(No Model.) 2 Sheets—Sheet 1.

L. W. HARDY.

FRICTIONAL DRIVING GEAR.

No. 462,433. Patented Nov. 3, 1891.

Fig 1.

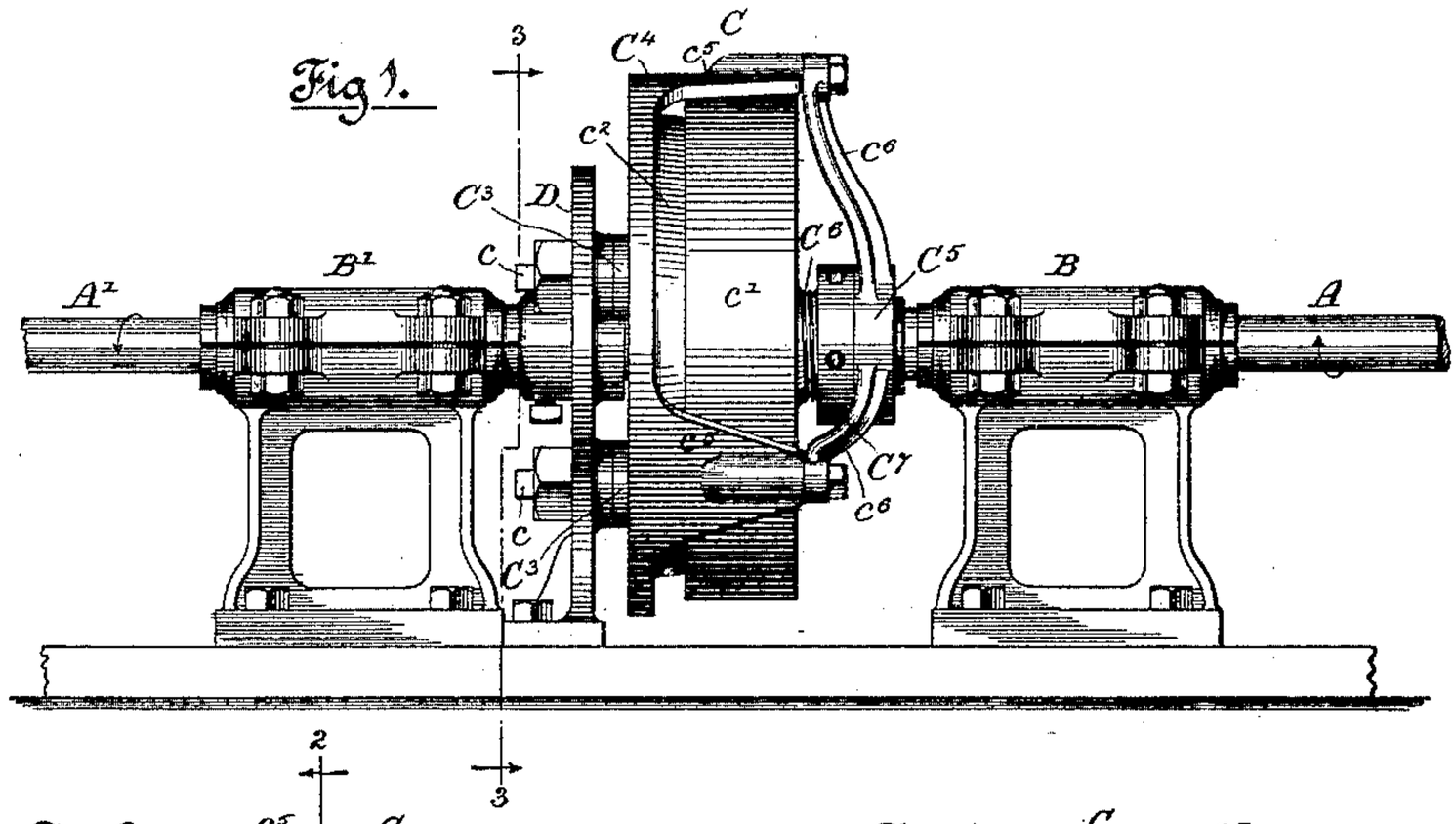


Fig 3.

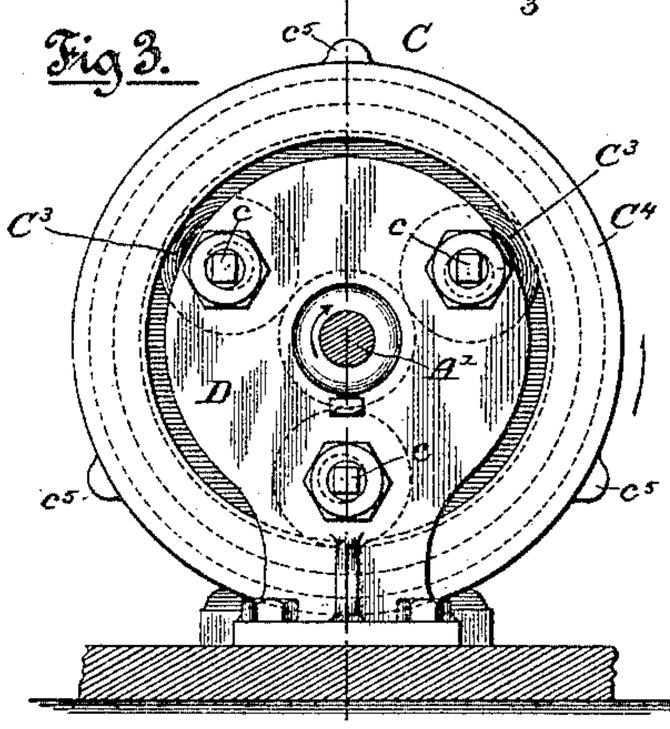


Fig 4.

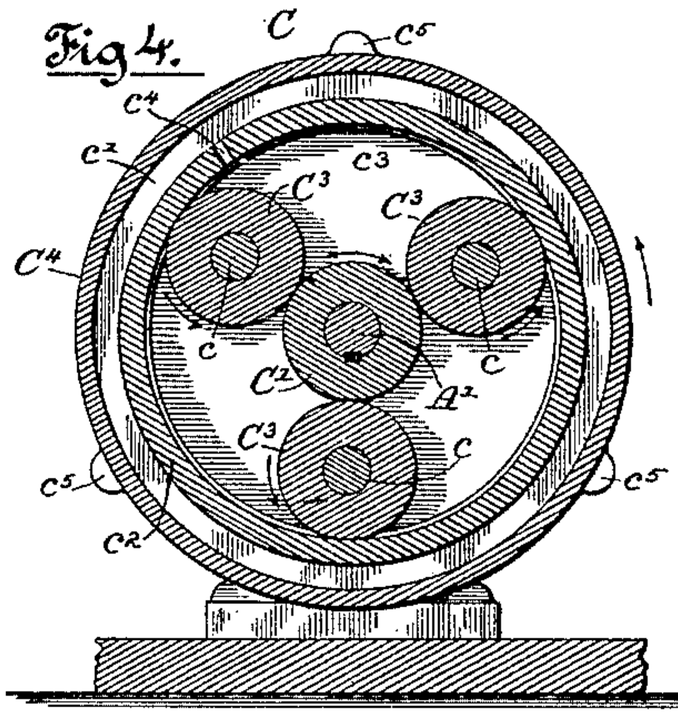
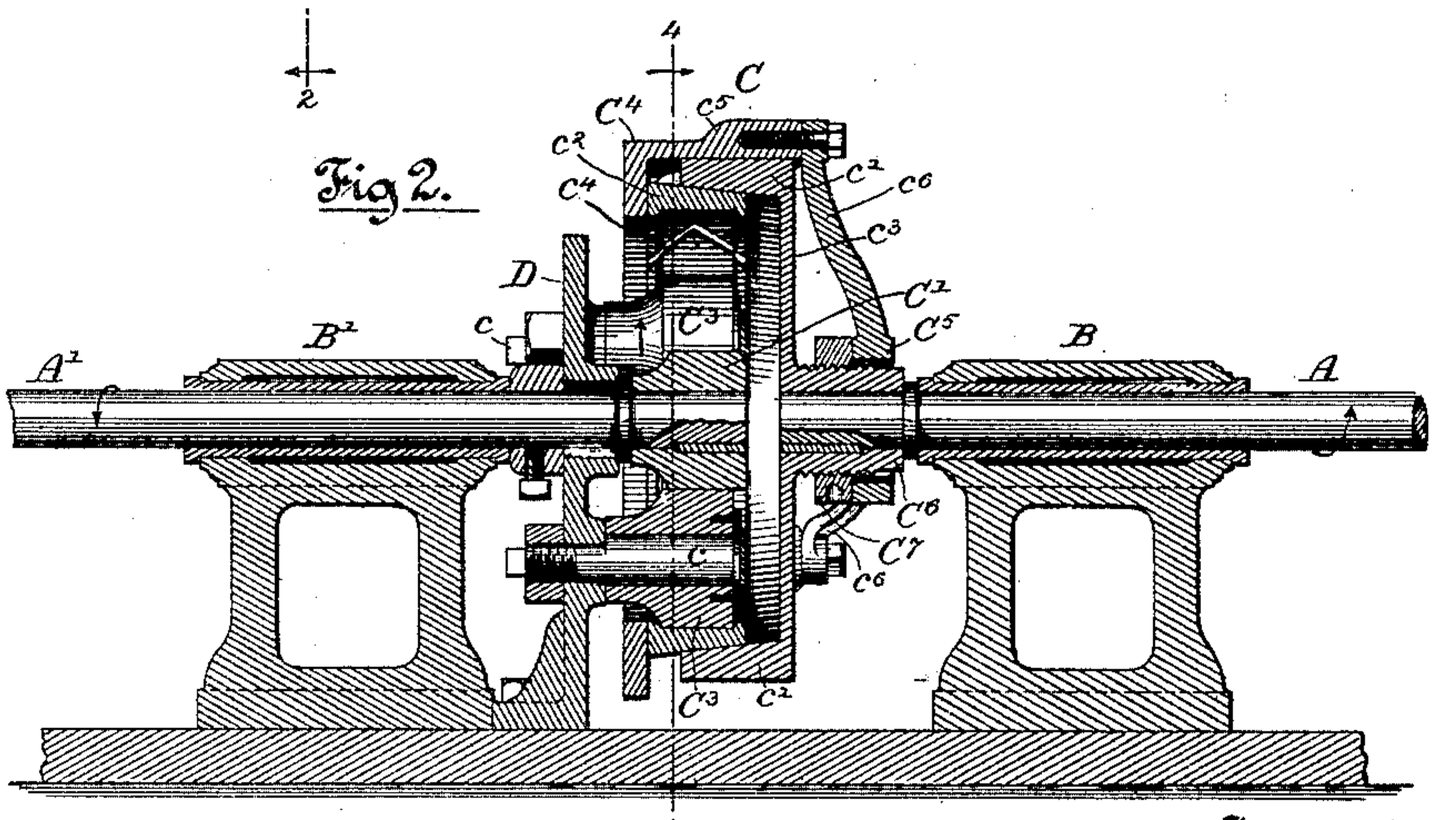


Fig 2.



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(No Model.) 2 Sheets—Sheet 2.

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FRICTIONAL DRIVING GEAR.

No. 462,433. Patented Nov. 3, 1891.

Fig 5.

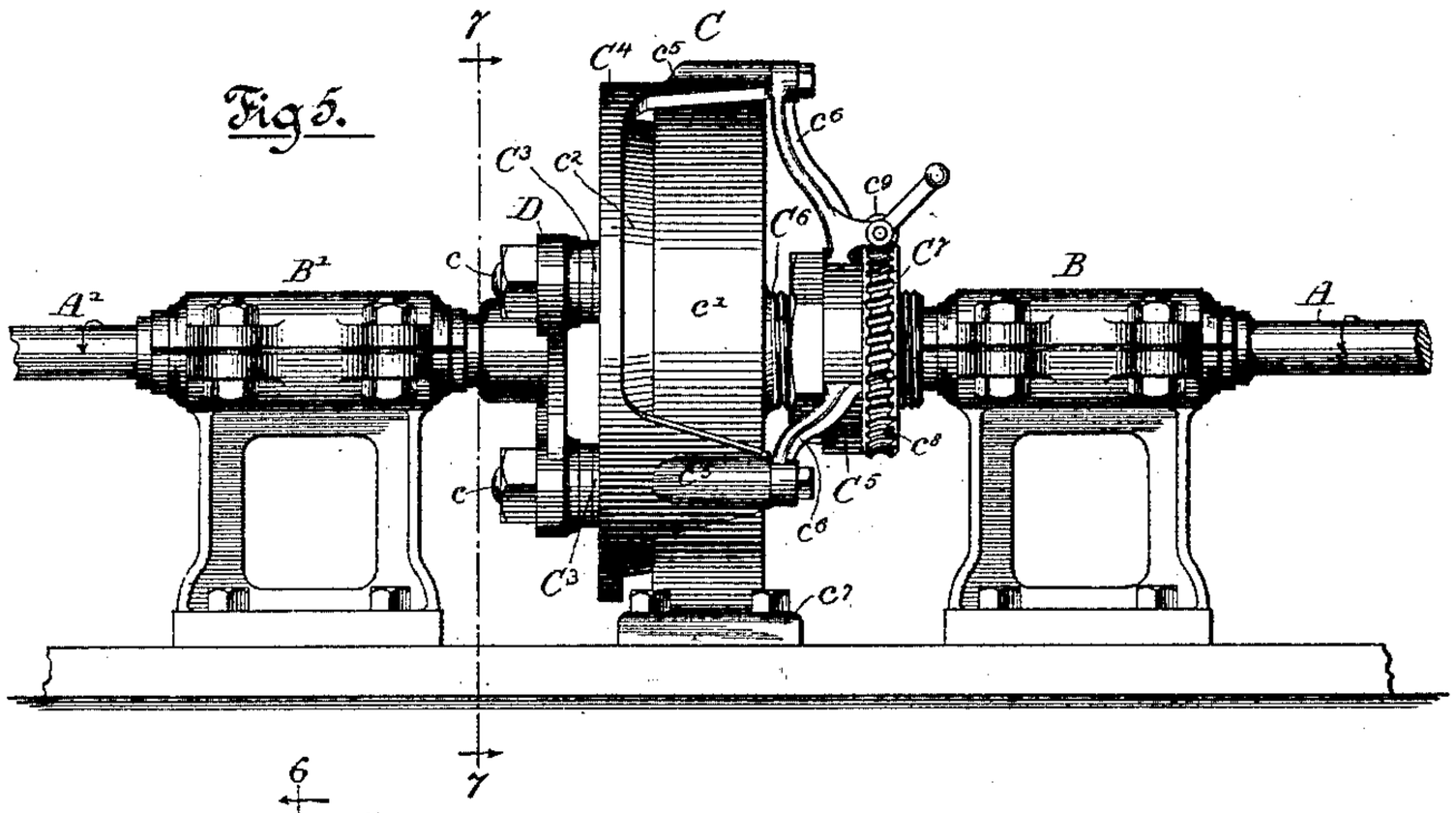

Fig 7.

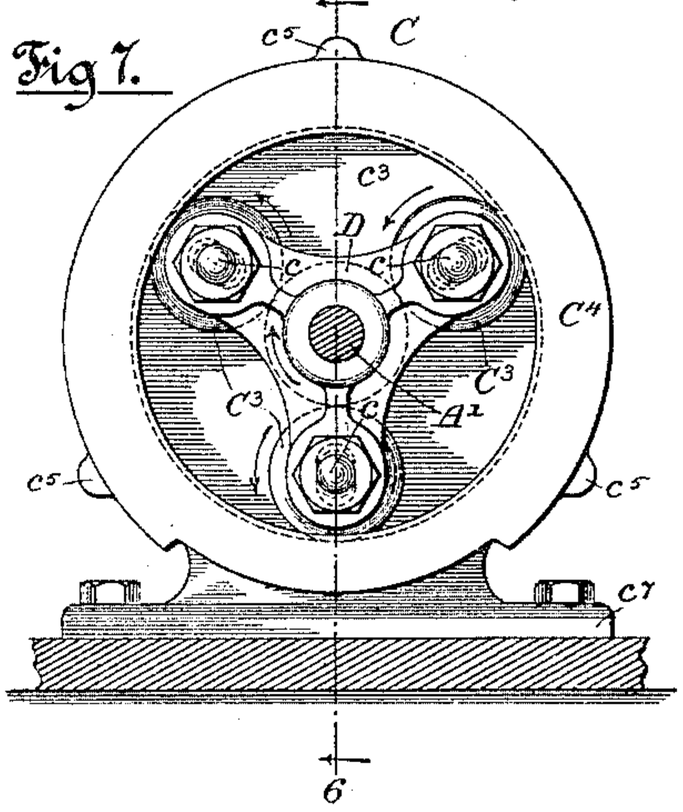

Fig 8.

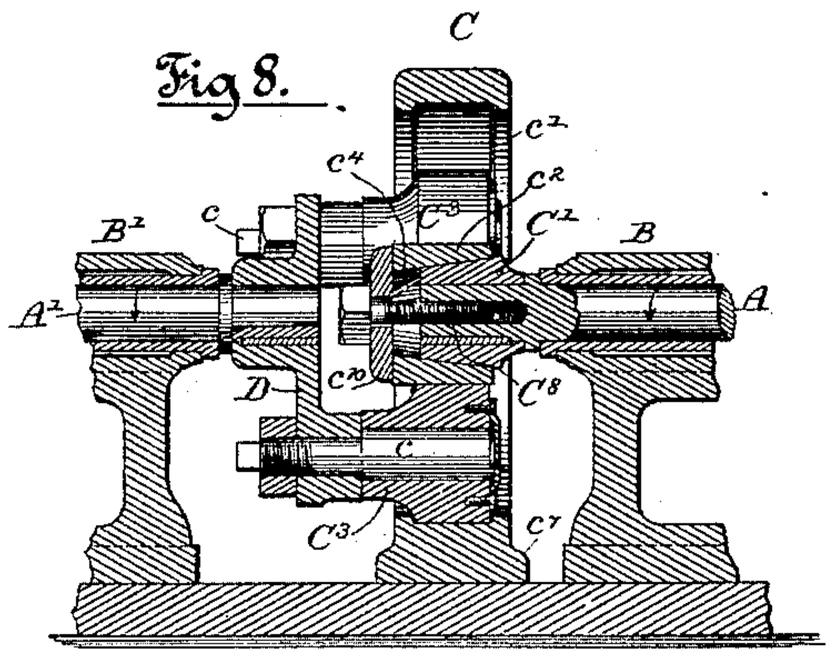

Fig 6.

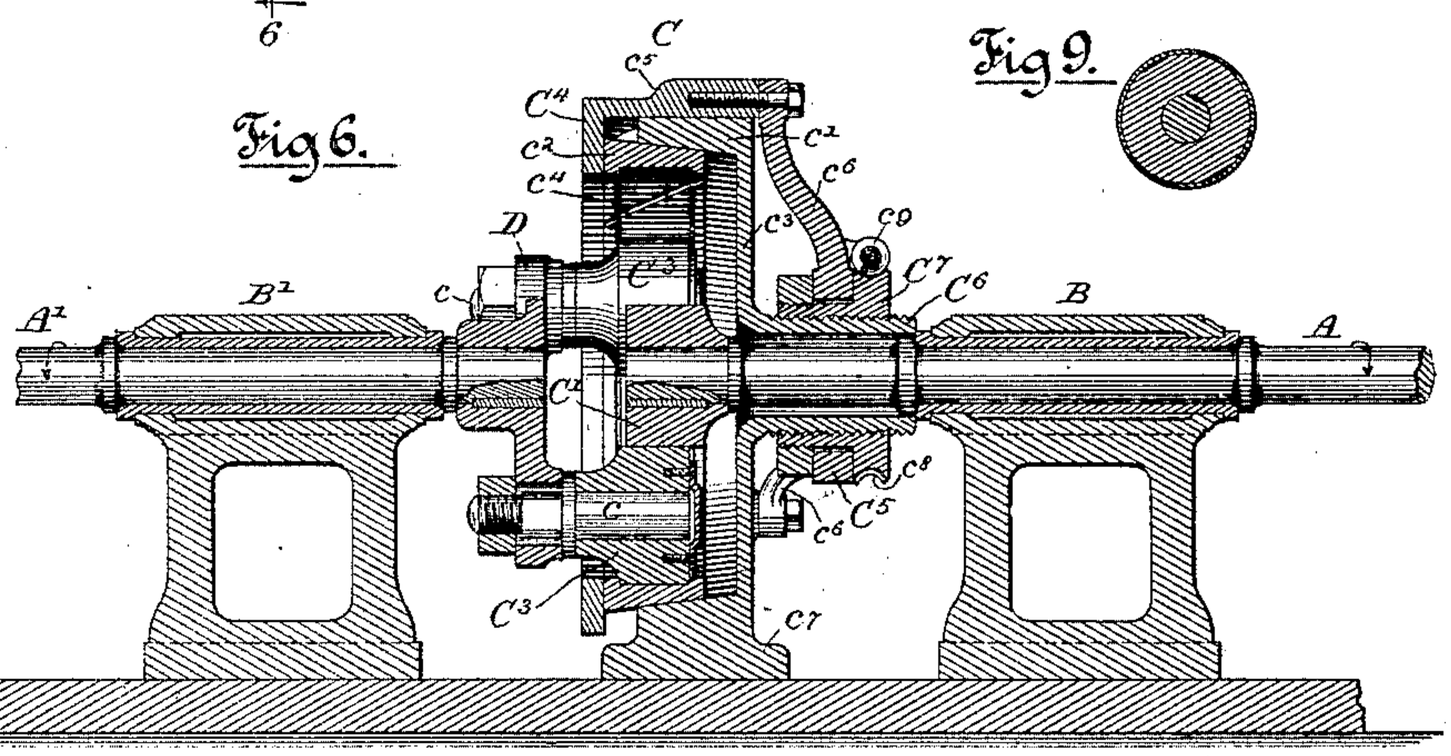

Fig 9.

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UNITED STATES PATENT OFFICE.

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FRICTIONAL DRIVING-GEAR.

SPECIFICATION forming part of Letters Patent No. 462,433, dated November 3, 1891.

Application filed March 16, 1889. Renewed April 14, 1891. Serial No. 388,897. (No model.)

To all whom it may concern:

Be it known that I, LEWIS W. HARDY, of Lake View, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Frictional Driving-Gear; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to an improvement in friction-gearing of that class in which an outer internally-bearing friction wheel or ring embraces a central pulley and a desired number of intermediate pulleys for transmitting motion from the ring to the central pulley, or vice versa.

One especial object of the invention is to provide an improved construction in devices in this class by which the force of the contact-pressure between the members of the gearing having cylindric contact-surfaces may be adjusted; and to this end the invention consists, essentially, in an annular expansible wedge or cylindro-conical ring applied to one or more of the members of the gearing and by which the diameter of the member to which it is applied may be increased or diminished, while maintaining a cylindric form of its surface.

Another object of the invention is to provide a construction in which neither of the intermediate pulleys nor rollers is subjected to a variation of its frictional bearing upon its axial support or pivot by reason of the variation of the pressure upon its surface.

To this end the invention consists in the employment of three or more intermediate rollers of equal diameter and arranged so as to oppose each other.

In the accompanying drawings are illustrated several desirable and practical forms of my improvement.

Figure 1 is a side elevation of one form of construction. Fig. 2 is a longitudinal central vertical section of Fig. 1 in the line 2 2 of Fig. 3. Fig. 3 is a transverse section in the line 3 3 of Fig. 1. Fig. 4 is a transverse section in the line 4 4 of Fig. 2. Fig. 5 is a side elevation of another form of construction. Fig. 6 is a central vertical longitudinal section of the structure shown in Fig. 5 in the line 6 6 of Fig. 7. Fig. 7 is a transverse section in the line 7 7 of Fig. 5. Fig. 8 is a central vertical longitudinal section illustrating a modification of the construction shown in Figs. 5 to 7. Fig. 9 is a sectional detail.

First describing the form of construction illustrated in Figs. 1 to 4, inclusive, A and A′ represent two end-to-end shafts axially in line with each other, from one to the other of which motion is to be imparted at a changed speed, and B B′ are bearings in which these shafts are respectively mounted. On the end of the shaft A is secured an interior friction gear wheel or ring C, provided with an expansible and contractible cylindro-conical friction-ring by which the first object of my invention is attained. On the adjacent end of the shaft A′ is the pulley C′, located radially within the wheel C, and between the peripheral friction-surfaces of the wheel C and the pulley C′ are located a desired number of idle-pulleys C^3 C^3, having frictional bearing against said surfaces of the wheel C and pulley C′ for the transmission of the motion of one to the other. Having in view only the first object of the invention, these pulleys or rollers C^3 may be of any number and in any wise arranged—as, for example, two of such pulleys placed directly opposite each other will be very effective; but preferably three or more of such pulleys will be employed. Having in view the second object of the invention, there should be at least three of such intermediate pulleys, and they should be arranged so as to oppose each other, as indicated more plainly in Figs. 3 and 4. The pulleys C^3 are mounted on studs *c c*, which in the form of construction now being described, Figs. 1 to 4, are sustained by a plate or support D, which is stationary or non-revoluble.

All the friction-surfaces in contact with each other are cylindric, this being an important feature in friction-gearing of this class, to the end that all chafing or rubbing of the surfaces in contact may be avoided. In order to preserve the cylindric form of all these surfaces and at the same time to provide for adjustment

or variation of the contact-pressure of these surfaces, my improvement, as shown in these figures, consists in making the revolving wheel or ring C of the two primary parts c' and c^2, of which the former is a ring connected concentrically with the shaft by the web c^3 or equivalent arms, said ring c' being conical on its interior surface and contracted inwardly toward the web, as plainly shown in Fig. 2. The part c^2 is also a ring made expansible and contractible by an inclined or V-shaped separating cut c^4 therein. This ring c^2 is conical on its exterior to fit broadly the interior conical surfaces of the ring c'; but on its inner surface, where it bears upon the intermediate rollers C^3, it is cylindric. It is plain that by forcing the split cylindro-conical ring c^2 inwardly within the ring c' the cylindric frictional surface of the former will be contracted, and vice versa.

For the general purposes of my invention any suitable means may be employed to shift the position of the ring c^2 with respect to the ring c'; but as a very desirable form of such means I have provided a third ring C^4, arranged to bear against the outer edge of the ring c^2 and provided with arms c^5, which extend back exterior to and in contact with the outer cylindric surface of the ring c', where they are connected with a hub C^5 through the medium of arms c^6. On the hub C^6, which here supports the ring c' and is embraced by the hub C^5, is an external screw-thread, and between the hub C^5 and the web c^3 is inserted a nut C^7, by which the hub C^5 may be forced away from the web and the ring C^4 thereby caused to bear inwardly against the outer edge of the friction-ring c^2, and thus force the latter farther into the ring c'. By this means the ring c^2 is contracted and forced with greater contact-pressure upon the intermediate rollers C^3, while a reversed movement of the nut allows the friction-ring to move or to be moved outwardly with the opposite effect.

The construction above described, and illustrated in Figs. 1 to 4, inclusive, will commonly be employed to obtain a motion of the shaft A′ the reverse of that of the shaft A, and, inasmuch as the device will commonly be used to obtain an increased speed in the driven as compared with the driving shaft, the driving-power will be applied to the shaft A, and the driven mechanism will be connected with the shaft A′.

Next describing the construction illustrated in Figs. 5 to 7, inclusive, the ring or wheel C is made stationary or non-revoluble by means of the base c^7, connected with the ring c' and resting on the floor or connected with the frame of the machine, the hub C^6 loosely embracing the shaft A. On the other hand the support D for the intermediate rollers C^3 is made revoluble by a rigid connection thereof with the shaft A′, the central pulley C′ being secured to the shaft A. To obtain an increased speed in the driven parts, power will be applied to the shaft A′, and vice versa. The hub C^5 is in this case shown fitted to an annular groove in a nut C^7, which is interiorly threaded to fit the correspondingly-threaded hub C^6, and said nut is provided with a worm-rack c^8, to which is fitted a worm-screw c^9, supported from the hub C^5 or arms c^6, by which the ultimate adjustment of the ring c^2 is effected.

In the construction last described the adjustment of the friction-ring c' can be made while the machinery is in motion, because the ring structure C does not rotate; but in the construction illustrated in Figs. 1 to 4, inclusive, such adjustment cannot be made while the machine is running for the reason that the wheel C is then in motion.

In Fig. 8 a construction is shown in which the adjustable friction-ring for increasing the contact-pressure in the gearing is applied to the central pulley C′ instead of to the outer wheel or ring C. In this case the body of said pulley C′ is externally conical and is surrounded by an expansible ring c^2, the outer surface of which is cylindric, but the interior surface of which is conical to correspond with the conical form of the body C′. The ring c^2 in this case is split and expansible and contractible, as in the case above described, and as a means for expanding it by forcing it inward upon the conical body C′ a cap or washer c^{10} is provided, which bears at its outer margin against the outer and thicker edge of the ring and is forced inward by means of a screw C^8, threaded into the end of the shaft A. The outer ring or wheel is in this case shown stationary, as in the last three preceding figures.

The pressure-adjusting device of Fig. 8 may obviously be applied to the central pulley C′ of the gearing in a construction in which the outer ring revolves, as shown in Figs. 1 to 4, inclusive.

The radial movement of the intermediate rollers to allow for the change in the position of the adjustable friction-surface is provided for by radially-oblong passages for the studs c in the support D, as seen in Fig. 6, or by an eccentric reduction of the studs where it passes through the support, as seen in Fig. 2.

While the revoluble outer wheel will ordinarily be mounted on a shaft it may in some cases have its support exclusively upon the intermediate rollers C^3 and take a belt on its outer periphery formed appropriately for the purpose.

The several intermediate pulleys can be provided with adjustable rings, as shown of the central one; but this is less practicable or desirable for obvious reasons. The best construction, as I now believe, is that in which the outer wheel or ring carries such device.

It will commonly be desirable to surround the intermediate pulleys, or these and the central pulley, when the latter does not have the adjusting-ring, with a band or facing of leather or other suitable material, as indicated

in Fig. 9 and as now often done in friction-gearing.

In the use of three or more equal intermediate pulleys or rollers C^3, arranged so as to oppose each other between the central and surrounding wheels, the pressure resulting from setting up the cylindro-conical ring manifestly produces no direct increase of friction of either of the said intermediate pulleys upon its axis for the reason that neither of said pulleys seeks to change its position to one or the other side of the radius previously occupied by its axis in consequence of the increased pressure put upon it by such adjustment of said ring. In these relative positions of the intermediate pulleys, moreover, and especially if they be substantially equidistant, there is no appreciable variation of the pressure of the shafts in their bearings by reason of such adjustment of the annular friction-wedge.

I claim as my invention—

1. In an internal friction-gear of the character described, and in which the surrounding wheel or ring, the central pulley, and the intermediate pulleys or rollers have cylindric contact-surfaces, one or more of these members constructed in two parts, of which the body part is conical and the other is a split cylindro-conical ring having its conical surface fitted to the conical surface of the body and its cylindric surface arranged to bear frictionally upon the adjacent members, and, combined therewith, means for shifting the position of the cylindro-conical part with respect to the conical body, substantially as described.

2. In an internal friction-gear of the character described, and in which the surrounding wheel or ring, the central pulley, and the intermediate pulleys or rollers have cylindric contact-surfaces, the outer and surrounding wheel constructed in two parts—to wit, an outer part having its inner surface conical and an inner part, which is a cylindro-conical split ring, fitted on its external conical surface to the inner conical surface of the outer part and its inner surface cylindric—in combination with means for adjusting the split ring in said outer part, substantially as described.

3. In combination with the ring c', having an interior conical surface, and with the split cylindro-conical ring c^2, a ring C^4, arranged to bear on the edge of the ring c^2, and arms c^5, attached to the ring C^4, through which to apply a screw action to the movement of the ring C^4 and to the contraction of the ring c^2, substantially as described.

4. In an internal friction-gearing of the character described, the combination, with the body of the central pulley applied to the end of a shaft, of the exterior cylindro-conical split ring embracing said body, a cap-plate, and a screw C^8, engaged with the end of the shaft and with the cap-plate, substantially as described.

5. The combination, with the shafts A and A′, arranged axially in line with each other, of a friction-gearing comprising an outer encircling wheel C, a central wheel or pulley C′, and three or more equal pulleys arranged to oppose each other between the interior surface of the wheel C and the periphery of the pulley C′, and a split cylindro-conical ring applied to the driving or to the driven wheel for the purpose of varying the frictional contact-pressure upon the intermediate pulleys C^3.

6. In an internal friction-gearing of the character described, having a split cylindro-conical ring adjustably applied either to the surrounding wheel or ring or to the central shaft-pulley, the combination, with a support for the intermediate pulleys, of studs upon which said intermediate pulleys revolve and which have eccentric bearings in the support, substantially as described.

7. In an internal friction-gearing of the character described, the combination of the stationary wheel or ring c', having a conical interior periphery, a cylindro-conical split ring c^2, having its inner surface cylindric, a threaded non-revoluble hub or sleeve C^6, surrounding a shaft, a nut C^7, provided with an annular groove and with an annular worm-rack c^8, a hub C^5, fitted to the annular groove of the nut C^7 and connected with the ring c^2, and a worm c^9, rigidly supported from the hub C^5 and engaged with the rack c^8, substantially as described.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

LEWIS W. HARDY.

Witnesses:
ELBERT C. POWER,
DEXTER D. HARDY.