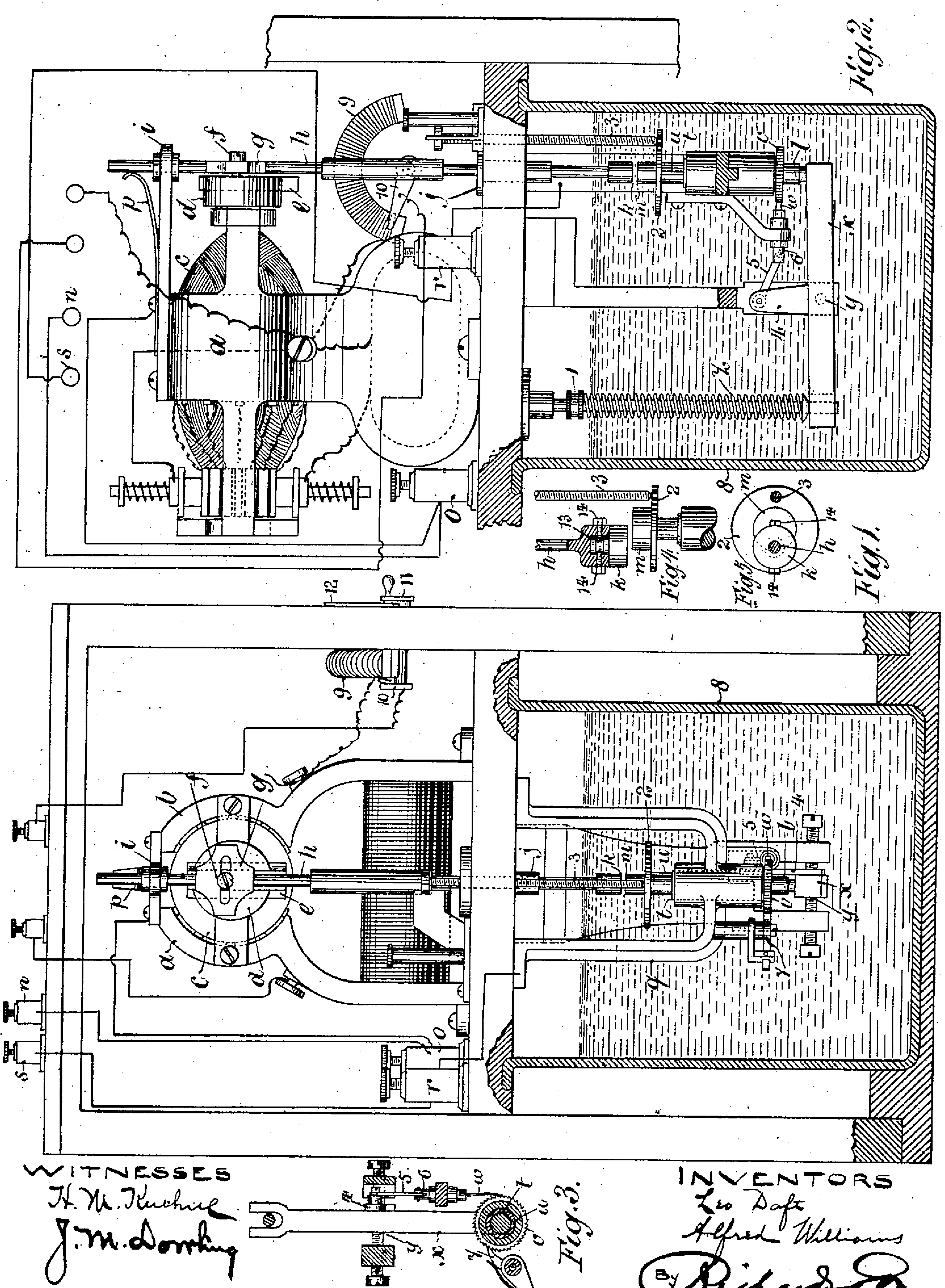
No. 730,236. PATENTED JUNE 9, 1903.

L. DAFT & A. WILLIAMS.

REPEATING BREAK FOR ELECTRIC CIRCUITS.

APPLICATION FILED NOV. 3, 1902.

NO MODEL. 2 SHEETS—SHEET 1.



WITNESSES

INVENTORS

ATTORNEYS

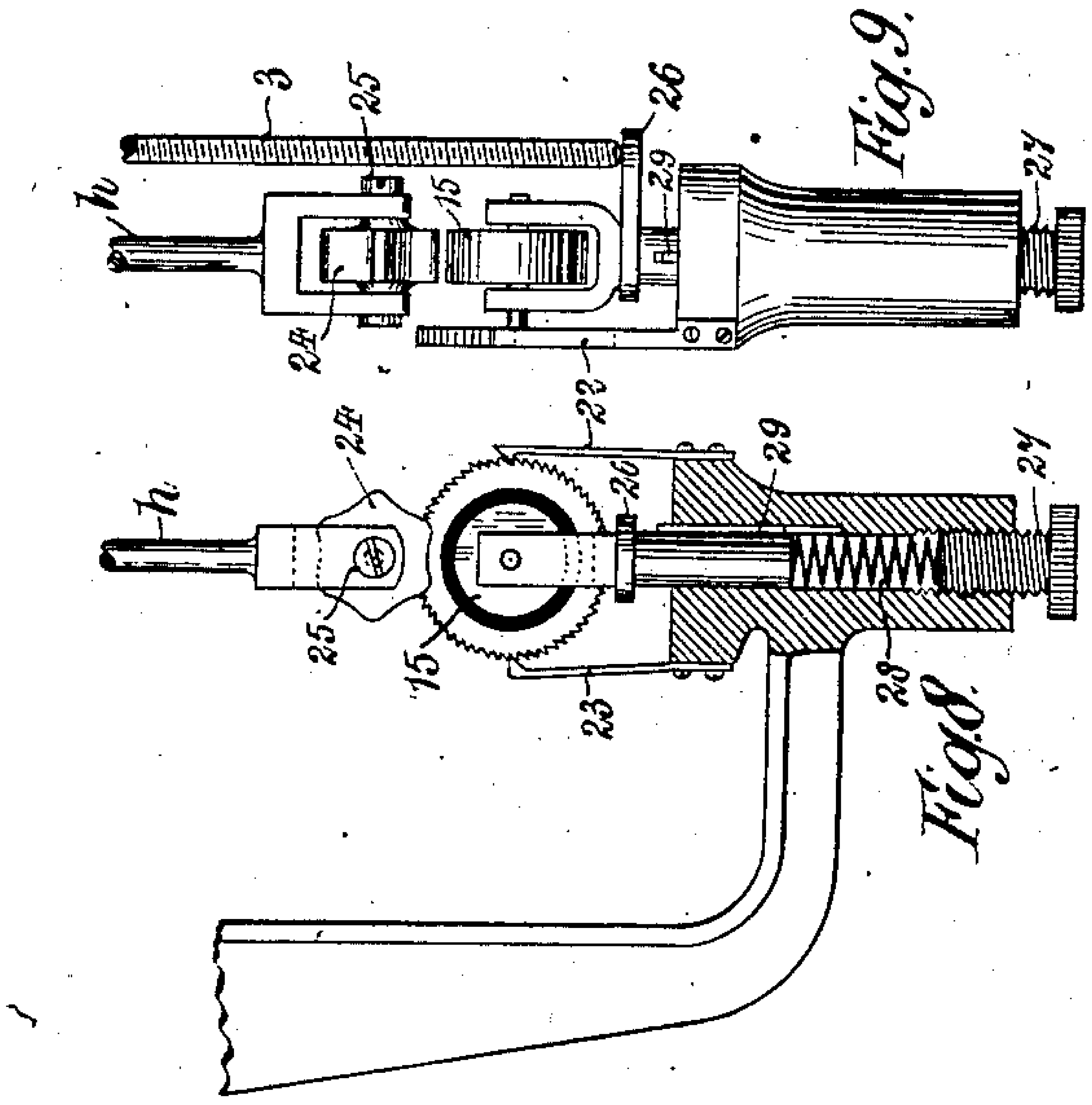
No. 730,236. PATENTED JUNE 9, 1903.

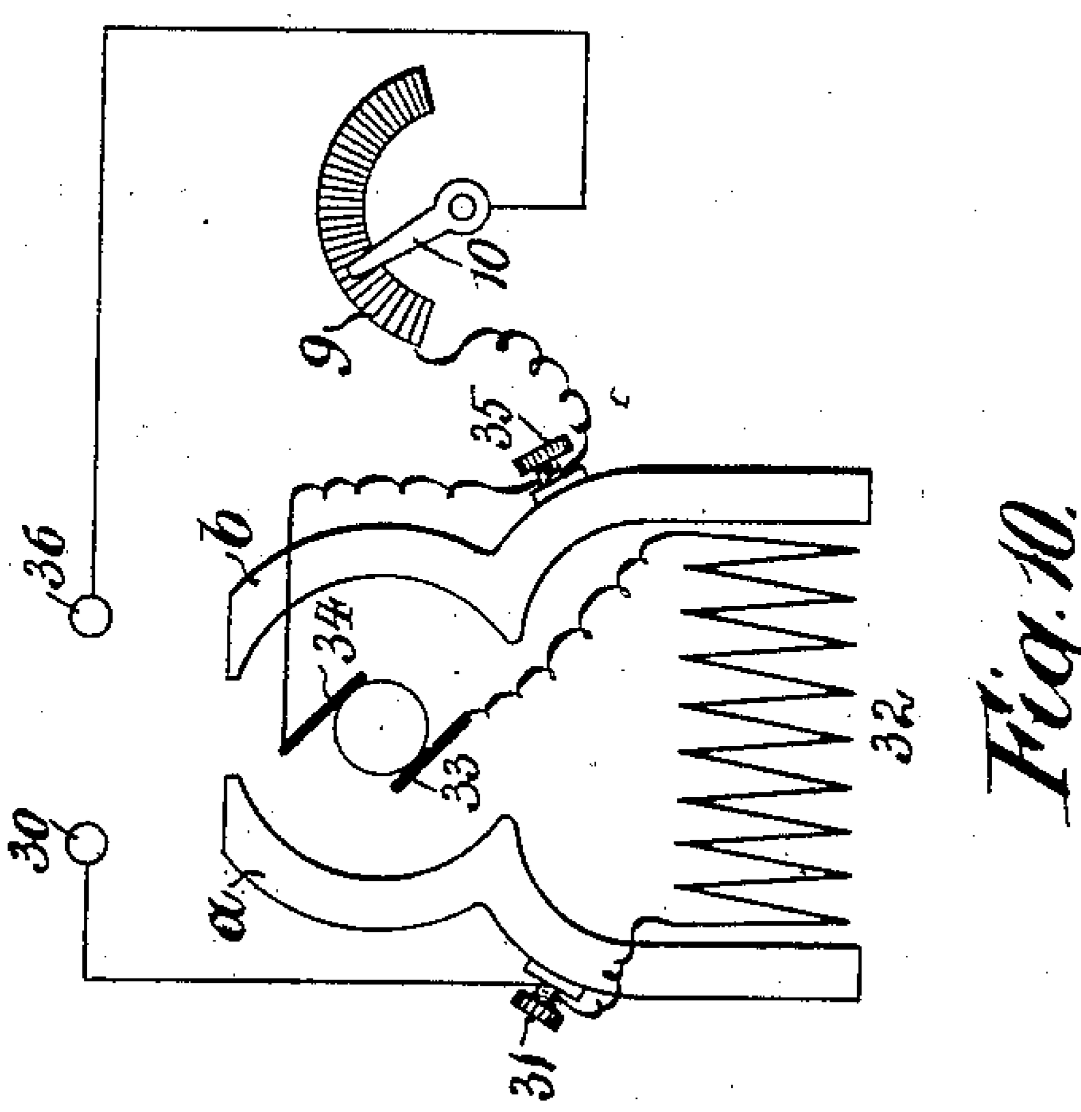
L. DAFT & A. WILLIAMS.

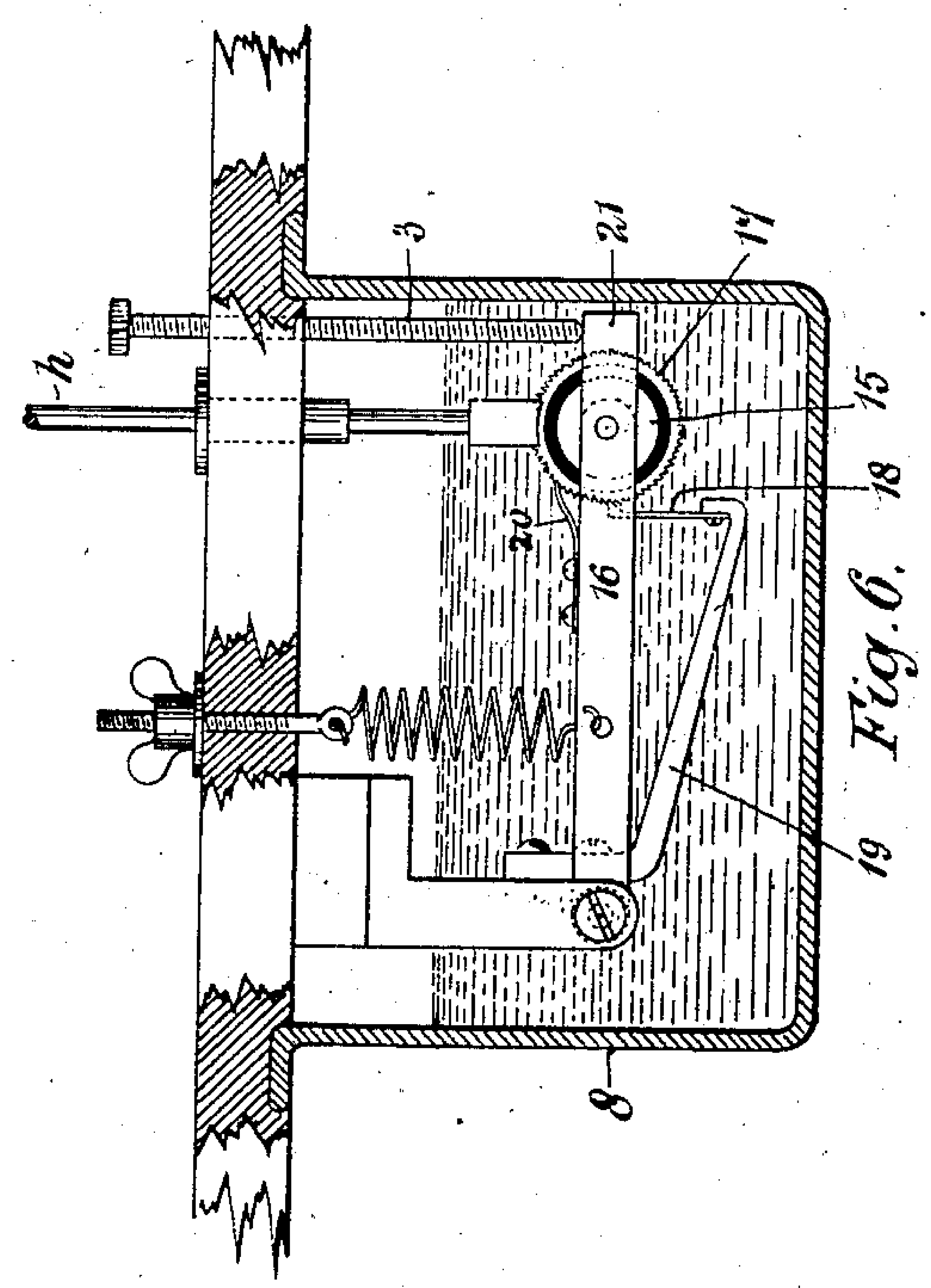
REPEATING BREAK FOR ELECTRIC CIRCUITS.

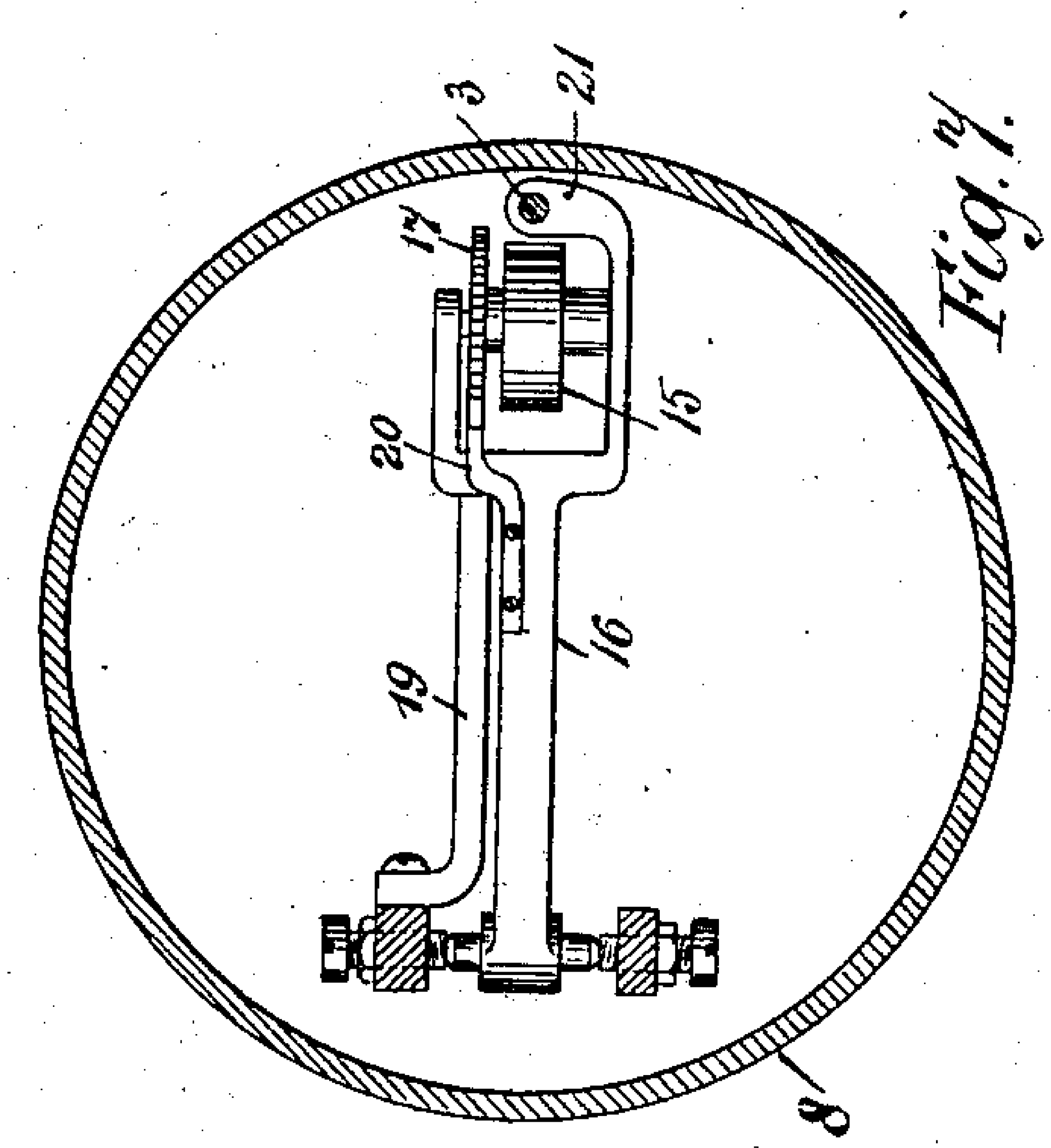
APPLICATION FILED NOV. 3, 1902.

NO MODEL. 2 SHEETS—SHEET 2.









WITNESSES

H. M. Kuehne

J. M. Dowling

INVENTORS

Leo Daft

Alfred Williams

By Richards & Co

ATTORNEYS

No. 730,236. Patented June 9, 1903.

UNITED STATES PATENT OFFICE.

LEO DAFT, OF EALING, AND ALFRED WILLIAMS, OF WIMBLEDON, ENGLAND, ASSIGNORS TO ELECTRICAL ORE FINDING COMPANY, LIMITED, OF LONDON, ENGLAND.

REPEATING BREAK FOR ELECTRIC CIRCUITS.

SPECIFICATION forming part of Letters Patent No. 730,236, dated June 9, 1903.

Application filed November 3, 1902. Serial No. 129,966. (No model.)

To all whom it may concern:

Be it known that we, LEO DAFT, of The Laboratory, Meadow House, The Mall, Ealing, in the county of Middlesex, and ALFRED WILLIAMS, of No. 10 Princess road, Wimbledon, in the county of Surrey, England, have invented a certain new and useful Improved Repeating-Break for Electric Circuits; and we 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.

This invention relates to a mechanism whereby an electric contact between the surfaces of two electrodes may be made and broken and which possesses the characteristics that, first, the frequency can within wide limits be regulated to any desired degree; second, the fraction of the period during which contact occurs before break can be regulated to satisfy any desired degree of saturation; third, the rapidity of the severance of the surface at the desired moment is a maximum; fourth, the electrodes are so constructed that new surfaces held in reserve can be presented for contact when the surface in use has become unduly worn, and, fifth, the two surfaces when in contact are caused to move relatively to one another. This has the effect of displacing air or other fluid or foreign matter from between the surfaces and allows them to come into more intimate contact and has the further advantage that the points of the two surfaces which mutually part company when the break occurs are changed in each successive break, the result being that the condition of the surfaces is rendered more permanent on account of the distribution of the unavoidable wear and tear, due to sparking, uniformly over the whole area of contact.

The shape of the surfaces of contact and the kind of relative motion to which they are subjected when in contact may be varied, as shown in the accompanying drawings, in which—

Figures 1, 2, and 3 show the construction when the two surfaces of contact are two parallel concentric circular plane areas, of which one is caused to turn in its plane about its center through a small angle in each contact, the other not rotating. Fig. 1 is a front elevation, Fig. 2 is a side elevation, partially in section, and Fig. 3 is a plan, of a portion of the mechanism. Figs. 4 and 5 show a modification of the setting of the two circular plane surfaces of the electrodes, which are in this case eccentric to one another, both surfaces being caused to revolve. Figs. 6 and 7 show a variation in which one of the surfaces consists of the rim of a circular disk which is caused to rotate on its axis and the other surface is concave of the same shape as a portion of the rim of the disk. In this case the fork which carries the revolving disk is part of a pivoted lever, which is caused to make angular reciprocations. Figs. 8 and 9 show a modification in which the fork which carries the revolving disk is mounted so as to make linear reciprocations and the upper electrode is adapted to have its contact-surface changed at intervals when the surface in use has become unduly worn. Fig. 10 is a diagram showing the circuit of the motor and rheostat.

Referring to Figs. 1, 2, and 3, an electromotor is shown, of which *a* and *b* are the two pole-pieces of the field-magnet, between which a drum-wound armature *c* is caused to revolve. On the end of the revolving spindle is secured a disk *d*, having a dovetailed slotway, in which a slide *e* is fitted. Into a tapped hole in the slide a screw *f* is inserted. By screwing the point of *f* against the bottom of the slotway the slide can be secured in any position with the radial distance of the screw *f* from the axis of the spindle any desired amount. The shank of the screw is made to fit a slotway in a yoke *g*, which forms a part of a rod *h*, which is mounted so as to be able to reciprocate vertically in the guides *i* and *j*. By such means a vertical reciprocating movement for the rod *h* is derived, the length of the stroke of which is capable of adjustment. The lower end of the rod is provided with a flat-ended platinum surface *k*, and this forms one electrode of the contact-breaker. Beneath the rod *h* is another rod *l*, which also is provided with a flat-ended platinum surface *m*, and this forms the second electrode. The current is led to the rod *h* from the binding-post *n*, thence to the post *o* and the spring-contact *p*, and from the rod *l* through its guiding-surface and frame *q* to the post *r*, and from thence to the post *s*. The rod *l*, with its platinum surface, is mounted so as to be capable of a vertical reciprocation and also of rotation about its axis. In its reciprocation it slides vertically in the sleeve *t*, having a feather-key *u* to prevent it from turning relatively to the sleeve. The sleeve is capable of rotation in the frame *q* and is required to turn through a small angle on each reciprocation of the rod by means of a ratchet-wheel *v*, which forms a part of it, and a spring-pawl *w*. The rod *l* and platinum contact *m* are tended to be forced upward by the front end of a lever *x*, pivoted in the frame at *y*, the rear end of the lever being forced downward by a compressed helical spring *z*, which can be adjusted by means of a nut 1. To the rod *l* is secured a disk 2. By the abutment of this disk against the lower end of a screw 3 a limit is imposed to the extent of the upward movement of the rod *l* and its platinum contact-surface *m*. On the downward movement of *h* the two surfaces come together and remain in contact during the remainder of the downward stroke and also during the corresponding portion of the upward stroke. The passage of electricity is thus freely permitted for a fraction of the period of reciprocation, which can be readily modified by adjusting the position of the screw 3. When the disk 2 in its upward movement strikes against the screw 3, it is abruptly arrested. The rod *h* continuing its upward movement breaks contact between the surfaces *k* and *m*. On the next downward movement an arm 4, which is affixed to the lever *x* and joined by a connecting-rod 5 to a slide 6, which carries the pawl *w*, causes the ratchet-wheel to be angularly advanced to the extent of one or more teeth, the number depending on the position of the adjusting-screw 3, which controls the amount of movement permitted to the rod *l* and lever *x*. In this way new points of the surface *m* become presented to the old points of the surface *k*, and the unavoidable wear and tear due to sparking is caused to be uniformly distributed over the surfaces, with the advantage that a very persistent condition of break can be maintained for hours and days on end, even when a considerable amount of electric energy is being transmitted. The pawl 7 prevents a back movement of the ratchet-wheel.

To aid in the preservation of the surfaces, they are immersed in a bath of non-conducting fluid, such as alcohol, petroleum, or other hydrocarbon contained in a beaker 8. The fluid serves to quench the spark, and it also collects the platinum dust and enables it to be recovered.

For the purpose of regulating the speed of the motor and the period of the break a rheostat 9 is fitted.

One convenient form of construction is shown in the figures and consists of a naked wire helically wound on a rod of vulcanite, which is afterward softened by heat and bent into an arc of a circle. An arm 10 with a finger is mounted so that it can be placed in contact with any desired turn of the helix, and thus cut out of the motor-circuit more or less of the resistance. By an arm 11 outside the case, with a pointer on it and a graduated sector 12, the motor may be set to run at any speed desired.

The speed of revolution can be readily determined if one point on the periphery of the disk has a distinguishing mark by timing the period of a revolution of the disk and knowing the number of the teeth in the ratchet-wheel and the number of teeth moved per revolution of the motor.

The normal condition of things is such that if there were no ratchet-and-pawl device the absence of absolute perfection of symmetry of action will cause a promiscuous slow rotation or oscillation to take place and permit the two butting surfaces to present fresh points of contact to one another at each successive reciprocation. Thus the ratchet-and-pawl device is not necessarily essential to the good working of the instrument, but it is desirable in order to secure certainty of action.

In Figs. 4 and 5 the platinum electrodes *k* and *m* are shown of larger diameter than in Figs. 1, 2, and 3. Moreover, they are situated eccentrically with respect to one another, so that they come in contact only over a portion of the surface of each at one time. The lower electrode *m* is constructed as previously described and is required to undergo a small amount of rotation in each downward stroke by means of the ratchet-and-pawl mechanism previously described. The upper platinum electrode *k* is provided with a grooved spill 13, which fits into a socket formed in the lower end of the reciprocating rod *h*, and while being retained in place by the points of two screws 14 14 is also free to rotate about the axis of *h*. When the two surfaces are pressed together and the lower electrode is required to rotate by the ratchet mechanism, the upper will be turned also by the friction between the two surfaces. A slight grinding motion will result, which will be very effective in removing interposed films and non-conducting matter and which will cause also the presentation of new points of contact with each break and thus maintain considerable permanency of condition in the surfaces of the electrodes.

In Figs. 6 and 7 a modification of the lower portion of the apparatus is shown, in which the lower electrode is a circular disk 15, which is mounted in the fork of a vibrating lever 16, so as to be able to rotate about a horizontal pin. The convex surface of the rim of the disk is one of the surfaces of contact, and to fit that surface the lower end of the upper platinum contact is correspondingly formed with a concave surface of equal radius. The lower contact-surface is composed of a ring of platinum, shrunk on or otherwise secured to a permanent center, which carries a ratchet-wheel 17. On the downstroke the spring-pawl 18, carried on the fixed arm 19, forces the ratchet-wheel and electrode 15 to turn through a small angle, and thus rub against the surface of the upper electrode and present a new surface of contact. The spring-pawl 20, carried on the vibrating arm, serves to prevent a back movement of the ratchet. The vibrating lever is prolonged to 21 to provide an abutment for the point of the arresting-screw 3, as described in connection with Figs. 1, 2, and 3.

In Figs. 8 and 9 are shown a modification of the construction of some of the parts, but by which the same kind of relative motion of the electrodes is provided, as in Figs. 6 and 7. In this case the lower disk electrode 15 is mounted in a fork, which undergoes linear instead of angular reciprocation, and it is caused to be circumferentially advanced by the pawl 22 on the upstroke as well as by the pawl 23 on the downstroke. The upper electrode 24 is also a wheel mounted in a fork formed on the lower end of the rod *h*. This wheel has indentations, each of which is made to fit the periphery of the disk 15. By slackening the screw 25 the wheel 24 can be turned through an angle and a fresh indentation-surface presented to the rotating electrode when the former one has become unduly worn. By tightening the screw the wheel 24 can be securely fixed in the new position. The elongated collar 26 serves as the abutment for the arresting-screw 3, the screw 27 enables the pressure of the spring 28 to be adjusted, and the feather-key 29 prevents the fork of the electrode 21 from turning.

In Fig. 10 is a diagram showing the electric circuit through the motor and rheostat, which is not easy to represent clearly in Figs. 1 and 2. An electric current from any convenient source is led by a wire fastened to the binding-post 30, which is connected to the binding-screw 31. After traversing the coil 32, which energizes the field-magnet whose poles are *a* and *b*, the current arrives at the commutator by the brush 33 and leaves by the brush 34, which is connected to the binding-screw 35. One end of the rheostat-coil 9 is connected to 35, and the rheostat-arm 10 is joined to the binding-post 36, from which a wire conducts the electricity back to the source, and so completes the circuit. By shifting the position of the arm 10 as much of the resistance-wire can be introduced into the circuit as desired and the speed of the motor regulated accordingly.

We claim—

1. An electric-circuit breaker consisting of a combination of an electrode, which is in connection with a source of electricity and which is adapted to be reciprocated, a second electrode which is adapted to make contact with the first and accompany it through a portion of its excursion and which is adapted also to receive a motion relatively to the first electrode, such second electrode being also in electric connection with the same source of electricity as the first, and an arrester which is adapted to stop the movement of the second electrode and break its contact with the first.

2. An electric-circuit breaker consisting of a combination of a rod, adapted to be reciprocated, connected with a source of electricity, a motor adapted to be rotated at a regulated speed, a mechanism, connecting the above two elements of the combination, adapted to vary the amplitude of the reciprocation, a wheel carried at the end of the rod adapted to be revolved, a circular disk mounted so as to revolve and also accompany the above-mentioned wheel in a part of its reciprocation, such disk also being connected with the above-mentioned source of electricity, a ratchet and pawl adapted to rotate the last-named circular disk on its reciprocation, an arresting-screw adapted to be adjusted in position and terminate the motion of the last-named disk and a bath of insulating fluid in which the contact-surfaces are immersed.

In testimony that we claim the foregoing as our invention we have signed our names in the presence of two subscribing witnesses.

LEO DAFT.
ALFRED WILLIAMS.

Witnesses:
T. A. HEARSON.
WALTER J. SKERTEN.