No. 680,316. Patented Aug. 13, 1901.

F. R. M. CUTCHEON.

TIMED ELECTRIC SWITCH FOR MULTIPLE RATE METER SYSTEMS.

(Application filed Mar. 29, 1901.)

(No Model.)

6 Sheets—Sheet 1.

Fig. 1.

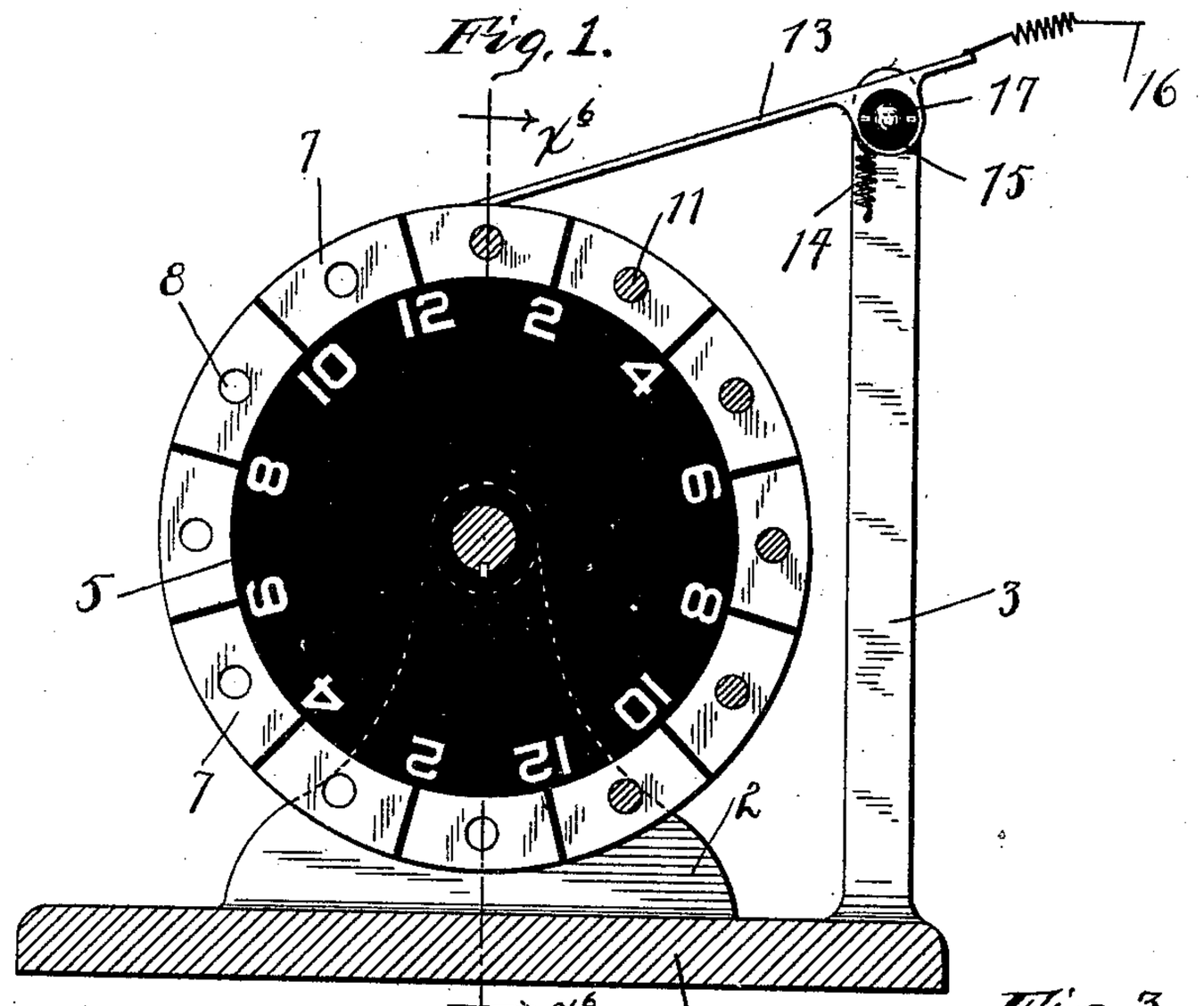

Fig. 2.

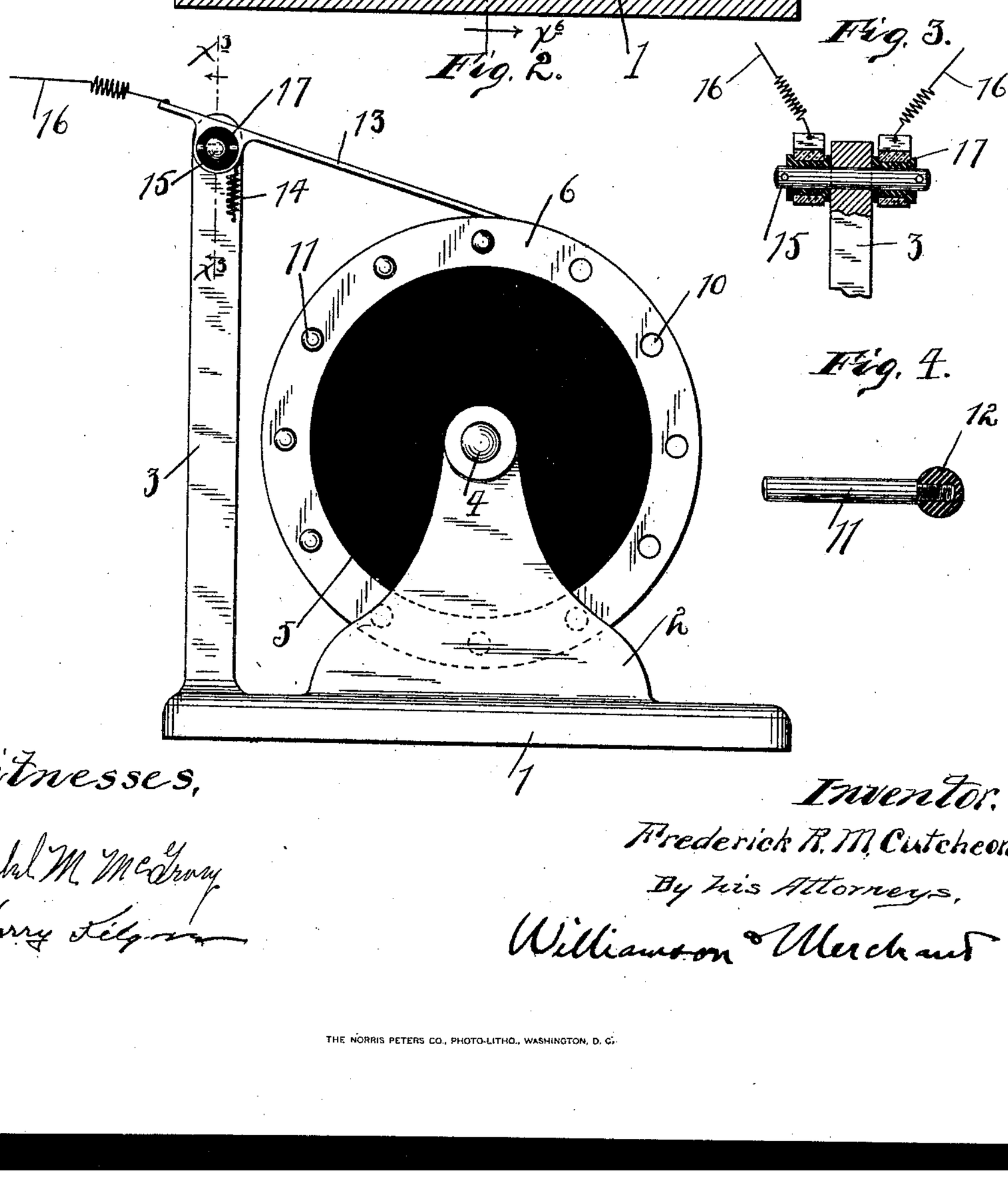

Fig. 3.

Fig. 4.

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Fig. 5.

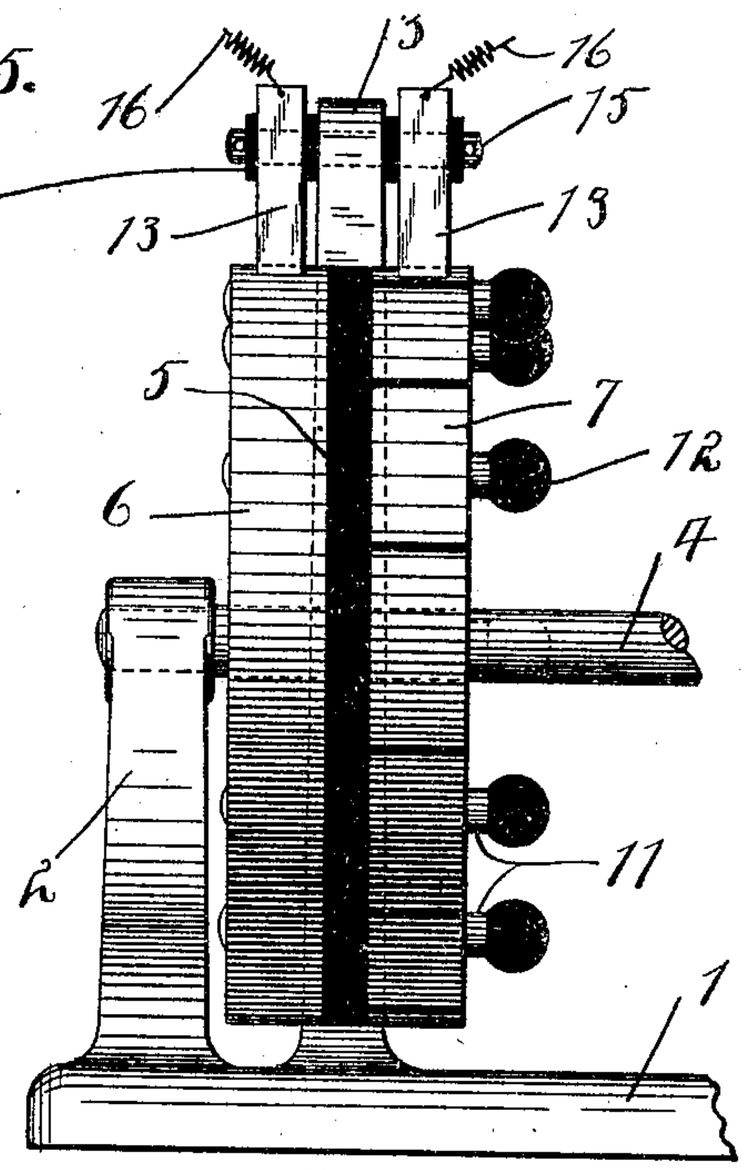

Fig. 6.

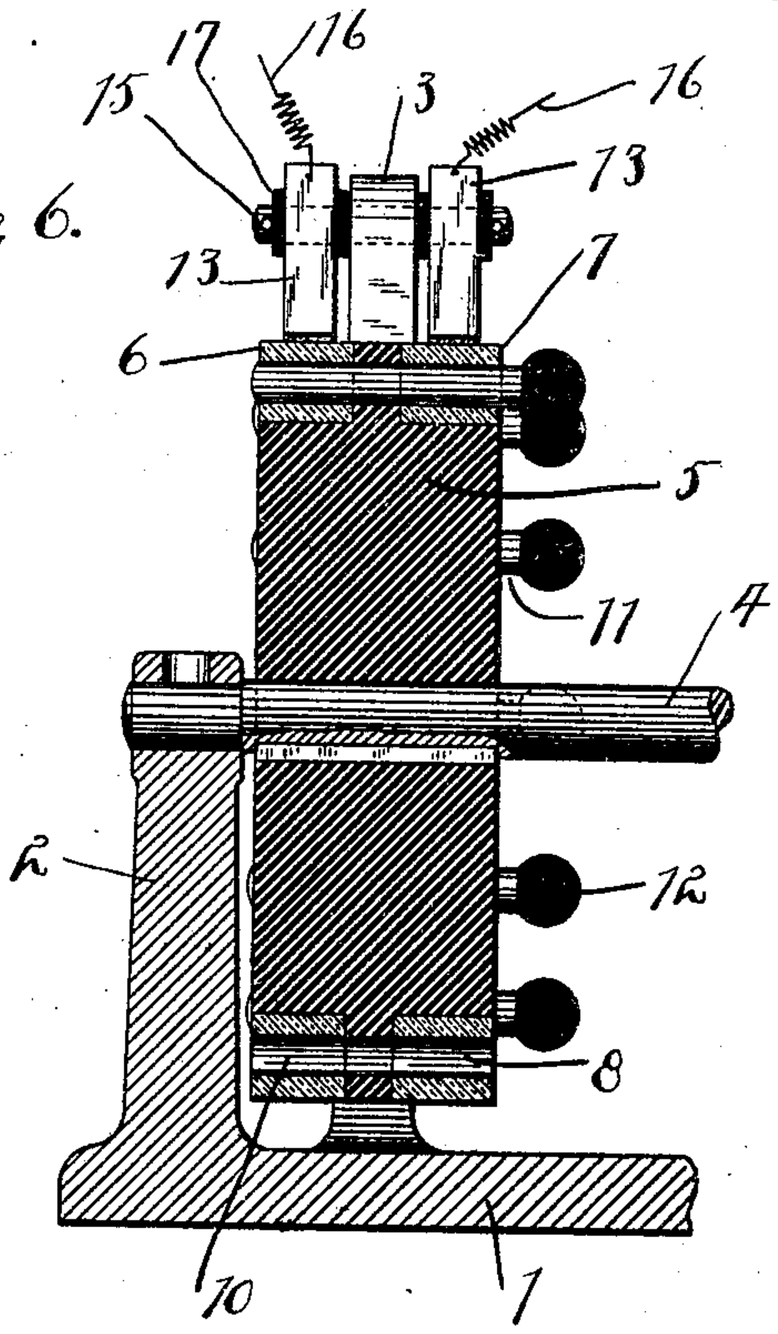

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Fig. 7.

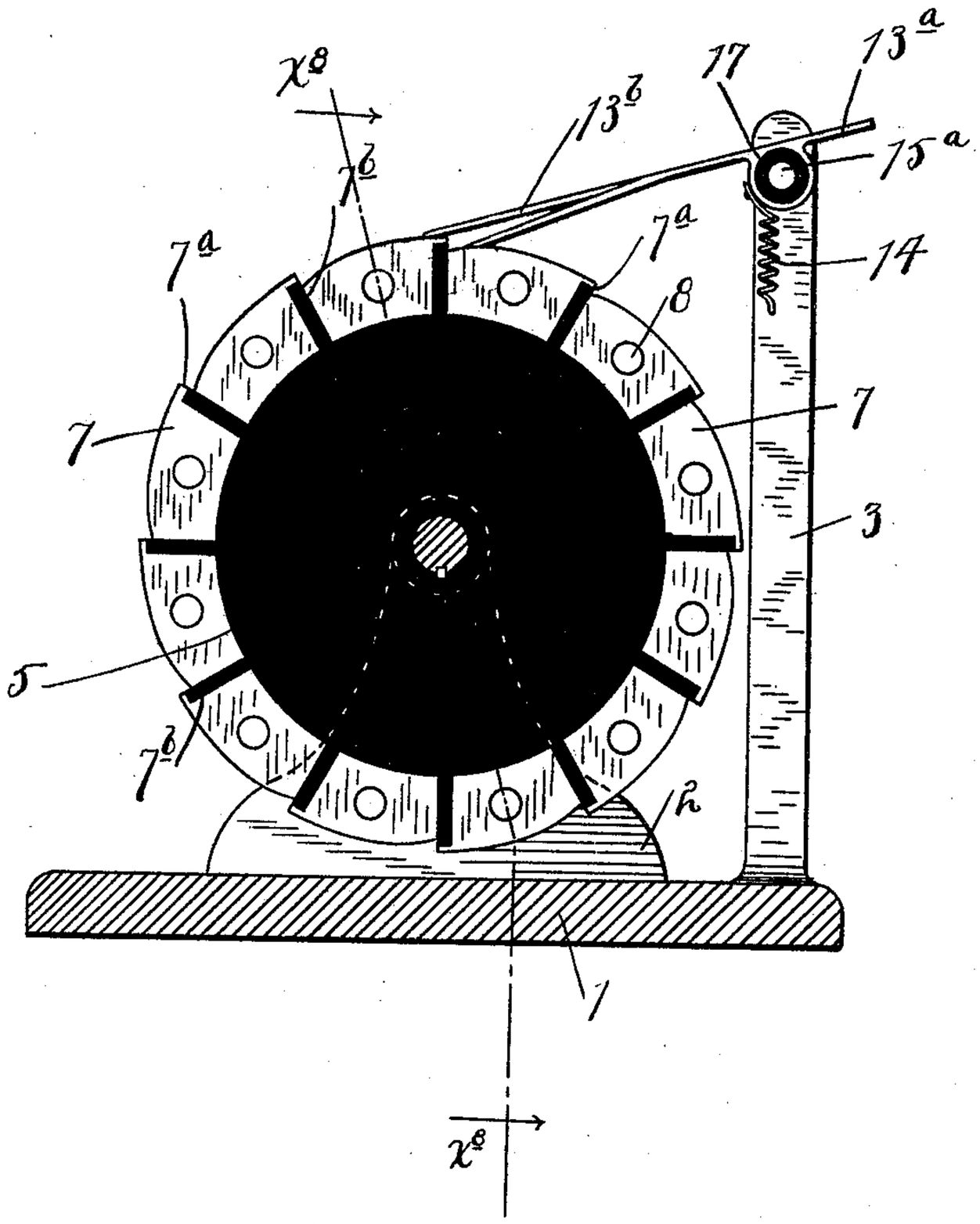

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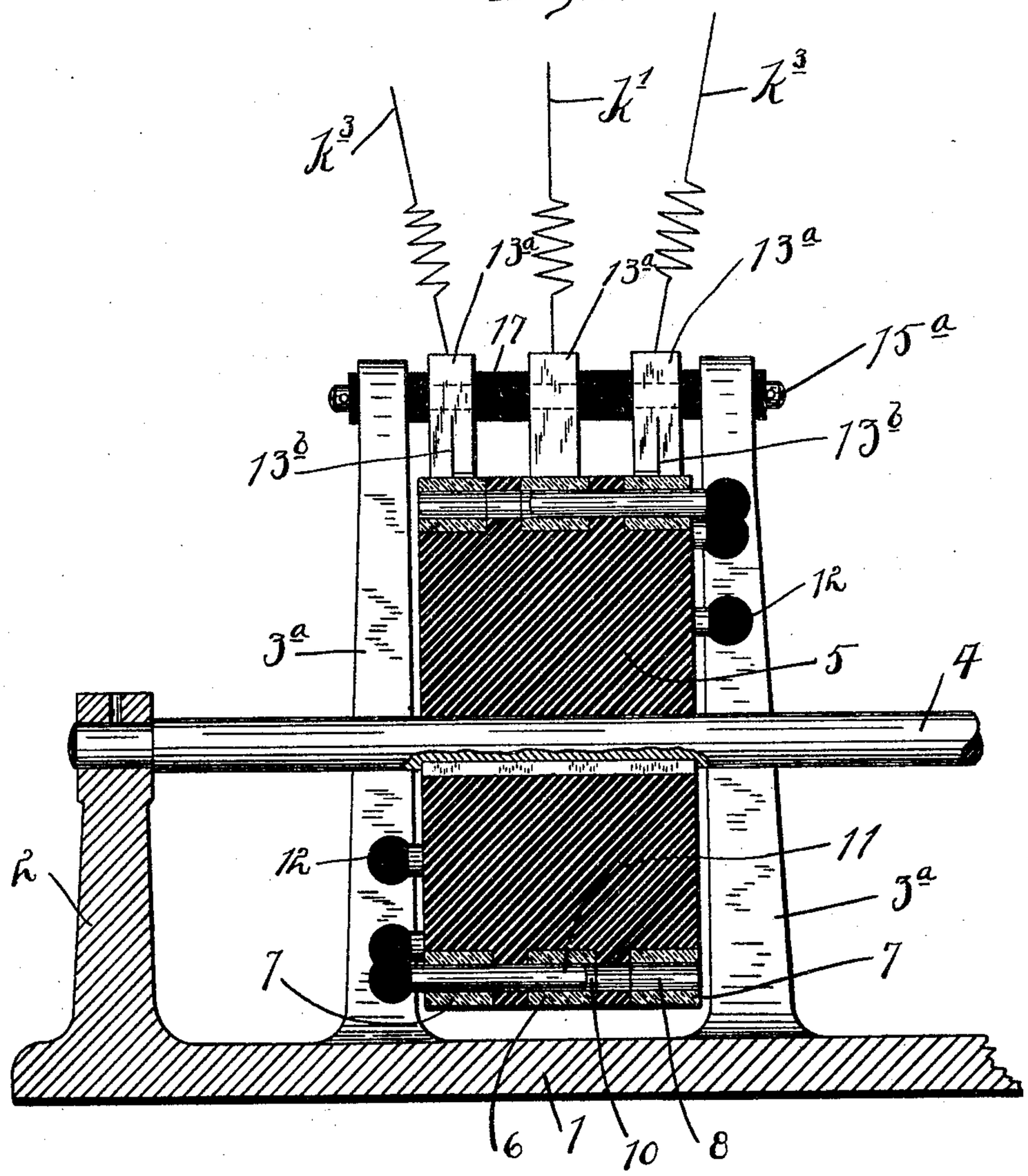
Fig. 8.



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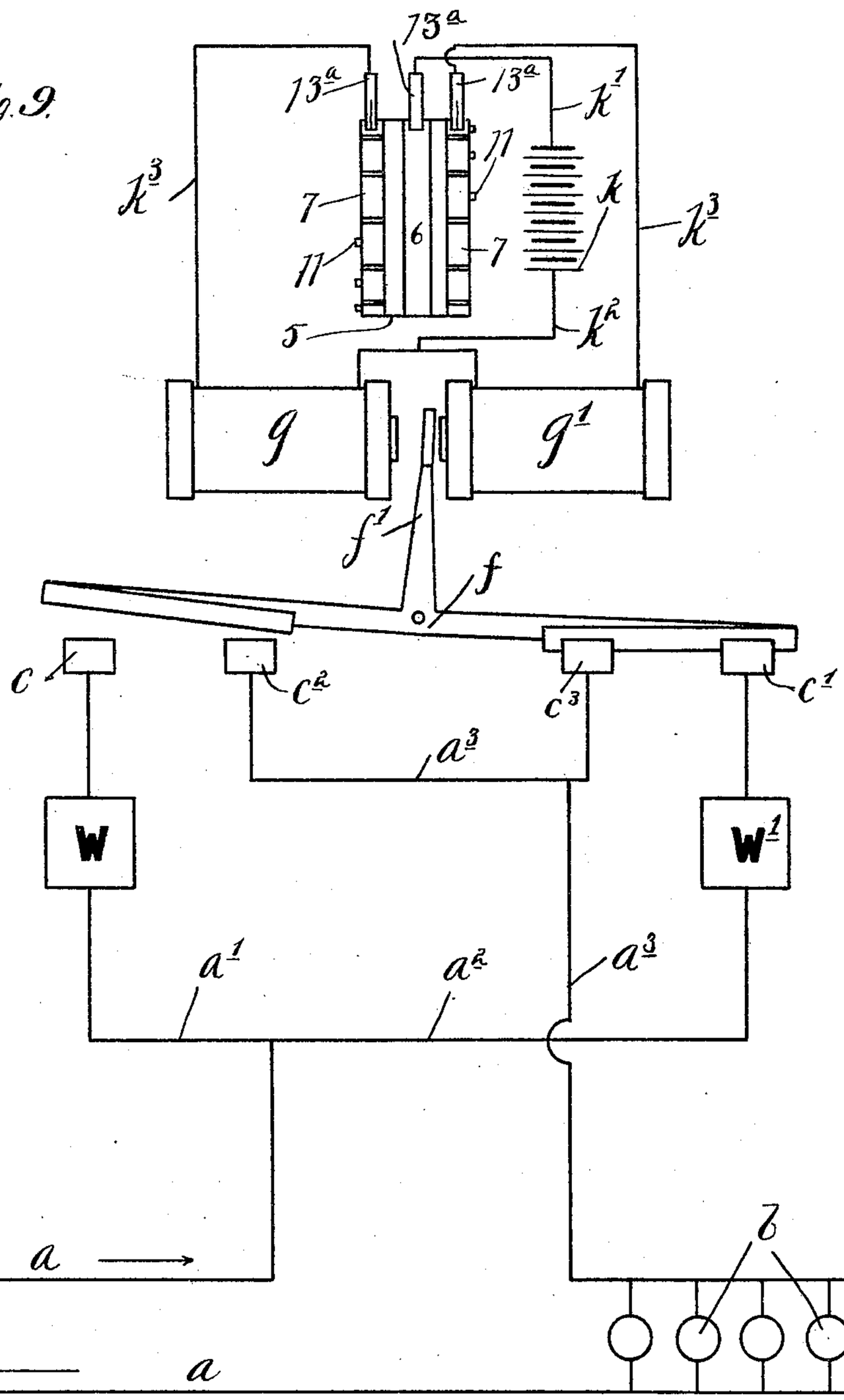
(No Model.) 6 Sheets—Sheet 5.

Fig. 9.



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(No Model.) 6 Sheets—Sheet 6.

Fig. 10.

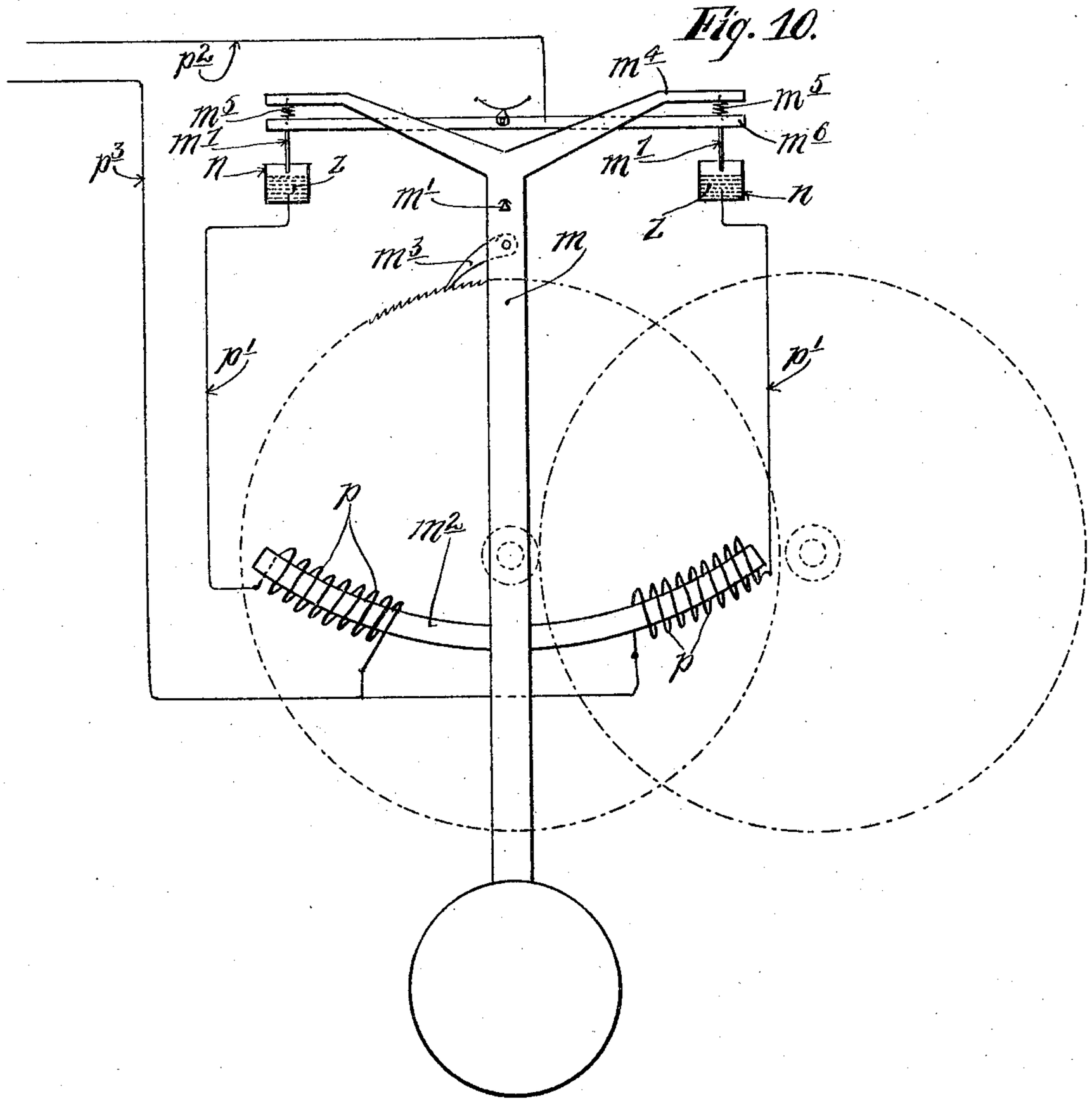
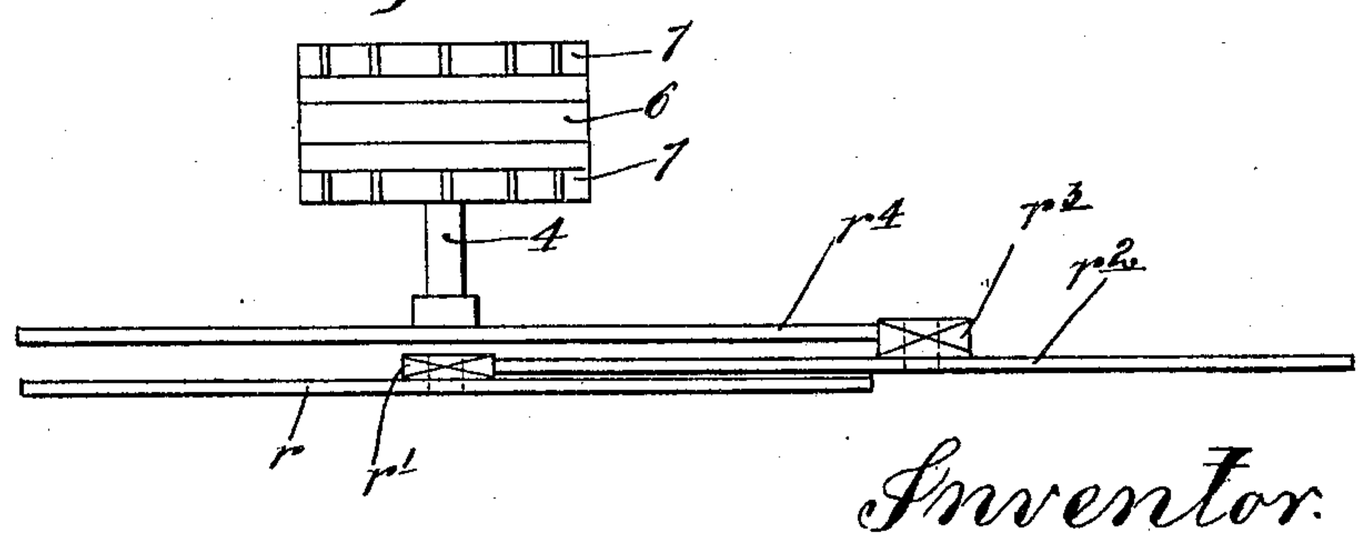


Fig. 11.



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UNITED STATES PATENT OFFICE.

FREDERICK R. M. CUTCHEON, OF ST. PAUL, MINNESOTA.

TIMED ELECTRIC SWITCH FOR MULTIPLE-RATE METER SYSTEMS.

SPECIFICATION forming part of Letters Patent No. 680,316, dated August 13, 1901.

Application filed March 29, 1901. Serial No. 53,400. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK R. M. CUTCHEON, a citizen of the United States, residing at St. Paul, in the county of Ramsey and State of Minnesota, have invented certain new and useful Improvements in Timed Electric Switches for Multiple-Rate Meter Systems; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention has for its object to provide certain improvements in timed electric switches; and to this end it consists of the novel devices and combinations of devices hereinafter described, and defined in the claims.

In its simplest form the switch comprises a rotary head or support which is moved with a timed action, a continuous metal ring, herein called the "collecting-ring," a coöperating broken or sectioned ring the sections of which are insulated from each other and from said continuous ring, and a plurality of contact plugs or pins which fit in suitable perforations or seats in the said rings and by the use of which any of the sections of the sectioned ring may be electrically connected with the continuous ring. For low-potential currents the brushes of the main or supply circuit may be mounted to work one on the continuous contact-ring and the other on the broken or sectioned contact-ring. For high-potential currents the switch may be used to control a magnet or magnets in a local circuit and such magnets in turn be used to control a double-throw switch in the main or supply circuit. This latter arrangement is serviceable in connection with two-rate pay systems, or, in other words, where one rate is charged for power furnished during certain hours of the day and another rate is charged during certain other hours of the day. For instance, during certain of the hours of the night, when the natural demand for power is less than during the day-time, it is a common practice to make a reduced charge in order to encourage the use of the power at such times, as the demands upon the power-station would naturally become lessened.

My invention in several of its forms is illustrated in the accompanying drawings, wherein like characters indicate like parts throughout the several views.

Figure 1 is a view in front elevation, showing my improved switch applied directly in a low-potential circuit. Fig. 2 is a rear elevation of the device shown in Fig. 1. Fig. 3 is a section on the line x^3 x^3 of Fig. 2. Fig. 4 is a detail, partly in plan and partly in section, showing one of the contact plugs or pins. Fig. 5 is a side elevation of the device shown in Figs. 1 and 2. Fig. 6 is a vertical section on the line x^6 x^6 of Fig. 1. Fig. 7 is a view corresponding to Fig. 1, but illustrating a switch of modified construction. Fig. 8 is a vertical section on the line x^8 x^8 of Fig. 7. Fig. 9 is a diagram view illustrating the switch shown in Figs. 7 and 8 applied in connection with the double-throw switch of a two-rate pay system of electrical distribution. Fig. 10 is a diagram view illustrating, briefly, an electric clock by means of which a switch is rotated; and Fig. 11 is a plan view in diagram, showing the switch and the train of clock-gears by means of which motion is transmitted.

Referring first to the simpler form of the device, (illustrated in Figs. 1 to 6, inclusive,) the numeral 1 indicates a base-plate having bearing-pedestals 2 and a brush-supporting post 3. In the pedestals 2 is loosely mounted a shaft 4, which is driven with a timed action by clockwork or other suitable device. Rigidly secured on and driven by the shaft 4 is a disk-like head or block 5, preferably of insulated material, such as vulcanized rubber. The shaft 4 and the head 5 are preferably driven at such a rate of speed that they will make one complete rotation in twenty-four hours. Countersunk into the periphery of the insulated head 5 is a continuous metal ring 6, called the "collecting-ring." Spaced apart laterally from and also insulated and also countersunk in the periphery of said head 5 is a broken metal ring 7, the sections of which are slightly separated and insulated from each other. There may be any number of sections in the broken ring 7; but, as shown in the drawings, there are twelve—that is, one for every two hours of the day. Each section of the broken ring 7 is provided with a perforation or seat 8, which stands in

line with a similar perforation 10 in the continuous collecting-ring 6. A series of contact plugs or pins 11, preferably having insulated heads 12, are adapted to be inserted, as best illustrated in Fig. 6, through the coincident perforations 8 and 10 of the said rings 6 and 7, and thus to electrically connect any one or more of the sections of said ring 7 with the said continuous ring 6. A pair of contact-brushes 13, yieldingly held operative by springs 14, are, as shown, pivotally mounted on a stud 15, projecting from the upper end of the post 3. In this construction or arrangement the wires 16 of the main or supply circuit are connected one to each of the brushes 13. As best shown in Fig. 3, the brushes 13 are mounted on insulating-bushings 17, with which the stud 15 is provided.

It is evident that with the construction just described the low-potential current may be automatically and intermittently broken and closed at intervals. For instance, with six of the plugs or pins 11 inserted through six adjacent sections of the broken ring 7 and into the continuous collecting-ring 6, as shown in Fig. 1, the supply-circuit will be closed for twelve hours and opened for the next twelve hours. By varying the number of sections which are connected by the plugs or pins 11 the time of opening and the time of closing may be increased and decreased by intervals varying by two hours. In practice the broken ring may be provided with a much larger number of sections, so that the time may be varied by hours or by shorter intervals.

The construction illustrated in Figs. 7 and 8 is the same as that above described with the following exceptions: The insulating-head 5 is in this case made wider and is provided with two broken rings 7, located one on each side of the continuous collecting-ring 6, and three brushes 13^a are provided, which brushes are, as shown, supported on a shaft 15^a, held by a pair of posts 3^a. The central brush 13^a, which works on the continuous ring 6, is of ordinary form; but the outer brushes 13^a, which work on the broken rings 7, are split or divided, as indicated at 13^b, one prong being a little longer than the other, for a purpose which will presently appear. As before described, the brushes are subject to springs 14. The peripheral surfaces of the sections of the broken rings (see Fig. 7) extend eccentric to the axis of the rotary head 5, so that steps 7^a are formed between the adjacent ring-sections. The ring-sections are separated by insulating material 7^b, which do not, however, run through to the peripheries of the said rings 7. The steps 7^a insure a quick break of the circuit when the brush passes from a live to a dead ring section.

With the ring-sections and the brushes arranged as just described the circuit is not broken in passing from one live section of the broken ring to another live section, inasmuch as the shorter prong of the brush will make engagement with the approaching section before the longer prong has left the advance section. This latter feature of construction is applicable to either of the forms of the switch above described.

The use of the switch illustrated in Figs. 7 and 8 in connection with a high-potential system of electrical distribution is illustrated in the diagram view, Fig. 9. In the said diagram view the character *a* indicates the leads or main circuit-wires which extend to and from the source of electrical supply and in which in the illustration given a number of lamps *b* are connected in multiple. These lamps *b*, however, might be electric motors or an electric plant of any character. One of the leads *a* is connected by branches a' a^2 with contacts *c* c', and another section of the lead *a* is connected by branch wire a^3 with a pair of contacts c^2 c^3. In the branch wire a' is connected a wattmeter *w*, and in the branch wire a^2 is connected a wattmeter w'.

The character *f* indicates a pivoted double-throw switch, which coöperates with the contacts *c* c' c^2 c^3 and is provided with an armature f', which is subject to a pair of opposing magnets *g* g'. *k* indicates a local battery. From one terminal of the battery *k* a wire k' extends to the central brush 13^a, which brush works on the continuous ring 6, and from the other terminal of the said battery a wire k^2 extends to both of the magnets *g* and g'. From each magnet *g* g' a wire k^3 extends to one of the outer brushes 13^a.

It is evident that when the circuit from the local battery *k* is closed through the magnet g' the double-throw switch *f* will be drawn into the position indicated in Fig. 9, so that the circuit through the leads or supply-wires *a* will be closed through the branch a^2, (including the wattmeter w',) through the contacts c' c^3, branch wire a^3, and the lamps *b*. It is equally evident that at this same time no current whatever will pass through the wattmeter *w*. It is also evident that when the magnet *g* is energized the switch *f* will be thrown into a position reversed from that indicated in Fig. 9, so that the main circuit will be closed through the branch wire a' (including the wattmeter *w*) and through the contact *c* c^2, wire a^3, and lamps *b*, and that no current will pass through the wattmeter w'.

Under the action of the timed switch illustrated in Figs. 7 and 8 it is evident that the circuit from the local battery *k* may be closed either through the magnet *g* or magnet g', according to the arrangement of the plugs or pins 11. With the said pins arranged as shown in Fig. 8—to wit, with six adjacent sections of each broken ring 7 connected with the continuous collecting-ring 6—the supply-circuit will be closed for twelve hours through the wattmeter *w* and for the next twelve hours through the wattmeter w'. In fact, two pins located at diametrically opposite points and connecting sections of the two rings 7 with the said ring 6 will accom-

plish the above result, inasmuch as the double-throw switch f will remain in whatever position it may be set. It is also evident that by the proper arrangement of said plugs or pins any desired manipulation of the said switch f may be accomplished.

The character m indicates a vibrating pendulum, which is mounted on a suitable fulcrum m' and is provided with a double-ended segmental soft-iron coil m^2 and with a pawl m^3. At its upper end the pendulum m is provided with reversely-projecting prongs m^4, which act through light springs m^5 to vibrate a pivoted bar m^6. The bar m^6 is provided with depending contact points or needles m^7, which are adapted to engage alternately with mercury z, contained in suitable cups n. The character p indicates a pair of solenoids through each of which one end of the core m^2 works without contact. Wires p' connect the solenoids, one with the mercury z of each cup m. A lead-wire p^2 connects with the vibrating bar m^6, and another lead-wire p^3 connects to both the solenoids p. The pawl m^3 of the pendulum m engages the teeth with a large ratchet-wheel r, which is suitably mounted and provided with a small pinion r'. The pinion r' meshes with a large gear r^2, which is provided with a small pinion r^3, which in turn meshes with a larger gear r^4 on the shaft 4 of the rotary switch.

With the above-described clock mechanism it is evident that when the pendulum vibrates its pawl m^3, acting on the ratchet-wheel r, will through the train of gears impart a rotary motion to the rotary head of the switch. It is also evident that under the movements of the metal bar m^6 and its contacts m^7 the solenoids p will be energized and deënergized in alternate order and that they acting upon the core m^2 will keep up the motion of the pendulum.

The above clockwork has been briefly described inasmuch as it forms no part of my present invention and for the further reason that various other forms of clockwork may be employed to impart the properly-timed movement to the rotary head of the switch.

It will also be understood that the device above described is capable of large range of modification within the scope of my invention. Of course the so-called "continuous" or "collecting" ring might be formed in sections, although it best serves its purposes when made continuous.

The so-called "split" or "divided" brushes might of course be made in completely-separated sections. The local circuit, which is controlled by the timed switch, may be used to operate a single-throw switch instead of a double-throw switch. Again, the device illustrated in Figs. 7 and 8 may for low-potential currents be used directly in the main or supply circuit. For instance, it might be substituted for the so-called "double-throw switch" and coöperating contacts. Many other alterations will naturally suggest themselves in practice.

What I claim, and desire to secure by Letters Patent of the United States, is as follows:

1. The combination with a rotary head, of a plurality of contact-rings carried thereby, at least one of which rings is formed by insulated sections, means for electrically connecting certain of the sections of said sectioned ring with a coöperating member of said rings, and leads having brushes working on said contact-rings, substantially as described.

2. The combination with a rotary head, movable with a timed action, of a plurality of contact-rings carried by said head, at least one of which rings is formed by insulated sections, means for electrically connecting certain of the sections of said section-ring with a coöperating member of said rings, and leads having brushes working on said contact-rings, substantially as described.

3. The combination with a rotary head movable with a timed action, of a plurality of contact-rings carried by said head, at least one of which is formed by insulated sections, contact plugs or pins insertible through alined seats in the sections of said sectioned ring, and in a coöperating member of said rings, and leads having brushes working on said contact-rings, substantially as described.

4. The combination with a rotary head movable with a timed action, of three contact-rings carried by said head, at least two of which are broken or sectioned, means for electrically connecting certain of the sections of the broken ring with the third ring, and the divided circuit having brushes working on the said three contact-rings, substantially as described.

5. The combination with a rotary head movable with a timed action, of three contact-rings carried by said head, at least two of which are broken or sectioned, contact plugs or pins for connecting certain of the sections of said broken rings to the third ring, brushes working on the said contact-rings and a divided circuit including the said brushes and through which the current is alternately switched, substantially as described.

6. The combination with leads for supplying current for a local plant, of a pair of meters with circuit connections to said leads, a switch for throwing the one or the other of said meters into circuit, and a magnetic controller for said switch including a rotary head movable with a timed action and provided with broken and continuous contact-rings, which controller operates to throw said switch, and to thereby render said meters operative in alternate order.

7. The combination with leads for supplying current to a local plant, of a pair of watt-meters with circuit connections to said leads, a double-throw switch for closing either of

the said wattmeters into the main circuit, a magnetic controller for said double-throw switch, and a timed switch for actuating said magnetic controller, connected in a local circuit and comprising a rotary head having a continuous contact-ring, two broken contact-rings, contact plugs or pins, for connecting the sections of said broken ring to said continuous ring, and brushes working on said contact-rings, substantially as described.

8. The combination with a rotary head, of contact-rings carried by said head, at least one of which is formed by insulated sections extended eccentric to the axis of said ring to form a series of steps, and leads having brushes working on the said contact-rings, substantially as described.

9. The combination with a rotary head, of contact-rings carried by said head, at least one of which rings is formed by insulated sections extended eccentric to the axis of said ring to form a series of steps, means for connecting said ring-sections with the coöperating ring, and a split or divided brush, sections of which are of different lengths and work on said broken ring, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

FREDERICK R. M. CUTCHEON.

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