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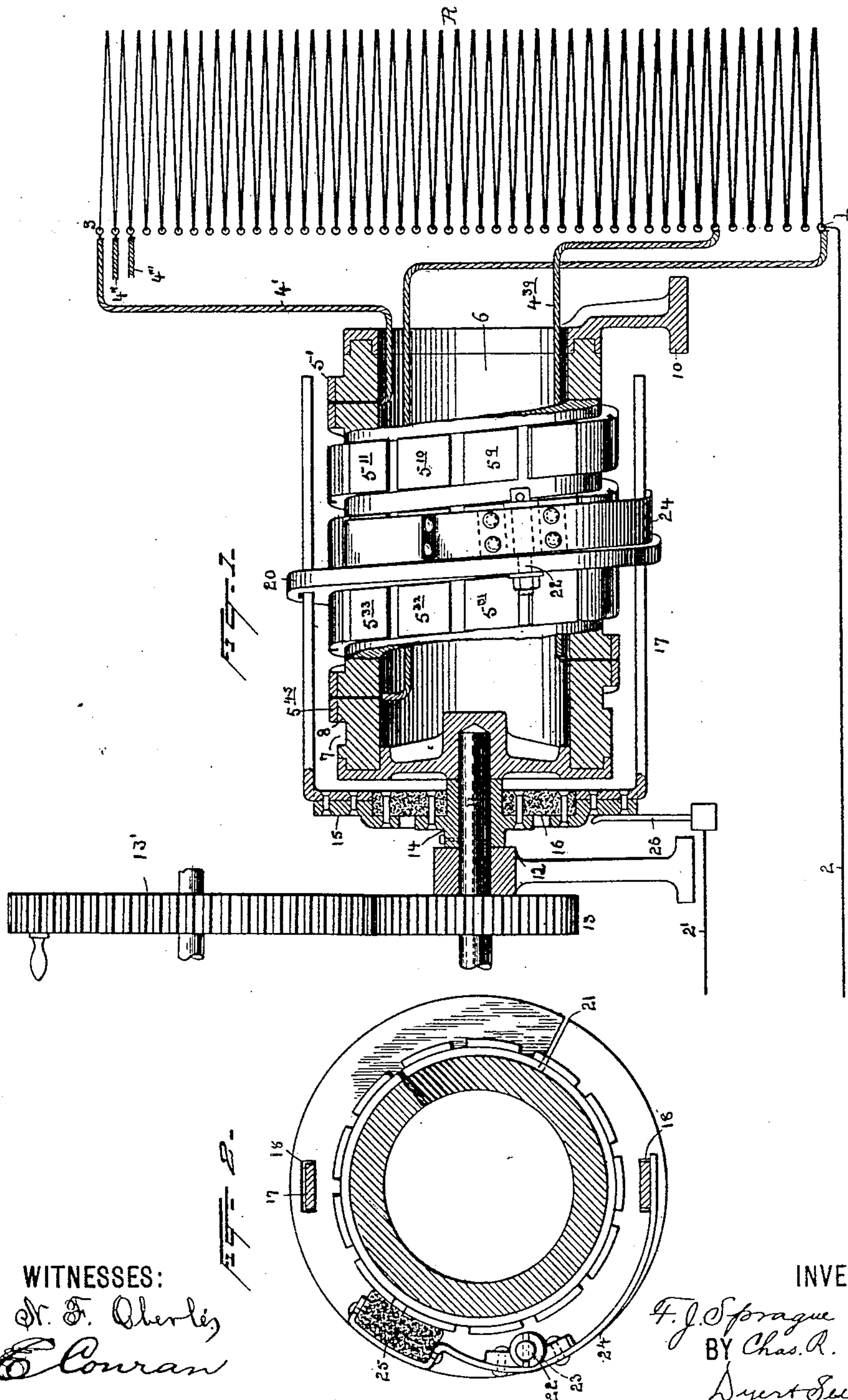
(No Model.)

2 Sheets—Sheet 1.

F. J. SPRAGUE & C. R. PRATT.  
ADJUSTABLE RHEOSTAT.

No. 465,218.

Patented Dec. 15, 1891.



WITNESSES:

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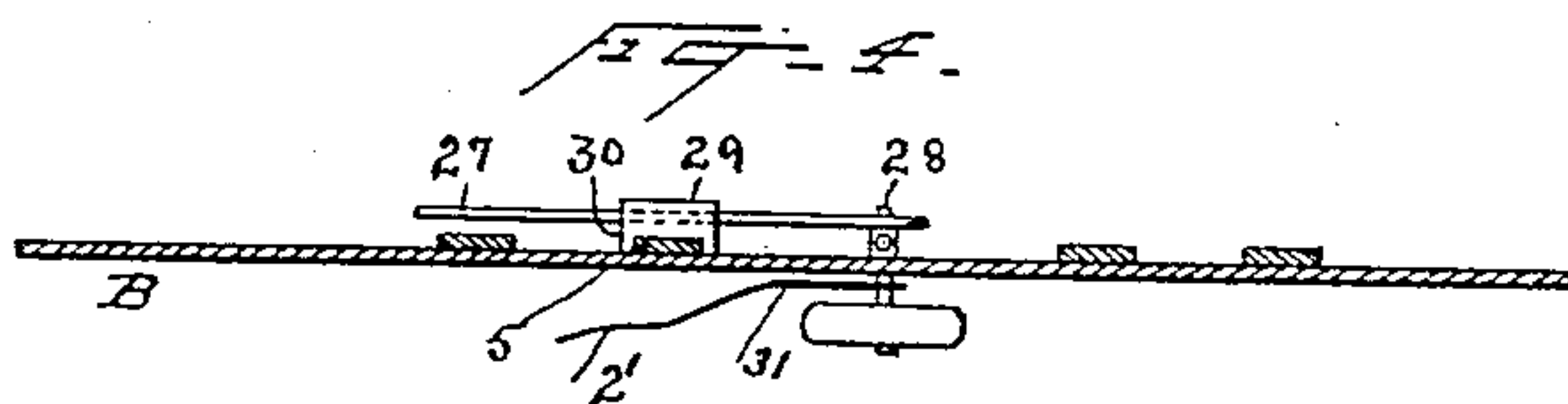
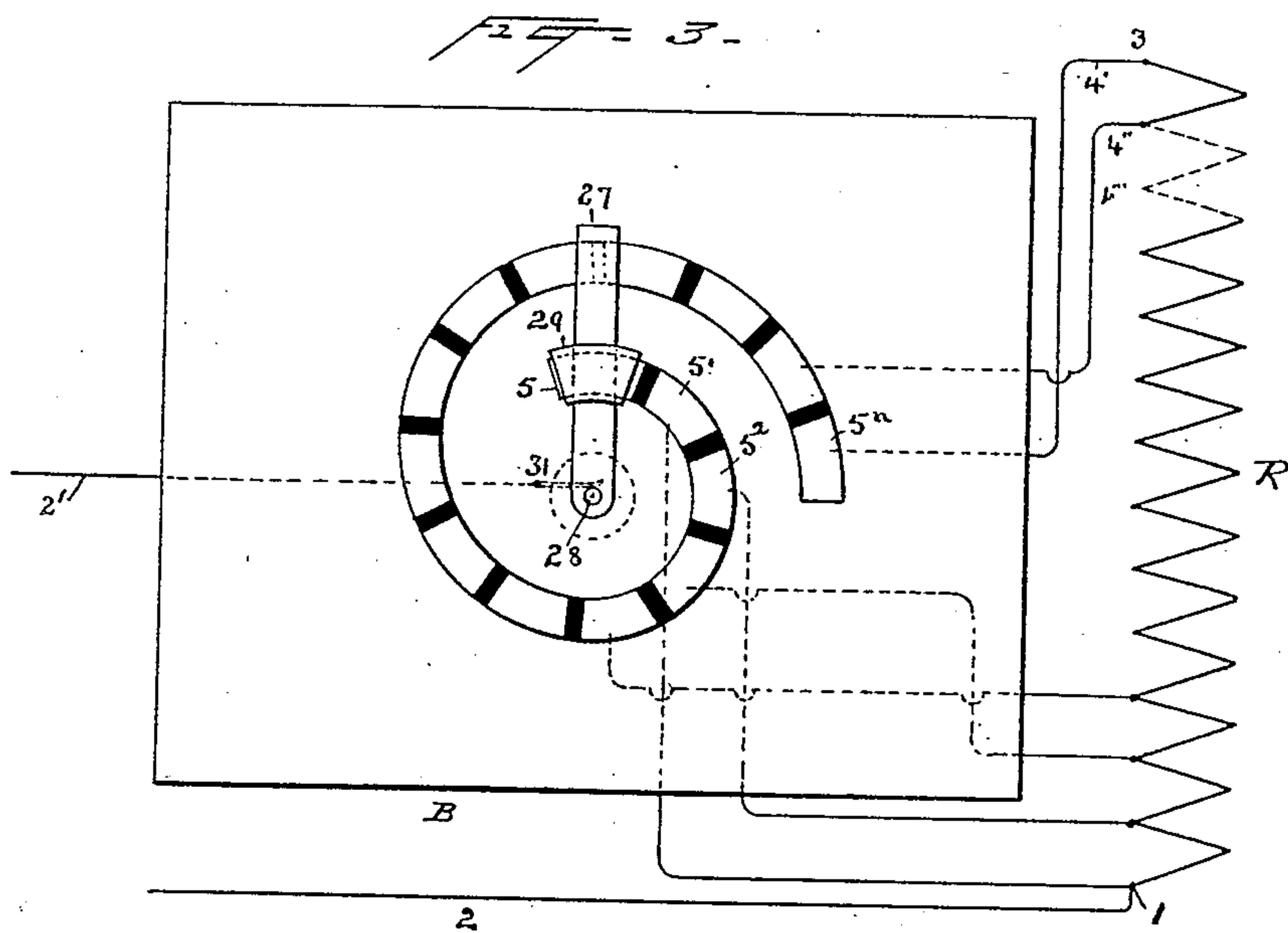
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Witnesses  
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## UNITED STATES PATENT OFFICE.

FRANK J. SPRAGUE AND CHARLES R. PRATT, OF NEW YORK, N. Y.

## ADJUSTABLE RHEOSTAT.

SPECIFICATION forming part of Letters Patent No. 465,218, dated December 15, 1891.

Application filed August 25, 1891. Serial No. 403,704. (No model.)

*To all whom it may concern:*

Be it known that we, FRANK J. SPRAGUE and CHARLES R. PRATT, both citizens of the United States, residing at New York city, County and State of New York, have invented certain new and useful Improvement in Adjustable Rheostats, of which the following is specification.

The present invention relates to devices for throwing more or less resistance into or out of an electric circuit and for making and breaking such circuit.

The main object of the invention is to provide a device of the character indicated having a large number of contact-plates in the switch, by means of which the resistance is varied, said contact-plates being large, but being so mounted that they occupy a small space, and to provide a rapidly-moving co-operating contact.

In the accompanying drawings, Figure 1 is a side view, partially in section, of the improved device. Fig. 2 is a section thereof at right angles to Fig. 1. Fig. 3 is a view of a modified form of switch, and Fig. 4 is a side view of the switch-arm.

R is a resistance-conductor or a series of resistance-conductors, the terminal 1 of which is connected or adapted to be connected to the circuit-wire 2. The opposite terminal 3 is connected by wire 4' to the first or second contact-plate 5, of which there are forty-six, numbered from 5 to 5<sup>45</sup> on the switch apparatus, which comprises an insulating or other suitable body 6, preferably in the form of a hollow cylinder, having a spiral groove 7 around it from end to end. On the raised thread 8 are mounted the contact-plates 5, which should be made of good conducting material and should be quite large in order to keep down the current passing between the contact-plates and the co-operating-contact per unit of surface, and in order that good contact may be obtained without the necessity of pressing the contact block or device strongly against the contact-plates there should be a wide space between adjacent contact-plates. By the construction described sparking and heating are reduced.

With this switch we have in practice used a current of one hundred amperes and two hundred and forty volts without injurious spark-

ing and without burning or welding together the contacts. The contact-block employed had a contact-surface of about two square inches, while the contact-plates were about an inch and a half square, and there were about fifty of the contact-plates. We do not, however, limit ourselves to these proportions or this number of plates.

From the stationary binding-posts between terminals 1 and 3 conductors 4'' 4''' &c., extend to the several spirally-arranged plates. The conductor 4'' will lead to the plate 5'', 4''' to plate 5''', and so on in regular order, all the conductors being led into the hollow cylinder and through the wall thereof to the contact-plates. It is evident that by supporting the contact-plates on the surface of the cylindrical body and leading the connecting-wires thereto from the inside of the cylinder a compact and convenient construction is obtained. To avoid confusion in the drawings only a few of the conductors 4 are shown. One end of the insulating-body is supported by the bracket 10 and the opposite end is supported loosely on the end of the shaft 11, which has a bearing 12. On the shaft is a wheel 13, which may be driven by any suitable power, such as an electric motor or by hand. To get a quick motion of the brush, speed-gearing (indicated by wheel 13') may be used. To the shaft is rigidly fixed a hub 14, carrying a rim 15, insulated by the web 16. The rim 15 carries one or more arms 17, which pass through slots 18 in the traveler or nut 20. This traveler consists of an insulating-ring cut at 21 and engaging or fitting into the spiral groove or channel 7. The contact-plates themselves form a spiral channel, and the groove 7 in the body is therefore not essential. Passing through the carrier is a pin 22, on which is a sleeve 23, carrying a spring 24, one end of which presses against the lower arm 17 and is adapted to move along said arm to maintain electrical contact with it, and the other end of which carries a switch-contact block or spring.

A carbon block is shown in the drawings, and is preferred on account of its conducting properties and because of the small amount of friction which results from the rubbing-contact between the block and the contact-plates. The block has a curved face adapted



to ride along on the spirally-arranged contact-plates and to pass on to one contact-plate before it leaves the preceding plate.

26 is a brush connected to the circuit-wire 2' and maintaining rubbing contact with the rim 15, and hence being electrically connected to arm 17, spring 24, and brush 25. While it is preferable to make the brush the movable member of the switch, this is not essential. When the first wire is connected to the contact-plate 5', the first contact-plate 5 (not shown in Fig. 1, but shown in Fig. 3) will be dead—that is, it will have no circuit connection, so that when the switch block or brush 25 moves onto the first contact-plate the wires 2 2' will be entirely disconnected.

The operation of the apparatus above described is as follows: Suppose the traveler 20, with the parts carried thereby, to be at the right end of the spirally grooved or channeled body, with the block 25 resting on the first contact, the circuit 2 2' being open. The wheel 13 is driven in the direction to move the block 25 toward the left, and when the block moves onto the second contact-plate, 2 is connected to 2' through the entire resistance between terminals 1 and 3. As block 25 moves onto the third contact-plate, the first section of resistance is thrown out of circuit, and as the traveler and block 25 advance the other sections of the resistance are successively cut out until, when block 25 rests on contact 5<sup>45</sup>, the wires 2 2' are connected directly through the switch without including any of the resistances.

As already indicated, the arrangement of contacts described enables us while using a large number of contact-plates for the purpose of dividing the resistance into numerous sections to make each one much larger than would be practicable if the contacts were arranged in a circle in the usual manner, and at the same time the space occupied by the contacts is reduced to a minimum, which is especially desirable when the switch is employed on elevators or vehicles or in other places where space is valuable, and by the means described the switch-contact can be rapidly and easily moved along over the contacts. It will be evident that the contacts may be arranged spirally on a body of different form, and that the switch-brush may be differently operated without departing from our invention. One such modification is shown in Figs. 3 and 4. B is a suitable base, on which are several contact-plates 5 5', &c., corresponding to similar plates in Fig. 1. These plates are insulated from each other and are arranged in a spiral line on the base. Ordinarily a large number of contact-plates will be used; but for simplicity of illustration a few only are shown. 27 is an arm mounted on a spindle 28, which may be turned by any suitable means. On the arm is a carbon or other switch block 29, having projections 30, embracing the contact-plates. R is the resistance, and 2 2' are the wires of the motor-

circuit, 2 being connected to the terminal post 1 and 2' being connected to the brush 31, bearing against the spindle 28, which is electrically connected with the arm 27 and block 29. The first plate 5 is dead; but the following plates are connected in regular order to the successive sections of the resistance by wires 4' 4'', &c., the last section being connected to the last plate 5<sup>n</sup>. When the arm 27 is moved, the switch-block will ride along on the successive contacts and will be moved lengthwise on the arm by the spirally-arranged contact-plates acting on the projection 30 of the block in an evident manner.

What we claim is—

1. The combination, in an adjustable rheostat, of a series of contact-plates spirally arranged and a relatively-moving switch-contact adapted to co-operate with said contact-plates, substantially as described.
2. The combination of a suitable body, several separate contact-plates arranged spirally thereon, and a switch contact adapted to co-operate with said spirally-arranged contacts, said contact-plates and switch-contact moving relatively in two directions, substantially as described.
3. The combination of a suitable body, several separate contact-plates arranged spirally thereon, and a switch-contact movable spirally along said body and adapted to co-operate with said spirally-arranged contacts, substantially as described.
4. The combination, in a switch, of a stationary body, several contact-plates spirally arranged thereon and connected or adapted to be connected to a circuit, and a switch-contact movable along spirally over said contact-plates and connected or adapted to be connected to a circuit, substantially as described.
5. The combination of a suitable body, a series of contacts arranged spirally thereon, there being a channel between the turns of the spiral, and a relatively-movable switch-contact engaging or fitting into said channel so as to be moved lengthwise of the body, substantially as described.
6. The combination of a body having a spiral groove or channel, contacts arranged spirally on said body, a traveler movable along the spiral groove or channel, and a switch-contact moved by the traveler, substantially as described.
7. The combination of a stationary cylinder, contacts arranged spirally thereon, a traveler carrying a switch-contact, and means for turning said carrier, whereby the switch-contact is moved along over the spirally-arranged contact, substantially as described.
8. The combination of a resistance-conductor, several contacts connected therewith at different points, said contacts being mounted spirally on a supporting-body, and a switch-contact co-operating with the several spiral contacts, substantially as described.
9. The combination of a resistance-conductor, several contacts connected therewith



at different points, said contacts being mounted spirally on a supporting-body, and a switch-contact movable spirally along said body in position to co-operate with the several spiral  
5 contacts, substantially as described.

10. The combination of a resistance-conductor, one end of which is connected or adapted to be connected to a circuit, and a switch for throwing more or less of said resistance into or out of circuit, said switch consisting of a suitable body on which are several  
10 contact-plates spirally arranged, and a co-operating switch-contact adapted to make contact with the several spirally-arranged contacts, and a connection from each of said contacts to a different point in the resistance-conductor, substantially as described.

11. The combination of a hollow cylindrical

body, a series of spirally-arranged contact-plates on the surface thereof, and wires leading to said plates from the interior of the  
20 body, substantially as described.

12. The combination, with a resistance-conductor, of a switch comprising a hollow cylindrical body, a series of contact-plates spirally  
25 arranged thereon, a co-operating switch-contact, and wires leading from the resistance-conductor through the cylindrical body to the contact-plates, substantially as described.

This specification signed and witnessed this  
30 11th day of August, 1891.

FRANK J. SPRAGUE.  
CHARLES R. PRATT.

Witnesses:

IRVING S. SMITH,  
J. C. GRISWOLD.

It is hereby certified that in Letters Patent No. 465,218, granted December 15, upon the application of Frank J. Sprague and Charles R. Pratt, of New York, N. for an improvement in "Adjustable Rheostats," errors appear in the printed specification requiring correction as follows: In line 46, page 1, a semicolon should be inserted after the word "contact-plates"; also after the same word in line 48, same page, and the following word "By" should commence with a small *b*, making a continuous sentence; and that the said Letters Patent should be read with these corrections therein to conform to the papers pertaining to the case in the Patent Office.

Signed, countersigned, and sealed this 29th day of December, A. D. 1891.

[SEAL.]

CYRUS BUSSEY,

*Assistant Secretary of the Interior.*

Countersigned:

W. E. SIMONDS,

*Commissioner of Patents.*