United States Patent

Hansen

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[54] SINGLE LEVER SELECTIVELY ACTUATED FORWARD AND REVERSE CLUTCHES

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[21] Appl. No.: **79,742**

[52] **U.S. Cl.**.....**192/51,** 74/361, 74/471, 192/4 R, 192/18 R, 192/48.9, 192/70.23, 192/93 A, 192/99 S

[51] **Int. Cl.**.....**F16d 21/04,** F16d 13/42, G05g 9/00

[58] **Field of Search**.....192/4 R, 4 L, 18 R, 21, 51, 192/93 R, 93 A, 99 S, 70.23, 48.9, 48.91; 74/361, 471 R

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[57] **ABSTRACT**

Clutches controlling motion in opposite directions have actuators movable oppositely, said actuators being moved by operating linkage from a control lever which includes lost motion designed to actuate one of the actuators only in one direction of lever oscillation and the other actuator in the opposite direction of lever oscillation. In a special arrangement, the driven part is locked against movement in either direction by manipulation of the normally stationary linkage to cause both disk packs to be engaged simultaneously.

6 Claims, 12 Drawing Figures

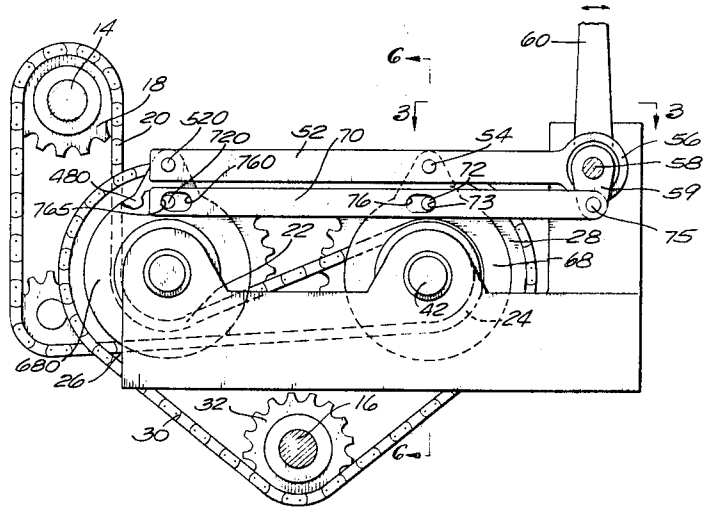
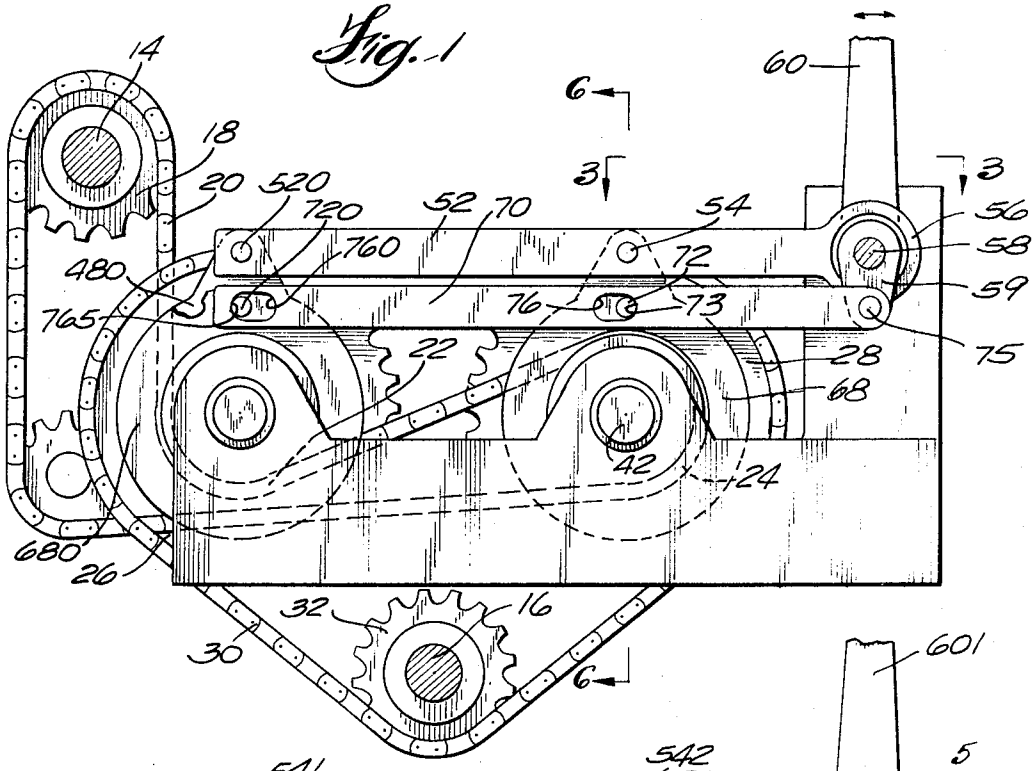


Fig. 1



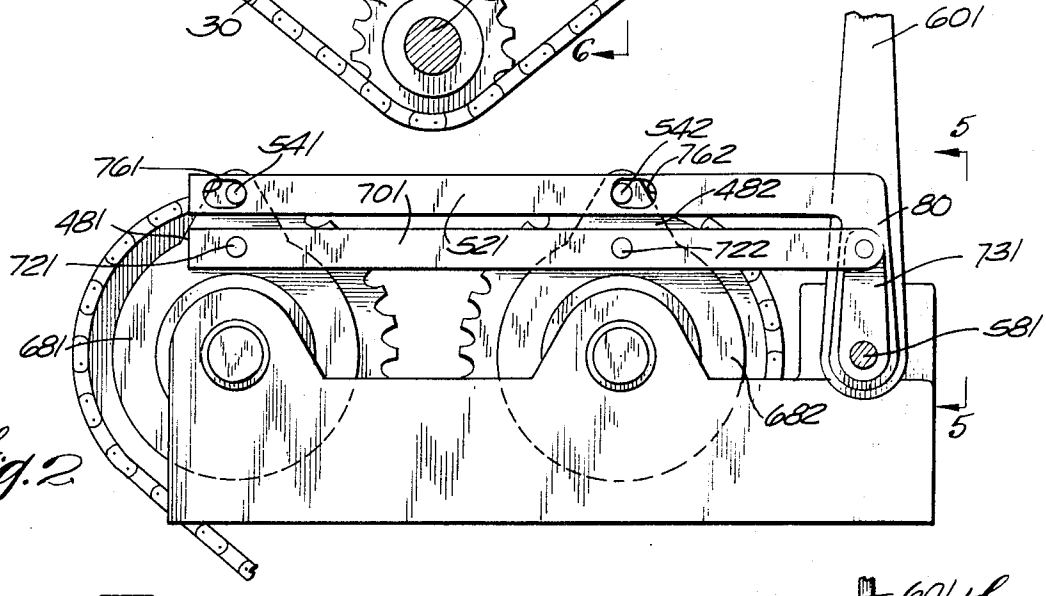


Fig. 2

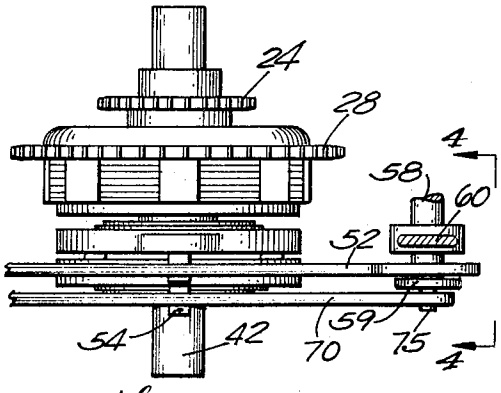


Fig. 3

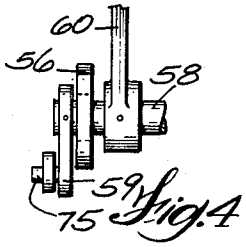


Fig. 4

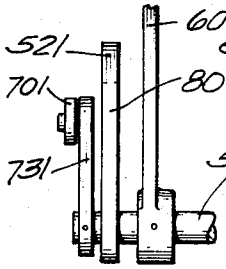


Fig. 5

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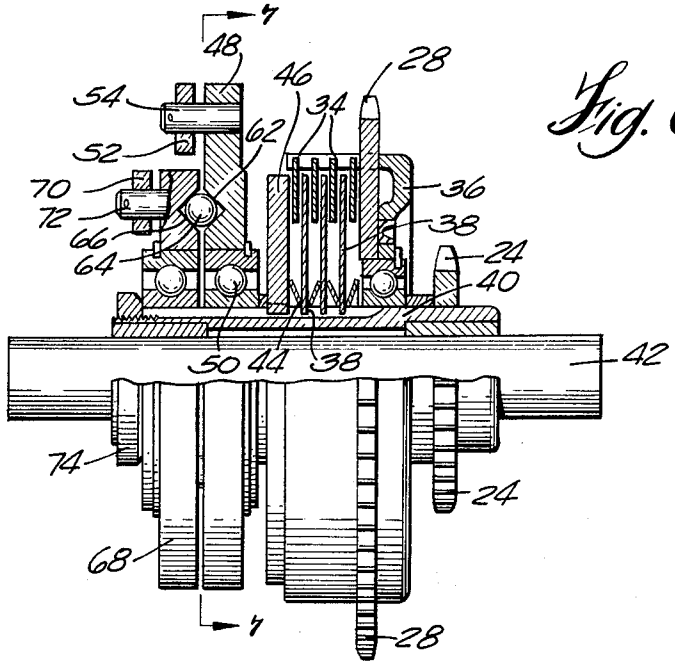


Fig. 6

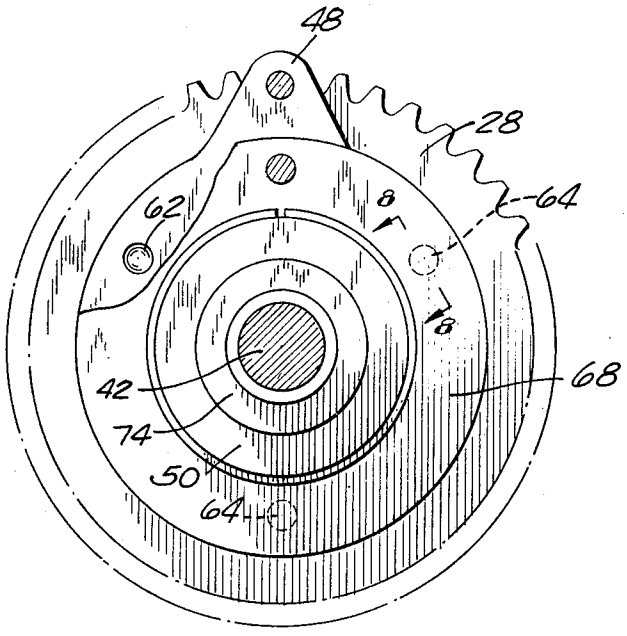


Fig. 7

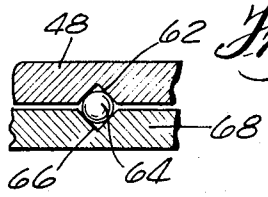


Fig. 8

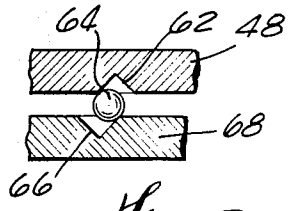


Fig. 9

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Fig. 10

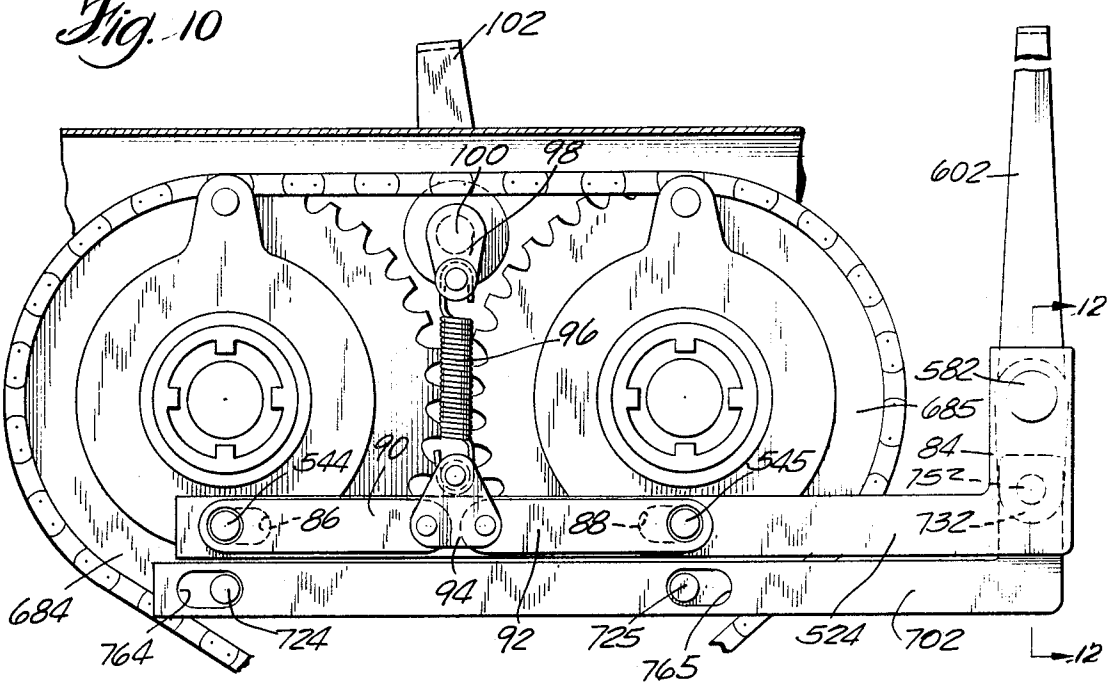


Fig. 11

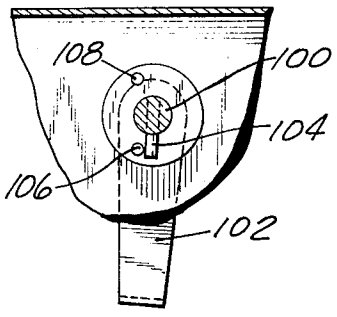
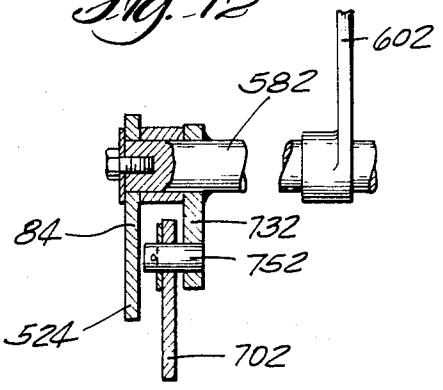


Fig. 12



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SINGLE LEVER SELECTIVELY ACTUATED FORWARD AND REVERSE CLUTCHES

BACKGROUND OF INVENTION

As taught in Zeidler U.S. Pat. No. 2,931,476 of Apr. 5, 1960 and in my former U.S. Pat. No. 3,386,547, it is old to operate separate clutches selectively from a single lever by providing cams which have dwells to permit motion between cam parts with which the intervening ball interacts. The instant clutch is not necessarily operated by cams but if it is so operated it is unique in that it does not and cannot depend for operation on the form of the cams. It is much simpler and less expensive to provide lost motion by simple slots in the actuating linkage.

The invention involves a combination of reversely operable clutches in which pressure is applied selectively to respective disk packs. If pressure is developed by cams, the camming mechanism may be identical in all cases, requiring no special cams and depending for selective action entirely on lost motion in the external actuating linkage. An ancillary feature involves the braking of both driven shafts by clutching them simultaneously. Since they are then engaged for rotation in opposite directions, it will be apparent that when they are clutched simultaneously neither one can rotate.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a view in side elevation of a drive arrangement using two oppositely rotating clutches selectively engageable by manipulation of a single lever in accordance with this invention, external linkage from the lever to the respective clutches being designed to provide lost motion to inactivate the clutch which is not in use.

FIG. 2 is a fragmentary comparable view showing a modified arrangement in which the lost motion is provided in the normally stationary portion of the linkage.

FIG. 3 is a fragmentary detail plan view of one of the clutches on the line 3—3 of FIG. 1.

FIG. 4 is a detail view of the operating lever and linkage from the viewpoint of the line 4—4 in FIG. 3.

FIG. 5 is a comparable detail view from the viewpoint of line 5—5 in FIG. 2.

FIG. 6 is a fragmentary detail view on an enlarged scale partially in section on the line 6—6 of FIG. 1.

FIG. 7 is a view taken in section on the line 7—7 of FIG. 6 parts being broken away.

FIG. 8 is a view in section on the line 8—8 of FIG. 7.

FIG. 9 is also taken in section on the line 8—8 of FIG. 7 but showing the parts in different position from that illustrated in FIG. 8.

FIG. 10 is a view somewhat similar to FIG. 1 but showing a modified embodiment of the invention which provides for braking driven shafts as well as operating in forward or reverse.

FIG. 11 is a fragmentary detail view taken on the line 7—7 of FIG. 10.

FIG. 12 is a fragmentary detail view taken on the line 12—12 of FIG. 10.

DETAILED DESCRIPTION

Before describing the lost motion operating means, reference is made to a simple embodiment of a drive in which motion from drive shaft 14 is communicated selectively in either direction to the driven shaft 16. A sprocket 18 on the drive shaft 14 engages a chain 20 which passes in one direction about the driven sprocket 22 of the lefthand clutch in FIG. 1 and in the opposite direction around the sprocket 24 on the righthand clutch of FIG. 1. Accordingly, the motion transmitted to the respective clutches is in opposite directions. From the respective driven sprockets 26 and 28 of respective clutches, motion is transmitted by a chain 30 to the sprocket 32 on the driven shaft 16.

The particular clutch design is also broadly immaterial to the lost motion operating mechanism herein disclosed. To emphasize this fact I have illustrated conventional clutches

each of which comprises a disk pack of conventional type having interleaved outer disks 34 connected to the spider 36 (FIG. 6) upon which the driven sprocket 24 is mounted, these being interleaved with inner disks 38 connected with a hub 40 on the shaft 42 upon which the driving sprocket 24 is mounted. The arrangement as shown in FIG. 6 illustrates the righthand clutch as viewed in FIG. 1. However, the organization of the lefthand clutch is similar. Belville springs 44 may desirably be used to keep the disks of the clutch pack normally disengaged.

Engagement of the disks is effected by a pressure element 46 slidably mounted on the hub 40 and keyed thereto. Although the pressure developing means is inmaterial in a broad sense, this embodiment contemplates that the pressure plate be actuated into thrust engagement with the disk pack by means of a cam disk mounted on the other race of a thrust bearing 50 which transmits axial motion to the pressure plate 46. In the FIG. 1 construction, the disk 48 is held against rotation by means of a link 52 mounted on a pin 54 which projects from pressure disk 48. The link is fixed against movement by a terminal ear 56 encircling the rock shaft 58 on which the control lever 60 is mounted.

At one or more places on the face of the pressure disk 48 (FIG. 6) there are cam sockets 62, preferably conical, in which there are balls 64 also engaged in complementary cam sockets 66 in the face of the companion disk 68 of the operating pair for this clutch. The companion disk 68 may be oscillated by a reciprocable link 70 mounted on the projecting pin 72 of the disk. This pin serves as a clutch actuator to engage its respective clutch.

Having described one conventional reversible drive embodiment and one conventional set of clutches and clutch operating cams for the control thereof, I shall now explain the means whereby lost motion linkage enables these or other devices for like control purposes to be actuated from a single shift lever, according to the direction of movement thereof.

The link 70 is pivoted to a pin 75 on the rocker arm 59 of rock shaft 58 so that it may be reciprocated in either direction by pivotal movement of the control handle 60. However, the link 70 may have lost motion in one direction of its reciprocation respecting the driven pin 72 of the disk 68, there being a slot 76 in link 70 which, in the neutral position of the part illustrated in FIG. 1 lies at the left of the clutch actuator 72. Thus this pin will be actuated only when the link 70 is moved to the left. When the link 70 is moved to the right as viewed in FIG. 1, the slotted portion of the link will pass over the pin 72 without actuation thereof.

When pin 72 is oscillated in the proper direction by oscillation of rock shaft 58, the disk 48 is oscillated angularly with respect to the paired stationary disk 48, thereby causing the ball 64 to emerge partially from both of the cavities 62 and 66 in which it is normally engaged as shown in FIG. 8. Axial yielding of disk 68 is prevented by its engagement with the stop ring 74 on shaft 42 as shown in FIG. 6. The result is to effect axial displacement of disk 48 with respect to disk 68. FIG. 8 shows the normal position of the parts when the disk pack is not compressed.

FIG. 9 shows the result of angular relative movement of disk 68 whereby disk 48 is forced to yield to the right as viewed in FIG. 6 to urge the clutch actuating pressure element 46 against the disk pack whereby motion is transmitted from the driving sprocket 48 to the driven sprocket 24 to actuate the chain 30. Assuming shaft 14 and power sprocket 18 to be rotating clockwise, sprocket 24 will likewise rotate clockwise as driven by chain 20. Thus engagement of the righthand clutch (as viewed in FIG. 1) will effect clockwise rotation of sprockets 28 and 32 and output shaft 16.

For securing counterclockwise rotation of the output shaft 16, it is necessary that the clutch which is at the right in FIG. 1 be disengaged and the clutch which is at the left in FIG. 1 be engaged. This is possible because the respective clutch actuators 72 and 720 are at opposite extremities of the lost motion slots 76 and 760.

The link **52** which engages pin **54** to hold the disk **48** stationary is also engaged with the corresponding pin **520** of the corresponding disk **480** of the clutch which appears at the left in FIG. **1**. Therefore, this disk is also stationary under all circumstances.

The disk **680** which is paired with the stationary disk **480** in the lefthand clutch as viewed in FIG. **1** is provided with a pin **720** which projects through a slot **760** in the link **70**. In the neutral position of the parts, this slot lies wholly at the right of the pin **720** controlled thereby. Thus when the lever **60** is actuated to shift the link **70** to the left, for the actuation of the righthand clutch, the lefthand clutch will remain inactive due to lost motion provided by the slot **760**. When the lever **60** is actuated to move the link **70** to the right as viewed in FIG. **1**, motion will be communicated from link thrust surface **765** to the pin **720** and thus to the disk **680** which will thereby be required to move rotatively with respect to the stationary paired disk **480**. This will actuate the lefthand clutch as viewed in FIG. **1**, while leaving the righthand clutch inactive. Because of the direction of movement of the chain **20** around the sprocket **22** of the lefthand clutch, the engagement of this clutch will result in counterclockwise rotation of sprocket **26** and sprocket **32** and output shaft **60**.

It will be understood that the lefthand clutch will be actuated by axial displacement of its pressure element by axial displacement of it non-rotative disk **480** in exactly the same manner in which the pressure element of the righthand clutch in FIG. **6** is actuated by axial displacement of its stationary disk **48**.

In the embodiment just described, the lost motion permitting selective operation of the respective clutches was provided by slots **76** and **670** in the link **70**. Alternatively, the lost motion may be provided in the non-reciprocating link **521** which is shown in the embodiment of FIG. **2** and which is prevented from longitudinal movement by an arm **80** having an aperture closely fitted upon the rock shaft **581** as shown in FIGS. **2** and **5**. The rocker arm **731** fixed to the rock shaft actuates the link **701**. This corresponds to the link **70** in the FIG. **1** embodiment but has no lost motion, being pivotally connected directly with the pins **721** of the lefthand clutch and **722** of the righthand clutch. These pins are mounted on the outer disk pairs **681** and **682** of the respective clutches. In the FIG. **1** embodiment, the oscillation of the outer disk **68** of either clutch will effect axial displacement of the complementary disk **48** of that clutch due to the fact that the complementary disk is held stationary.

In the FIG. **2** embodiment axial displacement will not occur if the inner paired disk **481** or **482** is free to move. Examination of FIG. **2** will show that pin **541** of the disk **481** is at the extreme righthand end of a slot **761** in the lefthand clutch whereas the pin **542** is at the extreme lefthand end of the slot **762** in the link **521**. Accordingly, when the actuating link **701** is moved to the right as viewed in FIG. **2** and thereby oscillates both of the disks **681** and **682** in a clockwise direction, the disk **481** which is paired with disk **681** will not be free to oscillate clockwise, being at the end of the slot **761**. Thus relative axial displacement of these disks will be effected by the resulting ball camming action. The disk **482**, on the other hand, will be free to oscillate in a clockwise direction with respect to the anchor pin **521** and therefore no camming action will occur between disk **682** and disk **482**.

Opposite oscillation of the control lever **601** removes the actuating link **701** to the left as viewed in FIG. **2** to permit movement in unison of the paired disks **481** and **681** of the lefthand clutch, whereas disk **482** of the righthand clutch will not be permitted to move in a counterclockwise direction and therefore relative axial displacement of the paired disks of the righthand clutch will occur to effect engagement of that clutch.

In the construction shown in FIGS. **10** to **12**, the hand lever **602** oscillates the rock shaft **582** either clockwise or counterclockwise, whereby the rocker arm **732** transmits motion from its end **752** to the actuating link **702**. The slots **764** and **765** extend oppositely from the pins **724** and **725** projecting from the respective disks **684** and **685** of the left and righthand clutches. Assuming that the companion disks are held stationary as, for example, in the embodiment described in FIG. **1**, it will be apparent that the lost motion provided by the slots **764** and **765** will effect operation of the righthand clutch when counterclockwise oscillation of hand lever **602** causes movement of the control link **702** to the right. Conversely, movement of control link **702** to the left will effect actuation of the lefthand clutch, while allowing the righthand clutch to remain inactive.

The anchor link **524** of this embodiment has an arm **84** held by the rock shaft **582** against lateral displacement. The pins **544** and **545**, instead of being fixed in the anchor link **524** are disposed in slots **86** and **88** which extend toward each other from the respective pins. The pins are normally held at the remote ends of these slots by toggle members **90** and **92** which are pivotally connected to the pins and have pivotal connection centrally with a toggle actuator **94** which is connected by a yieldable link **96** with a rocker arm **98** on a rock shaft **100** operable by hand lever **102**. The spring **96** is not initially under tension, being fully collapsed in the position of the parts shown in FIG. **10**.

However, when the control lever **102** is oscillated to effect rotation of rocker arm **98**, motion is communicated through the spring **96** to the toggle actuator **94** to draw the toggle links **90** and **92** upwardly at their inner ends, thereby causing the pins **544** and **545** to move toward each other in the slots **96** and **88** of the anchor link **534**. This will result in simultaneous displacement of the two normally stationary disks of the respective pairs, thereby causing axial displacement thereof to engage both the lefthand and righthand clutches simultaneously, the result being to lock the transmission. The shaft **16** cannot move because each of the clutches will act as a brake for the other.

As shown in FIG. **11**, the rock shaft **100** may have a projecting lug **104** selectively engageable with stops **106** or **108** in the extreme positions of the rock shaft. The lug **104** engages stop **106** only by moving over center with the spring **96** extended so that the brake will remain effective without continued pressure on the lever **102**. FIGS. **10** and **11** show the lever in its two extreme positions.

I claim:

1. The combination of a driven shaft and driving connections thereto including selectively operable cam-actuated clutches each comprising a disk pack with a pin actuator, a control member selectively movable in opposed directions for engaging respective clutches, lost motion linkage connected with said member and including a link provided with slots through which said pins project, said link having at opposed ends of said slots cam surfaces for engagement with respective pins according to the direction of movement of said link and constituting means for effecting engagement of the respective clutches and thereby causing the driven shaft to be operated from respective differing clutches according to the direction of operation of said member.

2. A combination according to claim **1** in which each disk pack has a pressure plate and relatively rotatable and non-rotatable complementary cam disks, the pin actuator for each clutch being connected with the pressure plate thereof, and a complementary disk having means fixing it against rotation.

3. A combination according to claim **1** in which each clutch comprises a disk pack including a pressure plate and relatively rotatable and non-rotatable complementary camming disks, a pin actuator of each clutch being mounted on the relatively rotatable camming disk thereof and the said link provided with opposing pin-engaging surfaces having such surfaces spaced in excess of spaces between the pins of respective clutches, whereby the respective pin of one clutch may be in engagement with a pin-engaging cam surface while the respective pin of another clutch may have moved from the opposing surface according to the direction of relative movement between the pins and the link.

4. A combination according to claim 3 in which the link is relatively fixed and one pin engaged therewith is on a relatively non-rotatable cam disk.

5. A combination according to claim 1 in which a pin for operating one of said clutches is engaged with a link surface connected with a camming disk which is relatively rotatable for engagement of the respective clutch.

6. A combination according to claim 1, each of the clutches having an actuator comprising a pair of cam disks which are relatively rotatable, one disk of each pair being normally relatively non-rotatable and the other disk of each pair being normally connected by said lost motion linkage with said member, said linkage comprising a pair of toggle links having means pivotally connecting them with each other and with which respective normally non-rotatable disks of respective pairs have lost-motion connection, a fixed anchorage with which one of the toggle links is connected, and displacing means connected with the toggle links adjacent the means which pivotally connect them with each other, said displacing means constituting means for concurrently subjecting the normally fixed disks of both of said pairs concurrently to movement in a clutch-applying direction, whereby both clutches may be engaged simultaneously to lock the driven shaft.

* * * * *