No. 609,188. Patented Aug. 16, 1898.

W. KINGSLAND.

ELECTRICAL TRACTION.

(Application filed Dec. 23, 1897.)

(No Model.) 4 Sheets—Sheet I.

FIG: 1.

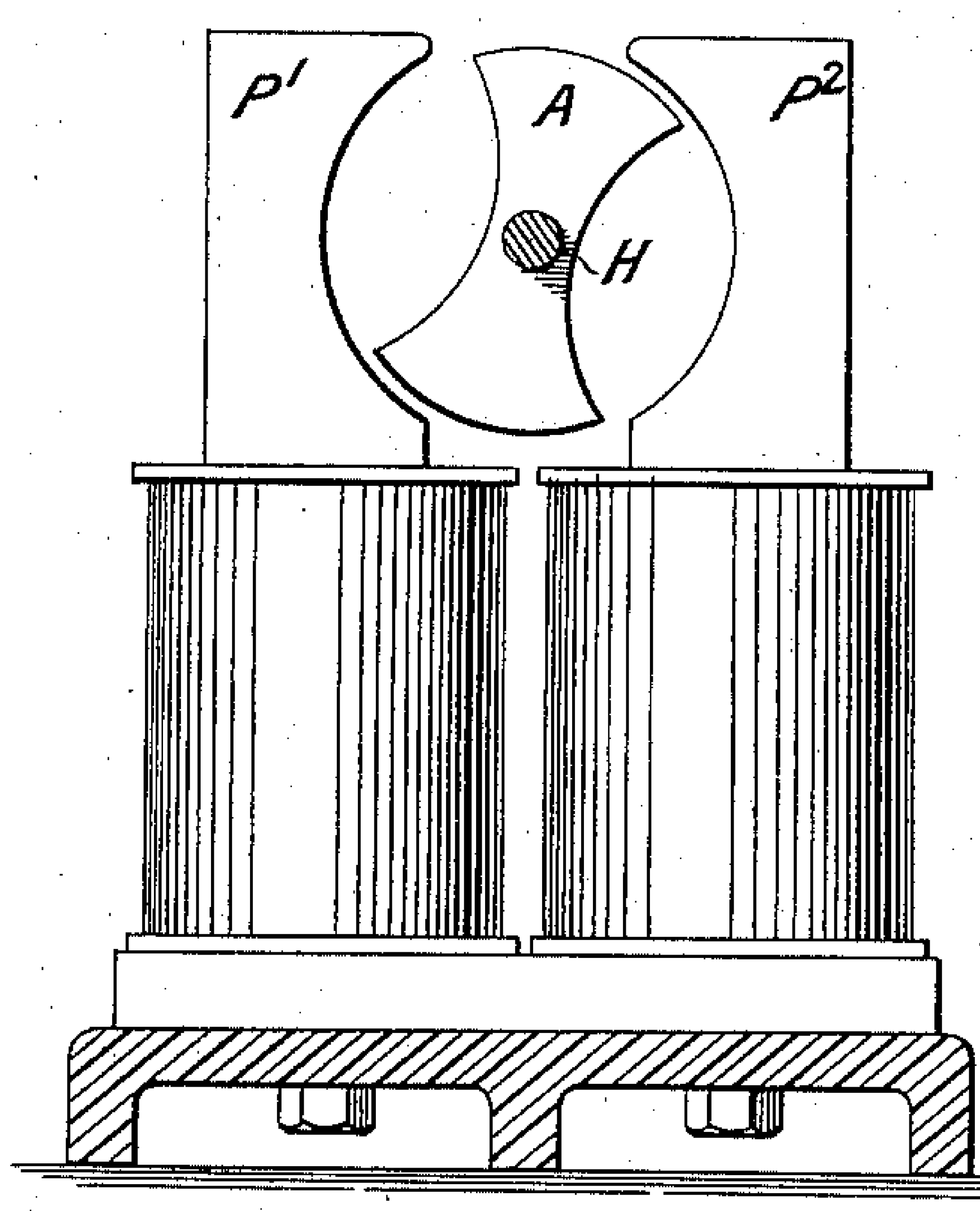



FIG: 3.

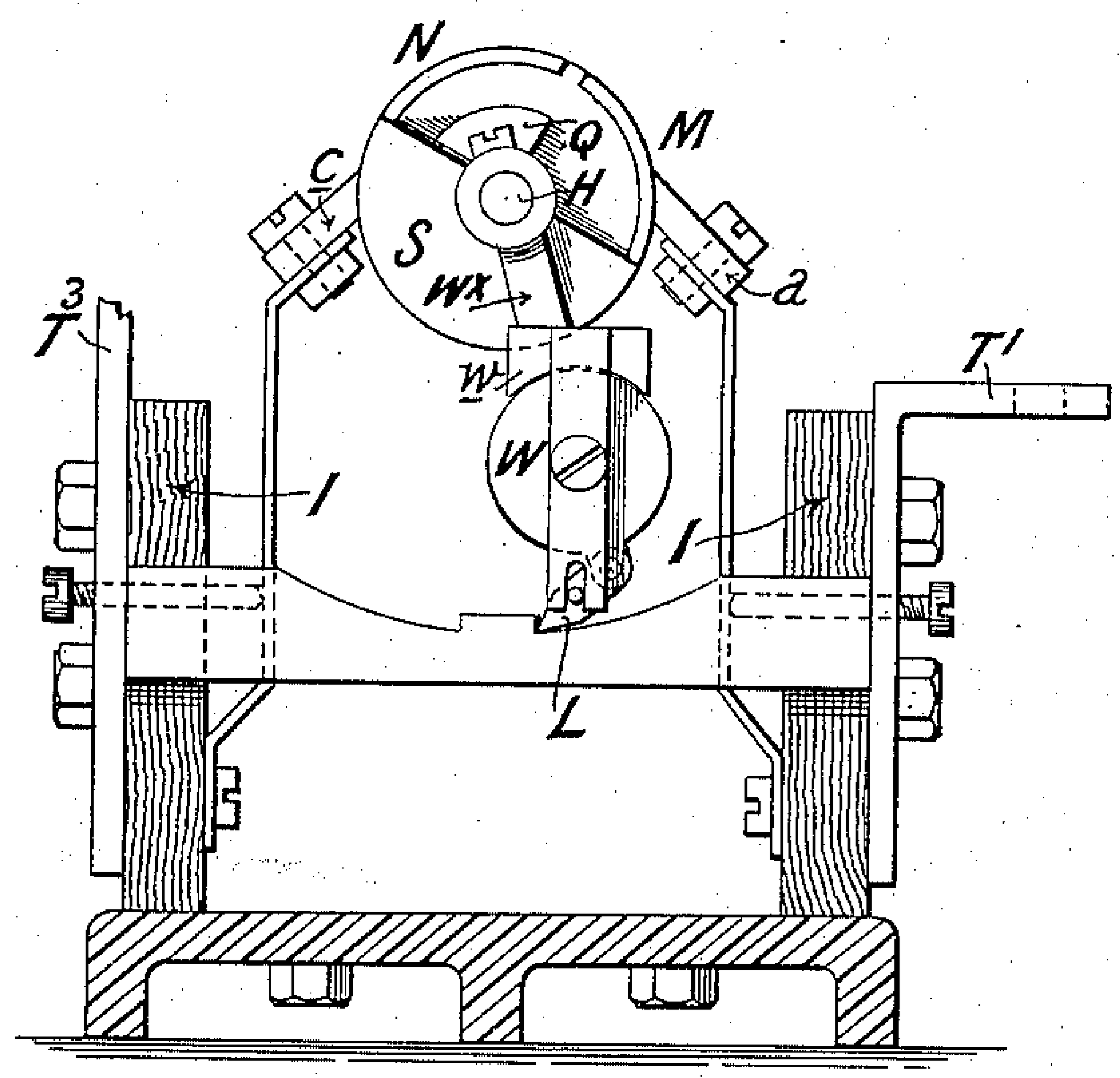
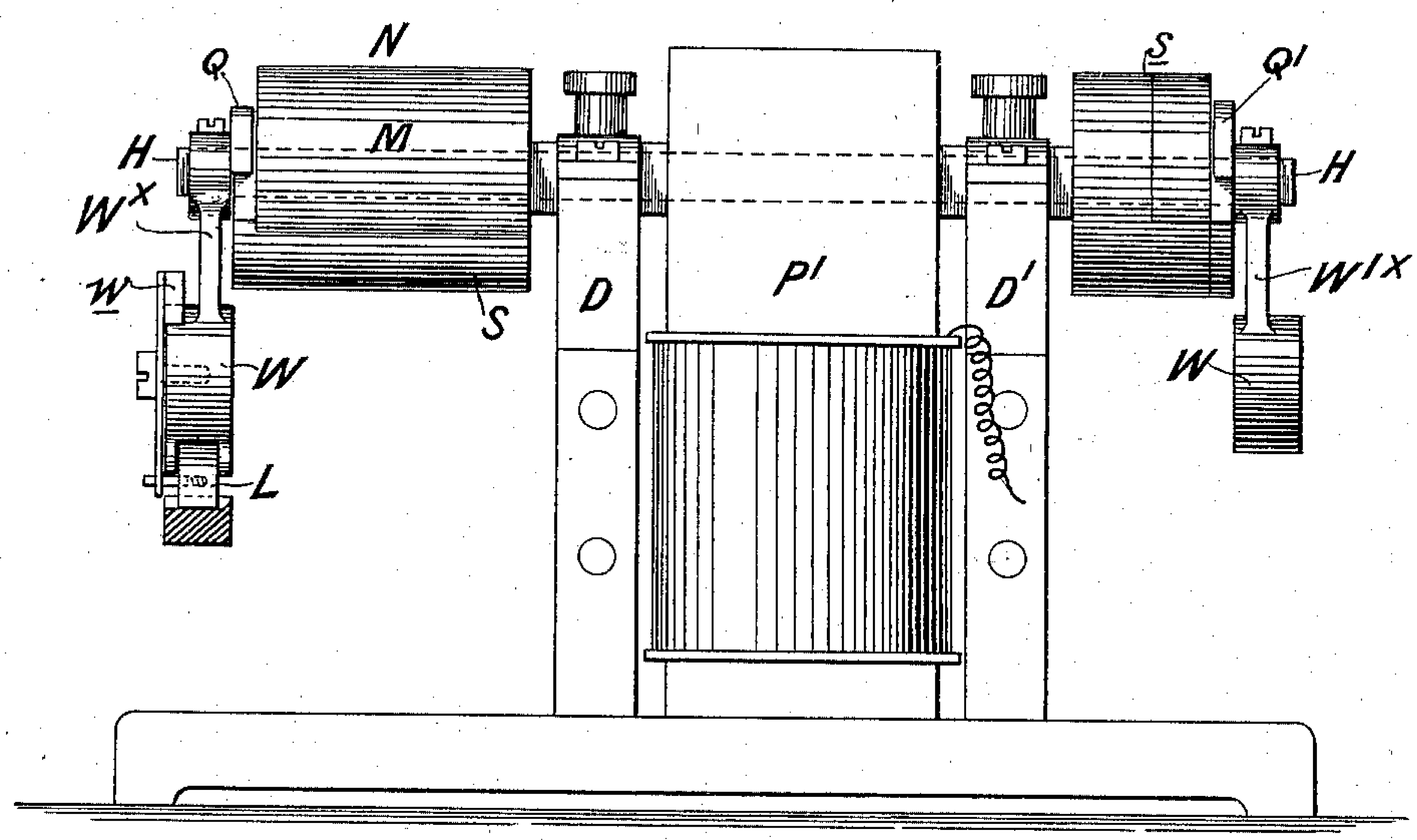



FIG: 2.

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4 Sheets—Sheet 2.

FIG: 4.

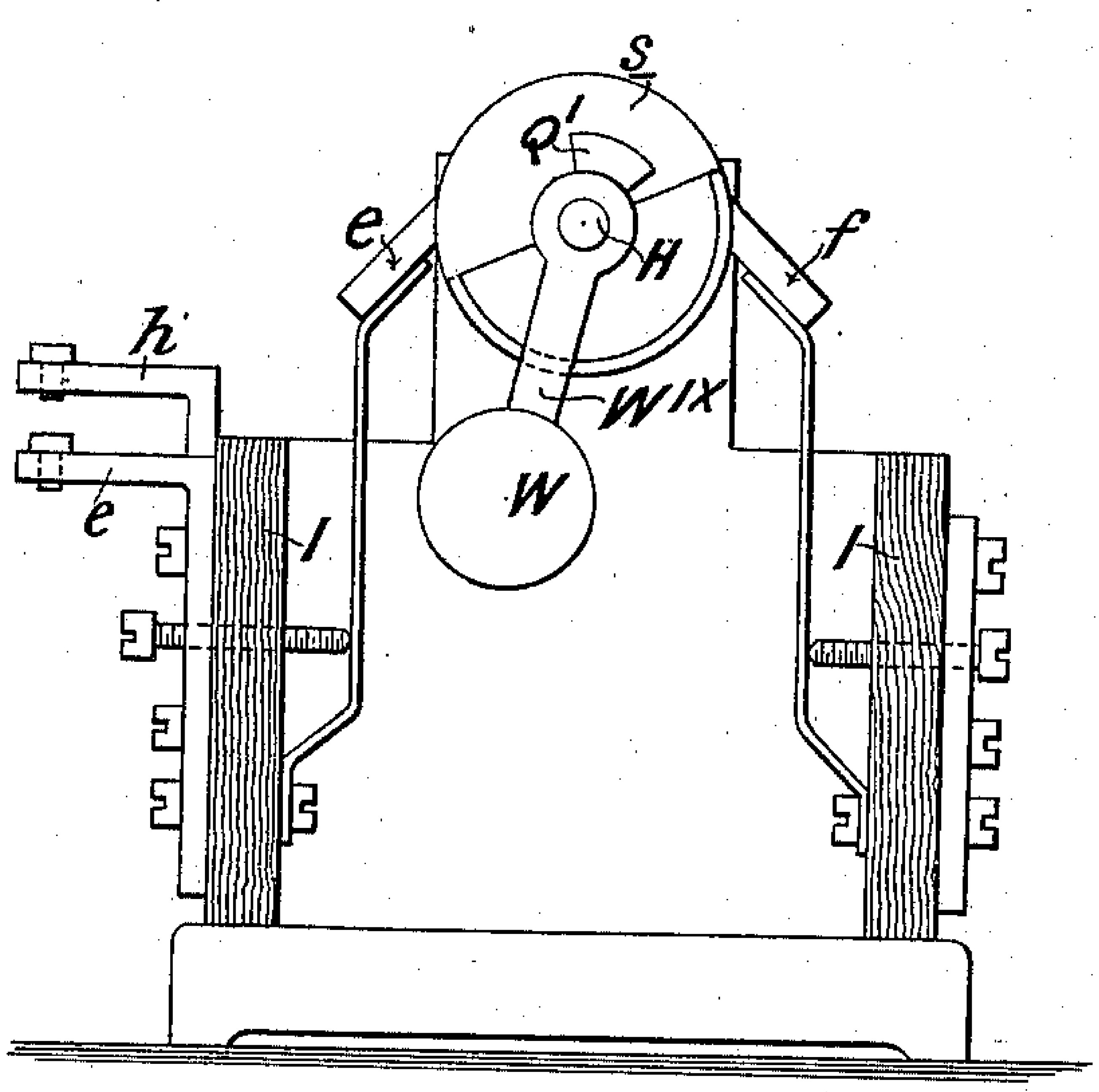



FIG: 7.

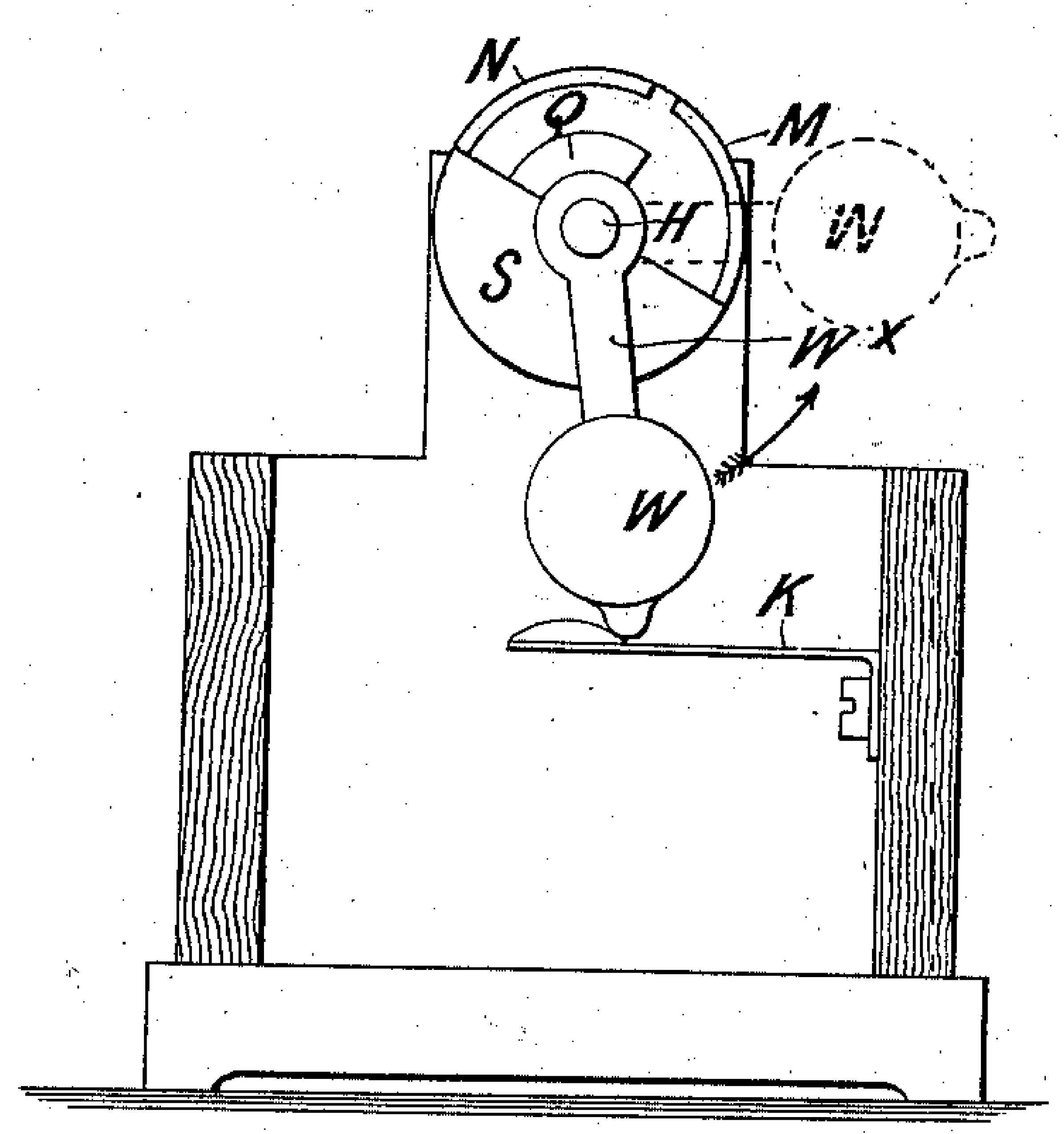
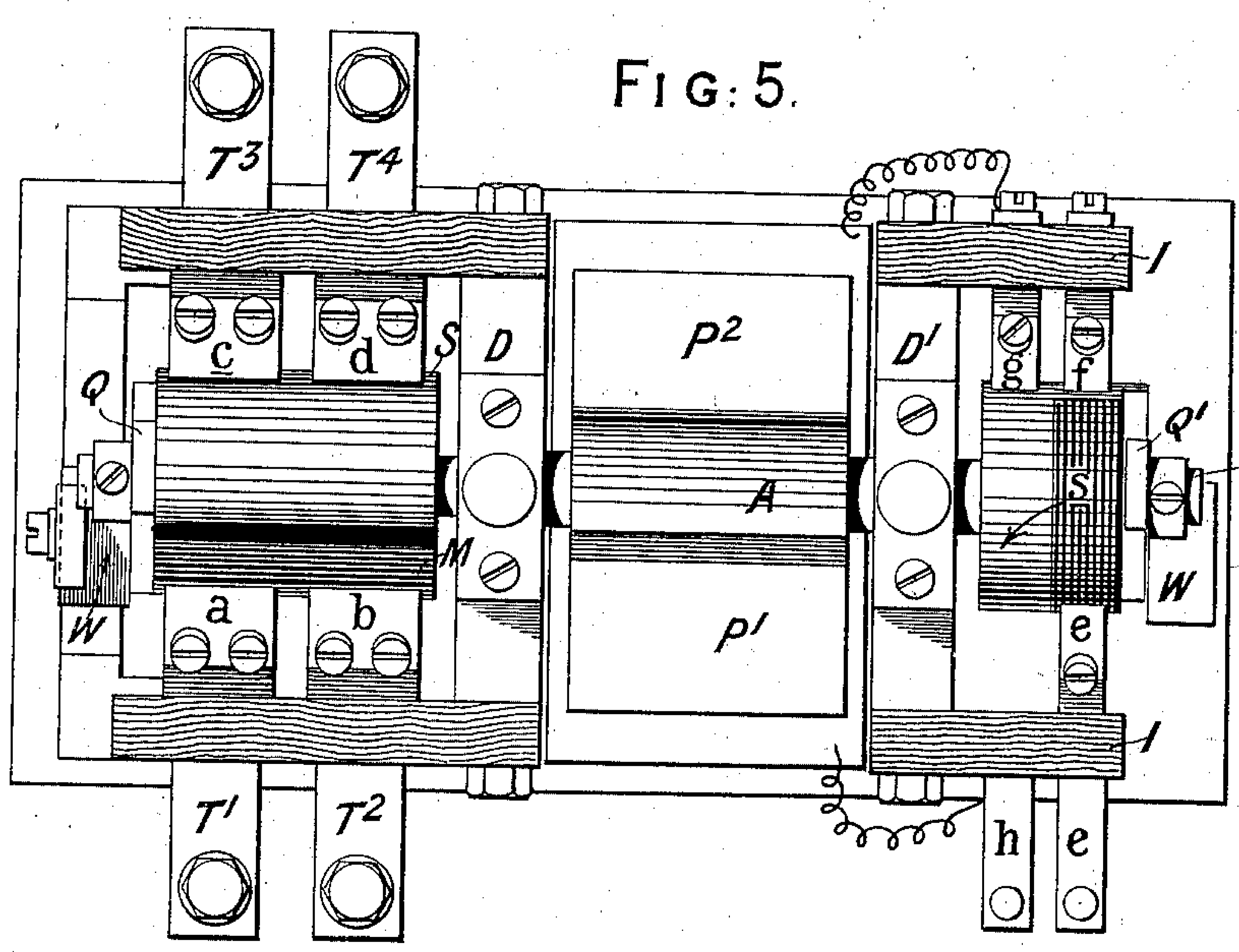



FIG: 5.

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4 Sheets—Sheet 3.

FIG: 6.

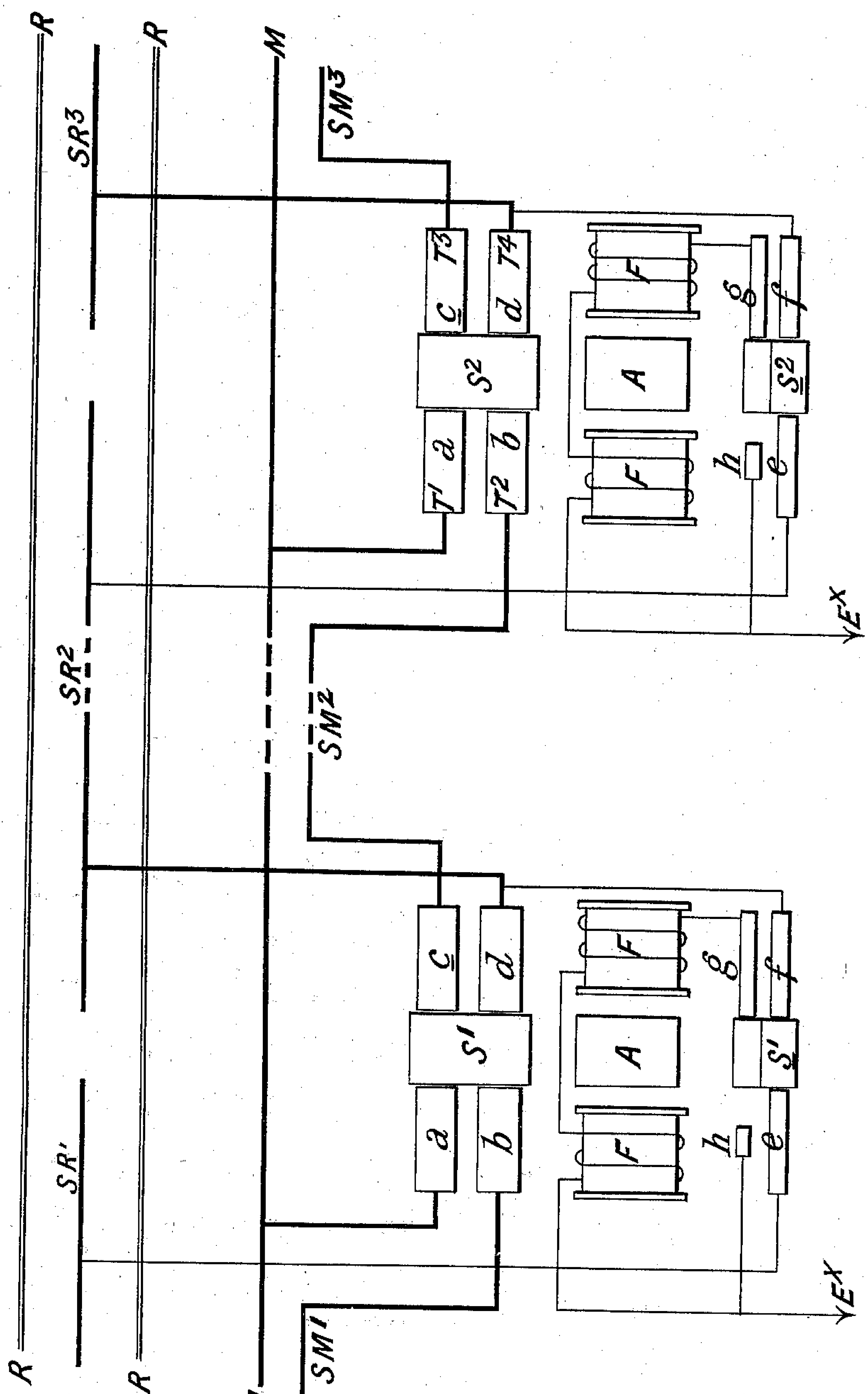


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FIG: 8.

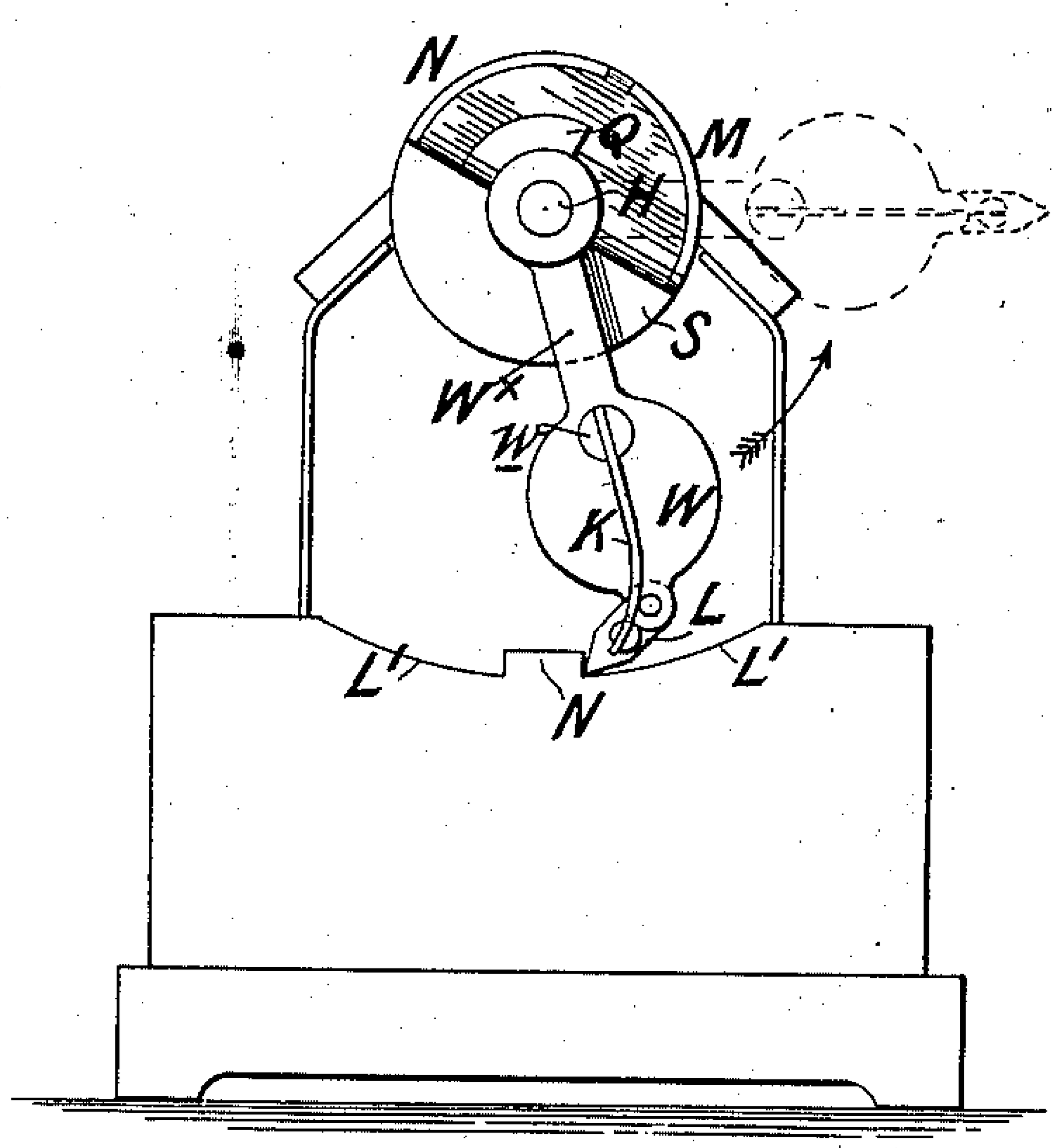



FIG: 9.

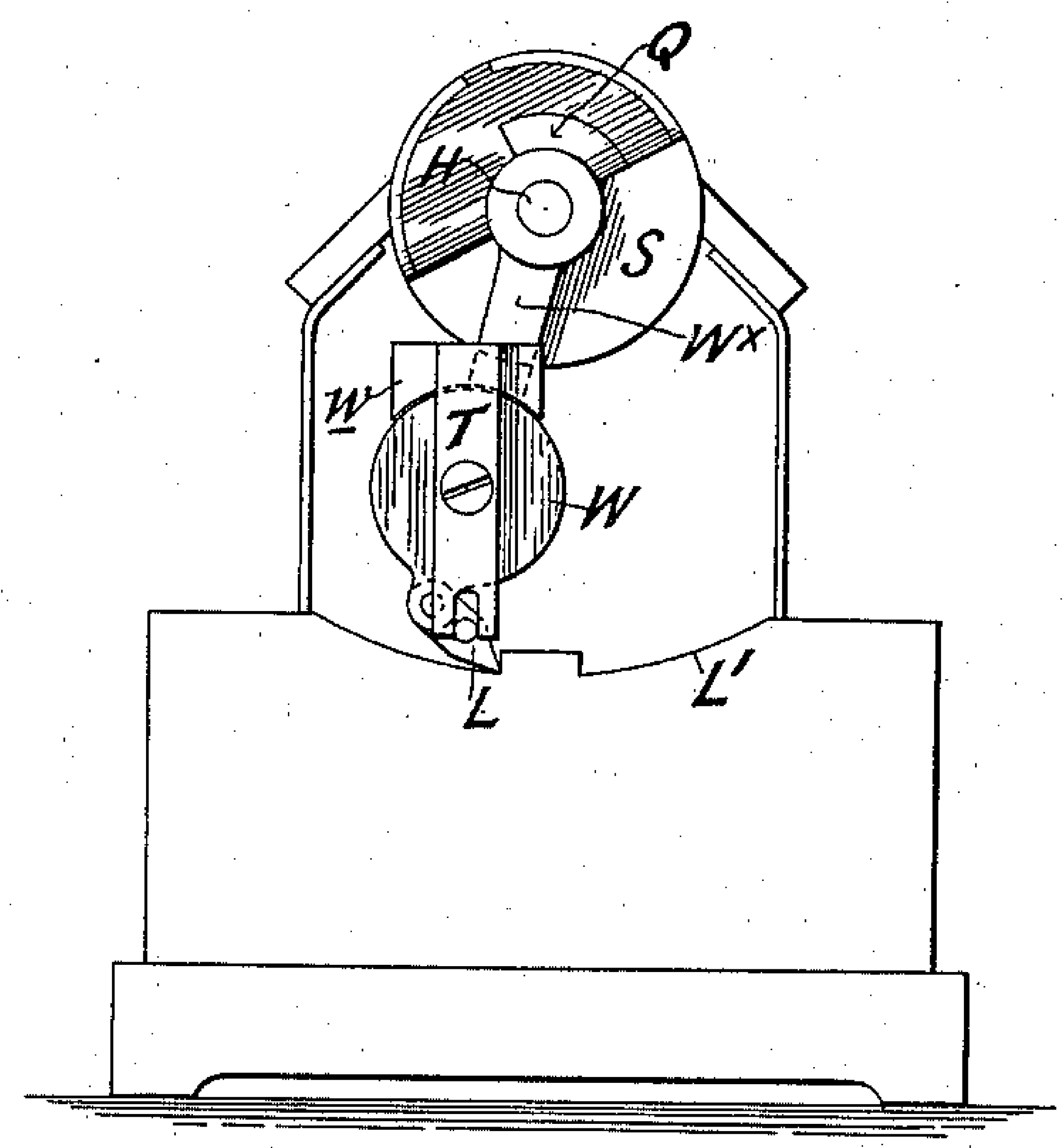



FIG: 10.

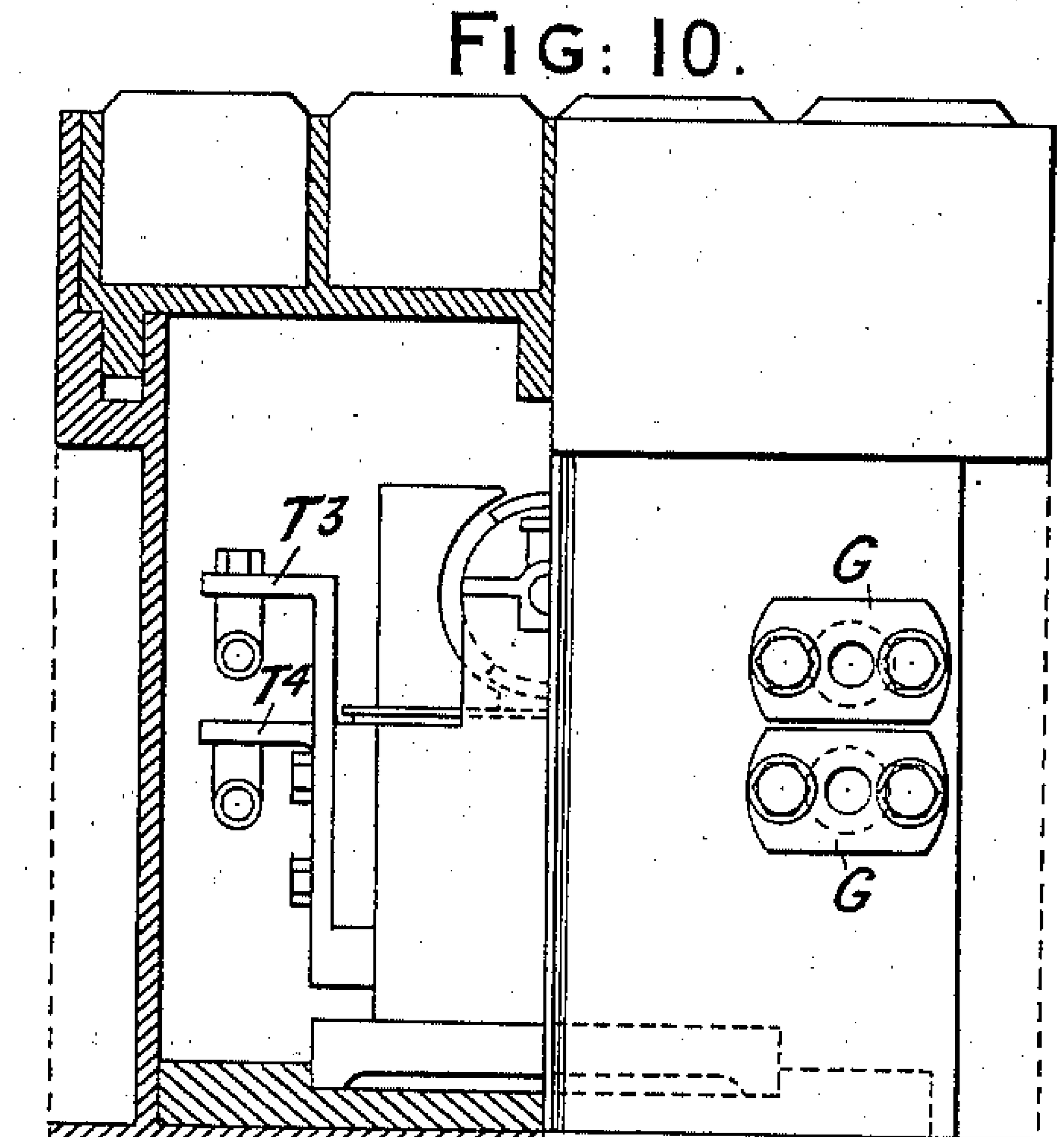
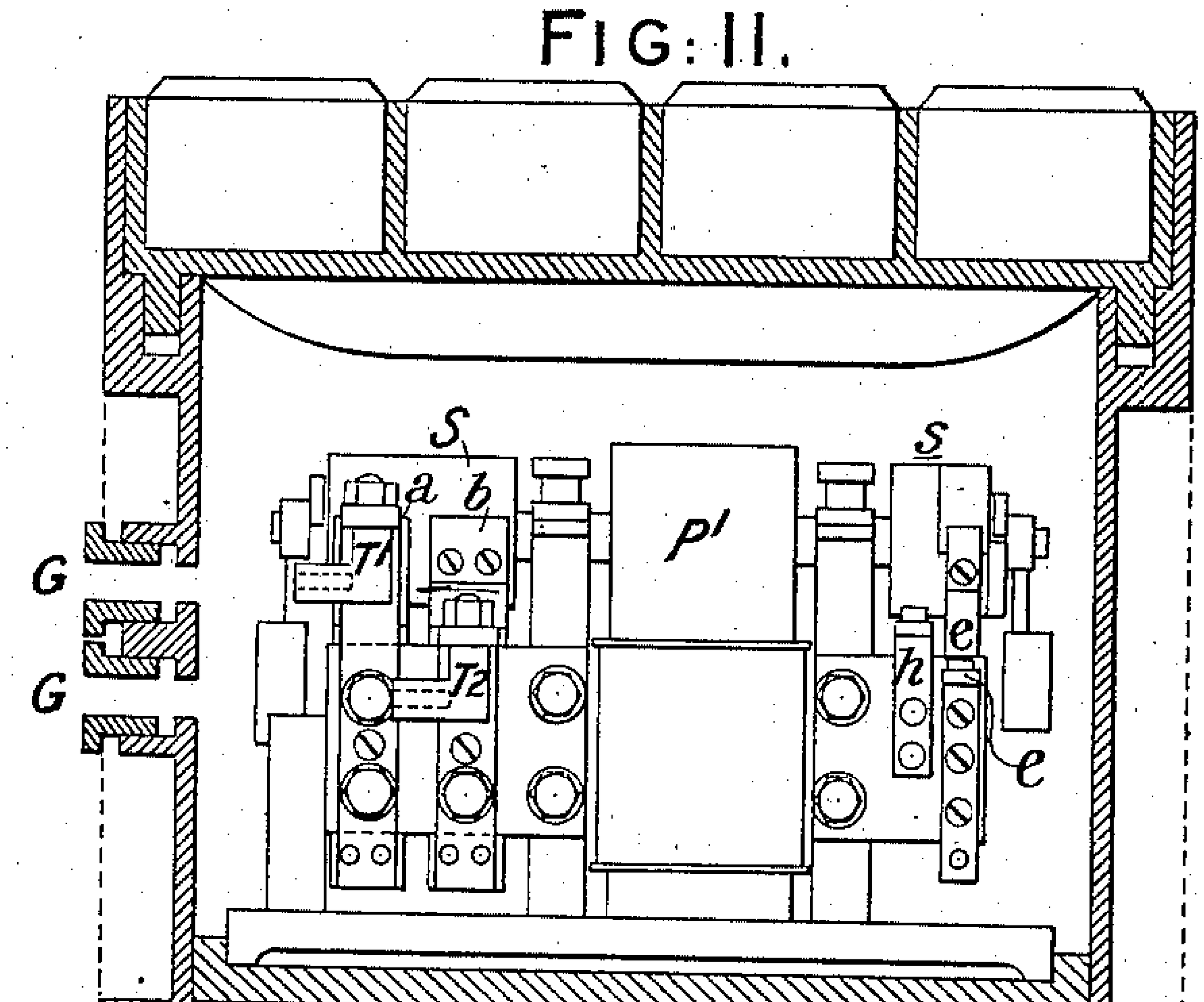



FIG: 11.



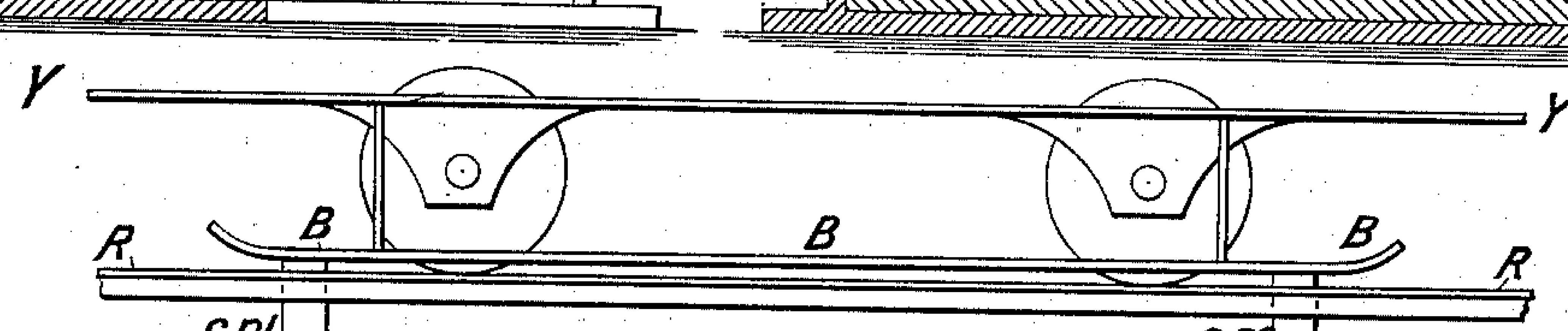




FIG: 12.

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# UNITED STATES PATENT OFFICE.

WILLIAM KINGSLAND, OF LLANDUDNO, ENGLAND.

## ELECTRICAL TRACTION.

SPECIFICATION forming part of Letters Patent No. 609,188, dated August 16, 1898.

Application filed December 23, 1897. Serial No. 663,161. (No model.) Patented in England May 21, 1896, No. 10,906.

*To all whom it may concern:*

Be it known that I, WILLIAM KINGSLAND, a subject of the Queen of Great Britain, residing at Llandudno, county of Carnarvon, England, have invented certain new and useful Improvements in Electrical Traction, (for which I have obtained Letters Patent in Great Britain, No. 10,906, dated May 21, 1896,) of which the following is a specification.

In electric traction where the electrical current is conveyed from a main conductor to the moving vehicle it is often advantageous to use sectional working conductors, rails, or studs, from which the current is immediately conveyed to the moving vehicle by means of some rubbing contact or collector carried by the vehicle. It is also advantageous that these sectional working conductors, rails, or studs should be connected and disconnected successively to and from the main conductors as the vehicle passes along.

In the specification of a prior United States patent granted to myself, No. 592,056, dated October 19, 1897, I have described novel means whereby this may be effected in an improved manner by the employment of a number of sectional auxiliary conductors, there being one such for every sectional working conductor, from which latter the vehicle directly collects the current. It is through a sectional auxiliary conductor that the current is passed from the main conductor to a sectional working conductor, and switches or commutators were provided at each end of each sectional auxiliary conductor, by which the latter was connected or disconnected to or from the main conductor or the sectional working conductor. These switches or commutators, as described in the aforesaid specification, were operated by the passing vehicle striking levers or arms in connection with the said commutators or switches.

Now my present invention refers to improved means whereby each of my sectional auxiliary conductors may be either connected to or disconnected from the main conductor or from its corresponding sectional working conductor, such means being brought into effect by the automatic action of the current as the vehicle passes from one sectional working conductor to another.

The apparatus I employ with the above object is illustrated at Figures 1 to 12, Fig. 1 being a sectional end elevation, showing an electromagnet and armature included in the said apparatus; Fig. 2, a side elevation of the apparatus with the contact-brushes and connections removed. Fig. 3 is a sectional end elevation showing the main commutator and contacts. Fig. 4 is an elevation of the opposite end of the apparatus, showing a second and smaller commutator and contacts. Fig. 5 is a plan view of the apparatus. Fig. 6 is a diagrammatic representation of the apparatus and the various connections. Fig. 7 shows a device whereby the armature is caused to operate in the right direction, and Figs. 8 and 9 are similar views of varied constructions. Fig. 10 is an end sectional elevation, and Fig. 11 a side sectional elevation, of a cast-iron road-box to contain the apparatus; and Fig. 12 shows adjacent studs with which a bar carried by the vehicle comes into contact.

According to my invention and with special reference to Figs. 1 to 6, the apparatus consists of an electromagnet with two pole-pieces $P'$ $P^2$, between which is a soft-iron armature A, rigidly attached to the spindle H and supported by pillars and bearings D D', in which it is free to turn. At one end of the spindle is what I call the "main commutator-switch" S, which is free to turn independently on the spindle H and is controlled by the quadrant-shaped piece Q, formed upon the boss of a pendent arm $W^{\times}$, fixed upon the spindle H. The upper half of the cylindrical end of the main commutator S is cut away, (see Fig. 3,) and the projecting piece Q when the arm $W^{\times}$ is rocked engages the uncut portion of the commutator S and gives same a partial turn. Fixed to the lower end of the pendent arm $W^{\times}$ is also the counterweight W, which normally keeps the spindle H and armature A in one particular position.

The main commutator-switch S consists of a cylinder of insulating material on which are fixed two metal plates M N, Figs. 2 and 3, which cover approximately one-half of the cylinder, with a small space between the two, so that they are insulated from each other.

The main commutator-switch S is in contact with four contact brushes or springs *a b c d*, Figs. 3 and 5, connected, respectively, with the main conductor M, (see Fig. 6,) the two adjacent ends of two sectional auxiliary conductors S M′ S $M^2$, and with one sectional working conductor—say S $R^2$—as shown in Fig. 6. The whole of the connections are supported by insulating material I I, Fig. 3, which is firmly bolted to the frame or base of the apparatus. The contact-brushes *a b c d* are connected with the four terminals T′ $T^2$ $T^3$ $T^4$, arranged to take the ends of the cables or conductors.

At the opposite end of the spindle H and free to turn thereon is a smaller commutator-switch S, Figs. 2, 4, and 5, operated in the same manner—by a quadrant-shaped piece Q′ and pendent weighted arm W′×—and at the same time as the main commutator-switch S. The metal plates on this smaller commutator S, however, differ from those on the main commutator S, in that the insulating-cylinder S is entirely covered with metal, as at Figs. 2, 4, and 5, with the exception of the upper half of, say, the end portion. There are three springs or brushes making contact with this smaller commutator S, one, which I will call *g*, being in contact with that part of the commutator which is covered with metal all around, and this will always be in electrical connection with it, while the other two brushes *e* and *f* are arranged so as to make contact alternately, as the switch is turned to the right or to the left, and the contact is broken with one just before it is made with the other. The action of the small commutator S will be to place one or other of the brushes *e* or *f* in metallic connection with the brush which I have called *g*. This small commutator S serves to control the action of the electromagnet in the following manner: One end of the circuit on the field-magnet, Figs. 5 and 6, is permanently connected to the contact-brush *g* and the other end to earth or to the return-conductor. The contact-brushes *e* and *f* are connected to the sectional working conductors—say S R′, S $R^2$—on either side of the apparatus. Consequently a current applied to either of the said sectional working conductors will find its way to earth through the electromagnet, provided the small commutator S is in the right position. Let it be supposed that in Fig. 6 a vehicle is passing over sectional working conductors S R′ and is about to enter sectional working conductor S $R^2$. As the vehicle is traveling over S R′ this sectional working conductor will be in connection with the main conductor M through the main commutator S′ and the contacts *a* and *b*. When, therefore, the collector on the vehicle makes contact with the sectional working conductor S $R^2$, which it does before leaving S R′, the current will flow from S R′ to S $R^2$ through the said collector, and from S $R^2$ it will pass to the contact-brush *f* of the small commutator and thence through the field-magnets F to earth. The effect of this will be to act upon the armature A of the electromagnet and turn the spindle H, which latter by its attached sector-shaped parts Q Q′ will operate the large and the small commutators simultaneously, so that the contacts will be changed, *a b* of the commutator S′ being insulated and *c d* connected, while *f* is insulated from *g*, and *e* is connected thereto. If *a* and *b* of the switch $S^2$, Fig. 6, of the next apparatus are already connected, then the vehicle can collect the current from sectional working conductor S R′; but if the switch $S^2$ should have been turned in the opposite direction by reason of the previous passage of a vehicle in the same direction then at the moment that the collector makes contact from sectional working conductors S R′ to S $R^2$ a current will flow through contact *e* of the small commutator $S^2$, Fig. 6, and, operating the electromagnet, will alter the connection of the main commutator $S^2$ from *c d* to *a b*, and so, in conjunction with the contacts *c d* of the switch S′ of the first apparatus, Fig. 6, will permit the vehicle to collect the current from the sectional rail S $R^2$. With this form of apparatus I may employ two circuits on the electromagnet and a polarized armature in order to turn the commutator-switches in the proper direction; but instead of doing this I use one circuit only and a soft-iron armature, as in the example described, and I cause the soft-iron armature to work in the right direction by the following device: If the armature is exactly perpendicular between the poles of the magnet, it will not be attracted either way when the magnet is energized, as the pull will be equal in either direction; but if it is slightly out of the perpendicular it will be immediately attracted when the magnet is energized to that side to which it is turned. In order to effect this, I fix underneath the depending counterweighted arm W×, Fig. 7, a spring K, which presses against the under side of the arm and which may have a slightly-raised projection or catch to engage therewith. When the armature A is attracted, the arm W× and counterweight W will be raised in the direction of the arrow to a horizontal position, and when it is liberated its momentum will carry it slightly beyond the vertical position and over the raised projection on the spring K, and it will be prevented from returning to the vertical position by the action of the spring K. It will therefore remain normally slightly out of the perpendicular on the one side or the other, and the armature A will also be in this position. Therefore the next time the electromagnet receives a current the armature will be attracted in the proper direction. Instead of employing a spring K as in Fig. 7 I may use a spring K to control a small hinged catch L, depending from the under side of the counterweighted arm, as in Fig. 8. The catch engages with a fixed guide-plate L′, curved so as to control the motion of the catch for some distance on each side of the center. At the center is a projecting plate N, which acts as a stop. If the counterweight

W is descending from, say, the left-hand side, the momentum will carry it beyond the vertical position and the catch L will ride over the projection N and will prevent the counterweight from returning to the vertical position. When the armature A is attracted, the arm $W^{\times}$ and counterweight W will be raised in the direction of the arrow to the horizontal position shown by dotted lines in Fig. 8, in which position the spring K causes the catch L to assume a position in line with the arm $W^{\times}$. When the parts are liberated, the momentum will carry them slightly beyond the vertical position and in the descent turn the catch L in the opposite direction, which will prevent the parts returning to the aforesaid vertical position. The operation of the catch L is alike with reference to Figs. 3, 8, and 9. The spring K serves to steady the motion of the catch L, when not controlled by the guide-plate L'. Instead of using a spring to steady the motion of the catch, I may employ a small counterweighted arm, as in Fig. 9, where T is a short arm pivoted at the center to the weight W and at the bottom end having a slot which engages a pin fixed to the catch L. At the top of the arm is a small counterweight W.

Figs. 10 and 11 show an end elevation and side elevation, respectively, of the apparatus in a cast-iron road-box. The main cables pass in through the water-tight glands G G and are connected to the terminals $T'$ $T^2$ $T^3$ $T^4$ in such a manner that on disconnecting them the whole apparatus can be lifted out of the box for inspection. Similar glands may also be provided for the earth connection *h*, Fig. 6, and for the wire from the sectional working conductor, which is connected with the terminal *e*, or the containing-box may be permanently connected to earth and a connection made between the box and the terminal *h*. The terminal *f*, Fig. 6, makes a local connection with the contact-brush *d*, which is permanently in connection with one of the sectional working conductors.

Instead of making the sectional working conductors of some considerable length they may obviously be mere contact-studs raised slightly above the level of the roadway at a distance apart approximating to the length of a vehicle. The vehicle will then carry a metal shoe or contact-bar, which will slide over the studs, making contact with one before it leaves the other, as shown at Fig. 12, where R is one of the rails on which the vehicle runs. S R' S $R^2$ are two of the contact-studs, and B is the contact-bar, depending from the frame Y of the vehicle.

I claim—

1. In electrical traction, the combination with a continuous main electrical conductor, sectional working conductors from which the motor-car directly collects the current, and a number of sectional auxiliary conductors, one such for every sectional working conductor, and through which auxiliary sectional conductor the current is passed from the main conductor to the sectional working conductor aforesaid; of means whereby each sectional auxiliary conductor can be either connected to or disconnected from the main electrical conductor, or to or from a corresponding sectional working conductor and an electromagnetic switch operated by the automatic action of the electric current as the motor-car passes from one of the sectional working conductors to another, as set forth.

2. In electrical traction, the combination with a continuous main electrical conductor, sectional working conductors from which the motor-car directly collects the current, and a number of sectional auxiliary conductors, one such for every sectional working conductor, and through which auxiliary sectional conductor the current is passed from the main conductor to the sectional working conductor aforesaid; of commutator-switches situated at each end of the sectional auxiliary conductors, and a device for automatically operating the commutator-switches by means of electromagnets having soft-iron armatures fixed on rocking shafts, mechanism for retaining the armatures normally in one or other of two positions so long as the magnets are not energized by a current of electricity, and mechanism whereby the movement of the rocking shaft is communicated to the commutator-switch, as set forth.

3. In electrical traction, the combination with a continuous main electrical conductor, sectional working conductors from which the motor-car directly collects the current, a number of sectional auxiliary conductors, one such for every sectional working conductor, and through which auxiliary sectional conductors the current is passed from the main conductor to the sectional working conductors, commutator-switches situated at each end of the sectional auxiliary conductors and electromagnets having soft-iron armatures fixed on rocking shafts whereby the commutator-switches are operated; of auxiliary commutator-switches, one such for each electromagnet, also operated by the rocking shaft to control the action of the electromagnet by connecting it with one or other of two adjacent sectional working conductors whereby the electromagnets may be energized by a current coming from one or other of two adjacent sectional working conductors, as set forth.

4. In electrical traction, the combination with a continuous main electrical conductor, sectional working conductors from which the motor-car collects the current, a sectional auxiliary conductor for each working conductor, through which the current is passed to the corresponding working conductor, a cylindrical commutator-switch located between adjacent ends of the sectional auxiliary conductors, contact-brushes for the commutator-switch, and metal conducting-plates thereon, whereby in one position thereof the main

conductor is connected with a sectional auxiliary conductor, and in the other position the latter conductors are disconnected, and the next sectional auxiliary conductor is connected with its corresponding sectional working conductor; of an electromagnet with two pole-pieces, a soft-iron armature located between the pole-pieces, a rock-shaft to carry the armature, an auxiliary commutator-switch to electrically connect the magnet-coils with either one or other of adjacent sectional working conductors, and means for partially rotating the main commutator-switch and auxiliary commutator-switch by the motion given to the shaft, as set forth.

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