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3,499,347

VARIABLE ECCENTRICITY DRIVER

Filed May 29, 1968

2 Sheets-Sheet 1

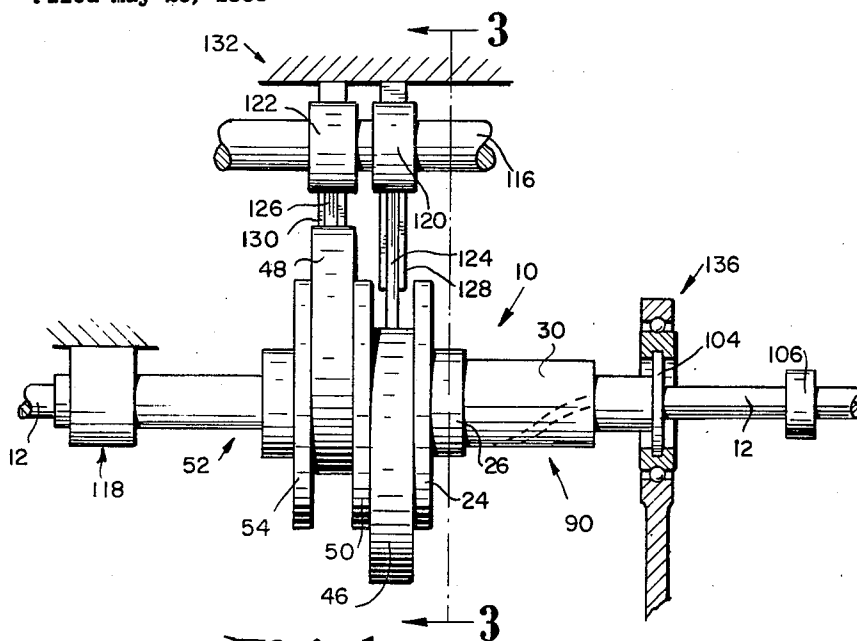


Fig. 1

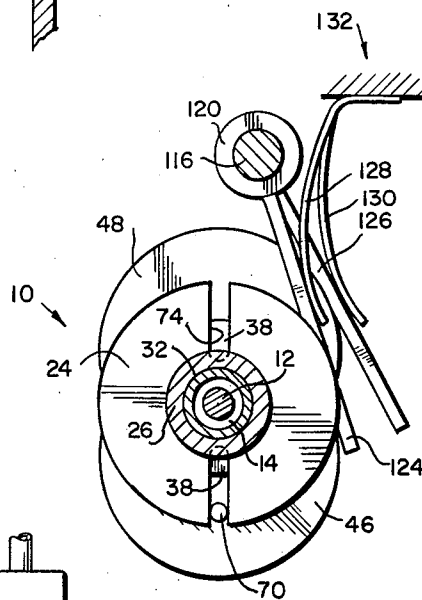


Fig. 3

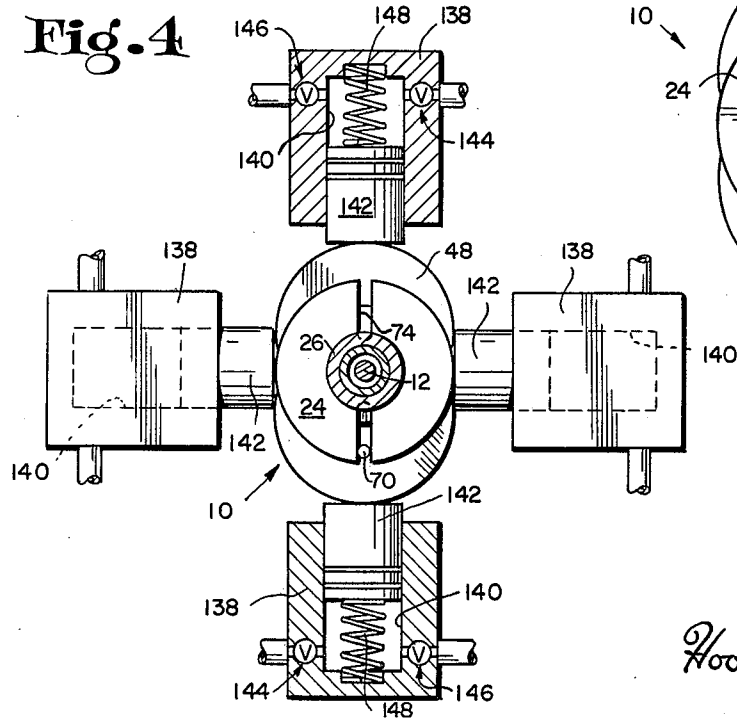


Fig. 4

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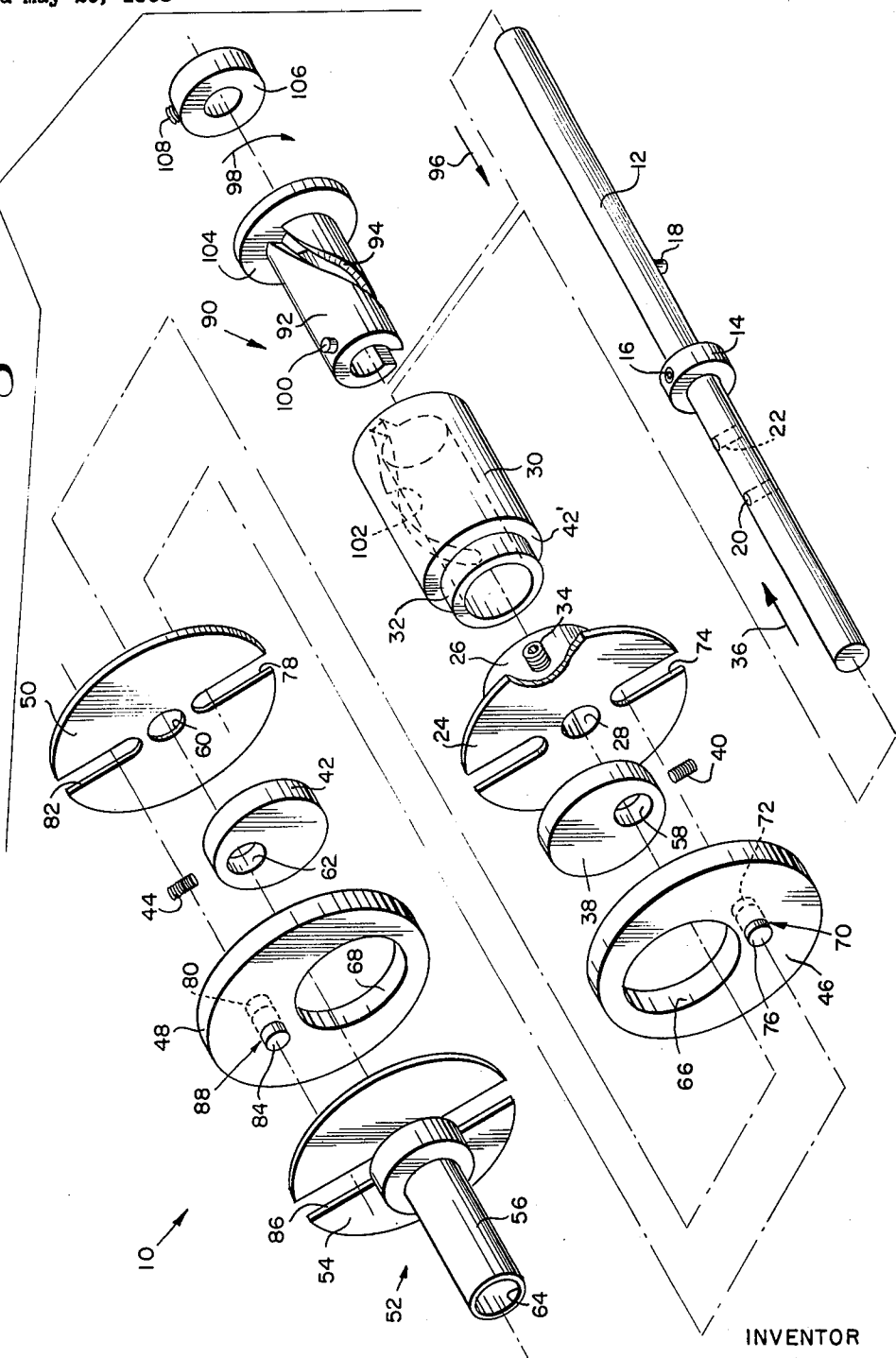
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2 Sheets-Sheet 2

Fig. 2



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VARIABLE ECCENTRICITY DRIVER

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18 Claims

ABSTRACT OF THE DISCLOSURE

A variable eccentricity driver comprising a cam shaft, a drive cam journaled on an eccentric portion of the cam shaft, and means for selectively positioning the drive cam about the axis of the eccentric portion. The positioning means includes a member connected to the drive cam and arranged for controlled rocking movement about the axis of the cam shaft. The drive cam is ideally suited for driving the piston of a variable stroke pump or other follower means.

It is a primary object of my invention to provide a variable eccentricity driver which is simple in construction and, yet, effective for imparting a reciprocatory or oscillatory movement to the driven element of a plurality of different types of apparatus. My driver may be characterized as a cam shaft having a selectively variable eccentricity.

Another object of my invention is to provide such a driver comprising a shaft, a cylindrical element eccentrically mounted on the shaft for rotation therewith with its axis parallel to the axis of the shaft, a drive cam journaled on the outer peripheral surface of the element and means for selectively positioning the drive cam about the axis of the element. I prefer that this last-mentioned means comprise a member mounted on the shaft for rocking movement relative thereto, means providing a driving connection between the drive cam and the member and control means for rocking the member about the shaft. My preferred control means is arranged smoothly, i.e., without a step-by-step motion, to rock the member about the shaft.

Still another object of my invention is to provide such a control means comprising a pair of members mounted on the shaft for rotation therewith, the members being arranged for relative axial movement, a radially extending pin carried by one of the members and the other of the members being formed with an elongated slot for slidably engaging the pin, the slot being spirally inclined about the axis of the shaft. Preferably, such members will be telescopically related sleeves, the sleeves being telescopically mounted on the shaft and one of the sleeves being operatively connected to the shaft so that such relative axial movement produces a rocking movement of the other sleeve relative to the shaft.

A further object of my invention is to provide such a driver comprising means for drivingly connecting the control means to the drive cam, the connecting means comprising means operatively connected to the control means and providing guide means extending outwardly from the shaft and slide means carried by the drive cam and cooperatively engaged with the guide means. In a preferred embodiment of my invention, this connecting means comprises a disc carried by the shaft and operatively connected to the control means, the disc having an outwardly extending, elongated slot formed therein, and the slide means comprises a pin rigidly mounted on the drive cam and arranged slidably to engage the slot.

Other objects and features of the present invention will become apparent as this description proceeds.

To the accomplishment of the above and related objects, my invention may be embodied in the forms illustrated in the accompanying drawings, attention being called to the fact, however, that the drawings are illustrative only, and that change may be made in the specific constructions illustrated and described, so long as the scope of the appended claims is not violated.

In the drawings:

FIG. 1 is a fragmentary sectional view showing a variable speed drive system embodying my variable eccentricity driver;

FIG. 2 is an exploded perspective view of my driver;

FIG. 3 is a fragmentary sectional view taken from FIG. 1 generally along the line 3—3; and

FIG. 4 is a sectional view of a pumping system embodying my driver.

Referring now to the drawings, and particularly to FIG. 2, it will be seen that I have illustrated a driver, indicated generally by the reference numeral 10, comprising a shaft 12 on which a bearing and stop collar 14 is mounted, the collar being secured to the shaft by means such as the illustrated set screw 16. A radially outwardly extending pin 18 is rigidly mounted on the shaft 12 and a pair of spaced-apart, transaxially extending openings 20, 22 is provided in the shaft, these openings preferably being threaded. The shaft 12 serves as the main supporting shaft for the rest of the elements of my driver.

A disc member 24 having a centrally disposed hub portion 26 thereon and a centrally located and axially extending bore 28 therein is journal mounted on the shaft 12. Specifically, the bore 28 through the hub portion 26 is enlarged so that the hub portion is peripherally disposed about the collar 14 to define an annular space therebetween. A sleeve 30 having a reduced end portion 32 is mounted on the shaft 12 with the reduced end portion inserted into the annular space defined by the hub 26 and the collar 14. The sleeve 30 and the disc member 24 are rigidly fastened together by means such as the illustrated set screw 34 which extends through the hub portion to engage the reduced portion 32. The disc member 24 and the sleeve 30, therefore, are secured together for rocking movement relative to the shaft 12 and collar 14. The member 24 is restrained from movement axially in the direction of the arrow 36 because the diameter of the collar 14 is greater than the smallest diameter portion of the bore 28 through the member 24. The disc member 24 is also restrained from axial movement in the direction opposite to the arrow 36 by means of the illustrated eccentric element 38 which is mounted on the shaft 12 and which is secured in position on the shaft by means of a set screw 40 which engages the opening 22. The main function of this eccentric element 38 will be more fully explained hereinafter.

The sleeve 30 is also restrained against axial movement in the direction opposite to the arrow 36 by engagement of the face 42' thereof with the hub portion 26.

Another eccentric element 42 is mounted on the shaft 12 for rotation therewith, this eccentric element being secured in position on the shaft by means such as the illustrated set screw 44 which engages the opening 20. In the illustrative embodiment, the eccentric elements 38, 42 are identical with cylindrical outer peripheral surfaces of equal diameter, the axes of these surfaces being parallel to the axis of the shaft 12. Further, in the illustrative embodiment, the elements 38, 42 are radially oppositely disposed on the shaft 12, i.e., the point of maximum eccentricity on the element 38 is 180° displaced from the point of maximum eccentricity on the element 42. A drive cam 46, 48 is journaled on the outer peripheral surface of each eccentric element 38, 42, these cams being

separated by a disc 50 which is journaled on the shaft 12 and which is disposed between the eccentric elements 38, 42. A retainer means 52 having a flange portion 54 and a hub portion 56 is journaled mounted on the shaft 12 and arranged to prevent axial movement of the cam 48 in a direction opposite to the arrow 36. Any suitable means may be used to hold retainer means 52 against axial movement relative to the shaft 12.

It will be apparent from FIG. 2 that the shaft 12 extends axially through the bore of the sleeve 30, the bore 28 of the disc member 24, the opening 58 in the eccentric element 38, the opening 60 in the disc 50, the opening 62 in the eccentric element 42, and the central bore 64 in the retainer means 52. It will further be apparent that each cam 46, 48 is provided with an axially extending, eccentric cylindrical opening 66, 68, the inner peripheral surface of which is in bearing contact with the outer peripheral surface of its associated eccentric element 38, 42.

Each cam 46, 48 carries an axially extending pin 70, 88 which, in the illustrative embodiment, has a portion extending outwardly from each side thereof. One end portion 72 of the pin 70 is slidably engaged in a radially outwardly extending slot 74 in the disc member 24 and the other end portion 76 of that pin is slidably engaged in a radially outwardly extending slot 78 in the disc 50. Similarly, one end portion 80 of the pin 88 slidably engages another radially extending slot 82 in the disc 50 and the other end portion 84 of that pin slidably engages a radially extending slot 86 in the flange 54. It will be understood, however, that the engagement of the pin 88 with the slot 86 is merely a matter of convenience and the slot 86 is only provided so that the pins 70 and 88 can be identical.

It will now be apparent that the pin 70 engages the slot 74 so that rocking movement of the disc member 24 about the axis of the shaft 12 will produce movement of the cam 46 about the axis of the eccentric element 38. Since the pin 70 is also engaged with the slot 78 and the pin 88 is engaged with the slot 82, such movement of the cam 46 about the axis of the eccentric element 38 will produce movement of the cam 48 in the same direction about the axis of the eccentric element 42. Since the slots 78, 82 and pins 70, 88 are radially oppositely disposed and since the eccentric elements 38, 42 are identical and disposed on radially opposite sides of the shaft 12, the amount of radial movement of the cam 48 will be equal to the amount of radial movement of the cam 46.

I can mount any number of cams and eccentric elements on a shaft and interconnect them by means of pins and discs as described above so that rocking movement of one cam will produce a corresponding rocking movement of the other cams. Further, I can vary the amount one cam moves relative to its adjacent cam by selectively positioning the pin carried by the cam and/or changing the angle or contour of the slot in the disc providing a driving connection between the cams. For instance, the slots 78, 82 need not extend rectilinearly radially outwardly from the center of the disc 50.

From the above description, it will be apparent that the degree of eccentricity of the cams 46, 48 relative to the axis of shaft 12 is dependent on the position of the disc member 24 and is infinitely variable from zero to a predetermined maximum. I have provided control means, indicated generally by the reference numeral 90, for selectively and rockably positioning the member 24 about the axis of the shaft 12. In the illustrative embodiment, the control means 90 comprises a sleeve 92 which is disposed telescopically on the shaft 12 and within the sleeve 30, the sleeve 92 being formed with an elongated slot 94 therein which inclines spirally about the axis thereof. The pin 18 is slidably engaged in this slot 94 so that axial movement of the sleeve 92 in the direction of the arrow 96 causes the sleeve 92 to rock in the direction of the arrow 98 relative to the shaft 12. Of course, movement

of the sleeve 92 in the direction of the arrow 36 causes the sleeve to rock in the direction opposite to the arrow 98. In order to provide a driving connection between the sleeve 92 and the sleeve 30, I have provided a radially outwardly extending pin 100 which is rigidly mounted on the sleeve 92 and which slidably engages an elongated slot 102 which, in the illustrative embodiment, is formed internally in the wall of the sleeve 30. Further, I have formed the slot 102 so that it is spirally inclined about the axis of the sleeve 30 such that axial movement of the sleeve 92 relative to the sleeve 30 will cause the sleeve 30 to rock about its axis relative to the sleeve 92. This slot 102 is spirally inclined so that axial movement of the sleeve 92 in the direction of the arrow 96 will produce movement of the sleeve 30 in the direction of the arrow 98 relative to the sleeve 92. Thus, the rocking movement of the sleeve 30 is in the same direction and, therefore, in addition to the rocking movement of the sleeve 92. Obviously, the pitch and direction of either or both of the slots 94 and 102 may be varied to provide any desired relation between the degree of axial movement of sleeve 92 relative to shaft 12 and the resultant degree of rotational movement of sleeve 30 and member 24.

Since the disc member 24 is rigidly fastened to the sleeve 30 by means of the set screw 34, movement of the sleeve 30 about the axis of the shaft 12 produces movement of the cams 46, 48 about their respective eccentric elements 38, 42.

A radially outwardly and peripherally extending flange 104 is rigidly mounted on the sleeve 92 to provide means for pushing and pulling the sleeve axially on the shaft 12. The axial movement of the sleeve 92 in the direction of the arrow 36 is limited by a stop 106 which is mounted on the shaft 12 and secured in position by means such as the illustrated set screw 108. In the illustrative embodiment, the stop 106 can be arranged so that, when the sleeve 92 is in the center of its axial path of movement, the disc member 24 is in the center of its radial extent of movement and the axes of the outer peripheral surfaces of the cams 46, 48 coincide with the axis of the shaft 12. Thus, movement of the sleeve 92 axially from one end of its travel to the other end will move each cam 46, 48 from its outermost position on one side of the shaft 12 to its outermost position on the radially opposite side of the shaft 12.

While I have illustrated the cams 46, 48 having a cylindrical outer peripheral surface, it will be understood that cams having any desirable contour may be journaled on the eccentric elements 38, 42 or, for that matter, any number of types of driving elements may be mounted on the eccentric elements 38, 42. For that reason, in this description and in the appended claims, the term "drive cam" or "cam" is intended to refer to any type of drive element which may be journaled mounted on the eccentric elements 38, 42 for movement toward and away from the axis of the shaft 12.

It will be seen that the shaft 12 with the eccentric elements 38, 42 mounted thereon for rotation therewith constitutes a cam shaft having a fixed eccentricity. Journal mounting of the cams 46, 48 on their respective eccentric elements 38, 42 provides a cam shaft having a variable eccentricity. Then, addition of the control means 90 and the above-described means for drivingly connecting the control means to the cams provides a cam shaft having a selectively variable eccentricity.

One application of my driver 10 is shown in FIGS. 1 and 3. In these figures, it will be seen that the driver 10 is journaled for rotation adjacent a shaft 116, one end of the driver 10 being supported as indicated at 118. The shaft 116 is journaled for rotation by conventional means (not shown) and a pair of longitudinally spaced-apart one-way clutches 120, 122 is mounted on the shaft. Such one-way clutches are well known in the art and need not be discussed, in detail, in this description. For instance, a simple one-way clutch may comprise an inner

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race which carries a ratchet wheel and which may be keyed to the shaft 116 and an outer race which carries a pawl for engaging the ratchet wheel and driving it in one direction.

An arm 124, 126 is mounted on the outer race of each one-way clutch 120, 122 to extend outwardly and downwardly therefrom as illustrated in FIGS. 1 and 3, the arm 124 being arranged to engage the outer peripheral contour of the cam 46 and the arm 126 being arranged to engage the outer peripheral contour of the cam 48. As illustrated in FIG. 3, a leaf spring 128, 130 may be utilized to urge yieldably each arm 124, 126 into engagement with the outer peripheral contour of its respective cam 46, 48. These leaf springs 128, 130 may be supported at their upper ends as indicated at 132 in FIG. 3.

Assuming that the shaft 12 is driven at a constant speed, it will be seen that the shaft 116 will be driven at a speed which is determined by the position, i.e., the eccentricity, of each of the cams 46, 48. If the cams are positioned so that the axes of their outer peripheral surfaces coincide with the axis of the shaft 12, the arms 124, 126 will not be driven to impart rotational movement to the shaft 116. Specifically, the amount that each arm 124, 126 is driven depends on the eccentricity of its associated cam 46, 48. Of course, the speed of the shaft 116 is directly dependent upon the amount of movement of each arm 124, 126.

I have shown a bearing 136 mounted on the flange 104 of the sleeve 92, this bearing providing means for axially moving the sleeve in order to position the cams 46, 48. It will be understood that this bearing 136, the inner race of which is mounted directly on the flange 104, is merely illustrative and that many means may be provided for pushing and pulling the sleeve 92 axially along the shaft 12.

Another application of my driver 10 is shown in FIG. 4. Referring to FIG. 4, it will be seen that I have illustrated four pumps 138 which are radially equally spaced about the axis of the shaft 12, two of the pumps being shown in section to facilitate this description. Each pump 138 comprises means defining a cylinder 140 in which a piston 142 is arranged for axial reciprocation, an input valve 144 and a delivery valve 146, these valves being conventional, and a spring 148 for yieldably urging the piston 142 in one direction in the cylinder. In FIG. 4, it will be seen that each of the pistons 142 is yieldably urged toward the axis of the shaft 12 to be engaged and reciprocated by the cams 46, 48. The stroke of each piston 142 is thus controlled by the eccentricity of each cam 46, 48 and can be varied from zero when the axes of the outer peripheral surfaces of the cams coincide with the axis of the shaft 12 to a maximum which is equal to the maximum eccentricity of the cams 46, 48. It will be apparent that, in order for the eccentricity to be zero, the eccentricity of each cam 46, 48 must be equal to the eccentricity of the element 38, 42 on which the cam is mounted.

In the embodiment of FIG. 4, two of the pistons 142 will be fully extended when the other two pistons are fully retracted. I believe that the system illustrated in FIG. 4 can ideally be used as a pumping system for a fuel injection system for a four cylinder Diesel engine. Each piston 142 is reciprocated twice during each revolution of the shaft 12.

What is claimed is:

1. A driver comprising a shaft, a cylindrical element eccentrically mounted on said shaft for rotation therewith, the axis of said element being parallel to the axis of said shaft, a cam journaled on the outer peripheral surface of said element, first means mounted on said shaft for rocking movement about the axis thereof, second means for drivingly connecting said cam to said first means whereby rocking of said first means rocks said cam about the axis of said element, and control means for selectively and rockably positioning said first means about

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said shaft, said control means being operatively connected to said first means, said control means including a sleeve telescopically disposed on said shaft, said sleeve having an elongated slot formed therein and inclining spirally about the axis of said shaft, a pin carried by said shaft and extending outwardly into sliding engagement with said slot, and third means for drivingly connecting said sleeve to said first means.

2. A driver as in claim 1 wherein said third means includes a second sleeve with which said first-mentioned sleeve is telescopically related, said second sleeve being provided with a second elongated slot, and a second pin carried by said first-mentioned sleeve and extending into said second slot.

3. A driver as in claim 2 wherein said second slot is inclined spirally about the axis of said shaft so that axial movement of said first-mentioned sleeve produces rocking movement of said second sleeve relative to said first-mentioned sleeve and in the same direction as the rocking movement of the first-mentioned sleeve.

4. A driver comprising a shaft, a cylindrical element eccentrically mounted on said shaft for rotation therewith, the axis of said element being parallel to the axis of said shaft, a cam journaled on the outer peripheral surface of said element, first means mounted on said shaft for rocking movement about the axis thereof, second means for drivingly connecting said cam to said first means whereby rocking of said first means rocks said cam about the axis of said element, and control means for selectively and rockably positioning said first means about said shaft, said control means being operatively connected to said first means, said control means including a sleeve telescopically disposed on said shaft, a first pin rigidly mounted on said shaft to extend outwardly therefrom, said sleeve having an elongated slot formed therein for slidably engaging said pin, another sleeve telescopically related with said first sleeve, a second pin rigidly mounted on one of said sleeves and a second elongated slot formed in the other of said sleeves for slidably engaging said second pin, at least one of said slots being spirally inclined about the axis of said shaft so that axial movement of said first-mentioned sleeve produces a rocking movement of said second-mentioned sleeve.

5. A driver comprising a shaft, a cylindrical element eccentrically mounted on said shaft for rotation therewith, the axis of said element being parallel to the axis of said shaft, a cam journaled on the outer peripheral surface of said element, first means mounted on said shaft for rocking movement about the axis thereof, second means for drivingly connecting said cam to said first means whereby rocking of said first means rocks said cam about the axis of said element, and control means for selectively and rockably positioning said first means about said shaft, said control means being operatively connected to said first means, said control means including a pair of sleeves mounted on said shaft for rotation therewith, said sleeves being telescopically related and one of said sleeves being axially movable relative to said shaft, a radially outwardly extending first pin rigidly mounted on said shaft, the axially movable sleeve having an elongated slot formed therein for slidably engaging said first pin, a second radially extending pin carried by one of said sleeves and the other of said sleeves being formed with a second elongated slot for slidably engaging said second pin, and at least one of said slots being inclined spirally about the axis of said shaft so that reciprocable movement of the axially movable sleeve produces a rocking movement of the other sleeve, said other sleeve being connected to said first means.

6. A driver comprising a shaft, a cylindrical element eccentrically mounted on said shaft for rotation therewith, the axis of said element being parallel to the axis of said shaft, a cam journaled on the outer peripheral surface of said element, first means mounted on said shaft for rocking movement about the axis thereof, second means

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for drivingly connecting said cam to said first means whereby rocking of said first means rocks said cam about the axis of said element, and control means for selectively and rockably positioning said first means about said shaft, said control means being operatively connected to said first means, said control means includes a pair of members mounted on said shaft for rotation therewith, said members being arranged for relative axial movement, a radially extending pin carried by one of said members, and the other of said members being formed with an elongated slot for slidably engaging said pin, said slot being spirally inclined about the axis of said shaft, and one of said members being operatively connected to said first means and oscillable about the axis of said shaft.

7. A driver comprising a shaft, a cylindrical element eccentrically mounted on said shaft for rotation therewith, the axis of said element being parallel to the axis of said shaft, a cam journaled on the outer peripheral surface of said element, first means mounted on said shaft for rocking movement about the axis thereof, second means for drivingly connecting said cam to said first means whereby rocking of said first means rocks said cam about the axis of said element, and control means for selectively and rockably positioning said first means about said shaft, said control means being operatively connected to said first means, said first means including a disc carried by said shaft, said disc having an outwardly extending, elongated slot formed therein, and wherein said second means comprises a pin rigidly mounted on said cam and arranged slidably to engage said slot.

8. A driver comprising a shaft, a cylindrical element eccentrically mounted on said shaft for rotation therewith, the axis of said element being parallel to the axis of said shaft, a cam journaled on the outer peripheral surface of said element, first means mounted on said shaft for rocking movement about the axis thereof, second means for drivingly connecting said cam to said first means whereby rocking of said first means rocks said cam about the axis of said element, and control means for selectively and rockably positioning said first means about said shaft, said control means being operatively connected to said first means, said first means including means carried by said shaft and providing a guide means extending outwardly therefrom, and wherein said second means comprises slide means carried by said cam and cooperatively engaged with said guide means.

9. A driver as in claim 8 wherein said control means includes a pair of members mounted on said shaft for rotation therewith, said members being arranged for relative axial movement, one of said members being connected to said first means and oscillable about the axis of said shaft, a radially extending pin carried by one of said members and the other of said members being formed with an elongated slot for slidably engaging said pin, said slot being spirally inclined about the axis of said shaft.

10. A driver as in claim 8 wherein said control means includes a pair of sleeves mounted on said shaft for rotation therewith, said sleeves being telescopically related and one of said sleeves being axially movable relative to said shaft, a radially outwardly extending first pin rigidly mounted on said shaft, the axially movable sleeve having an elongated slot formed therein for slidably engaging said first pin, a second radially extending pin carried by one of said sleeves and the other of said sleeves being formed with a second elongated slot for slidably engaging said second pin, and at least one of said slots being inclined spirally about the axis of said shaft so that reciprocable movement of the axially movable sleeve produces a rocking movement of the other sleeve and said other sleeve being connected to said first means.

11. A driver as in claim 7 wherein said control means includes a sleeve telescopically disposed on said shaft, said sleeve having an elongated slot formed therein and inclining spirally about the axis of said shaft, a pin carried by said shaft and extending outwardly into sliding engage-

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ment with said slot, and third means for drivingly connecting said sleeve to said first means, said third means including a second sleeve with which said first-mentioned sleeve is telescopically related, said second sleeve being provided with a second elongated slot, a second pin carried by said first-mentioned sleeve and extending into said second slot, said second slot being inclined spirally about the axis of said shaft so that axial movement of said first-mentioned sleeve produces rocking movement of said second sleeve relative to said first-mentioned sleeve and in the same direction as the rocking movement of the first-mentioned sleeve.

12. The combination of a pump comprising a cylinder and a piston arranged for axial reciprocation in said cylinder, and a driver comprising a shaft, a cylindrical element eccentrically mounted on said shaft for rotation therewith, the axis of said element being parallel to the axis of said shaft, a cam journaled on the outer peripheral surface of said element, first means mounted on said shaft for rocking movement about the axis thereof, second means for drivingly connecting said cam to said first means whereby rocking of said first means rocks said cam about the axis of said element, and control means for selectively and rockably positioning said first means about said shaft, said control means being operatively connected to said first means, said piston being engaged with the peripheral contour of said cam to be reciprocated thereby.

13. The combination of a plurality of pumps, each pump comprising a cylinder and a piston arranged for axial reciprocation in said cylinder, and a driver comprising a shaft, a cylindrical element eccentrically mounted on said shaft for rotation therewith, the axis of said element being parallel to the axis of said shaft, a cam journaled on the outer peripheral surface of said element, first means mounted on said shaft for rocking movement about the axis thereof, second means for drivingly connecting said cam to said first means whereby rocking of said first means rocks said cam about the axis of said element, and control means for selectively and rockably positioning said first means about said shaft, said control means being operatively connected to said first means, said pumps being radially disposed about said shaft with each of said pistons being engaged with the peripheral contour of said cam to be reciprocated thereby.

14. The combination of a second shaft, clutch means mounted on said second shaft and arranged to move said shaft in one direction only about its axis in response to oscillation of said clutch, follower means connected to said clutch means, and a driver comprising a shaft, a cylindrical element eccentrically mounted on said shaft for rotation therewith, the axis of said element being parallel to the axis of said shaft, a cam journaled on the outer peripheral surface of said element, first means mounted on said shaft for rocking movement about the axis thereof, second means for drivingly connecting said cam to said first means whereby rocking of said first means rocks said cam about the axis of said element, and control means for selectively and rockably positioning said first means about said shaft, said control means being operatively connected to said first means, said follower means being cooperatively engaged with the peripheral contour of said cam.

15. The combination of claim 14 wherein said second shaft is generally parallel to said first-mentioned shaft, and spring means yieldably urging said follower means into engagement with the outer peripheral contour of said cam.

16. A driver comprising a shaft, a cylindrical element eccentrically mounted on said shaft for rotation therewith, the axis of said element being parallel to the axis of said shaft, a cam journaled on the outer peripheral surface of said element, first means mounted on said shaft for rocking movement about the axis thereof, second means for drivingly connecting said cam to said first means whereby rocking of said first means rocks said cam about the axis

of said element, and control means for selectively and rockably positioning said first means about said shaft, said control means being operatively connected to said first means, a second cylindrical element eccentrically mounted on said shaft for rotation therewith, the axis of said second element being parallel to the axis of said shaft, a second cam journaled on the outer peripheral surface of said second element, and third means providing a driving connection between said cams so that movement of said first-mentioned cam about the axis of said first-mentioned element produces a similar movement of said second cam about the axis of said second element.

17. A driver as in claim 16 wherein said third means includes a disc journaled on said shaft and disposed between said cams, an axially extending pin rigidly mounted on each of said cams to extend toward said disc, and said disc being provided with an outwardly extending slot for slidably engaging each of said pins.

18. A driver as in claim 17 wherein said cylindrical elements are identical in diameter and diametrically oppositely and equally spaced from the axis of said shaft, wherein said cams have cylindrical outer peripheral surfaces which are equal in diameter, said cams being eccentrically journaled on their respective cylindrical ele-

ments, wherein said slots in said disc are radially outwardly extending and peripherally spaced apart 180°, wherein said pins are peripherally spaced apart 180°, and wherein the eccentricity of each of said cams is equal to the eccentricity of said element on which said cam is journaled so that, in one position of said first means, the axes of said outer peripheral surfaces of said cams coincide with the axis of said shaft.

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