

H. D. JAMES.
ELECTRIC MOTOR CONTROLLER.

APPLICATION FILED APR. 3, 1905.

2 SHEETS—SHEET 1.

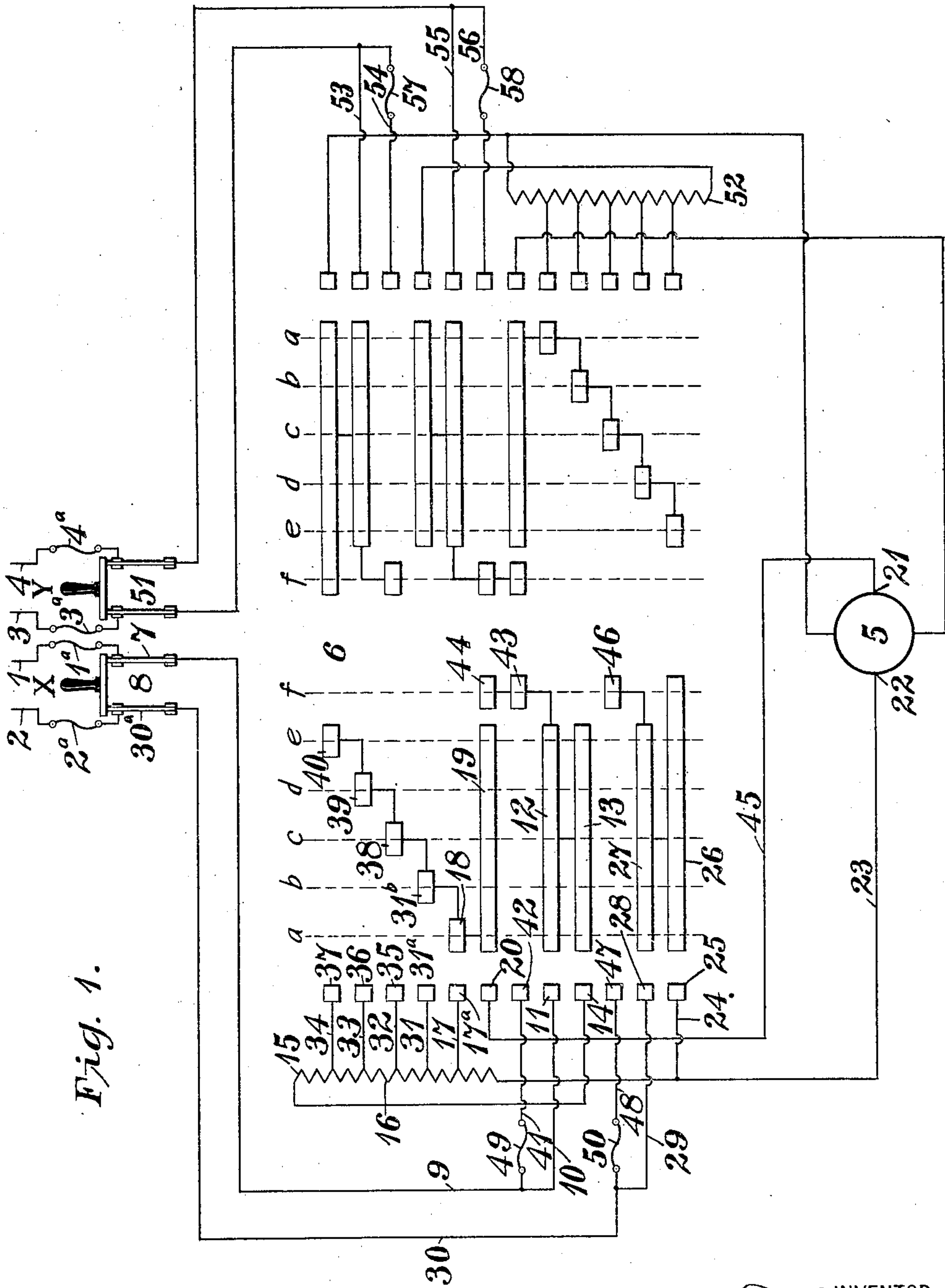


Fig. 1.

WITNESSES:

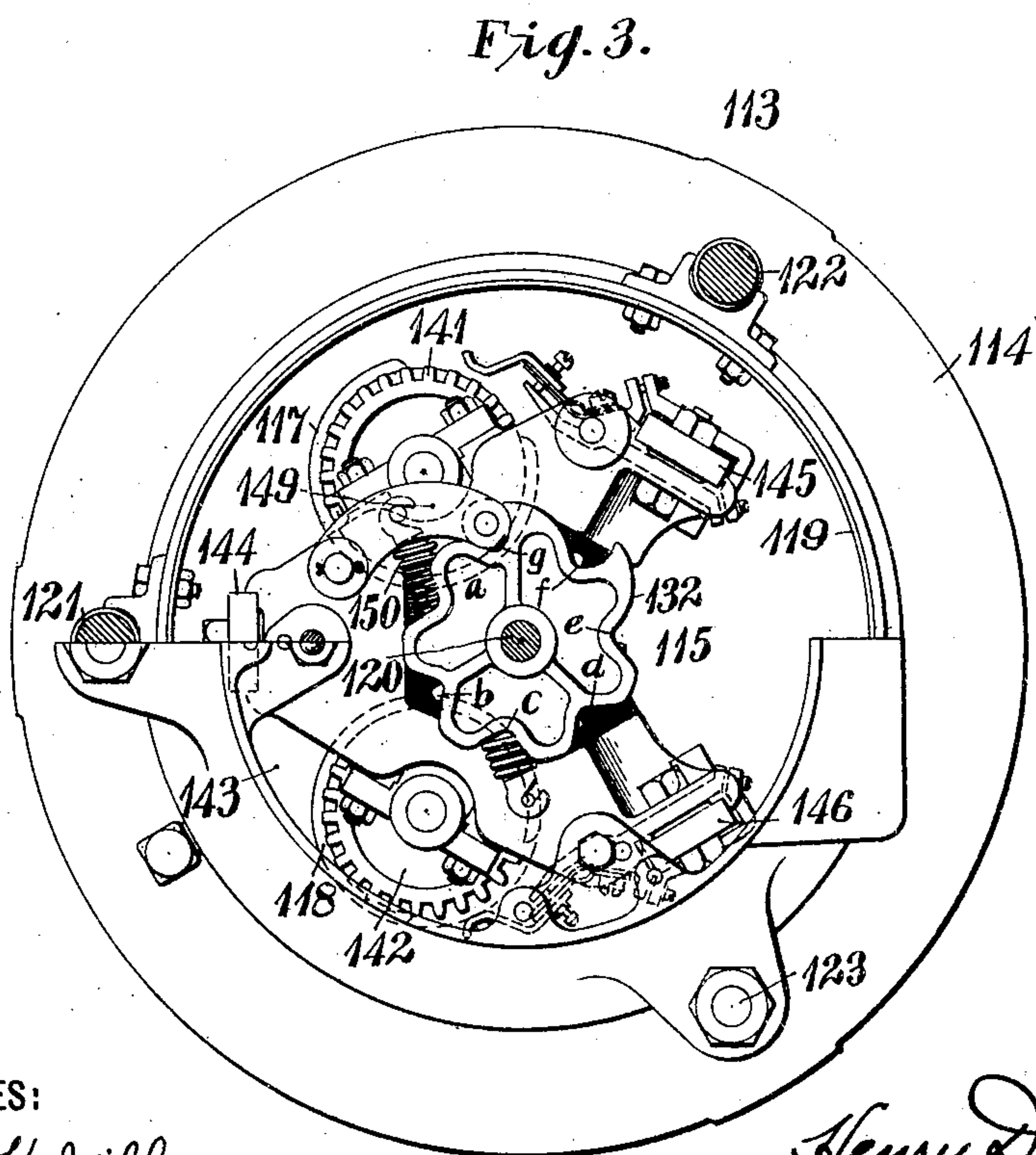
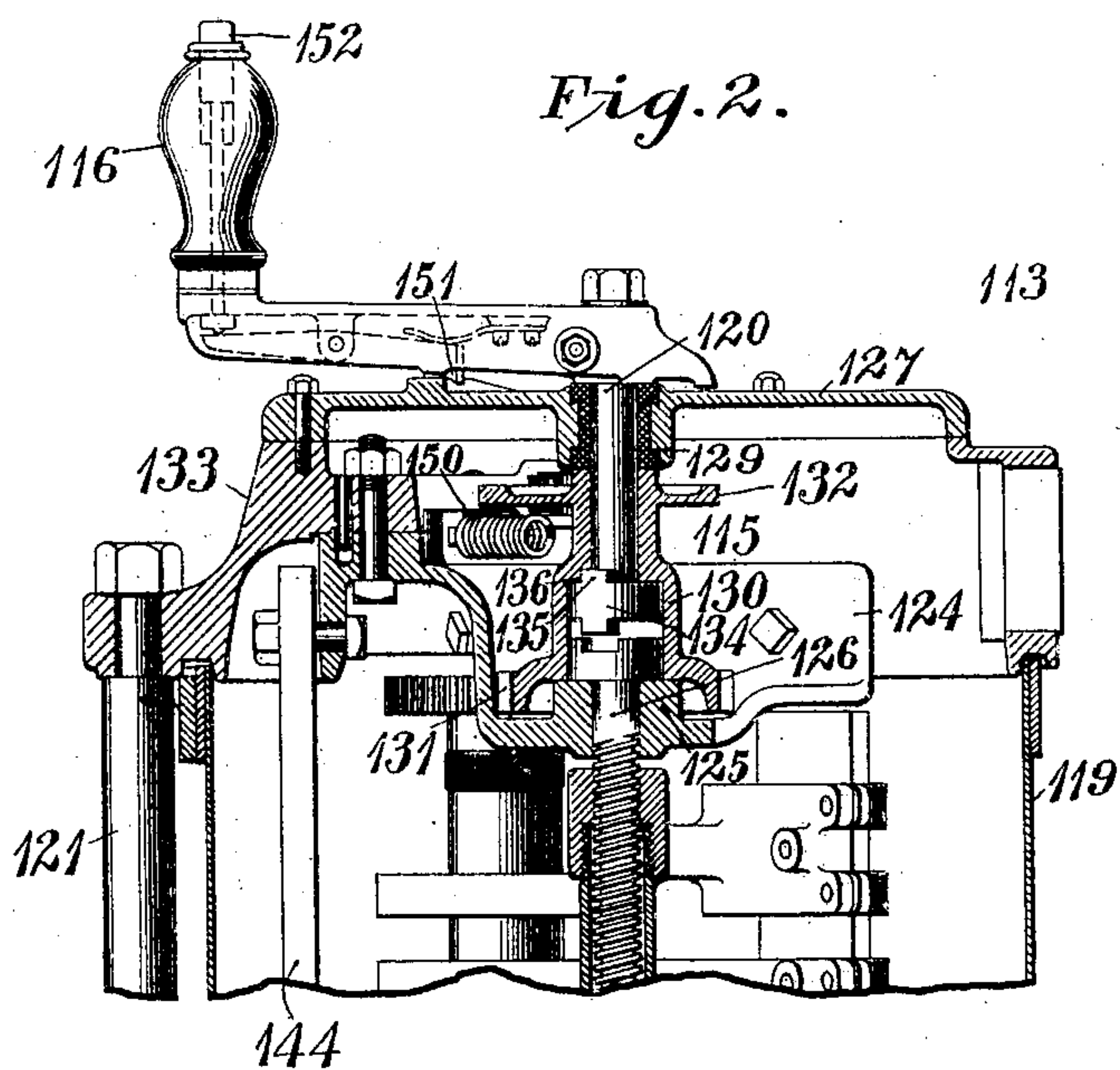
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R. J. Pearson.

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2 SHEETS—SHEET 2.



WITNESSES:

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UNITED STATES PATENT OFFICE.

HENRY D. JAMES, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO WEST-
INGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION
OF PENNSYLVANIA.

ELECTRIC-MOTOR CONTROLLER.

No. 807,937.

Specification of Letters Patent.

Patented Dec. 19, 1905

Application filed April 3, 1905. Serial No. 253,633.

To all whom it may concern:

Be it known that I, HENRY D. JAMES, a citizen
of the United States, and a resident of Pitts-
burg, in the county of Allegheny and State of
5 Pennsylvania, have invented a new and useful
Improvement in Electric-Motor Controllers,
(Case No. 1,367,) of which the following is a
specification.

My invention relates to controllers for elec-
10 tric motors, and particularly to such controllers
as are employed in connection with motors
that require heavy starting-currents.

The object of my invention is to provide a
controller which shall be simple in construc-
15 tion, effective in operation, and well adapted
for application to a system of motor control
that embodies separate protective means for
the starting and the running positions, re-
spectively.

20 The separate protection of the motor under
starting and running conditions makes it ad-
visable to prevent the motor-controller from
running over the starting positions in pass-
ing from the running position to the "off"
25 position, since an interruption of the running-
circuit may occur for any reason, such as an
overload, and the motor be brought to rest,
while the controller remains in the running
position. If it is then returned to the last
30 starting position, which, being in a separate
circuit, is still connected to the line, an ex-
cessive current is delivered to the motor. To
prevent disastrous results of this kind, my
invention provides a controller which is pre-
35 vented by an interlocking device from return-
ing through the starting positions and is free
to pass directly and forwardly from a run-
ning position to the off position.

My invention is illustrated in the accompa-
40 nying drawings, of which—

Figure 1 is a diagrammatic view of a con-
trol system in which fuses are employed as
protective devices. Fig. 2 is a longitudinal
section, and Fig. 3 a plan view, of a controller
45 with cover removed to disclose the drum-ac-
tuating mechanism.

Referring particularly to Fig. 1, polyphase-
alternating-current energy is supplied from
line conductors 1 2 and 3 4 to a two-phase
50 motor 5 through a controller 6, which has a
plurality of starting positions *a*, *b*, *c*, *d*, and
e and one running position *f* so arranged that

the electromotive forces of the two phases are
varied in unison.

Considering first the phase X, that is sup- 55
plied by conductors 1 2, connections are com-
pleted when the controller 6 is in the position
a from conductor 1, through the blade 7 of a
main-line switch 8, conductors 9 and 10, con-
60 tact-finger 11, contact-ring segment 12, con-
tact-ring segment 13, and contact-finger 14,
to one terminal 15 of an autotransformer 16,
which regulates the voltage of phase X that
is supplied to the motor 5. From a tap 17 on
the autotransformer 16 connection is com- 65
pleted, through contact-finger 17^a, contact-
ring segments 18 and 19, and finger 20, to one
terminal 21 of the motor 5. The other termi-
nal 22 of the motor 5 pertaining to phase X
is connected, through conductors 23 and 24, 70
finger 25, ring-segments 26 and 27, finger 28,
conductors 29 and 30, and blade 30^a of the
switch 8, to the line conductor 2.

When the controller 6 is moved from posi-
tion *a* to position *b*, connection is similarly 75
made through another tap 31, finger 31^a, and
ring-segment 31^b, thereby increasing the vol-
tage supplied to the motor 5. The voltage is
similarly increased as the controller passes
through positions *c*, *d*, and *e*, since current 80
flows successively from the taps 32, 33, and
34 of the autotransformer 16, through fingers
35, 36, and 37 and ring-segments 38, 39, and
40, to the ring-segments 19 without any other
change in the circuit connections; but as the 85
controller passes from the position *e* to the po-
sition *f* current from line conductor 1 passes
through conductor 41 instead of through the
conductor 10, since the finger 11 no longer
engages with the ring-segment 12 and finger 90
42 engages ring-segment 43 and completes
connection from the conductor 41, through
the finger 42, ring-segment 43, ring-segment
44, finger 20, and conductor 45, to terminal 21
of the motor 5, which connection throws the 95
full-line voltage on the motor, but causes the
current to flow through the conductor 41,
which was not used in the starting positions
a, *b*, *c*, *d*, and *e*. At the same time connec-
tions are completed from the terminal 22 of 100
the motor 5, through conductors 23 and 24,
finger 25, ring-segment 26, ring-segment 46,
finger 47, conductor 48, and conductor 30, to
line conductor 2, conductor 48 being used for

this position instead of conductor 29, which was used for the starting positions *a*, *b*, *c*, *d*, and *e*, so that by inserting a fuse 49 in the path 41 and a similar fuse 50 in the path 48 the motor 5 may be protected to suit running conditions without preventing the use of heavy starting-currents, which may be limited by equipping the main line 12 with proper fuses 1^a and 2^a to suit starting conditions.

10 The conductors 3 4 supply alternating current of phase Y to the motor 5, which is regulated in an exactly similar manner to that employed for phase X, as hereinbefore described. In connection with phase Y a switch 51 corresponds to the switch 8 of phase X, an auto-transformer 52 corresponds to the transformer 16, and a plurality of conductors 53, 54, 55, and 56 to the conductors 29, 48, 10, and 41, respectively. The conductors 54 and 56 are 20 provided with fuses 57 and 58, which are respectively similar to the fuses 50 and 49, that pertain to phase X, and line conductors 3 and 4 may be provided with fuses 3^a and 4^a.

In Figs. 2 and 3 is illustrated a controller 25 113, comprising a base 114, a drum-actuating mechanism 115, a manually-operated controller-handle 116, a plurality of drums 117 and 118, a tank or casing 119, and a shaft 120. The drum-actuating mechanism 115 is supported from the main base 114 by a plurality of 30 rods 121, 122, and 123 and comprises a spider 124, having a bearing 125 for the upper end of a shaft 126, which constitutes one section of the main shaft, the shaft 120 constituting the other 35 section. A top plate 127 supports the shaft 120 in a bearing 129 and a sleeve 130, on which are cast a spur-gear 131 and a cam-wheel 132. Attached to the plate 127 is a frame 133, to which the bearing-spider 124 and the supporting-rods 121, 122, and 123 are fastened. The 40 lower end of the shaft 120 is provided with a collar 134, which has a projection 135 that may engage with a notch 136 in the sleeve 130. Under normal operating conditions the 45 collar 134 is held in engagement with the sleeve 130, and the gear-wheel 131 on the sleeve 130 engages gear-wheels 141 and 142, which are keyed to the shafts of the controller-drums 117 and 118, respectively, that are 50 rotatably supported upon an independent base 143, which is suspended from the spider-casting 124 by means of a plurality of rods or bars 144, 145, and 146. A pawl 149 is pressed into engagement with the cam-wheel 55 132 by a spring 150 in the usual manner. A plurality of notches *a*, *b*, *c*, *d*, *e*, *f*, and *g* in the cam-wheel 132 correspond to different controller positions and serve to indicate each operating position. In order to further accentuate the operating positions and to prevent passing from the running to the off position by mistake, I provide a series of corresponding notches on the top plate 127, that are engaged by a pawl 151 in the handle 116,

which must be released by a push-button 152 65 in the usual manner, when the controller occupies the running position.

Assuming that the cam-wheel 132 is moved so that the pawl 149 first engages the notch *g* and then the notches *a*, *b*, *c*, *d*, and *e*, which 70 correspond to the starting position of the controller, and finally the notch *f*, which corresponds to the running position of the controller, the notches *g* and *f* of the cam 132 are so formed that when the pawl 149 en- 75 gages either of them the cam-wheel cannot be reversely rotated. In other words, when the controller is in the off position it may be moved only to the first starting position, and when it is in the full running position it can 80 be moved only to the off position.

While I have shown and described a specific combination of devices for effecting a desired result, I desire it to be understood that all variations in form, dimensions, and arrange- 85 ment of parts which do not materially change the mode of operation or result are within the scope of my invention.

I claim as my invention—

1. In a controller, the combination with a 90 rotatable, contact-carrying member and an operating-handle therefor, of a notched wheel attached to said rotatable member, the notches of which correspond to a series of controller positions, a pawl held in engagement with 95 said notches by a spring, certain of said notches being constructed to limit the motion of said contact-carrying member to one direction of rotation, and a separate means for stopping and holding a rotatable member in 100 certain positions.

2. In a controller, the combination with a rotatable, contact-carrying member, and an operating-handle therefor, of an interlocking 105 device for permitting the progressive rotation of said contact-carrying member in one direction and for preventing rotation in the opposite direction when said member occupies certain predetermined positions, comprising a notched wheel rigidly fixed upon 110 the shaft of said contact-carrying member and a pawl held in engagement with the wheel-notches, and a separate latching device for positively stopping and holding said rotatable member in one or more predetermined posi- 115 tions.

3. The combination with a translating device and a controller therefor, of an interlocking device and separate protective device that is operative only when said controller occupies a predetermined running position from which said controller is limited by said interlocking device to a single direction of motion but is permitted an indefinitely progressive motion in said direction. 125

4. The combination with an electric motor and a controller therefor, of an interlocking device and protective means that are operative

at certain predetermined current values when
said controller occupies a plurality of start-
ing positions and that are operative at certain
other predetermined current values when said
5 controller occupies a predetermined running
position from which said controller is limited
by said interlocking device to a single direc-
tion of motion and is permitted an indefinitely
progressive motion in said direction.
10 5. The combination with an electric motor
and a controller therefor, of an interlocking
device and protective means that are operative
at certain predetermined current values when
said controller occupies a plurality of start-
15 ing positions from which said controller is
free to move in either direction and that are
operative at certain other predetermined cur-
rent values when said controller occupies a
predetermined running position from which
20 said controller is limited by said interlocking
device to a single direction of motion and is

permitted an indefinitely progressive motion
in said direction.

6. In a controller, the combination with a
rotatable, contact-carrying member, and an 25
operating-handle therefor, of two independ-
ent interlocking devices of which one com-
prises a cam-wheel attached to said member
and engaged by a pawl to limit the motion of
said member to a single direction of rotation 30
from certain predetermined positions, and the
other comprises a manually-released ratchet
attached to said operating-handle to lock said
contact-carrying member in certain prede-
termined positions, which may or may not 35
correspond to the aforesaid positions.

In testimony whereof I have hereunto sub-
scribed my name this 22d day of March, 1905.

HENRY D. JAMES.

Witnesses:

OTTO S. SCHAIRER,
BIRNEY HINES.