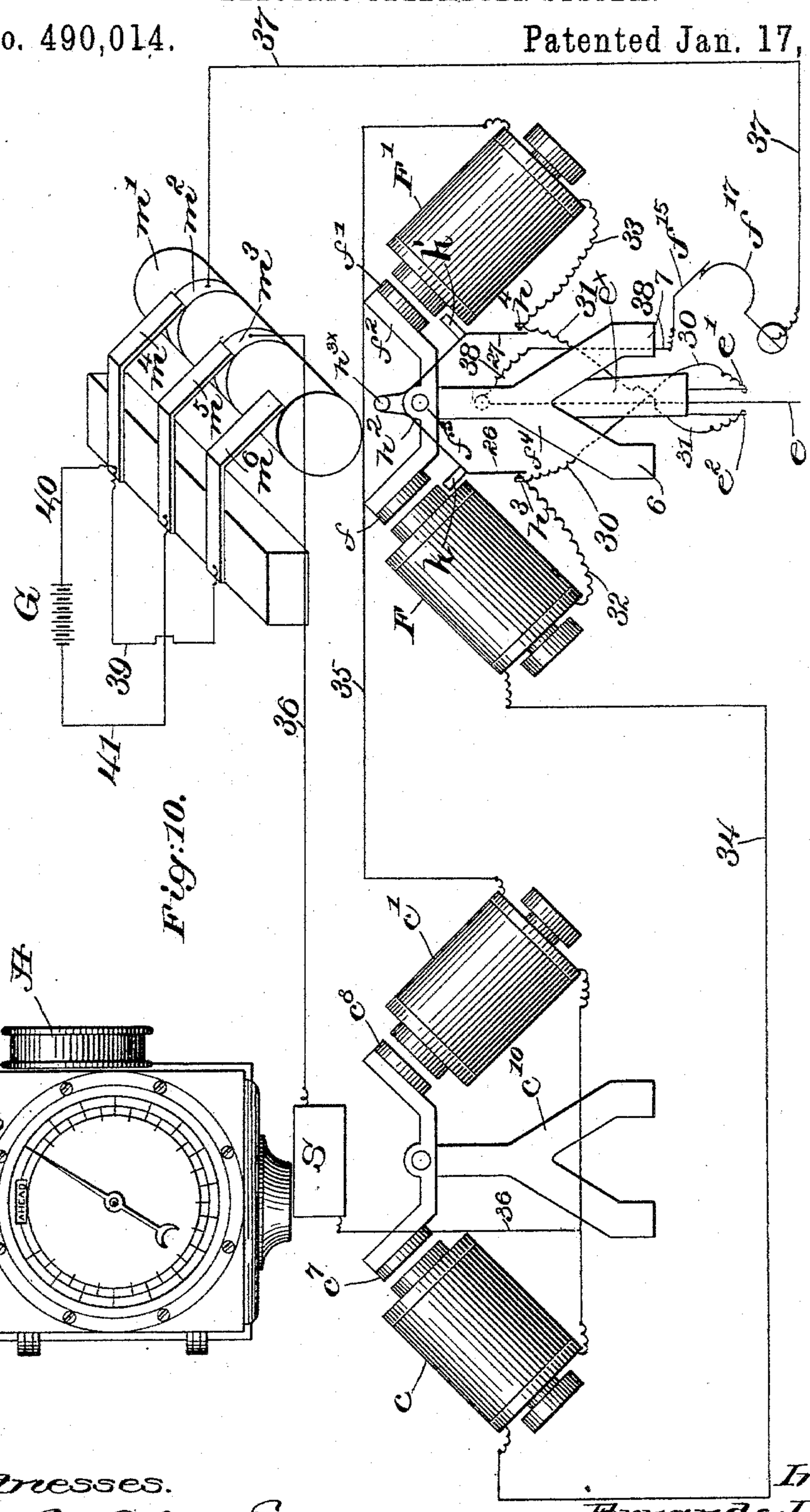
(No Model.) 5 Sheets—Sheet 1.

F. J. DIBBLE.

ELECTRIC TELEMETER SYSTEM.

No. 490,014. Patented Jan. 17, 1893.



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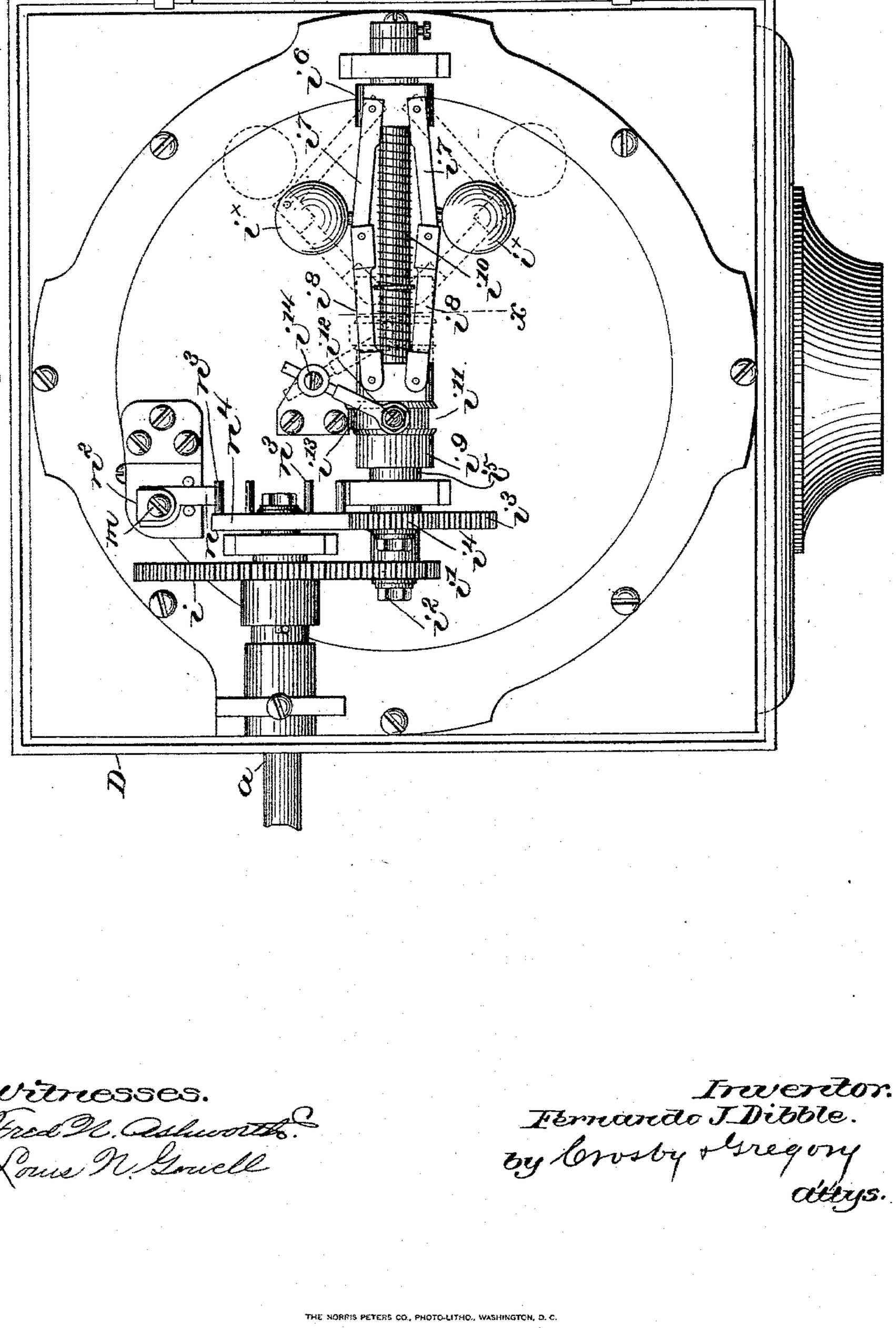
F. J. DIBBLE.

ELECTRIC TELEMETER SYSTEM.

No. 490,014. Patented Jan. 17, 1893.

Fig. 2.



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F. J. DIBBLE.

ELECTRIC TELEMETER SYSTEM.

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Fig: 5.

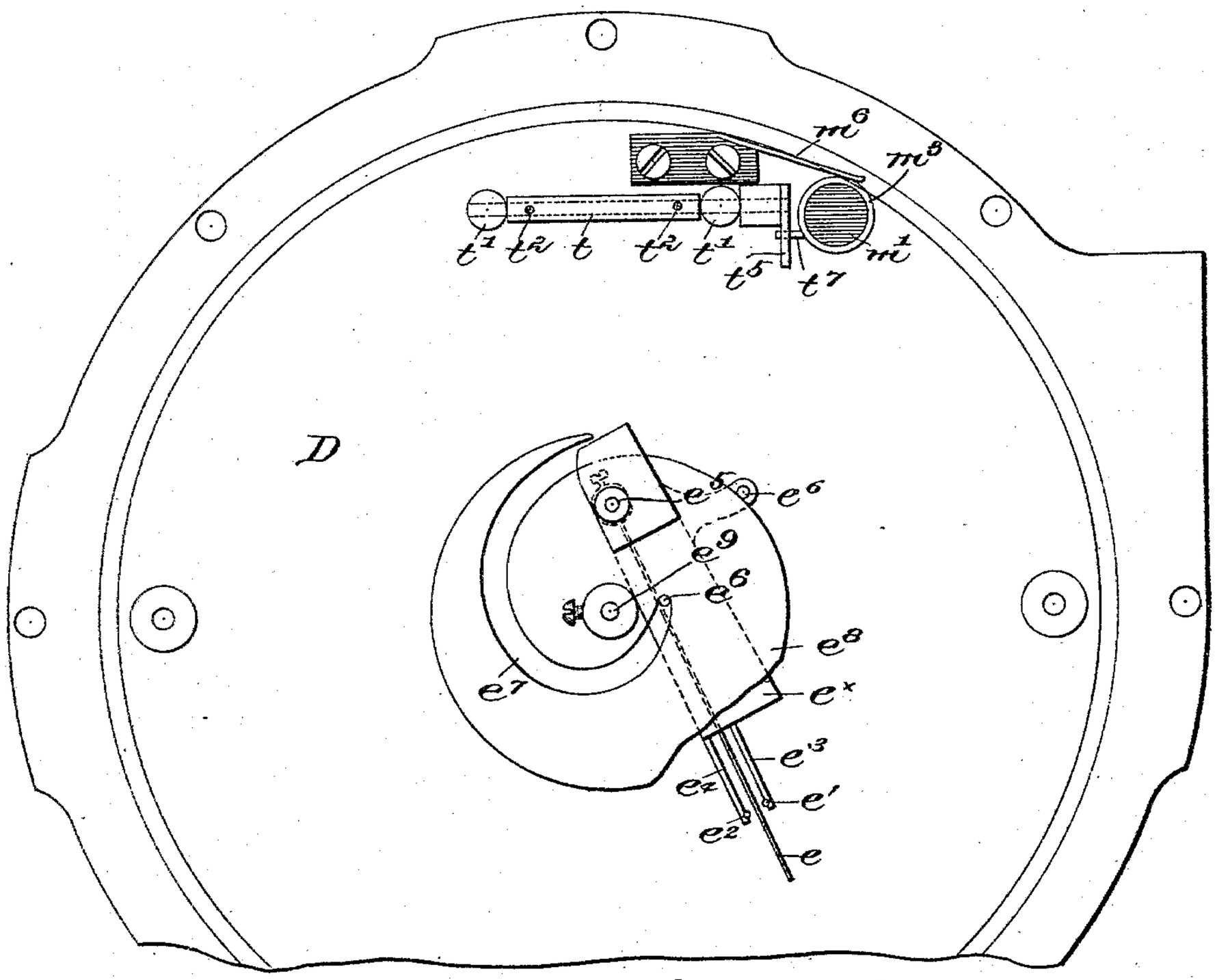
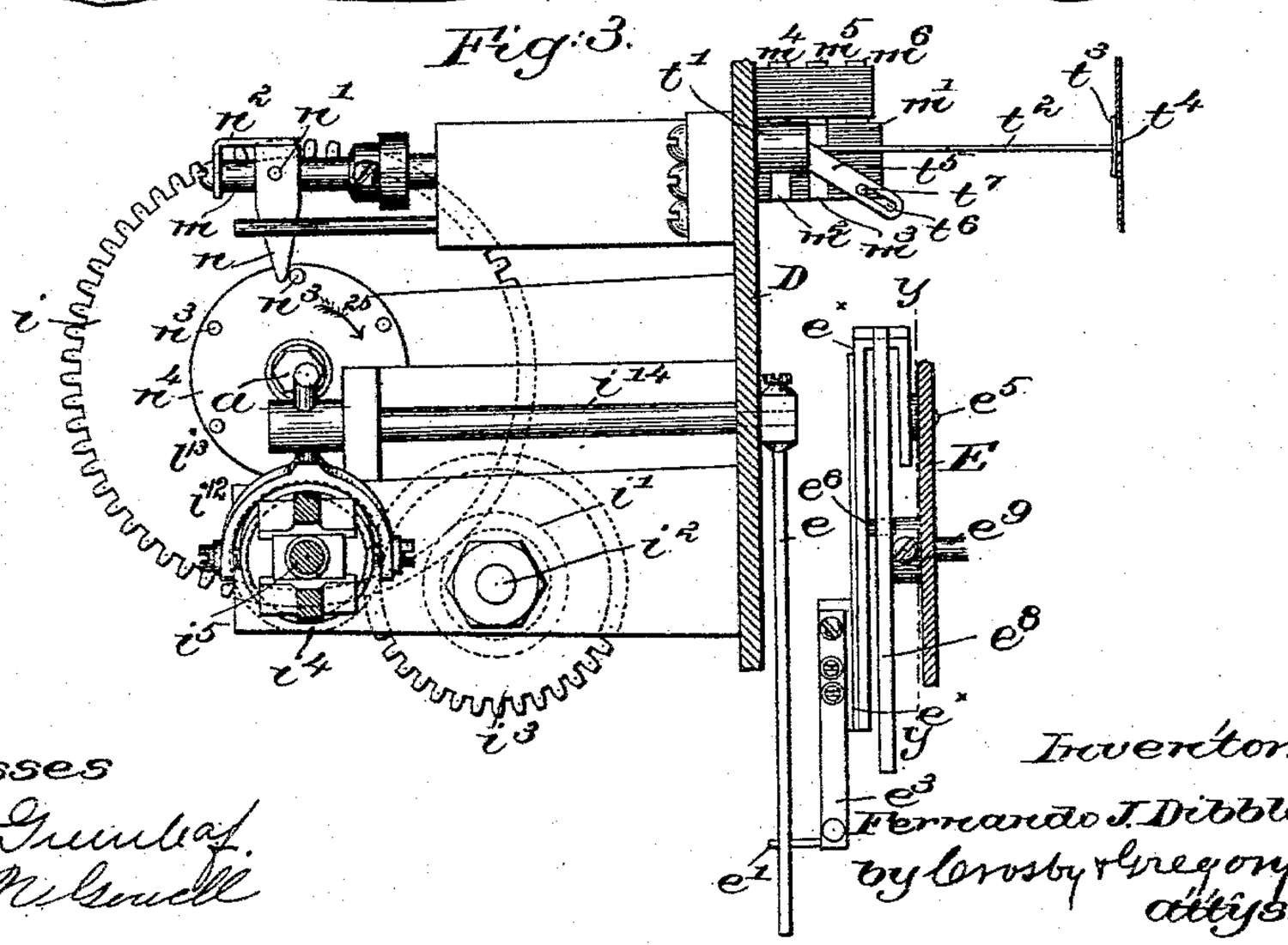


Fig: 3.



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(No Model.)

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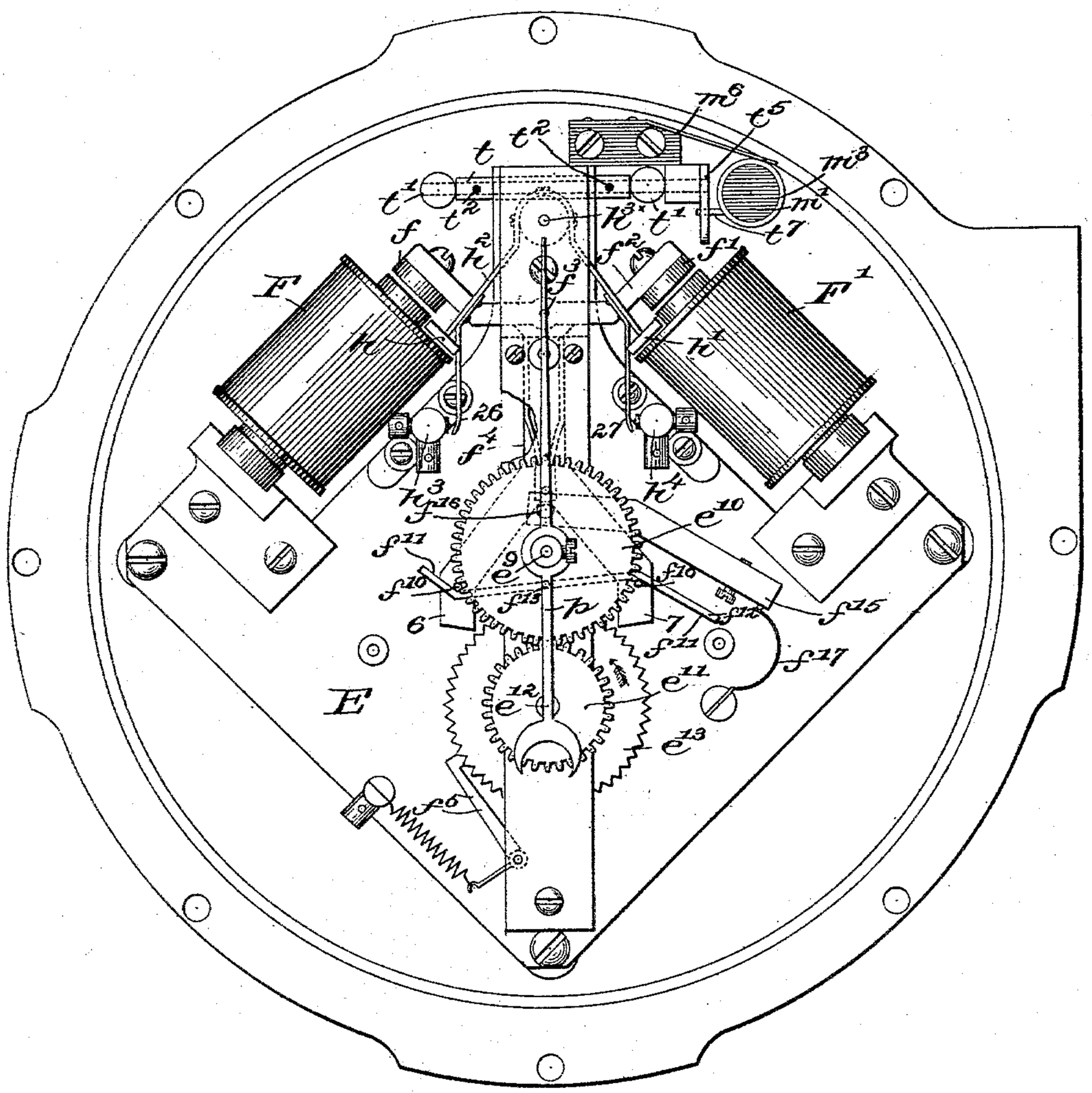
ELECTRIC TELEMETER SYSTEM.

No. 490,014. Patented Jan. 17, 1893.

Fig: 4.



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(No Model.) 5 Sheets—Sheet 5.

F. J. DIBBLE.

ELECTRIC TELEMETER SYSTEM.

No. 490,014. Patented Jan. 17, 1893.

Fig: 6.

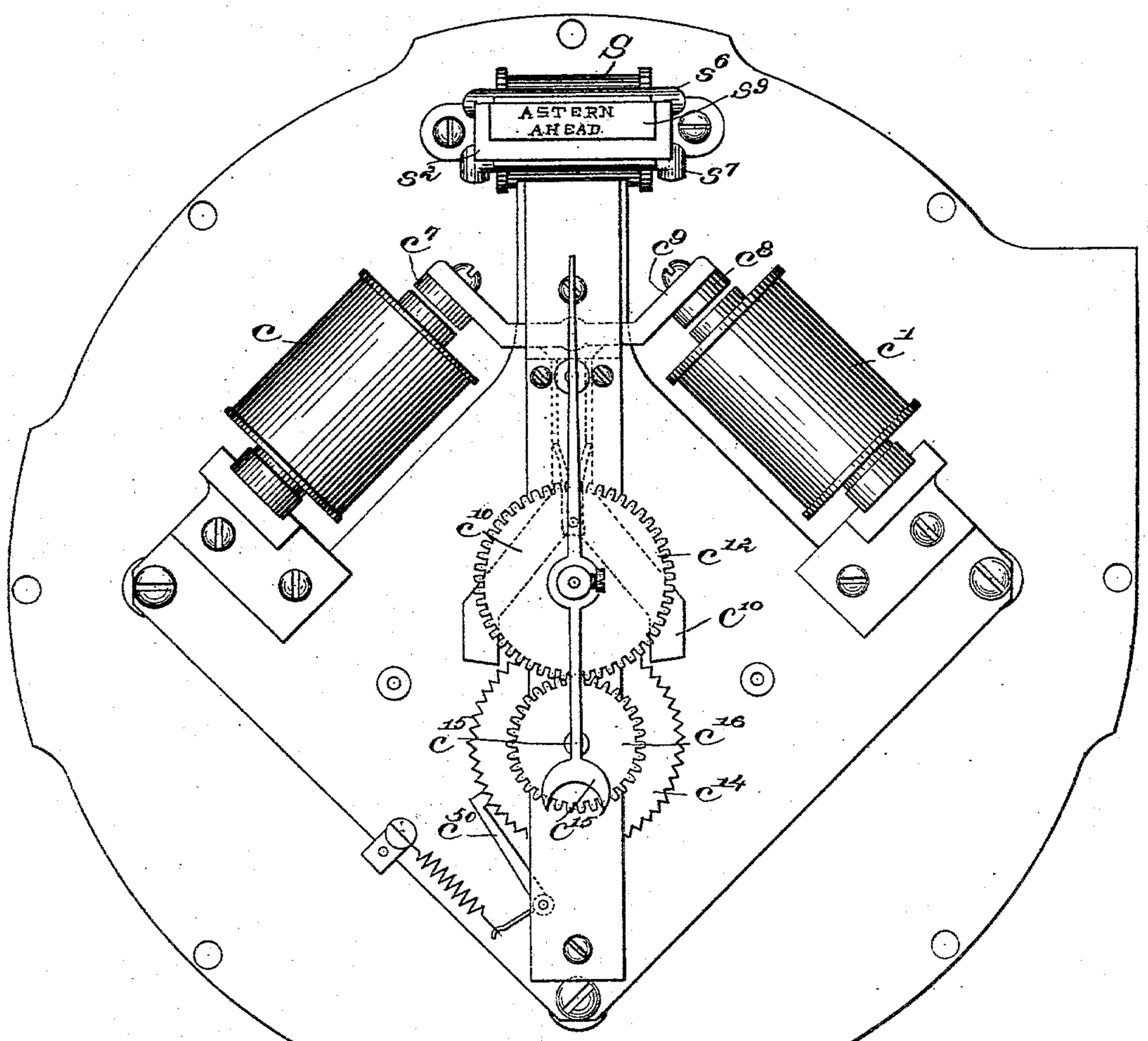


Fig: 7.

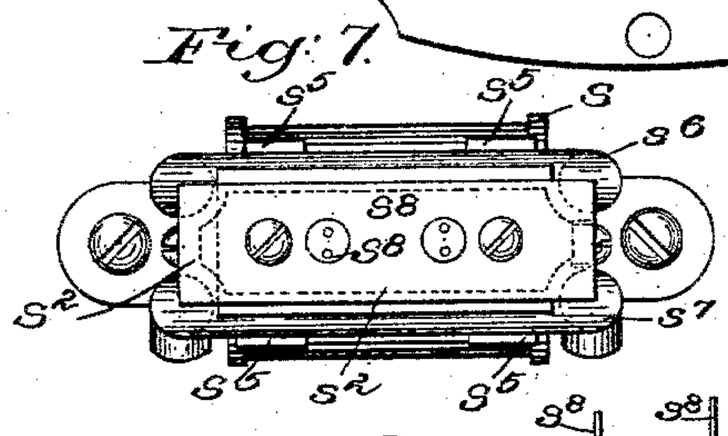


Fig: 8.

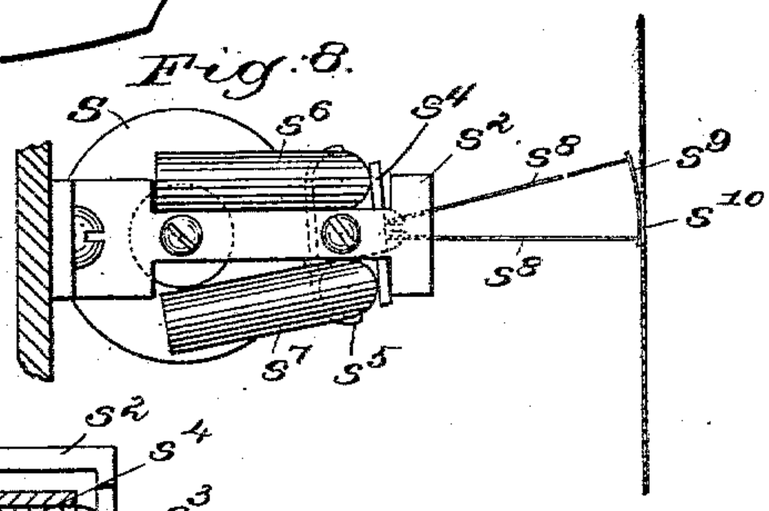
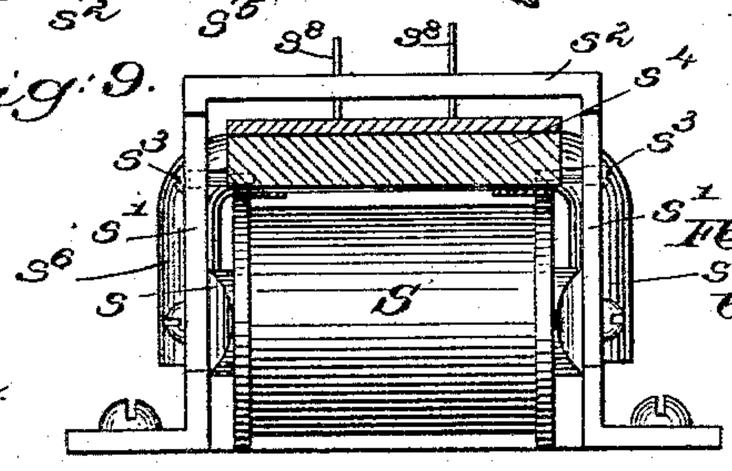


Fig: 9.



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UNITED STATES PATENT OFFICE.

FERNANDO J. DIBBLE, OF PEABODY, MASSACHUSETTS.

ELECTRIC TELEMETER SYSTEM.

SPECIFICATION forming part of Letters Patent No. 490,014, dated January 17, 1893.

Application filed May 12, 1892. Serial No. 432,704. (No model.)

To all whom it may concern:

Be it known that I, FERNANDO J. DIBBLE, of Peabody, county of Essex, State of Massachusetts, have invented an Improvement in Telemeter Systems, of which the following description, in connection with the accompanying drawings, is a specification, like letters and figures on the drawings representing like parts.

This invention relates to telemeter systems for indicating and recording the speed and direction of movement of a rotating shaft.

In another application Serial No. 412,670, filed November 21, 1891, a telemeter system of this class is shown and described wherein both a transmitter and a receiver are necessary in order to indicate and record the speed and the direction of rotation of a shaft. In the application referred to, the transmitter has two magnets, one of which responds to indicate increase of speed, while the other responds to a decrease of speed, a suitable device actuated by changes in the direction of rotation of a shaft being employed to determine which of the receiving magnets of the receiver is to be in circuit with the transmitting magnet which responds to increase of speed, and which of the receiving magnets is to be in circuit with the transmitting magnet which responds to a decrease of speed, the direction of movement of the indicating device or pointer actuated by the said receiving magnets, being in one or the other direction to indicate an increased speed according as one or the other of the receiving magnets is placed in circuit with the transmitting magnet which responds to increase of speed, so that by viewing the indicating device and noting in which direction the indicating pointer had been moved, the direction of rotation of the shaft is indicated, while the distance through which the said pointer had been moved indicates the number of revolutions per minute of speed of rotation of the shaft. In the system referred to, the transmitter is provided with a pointer which indicates the speed or number of revolutions per minute of the shaft, but does not indicate the direction of rotation of the shaft, making it necessary to employ the receiver in order that the direction of rotation may also be indicated.

This present invention has for its object to provide a telemeter system of the class illustrated in my said application, but by which not only the number of revolutions of a shaft but the direction of rotation as well may be indicated by the transmitter as well as by the receiver. Accordingly the transmitter is provided with an indicating device or annunciator to show the direction or rotation of the shaft, so that the receiver may be dispensed with, except in instances where it is necessary to communicate the speed and direction of rotation of the shaft to some remote or distant point.

Whereas in the application referred to, the indicating pointer of the receiver is moved in one or the other direction from a central point, to indicate that the shaft is rotating in one or the other direction; in this my present invention the indicating pointer of the receiver moves always in one direction to indicate an increase of speed, and always in an opposite direction to indicate a decrease of speed irrespective of the direction of rotation of the shaft, the direction of rotation being indicated by an independent dial or annunciator actuated by changes in the polarity of the current, the polarity being changed automatically whenever the direction of rotation of the shaft is changed.

One part of this invention therefore consists in a telemeter system containing the following instrumentalities, viz:—a rotating shaft; two transmitting magnets responsive respectively to increase and decrease in speed of rotation of said shaft, an indicating device controlled by said magnets, and an annunciator actuated by changes in the direction of rotation of said shaft; substantially as will be described. Also, in a telemeter system containing the following instrumentalities, viz:—a rotating shaft; two transmitting magnets responsive respectively to the increase and decrease in speed of rotation of said shaft; armatures for the said transmitting magnets; two receiving magnets, the circuits through which are controlled by the said transmitting magnets; a speed indicating device actuated thereby; a device actuated by changes in the direction of rotation of said rotating shaft to change the polarity of the circuits of the said receiving magnets; and

an annunciator controlled by changes in the polarity of said circuits; substantially as will be described. Also, in a telemeter system containing the following instrumentalities, viz:—a rotating shaft; two transmitting magnets responsive respectively to increase and decrease in speed of rotation of said shaft; a pole changer actuated by changes in the direction of rotation of the said shaft; a polarized magnet; and an annunciator controlled thereby; substantially as will be described.

Other features of this invention will be hereinafter described and pointed out in the claims.

Figure 1, represents in front elevation a transmitter forming a part of my improved telemeter system; Fig. 2, a rear side view of the same with the back swung open to expose the mechanism responsive to changes in the speed and direction of rotation of a shaft; Fig. 3, a sectional view taken on the dotted line x—x Fig. 2; Fig. 4, a face view of the transmitting magnets and co-operating mechanism looking from the front of the transmitter, or from the back of Fig. 2; Fig. 5, a section taken back of the base plate Fig. 3; on the dotted line y—y. Fig. 6, a face view of the receiver, showing the receiving magnets and co-operating mechanism; Figs. 7, 8 and 9, details illustrating the annunciator actuated by changes in polarity of the circuit; Fig. 10, a diagram view illustrating the electrical connections of the system.

Referring to the drawings, Figs. 1 and 2, A represents a pulley in the present instance fast on a shaft a, journaled in suitable bearings in the casing D of the transmitter, said pulley being belted or otherwise connected with a rotating shaft the speed and direction of rotation of which it is desired to indicate and record, the connections between said pulley and rotating shaft preferably being such that the said pulley may be thrown out of gear and stopped at will, a mechanism for accomplishing this being shown and described in the application Serial No. 412,670 referred to.

The shaft a, within the casing D of the transmitter is provided with a toothed wheel i, in mesh with a pinion i', on a counter-shaft i^2, said counter-shaft also having fast upon it a toothed wheel i^3, in mesh with and driving a pinion i^4, on dotted lines Fig. 3, fast on the governor shaft i^5, journaled in suitable bearings within the casing all as in the application referred to.

The governor shaft at one end has a fixed hub i^6, to which are jointed at diametrically opposite points, the links i^7, carrying the governor balls $i^\times$, and in turn jointed to like links i^8, jointed at their opposite ends to the sliding sleeve i^9, a spring or springs i^{10}, interposed between the fixed hub i^6, and the sliding sleeve i^9, normally separating the same maintaining the toggle links i^7, i^8, together with the governor balls $i^\times$, normally in their innermost full line positions Fig. 2 the construction of this portion of the mechanism being substantially the same as that of any of the well known ball governors now in common use. Rotation of the shaft a, causes the balls to move away from the axis of rotation as the speed of rotation increases while a decrease of speed will permit the spring or springs i^{10} to draw the balls toward the axis of rotation. The sliding sleeve i^9 has a peripheral groove i^{11} to receive the roll or other stud i^{12}, on the free end of an arm i^{13} fast on one end of the arbor i^{14} Fig. 3, journaled in the back plate of the casing D of the transmitter, the said arbor at the opposite or front side of said back plate carrying the contact arm e, see Fig. 5. The contact arm e, normally lies between the two contact points or pins e', e^2, on the outer ends of the arms e^3, e^4, which latter are insulated from each other and carried by a carrier $e^\times$, shown by dotted lines Fig. 5 and in Fig. 3, pivoted at its upper end on an arbor e^5, journaled in suitable bearings in the face plate E of the transmitter, see Fig. 3.

The insulated carrier $e^\times$, for the contacts e', e^2, is provided with a pin e^6, fitted to move in the cam slot e^7, formed in the plate or disk e^8, fast on the inner end of a staff e^9, journaled in the face plate E Fig. 3, and having at its outer front end a toothed wheel e^{10}, see Fig. 4, in mesh with a pinion e^{11}, on an arbor e^{12}, which latter carries the toothed driving wheel e^{13}. The contacts e', e^2, are arranged in circuit respectively with the transmitting magnets F, F', arranged as in Fig. 1, and having their main armatures f, f', Fig. 4, attached to opposite ends of the armature carrier f^2, pivoted at f^3, in a suitable frame carried by the face plate E, said carrier having attached to and movable with it a pallet f^4, shown mostly in dotted lines Fig. 4, the arms 6, and 7, of the said pallet being arranged at opposite sides of the axis of the driving wheel e^{13}, and to co-operate with one or another of the V-shaped teeth thereon, vibrations of the pallet in one or the other direction caused by attraction of one or the other of the armatures f, f', causing the said driving wheel to be rotated in one or other direction, a spring-controlled pawi f^5, by its wedge-shaped end co-operating with the V-shaped teeth to assist in the rotation of the driving wheel and to retain the latter in position.

The arms 6, 7, of the forked pallet f^4, are provided with pins f^{10}, which co-operate with the inclined or cam surfaces f^{11}, on a lever f^{12}, pivoted at f^{13}, the said lever when turned on its pivot acting upon and move a circuit breaking arm f^{15}, pivoted at f^{16}, and normally having its free end in contact with a contact spring f^{17}, movement of the said lever f^{15} by the lever f^{12} breaking the circuit between it and the said contact spring. Whenever the forked pallet f^4, is vibrated, whether it be in one or the other direction, one or the other of the pins f^{10}, will act upon its cam surface to move the lever f^{12}, to lift the circuit breaking lever f^{15} to break the circuit between the same and its contact spring f^{17}. Springs $f^\times$

shown principally by dotted lines Fig. 4, act in opposite directions upon a pin $p^{\times}$ on the pallet f^4 to center the latter and return it to its normal central position after each vibration. The electro-magnets F, F′, are also provided with auxiliary armatures h, h', carried by the arms of the U-shaped carrier h^2, pivoted at $h^{3\times}$, and having its ends 26, 27, arranged to lie between and normally out of contact with the fixed contacts h^3, h^4, see Fig. 4. When a current of electricity is caused to pass through either of the transmitting magnets F, F′, by engagement of the contact arm e, with either of the contacts e', e^2, the auxiliary armature of the particular magnet energized being first attracted to bring the end of its carrier into engagement with one or the other of the fixed contacts h^3, h^4, to shunt out the contact arm e, as will be fully hereinafter described, the main armature of the magnet energized, being then attracted to cause rotation of the driving wheel e^{13}.

Referring again to Figs. 2 and 3, the inner end of the shaft a, which is rotated from the shaft the speed and direction of rotation of which it is desired to indicate and record, has fast upon its end a disk or plate n^4, provided with a series of circumferentially arranged projecting pins n^3, which as the said disk is rotated, act upon the lower depending end of a dog n, pivoted at n', on a spindle m, and normally retained in its vertical position by a spring n^2, the said spindle m, being mounted and made longitudinally movable in a suitable bearing secured to the back plate of the casing D, the said spindle at its front end carrying an insulated block m' preferably circular in cross-section see Fig. 10, and provided with two circumferential contact rings m^2, m^3, which co-operate with three spring-pens m^4, m^5 or m^6, the said contact rings when the block m' is in its extreme right-hand position Fig. 3, contacting with the spring pens m^5, m^6, but when the said insulated block is moved to its extreme left-hand position Fig. 3, said rings will contact with the spring pens m^4, m^5. The spindle m, is moved longitudinally to effect this change of position of the block m' by the action of the pins n^3, on the dog n, the rotation of the disk which carries the said pins in one or the other direction, causing the dog to be turned or tipped on its pivot in one or the other direction according as the pin strikes it upon one or the other side, in order to permit the pins to pass beneath.

The limit of vibration of the dog n, on its pivot is somewhat less than that necessary to clear the pins and permit the latter to pass beneath it, so that by reference to Fig. 3, if the shaft a, and disk n^4 are rotated in the direction of arrow 25, the first pin n^3 which strikes the depending end of the dog, will first turn the same on its pivot to the limit of its movement and as such is not quite sufficient to permit the pin to pass beneath it, it will carry the said dog and the spindles m, to which it is pivoted, bodily to the right, until the pin clears the dog, such movement of the spindle causing the insulated block m' to be moved to the right Fig. 3, with its contact strips m^2, m^3, in engagement with the contact springs m^5, m^6, the tipping movement of the dog n, being alone thereafter sufficient to permit the pins n^3, to pass freely beneath, as the shaft a, is rotated. Conversely, assuming the spindle to have been moved bodily to the right as described, if the rotation of the shaft a, be stopped, and if it be rotated in an opposite direction to that indicated by arrow 25, the first pin n^3, which strikes the depending dog from the opposite or right-hand side, will first tip the dog on its pivot until it shall have reached the limit of its tipping movement, when it will thereafter move the dog and the spindle to which it is pivoted, bodily to the left, Fig. 3, until the dog clears the pins n^3, such movement of the spindle causing the insulated block m' to be moved to the left, carrying its contact strips m^2, m^3, beneath and in engagement with the contact springs m^4, m^5. The tipping movement of the dog n, when the latter has been moved into one or the other of its extreme positions is sufficient to permit the pins n^3, to pass freely beneath it; but a change in direction of movement of the said pins must necessarily move the dog bodily to its opposite extreme position before the tipping movement of the same will permit the pins to pass beneath it.

The contact arm e, and the armature carriers f^2, h^2, are electrically connected with the base of the instrument, through their bearings, while the fixed contacts h^3, h^4, and movable contacts e', e^2, are insulated from the base of the instrument, and referring to Fig. 10, the arrangement of circuits is as follows:—The contacts e', e^2, are connected respectively by wires 30, 31, with the fixed contacts h^3, h^4, on and insulated from the base of the transmitter, said contacts being in turn connected by wires 32, 33, with the transmitting magnets F, F′, said magnets being respectively connected by line-wires 34, 35, with the receiving magnets c, c', of the receiver represented in Fig. 6, which is of substantially the same construction as the receiver shown and described in my patent No. 474,771, dated May 10, 1892, to which reference may be had, like letters representing like parts, the said magnets being connected by a common return wire 36, which is connected with the contact strip or ring m^3, on the insulated block m', of the transmitter, the insulated ring m^2, on the said block being connected by a wire 37, with the fixed spring contact f^{17}, the circuit breaking lever f^{15}, being connected by wire 38 with the contact arm e at its pivotal point. The two outside spring contacts m^4, m^6, of the transmitter are connected together in circuit by a wire 39, both being connected with one pole of a battery or generator

G by a wire 40, the other pole of said generator being connected by wire 41 with the middle spring pen m^5.

Referring to Figs. 6 to 10 inclusive, S represents an electro magnet which is included in the common return line wire 36, the said magnet being of suitable or usual construction to respond to changes in the direction of the current in which it is placed. I have, however, herein represented a particular construction which is well adapted for this particular use, the projecting ends of the core s, of the magnet, being supported between the legs s' of an inverted U-shaped frame piece s^2, secured to the back piece of the receiver, the said legs also having pivoted between them by suitable pivot screws s^3, an armature piece s^4, to which are clamped by means of adjustable clamping plates s^5, the two U-shaped permanent magnets s^6, s^7, the ends or poles of the magnets lying at opposite sides of the projecting ends of the core of the magnet, so that according as the said magnet is energized by a current of one or another direction will one or another of the permanent magnets s^6, s^7, be attracted to its core and the other repelled therefrom to rock the armature piece s^4, on its pivots s^3, the said armature piece carrying by means of suitable rods s^8, an annunciator dial s^9, on which are printed the words "astern" and "ahead," one above the other, or words of the same or desired purport, one of which, as the annunciator is moved vertically by attraction of one or another of the permanent magnets s^6, s^7, will be displayed behind a suitable slit or opening s^{10}, in the dial plate of the receiver. The transmitter is also provided with a suitable annunciator t^3, Figs. 3 and 4, carrying words similar to those carried by the annunciator of the receiver, and which is supported by two arms t^2, on the rock shaft t, journaled in suitable posts t', standing out from the face plate E of the transmitter, one or another of the characters on the annunciator being displayed behind the opening t^4 in the face plate of the transmitter according as the said annunciator is moved into one or another position by rotation of the rock shaft. The rock shaft t, is actuated by the crank arm t^5, having a slot t^6, to receive a pin t^7, on the insulated block m' which, as the said block is moved to the right or to the left Fig. 3, to change the polarity of the line circuit, will rock the shaft t, and move the annunciator t^3, into one or another position to display the characters thereon behind the opening t^4.

With the insulated block m' to be in the position represented in Fig. 10, the operation of the system is as follows:—Assuming the shaft, the speed and direction of rotation of which is to be indicated and recorded, to be in rotation, and the pulley A connected with and rotated thereby, the rotative movement communicated to the shaft a, will cause the balls $i^\times$ of the governing device, Fig. 2, to be moved away from the axis of the shaft i^5 by centrifugal action, as indicated by dotted lines, and to move the sliding sleeve i^9 to the right a distance corresponding to the speed of rotation of the shaft, said sleeve being moved more or less according as the balls $i^\times$ are moved nearer to or farther away from the axis of rotation by the speed of the shaft. The sleeve i^9 as it is moved, acts through the arm i^{13} to rotate the arbor i^{14} and cause the contact arm e, on the outer end thereof to be moved to the left Figs. 3, 5 and 10, into engagement with the contact pin e^2, and close the circuit through that contact and the electro-magnet F' of the transmitter, and through the electro-magnet c' of the receiver, the circuit being traced as follows, reference being had to Fig. 10,:—From the generator G, by wire 40, spring pen m^4, contact ring m^2 on the block m', wire 37, spring f^{17}, circuit breaking lever f^{15}, wire 38, contact arm e, contact e^2, its arm, wire 31, contact h^4, transmitting magnet F', line wire 35, receiving magnet c' of the receiver, wire 36, through the polarized magnet S, line wire 36, contact ring m^3 on the block m' of the transmitter, spring pen m^5, and wire 41 to the opposite pole of the generator. The magnet F' of the transmitter being thus energized, will attract its auxiliary armature h', causing the arm 27 of its carrier to contact with the fixed contact h^4, to thus shunt out the contact arm e and contact e^2, and the imperfect engagement between the same, the current then passing from the wire 38 through the pivotal point of the contact arm e through the base of the instrument to the auxiliary armature carrier h^2, thence through its arm 27 to the contact h^4, permitting a strong current to flow through the transmitting magnet F', to attract its main armature f' and move the pallet f^4 to the left Fig. 4, causing its arm 7 to engage one of the teeth on the driving wheel e^{13} and move the latter one tooth in the direction of the arrow, such movement of the driving wheel rotating the staff e^9, in an opposite direction, as indicated, to thereby rotate the indicating pointer p thereon one step to the right to indicate a certain speed. As the pallet f^4, is moved to rotate the driving wheel e^{13}, it will act through one of the pins f^{10} to move the lever f^{12} and lift the circuit breaking lever f^{15} to break the circuit between it and its fixed spring f^{17}, permitting the main and auxiliary armatures of the transmitting magnet F' to resume their normal retracted positions, the arm 27 of the auxiliary armature carrier moving away from its contact h^4. The receiving magnet c', of the receiver is energized at the same time as the transmitting magnet F', said receiving magnet attracting its armature c^8 to move the pallet c^{10} to the left Fig. 6, and thereby cause rotation of the indicating pointer one notch to the right to indicate a certain speed. Thus the indicating pointer of the receiver and of the transmitter are moved together one step. As the staff e^9, of the transmitter is rotated to

turn the pointer, the cam e^8, on the inner end thereof is rotated with it, acting through the cam slot e^7, and the pin e^6, to move the contact carrier $e^\times$, to the left to move its contact pin e^2 away from and out of engagement with the contact arm e. The circuit having been broken by the circuit breaking lever f^{15}, if the speed of the shaft is such that the contact arm e, actuated by the movement of the governing balls, is caused to follow the movement of the contact e^2 away from it, and still maintain its engagement therewith, it will immediately close the circuit at that point as soon as it is broken by the current breaking lever f^{15}, the latter having resumed its normal position after having broken the circuit by reason of the return of the pallet f^4 to its central position when the circuit was broken, so that a second impulse will be sent through the transmitting magnet F' and receiving magnet c', to again attract their respective armatures and move their respective pointers a second step, to indicate an increased speed over that indicated by movement of the said pointer one step and in like manner the contact e^2 is moved another step forward and away from the contact arm e and the circuit is again broken by the circuit breaking lever f^{15}. Successive impulses are sent over the line in this manner, each impulse moving the indicating pointers of the transmitter and receiver one step to the right, until the contact e^2 has been moved by the cam slot e^7, such a distance that the contact arm e, actuated by the governing balls will not follow it, such indicating that the highest speed of the shaft has been reached, the indicating pointers of the transmitter and receiver having been moved by the successive impulses sent over the line into proper positions to indicate with relation to the proper dials that a certain speed has been reached in the rotation of the shaft, such speed being recorded by the receiver in the manner referred to in said Patent No. 474,771. The successive impulses sent over the line have all been of the same polarity and passing through the polarized magnet S, said impulses will cause the core of the said magnet to attract one or the other of the permanent magnets s^6, or s^7, as for instance the magnet s^6, to raise the annunciator s^9, so that the word "ahead" will be displayed through the opening in the dial of the receiver, thus showing that the rotation of the shaft is in a direction corresponding to the meaning of the word "ahead," this, taken in connection with the position of the indicating pointer of the receiver, showing the speed and direction of rotation of the shaft. If now the speed of the shaft should decrease, the governing balls will be drawn nearer their axis of rotation and will move the contact arm e, in the opposite direction into engagement with the contact e', in which case an impulse will be sent through the transmitting magnet F and through the receiving magnet c of the receiver, the circuit being then traced as follows:—From the generator G by wire 40, spring pen m^4, contact ring m^2 on the block m', wire 37, spring f^{17}, circuit breaking lever f^{15}, wire 38, contact arm e, contact e', wire 30, contact h^3, wire 32, transmitting magnet F, line wire 38, receiving magnet c, through the polarized magnet S, line wire 36, back to the contact ring m^3 on the block m', through the spring contact m^5, and wire 41 to the other pole of the generator, such impulse causing the transmitting magnet F to attract its auxiliary armature h, to bring the arm 26 of the auxiliary armature carrier into engagement with the contact h^3 to shunt out the contact arm e and its contact e' in the manner previously described, and permit the current from the battery to pass from the pivotal point of the contact arm e, through the base of the instrument and auxiliary armature carrier direct to the contact h^3, sending a strong impulse through the transmitting magnet F, causing it to attract its main armature f, to move the pallet f^4 to the right Fig. 4, and move the driving wheel e^{13}, and the staff e^9, in the directions opposite to that indicated by the arrows, to move the indicating pointer of the transmitter one step back toward its normal position to indicate that the speed has been reduced the number of revolutions represented by a movement of one step. The same impulse sent through the receiving magnet c of the receiver, will act to move the pointer of the receiver also one step back toward its normal position to indicate the reduced speed at that point, the said impulse being, however, of the same polarity as the impulses sent through the transmitting magnet F' and the receiving magnet c', the position of the annunciator controlled by the polarized magnet S not being changed. As the staff e^9, is rotated to move the indicating pointer of the transmitter one step back, the cam e^8 will move the contact carrier back toward its normal position one step to move the contact e' away from and out of engagement with the contact arm e, the circuit being broken as before also by the circuit breaking lever f^{15}. Should the speed of the rotation of the shaft a, continue to decrease, the further movement of the governing balls toward their axis of rotation will cause the contact arm e, to follow the movement of the contact e' away from it and to close the circuit at that point again as soon as it is broken by the circuit breaking lever f^{15}, thus sending a second impulse through the transmitting magnet F and the receiving magnet c, to move their respective pointers a second step back, to indicate the further reduction of speed. These successive impulses are sent through the transmitting magnet F and receiving magnet c so long as the speed continues to decrease, the pointers being moved at each impulse one step back toward their normal position, so that the position of the said pointers both of the receiver and transmitter will at all times indicate the true speed of rotation of

the shaft a. During all this time the pins n^3, on the disk n^4, which rotates with the shaft a, have passed freely beneath the pawl n, in the direction opposite to that indicated by the arrow 25, without moving the spindle m. If, however, the speed of rotation of the shaft a, should continue to decrease until it should stop, the indicating pointers of the transmitter and receiver would be moved back to their normal positions, indicating that the shaft was not in motion. If the shaft should be again rotated, but in a direction indicated by the arrow Fig. 3, the governing balls would move away from their axis of rotation in precisely the same manner as before, and would send the successive impulses through the transmitting magnet F′ and the receiving magnet c', to cause their indicating pointers to be moved to the right to indicate the gradual increase in speed in precisely the same manner as described when the shaft a, was rotating in the opposite direction. It is necessary, however, to be able to distinguish the difference in the direction of rotation of this shaft, and this is accomplished at the receiver by means of the electro magnet S, with the co-operation of the sliding block m' in the transmitter. As the direction of rotation of the shaft a, of the transmitter is changed to the direction indicated by the arrow 25, the pins n^3 on the disk n^4 striking the dog n, from the opposite side, will first tip the same on its pivot and then move the dog and the spindle to which it is pivoted, bodily to the right (Figs. 3 and 10), carrying the contact rings m^2, m^3, on the insulated block m' from engagement with the spring pens m^4, m^5, as in said figure into engagement with the spring pens m^5, m^6, so that the direction of the current now sent to the receiver and returning through the electro magnet S, will be reversed for by reference to Fig. 10, whereas when the shaft was rotating in the direction opposite to the arrow 25 Fig. 3, and the contact rings m^2, m^3, were in engagement with the pens m^4, m^5, the current from the battery G, leaving by wire 40, passed first through the ring m^2, wire 37, thence by wire 34 or 35 to the receiver, and back by wire 36 to the ring m^3 and pen m^5; now, with the position of the block m' changed, the current from the battery by wire 40 will pass through the pen m^6 and the ring m^3 through the wire 36, magnet S of the receiver, and back through either the wire 34 or 35, thus traversing the wire 36 in which the polarized relay is located, in a direction opposite to that in which it passed when the block m' was in its first position, reversing the polarity of the said magnet and causing it to repel the permanent magnet s^6, which it had previously attracted, and attract the magnet s^7, previously repelled. This change of position of the magnets s^6, s^7, due to a change in direction of the current traversing the electro magnet, causes the annunciator s^9, to be moved into its lowermost position to display the word "astern" or some word or sign of equivalent or desired purport, showing that the direction of rotation of the shaft is now opposite to the direction in which it rotated when the word "ahead" was displayed. Thus while the indicating pointer of the receiver always moves in the same direction to indicate increased speed, and always in the same direction to indicate a decreased speed, whether the rotation of the shaft a, be in one or the other direction, the particular direction in which the shaft is rotating will be indicated by the particular word or character displayed at the opening in the dial by the annunciator, such character being changed by the annunciator and polarized magnet whenever the direction of the current is changed, such polarity being changed whenever the direction of rotation is changed through the dog n, and the block m'. At the transmitter, the change in direction of rotation is in this present instance indicated by a purely mechanically-actuated annunciator, for as the insulated block m' carrying the contact rings m^2, m^3, is moved by the dog n, to change the direction of the circuit, to indicate the change in direction of rotation at the receiver, the pin t^7, on the said block will move the crank arm t^5, to turn the rock-shaft and move the annunciator either upwardly or downwardly, to display either "ahead" or "astern" or words or characters of like or desired purport, whichever should be displayed behind the opening t^4, to indicate the direction of rotation of the shaft.

Where the device is to be used at the point where the rotating shaft is located, as for instance, the shaft being in one room and the transmitter in an adjoining room, the transmitter may be used alone as a self-contained indicating device, it indicating the speed and direction of rotation of the shaft as described, and if desired in place of the mechanically actuated annunciator shown as applied to the transmitter, an electro magnet may be employed in precisely the manner in which such a magnet is employed in the receiver to indicate changes in the direction of rotation by means of a change in direction of an electric circuit, rather than by mechanical means.

This invention is not limited to the particular arrangement and construction of parts herein shown and described, for the same may be varied without departing from the spirit and scope of this invention. The pivot screws of the annunciators may be tightened sufficiently to prevent rebounding of the annunciators when moved into their different positions.

I claim—

1. A telemeter system containing the following instrumentalities, viz:—a rotating shaft; two transmitting magnets responsive respectively to increase and decrease in speed of rotation of said shaft; an indicating device controlled by said magnets, and an annunciator actuated by changes in the direction of rotation of the said shaft; substantially as described.

2. In a telemeter system, the combination of a rotating shaft, a contact arm moved by variations in the speed of rotation thereof, a movable contact, an electro-magnet, its armature, a speed indicating device actuated by movement of said armature, and an annunciator actuated by changes in the direction of rotation of said shaft, substantially as described.

3. In a telemeter system, the combination of a rotating shaft, a pin rotated thereby, a contact arm moved by variation in the speed of rotation of said shaft, two movable contacts, two electro-magnets, their armatures, and a speed indicating device actuated thereby, a movable spindle, a dog flexibly connected thereto, and adapted to be struck by said pin upon one or the other side according as the rotation of said shaft is in one or the other direction to move said spindle, and an annunciator actuated by said spindle, substantially as described.

4. The combination of a rotating shaft, a pin rotated thereby, a movable spindle having a dog adapted to be engaged by said pin to move the spindle whenever the direction of the rotation of the shaft is changed, and an annunciator actuated by said spindle, substantially as described.

5. The combination of a rotating shaft, a disk thereon carrying a pin, a longitudinally movable spindle *m*, a dog *n*, flexibly connected thereto, a rock-shaft *t*, actuated by said spindle, and an annunciator moved by said rock-shaft, substantially as described.

6. A rotating shaft, a pole changing device actuated by changes in the direction of rotation of said shaft, an electro magnet in circuit with the said pole changing device, and an annunciator actuated by said magnet, substantially as described.

7. A telemeter system containing the following instrumentalities, viz:—a rotating shaft; two transmitting magnets responsive respectively to increase and decrease in speed of rotation of said shaft; armatures for said transmitting magnets; two receiving magnets, the circuits through which are controlled by the said transmitting magnets; a speed indicating device actuated thereby; a device actuated by changes in the direction of the current through the said receiving magnets; and an annunciator controlled by changes in the direction of the currents; substantially as described.

8. A telemeter system containing the following instrumentalities, viz:—a rotating shaft; two transmitting magnets responsive respectively to increase and decrease in speed of rotation of said shaft; a pole changer actuated by changes in the direction of rotation of the said shaft; a polarized magnet; and an annunciator controlled thereby, substantially as described.

9. In a telemeter system, a rotating shaft, a contact arm moved by variations in the speed thereof, two movable contacts, two transmitting magnets, two receiving magnets in circuit therewith, and an indicating device actuated thereby, a polarized magnet in circuit with said receiving magnets, an annunciator actuated thereby, and a pole changing device for said magnet actuated by changes in the direction of rotation of said shaft, substantially as described.

10. In a telemeter system, a rotating shaft, an annunciator actuated by changes in the direction of rotation thereof, a contact arm moved by variations in the speed of said shaft, two movable contacts, two transmitting magnets, two receiving magnets in circuit therewith, and an indicating device actuated thereby, a polarized magnet in circuit with said receiving magnets, an annunciator actuated thereby, and a pole changing device for said magnet actuated by changes in the direction of rotation of said shaft, substantially as described.

11. A telemeter system containing a rotating shaft, a block *m'*, moved by changes in the direction of rotation thereof, and having two contacts, three co-operating spring pens therefor, a generator having one of its poles connected with the two outside pens, and its other pole connected with the middle pen, a contact arm moved by variations in the speed of said shaft and connected in circuit with one of the contacts on said block *m'*, two transmitting magnets, two receiving magnets in circuit therewith, and also with the other of the contacts on the block *m'*, a polarized magnet in circuit with the said receiving magnets, and an annunciator operated thereby, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FERNANDO J. DIBBLE.

Witnesses:
FREDERICK L. EMERY,
EMMA J. BENNETT.