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[56]

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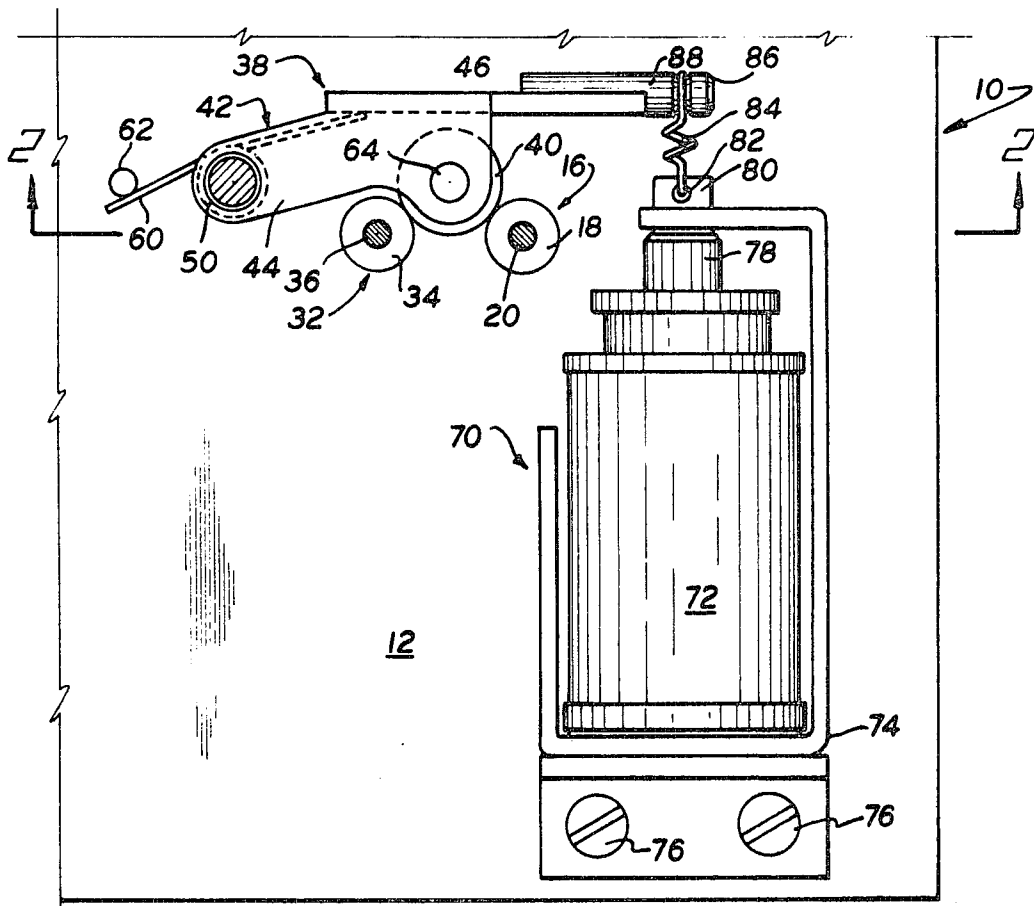
[54] **DRIVE MECHANISM EMPLOYING REACTION FORCES**
5 Claims, 4 Drawing Figs.

[52] U.S. Cl. 226/188

[51] Int. Cl. B65h 17/22

[50] Field of Search 226/188,
 178, 176, 199; 74/200, 201; 242/201, 202, 208

ABSTRACT: A drive mechanism for a tape deck and the like comprising a drive cylinder connected with driving means. A rotatable load cylinder is spaced from the drive cylinder and is adapted to be rotated in the same direction as the drive cylinder. A movable bracket rotatably supports a clutch cylinder which is adapted to be moved into contact with both the drive and load cylinders by the bracket whereby the reaction forces between the cylinders drive the clutch cylinder into further intimate contact with the drive and load cylinders. Moving means is provided to effect movement of the bracket.



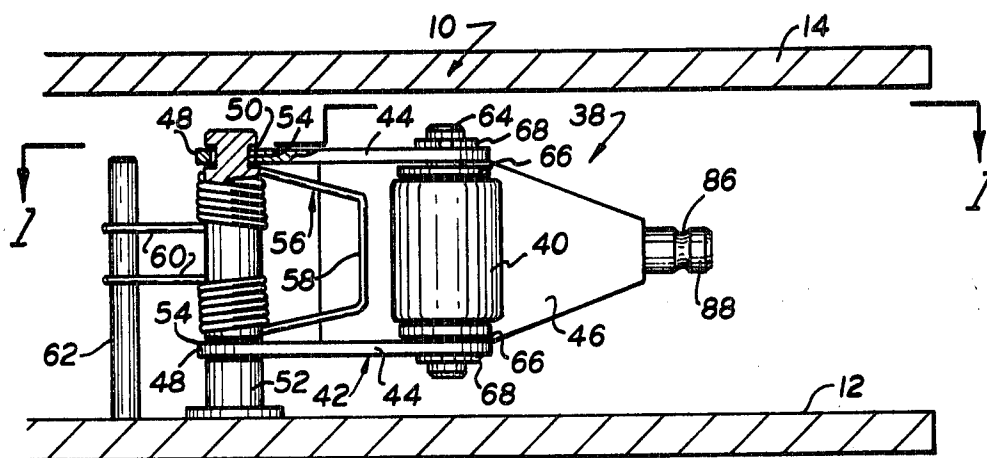
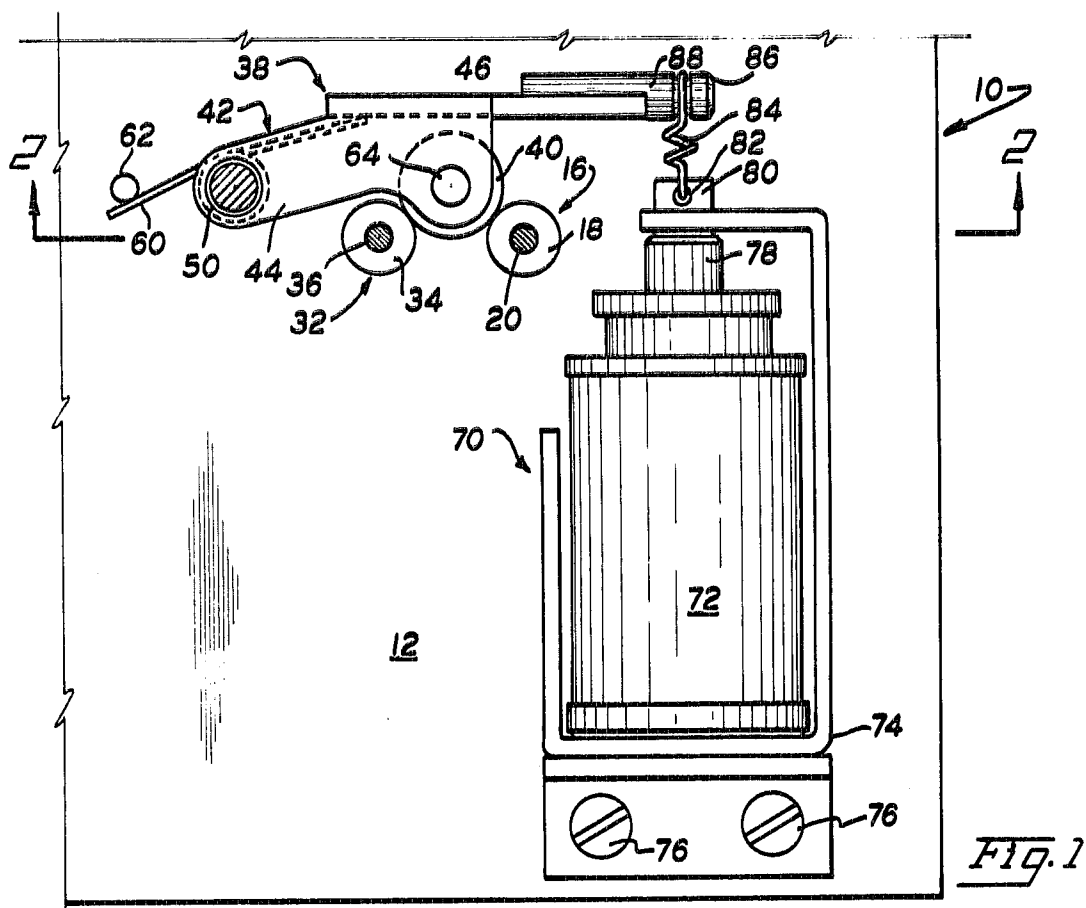


Fig. 2

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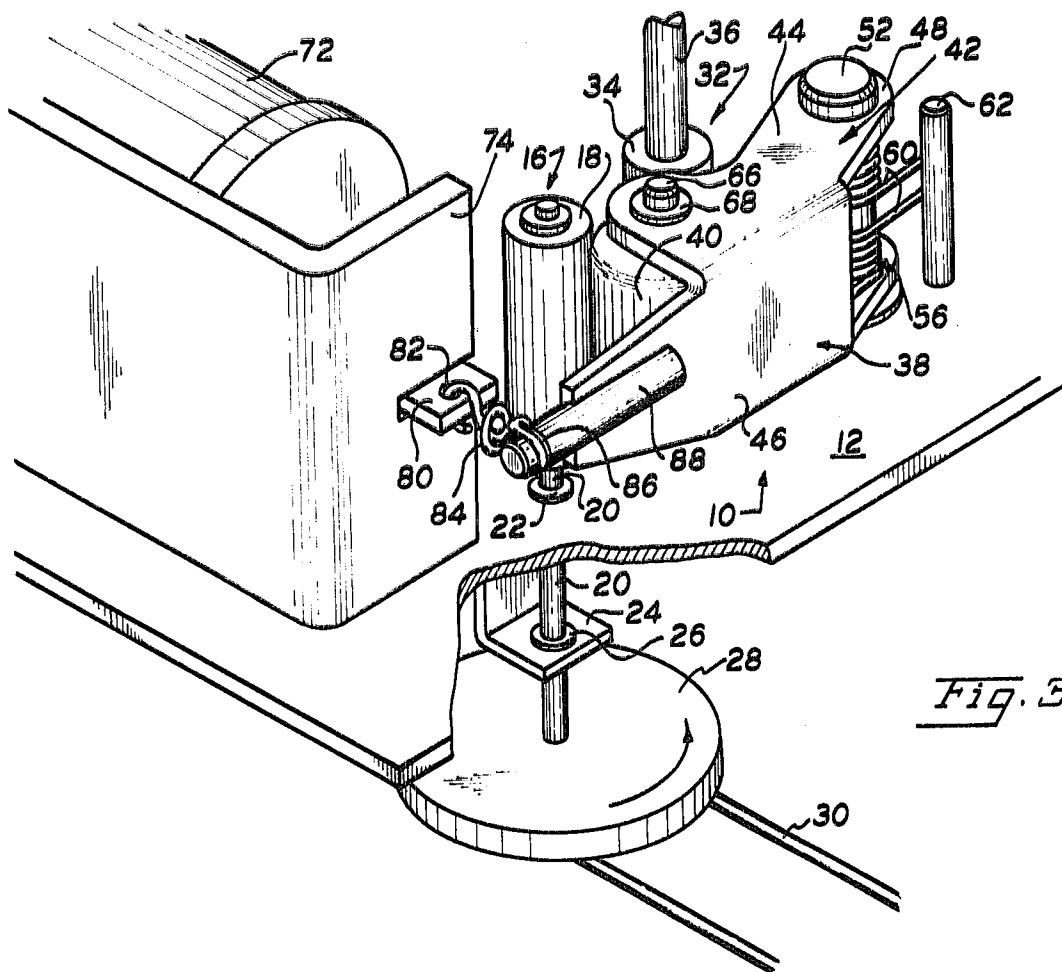


Fig. 3

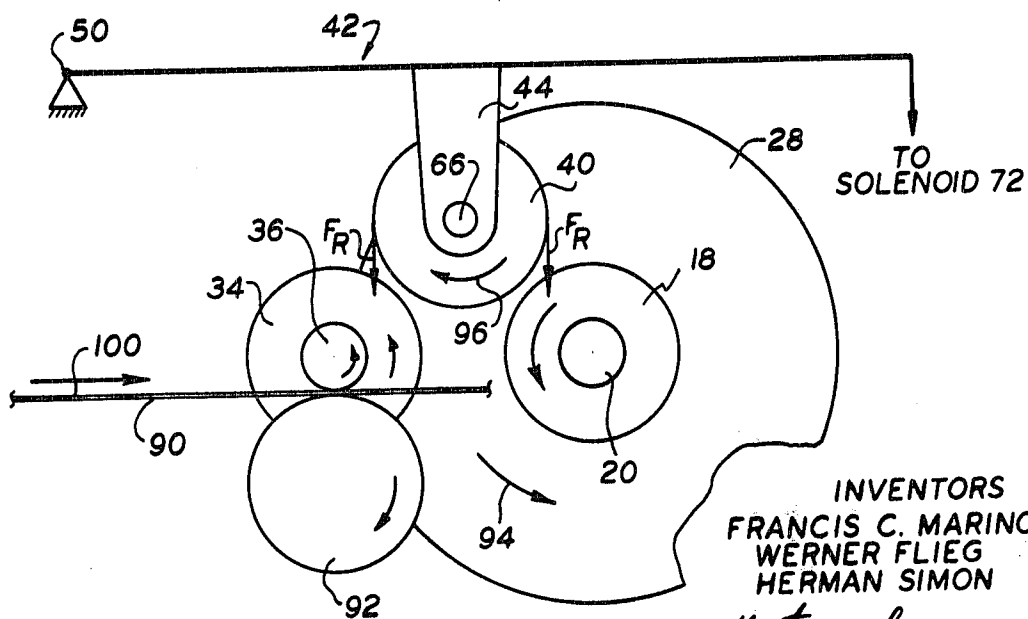


Fig. 4

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DRIVE MECHANISM EMPLOYING REACTION FORCES

This invention relates generally to a drive system and, more particularly, pertains to a drive system employing reaction forces to move the members comprising the system into intimate contact with each other.

At present, there are a number of different tape-transport mechanisms commercially available to move a tape, such as a magnetic-recording tape, from a feed-reel to a takeup reel past a write or a read head. Practically all of these systems employ a continuously rotating capstan and a pinch roller which is normally spaced from the capstan but which is selectively moved into position to "pinch" the tape between the roller and the capstan to effect movement of the tape. In practice, it has been found that these constructions have inherent disadvantages which produce serious drawbacks particularly in situations wherein the tape is stepped intermittently as in data communication systems.

More specifically, the pinch roller is initially spaced from the capstan by a relatively large distance to permit initial placement of the tape between these elements when the reel of tape is mounted on the tape deck. Thereafter, the pinch roller is moved toward the capstan by an appropriate apparatus so that the pinch roller is only a relatively small distance from the capstan to quicken the response of the transport mechanism when it is desired to step the tape medium. Moreover, this apparatus must be able to repetitively move the pinch roller into and out of operable association with the tape medium and the capstan and also maintain the pinch roller spaced from the capstan by the aforementioned relatively small distance when the tape medium is idle. Of necessity, this requires complex and sophisticated mechanisms which are relatively expensive, difficult to maintain, and susceptible to breakdown.

An additional disadvantage associated with the above-described type arrangement is due to the fact that the capstan is always rotating at maximum speed. Hence, when the pinch roller is operated to move the stationary tape medium against the rotating capstan there is a large initial slippage between the elements which results in tape skew and attendant errors.

Accordingly, an object of the present invention is to provide an improved drive mechanism for a tape-transport device.

A more specific object of the invention is to provide a drive mechanism which is simple in construction and reliable in operation.

Another object of the invention is the provision of a drive mechanism for a tape deck which is relatively inexpensive to produce.

A further object of this invention resides in the novel details of construction which provide a drive mechanism for a tape-transport device of the type described wherein the tape medium is continuously pinched between a pinch roller and a capstan to eliminate the problems heretofore encountered in mechanisms which selectively and repetitively pinch the tape medium to effect movement thereof.

Accordingly, a drive mechanism constructed according to the present invention comprises a drive cylinder adapted to be connected with driving means for rotating said drive cylinder. A rotatable load cylinder is spaced from the drive cylinder. A motion-transmitting cylinder is provided which is rotatably supported by movable bracket means which is operable to be moved between a first position in which the motion-transmitting cylinder is spaced from the load and drive cylinders and a second position in which the motion-transmitting cylinder contacts said load and drive cylinders to effect movement of the load cylinder. Moving means is also provided for selectively moving the bracket means to the second position.

Other features and advantages of the present invention will become more apparent from a consideration of the following detailed description when taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a top plan view of a drive mechanism constructed according to the present invention, taken along the line 1—1 of FIG. 2;

FIG. 2 is a front elevational view thereof taken along the line 2—2 of FIG. 1;

FIG. 3 is a perspective view of the drive mechanism as seen looking from the rear and with parts broken away for clarity; and

FIG. 4 is a diagrammatic representation of the elements comprising the drive mechanism.

As noted hereinabove, the drive mechanism of the present invention is used in conjunction with a tape-transport device to move a tape medium past a write or a read head on a tape deck. However, in the interest of clarity, the elements normally associated with a tape deck, such as the recording heads, the pinch roller mechanisms, etc., have not been shown since these elements are conventional. Only those elements necessary for an understanding of the present invention have been shown in detail.

Accordingly, a drive mechanism constructed in accordance with the present invention is designated generally by the reference numeral 10 in the Figures and is adapted to be mounted on a supporting platform 12 which is spaced below a tape deck support 14 (FIG. 2).

More specifically, as shown in FIGS. 1 and 3, the mechanism 10 includes a drive cylinder arrangement 16 which comprises a drive cylinder 18 fixedly received on a rotatable shaft 20 which extends through a bushing 22 in the platform 12. An L-shaped bracket 24 depends from the lower surface of the platform 12 and receives a bushing 26 therethrough which, in turn, rotatably supports the shaft 20. Connected to the lower end of the shaft 20 is a flywheel 28 which is connected to a motor (not shown) by a belt 30 which engages a pulley affixed to the lower face of the flywheel.

Spaced from and rotatably supported on the support 12 is a load-cylinder arrangement designated generally by reference numeral 32. The load-cylinder arrangement 32 comprises a load cylinder 34 affixed to a shaft 36 which is secured in appropriate bearings (not shown) on the support 12 to permit rotation of the shaft 36 and, concomitantly, the cylinder 34. The shaft 36 extends upwardly through the tape deck support 14 and functions as the capstan. Accordingly, when the load cylinder 34 is rotated in the manner noted below, the capstan (shaft) 36 similarly will rotate.

A clutch arrangement, which is designated generally by the reference numeral 38, is provided to transmit motion from the drive cylinder arrangement 16 to the load-cylinder arrangement 32. More particularly, the clutch arrangement 38 includes a clutch cylinder 40 which is rotatable on a movable bracket 42. The bracket 42 comprises spaced upper and lower arms 44 which are connected together by a rear wall 46 which extends beyond the respective arms. Additionally, the arms 44 extend beyond the rear wall 46 in the opposite direction and terminate in respective ear portions 48. Provided in the ear portions 48 are respective aligned apertures 50 which rotatably receive a shaft 52, upstanding from the support 12, therethrough.

The shaft 50 is provided with vertically spaced peripheral grooves 54 in which are received the respective ears 48. As shown in FIG. 2, the apertures 50 are of substantially greater diameter than the grooves 54 so that the bracket 42 may be moved slightly in both the horizontal and vertical directions to provide for the self-alignment of the clutch cylinder 40, as noted in detail below. A coil spring 56 surrounds the shaft 52 and includes a bight portion 58 which bears upon the rear wall 46 of the bracket and end portions 60 which extend outwardly from the shaft 52 and bear upon an upstanding post 62. The spring 56 is operable to bias the bracket 42 counterclockwise as taken in FIG. 1 to bias the clutch cylinder away from the drive and load cylinders 18 and 34.

The clutch cylinder 40 is rotatably received on a shaft 64 which is received through aligned bores in the arms 44. Spacers 66 of Teflon or the like are provided between the

cylinder 40 and the arms 44 and snap-lock washers 68 are received in appropriate grooves adjacent the ends of the shaft to lock the shaft in place.

The mechanism 10 further includes moving means 70 for selectively moving the clutch cylinder 40 into engagement with the drive and load cylinders 18 and 34. More specifically, a solenoid 72 is provided which is connected to the support 12 by a bracket 74 which is maintained in place by screws 76. The solenoid 72 includes a core 78 which terminates in a blade 80 having an aperture 82 therethrough. A coil spring 84 has one end received in the aperture 82 and the other end received in a peripheral groove 86 in a rod 88 which extends laterally from the wall 46.

In practice, the drive and load cylinders 18 and 34 are fabricated from neoprene and the clutch cylinder 40 is fabricated from stainless steel.

The operation of the present invention may best be understood by reference to FIG. 4 in addition to FIGS. 1-3. Accordingly, in operation, a tape medium 90 is pinched between a rotatable pinch roller 92 and the capstan 36 on the tape deck. Additionally, the motor is energized to cause the rotation of the flywheel 28 in the direction indicated by the arrowhead 94 and, concomitantly, the drive cylinder 18.

As noted above, the clutch cylinder 40 is normally spaced from the drive and load cylinders by the action of the biasing spring 56. However, when it is desired to step or move the tape medium 90, the solenoid 72 is energized by selectively connecting the same to a source of energy (not shown) thereby to retract the core 78. Thus, the spring connection 84 will draw the bracket 42 toward the drive and load cylinders 18 and 34 until the clutch cylinder 40 engages the drive and load cylinders, it being understood that the clutch cylinder 40 is positioned intermediate the drive and load cylinders. The spring 84 may be chosen to have characteristics such that the spring does not expand until the cylinder 40 engages the cylinders 18 and 34.

Since the diameter of the apertures 50 in the ears 48 of the bracket 42 are greater than the diameters of the grooves 54, the bracket 42 will be able to move or shift slightly on the shaft 52 so that the clutch cylinder 40 will, in effect, be self-aligning. Accordingly, with the solenoid 72 operated the clutch cylinder is driven in the direction indicated by the arrowhead 96. Hence, the clutch cylinder 40 will drive the load cylinder 34 in the direction indicated by the arrowhead 98 to effect movement of the tape medium 90 in the direction indicated by the arrowhead 100. When it is desired to stop movement of the tape medium, the solenoid 72 is deenergized and the clutch cylinder 40 moves back to its normal position under the influence of the biasing spring 56 whereby the capstan 36 stops rotating.

A feature of the present invention resides in the fact that the drive mechanism 10 produces reaction forces which force the clutch cylinder 40 into intimate contact with the drive and load cylinders 18 and 34. To be more specific, the drive cylinder 18 and the load cylinder 34 will exert forces upon the clutch cylinder 40 in such a manner as to produce reaction forces F_R on the clutch cylinder. As shown in FIG. 4, these forces act in a direction which further forces the clutch cylinder into engagement with the load and drive cylinders. Thus, this "positive" clutch reaction permits the transfer of

large torques under relatively small initial operating forces.

Moreover, the rest position of the clutch cylinder 40 can be accurately maintained to a few thousandths of an inch from the drive and load cylinders 18 and 34 without the need for complex and expensive equipment. As a consequence of the construction, operate and release times are minimized thus permitting the transmission of large torques at relatively high-stepping with only moderate actuation forces.

Another feature of the invention resides in the use of cylinders rather than discs to transmit the rotational movement between the members. To be more specific, the cylinders of the present invention provide substantially more contact area. As a result, torque is transmitted at reduced moments of inertia.

Accordingly, a drive mechanism has been provided for a tape transport wherein the large forces encountered with initial transfer of motion is absorbed in the clutch mechanism to substantially eliminate tape medium skew during startup and which is simple in construction and reliable in operation.

While a preferred embodiment of the invention has been shown and described herein it will become obvious that numerous omissions, changes and additions may be made in such embodiment without departing from the spirit and scope of the present invention.

What is claimed is:

1. A drive mechanism for a tape-transport system including a drive cylinder connected with driving means for rotating said drive cylinder in a first direction, a rotatable load cylinder in spaced relation to said drive cylinder, each of said drive and load cylinders having respective axes which are substantially parallel and in spaced relationship to each other, tape moving means comprising a capstan connected to said load cylinder, a movable bracket, an intermediate clutch-cylinder rotatably supported on said movable bracket and adapted to be moved into intimate contact with both of said drive and load cylinders when said bracket is moved to a first position to rotate said load cylinder in said first direction when said drive cylinder is rotated in said first direction by said driving means, selectively operable operating means for moving said bracket to said first position, and biasing means for biasing said bracket away from said first position for normally maintaining said clutch cylinder spaced from said load and drive cylinders.

2. A drive mechanism as in claim 1, and a shaft, said bracket comprising a pair of spaced arms connected together at one end and having aligned bores at the respective other ends of greater diameter than said shaft and receiving said shaft therethrough whereby said spaced arms are rotatable and shiftable on said shaft, and mounting means on said arms intermediate the ends thereof for rotatably mounting said clutch cylinder between said arms.

3. A drive mechanism as in claim 2, in which said moving means comprises a solenoid having a movable plunger, and a spring connecting said plunger to the end of said arms remote from said shaft whereby the energization of said solenoid causes movement of said bracket to said first position.

4. A drive mechanism as in claim 1, in which said drive and load cylinders are fabricated from neoprene and said clutch cylinder is fabricated from stainless steel.

5. A drive mechanism as in claim 1, wherein said drive, load and clutch cylinders are mounted to be coplanar.