(No Model.) 3 Sheets—Sheet 1.

O. FLOHR.

FRICTION CLUTCH.

No. 375,739. Patented Jan. 3, 1888.

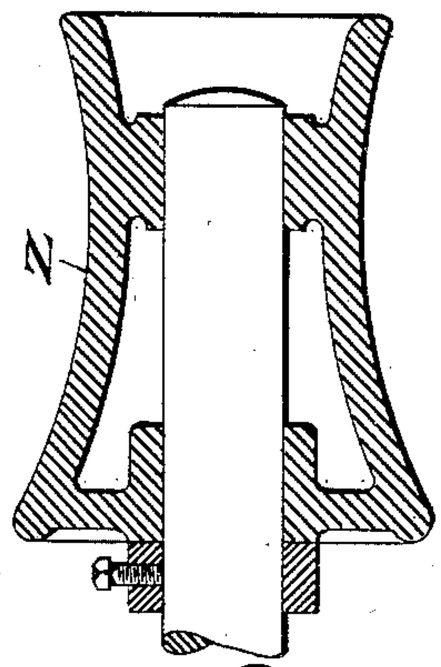

Fig. 4.

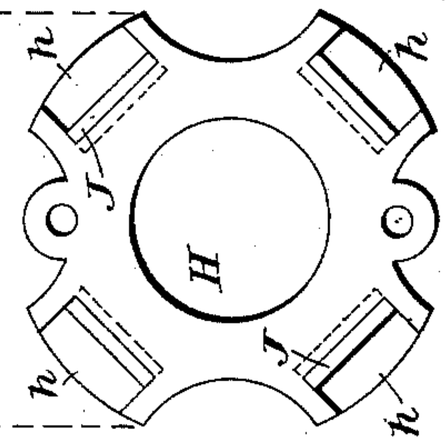

Fig. 5.

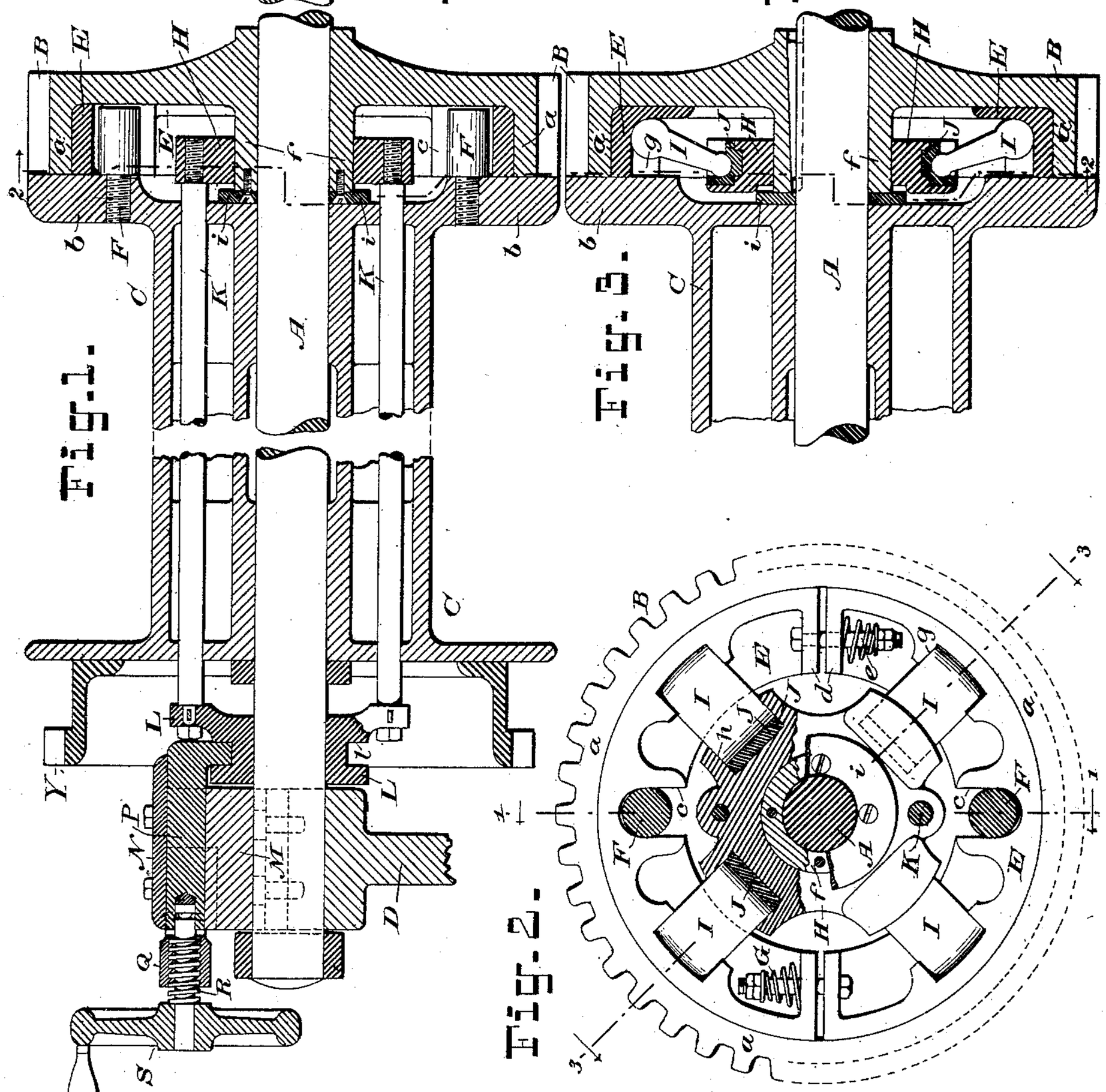

Fig. 1.

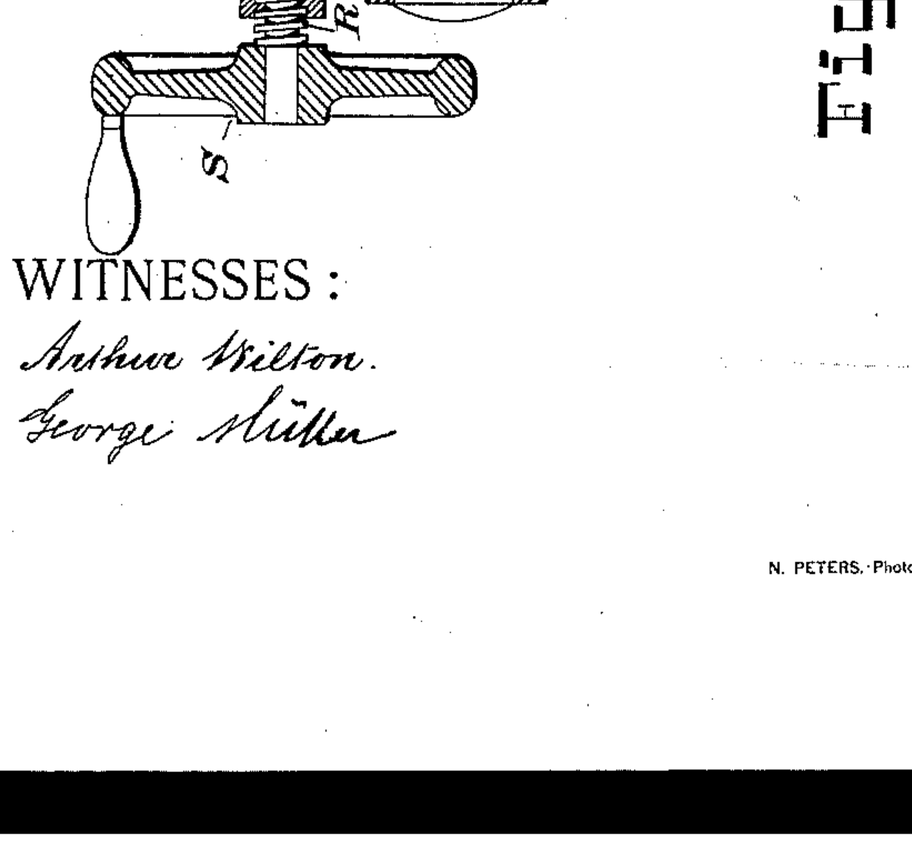

Fig. 3.

Fig. 2.

WITNESSES:

Arthur Wilton.

George Müller

INVENTOR:

Otto Flohr.

By his Attorneys,

Arthur G. Fraser & Co.

(No Model.) 3 Sheets—Sheet 2.

O. FLOHR.

FRICTION CLUTCH.

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Fig. 9.

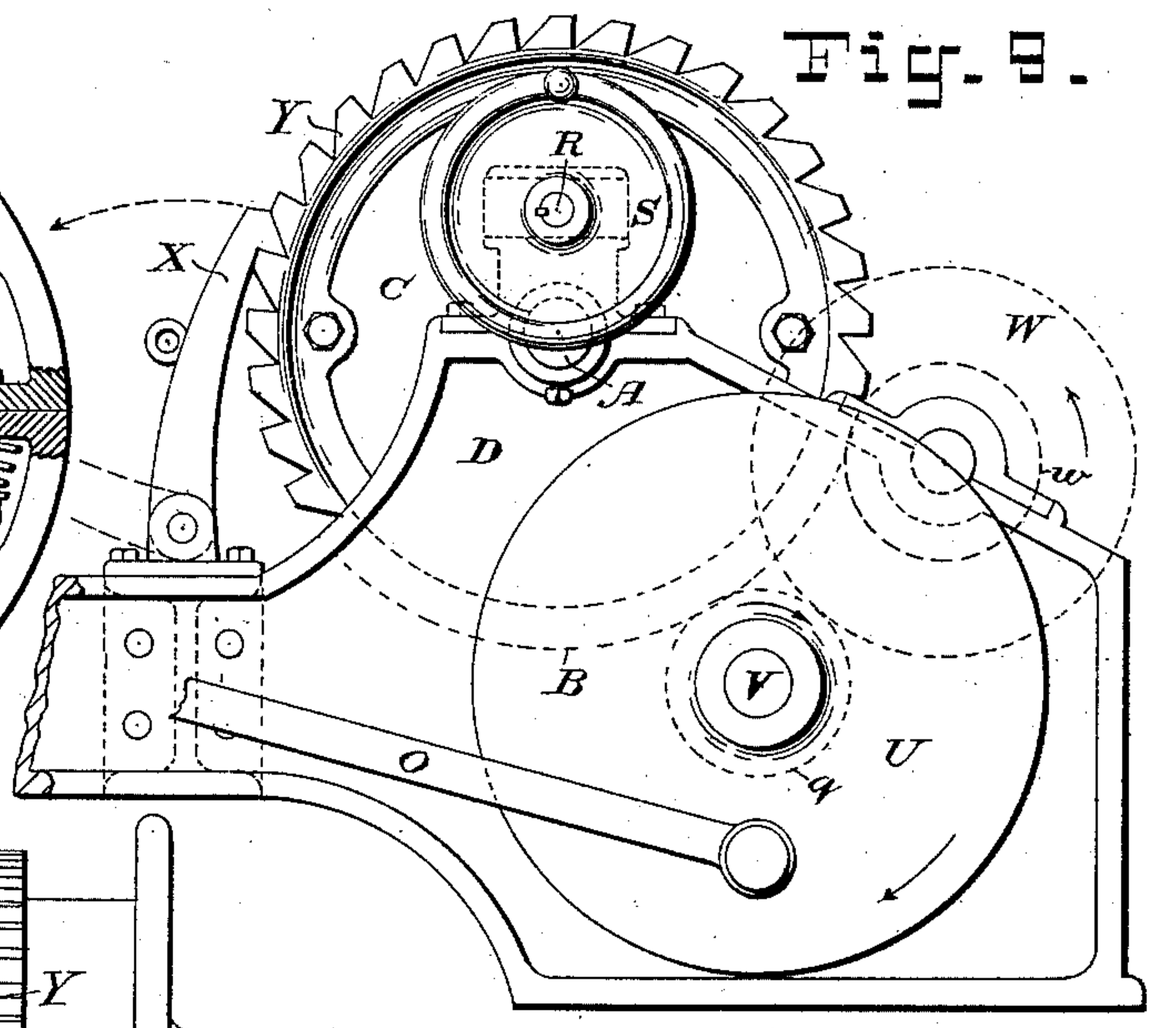


Fig. 6.

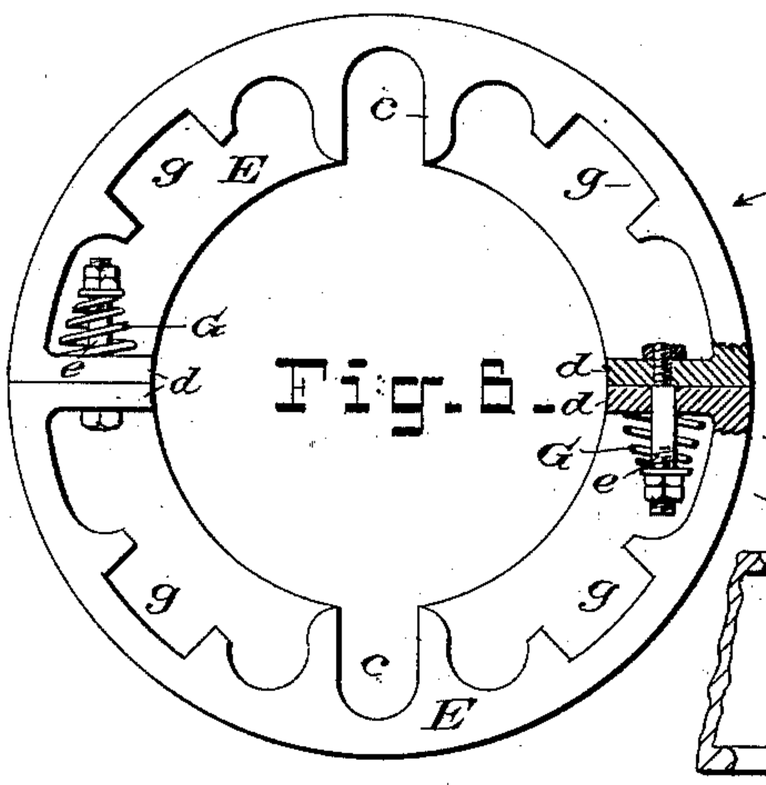


Fig. 7.

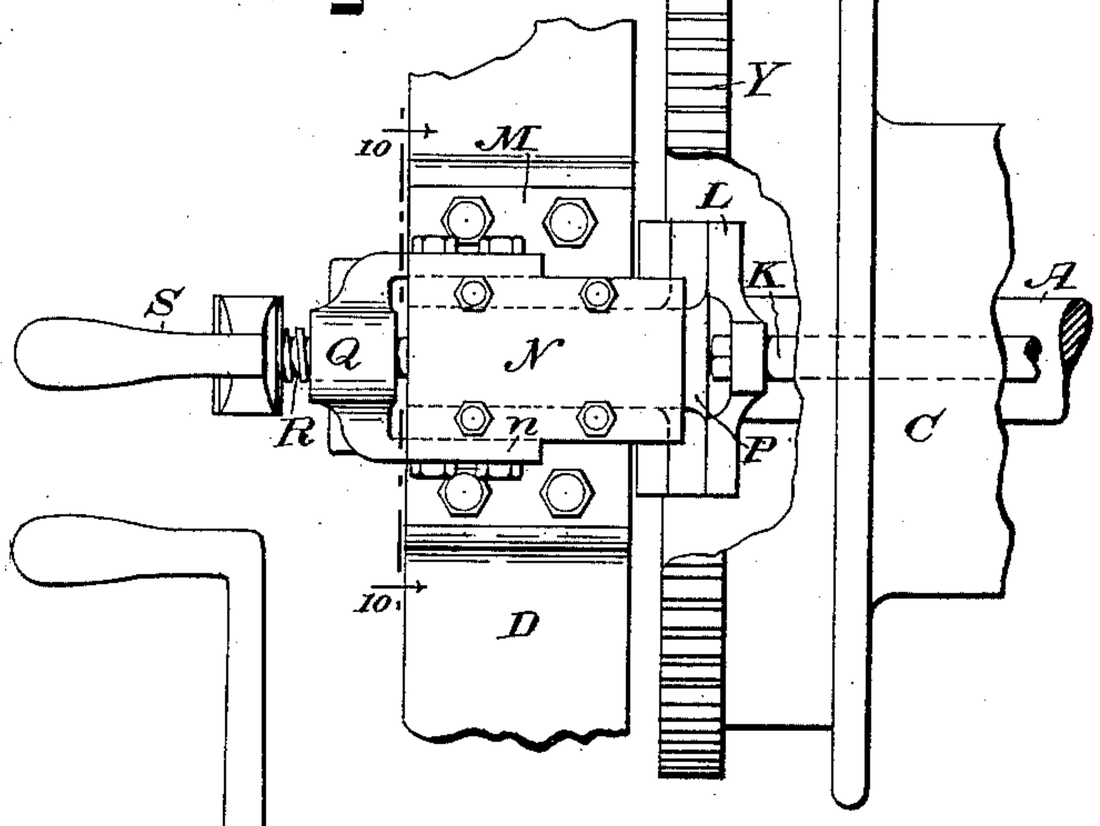


Fig. 10.

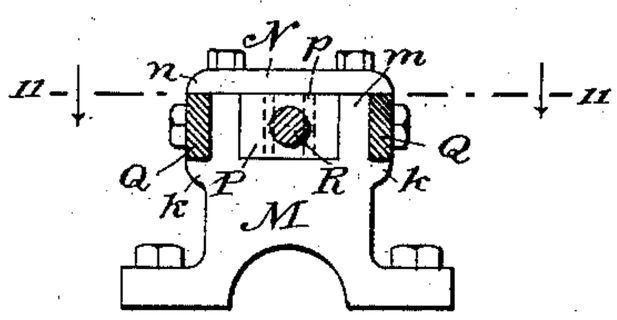


Fig. 8.

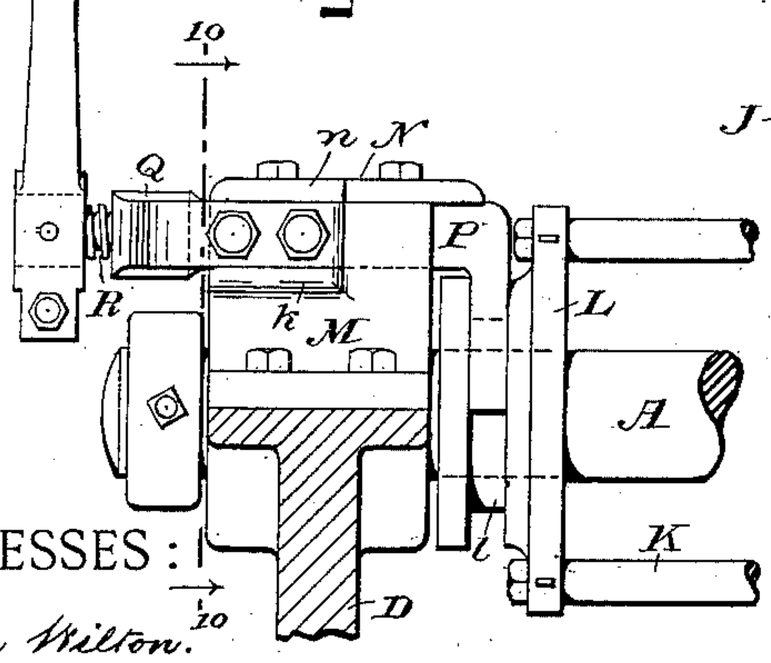


Fig. 12.

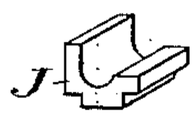
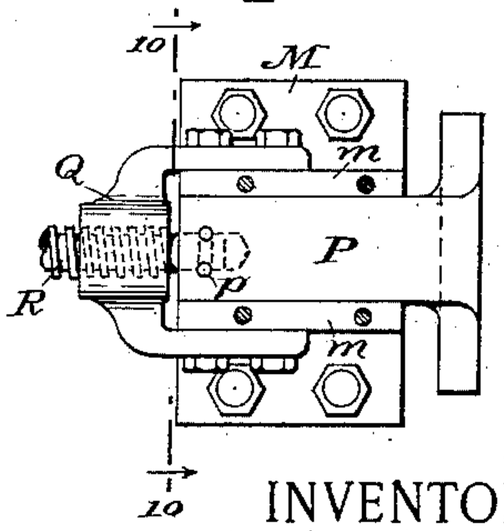


Fig. 11.



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(No Model.) 3 Sheets—Sheet 3.

O. FLOHR.

FRICTION CLUTCH.

No. 375,739. Patented Jan. 3, 1888.

Fig. 13.

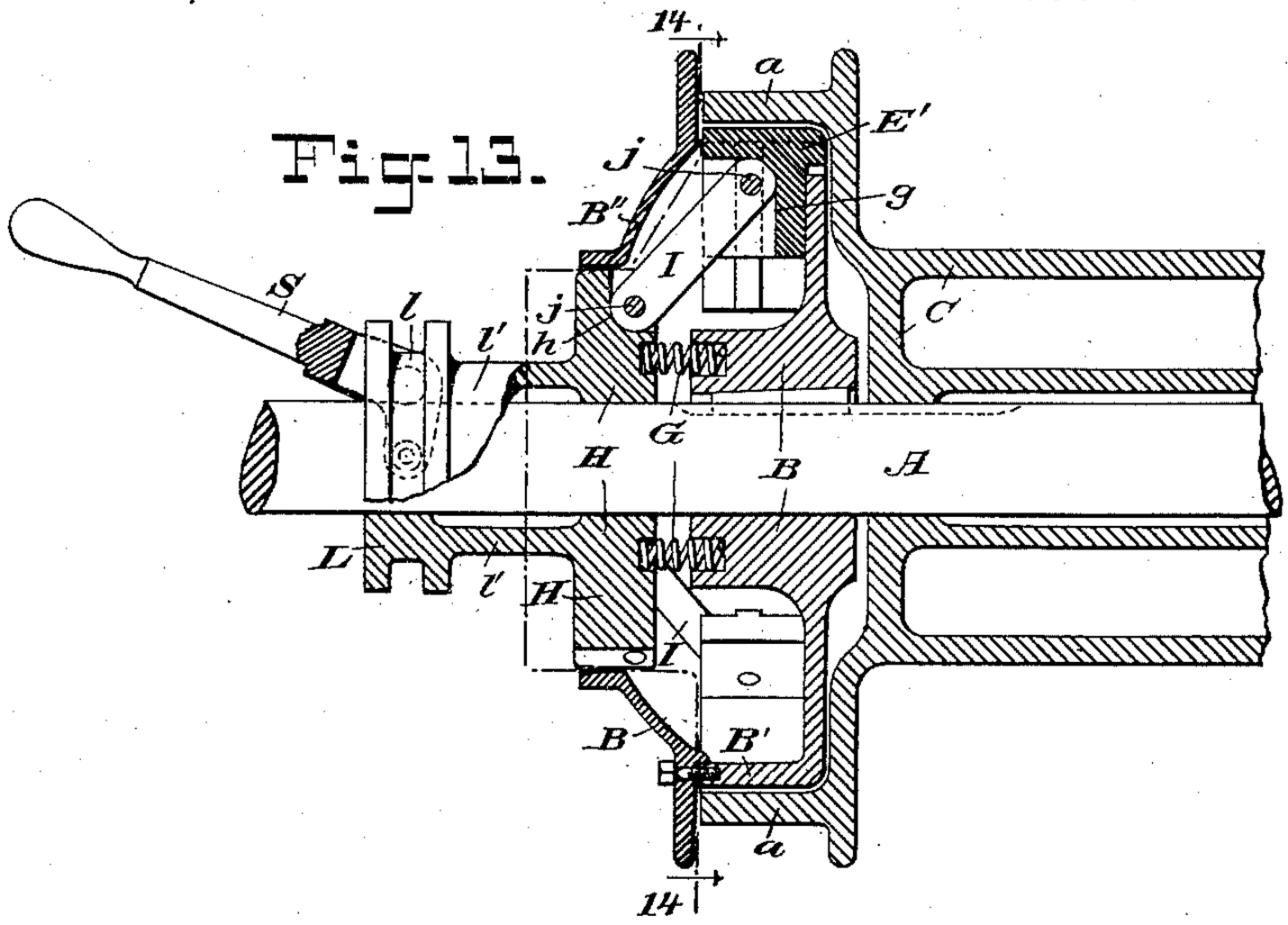


Fig. 14.

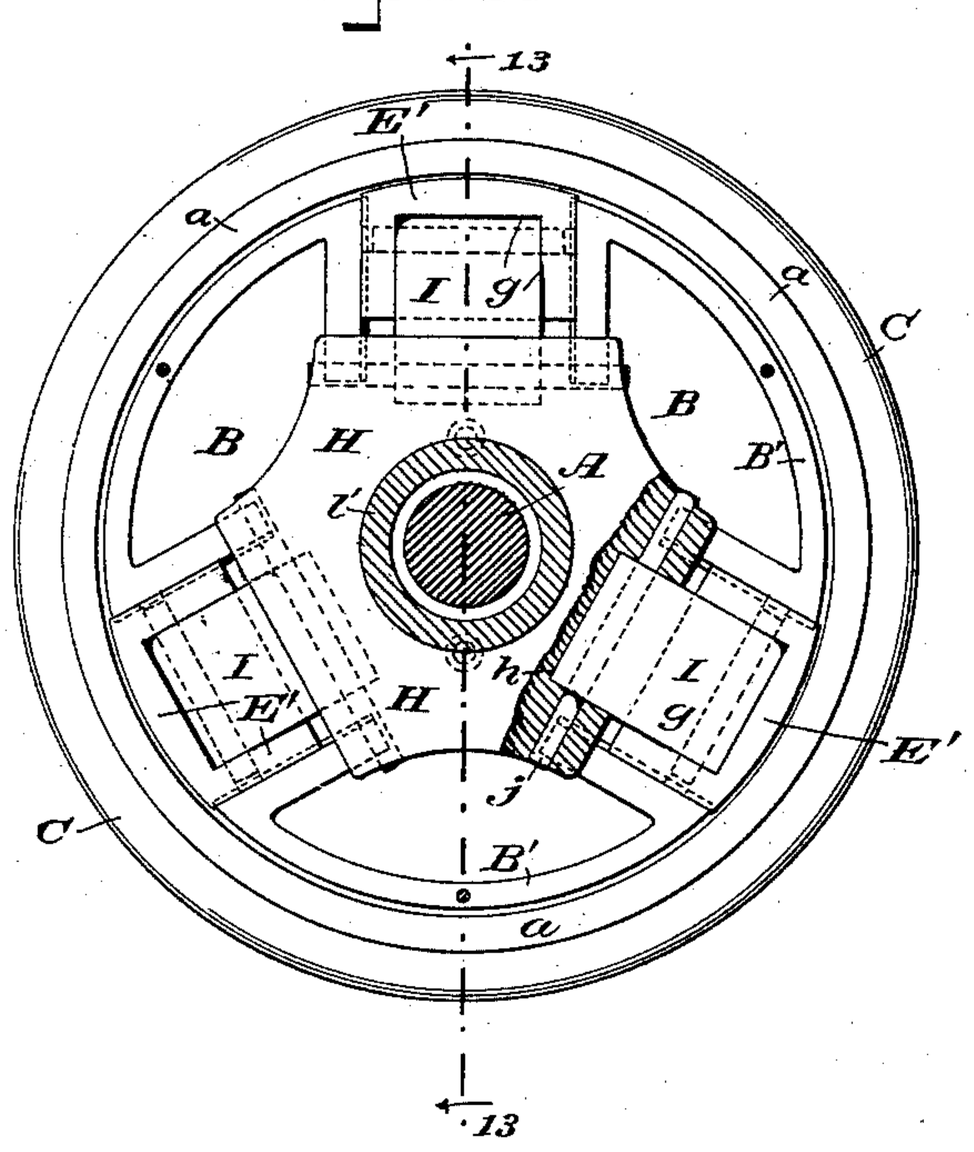
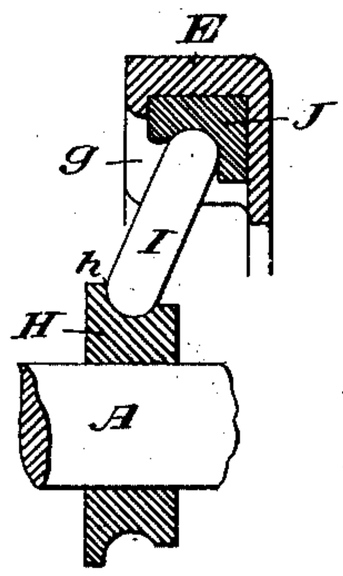


Fig. 15.



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UNITED STATES PATENT OFFICE.

OTTO FLOHR, OF NEWARK, NEW JERSEY.

FRICTION-CLUTCH.

SPECIFICATION forming part of Letters Patent No. 375,739, dated January 3, 1888.

Application filed December 21, 1886. Serial No. 222,140. (No model.)

To all whom it may concern:

Be it known that I, OTTO FLOHR, a citizen of the United States, and a resident of Newark, Essex county, New Jersey, have invented certain new and useful Improvements in Friction-Clutches, of which the following is a specification.

This invention relates to that class of clutches by which one rotary part is coupled to or uncoupled from another at will and without regard to the direction of rotation. More specifically, it relates to clutches wherein the one moving part is constructed with an overhanging flange, and the other moving part carries a divided friction-ring, which may be expanded within said flange in order to bind the two parts together or slackened in order to disconnect them. Such clutches have heretofore been made in which the divided ring is expanded within the flange by means of wedges forced in between the sections of the ring. As an instance of such a construction I would make reference to my Patent No. 351,370, dated October 26, 1886. Clutches of this character have also been made wherein the sections of the expanding-ring have been forced apart by levers pivoted to the sections or pivoted to or borne by their carrier. Clutches of this character have also been constructed wherein the sections of the ring are spread apart by means of toggles. In this way a clutch of great power can be made with but few parts, and those of simple and cheap construction. It is to clutches of this kind that my invention pertains.

I provide two or more toggle-arms with their outer ends braced or seated against the sections of the ring and their inner ends against a knee-piece, which is movable in longitudinal direction, being moved to apply or release the clutch through the medium of rods and levers or other usual or suitable mechanism for the purpose. The sections of the ring, preferably two in number, are drawn together by springs and are forced apart by the straightening of the toggles.

In order to provide a ready and powerful means of applying my improved clutch, I arrange a screw in connection with the grooved sleeve to which the rods are fixed, through the medium of which the sliding knee-piece is moved, so that by turning this screw in one direction or the other the knee-piece is either advanced or retracted, and the clutch consequently either applied or released.

Figures 1 to 12, inclusive, of the accompanying drawings illustrate my invention in its preferred construction. Fig. 1 is a longitudinal mid-section cut in the plane of the line 1 1 in Fig. 2. Fig. 2 is an elevation looking in direction parallel with the axis of rotation and partly in transverse section, as indicated by the dotted line 2 2 in Figs. 1 and 3. Fig. 3 is a fragmentary longitudinal mid-section cut in the plane of the line 3 3 in Fig. 2. Figs. 4 and 5 are respectively front and rear elevations of the knee-piece. Fig. 6 is a front elevation of the divided friction-ring. Fig. 7 is a plan of the mechanism for applying or operating the clutch. Fig. 8 is a side elevation thereof, the frame of the machine being shown in transverse section. Fig. 9 is a front elevation of a portion of a hoisting-engine embodying my improved construction of clutch. Fig. 10 is a fragmentary front elevation, partly in vertical section, cut in the plane of the lines 10 10 in Figs. 7 and 8; and Fig. 11 is a plan of the same parts partly in horizontal section, as denoted by the line 11 11 in Fig. 10. Fig. 12 is a perspective view of one of the socket-blocks. The remaining views illustrate modifications. Fig. 13 is a longitudinal mid-section of a modified construction of hoisting-gear cut in the plane of the line 13 13 in Fig. 14, and Fig. 14 is a transverse section thereof cut in the plane of the line 14 14 therein. Fig. 15 is a section answering to Fig. 3 and showing a modified construction of the sockets for the toggle-arms.

I will first describe the construction illustrated in Figs. 1 to 11. Referring to these figures, let A denote (for instance) the drum-shaft of a hoisting-engine; B, the driving-gear fixed thereto; C, the winding-drum mounted loosely thereon, and D the fixed frame-work of the engine. In hoisting the gear B is rotated by the engine. The drum C is coupled to the gear through the medium of the friction-clutch, and is revolved thereby until the load is raised to the desired height. Then, when it is desired to lower the load, the clutch is partially released, and the drum is thereby permitted to be revolved backward by the descent of the load, the rapidity of its backward

revolution being governed by the clutch, which then acts as a friction-brake. The gear-wheel B is formed with an annular overhanging flange, *a*, and within this flange is placed the divided friction-ring E. This ring is divided at diametrically-opposite points into half-sections, as shown in Figs. 2 and 6. The friction-ring is carried by the drum, the latter being formed with an expanded flange, *b*, to which the ring is connected through the medium of carrying-pins F F. (Shown in elevation in Fig. 1 and in transverse section in Fig. 2.) These pins are screwed securely into the flange *b*, and their heads enter recesses or sockets *c c* in the opposite sections of the divided ring, (see Fig. 6,) so that the ring is forced to turn with the drum; but the sections are free to be moved slightly from or toward each other. The two sections of the ring are formed with flanges *d d* at their division, and a pin or stud, *e*, is screwed firmly into one of these flanges and passes freely through a close-fitting hole in the other flange. There are two studs, *e*, on opposite sides, arranged parallel to each other, so that they serve to guide the sections in their expanding and collapsing movement and keep them in proper alignment. On each stud *e* is placed a stiff spring, G, which is confined by nuts screwed upon the end of the stud. The two springs G G serve to draw together or collapse the sections of the ring.

The gear B is formed with a prolonged hub, *f*, fitting the shaft A, and on the exterior of this hub, which is turned to a true cylinder, is fitted the "knee-piece" H, which is shown detached in Figs. 4 and 5. This knee-piece is free to slide on the hub *f* in a direction parallel to the axis of rotation. Four toggle-arms, I I, are arranged in radial manner, as shown in Fig. 2, between the knee-piece H and the ring E. Both the knee-piece and the ring have recesses or sockets which receive the respective ends of the toggle-arms. The sockets in the ring are lettered *g g*, Fig. 6, and those in the knee-piece are lettered *h h*, Fig. 5. The sockets *h h* in the knee-piece are by preference formed in separate detachable blocks J J, as shown in Figs. 2, 3, and 5. Fig. 12 is a perspective of one of these blocks. These blocks should be made of hard steel, in order to reduce the wear. They are fitted into angular sockets in the knee-piece, as shown in Fig. 3, in such manner that they cannot become displaced. The ends of the arms I I and their respective sockets *g h* are rounded to fit each other.

The proportions of the parts should be such that the toggle-arms will stand at about the angle shown in Fig. 3. It is obvious, referring to that figure, that on forcing the knee-piece H to the right the toggle-arms will be pressed outwardly against the sections of the ring and somewhat straightened, and that thereby the sections of the ring will be forced outwardly against the inner surface of the flange *a*. Thus the clutch is applied and the two moving parts B and C are coupled together. On moving the knee-piece H to the left the pressure against the toggle-arms is relieved and the sections of the ring are released, whereupon their springs G G draw them together, so that the ring no longer presses against the flange *a*, and the two moving parts B and C are uncoupled or disconnected.

It is important to provide some stop for limiting the retractile movement of the knee-piece, as otherwise the springs G G, acting upon it through the medium of the ring-sections and toggle-arms, would force it so far to the left (in Figs. 1 and 3) that it would bind against the drum and generate sufficient friction to prevent the running down or backward rotation of the drum under a light load. To obviate this I provide a flange or collar, *i*, which is placed against the left hand or front end of the hub *f* and screwed thereto, as shown in Fig. 1. When the retractile movement of the knee-piece brings it against this flange *i*, it is stopped.

The advancing and retractile movements of the knee-piece H are imparted to it through the medium of rods K K, which are carried by the drum and slide longitudinally through holes therein and are fixed at their front ends to a sliding sleeve, L, which is mounted to slide freely on the shaft A and has an annular groove, *l*, into which projects any suitable moving part by means of which the requisite longitudinal movement may be imparted to the sleeve. This is the usual construction heretofore adopted in clutches of this character.

My improved construction of friction-clutch has the advantages of enabling the respective moving parts to be coupled together very powerfully with but slight exertion on the part of the person operating it, of effecting a free and quick release, and of uniformly distributing and equalizing the strains incident to the forcing of the frictional surfaces together. There is but little wear, and such as there is will be compensated automatically by the moving parts for a considerable time.

In constructing the clutch the toggle-arms and their connections should be accurately proportioned and fitted, although slight inequalities will be compensated for by the self-adjustment of the parts. If my preferred construction be adopted, wherein the sockets *h h* are formed in separate blocks J J instead of in the knee-piece H itself, the proper adjustment of the machine will be greatly facilitated. For example, if, after putting the parts together, any one or two of the toggle-arms are found to sustain less strain than the others, the blocks J J, against which those arms are seated, are taken out of their sockets and a piece of paper, card-board, or sheet metal of the proper thickness is inserted under each block, thereby lifting it away from the center of the knee-piece, which has the same effect that the insertion of a longer toggle-arm would have. The same construction enables the wear of the machine to be taken up when-

ever necessary, which would only occur at long intervals whenever the parts have worn to such extent that the toggle-arms are straightened out to too obtuse an angle. This is done by underlaying the blocks J J of all four toggle-arms in the same manner as has been just described for adjusting those of one or two arms.

Instead of providing the knee-piece with removable blocks J J, the sections of the ring may be thus provided, as shown in Fig. 15; or blocks may be provided in both the knee-piece and the ring.

My invention is susceptible of various structural modifications without departing from its essential features. There may be more or fewer of the toggle-arms I I, two being the smallest number that can be made operative. The friction-ring may be divided into more or fewer sections, with one, two, or more toggle-arms to each section. Different means may be provided for collapsing the sections of the ring, and other devices may be employed for imparting motion to the knee-piece. I will presently describe a construction embodying these modifications.

I will now describe the mechanism which I have devised for imparting the clutching and releasing movements to the sleeve L.

The shaft A has its bearings in the side frame, D, as usual, a bearing-cap, M, being fixed over the journal. This bearing-cap I extend upwardly, as best shown in Fig. 10, it being formed with side ledges, *k k*, and with upwardly-projecting walls or flanges *m m*. On top of these walls is fastened a top plate, N, which has wings or flanges *n n*, which project beyond the walls *m m* and correspond to the ledges *k k* beneath them. In the space between the walls *m m*, beneath the top plate, N, is confined a slide, P, which is so guided in this space as to be capable of free longitudinal movement. The rear end of this slide is turned downwardly and enters the groove *l* in the sleeve L. Thus the sleeve is free to rotate while being held stationary in longitudinal direction by the slide P, and the longitudinal movement of the latter effects a like forward or backward movement of the revolving sleeve. A yoke, Q, has its arms bolted to the walls *m m*, being confined in place vertically by the flanges *n* and *k*, between which they are closely confined. In the front portion of this yoke, which extends across in front of the end of the slide P, is formed a threaded hole or socket, in which turns a screw, R, on the front end of which is fixed a hand-wheel, S, as shown in Fig. 1, or a crank-lever, as shown in Figs. 7 and 8. The rear end of the screw R enters a socket in the slide P, and is swiveled therein by means of one or more pins, *p p*, in the slide entering a groove in the screw, so that as the screw is turned, and thus moves forward or backward, the slide is caused to move forward or backward with it. By turning the hand wheel or crank S in one direction or the other the parts P, L, K, and H are advanced or retracted, and the clutch is either applied or released; but a very slight motion is required to either apply or release the clutch, and by imparting this motion through the medium of a screw and lever (namely, the hand wheel or crank S) a considerable mechanical advantage is gained, and the operator is enabled to regulate to a nicety the pressure applied to the frictional surfaces. This construction renders it practicable to use my friction-clutch as a brake to regulate the speed of descent of the load which has been hoisted. A very slight turn of the wheel or crank S will cause the load to descend faster or slower, the control being as perfect in this respect as with any brake now in use.

Fig. 9 shows my invention as applied to a hoisting-engine. Only that end of the machine which carries the hoisting-gear is shown. The steam-engine may be constructed in any way desired—for instance, like that described in Patent No. 295,289, dated March 18, 1884. D is the side frame. O is the pitman. U is the crank-wheel, which is fixed on the crank-shaft V. *q* is the driving-pinion, (shown in dotted lines,) which is fixed on the shaft V, and which gears either directly with the gear-wheel B (the pitch-line of which is shown by a dotted line) or with a slow-motion gear-wheel, W, (the pitch-line of which is shown by a dotted line,) and which in turn drives the gear B through the medium of a pinion, *w*, (also indicated by a dotted line.) This is the usual construction of hoisting-engines whenever either a slow or quick motion is desired. C is the winding-drum; A, the drum-shaft; S, the crank-wheel for applying the clutch, and R its screw. Y is a ratchet-wheel or notched wheel, which is carried by the drum, being constructed in the form of a ring and bolted to the end of the drum, as shown in Figs. 1 and 7.

It is frequently desirable or necessary to have some means for locking the drum fast in position, in order to hold the load suspended at any desired point independently of the action of the clutch and engine. For this purpose I provide a locking pawl or hook, X, which is pivoted to the fixed frame D, and the hooked end of which engages the teeth or notches in the wheel Y. Normally this pawl is thrown down horizontally upon the frame D; but whenever it is desired to lock the drum fast it is moved into engagement with it, as shown in Fig. 9.

In Fig. 1, Z is a windlass barrel or winch, which is fastened upon the rear end of the shaft A, outside of the fixed frame.

Figs. 13 and 14 illustrate a modification of my invention, which I will now describe.

A is the driving-shaft. B is a carrier fixed thereon, and C is the winding-drum. In the construction before described the flange *a* was formed on the part B and the friction-ring E was carried by the part C. In this construction, however, this arrangement is reversed. The flange *a* is formed on the drum C and the friction-ring is carried by the carrier B, which,

as here shown, is not a gear-wheel. The friction-ring is divided into three sections instead of two, and a considerable portion of the ring is removed between these sections, so that the sections are reduced to the semblance of friction-blocks or brake-shoes. They are lettered E′ E′. The carrier B is constructed with filling portions B′ B′, which fill the spaces between the sections E′ E′. The carrier B is formed with three radial slideways, in which the blocks or sections E′ are fitted, the latter being thus capable of moving out and in radially, being guided by these slideways. The knee-piece H and grooved sleeve L are both constructed in one piece, connected by a portion, *l′*, and slide upon the shaft A, with which they revolve. There are three toggle-arms I I—one to each ring-section E′—and each arm is socketed at one end in a socket, *g*, in the section E′, and at the other end in a socket, *h*, in the knee-piece, and is pivoted to both the sections and the knee-piece by pins or pintles *j j*. G G are retracting springs, which are interposed between the carrier B and the knee-piece H, and act to force the latter to the left, thus pulling back the toggle-arms I I and the sections E′ E′. B is a cap or hood for inclosing and concealing the clutching parts. The clutch is applied by means of a hand-lever, S, which is forked at its fulcrum and carries pins or rollers, which engage the groove *l* in the sliding sleeve. In operation the friction-ring sections E′ E′ are forced outwardly against the flange *a* by the thrust of the knee-piece H, acting through the toggle-arms I I, and are drawn back by the tension of the springs G G.

My invention may be otherwise variously modified in construction, as will be well understood. It is obvious that either of the respective parts B C may constitute the driver, it being immaterial whether the power is transmitted from the friction ring to the flange *a* or from the latter to the friction-ring.

I claim as my invention the following-defined novel features and combinations as applied to a friction-clutch, substantially as hereinbefore specified, namely:

1. The combination of a driving and a driven part, one of said parts formed with an overhanging flange, a divided friction-ring within said flange and so connected to the other of said parts that both must rotate together, the axial shaft upon which said rotating parts are mounted, a longitudinally-moving knee-piece on said shaft, and said sections and knee-piece formed with opposite sockets, inclined toggle-arms with their opposite ends entering said opposite sockets and abutting directly against the sections and knee-piece, respectively, whereby on advancing said knee-piece the friction-ring is expanded by the direct and unyielding thrust of said toggle-arms, and retracting-springs arranged to contract said ring and thereby release the clutch.

2. The combination of a driving and a driven part, one of said parts formed with an overhanging flange, a divided friction-ring within said flange and so connected to the other of said parts that both must rotate together, the axial shaft upon which said rotating parts are mounted, a longitudinally-moving knee-piece on said shaft, and said sections and knee-piece formed with opposite sockets extended laterally in planes perpendicular to the axis of rotation, inclined toggle arms or plates broadened laterally to a width corresponding to the length of said sockets and arranged with their opposite ends entering said opposite sockets and abutting directly against the sections and knee-piece, respectively, whereby on advancing said knee-piece the friction-ring is expanded by the direct and unyielding thrust of said toggle-arms, and retracting-springs arranged to draw back the sections of said ring and release the clutch.

3. The combination of a driving and a driven part, one of said parts formed with an overhanging flange, a friction-ring within said flange so connected to the other of said parts that both must rotate together, and diametrically divided into two sections, the axial shaft upon which said parts are mounted, four inclined toggle-arms arranged radially with their outer ends bearing against the sections of said ring, two against one section and two against the other, and a knee-piece movable longitudinally on said shaft and against which the inner ends of said toggle-arms bear.

4. The combination of a driving and a driven part, one of said parts formed with an overhanging flange, a friction ring arranged within said flange and diametrically divided into two sections, each of which is formed at its middle with a socket, driving-pins entering said socket and carried by the other of said parts, whereby the sections are forced to rotate with the latter part, the axial shaft upon which said parts are mounted, four inclined toggle arms arranged radially, with their outer ends bearing against the sections of said ring, two against each section and on opposite sides of said socket therein, and a knee-piece movable longitudinally on said shaft and against which the inner ends of said toggle-arms bear.

5. The combination of a driving and a driven part, one of said parts formed with an overhanging flange, a friction-ring arranged within said flange and so connected to the other of said parts that both must rotate together, and divided into sections, retracting-springs applied to the sections of said ring and acting to draw them together, and thereby contract the ring, toggle-arms arranged at an inclination with their outer ends bearing against the sections of said ring, a knee-piece movable longitudinally and against which the inner ends of said toggle-arms bear, and mechanism for longitudinally moving said knee-piece.

6. The combination of a driving and a driven part, one of which is formed with an overhanging flange, a divided friction-ring within said flange and so connected to the

other of said parts that they must both rotate together, guiding devices upon the respective sections of said ring, adapted to guide them in their expanding and contracting movements, inclined toggle-arms with their outer ends bearing against the sections of said ring, a longitudinally-movable knee-piece, against which the inner ends of said toggle-arms bear, and retracting-springs acting to contract said ring.

7. The combination of driving and driven parts, one of which is formed with an overhanging flange, a divided friction-ring within said flange and so connected to the other of said parts that both must rotate together, a longitudinally-movable knee-piece, inclined toggle-arms with their outer ends bearing against the sections of said ring and their inner ends against said knee-piece, and removable blocks in which the ends of said toggle-arms are socketed.

8. The combination of a driving and driven part, one of which is formed with an overhanging flange, a divided friction-ring within said flange and so connected to the other of said parts that both must rotate together, a longitudinally-movable knee-piece, inclined toggle-arms with their outer ends bearing against the sections of said ring and their inner ends against the said knee-piece, and adjustable socket-blocks, each interposed between one end of one of said toggle-arms and the part against which it bears and angularly socketed in said latter part.

9. The combination of driving and driven parts, one of which is formed with an overhanging flange, a divided friction-ring within said flange and so connected to the other of said parts that both must rotate together, a longitudinally-movable knee-piece, inclined toggle-arms with their outer ends bearing against the sections of said ring and their inner ends against said knee-piece, retracting-springs acting to contract said ring and retract said knee-piece, and a stop for limiting the retractile movement of the knee-piece.

10. The combination of driving and driven parts, one of which is formed with an overhanging flange, a divided friction-ring within said flange, a knee-piece and inclined toggle-arms for expanding said ring, an annularly-grooved sleeve connected to said knee-piece, a longitudinally-moving slide engaging the groove in said sleeve, and an operating-screw engaging said slide and adapted, when rotated, to impart longitudinal movement thereto and thereby to engage or release the clutch.

11. A clutch operating mechanism consisting of the combination of cap M, formed with walls *m m*, top plate, N, fixed thereon, yoke Q, fixed thereto, slide P, confined between said walls and beneath said top plate, and operating-screw R, engaging said yoke and swiveled to said slide.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

OTTO FLOHR.

Witnesses:
ARTHUR C. FRASER,
GEORGE H. FRASER.