(No Model.) 4 Sheets—Sheet 1.

# G. S. STRONG.

## DEVICE FOR TRANSMITTING MOTION.

No. 471,655. Patented Mar. 29, 1892.

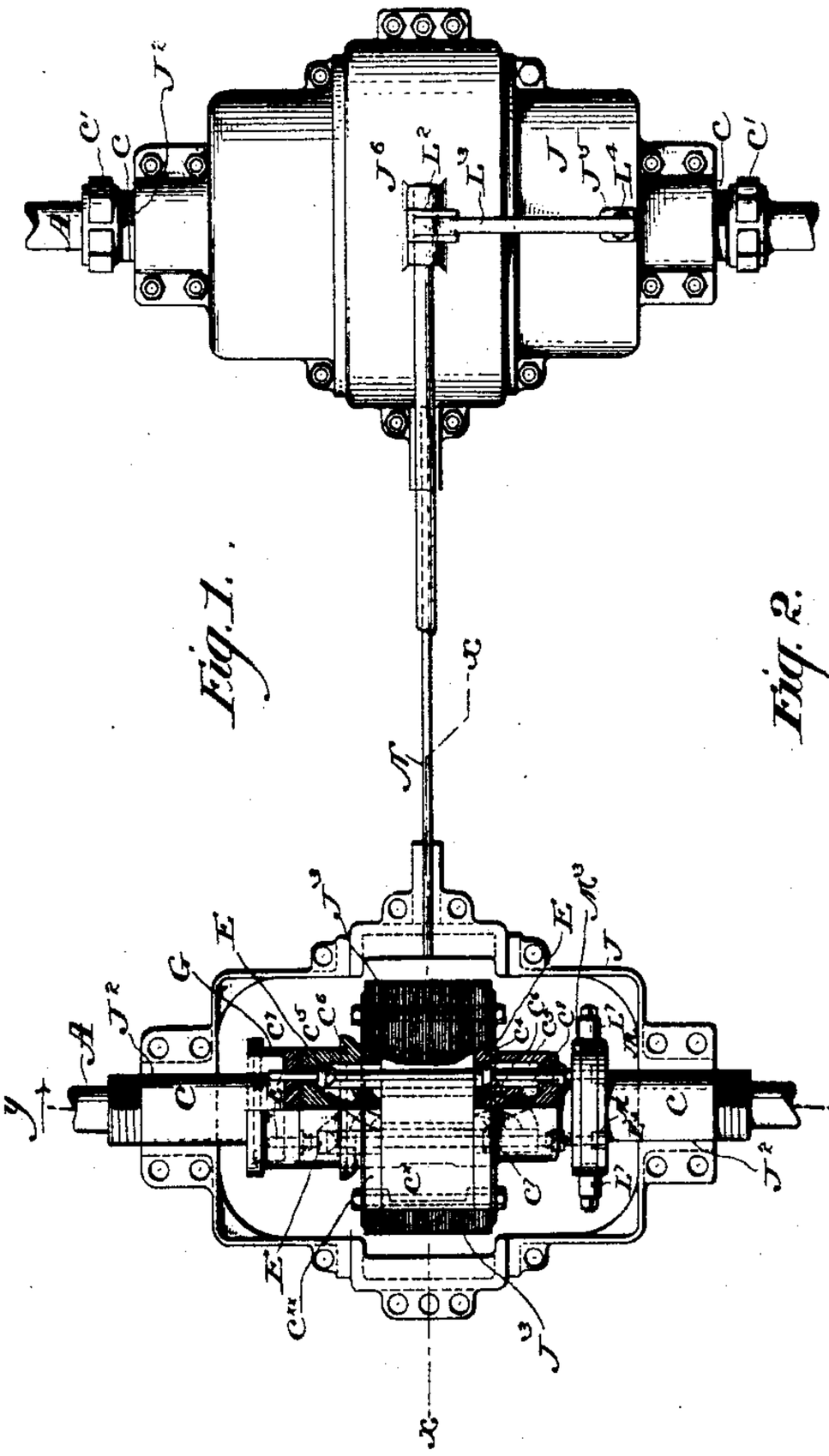

Fig. 1.

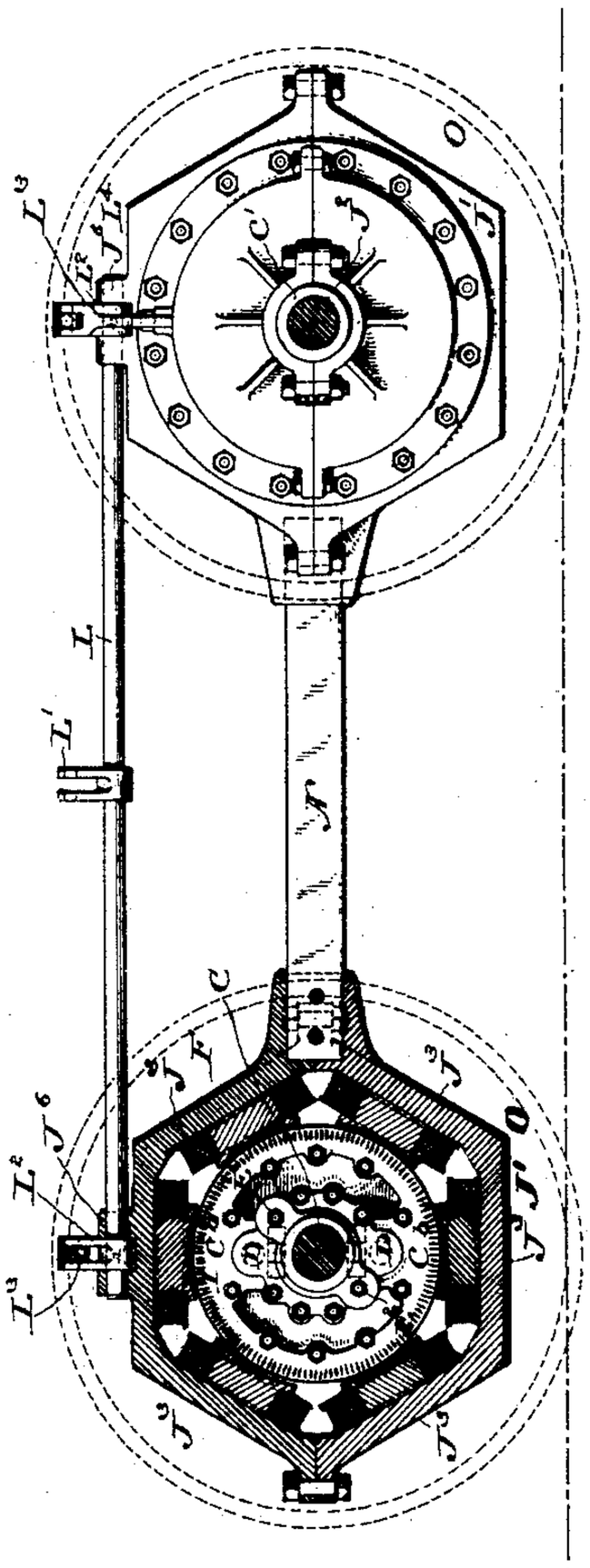

Fig. 2.

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(No Model.)

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# G. S. STRONG.

## DEVICE FOR TRANSMITTING MOTION.

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Fig. 5.

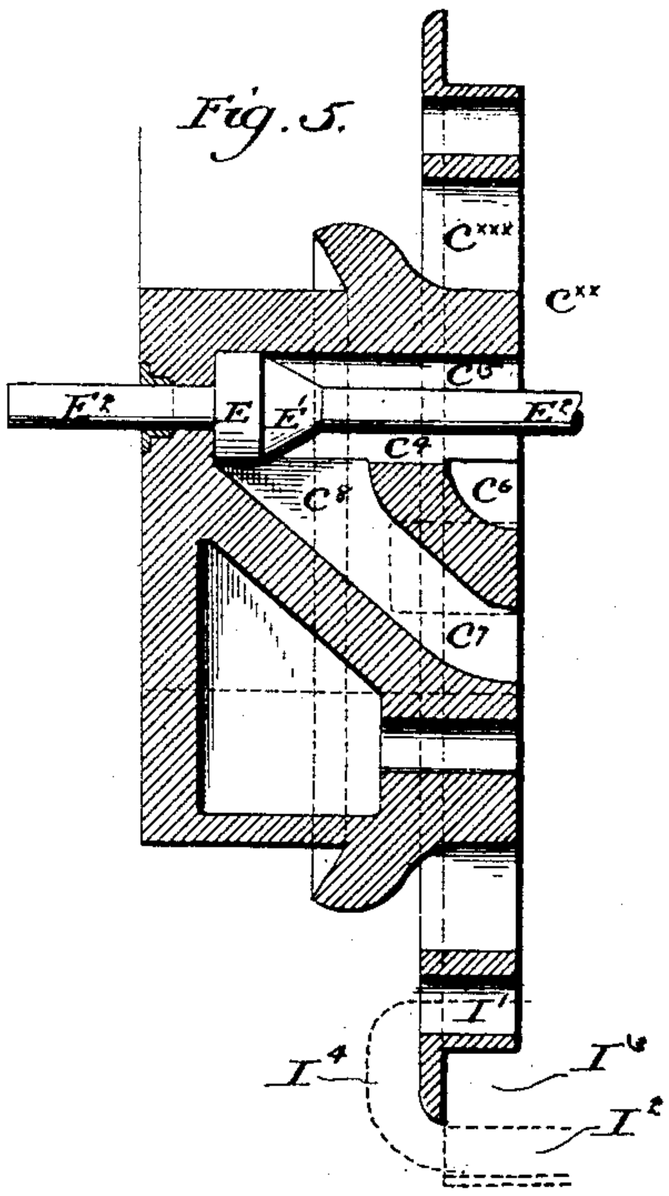



Fig. 4.

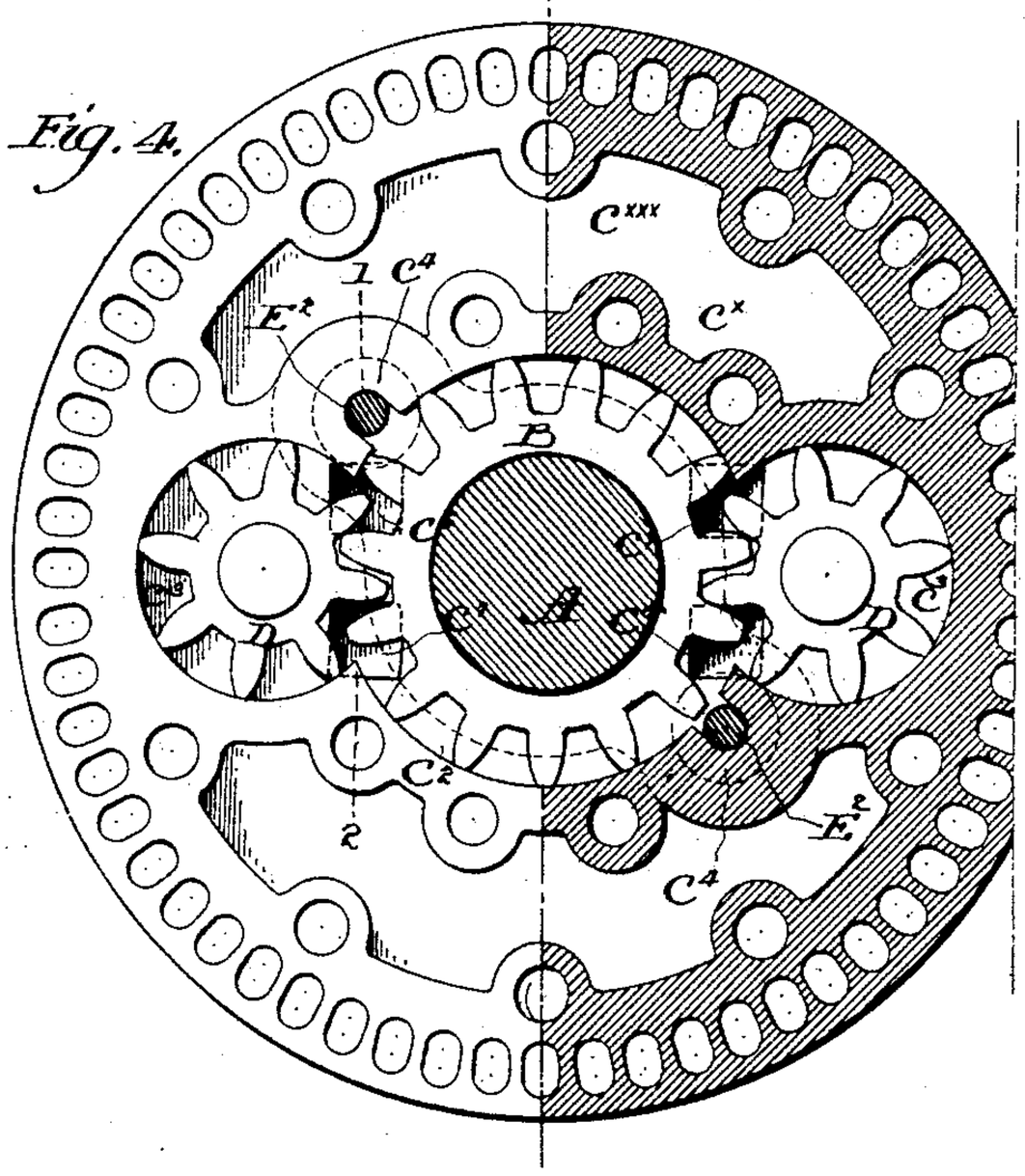
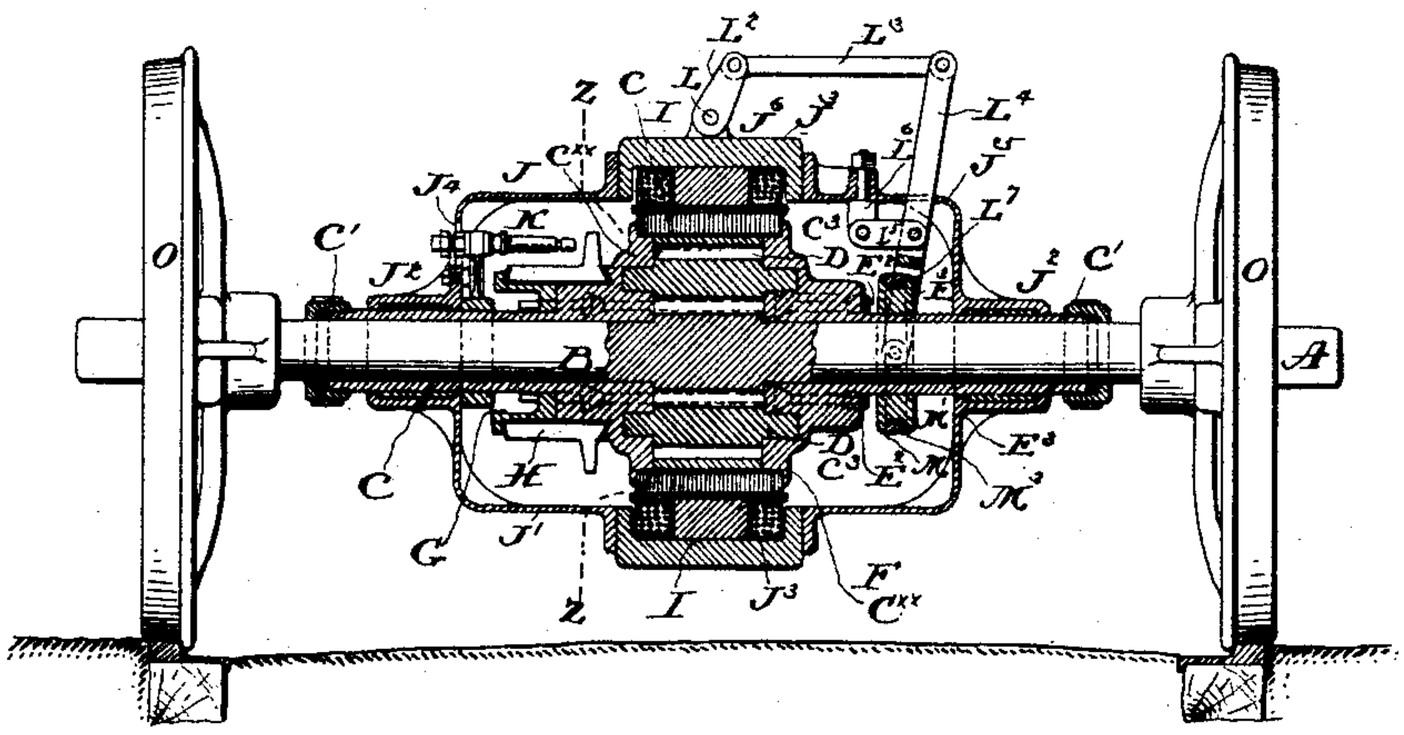



Fig. 3.

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(No Model.) 4 Sheets—Sheet 3.

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## DEVICE FOR TRANSMITTING MOTION.

No. 471,655. Patented Mar. 29, 1892.

*Fig. 7.*

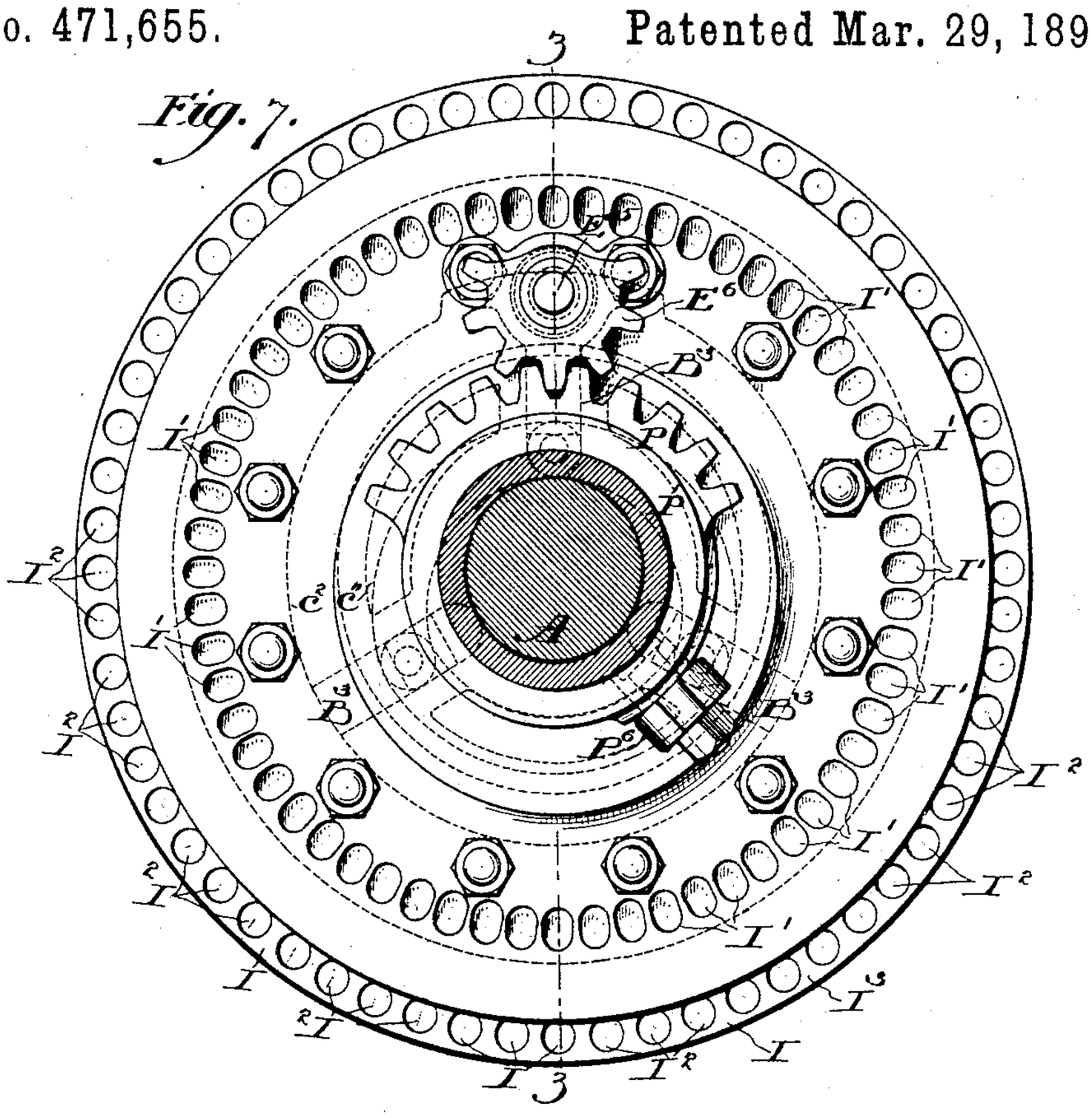
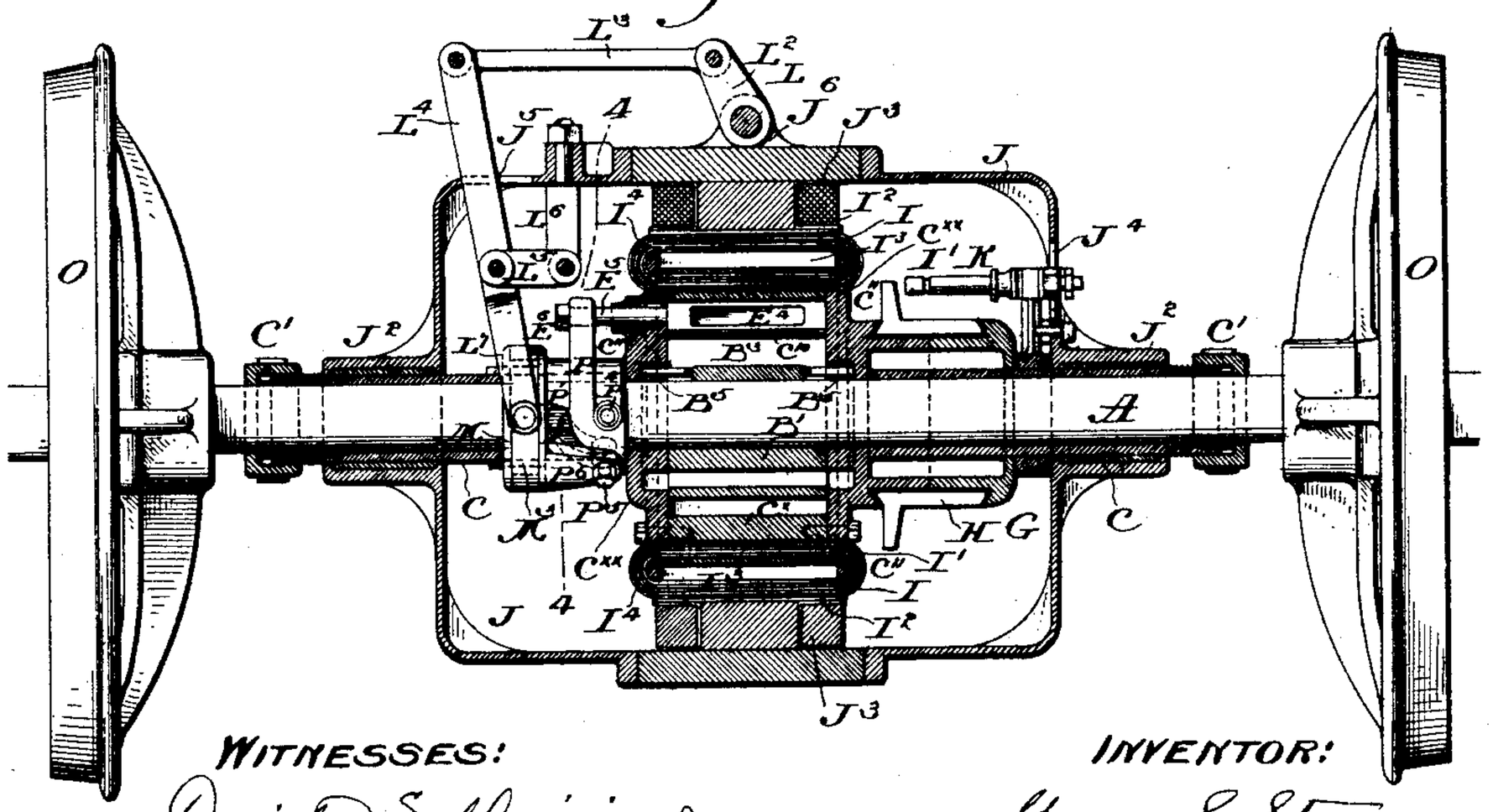



*Fig. 6.*

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(No Model.) 4 Sheets—Sheet 4.

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## DEVICE FOR TRANSMITTING MOTION.

No. 471,655. Patented Mar. 29, 1892.

*Fig. 8.*

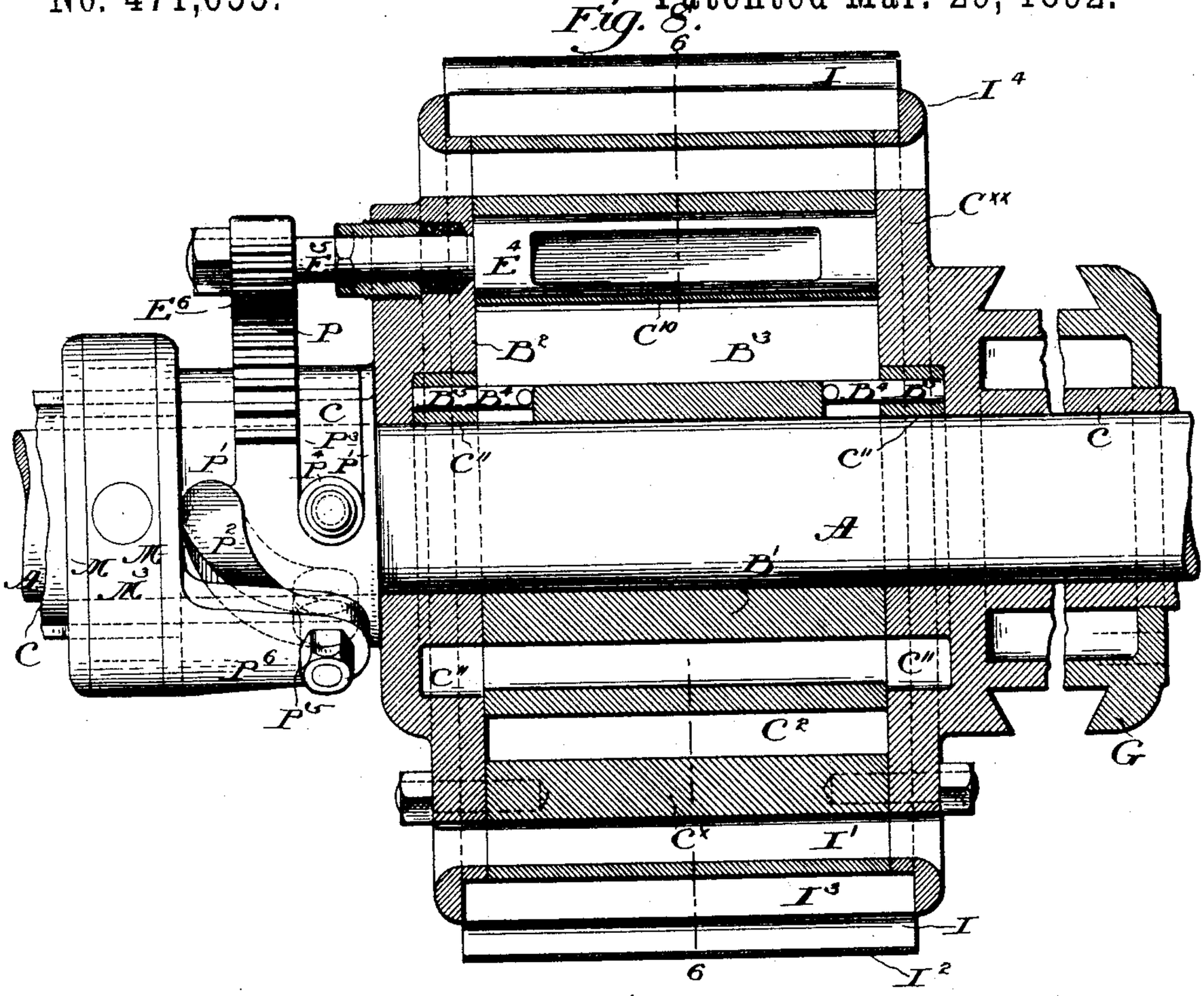
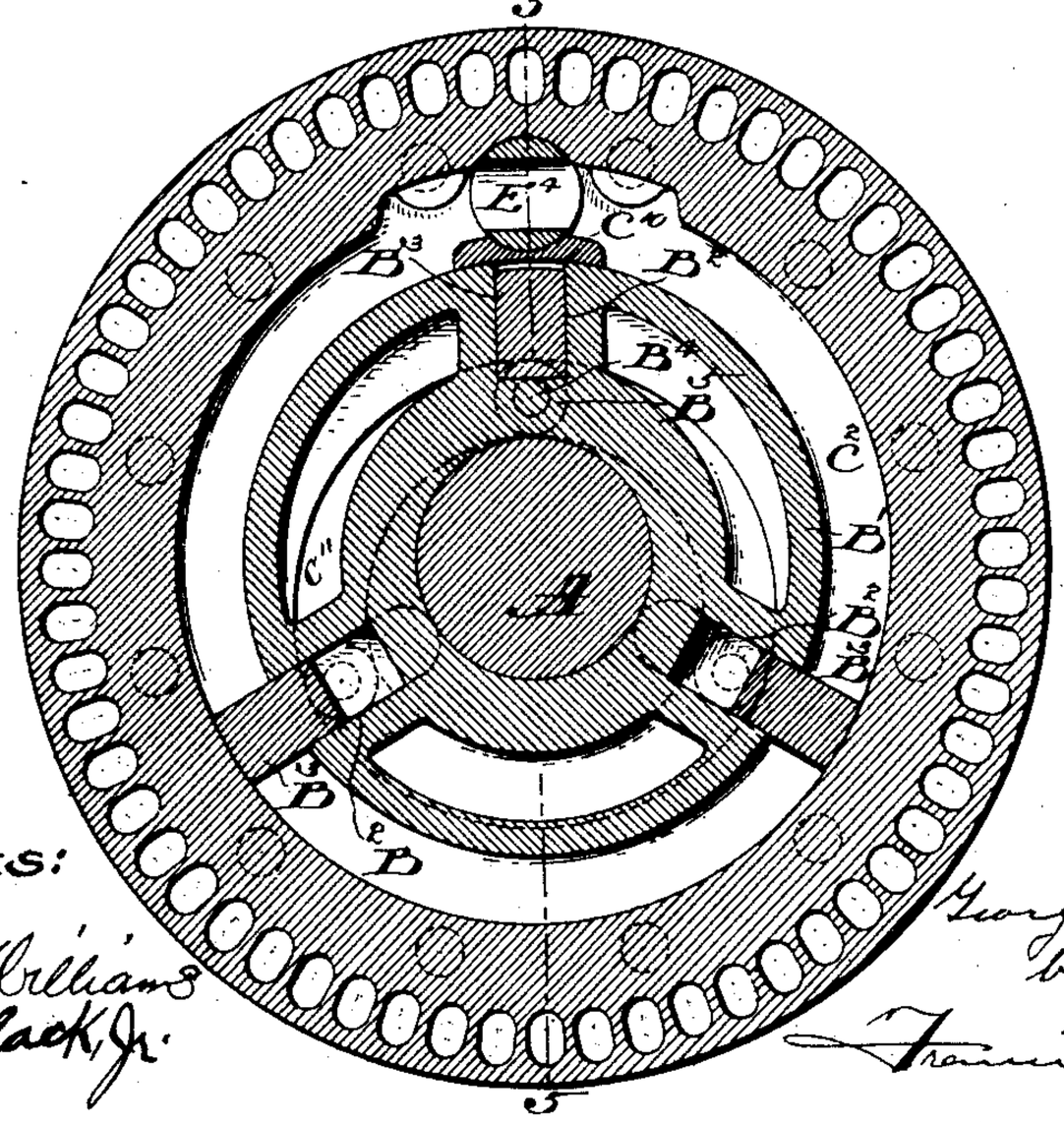



*Fig. 9.*

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# UNITED STATES PATENT OFFICE.

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## DEVICE FOR TRANSMITTING MOTION.

SPECIFICATION forming part of Letters Patent No. 471,655, dated March 29, 1892.

Application filed May 29, 1891. Serial No. 394,465. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE S. STRONG, of the city and county of New York, State of New York, have invented a certain new and useful Device for Transmitting Motion, of which the following is a true and exact description, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to devices for transmitting motion from one rotary body to another moving about the same axes of rotation, and particularly to devices used in connection with an electric motor.

The object of my invention is to provide what I may call a "fluid-clutch," by which the motion of the one body is transmitted to the other, together with means for regulating the resistance of the said clutch, so that the driving-body may rotate at a greater speed than the driven body, the ratio of relative rotation being within the control of the operator.

My invention will be best understood as described in connection with the drawings, in which I have illustrated it as applied to the axles of railway-cars, and in which—

Figure 1 is a plan view showing two axles of a truck, each equipped with one modification of my invention and partly shown in section. Fig. 2 is an elevation of the parts shown in Fig. 1, the mechanism connecting with one axle being shown in section on the line $x\,x$ of Fig. 1. Fig. 3 is a cross-sectional view taken on the line $y\,y$ of Fig. 1. Fig. 4 is an end view of the car-axle and the casing surrounding it with the side plate of the casing removed, and is shown partly in section, as on the line $z\,z$ of Fig. 3. Fig. 5 is a cross-sectional view taken on the line 1 2 of Fig. 4. Fig. 6 is a longitudinal central section taken as on the line 3 3 of Fig. 7 and showing another modification of my invention. Fig. 7 is an end view taken on the section-line 4 4 of Fig. 6, but omitting the magnetic field of the electro-magnet and the windings of the armature. Fig. 8 is a cross-sectional view taken as on the line 5 5 of Fig. 9, and Fig. 9 a cross-sectional view taken on the line 6 6 of Fig. 8.

Before describing the details shown in the drawings I may state that the two rotating bodies which in my invention are coupled together consist of a shaft and a casing surrounding and journaled upon the shaft, and that I secure to the shaft and within the casing projecting blades or teeth, which operate in the casing like the pistons of a rotary engine or rotary pump. The casing is filled with a fluid and provided with a by-pass leading from what may be called its "delivery-port" to its admission-port, and this by-pass is controlled by a valve by which it can be opened and closed and by which its opening can be regulated at will. When the by-pass is closed, the fluid in the casing effectually prevents any movement of the blades or pistons with respect to the casing, and therefore if either the casing or the shaft is rotating the other member of what I may call the "couple" necessarily rotates with it. By opening the by-pass the fluid is permitted to rotate in the casing against more or less resistance, and the driving member of the couple can then move with respect to the driven member, the speed of the driving member being communicated to the driven member to a degree depending on the opening of the by-pass or the resistance offered to the passage of the fluid through it.

In the broad general features above described I am informed and believe that the invention is not original with me, and therefore make no claim to it in this specification except in combination with the other features shown in the drawings, which I am about to describe.

Referring now again to the drawings, A indicates the axle of the car, or in the construction shown the driven shaft. Upon this axle or shaft is secured a casing made up of face-plates $c^{\times\times}$ $c^{\times\times}$, having outwardly-extending sleeves $c\,c$ with stuffing-boxes $c'$, making a close joint with the shaft A and a casing center $c^{\times}$, to which the face-plates are bolted, or the casing center may be, if desired, made integral with one of the face-plates. A tightly-inclosed cylindrical chamber $c^2$ is thus formed around the shaft or axle. In the modification shown in Figs. 1 to 5 supplemental chambers $c^3\,c^3$, also cylindrical in shape, are formed in the casing on each side of the central chamber $c^2$, and along the lines where the chamber $c^2$ connects with the chambers $c^3$ ports $c^6$

and $c^7$ are formed in the face-plate. The port $c^6$ connects with a passage $c^5$, extending through the face-plates, or one of them, and the port $c^7$ opens into the passage $c^5$ at $c^8$. (See Fig. 5.) Fitting neatly in the chamber $c^2$ is the gear-wheel B, firmly secured to the shaft A, and in engagement with said gear-wheel are supplemental gear-wheels D D, fitting neatly in the chambers $c^3$, the teeth of the engaged gear-wheels being formed so that as they roll together they will cut off or segregate temporary chambers, the area of which diminishes as they move apart. This construction is well known in certain types of engines and pumps. The chambers $c^2$ and $c^3$ are filled with fluid, (oil, for instance,) and it will be seen that, supposing the gear-wheels to be moving in the direction indicated by arrows in Fig. 4, the fluid will be forced out of the port $c^6$ through the passage $c^5$ into the port $c^7$, from which it returns to the chambers, the same action in the construction shown taking place on each side of the central chamber.

E E′ is a valve secured to a valve-stem $E^2$ and by which the connection between the ports $c^6$ and $c^7$ is regulated at will. As shown in Fig. 5, the valve is open, so that fluid can freely pass through the united ports. When it is desired to close the connection, the valve is moved forward to the portion $c^9$ of the passage $c^5$, completely closing the connection between the ports, or if a partial connection is desired the valve is moved to an intermediate position. In the construction shown each valve-stem $E^2$ has attached to it two valves E, each of which controls a by-pass in one of the face-plates. (See Fig. 1.) Supposing now that power is applied to rotate the casing, it will readily be seen that when the by-pass connecting-ports $c^6$ and $c^7$ are closed by their appropriate valves the fluid in the casing will effectually prevent the gear-wheels B and D from rotating, and therefore as the wheels D are carried around by the casing in which they are journaled they will carry the wheel B with them, causing it and the shaft to which it is attached to rotate. On the other hand, when the by-passes are opened the fluid can pass through the said by-passes, and as the casing rotates the wheels D are free to rotate in as well as with the casing and to roll around the periphery of the wheel B, which can thus remain stationary, or which is caused to rotate at a less speed than the casing after the by-pass is contracted so as to let some, but not all, of the fluid escape through it.

It is important, especially in applying devices of the kind described to the propulsion of cars, that means should be provided whereby the operator or driver can control the flow of fluid through the by-pass at will, and this means I provide by securing to the sleeve $c$ of the casing an annular ring M, which turns with the casing, but is free to move laterally with respect to it. To this ring I connect the valve or valve-stems by means which will cause the valves to open or close, according as the ring is moved toward or away from the casing. In the device already especially referred to the connection is made simply by continuing the valve-stems $E^2$ through the ring and connecting the stems therewith, as indicated at $E^3$, Figs. 1 and 3. Around the periphery of the ring M, which is flanged, I place a ring $M^3$, which is free to turn on the ring M and to which the forked arms $L^7$ of a lever $L^4$, pivoted at $L^5$, are connected. In the plan shown the link $L^5$, to which lever $L^4$ is pivoted, is connected with a stud $L^6$, attached to a casing J, hereinafter to be described, and the end of lever $L^4$ is connected by link $L^3$ with a lever-arm $L^2$, extending out from a shaft L, journaled in extensions $J^6$ of the casing J, and having an intermediate lever-arm L′, which is connected by convenient means to be actuated by the driver of the car.

Before describing the other mechanism shown in Figs. 1 to 5, inclusive, I will describe the other modification of the device for transmitting motion from one rotary body to the other, (shown in Figs. 6 to 9, inclusive,) here stating, however, that the device already described is not specifically claimed by me in this specification, for the reason that it forms the subject-matter of another application for Letters Patent, filed by me May 29, 1891, Serial No. 394,466.

Referring now to Figs. 6 to 9, inclusive, it will be seen that the casing journaled on the shaft or axle A is made up in substantially the same way as the one before described, but that the chamber $c^2$, formed in the casing, is not connected with the chambers $c^3$, as shown in the other modification, but is provided with the bridge $c^{10}$, between which and the outer wall of the chamber is formed the by-pass, the opening of which is controlled by a cock-valve $E^4$. Secured to the shaft and fitting in the casing is what I may call the "piston-guide" B′, in which are formed radial guide-slots $B^2$ and within which slots move the piston-blades $B^3$. The position of these blades $B^3$ is regulated by eccentric grooves $c^{11}$, formed in the side plates of the casing, and in which move rollers $B^5$, secured on projecting journals $B^4$, attached to the piston-blades $B^3$, the shape of the cams being such as will thrust the blades $B^3$ out against the periphery of the chamber $c^2$ during a portion of their rotary movement within the chamber and draw them back into the guide-slot $B^2$ when they pass the bridge $c^{10}$. The ring or cylinder B′, in which the slots $B^2$ are formed, fits neatly against the inner face of the bridge $c^{10}$, as shown in Fig. 9. Supposing now that power is applied to rotate the casing and the valve $E^4$ open, it will be seen that the casing can rotate freely without driving the shaft A, because the rotating cam-groove $c^{11}$ will draw the blades $B^3$ in to permit the fluid to pass around the periphery of the chamber $c^2$ and through the open by-pass from bridge $c^{10}$. If, however, the said by-pass be closed by

turning the valve $E^4$, then the water can no longer rotate in the casing, nor can the casing rotate independently of the shaft, for one or more of the blades $B^3$ in addition to the cock $E^4$, acts to close the communication from one port of the chamber to the other, and the blades $B^3$ are thus carried around with the casing and in turn carry the shaft A with them. The stem $E^5$ of the cock-valve $E^4$ is carried through the casing to one side and has connected with it a gear-segment $E^6$. A ring M, constructed and operating in the same way as I have fully described above, is secured to turn with the sleeve *c*, and the ring or annulus P′ surrounds the sleeve *c* between the ring M and the face-plate of the casing, this annulus being secured so as to be laterally fixed on the sleeve, but being free to turn thereon for a certain distance. In the plan shown a slot $P^3$ is formed in the annulus, into which projects a roller $P^4$, secured to the sleeve *c*. Extending up from the annulus P′ is a gear-segment P in engagement with the segment $E^6$, and in the annulus P′ is formed a cam-guide $P^2$, (here shown as a slot,) which is engaged by the end of an arm $P^6$, extending out from the ring M. In the plan shown this engagement is made by means of a roller $P^5$, secured to arm $P^6$ and resting in groove $P^2$. It will be seen that any lateral movement of the ring M is by the construction described made to effect a rotary movement of the annulus P′, and whose rotary movement, communicated through the gear-segments P and $E^6$, is made to rotate the cock-valve $E^4$, opening or closing it, as the case may be.

An important feature of my invention consists in combining with that one of the two rotary members of the device for communicating motion which is used as the driving member the rotating member of an electric motor, the said rotating member being made of annular form and secured to and around the said driving member. In connection with these devices the stationary member of the electric motor is arranged around the rotating member in the usual way to drive it. In cases where the device is used to drive the axle of a car, as in the drawings, the rotating member of the electric motor is secured to and around the periphery of the casing journaled upon the axles, as indicated at I in the drawings, and the stationary member of the electric motor secured in any convenient way around the rotating member. Preferably this stationary member is secured to and inside of a casing J, which surrounds the casing containing the fluid and is journaled either on the sleeves *c c*, as shown at $J^2$ of the first-mentioned casing, or directly upon the axle A.

I have referred generally to the rotating and stationary members of an electric motor because, as is well known, motors can be and have been constructed in which the armature is stationary and the field revolves, as well as in which the armature revolves and the field is stationary.

The last-mentioned construction is the best understood and is the one illustrated in my drawings, I indicating the armature, made up of wire windings $I^4$, passing through holes I′ in the periphery of the casing and holes $I^2$ in an iron core $I^3$, resting upon the casing. The field is made up of a series of electro-magnets (indicated at $J^3$) secured to and around the inside of the casing J, and this casing is supported upon the axle A, as already described, and prevented from turning by having another point of support or attachment—as, for instance, an iron brace N, Figs. 1 and 2—connecting two casings J on adjacent axles.

G H indicate a commutator of ordinary construction secured to one of the face-plates of the interior casing, and K is the brush-support fastened to the casing J and extending out through an opening $J^4$ in said casing. Another opening $J^5$ is formed for the valve-actuating lever $L^4$, both of these openings being made as small as convenient and preferably constituting the only openings in the casing J.

The compactness and simplicity of the device above described will be readily appreciated, as will be also the peculiar value of the device for communicating motion from the armature to the shaft or axle, in that the armature can be made to run at any desired speed, and that speed may remain at constant while the axle is rotating at varying and different speeds.

By proper manipulation of the valve relative speed of the axle and armature can be varied at will, and by the instrumentalities I have described these variations are under the control of the operator and can be made without stopping the car.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with the casing, of the cock-valve controlling a by-pass of the casing, the segment $E^6$ on the valve-stem, a sleeve P′, coupled to the casing so as to be free to turn thereon, but fixed laterally, said sleeve having a segment-arm P, engaged with segment $E^6$, and an oblique cam-guide $P^2$, and a laterally-movable ring M, coupled to turn with the casing and having an arm $P^6$, engaged with cam-guide $P^2$, as described, so as to turn sleeve P′ when the ring has moved to or from it.

2. The combination of a shaft, a casing journaled thereon and coupled therewith through the medium of a body of fluid contained in the casing, a by-pass in the casing, through which when open the fluid can flow, permitting the shaft to turn independently of the casing, a valve controlling the opening of the by-pass, the movable member of an electric motor secured to and around the shaft or casing, and the stationary member of said motor, arranged annularly around said movable member.

3. The combination of a shaft, a casing journaled thereon and coupled therewith through the medium of a body of fluid contained in

the casing, a by-pass in the casing, through which when open the fluid can flow, permitting the shaft to turn independently of the casing, a valve controlling the opening of the by-pass, the movable member of an electric motor secured to and around the casing, and the stationary member of said motor, arranged annularly around said movable member.

4. The combination of a shaft, a casing journaled thereon and coupled therewith through the medium of a body of fluid contained in the casing, a by-pass in the casing, through which when open the fluid can flow, permitting the shaft to turn independently of the casing, a valve controlling the opening of the by-pass, an annular electric-motor armature secured to and around the casing, and a stationary field arranged to act upon and actuate the armature and casing.

5. The combination of a shaft, a casing journaled thereon and coupled therewith through the medium of a body of fluid contained in the casing, a by-pass in the casing, through which when open the fluid can flow, permitting the shaft to turn independeutly of the casing, a valve controlling the opening of the by-pass, an annular electric-motor armature secured to and around the casing, an exterior casing J, journaled directly or indirectly on the shaft and surrounding the casing coupled thereto, and an electric field supported in and on said casing so as to embrace the armature, substantially as and for the purpose specified.

6. The combination of a shaft, a casing journaled thereon and coupled therewith through the medium of a body of fluid contained in the casing, a by-pass in the casing, through which when open the fluid can flow, permitting the shaft to turn independently of the casing, a valve controlling the opening of the by-pass, a laterally-movable ring connected to the casing so as to turn with it and around the shaft, means for operatively connecting the valve and ring, means for moving the ring laterally, an annular electric-motor armature secured to and around the casing, and a stationary field arranged to act upon and actuate the armature and casing.

7. The combination of a shaft, a casing journaled thereon and coupled therewith through the medium of a body of fluid contained in the casing, a by-pass in the casing, through which when open the fluid can flow, permitting the shaft to turn independently of the casing, a valve controlling the opening of the by-pass, a laterally-movable ring connected to the casing so as to turn with it and around the shaft, means for operatively connecting the valve and ring, means for moving the ring laterally, an annular electric-motor armature secured to and around the casing, an exterior casing J, journaled directly or indirectly on the shaft and surrounding the casing coupled thereto, and an electric field supported in and on said casing so as to embrace the armature, substantially as and for the purpose specified.

8. The combination, with the casing, of the cock-valve controlling a by-pass of the casing, the segment $E^6$ on the valve-stem, a sleeve P′, coupled to the casing so as to be free to turn thereon, but fixed laterally, said sleeve having a segment-arm P, engaged with segment $E^6$, and an oblique cam-guide $P^2$, a laterally-movable ring M, coupled to turn with the casing and having an arm $P^6$, engaged with cam-guide $P^2$, as described, so as to turn sleeve P′ when the ring is moved to or from it, an annular electric-motor armature secured to and around the casing, an exterior casing J, journaled directly or indirectly on the shaft and surrounding the casing coupled thereto, and an electric field supported in and on said casing so as to embrace the armature, substantially as and for the purpose specified.

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