

March 16, 1926.

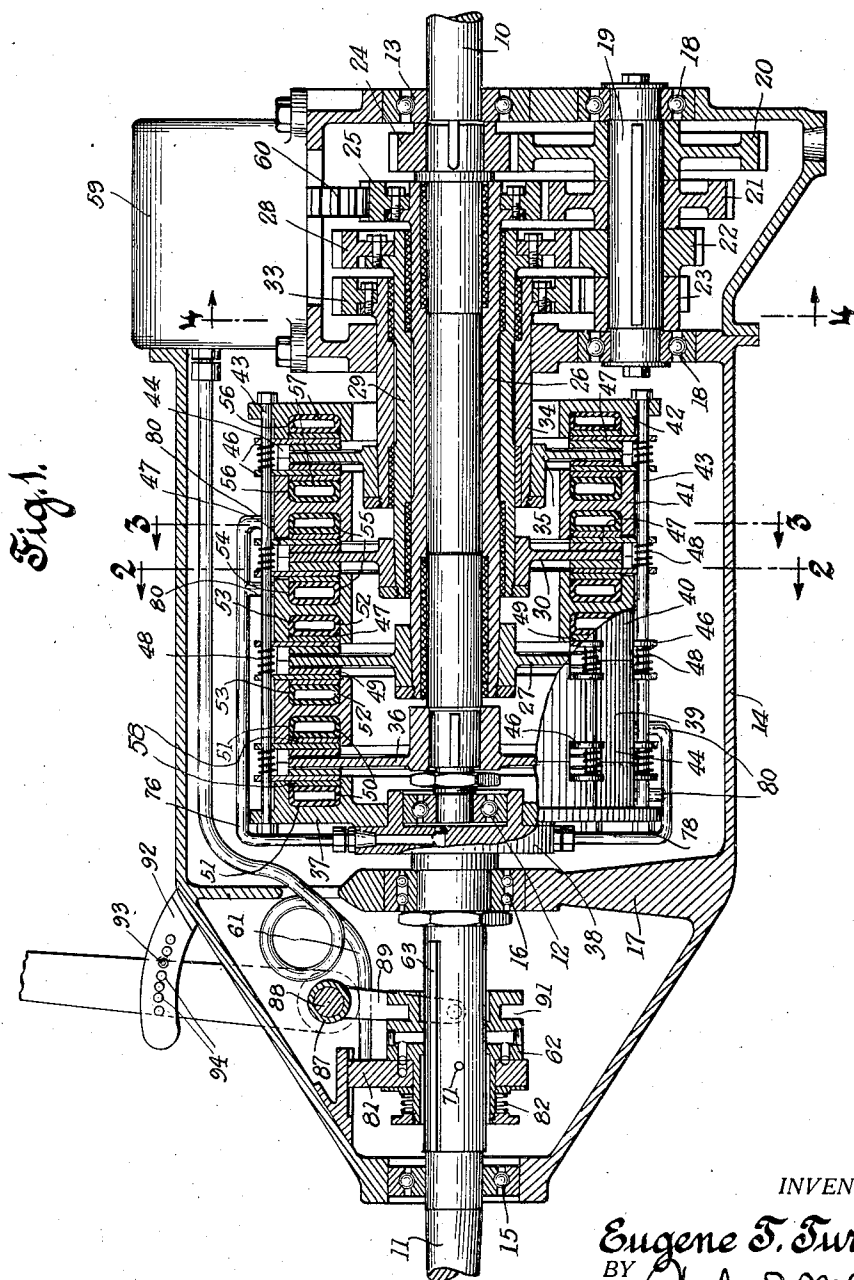
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E. T. TURNEY

CLUTCH MECHANISM

Filed Dec. 23, 1922

3 Sheets-Sheet 1



INVENTOR

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3 Sheets-Sheet 2

Fig. 2.

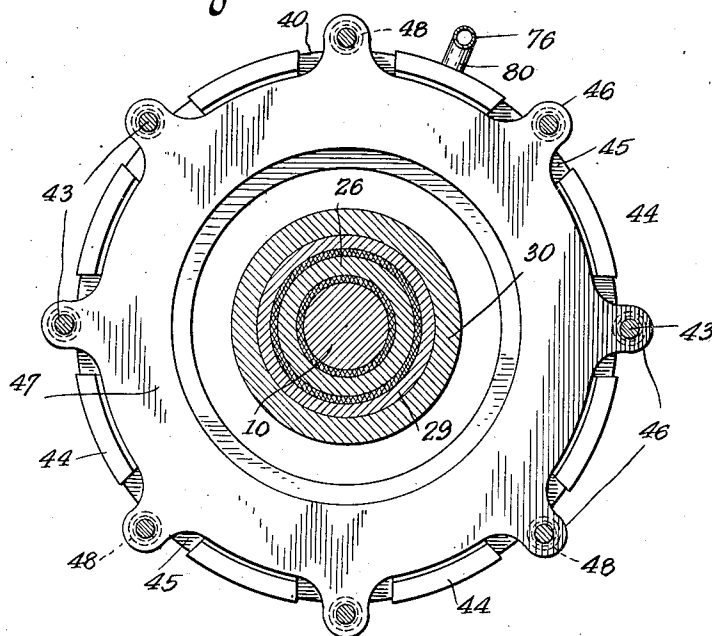
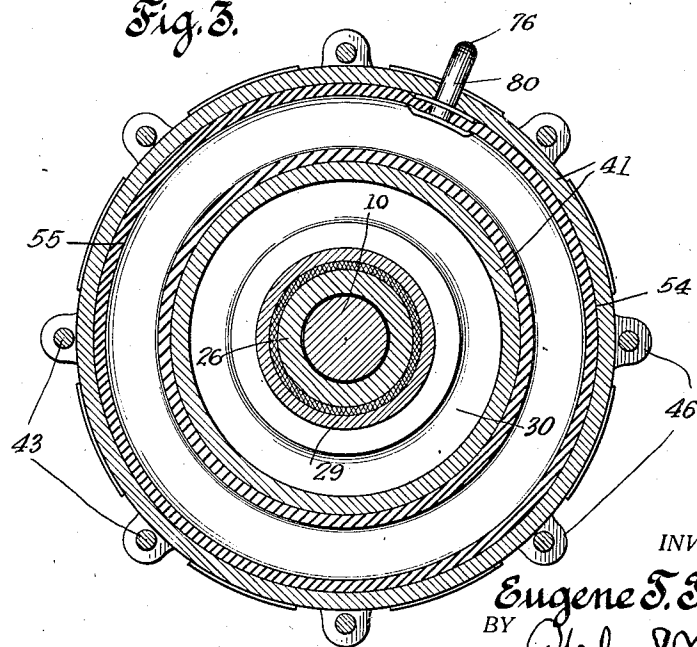


Fig. 3.



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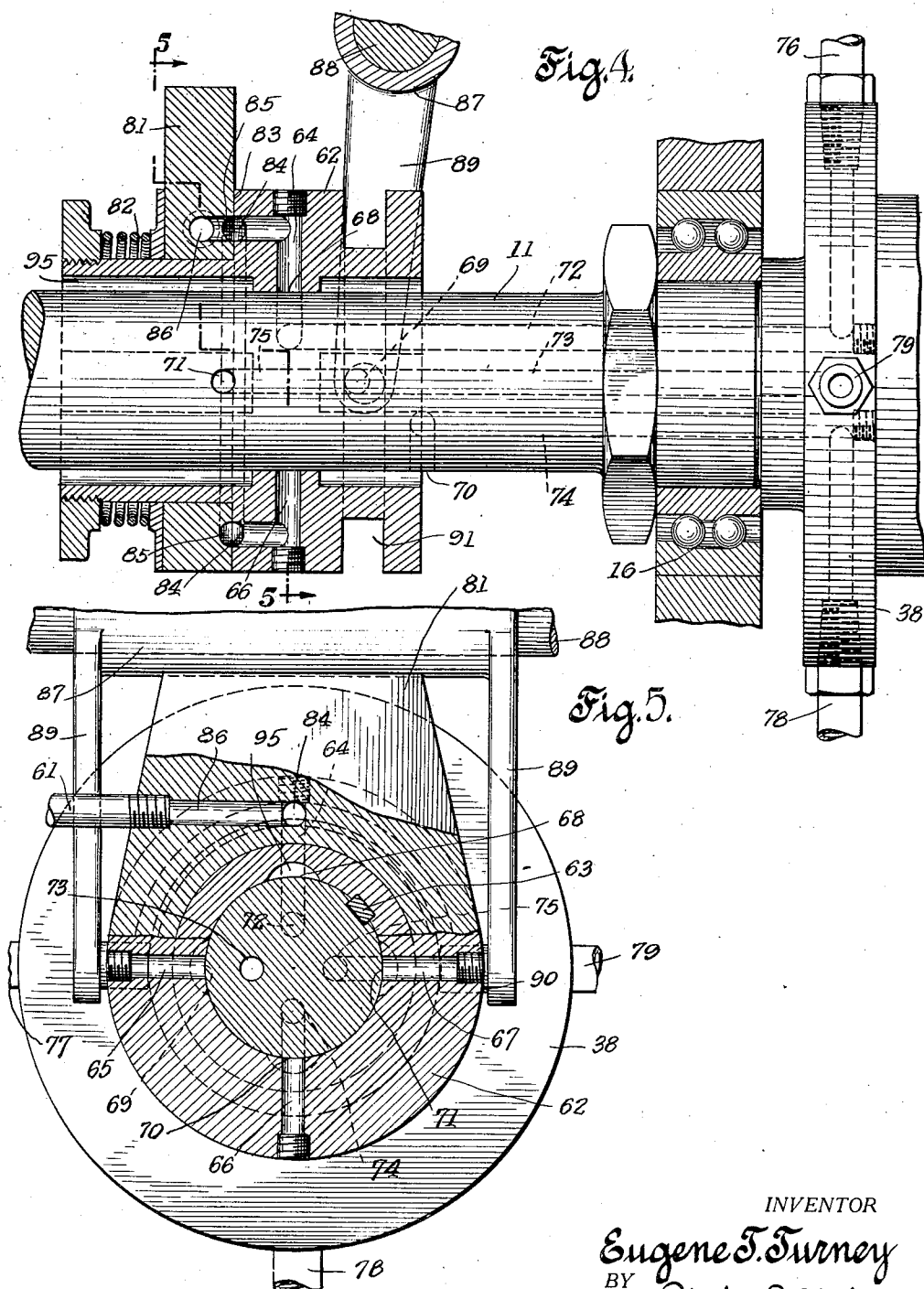
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3 Sheets-Sheet 3



UNITED STATES PATENT OFFICE.

EUGENE T. TURNEY, OF HOLMES, NEW YORK, ASSIGNOR TO GEORGE L. HATHAWAY,
CHARLES L. GESELL, JR., AND GEORGE C. KNOTT, ALL OF BROOKLYN, NEW YORK.

CLUTCH MECHANISM.

Application filed December 29, 1923. Serial No. 606,632.

To all whom it may concern:

Be it known that I, EUGENE T. TURNEY, a citizen of the United States, and a resident of Holmes, Dutchess County, and State of New York, have invented certain new and useful Improvements in Clutch Mechanism, of which the following is a specification.

The objects of the present invention, generally stated, are to provide clutch mechanism for a variable speed transmission which will be of simple, sturdy, practical construction, and which will enable the different speeds to be selected without meshing and unmeshing of gears and the changes to be effected smoothly and easily.

These and other objects are attained in my invention through certain novel features of construction and combination, involving in part, a novel arrangement of independently controlled clutches enabling selective coupling of the driving and driven elements.

Various other novel features of the invention will appear as the specification proceeds.

In the drawings accompanying and forming part of this specification I have illustrated but one practical embodiment of the invention, but wish it understood that the structure may be modified in various ways without departure from the broad spirit and scope of the invention as hereinafter defined and claimed.

Figure 1 is a longitudinal sectional view of the complete gear set.

Figure 2 is a cross sectional view of the same taken on substantially the plane of line 2—2 of Figure 1, showing particularly one of the clutch plates.

Figure 3 is a similar view taken on substantially the plane of line 3—3 of Figure 1, showing particularly the expansible element of one of the pneumatic clutches.

Figure 4 is an enlarged broken sectional view of the distributing mechanism for the air connections.

Figure 5 is a cross sectional view of the parts as they appear on substantially the plane of line 5—5 of Figure 4.

In Figure 1 a drive shaft is indicated at 10 and a driven shaft at 11, the two standing in axial alinement. The first may be the crank shaft of an internal combustion engine and the latter, the propeller shaft

for transmitting power to the road wheels. To maintain the two in proper axial alinement, the rear end of the drive shaft is shown as having a bearing at 12 in the forward end of the driven shaft. At its forward end the drive shaft is illustrated as having a bearing 13 in the front end of the gear case 14 which encloses the parts and the driven shaft is shown as having a bearing at 15 in the rear end of the case and a forward bearing at 16 carried by an intermediate web or partition 17 provided in the case. The gear case may be constructed so that it may be bolted direct to the rear end of the crank case of a motor, thus constituting the transmission set a unit adapted for application to any ordinary internal combustion engine.

Journaled in the gear case in suitable bearings 18, preferably below the drive shaft, is a jack shaft 19 having gears 20, 21, 22 and 23 fixed thereon, the first and largest of these, (20) being driven by a pinion 24 fixed on the drive shaft.

The second gear, 21, on the jack shaft meshes with a gear 25 carried by a sleeve 26 rotatably engaged on the drive shaft and carrying at its inner end a clutch member which may be in the form of a relatively flat disc such as indicated at 27.

The third gear or pinion, 22, of the jack shaft meshes with a gear 28 carried by a sleeve 29 rotatably engaged on the first sleeve and carrying at its inner end a clutch disc 30.

The fourth gear or pinion, 23, on the jack shaft is for the reverse drive and meshes with a pinion carried by a stub shaft meshing with a gear 33 fixed on a sleeve 34 which is journaled on the second sleeve and carries at its inner end a clutch disc 35.

In the order described, the gear couples and clutch discs just referred to are for second speed, first speed and reverse drive respectively and the third speed or so-called "direct" drive is effected by means of a clutch disc 36 fixed on the inner end of the drive shaft. This provides a three-speed-forward and one-speed-reverse gear set in which the ratio of the gear couples employed determines the respective speeds. This is in conformity with automobile design of the present day, but it will be under-

stood that the invention is not limited in any way to this particular number or relation of speeds.

The cooperating driven elements of the several clutches are combined in a single unit, in the nature of a drum, fixed on the end of the driven shaft and enclosing the clutch discs described. In the construction illustrated this drum is made up of a series of disc-like elements disposed at opposite sides of the driving discs and carrying pneumatic elements for effecting engagement with opposite sides of each clutch disc.

The first or main section of the drum is designated 37 and is indicated as bolted or otherwise secured directly to the hub 38 provided on the end of the driven shaft. The second drum section is designated 39, the third 40, the fourth 41 and the fifth or last, 42. These sections are shown as all secured together by through bolts 43. The adjacent or opposing sections are spaced apart by webs or arcuate lugs 44 at the outer opposing edges of the sections (Figures 1 and 2) which provide between them spaces 45 for the guide lugs 46 projecting outwardly from the clutch plates 47 and slidably engaged over the through bolts 43. These clutch plates are arranged in pairs, disposed at opposite sides of each clutch disc and held, when not in service, spaced apart and out of contact with the clutch discs by coiled springs 48 on the bolts 43 between the guide lugs 46. The clutch plates therefore all rotate with the drum but are slidably supported so that they may be approached into gripping engagement with the driving clutch discs or may be separated out of contact therewith. Preferably these clutch plates have a facing of frictional material, as indicated at 49, which may be on the order of that employed for brake linings.

The engagement of the clutch plates on the drum with the driving clutch discs is effected in the present disclosure by expansible pneumatic elements seated in the drum at opposite sides of the clutch plates in position to operate directly thereon. These pneumatic elements are shown in the form of annular tubes or sacks seated in annular recesses provided in the opposing faces of the several sections of the drum. The two expansible tubular rings for the high speed clutch are designated 50 and are shown engaged in annular seats 51 provided in the opposing faces of the first and second drum sections 37 and 39; similarly, the expansible members 52 of the second speed clutch are shown as seated in recesses 53 in the opposing faces of the second and third drum sections 39, 40; the expansible members 54 of the first speed clutch are located in annular seats 55 in the third and fourth drum sections 40, 41; and the

expansible members 56 of the reverse clutch are located in annular seats 57 in the opposing faces of the fourth and fifth drum sections 41, 42.

The clutch plates overlie the expanding rings and therefore stand in position to be shifted thereby. As there is no relative rotation between these parts, there is no wear on the pneumatic rings and they may therefore be constructed of rubber, rubberized fabric or even metal of sufficient flexibility to allow for the necessary expansion and contraction. To prevent conduction of heat from the clutch plates to the pneumatic rings, there may be interposed between the two, heat insulating discs 58 of asbestos or other suitable material which may either be fixed on the backs of the discs or else be retained in the annular seats holding the expanding rings.

The compressed air for expanding the clutch rings is shown as supplied in the present instance by a pump 59 of suitable construction, indicated as driven by gearing 60 from one of the gears on the drive shaft. This pump is connected by piping 61 with a distributor constructed and arranged to deliver the air to the selected pairs of companion clutch rings.

In the present disclosure, the air distributor comprises a sleeve 62 slidably keyed at 63 on the driven shaft and having quadrangularly related radial ports 64, 65, 66, 67, adapted to register with correspondingly related but longitudinally spaced ports 68, 69, 70, 71, in the shaft, the latter communicating by longitudinal passages 72, 73, 74, 75 and external piping 76, 77, 78, 79, with the expanding rings of the first, second, third and reverse clutches. These passages in the shaft are shown as brought out through the sides of the supporting hub 38 which provides a convenient mounting for the connection of the sections of tubing which extend from this hub over the outside of the drum and are branched as indicated at 80 and entered through the sides of the annular seats into the expansible rings arranged therein (Figure 3).

The air is led to the rotating distributing sleeve by a block 81 loosely fitted on such sleeve and held by a spring 82 closely engaged with a shoulder 83 containing ports 84 opening to the radial ports in the sleeve, said block having in its abutting face, an annular groove 85 registering with the ports 84 and connected by an internal passageway 86 with the air supply pipe, which latter is shown as having a direct connection with this block.

The distributor sleeve is shown as shifted in the present instance by means of a hand lever 87 pivoted at 88 and having a fork 89 carrying pins 90 engaging in a groove 91 in the sleeve and in the particular arrangement

disclosed, the extreme forward position of the lever positions the sleeve to register with the reverse air port while successive rearward movements of the lever bring into operation the first, second and third speed clutches respectively. To restrain the parts in these various positions I have illustrated a quadrant 92 and have shown the lever as having a spring-pressed pin 93 to yieldingly engage in properly spaced seats or notches 94 in such segment.

The air supply block 81 is suitably held against rotation, as by means of the air supply piping and a portion at least of this piping is made flexible enough to allow for the shifting movements of the sleeve upon the driven shaft.

The distributing sleeve is accurately fitted to the shaft on which it is mounted and as its only motion thereon is a sliding one of relatively short extent, to establish connection with the four ports, the parts can be made practically air-tight or at least so that the loss of air is inappreciable so far as the desired operations are concerned.

To release the air from the expansible elements of the clutches the interior of the distributing sleeve is preferably grooved or recessed at opposite sides of the four ports therein, as indicated at 95, so that as the sleeve is shifted, the port which was in register with a supply port in the sleeve will be quickly exhausted to atmosphere.

Operation.

The gears being constantly in mesh, they will rotate so long as the drive shaft is turning, with the result that the first sleeve, carrying the second speed clutch disc, rotates in the same direction but at somewhat lesser speed than the drive shaft, and the second sleeve, carrying the first speed clutch disc, turns in the same direction but at somewhat lesser speed than the first sleeve. The outer sleeve carrying the reverse clutch disc turns in the opposite direction from the sleeve on which it is mounted, but at relatively slow speed and the supporting sleeve is also turning quite slowly. The parts therefore all operate quietly and with but little friction.

In the condition of the apparatus illustrated in Figures 1 and 4, the control lever stands in the first speed position and the force of the compressed air is therefore directed from the pump through the supply connection and through the passages 86, 85 in the slip ring 81 in through port 84 and radial passage 64 in the distributing sleeve in through port 68 and passage 72 in the drive shaft and by way of external connections 76 to the expanding rings 54 of the first speed clutch. These pneumatic rings, as they expand, force the clutch plates 47 together, thereby carrying the clutch facings 49 thereon into

gripping engagement with the opposite sides of the first speed clutch disc 30. This clutch disc is rotating at relatively slow speed and as the clutch plates are fixed to the drum by reason of their sliding engagement on the bolt rods 43, motion will be thereby imparted to the drum and consequently to the driven shaft by which it is carried.

In effecting this engagement of the clutch plates with the first speed clutch disc, the springs 48 which normally hold such plates separated are compressed and put under tension, ready to act to separate such plates as soon as the pneumatic pressure thereon is released. The springs 48 of the other clutch plates, however, are effective during this period to maintain these plates separated and the other clutches therefore inoperative.

To go into second speed the hand lever is simply drawn back one step to bring the radial port 65 in the distributor sleeve into register with the radial port 69 in the drive shaft so as to open up a path for the compressed air to the second speed pneumatics 53 which will thereupon by their expansion effect operative engagement of the second speed clutch.

In shifting between speeds, the sleeve will first establish a neutral condition between registration of successive ports in the sleeve and shaft and then as registration is effected to establish a new line of communication, the shifting of the sleeve will uncover the shaft port and exhaust the force from the first set of pneumatics by way of the relief grooves 95. The parts can thus be arranged so that one clutch will hold on momentarily or even longer and will not actually let go until the next engaged clutch commences to take hold. This enables the shifting from one speed to the next to be accomplished smoothly and easily, without abrupt changes and with no severe strains on the apparatus or mechanism associated therewith.

The change from second to third or direct is effected by simply pulling the hand lever a further step to the rear so as to bring the radial sleeve port 66 into register with the shaft port 70, whereupon it will be seen that the expansive force will be directed to the high speed clutch pneumatics which will operate to couple the clutch disc 36 carried by the driving shaft directly to the drum, causing the drum and the driven shaft to thereupon rotate at the same speed as the driving shaft.

For reverse drive, with the present construction, the control lever is shifted forward past the first speed position to thereby bring the radial port 67 in the sleeve into register with the reverse port 71 in the driven shaft; whereupon the reverse pneumatics 56 will be energized so as to couple the drum through the clutch plates 47 with

the clutch disc 35 which because of the interposition of the idler is driven from the counter-shaft in a direction reverse to that of the other clutch discs.

5 What I claim is:

1. In combination, concentrically disposed driving members, rotating at different speeds, concentrically arranged driven members disposed in opposition to the driving members and selectively operable fluid pressure clutches between adjacent pairs of driving and driven members, there being two driven members for each speed, disposed at opposite sides of a driving member and each driven member having cavities in the opposite faces of the same with elements of the fluid pressure clutches seated therein.

2. In combination with a rotating shaft carrying clutch pneumatics and having passages in communication with the several pneumatics, said passages terminating in longitudinally spaced ports at the surface of the shaft, a sleeve slidingly keyed on the shaft and having a port or ports to register with the shaft ports in different positions of the sleeve on the shaft and a non-rotating air supply block having a slip connection with the sleeve and movable therewith in the various adjustments of the sleeve on the shaft.

3. In combination, a rotating shaft having passages therein terminating in spaced ports at the surface of the shaft, movable clutch elements carried by said shaft, pneumatics carried by the shaft positioned to actuate said movable clutch elements, air supply means adapted to be selectively coupled with said ports in the shaft and a second shaft carrying clutch members positioned for engagement by the movable clutch elements.

4. The structure of claim 3 in which the last mentioned shaft is a driving shaft and the shaft carrying the pneumatics and provided with the air supply connections is a driven shaft and in which the movable

clutch elements are supported non-rotatably in respect to the pneumatics to avoid rotating friction between these parts.

5. In combination with a plurality of concentric clutch discs driven at different speeds, a member carrying clutch plates movably supported at opposite sides of said clutch discs, pneumatics carried by said member in position to actuate the clutch plates and controllable air supply connections to said member in communication with said pneumatics.

6. In combination with a shaft having longitudinally and circumferentially spaced ports in communication with separate passages, clutch pneumatics carried by said shaft and connected with said passages, a sleeve longitudinally slidable on the shaft and having radial ports to register with the shaft ports in variously shifted positions of the sleeve on the shaft and an air supply block having a spring-pressed slip connection with the sleeve.

7. In combination, aligned shafts, a plurality of concentric clutch discs on one of said shafts, a clutch drum on the other shaft enclosing said clutch discs, annular clutch plates keyed to the clutch drum and disposed at opposite sides of each clutch disc, springs interposed between each pair of clutch plates for holding them separated and free of clutching engagement with the clutch discs, fluid pressure members seated in the drum in back of the discs of each pair and selectively controlled fluid pressure connections to each pair of fluid pressure members.

8. A structure as in claim 7 in which the drum is made up of annular sections secured together by tie bolts, the clutch plates being keyed to the drum by lugs slidingly engaged on said tie bolts and the springs encircling the bolts between said lugs.

In witness whereof, I have hereunto set my hand this 28th day of November, 1922.

EUGENE T. TURNEY.