

No. 760,289.

PATENTED MAY 17, 1904.

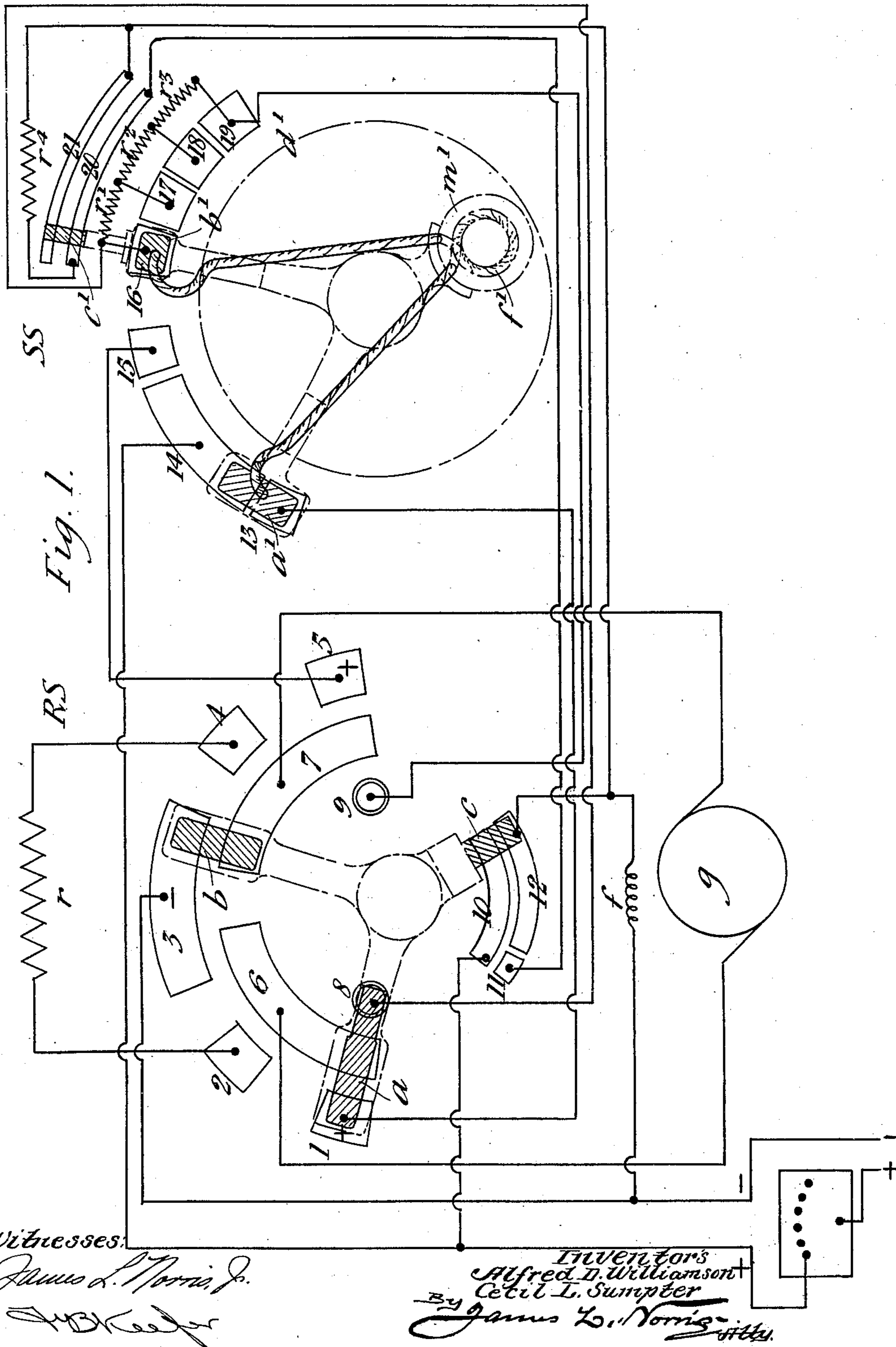
A. D. WILLIAMSON & C. L. SUMPTER.

ELECTRICAL APPARATUS FOR WORKING RECIPROCATING TOOLS.

APPLICATION FILED JAN. 31, 1903.

NO MODEL.

4 SHEETS—SHEET 1.



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Fig. 2.

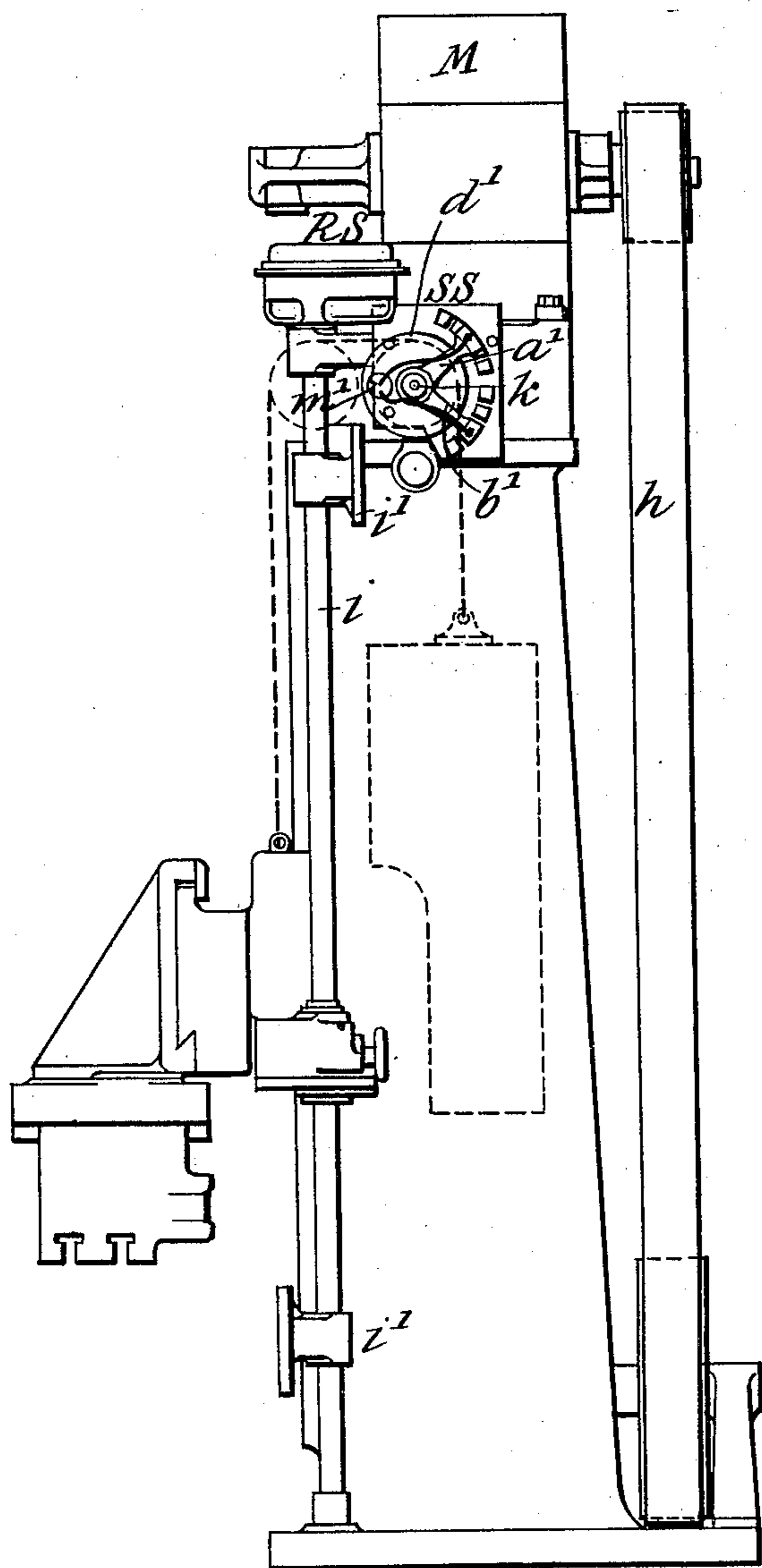
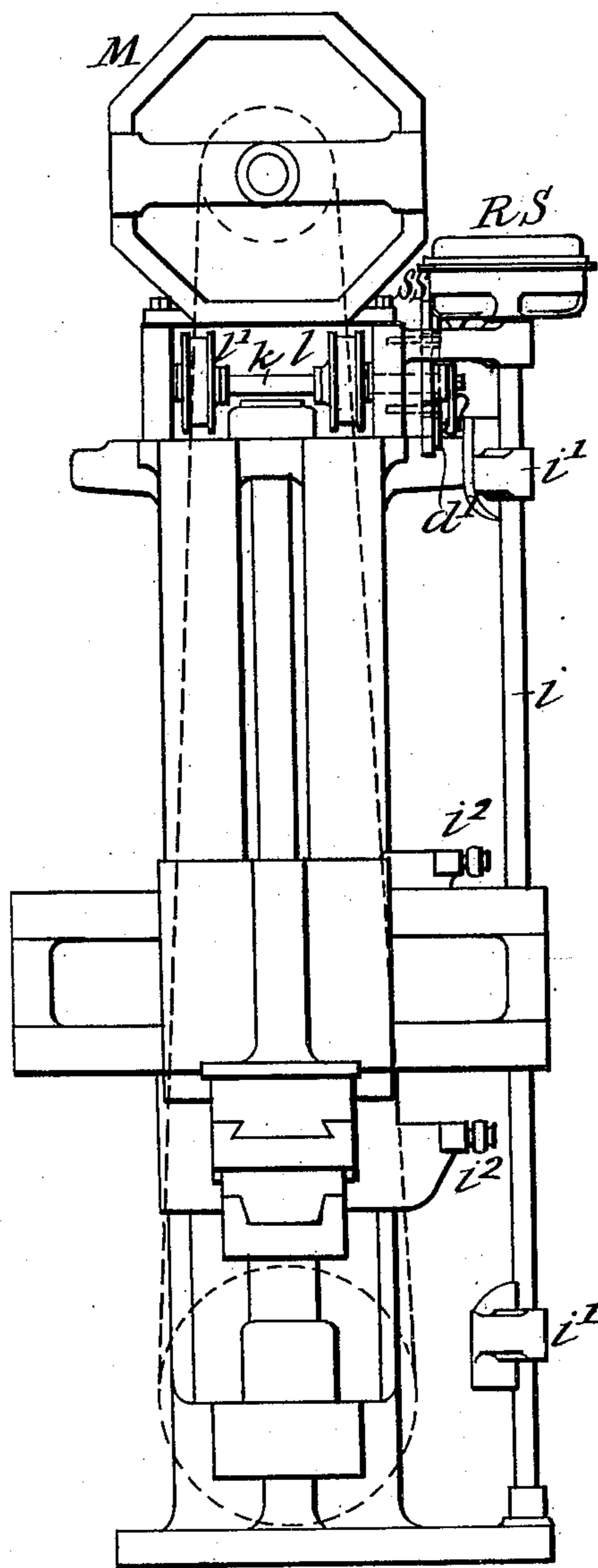


Fig. 3.



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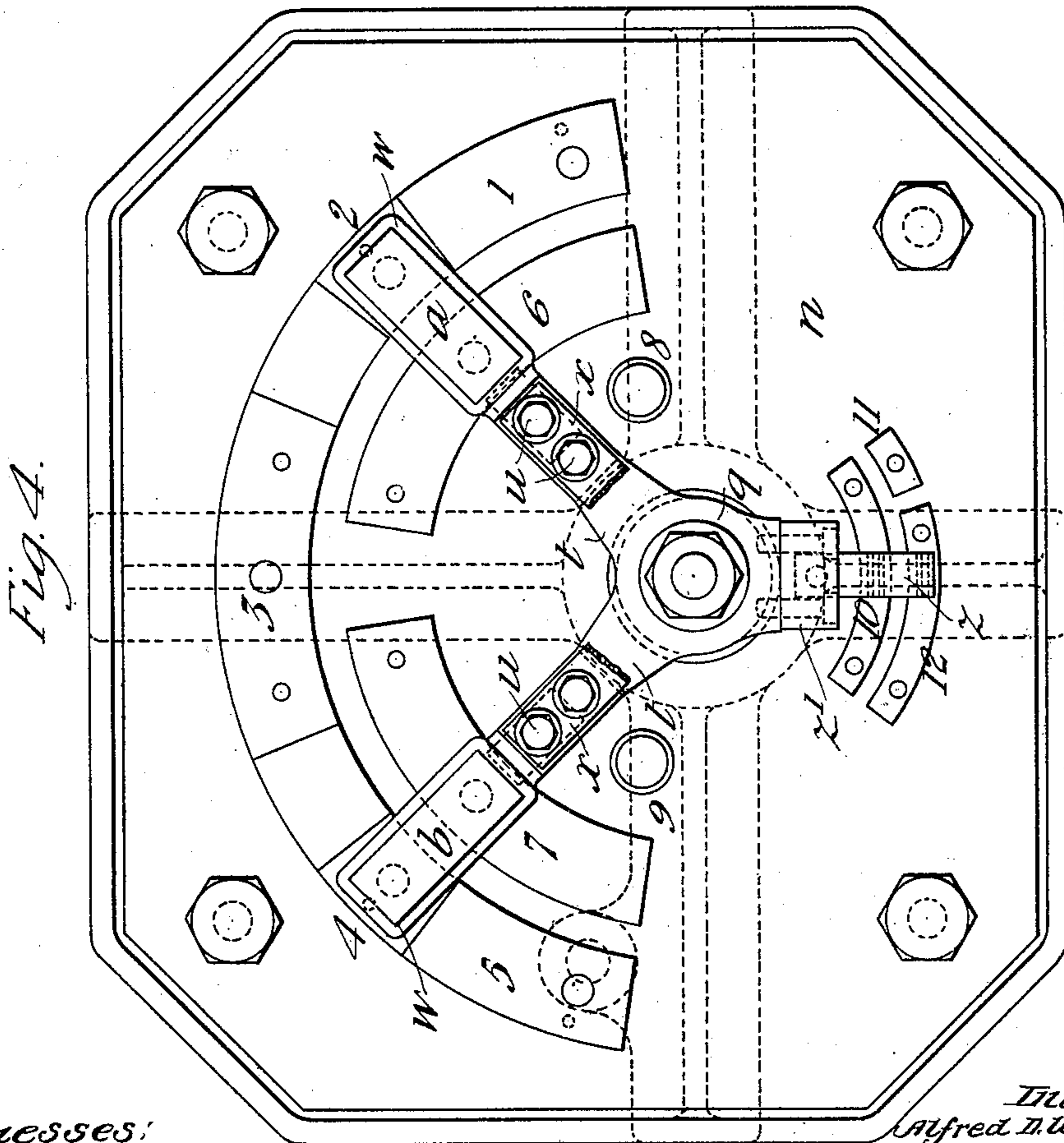
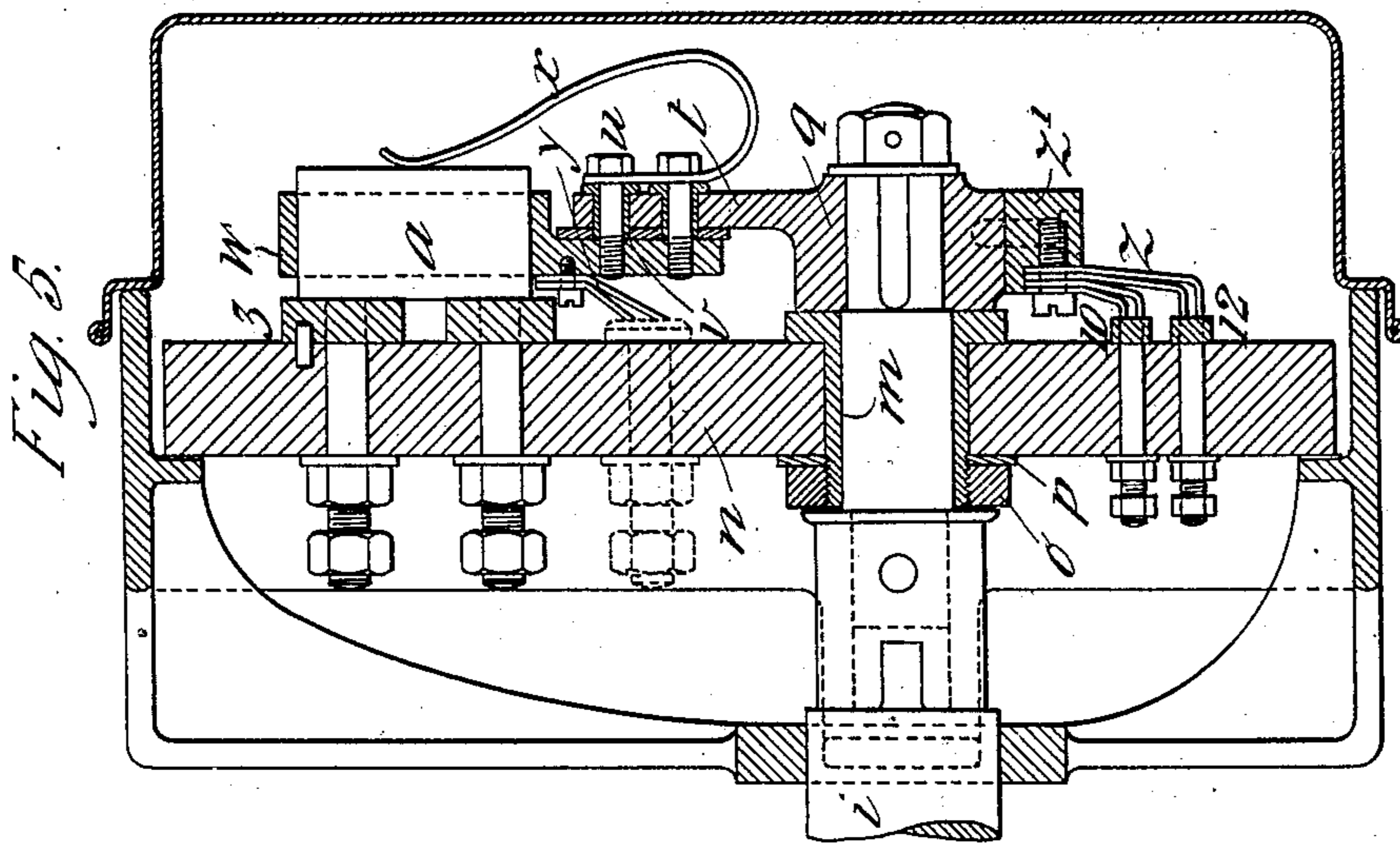
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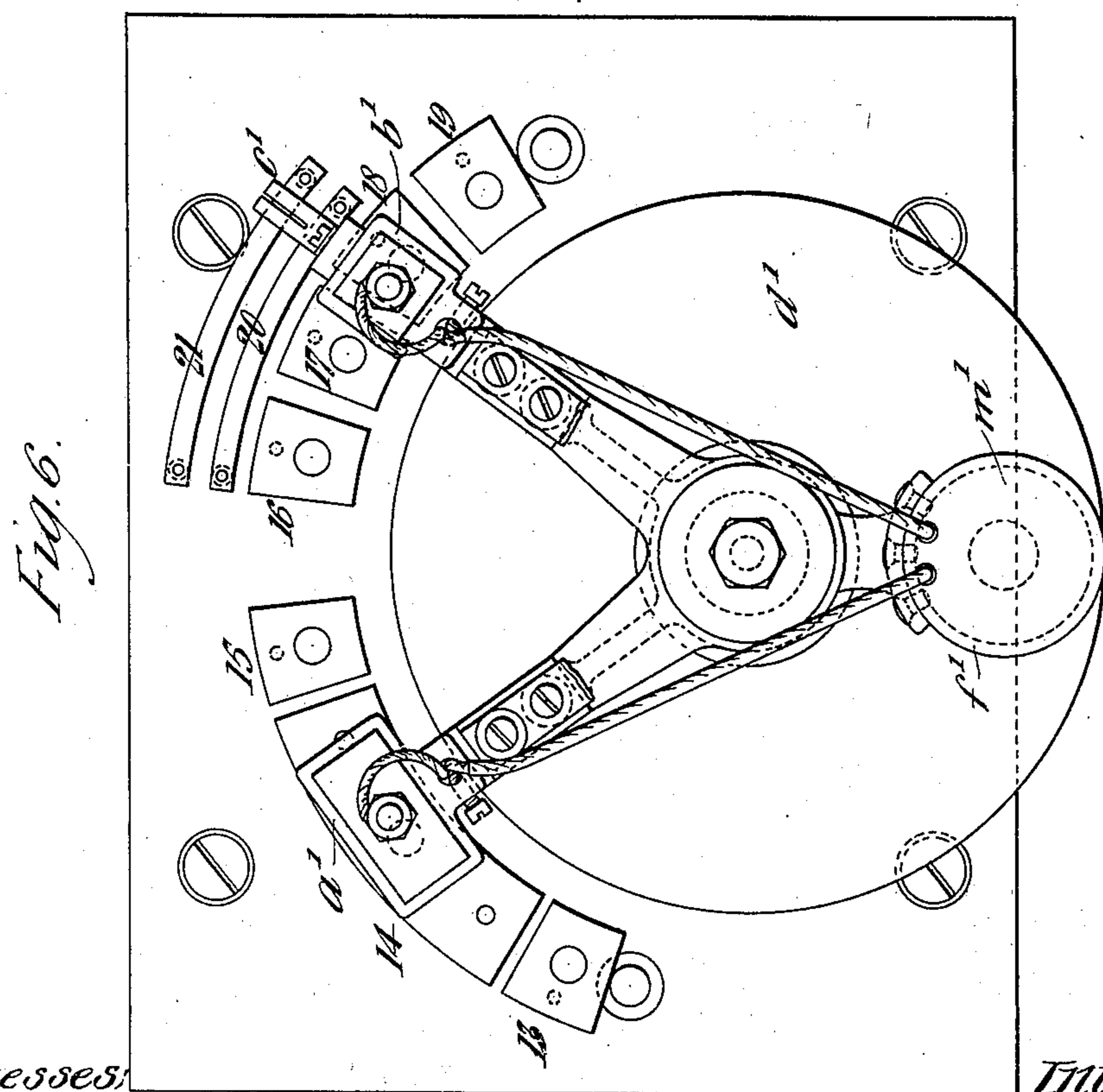
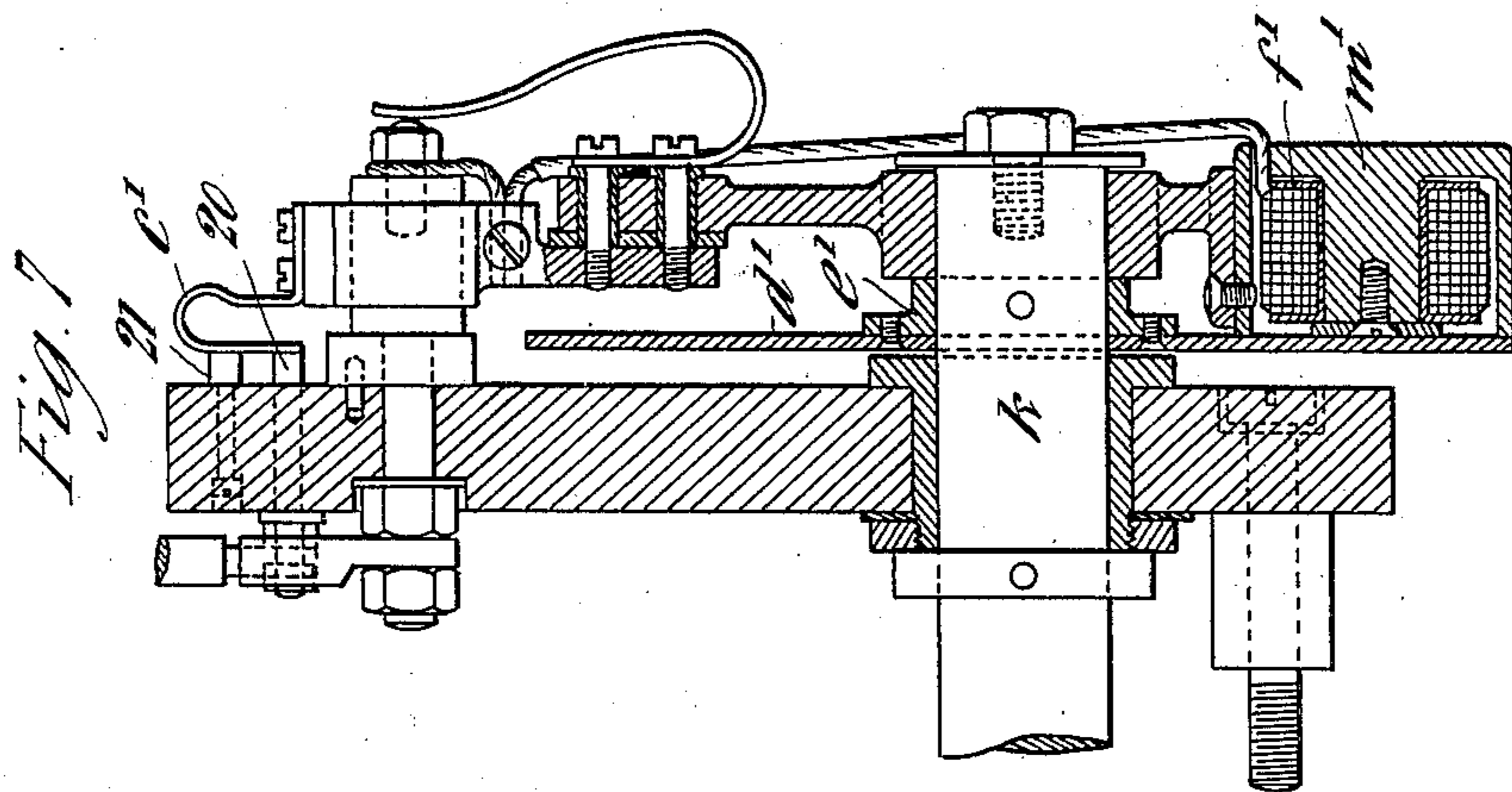
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NO MODEL.

4 SHEETS—SHEET 4.



Witnesses:

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# UNITED STATES PATENT OFFICE.

ALFRED DAVID WILLIAMSON AND CECIL LESLIE SUMPTER, OF SHEFFIELD, ENGLAND, ASSIGNORS TO VICKERS SONS & MAXIM, LIMITED, OF SHEFFIELD, ENGLAND.

## ELECTRICAL APPARATUS FOR WORKING RECIPROCATING TOOLS.

SPECIFICATION forming part of Letters Patent No. 760,289, dated May 17, 1904.

Application filed January 31, 1903. Serial No. 141,300. (No model.)

*To all whom it may concern:*

Be it known that we, ALFRED DAVID WILLIAMSON and CECIL LESLIE SUMPTER, electrical engineers, citizens of England, both residing at The River Don Works, Sheffield, in the county of York, England, have jointly invented certain new and useful Electrical Apparatus for Working Reciprocating Tools, (for which we have made application for a patent in Great Britain, No. 14,774, dated July 2, 1902,) of which the following is a specification.

This invention relates to apparatus for electrically working reciprocating tools—such, for instance, as planing-machines—in which provision has to be made for automatically reversing the direction of motion of the tool and making the return stroke more rapid than the operating stroke. For this purpose a reversible motor of variable speed is employed in conjunction with two switches which control the various electric circuits. One of these switches (the reversing-switch) is operated by the reciprocating mechanism and completes in rotation circuits which, first, drive the tool forward; second, short-circuit the motor-armature at the end of the forward stroke, thereby slowing the motor; third, reverse the motor, thereby driving the tool backward; fourth, short-circuit the motor-armature toward the end of the backward stroke; fifth, reverse the motor again. The other switch is also operated from the mechanism and performs a double function. It is a starting-switch and automatically cuts out resistances in the motor-circuit step by step as the motor gets up speed, and it also accelerates the motor on the return stroke by automatically introducing, in conjunction with the reversing-switch, an additional resistance into the motor field-circuit at the beginning of the return stroke.

In the accompanying drawings, Figure 1 is a diagram of the electrical connections. Figs. 2 and 3 are end and side elevations of the apparatus as applied to a vertical planing-machine. Fig. 4 is an elevation, and Fig. 5 a vertical transverse section of the reversing-switch, and Figs. 6 and 7 are corresponding views of the automatic starting-switch.

Referring first to Figs. 2 and 3, the motor M is arranged to drive through suitable gearing the balanced tool-holder *h* of a vertical planing-machine. The motor is controlled by means of a starting-switch SS and a reversing-switch RS. The former is driven, as will be hereinafter described, through a magnetic clutch-disk *d'*, mounted on the shaft *k*, on which are fixed pulleys *l l'*, which support the balanced tool-holder. The pulleys *l l'*, and therefore the starting-switch, will turn in one direction or the other, according to the direction of travel of the planing-machine. The reversing-switch is mounted on a rocking shaft or reversing-rod *i*, journaled in the frame of the machine and having fixed toward each end suitable cam-shaped blocks *i''*, which are arranged to engage with tappets *i''* on the machine-head at either end of its travel in the well-known manner. By this means the reversing-switch RS is operated at the end of the forward stroke and of the return stroke of the tool to reverse the direction of the motor M, and consequently of the tool.

As shown in Figs. 4 and 5, the reversing-rod *i* passes through a bush *m* in a switch-board *n*, of slate or other suitable material, and secured thereto by means of the flange and the nut *o* and washer *p*. On the projecting end of the reversing-rod *i* is fixed a metal collar *q*, carrying two metal bars or fingers *t t*. To each of these bars is fixed, by means of set-screws *u*, passing through insulating-bushings *v*, a metal carrier *w*, on which is fitted a carbon contact block or brush. These brushes *a b* are pressed by springs *x* against contact-pieces 1 2 3 4 5 6 7, suitably fixed in the board *n* and connected to the electric circuits, as shown in Fig. 1. To each of the brush-carriers *w* are also attached small metal brushes *y y'*, which are arranged to bear on the contact-pieces 8 9, respectively, in the forward and return positions of the switch. In addition to these a double metal brush *z*, carried by an insulating-piece *z'* on the collar *q*, bears on two of the three contact-bars 10 11 12 at various positions of the switch RS.

In Figs. 6 and 7 are shown the construc-

tional details of the automatic starting-switch SS, many of which are similar to those of the reversing-switch RS and need not be again described. The iron disk  $d'$ , through which the switch is operated, is fixed by set-screws to a collar  $c'$ , which is cottered to the driving-shaft  $k$ . The switch-arm is loosely mounted on the shaft  $k$  and carries, in addition to the insulated brushes  $a' b'$ , an electromagnet the energizing-coil  $f'$  of which is connected to the brushes  $a' b'$  and the magnetic circuit of which is closed through the iron core  $m'$  and the iron disk  $d'$ . When the magnet is energized, the switch-arm is therefore magnetically clamped to the shaft  $k$  and will move with it; but as soon as the circuit including the coil  $f'$  is broken the switch will cease to follow the movement of the shaft  $k$ . The brushes  $a' b'$  cooperate with contact-blocks 13 14 15 16 17 18 19, connected with the electrical circuit, as shown in Fig. 1, and in addition a third brush  $c'$ , (shown diagrammatically in Fig. 1,) in conjunction with contact-blocks 20 21, controls a resistance in the field-circuit of the motor.

The operation of the apparatus will be readily understood from a consideration of Fig. 1, which shows the correlation of the various parts of the electrical apparatus and the circuit connections.

When the switches are in the positions shown in Fig. 1, a circuit is completed from the + supply lead through a hand-operated starting-switch, which may optionally be dispensed with, brushes  $c$ , motor-field  $f$ , (from right to left,) back to the - supply lead. At the same time another circuit is completed from the + lead through brush  $a'$  of the automatic starting-switch SS, brush  $a$  of reversing-switch RS, motor-armature  $g$ , (from left to right,) brush  $b$  to the - lead. The motor is now working at maximum torque, driving the tool in the cutting direction. Since the coil  $f'$  in the starting-switch is short-circuited by brush  $a'$ , the magnet  $m'$  is not energized, and therefore the switch will be at rest. As the reversing-switch is turned by the reversing mechanism from the forward to the backward position it passes through an intermediate position in which the motor-armature  $g$  is short-circuited through brushes  $a b$  and resistance  $r$ . In this position the motor field-circuit remains as before, while the armature-circuit is disconnected from the supply. The reversal of the current in the armature is therefore completed at a low speed and in a strong field. As soon as reversal has taken place, however, it will be found on tracing the circuits in Fig. 1 that the motor field-circuit is completed from the + lead through brush  $c$  of switch RS, brush  $c'$  of switch SS, field-coil  $f$  in the same direction as previously, and back to the - lead, while the armature-circuit is completed from the + lead through contact 14 on switch SS, coil  $f'$ , contact 16, resistances  $r' r^2 r^3$ , arm  $b$  of switch RS, armature  $g$ , arm  $a$ , and back to - lead. Thus

in the reversed position of the switch RS the magnet  $m'$  is energized, and therefore the switch SS is rotated with the iron disk  $d'$ , cutting out in succession the resistances  $r' r^2 r^3$ . As the last of these resistances is cut out the brush  $c'$  moves free of the contacts 20 21, and the resistance  $r^4$  is thus introduced into the field-circuit of the motor. At the same time brush  $a'$  short-circuits contacts 14 15, the energizing-coil  $f'$  is cut out of the armature-circuit, and the switch SS comes to rest. The motor is now working at maximum speed in the return direction. At the end of the return stroke of the tool the reversing-switch is turned back to its original position through the intermediate short-circuiting position, and the starting-switch is operated and the various circuits controlled in a manner similar to that above described, the disk  $d'$  in this case being rotated in the reverse direction and the regulating resistances  $r' r^2 r^3$  cut out in the reverse order.

The switches above described are of a convenient construction for carrying out the regulating arrangements of the device, but obviously may be modified greatly in constructional details without departing from the invention.

We claim—

1. Apparatus for electrically working reciprocating tools, comprising a reversible electric motor, a reversing-switch and a starting-switch operated from the reciprocating mechanism, and circuits connecting the motor and switches, substantially as described.
2. In apparatus for electrically working reciprocating tools, a starting-switch consisting of a collar mounted loosely on a shaft, switch-arms attached to the collar, an electromagnet attached to one of the switch-arms, a disk of magnetic material keyed on the before-mentioned shaft and in close proximity to the said electromagnet, and contact-pieces and circuits leading therefrom, substantially as described.
3. In apparatus for electrically working reciprocating tools, a reversing-switch consisting of a reversing-rod operated from the reciprocating mechanism, switch-arms attached to the said rod, brushes attached to the switch-arms but insulated therefrom, and contact-pieces and circuits leading therefrom, substantially as described.
4. Apparatus for electrically working reciprocating tools comprising a reversible electric motor, a reversing-switch operated by the reciprocating tool at each end of its stroke, a resistance-coil connected between two contact-pieces and circuits connecting the said contact-pieces to the motor-armature through the switch before each reversal of the latter, substantially as described.
5. Apparatus for electrically working reciprocating tools, comprising a reversible electric motor, a reversing-switch and a starting-switch operated from the reciprocating mech-

anism, contact-pieces 10, 11, 12 and brush  $z$  on the reversing-switch, contact-pieces 20, 21 and brush  $z'$  on the starting-switch, a resistance-coil  $f$  and circuits connecting said motor, 5 contact-pieces, brushes and resistance-coil during the return stroke of the tool, substantially as described.

6. In starting and reversing switches for electrically working reciprocating tools a magnetizing-coil attached to the switch and moving therewith, resistance-coil in series with the magnetizing-coil and circuits connecting 10

the said magnetizing and resistance coils with the motor - armature substantially as described.

In testimony whereof we have hereunto set our hands in presence of two subscribing witnesses. 15

ALFRED DAVID WILLIAMSON.  
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Witnesses:

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