L. WIRTZ.

CLUTCH.

APPLICATION FILED OCT. 26, 1908.

957,401.

Patented May 10, 1910.

5 SHEETS—SHEET 1.

FIG 1

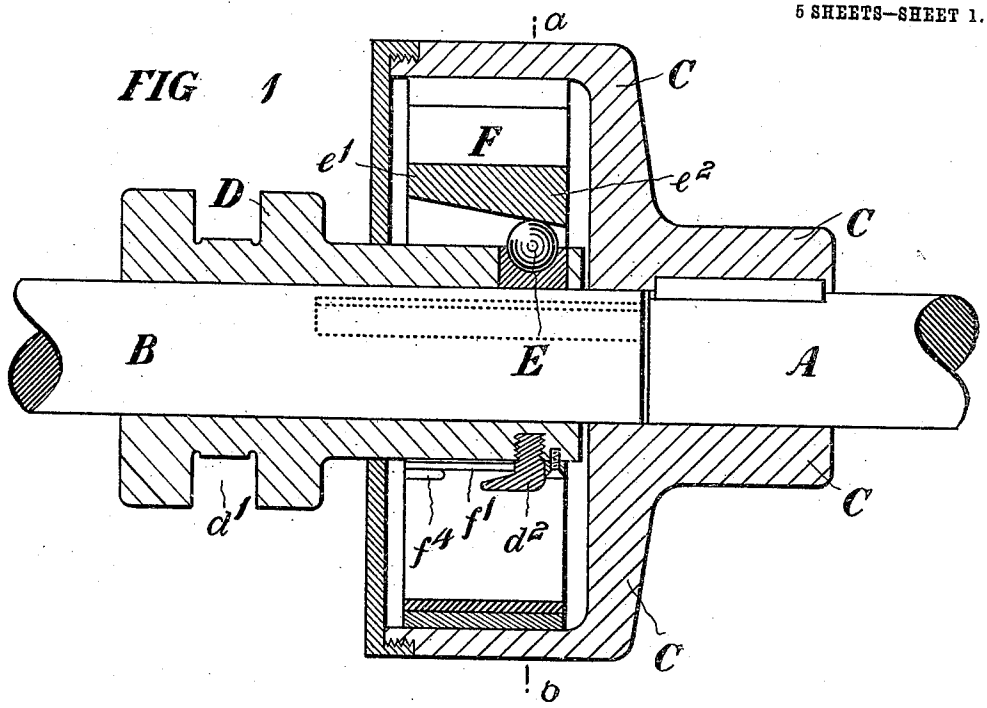
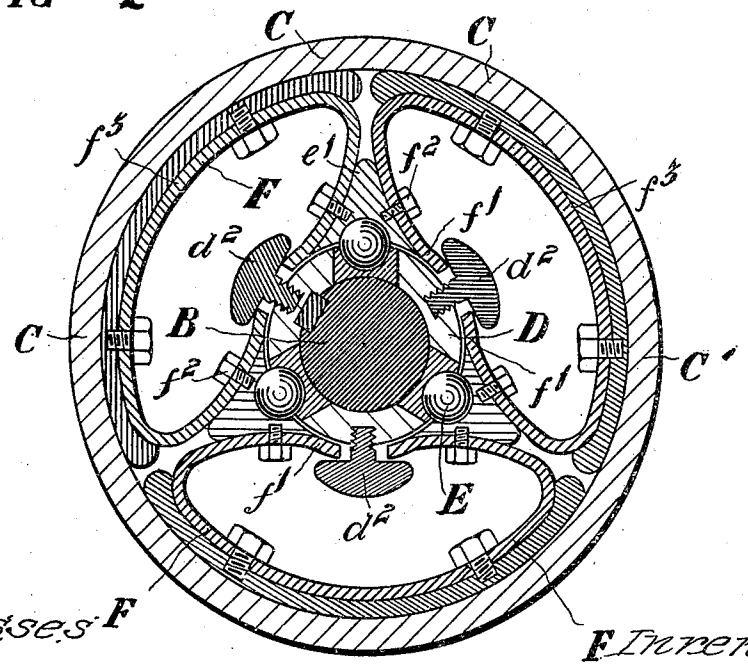


FIG 2



Witnesses:

C. M. Crawford

E. Schallinger

Inventor:-

Louis Wirtz

By B. Singer Attorney

L. WIRTZ.

CLUTCH.

APPLICATION FILED OCT. 26, 1908.

957,401.

Patented May 10, 1910.

5 SHEETS—SHEET 2.

FIG 3

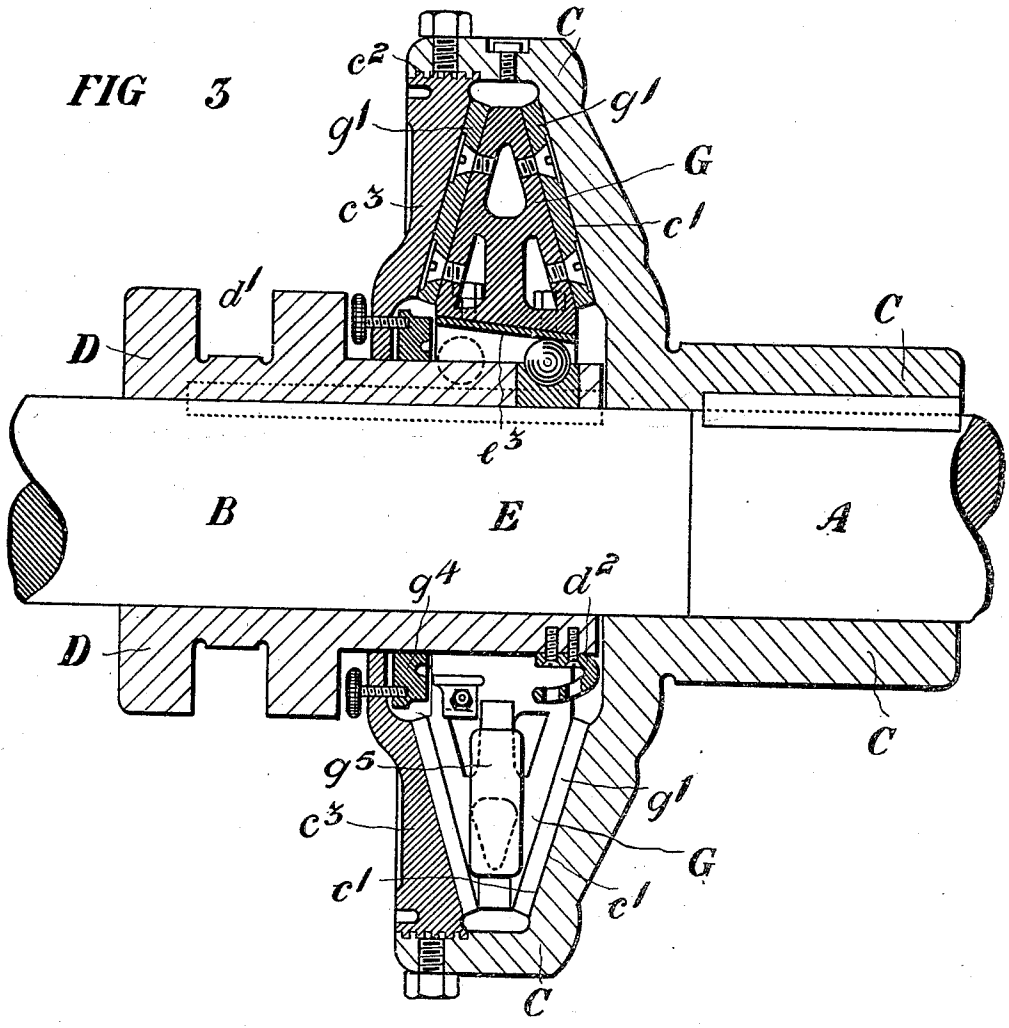
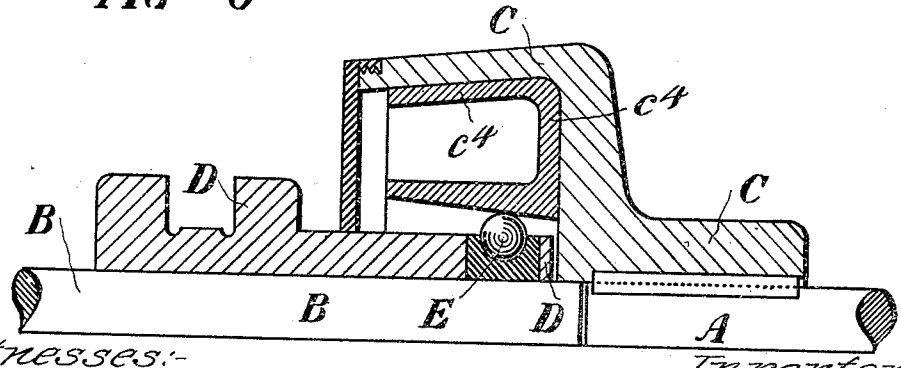


FIG 6



Witnesses:-
C. H. Crawford
E. Schallinger

Inventor:-
Louis Wirtz
By B. Singer Attorney

L. WIRTZ.

CLUTCH.

APPLICATION FILED OCT. 26, 1908.

957,401.

Patented May 10, 1910.

5 SHEETS—SHEET 3.

FIG 4.

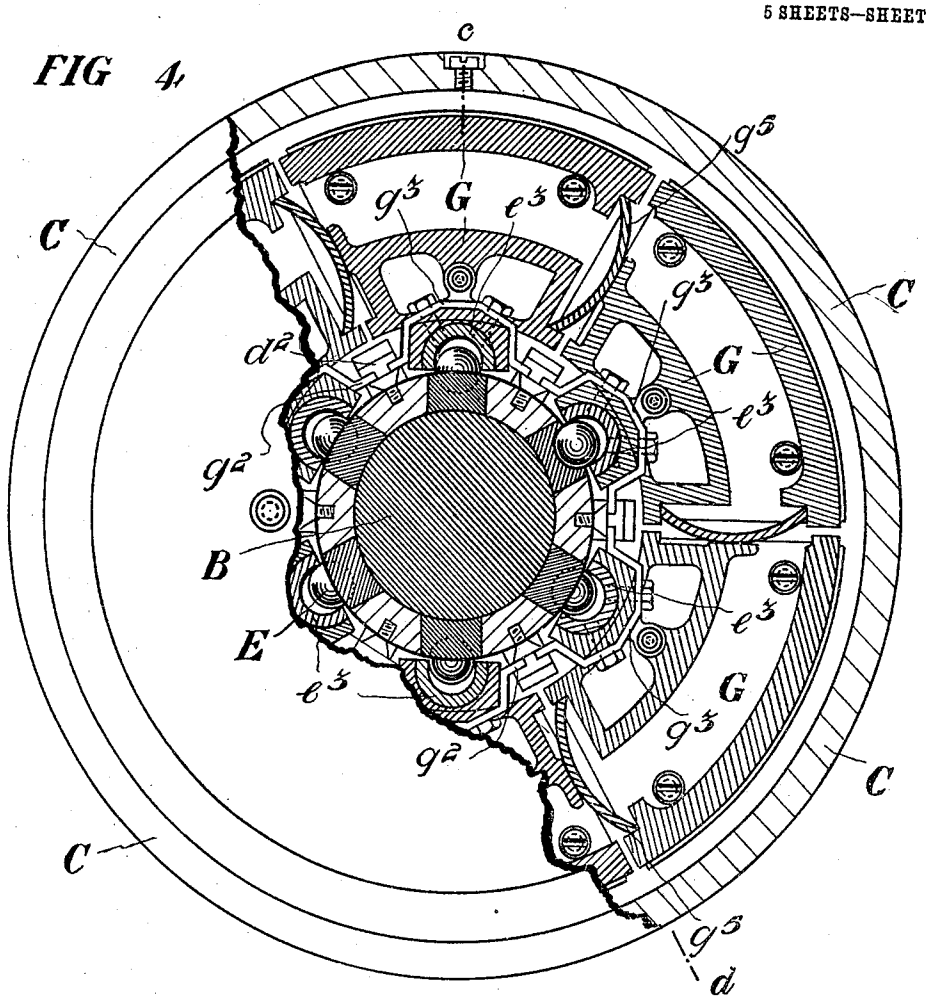
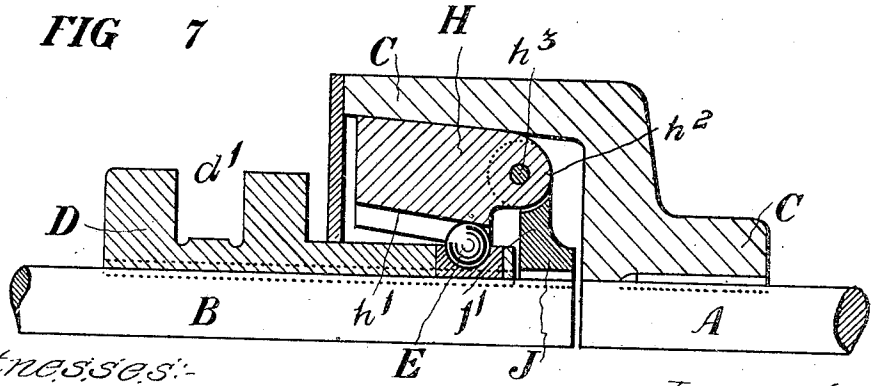


FIG 7



Witnesses:-

C. H. Crawford

E. Schallinger

Inventor:-

Louis Wirtz

by B. Singer

Attorney

L. WIRTZ.

CLUTCH.

APPLICATION FILED OCT. 26, 1908.

957,401.

Patented May 10, 1910.

5 SHEETS—SHEET 4.

FIG 5

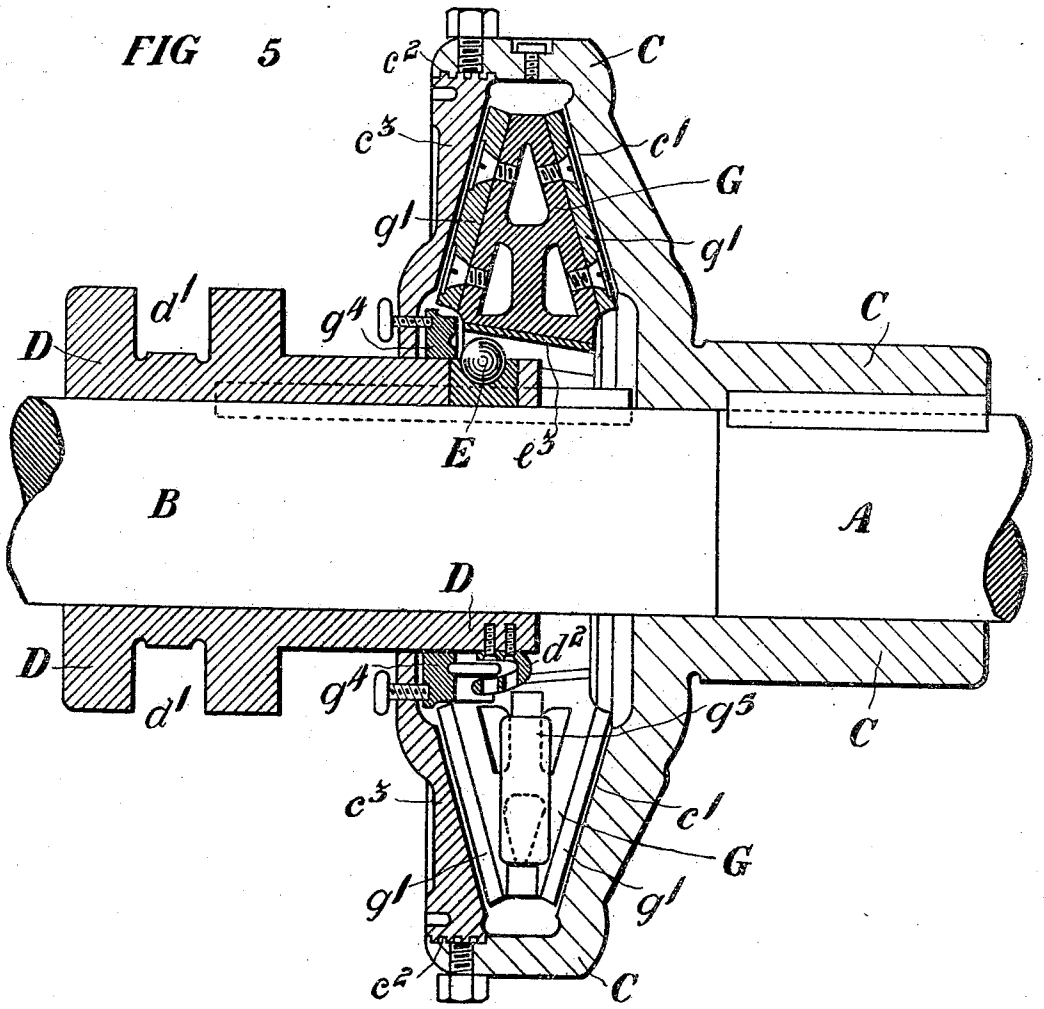


FIG 8

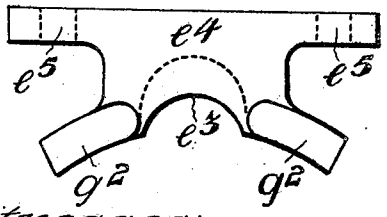
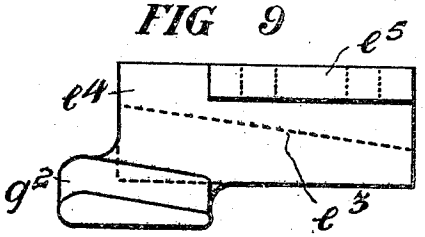


FIG 9



Witnesses:-

C. H. Crawford

E. Schallitzer

Inventor:-

Louis Wirtz

By B. Singer

Attorney

L. WIRTZ.

CLUTCH.

APPLICATION FILED OCT. 26, 1908.

957,401.

Patented May 10, 1910.

5 SHEETS—SHEET 5.

FIG 10

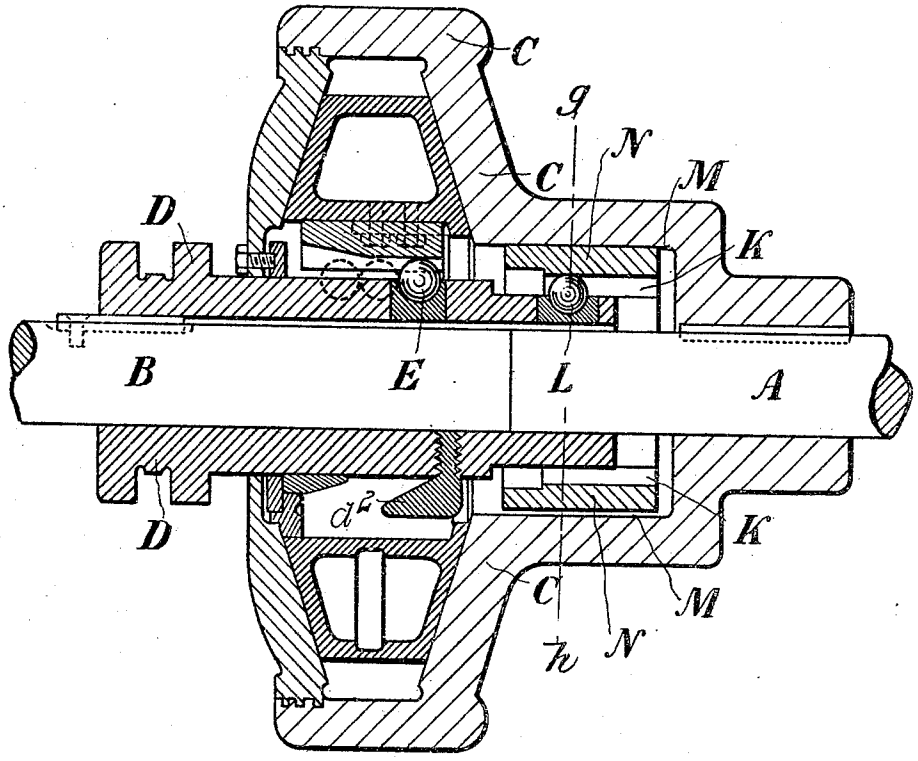
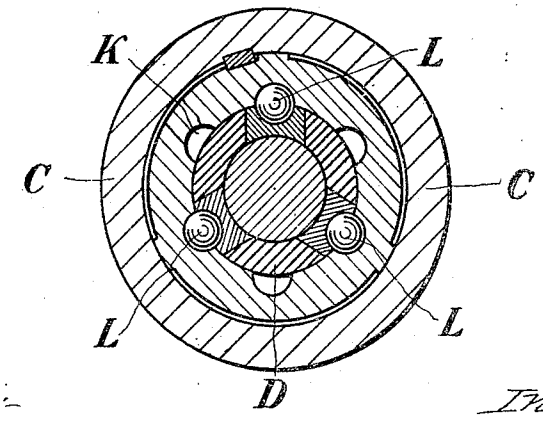


FIG 11



Witnesses:-

C. H. Crawford

E. Schallinger

Inventor:-

Louis Wirtz

by B. Singer

Attorney

UNITED STATES PATENT OFFICE.

LUIS WIRTZ, OF SMETHWICK, ENGLAND.

CLUTCH.

957,401. Specification of Letters Patent. Patented May 10, 1910.

Application filed October 26, 1908. Serial No. 459,645.

To all whom it may concern:

Be it known that I, LUIS WIRTZ, a citizen of Great Britain, and resident of 368 Bearwood road, Smethwick, in the county of Stafford, England, civil engineer, have invented certain new and useful Improvements in Clutches, of which the following is a specification.

This invention relates to improvements in clutches and refers more particularly to friction clutches.

The essential feature of the invention is the employment of balls in a manner allowing of their being readily moved axially engaging taper or like surface to effect the throwing out or expansion of a set of members for the frictional engagement of a surrounding surface.

In order that the invention may be thoroughly understood and easily carried into practice, I have appended hereunto five sheets of drawings showing examples of the invention carried into practice with the frictional members arranged as spring, direct acting blocks, and pivotal blocks.

On these drawings: Figure 1. is a longitudinal sectional view of a clutch with spring frictional members. Fig. 2. is a transverse section of same at *a*—*b*. Fig. 3. is a longitudinal sectional view taken at line *c*—*d* of Fig. 4, showing direct acting frictional members. Fig. 4. is a part sectional view, the section being taken transversely of Fig. 3. Fig. 5. is a similar view to Fig. 3, but showing the clutch in inoperative position. Fig. 6. is a sectional view showing a simpler form of direct acting frictional member. Fig. 7. is a sectional view showing a pivotal frictional member. Figs. 8 and 9 show modifications of details connected with the form shown at Fig. 3. Fig. 10. is a longitudinal sectional view showing the method which may be employed in combining the friction clutch with the positive clutch. Fig. 11. is a transverse section taken at line *g*—*h* of Fig. 10.

In all these figures, the shafts to be connected are arranged coaxially as A, B, and A is assumed for the purposes of description to be the driving shaft. At Figs. 1 and 2, a drum C is keyed on this shaft A, which drum C projects therefrom and surrounds a portion of the driven shaft B. On the end of the driven shaft a sleeve D is mounted to slide on a feather so that it rotates with, but is capable of axial movement along the shaft. The sleeve carries at a convenient part of its surface a ring or rings of balls E disposed in cavities at equidistant points around its circumference. The sleeve D with the balls is capable of being moved into or out of the drum C by a fork connection to a grooved collar d^1 on its outer end, or by any other means. Another form of operating the sleeve might be to constitute this sleeve the female screw of a thread on the driven shaft. The required sliding motion of the sleeve would be obtained by rotating the said sleeve around the shaft in the opposite direction to the rotation of the latter or keeping the sleeve still while the shaft itself rotated.

Along the sleeve and over the protruding portions of the balls E, I arrange a series of inverted troughs or channel members e^1 of steel, which troughs adapt themselves loosely to the contour of the balls. These trough or channel members are housed in the interior of the drum and lie approximately parallel to the common axis of the two shafts without touching the surface of the sleeve. These inverted trough members are further formed of graduated thickness, that is the metal particularly at the base of the trough is gradually increased in thickness toward one end e^2 as at Fig. 1. Friction springs F are formed of a strip of metal bent to approximately the shape shown in cross section at Fig. 2, or other suitable shape and they are disposed between the inverted ball troughs e^1 in the space between the hollow drum and the surface of the movable sleeve D. The normal position of each spring is with its inturned portions f^1 in contact with the two adjacent ball troughs e^1 and the top of its arch or back in close proximity to the internal surface of the hollow drum. The springs F are loosely secured to the troughs e^1 by studs f^2 passing into the latter and having heads bearing on the inturned portions of the springs or by any other means that will not impede the axial movement of the sleeve. The springs could be kept in position by prolonging them and the ball troughs, and securing them together at the contacting edges with rivets or the like. The springs are preferably provided with bearing pieces f^3 on the backs for contacting with the drum C.

In operation, to couple up the shafts, the sleeve D is moved along its shaft into the drum C carrying the balls into the thicker

parts e^2 of the troughs e^1 and thus throwing out the latter. This causes the forcing in of the turned in portions f^1 of the C springs causing a rise of the back or arch which then comes into frictional contact with the internal surface of the drum C thus connecting the shafts. This movement of the balls in the troughs forms a smooth method of operation and the springs are gradually brought up to the contacting surface and thus gradually adapt themselves to it. To insure the positive disengagement of the clutch I provide the hook pieces d^2 on the sleeve D which are adapted to engage projections f^4 on the inturned portions f^1 of the springs F when the sleeve D is drawn out for freeing the clutch, thus pulling down the springs F and the ball troughs e^1.

In the example shown at Figs. 3–5, the sleeve is employed as before, but the drum C is differently formed; in this case the frictional surface is arranged as an inclined surface on the end plate as at c^1. The edge c^2 of the drum C is threaded internally and receives a second frictional plate c^3 similarly inclined and the two surfaces c^1 and c^3 are thus adapted for the reception of a wedge block G. The inclined bearing troughs e^3 for the balls E are secured to the blocks G so that the axial movement of the balls acts directly on the blocks throwing the same out to engage the friction surfaces c^1 and c^3. The blocks G may or may not be provided with detachable friction plates g^1 as found desirable. With this form of clutch it is advisable to employ some positive engaging means for pulling the blocks out of contact; these may be similar in form to those illustrated at Figs. 1 and 2, comprising hook like parts d^2 on the sleeve D. Each hook like part d^2 is adapted to engage two adjacent projecting-portions g^2 of the stirrups g^3 secured toward one side of the blocks as shown at Fig. 4. These stirrups are engaged by the hooks when the sleeve D is withdrawn as shown at Fig. 5, and when in this position the stirrups may be forced into engagement with an adjustable grooved ring g^4 for maintaining all the blocks in regular position ready for further operation. The hooks as shown are formed with taper surfaces so that as they engage the stirrups and are moved axially of the shaft they draw the stirrups inward as at Fig. 5. The blocks G are of segmental form and a number are employed around the clutch with stout springs g^5 serving to hold them in position so that they act as a compact whole. In connection with this form of clutch Figs. 8 and 9, show an improved form of making the troughs and stirrup projections in one. The troughs e^3 are machined along the under surface of the block part e^4 and side extensions e^5 are formed integral with this part for screwing to the frictional blocks G. At the lower part of e^4 and on each side of the troughs e^3 the projections g^2 are formed, thus making a more compact and more easily fitted arrangement for these parts.

The form shown at Fig. 6, is very simple in construction but is designed for obtaining the most of the forces which must necessarily tend to act in two directions when the balls are moved along the taper troughs. The forces are radial in planes running parallel with the shaft and have a direction forming an acute angle to the shaft in planes at right angles to the shaft acting of course in the direction of the travel of the balls. In this form of clutch, as will be seen, a frictional surface c^4 is provided for utilizing both these forces giving considerable clutching effect.

In the form shown at Fig. 7, where half the clutch only is represented for convenience of illustration the drum C and ball sleeve D are employed as in Fig. 1, a number of frictional members H each having an inner trough part h^1 along which the balls E travel are also employed as before, but in the present modification these members are provided with an outer arched surface and are pivoted near one end as at h^2. The surfaces of each trough along which the balls bear are so tapered in respect to the outside surfaces of the frictional members that as the balls are moved along these members, the latter are forced outwardly and brought into contact with the surrounding friction drum. For the purpose of pivoting the members I provide them with trunnion pins h^3 in bearings formed in projecting arms j^1 from a back ring or disk J bored and mounted on the shaft B. By pivoting the members a more powerful and precise action may be obtained.

In any of these examples it may be advantageous to provide the frictional parts of the members separable therefrom, secured by screws or otherwise, so that they could be easily replaced when desired. This would also allow of their being turned as a barrel, or sleeve and then split, thus insuring their contour being properly adapted to its work.

The balls may be adapted to work between the tapered and shaped sides of adjacent members instead of under the same, thus raising them on their pivots; or they may be otherwise arranged so long as their axial movement effects the movement of the frictional elements in order to set up the necessary friction. In any of these cases the friction clutch may be combined with the positive clutch. With this object in view the inner end of the drum may be formed or provided with a number of pockets, cavities or grooves into engagement with which the balls may be brought by a further movement of the sleeve than is required for the application of the friction clutch.

In the method illustrated at Figs. 10 and 11, the drum C is formed with a recess M into which recess a collar N having pockets or grooves K formed in its interior is keyed. The sleeve D is extended farther than in the friction clutch type to carry a ring of balls. When the sleeve D brings the ring of balls E into engagement in the friction clutch, the ring of balls L are out of mesh with grooves in the collar N. By a further movement of the sleeve D the balls L take into the grooves K thus directly locking the drum C to the shaft D.

What I claim then is:

1. A friction clutch comprising in combination, a shaft, a friction member mounted on said shaft, a radially movable friction member adapted to coöperate with said other member, anti-friction elements engaging both of said friction members, and means for shifting said elements to effect frictional engagement of said members with each other and locking engagement with one of said members with said means.

2. A friction clutch comprising in combination, a shaft, a friction member mounted on said shaft, a coöperating friction member, anti-friction elements engaging both of said members, and means for shifting said elements to effect frictional engagement of said members and locking engagement of one of said members with said means.

3. A friction clutch comprising in combination, a shaft, a friction member mounted on said shaft and provided with groove portions, a second friction member adapted for engagement with said shaft member and provided with grooved surfaces, a sleeve on said shaft, and anti-friction elements carried by said sleeve and adapted for successive engagement with said grooved portions for effecting frictional engagement with said member and locking engagement between one of said members and said sleeve.

4. A friction clutch comprising in combination, a shaft, a friction member rigidly mounted on said shaft and provided with grooved surfaces, a second friction member adapted for engagement with said first friction member and provided with grooved surfaces, a second shaft, a sleeve keyed on said second shaft and movable longitudinally thereof, and anti-friction members carried by said sleeve and adapted for successive engagement with said grooved surfaces to effect engagement of said friction members and positive locking engagement of one of said members with said sleeve.

5. A friction clutch comprising in combination, shafts arranged for operative connection with each other, rotative coacting friction members one of which is connected with one of said shafts and the other of which is free therefrom and radially movable, said free member having a plurality of axially arranged grooves inclined with respect to its axis, a sleeve non-rotatively and slidably mounted on the other of said shafts, a ring of anti-friction balls carried by said sleeve and engaging said inclined grooves to non-rotatively connect said free member and said sleeve and serving upon axial movement of said sleeve to radially move said free member into frictional engagement with said other member.

6. A friction clutch comprising in combination, shafts arranged for operative connection with each other, rotative coacting friction members one of which is connected with one of said shafts and the other of which is radially movable and free therefrom, a sleeve non-rotatively and slidably mounted on the other of said shafts, and anti-friction balls interposed between and non-rotatively connecting said sleeve and free member, said sleeve and free friction member having relatively inclined rigid portions engaging said balls and serving upon axial movement of said sleeve to radially move said free member into frictional engagement with said other member.

7. A friction clutch comprising in combination, shafts arranged for operative connection with each other, rotative coacting friction members one of which is connected with one of said shafts and the other of which is radially movable and free therefrom, means non-rotatively and slidably connected with the other of said shafts, and anti-friction elements non-rotatively connecting said means with said free friction member, said free friction member and means having portions spaced to receive said elements and serving upon movement of said means relatively to said free member to radially move the latter into frictional engagement with said other member.

8. A friction clutch comprising in combination, coacting rotative friction members, one of which is radially movable, means axially movable with respect to one of said members, and a ring of anti-friction elements non-rotatively connecting said means and the radially movable member, such member and means having portions engaged by said elements and shaped to effect movement and frictional engagement of said radially movable member with said other member.

Signed at Birmingham in the county of Warwick, England, this 13th day of October A. D. 1908.

LUIS WIRTZ.

Witnesses:

F. GILBERT BRETTELL,

J. BEAUMONT PERCIVAL.