft 22 of the gear box. That is to say, the eccentric pin 56 is formed with a hollow cylindrical or cup-shaped base portion 57 fitted over the free end of the horizontal drive shaft 22 and secured thereto as by a key-and-groove connection 58.

In Fig. 5 the pin 45 is provided with a pointer 59 which may reciprocate in the arcuate slot 60 of a casing 61 surrounding the oscillatory mechanism and diagrammatically shown in Fig. 11.

Fig. 12 shows a modification in the arrangement of the elements of the oscillatory mechanism of Fig. 10 in that the auxiliary bracket 33 thereof is replaced with a slightly differently shaped auxiliary bracket 62 providing a pair of pivotal points 63 and 64 about which are swingable a pair of parallel links 65 and 66 respectively, the outer ends 65^a and 66^a of which links are in turn pivotally connected to and interconnected by a floating reciprocatory member 67. The upper end of a pump rod R' is pivotally connected as at 68 to the intermediate portion of the floating member 67.

With respect to the operation of the pump, by turning the handwheel 23 even while the pump drive is running, the pump can be operated as between maximum and zero capacity. That is to say, turning the handwheel 23 so as to place the nut 38 in the right-hand position on spindle 24 (see Fig. 9) will place the pivotal point 59 of oscillatory member 42 a horizontal distance "h" to the right of the top end of pump rod R so that the drive link 51 will reciprocate the pump rod R vertically (see arrows w₁) thereby imparting maximum pumping stroke to the pump. On the other hand, by turning the handwheel 23 so as to place the nut 38 in the left-hand end position upon spindle 24 will place a pivotal point 59 a vertical distance "v" above the top end of pump rod R so that drive link 51 will merely reciprocate the top end of the pump rod in a horizontal direction (see arrows w₂) thereby reducing the pumping stroke to practically zero. Consequently, by placing the nut 38 in any of the intermediate positions upon the spindle 24 there can be obtained corresponding intermediate values for a pumping stroke and thus for the delivery volume desired to be delivered by a pump.

Similar effects with respect to adjusting the drive mechanism and various delivery volumes are obtainable with the Figs. 12 and 13 modification of the oscillatory mechanism. That is to say, the drive link 51^a therein (which corresponds to the drive link 51 in Figs. 9 and 10) will either reciprocate the pumping rod R' bodily in a vertical direction as is indicated by corresponding arrows to ob-

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tain maximum pumping stroke, or the reciprocation will be effected with a setting of Fig. 13 whereby only the top end of pump rod R' is reciprocated horizontally as indicated by corresponding arrows, whereby the pumping stroke and thus the delivery volume of the pump are reduced to practically zero. Again any intermediate flow of delivery volume is attainable by placing the nut 38^a in any of the intermediate positions upon spindle 24, namely, between the right-hand end position of Fig. 12 and the left-hand end position of Fig. 13.

I claim:

1. A drive-head having a motor driven box containing speed reducing mechanism and providing a low speed drive shaft, oscillatory or reciprocatory mechanism associated with and driven by the shaft for imparting oscillatory or reciprocatory movements to a driven apparatus, and stroke adjusting means for said mechanism for varying the length of said movements imparted to said apparatus; characterized thereby that the mechanism is fastened to and supported by the gear box in operative relationship with and surrounding the outer end of the low speed shaft, said mechanism comprising an eccentric drive pin upon said shaft, a substantially hollow adaptor bracket fastened shield-like to the adjoining wall portion of the box structure and having a cylindrical hub portion surrounding the shaft, an auxiliary bracket member rotationally adjustable upon the hub portion, means for fixedly holding the auxiliary bracket member in an adjusted position relative to the adaptor bracket, a motion transmitting member mounted upon said auxiliary bracket member for movement in a vertical plane and having pivotal connection with said driven apparatus, and an actuating means or drive link effective between the eccentric and the motion-transmitting member for imparting reciprocations or oscillations thereto and thereby to the driven apparatus, the direction of reciprocation or oscillation of said motion transmitting member being adjustable by the rotational adjustment of said auxiliary bracket member whereby the length of said oscillating or reciprocating movement is variable.

2. A drive-head according to claim 1, with the addition of a turnable member, for example a screw spindle rotatably mounted upon the adaptor bracket, and motion-transmitting means effective between the auxiliary bracket and the turnable member for rotationally adjusting the auxiliary bracket member and thus for adjusting the length of the said oscillatory or reciprocatory movement.

3. A drive-head according to claim 1, in which the motion-transmitting member is an oscillatory member having its outer end pivotally mounted upon a laterally outlying point of the auxiliary bracket member, and having its inner end pivotally connected with an actuating rod

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or the like for imparting movements to said apparatus, while an intermediate upper portion of a motion-transmitting member is connected by a drive link to the eccentric.

4. A drive-head according to claim 1, in which the motion-transmitting member is mounted for bodily reciprocation by means of a pair of parallel links upon the auxiliary bracket member, the links being disposed at respective ends of the motion-transmitting member while an actuating rod or the like is pivotally connected to an intermediate portion of the motion-transmitting member for imparting movements to said apparatus.

5. The drive-head according to claim 1, as applied to a diaphragm pump having a pump rod rising from the diaphragm, characterized thereby that the pump housing is mounted upon the foot end of an upright frame structure, and that the drive-head is an assembly unit atop the frame structure with said low speed shaft extending horizontally and the adaptor bracket extending vertically.

6. The drive-head in combination with diaphragm pump according to claim 5, in which the upright frame structure is in the form of a hollow columnar member or length of pipe having a base plate and top flange or platform, with the drive head mounted upon and fastened to top flange.

7. The drive-head in combination with a diaphragm pump according to claim 1 as applied to a diaphragm pump having an upright frame structure and having a pump rod rising from the diaphragm, characterized thereby that the frame structure comprises a columnar member, that the pump housing has a laterally extending bracket portion and means for clamping this bracket portion to and around the lower portion of the columnar member, and that the drivehead is in the form of an assembly unit mounted atop the columnar member with said low speed shaft extending horizontally and the adaptor bracket extending in a plane vertically and at right angles with respect to said low speed shaft.

8. A drive head according to claim 1, in which said eccentric drive pin has a cup shaped adaptor base portion surrounding and detachably fixed to the free end of said low speed drive shaft.

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