(No Model.)

3 Sheets—Sheet 1.

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CLUTCH.

No. 452,162. Patented May 12, 1891.

Fig. 2.

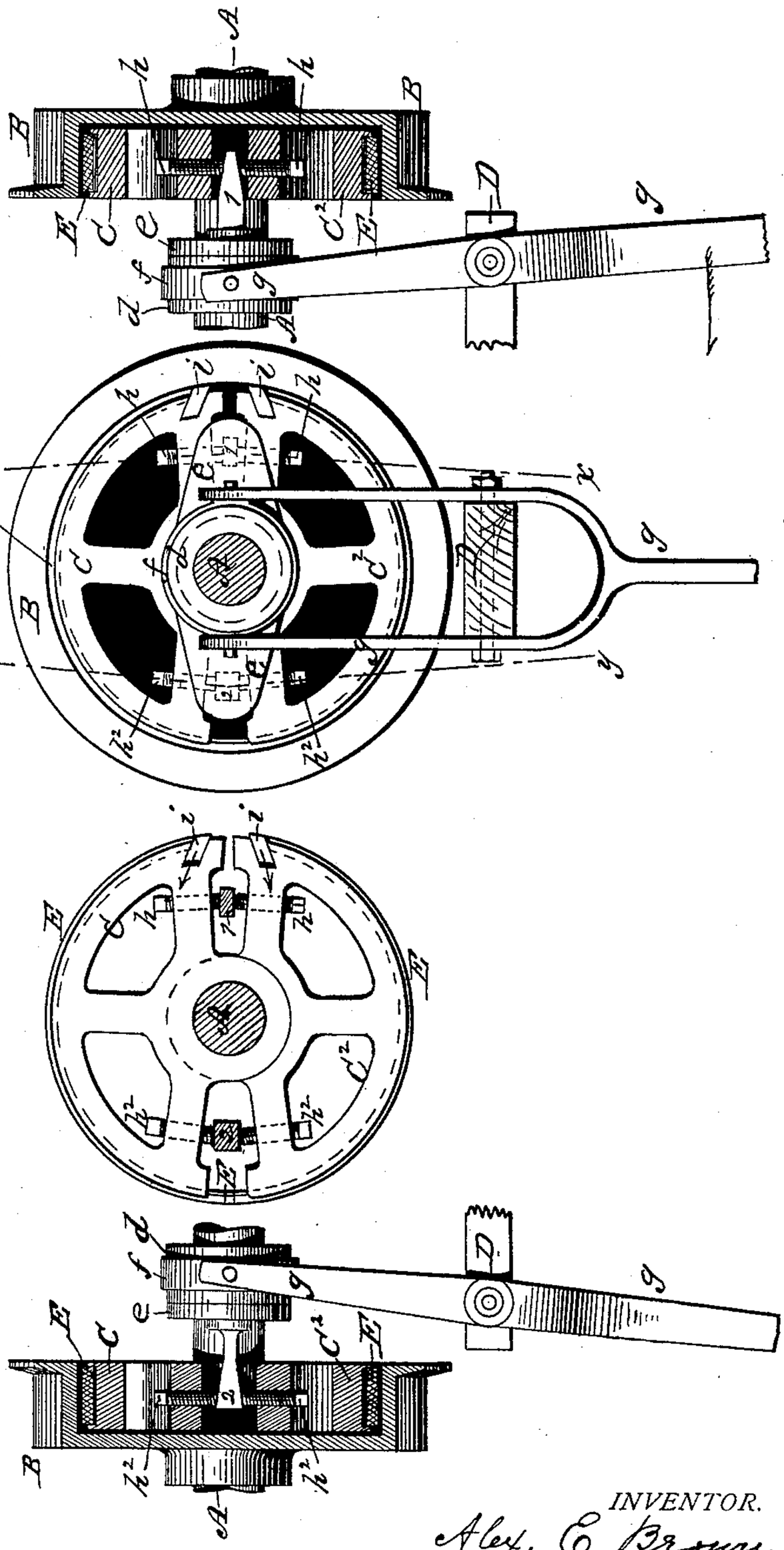

Fig. 1.

Fig. 4.

Fig. 3.

WITNESSES,

Florence M. Brown.

Edw. D. Leary.

INVENTOR.

Alex. E. Brown

By J. N. McIntire

ATTORNEY.

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Fig. 6.

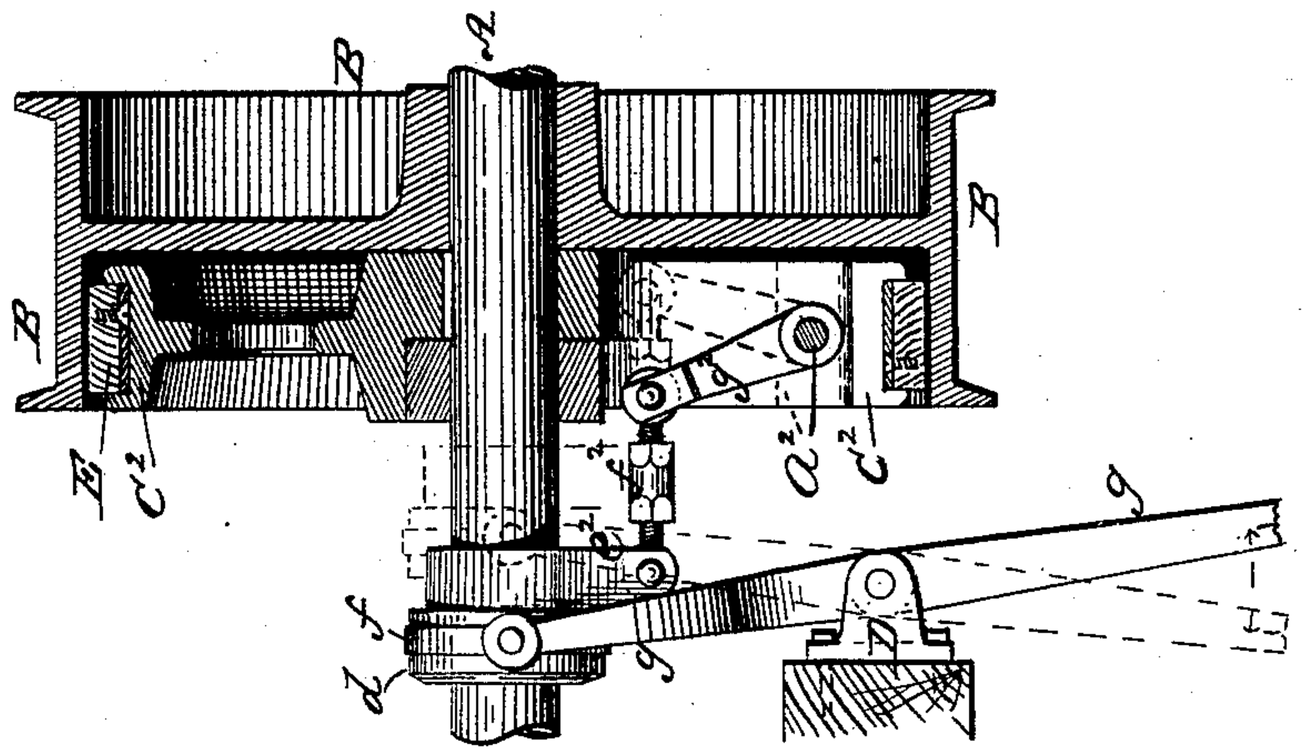

Fig. 5.

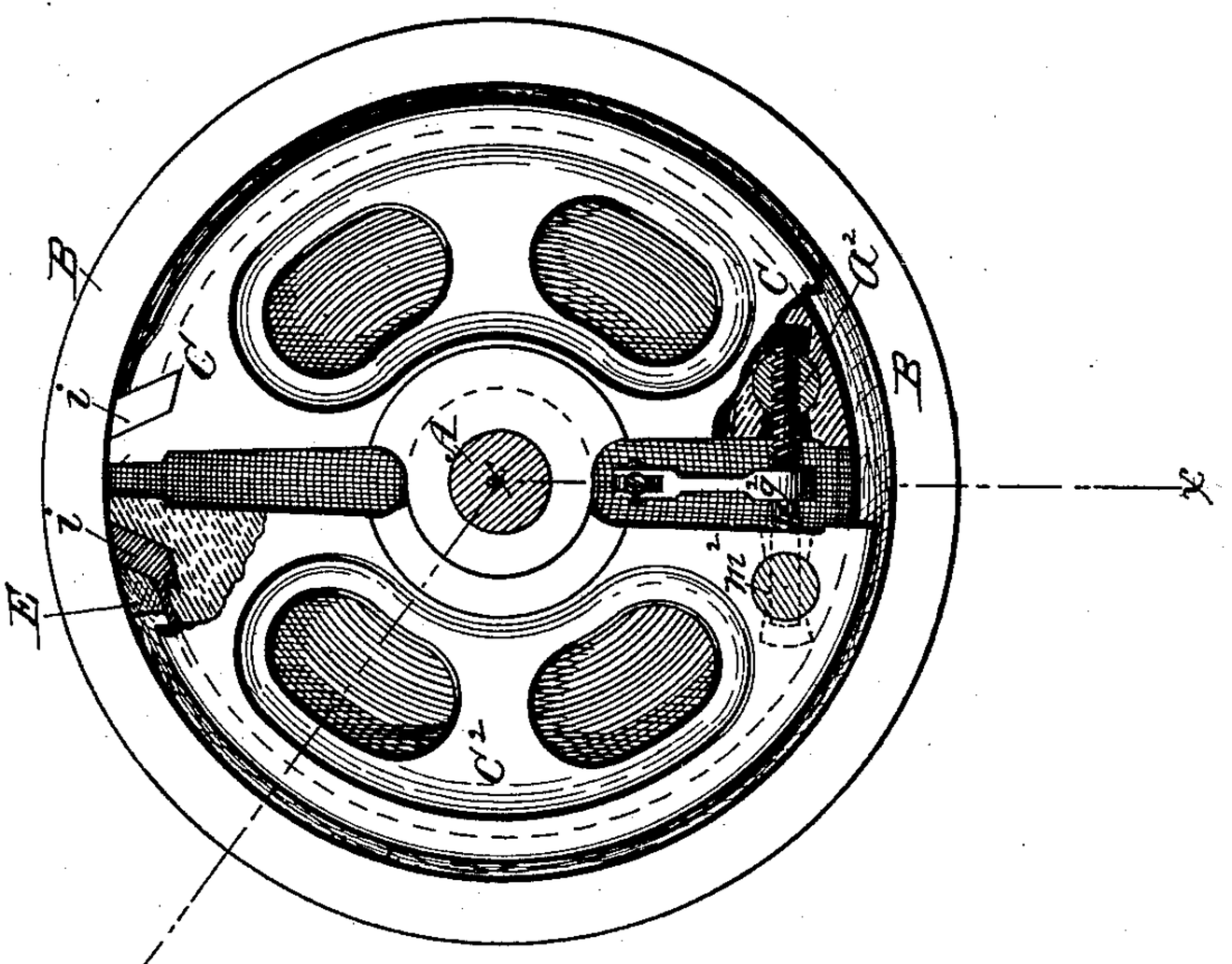

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Fig. 8.

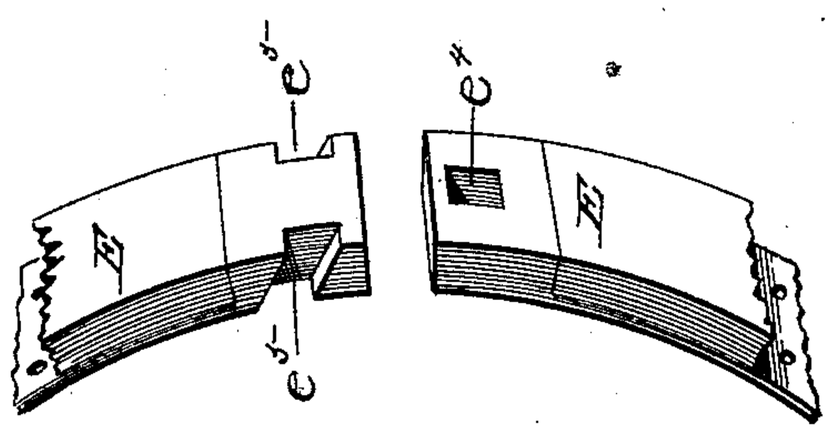
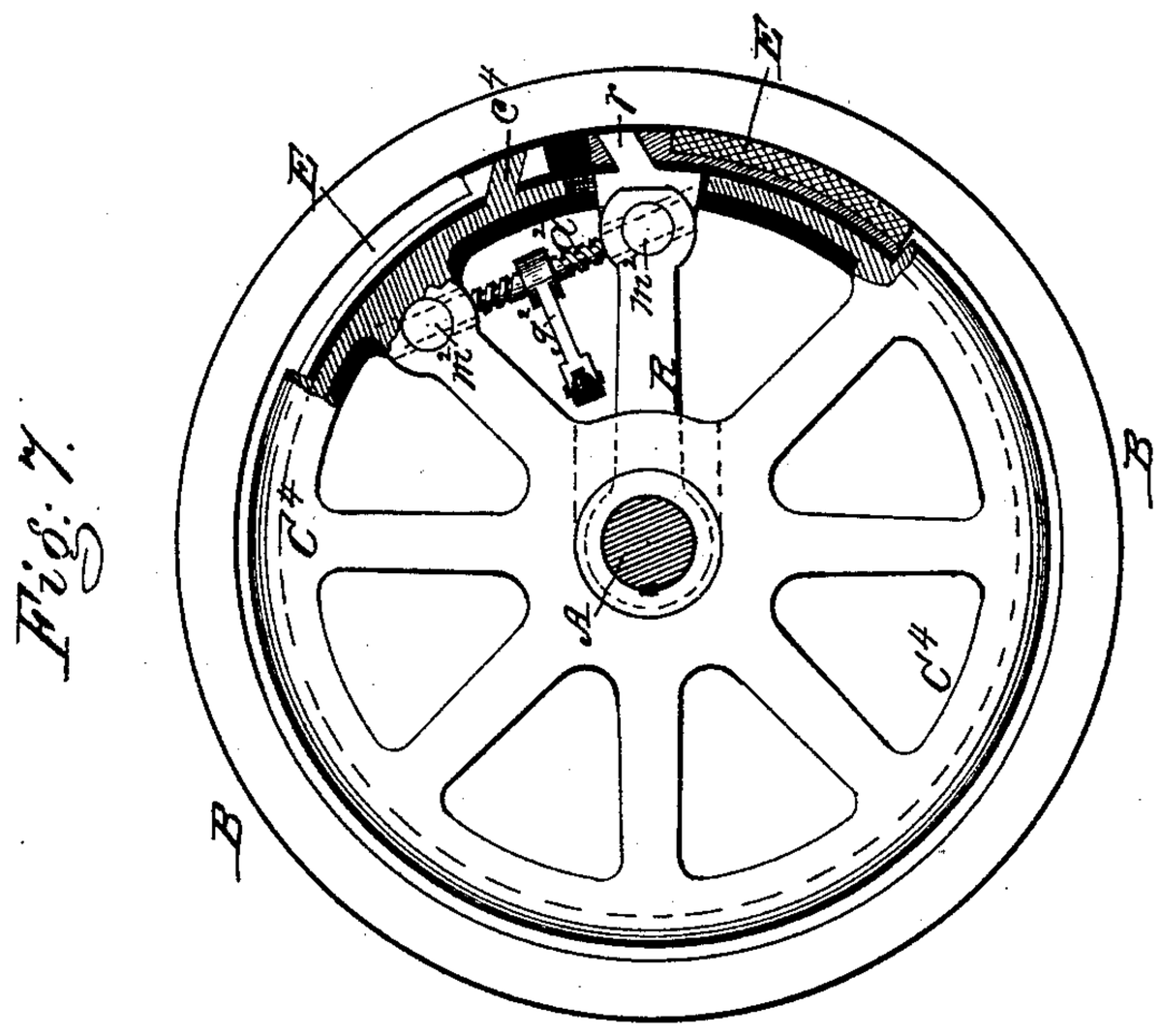


Fig. 7.



WITNESSES.

Florence M. Brown.

Edw. D. Leavy.

INVENTOR.

Alex. C. Brown

By J. N. McIntire

ATTORNEY.

UNITED STATES PATENT OFFICE.

ALEXANDER E. BROWN, OF CLEVELAND, OHIO.

CLUTCH.

SPECIFICATION forming part of Letters Patent No. 452,162, dated May 12, 1891.

Application filed May 6, 1890. Renewed March 17, 1891. Serial No. 385,362. (No model.)

To all whom it may concern:

Be it known that I, ALEXANDER E. BROWN, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Clutch Mechanism; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, making a part of this specification.

My invention relates to that species of friction-clutch which involves the use in some manner of a curved band, or nearly annular fillet, the circumferential surface of which (or more commonly a portion of the surface of which) is moved into forcible contact with the peripheral surface of the part or device to be driven, (whenever it may be desired to drive such part,) and is in some manner moved out of contact with said part whenever the latter is to remain motionless. In all friction-clutches of this species or type, as heretofore made, it has been necessary, in order to move the band-like clutch device into and out of the clutching position or condition, to have a considerable amount of movement in the clutch-operating lever or other device. In order to assure the complete releasement of the clutch-band from contact with the part to be released from the influence of said clutch-band throughout the entire extent of its friction-creating surface, and, under many conditions or circumstances, this necessary extent of movement is more or less objectionable. Another defect or objection to this species of friction-clutch has been that in throwing the band into gear a portion of its contacting surface has usually had to move in a direction opposite to that in which traveled the surface to be engaged by said band, the consequences of which have been a tendency on the part of the band to chatter and a loss of power and motion in the effort to contact such portion of the band with the thus repellent opposing surface.

I propose to provide for use a friction-clutch device or mechanism of the type alluded to, in which the novel principle of construction and mode of operation are such that while I am enabled to quickly throw the clutch mechanism into an operative condition with the minimum extent of motion to the movable parts or devices and without any repellent action on any part of the band I can also with the minimum extent of operative movement completely and perfectly separate the contacting surfaces of the movable and stationary parts of the clutch device throughout the whole extent of said surfaces and nearly or quite simultaneously at every point therein, while at the same time I attain to the greatest possible extent of perfection in the particular of the efficiency of a friction-clutch device of the type mentioned.

To these main ends and objects my invention may be said to consist, essentially, in the novel devices and combinations of parts which will be found hereinafter explained, and which will be more specifically pointed out and more clearly defined in the claims of this specification, and the leading or cardinal point of novelty in which is a friction-band movable circumferentially throughout the entire length of its contacting surface.

To enable those skilled in the art to which my invention relates to make and use the latter, I will now proceed to more fully describe my invention, referring by letters and figures to the accompanying drawings, which form part of this specification, and in which I have shown my said invention carried into effect in those precise forms of clutch mechanism in which I have so far successfully practiced it, although, of course, other modifications than those herein shown and described may be devised and employed without departing from the spirit of my invention.

In the drawings, Figure 1 is a face view or elevation of a friction-clutch embracing my improvements. Fig. 2 is a sectional elevation of the same, taken at the line $x\,x$ of Fig. 1. Fig. 3 is a similar sectional view or elevation, but taken from an opposite point of view and at the line $y\,y$ of Fig. 1. Fig. 4 is a face view showing only the drive-shaft and the clutch-band segments which are mounted thereon together with the clutch-band proper and the adjusting wedges or devices by which said segments are relatively oscillated about the drive-shaft. Fig. 5 is another face view or elevation of my improved clutch device or mechanism, but drawn on a somewhat larger scale than the preceding figures and showing

a modification of the mechanism, in which the relatively-movable segments are operated upon by means of a screw-stud having a right and left hand thread and worked through the medium of a rocking arm or lever connected with the sliding collar of the clutch mechanism. Fig. 6 is a sectional elevation of the modified form of clutch mechanism partially shown at Fig. 5, the parts drawn in section, representing the appearance of said parts as cut through on the lines $x\,x$ and $y\,x$ of Fig. 5. Fig. 7 is a partial sectional elevation or face view of still another modification of the clutch mechanism, and Fig. 8 is a detail view showing in perspective and on a slightly enlarged scale the two end portions of the clutch-band proper detached from the other parts of the device.

In the several figures the same parts wherever they are duplicated will be found designated by the same letter or figure of reference.

Referring now to Figs. 1 to 4, inclusive, of the drawings, A represents a drive-shaft from which it is proposed to impart power and motion on such occasions as may be desired to the pulley or wheel B, that is supposed to be mounted loosely on said rotatory shaft. This wheel B is made hollow or dish-shaped, as clearly shown, (and as is customary in making such wheels of a clutch mechanism,) and within the dish-shaped portion of said wheel is mounted another wheel (or the greater portion of a wheel) that is composed of two portions or segments C and C^2, which, as shown, are mounted, one loose and the other fast, on the shaft A and are capable of more or less movement relatively about the axis of said shaft as a center of such relative movement, and on the periphery of this duplex wheel or these segmental devices C and C^2 is arranged the friction-band proper E, which, as shown, is partially seated within the circumferentially-formed recess or recesses in the said parts C and C^2, and which is formed or provided at its adjacent (and nearly meeting) ends with obliquely-arranged projections or block-like portions $i\,i$, (see Figs. 1 and 4,) which are seated in and are capable of sliding bodily within obliquely-arranged cavities or recesses formed in two of the adjacent end portions of the segments C and C^2, all as clearly shown.

$h\,h$ and $h^2\,h^2$ are four set-screws arranged, as shown, in pairs and mounted in threaded holes in the arm-like portions of the segments C and C^2 for the purpose of constituting at their opposing or opposite ends adjustable bearing-surfaces, against which act the opposite working sides or surfaces of two wedge-like devices marked, respectively, 1 and 2, (see Figs. 2, 3 and 4,) which project from the arm-like portion e of the clutch-collar d and that operate to force apart the opposing ends of each pair of the set-screws $h\,h$ and $h^2\,h^2$ for the purpose of producing the necessary relative movements of the segments C and C^2 to set and unset the clutch-band, all in a manner to be presently more fully described.

The clutch-collar d is arranged and adapted, as shown, to slide longitudinally on the drive-shaft A, and has combined with it a collar f, within which the clutch-collar d is free to rotate, but by means of which said collar d is moved bodily endwise through the medium of the usual shipper-bar or handle g, which is pivotally connected at one end or point to some suitable stationary bar or fixture D, and which at the end opposite to that designed to be grasped by the operator of the clutch mechanism is connected (at diametrically-opposite points) with the collar f of the clutch mechanism, the said shipper-bar or clutch-lever g being bifurcated, as shown, (see Fig. 1,) so that its ends straddle or embrace the said collar, all in a manner well understood by the skilled mechanic.

The wedge-shaped operating devices 1 and 2, which, as before remarked, project from the arm-like portion e of the sliding clutch-collar, are made just the reverse of each other with reference to the direction of their inclined operating-faces or wedge-like surfaces, that one marked 1 being tapered, as shown, (see Fig. 2,) so as to be largest at its root portion and smallest at its free end, while the other (marked 2) is largest at its extreme free end (see Fig. 3) and is tapered, so as to be smaller at its root or that end which communicates with the arm-like portion e of the clutch-collar.

The clutch-band proper or friction-creating device E is composed, preferably as shown, of a thin metallic band having securely attached to it an outer and thicker fillet or band of vulcanized fiber or some other material best adapted to act as a contacting surface against the internal circumferential surface of the dish-shaped metallic part B of the clutch mechanism, and the obliquely-arranged end blocks or club-like end portions $i\,i$ of the concrete clutch-band proper E are purposely arranged to fit movably within and so as to slide inwardly and outwardly in the obliquely-arranged cut-outs formed, as shown, in two adjacent ends of the segments C and C^2, all in such manner that any relative movement of these segments operating to further separate those adjacent ends thereof, to which the ends of the friction-band are coupled by means of the end blocks $i\,i$, will cause the friction-band to be moved circumferentially throughout its entire length and at the same time expanded radially at all points throughout its length, while any relative movement of said segments in an opposite direction will have a reverse effect on said friction-band, causing it to be positively contracted with a combined circumferential and radial movement throughout its entire length.

In the operation of a clutch device or mechanism such as shown in Figs. 1 to 4, inclusive, and so far described, the clutch is thrown into

an operative condition by moving the shipper-bar or handle g on its fulcrum in the direction indicated by the arrow at the lower part of Fig. 2, while to release the contacting devices or throw them into an inoperative condition said lever is of course moved in the opposite direction.

It will be seen that whenever in thus moving the hand-lever g the clutch-collar, with its laterally-projecting wedges 1 and 2, is moved toward the segmental devices C and C^2 the wedge 1 operates by its direct action on the bearer-screws $h\,h$ to force farther apart those portions of said segments in which are seated the end blocks $i\,i$ of the clutch-band E, and that thereby said band is distended, both circumferentially throughout its entire length and radially at all points until its outer peripheral surface comes into perfect contact with the internal circumferential surface of the wheel or device B to be rotated, the other wedge 2 at the same time and to substantially the same extent permitting the opposite ends of said segmental devices to approach each other, and that whenever the said clutch-collar is moved farther away from the said segmental devices then the wedge 2 operates on the bearer-screws $h^2\,h^2$ in such manner as to force farther apart those end portions of the segments in which said bearer-screws are located, the wedge 1 at the same time permitting the opposite ends of said segments to approach each other. Hence the movements of the clutch-collar with its attached or projecting wedge-like devices 1 and 2 operate to positively enforce a relative oscillating movement of the segments C and C^2 about an axis of motion coincident with the axis of the shaft A in each one of the two directions in which said segments are capable of relative motion, and when moved in one way the band E is expanded positively, and when moved in the other direction said band is positively contracted.

Since the band E, when distended, moves circumferentially (and of course in one direction) throughout its entire length, the greatest extent of motion occurring, of course, at that end which is coupled to the segment that turns on shaft A and the least extent at the other end, and inasmuch as the said band, when expanded, is forced outward against the contacting surface of B nearly simultaneously and with substantially the same degree of pressure at every point throughout its entire external peripheral surface, and is, when positively contracted, forced in a like manner into contact at its inner peripheral surface with the depressed portions of the peripheral surfaces of the segments C and C^2, and these portions of said segment-surfaces lie always in a circle concentric to that in which lies the friction-surface of the part B, it follows as a necessary result that in shifting the said band E from its extreme state of expansion to its extreme state of contraction, and vice versa, and in thus changing slightly its degree of curvature, the least possible amount of movement in the said band and its distending and contracting devices will serve to throw the band into frictional contact with the part B (to be driven by said band) and perfectly clear thereof or fully out of contact therewith. Hence in my improved clutch mechanism not only is the friction-band E, when thrown into gear, moved at every point of its contacting surface in the same direction in which is traveling the surface to be clutched and when thrown out of gear moved at every point in the direction in which the clutched surface tends to throw off the said band, but, furthermore, a perfect and efficient clutching together of the parts and a perfect releasement of the parts can be effected with the smallest possible extent of motion in that end of the shipper-bar or handle g which has to be grasped in the hand of the operator. This is of considerable importance and advantage, especially where the clutch mechanism may be used in connection with other machinery, certain operating-handles or hand-levers of which have to be manipulated simultaneously with or in rapid succession relatively to the shipper-bar of the clutch device—as, for instance, in the case of the use of a friction-clutch in connection with the engine of some of the well-known forms or types of hoisting and conveying machines.

Another advantageous peculiarity in the principle of construction and mode of operation of my improved clutch mechanism is that in those movements of the parts designed to release or separate the surfaces frictionally clutched together the clutching-surface of the band E moves away from the contacting surface of the pulley B rapidly and with an initial movement that is nearly or quite radial, and almost simultaneously at all points throughout its entire circumference, this mode of action being due to the fact that at the initial relative movement of the band-contracting segments C and C^2 the end blocks $i\,i$ tend to slide or move quickly in the directions indicated by the arrows marked thereon at Fig. 4, while at about the same time these end blocks are drawn toward each other by the circular movement of that one of the segments which turns on the shaft A.

Of course it will be understood that in lieu of the precise detail construction shown, involving the obliquely-arranged club ends $i\,i$, adapted to slide bodily in their housings in the relatively-movable ends of the segments, as set forth, some other means may be adopted which will effectuate the circumferential movement of the band throughout its entire length, and at the same time cause it to have an initial movement almost radial in direction.

By the combination, as explained, of a flexible clutch-band E with the surrounding contacting surface of the wheel B and a band-

contracting device such as described, the periphery of which is about concentric to the said contacting surface, and onto which the band is positively (and forcibly) drawn or clasped, I am enabled, it will be understood, with the least possible degree or extent of motion of the working or clutch-operating parts of the mechanism to rapidly, completely, and positively move the frictionally-engaging surfaces of the clutch wholly out of contact, and by making the clutch-band E (no matter what suitable material or materials it may be composed of) with a sufficient degree of innate rigidity or stiffness said band may be distended in the manner described, so as to have the said frictionally-engaging surfaces of the clutch mechanism brought forcibly into perfect contact throughout the whole extent thereof. By having the band E capable thus of frictional contact with the part B throughout its entire length the greatest possible degree of efficiency is of course attained to, since in the band species of clutch mechanism the greater the length of the contacting surfaces of the band the greater amount of friction there will be tending to lock together the parts to be engaged.

I am not aware of the existence prior to my invention of any band-clutch device in which the construction has been such that the friction-band, when either distended or contracted, was moved circumferentially (in one direction) throughout its entire length, or could be positively expanded into contact throughout its entire length with one circular surface and also positively contracted onto another contacting surface, (irrespective of which surface might be the one to be clutched,) and I deem these structural features of my improved mechanism as among its most important characteristics.

The arrangement I show and describe of the band within the contacting surface to be clutched, so that to do the clutching the band is expanded or distended, is the preferable one, because there are in the mechanism no overhanging or overreaching parts, such as are necessary where the band is carried by the outer device and has to be contracted onto the surrounded pulley or device to throw the latter into motion; but under either arrangement the characteristic features above alluded to may be introduced into the clutch mechanism.

It will be seen that in my improved clutch there is a constant tendency in the friction-band to move bodily and radially away from the clutched surface, and that therefore the unclutching operation can be effectuated with the greatest ease and rapidity, no matter under how great strain the band may be held against the surface with which it may be in engagement.

By the combination with the band expanding and contracting segments of the wedge-like devices shown, operating as described, a very simple, durable, and efficient contrivance is produced, and for clutches of small size I consider the specific means I have so far described for actuating these segments an important part of my invention.

At Figs. 5 and 6 the modified construction shown is one in which the clutch-collar d, instead of being provided with two operating-wedges to act on the relatively-movable segments C and C^2, has a portion e^2, to which is pivotally connected one end of a link or short rod f^2, the other end of which is coupled to the free end of a vibratory arm g^2, that is made fast at its other end to the small rock-shaft a^2. This rock-shaft a^2 is threaded on opposite sides of the attached arm g^2, the screw on one part being right-handed, while that on the other part is left-handed, and each of these differently-threaded parts engages with a female thread to match it, cut in a cylindrical block or nut m^2, (see Fig. 5,) mounted so as to be capable of a slight amount of motion axially within its seat in the segment with which it is connected.

In the operation of my improved clutch under the modified construction shown in these two figures (5 and 6) the movement of the shipper-bar or hand-lever g in one or the other direction causes the sliding collar d, through the medium of its attached arm-like portion e^2 and the connecting-rod f^2, to vibrate in one direction or the other the arm g^2, and such movements of said arm cause the rock-shaft a^2 to be oscillated on its axis. Any such oscillatory movement of the said shaft causes its screw-threads, of course, to either screw into and thus draw toward each other or to unscrew out of and thus force farther apart the nut-blocks m^2 m^2, and thus the end portions of the segments C and C^2, in which said nut-blocks are mounted, are either drawn nearer together or are forced further apart, whereby the clutch-band E is affected in the same manner as in the form of clutch mechanism illustrated in Figs. 1 to 6, inclusive, of the drawings.

The means for operating the segments seen at Figs. 5 and 6 I have found to work well, and I deem it preferable to the first-described means for clutches of large size.

At Figs. 7 and 8 is shown still another modification with reference to the means employed to work the clutch-band. In this form of my machine there is employed in lieu of the two segments C and C^2 (shown in the other views) a complete single band-wheel C^4, which is preferably of that form which comprises a cylindrical hub, an annular rim, and a series of radially-arranged arms or spokes connecting the said hub and rim. There is an omission, however, of one of the arms to make room, as shown, for a band-operating arm R, that is pivoted or mounted at its inner end on the shaft A, and that is formed or provided at its outer end with an engaging lug r, that enters the obliquely-located aperture e^4 (see

Fig. 3) in and near one end of the friction-band E, for a purpose to be presently explained.

In the outer end of the arm R is mounted so as to be capable of a slight turning movement a nut-block m^2, and in one of the nearest two arms of the wheel C^4 is similarly arranged another such nut-block, all as clearly shown, while in engagement with the female threads of these two nut-blocks are the right and left handed threads of a rock-shaft a^2, similar to that previously explained and shown in Figs. 5 and 6, and provided with a vibratory arm g^2, which is supposed to be moved at pleasure in either direction by means (not shown at Figs. 7 and 8) the same as that seen at Figs. 5 and 6 and hereinbefore fully described.

In the construction shown at Figs. 7 and 8 that end of the brake-band E that has two oblique depressions or cut-outs e^5 at the edges of the band (see Fig. 8) is movably secured to the peripheral surface of the wheel C^4 by means of two obliquely-located lug-like projections C^4, which enter or engage with the said recesses e^5 e^5, and in the operation of the working parts whenever the free or outer end of arm R is moved farther away from that one of the arms of wheel C^4 in which is mounted one of the nut-blocks m^2 that end of the friction-band E that is coupled to said arm (by lug r and hole e^4) is of course forced away from the other end of the band, so that the latter is expanded and forced into frictional contact with the surrounding internal circumference of the rim of the wheel B to be clutched and driven, the expansion of the band E in this modification of my improved clutch being effected, however, by the movement bodily in a circumferential direction of the band, the whole action and the movements of the said band being substantially the same as in the cases shown in the other figures, since, notwithstanding the fact that one end is coupled (by the lugs C^4 and recesses e^5) to the complete wheel C^4, said end of the band E moves initially in a nearly radial direction away from its peripheral seat in the wheel C^4 and against the surface of B to be clutched, all in a manner quite analogous to that peculiar to the other shown forms of my improved clutch.

As indicated by the dotted lines at Fig. 7, the central or hub portion of the wheel C^4 is cored out or cast with a laterally-extended cavity or housing, through which the perforated end of the arm R is passed, in order that the arm may occupy a proper position relatively to the perforated hub of the wheel in the manner shown, and the said wheel and arm are then threaded, so to speak, on the shaft A.

Having now so fully explained the construction and operation of a friction-clutch embracing the structural features peculiar to my invention that those skilled in the art can understand and practice said invention, either as to some only or as to all of the said structural features, and wishing it to be understood that I do not limit myself to any precise details of construction not essential to the essence of my invention,

What I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with a suitable shaft and a wheel or part mounted loosely thereon and adapted to be acted upon by a frictional clutching-band, of a clutch-band which is movable circumferentially throughout its entire length, means by which said clutch-band is positively expanded or distended against the contacting surface of said wheel or part, with a combined radial and circumferential movement throughout its entire length, and means by which said clutch-band and its attachments are caused to rotate with the said shaft, substantially as and for the purposes set forth.

2. The combination, with a suitable shaft and a wheel or part mounted loosely thereon and adapted to be acted upon by a frictional clutching-band, of a clutch-band which is movable circumferentially throughout its entire length, means by which said clutch-band is positively expanded or distended against the contacting surface of said wheel or part, with a combined radial and circumferential movement throughout its entire length and by which said clutch-band is also positively contracted with a similar combined movement, and means by which said clutch-band and its attachments are caused to rotate with the said shaft, substantially as and for the purposes set forth.

3. In a friction-clutch mechanism, the combination, with the wheel or part to be clutched to the drive-shaft and the part having a circular surface which is concentric to the surface of the said wheel or part to be clutched and that rotates with the said drive-shaft, of a clutch-band which is positively expanded and contracted with a combined radial and circumferential movement throughout its entire length, and means operating to thus expand and contract said clutch-band respectively against the contacting surface of the wheel or part to be clutched and against the concentric contacting surface of the said part that rotates with the drive-shaft, substantially as and for the purposes set forth.

4. In a friction-clutch mechanism, the combination, with the wheel or part to be clutched to the drive-shaft, a frictional clutch-band movable circumferentially throughout its entire length, and the parts which are fast on the drive-shaft and carry said frictional clutch-band, of means operating to move the said clutch-band circumferentially and also radially throughout its entire length and operating when in action to exert a constant tendency to thus move the clutch-band in both a radial and a circumferential direction, all substantially as and for the purposes set forth.

5. The combination, with the wheel or part to be clutched to the drive-shaft and with the parts which rotate with said shaft, of a friction-band movably secured to said rotatory parts, a sliding collar or device arranged on the drive-shaft, and wedge-like devices having their tapering surfaces arranged relatively in an opposite manner and operating to positively oscillate said rotatory parts to expand the clutch-band and also to contract it, the whole constructed and operating substantially as hereinbefore set forth.

In witness whereof I have hereunto set my hand this 2d day of May, 1890.

ALEX. E. BROWN.

In presence of—
C. S. MALTBIE,
M. MILLARD.