No. 701,455. Patented June 3, 1902.

T. VON ZWEIGBERGK.

CONTROLLER.

(Application filed Jan. 23, 1902.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.

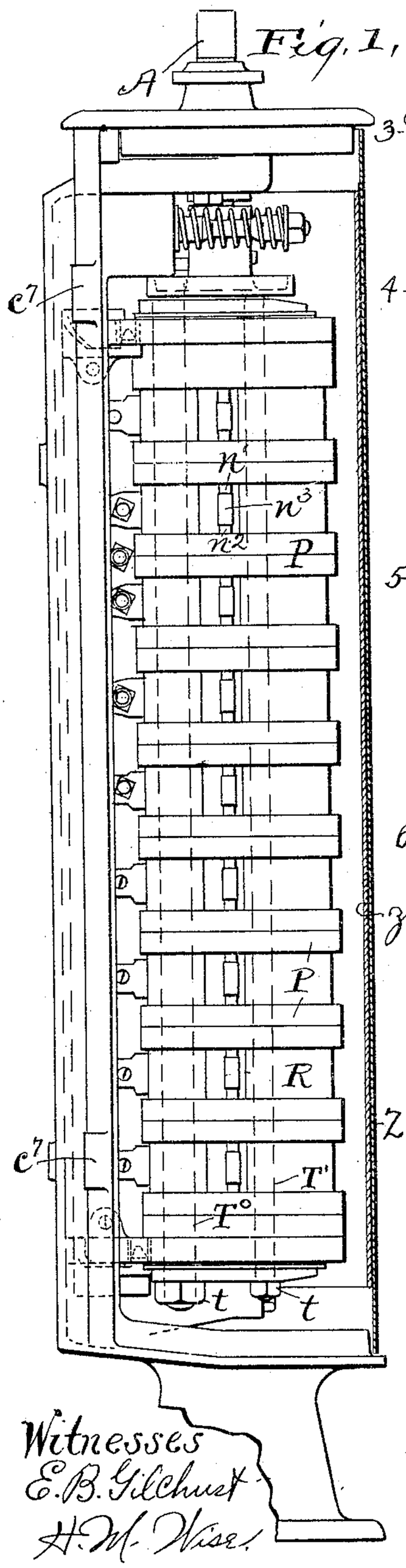
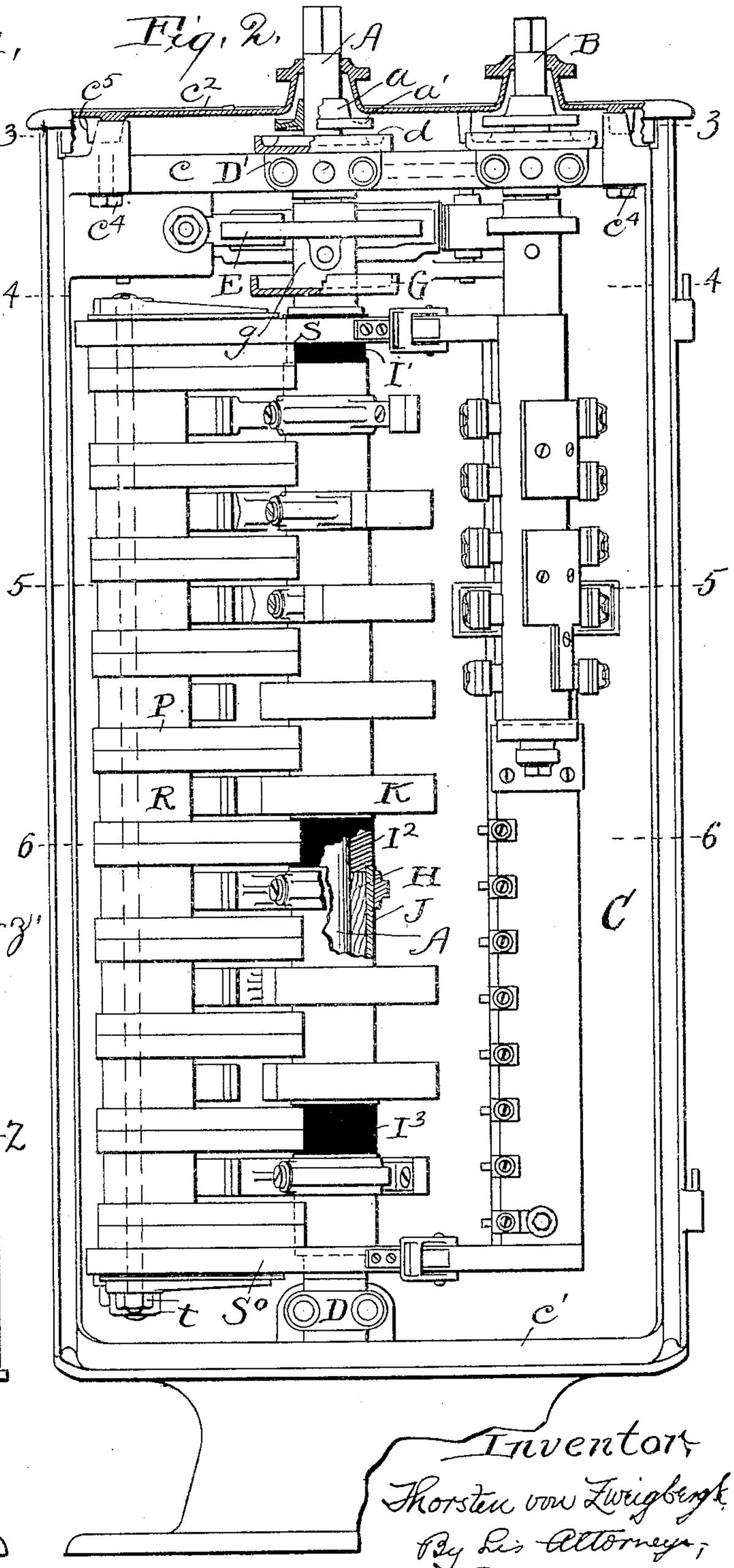


Fig. 2.



Witnesses
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(No Model.) 4 Sheets—Sheet 2.

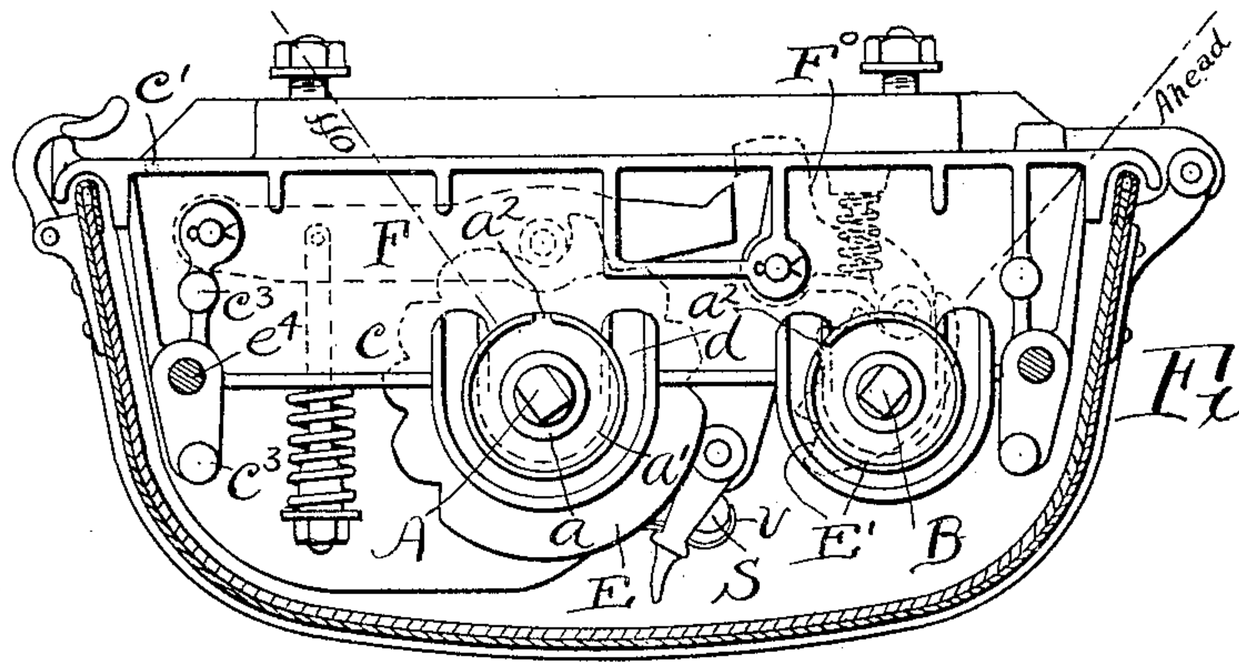

Fig. 3.

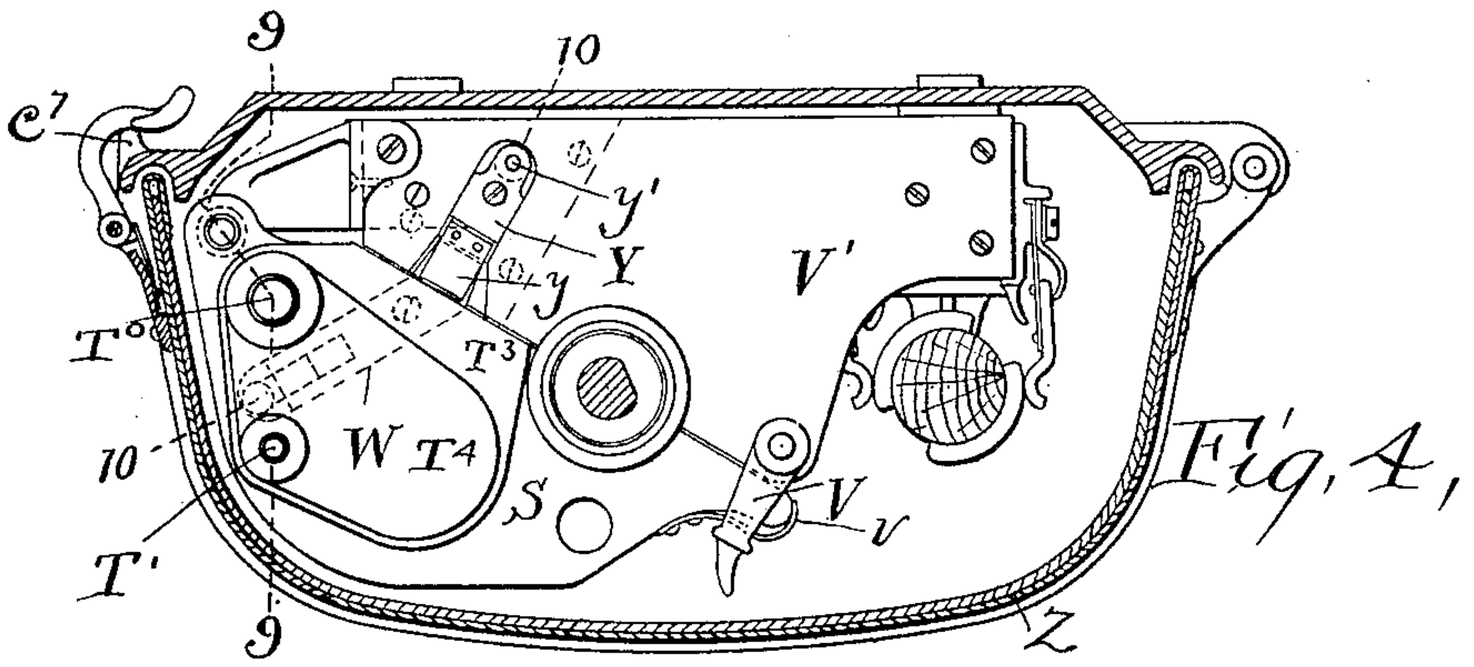

Fig. 4.

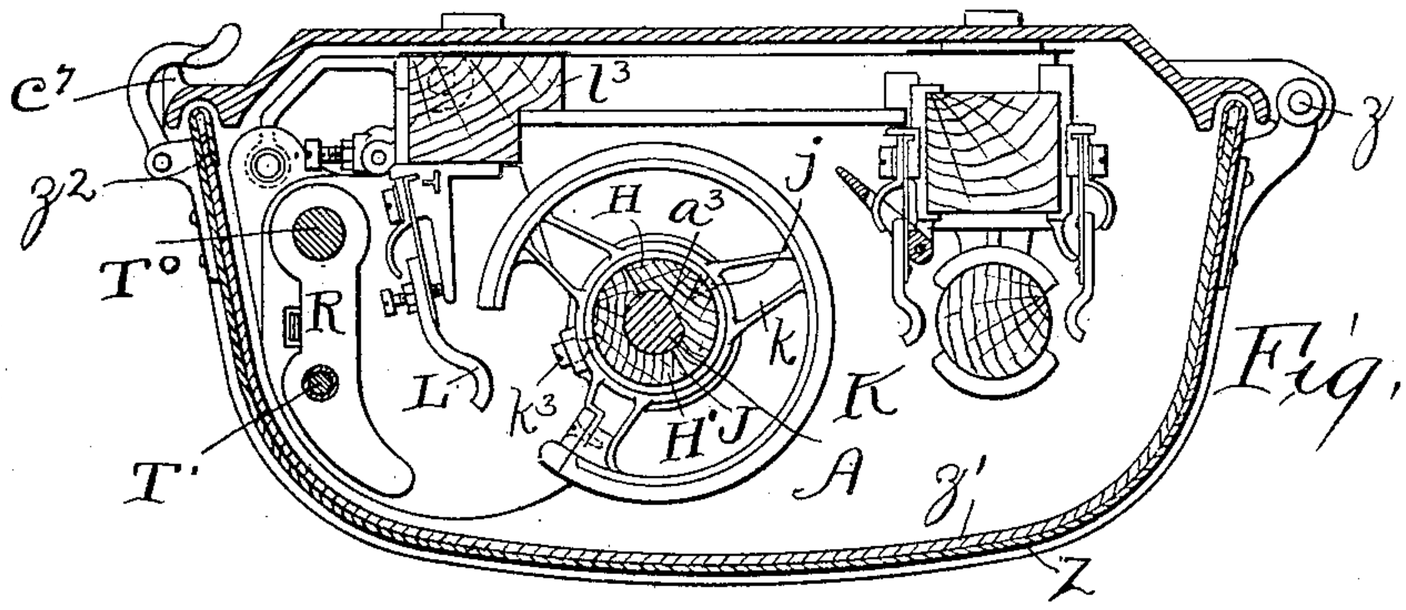

Fig. 5.

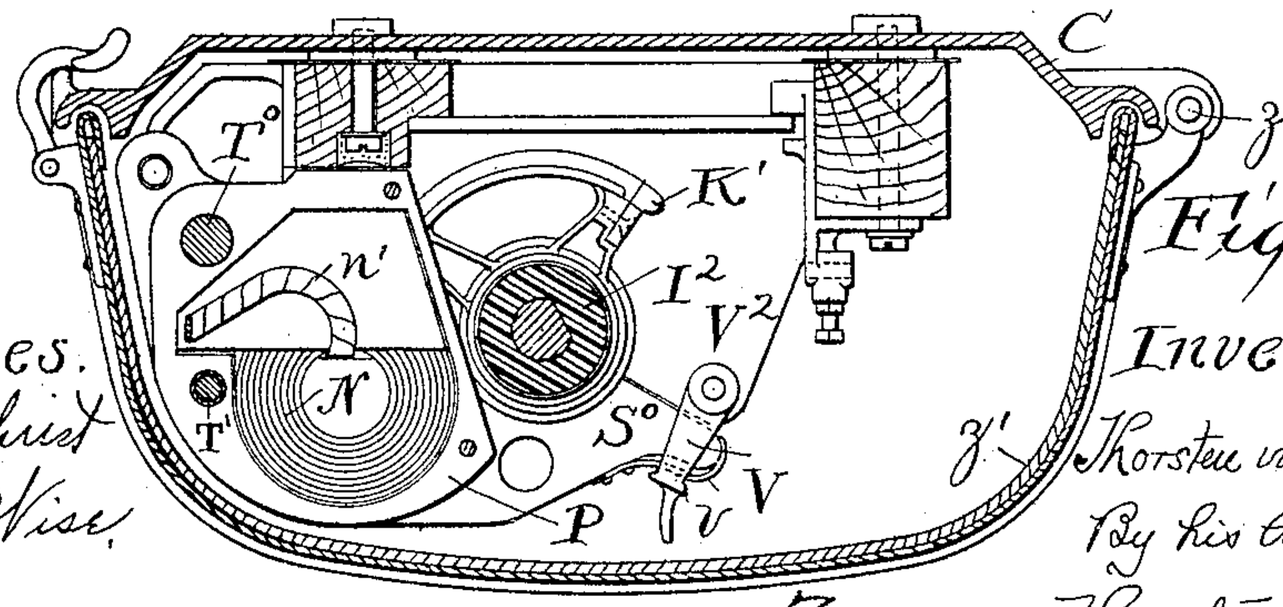

Fig. 6.

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(No Model.) 4 Sheets—Sheet 3.

Fig. 8,

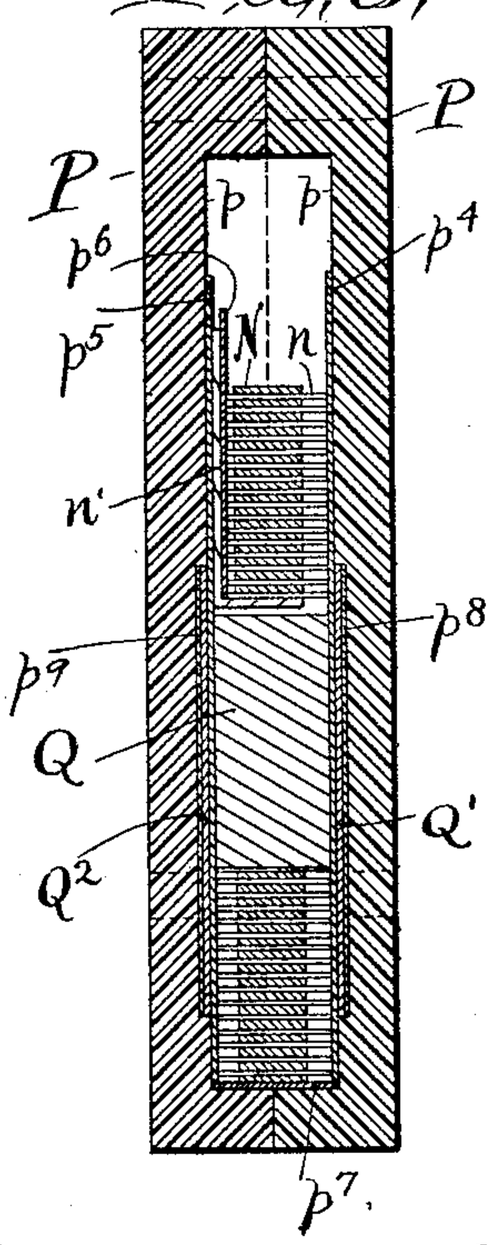


Fig. 7,

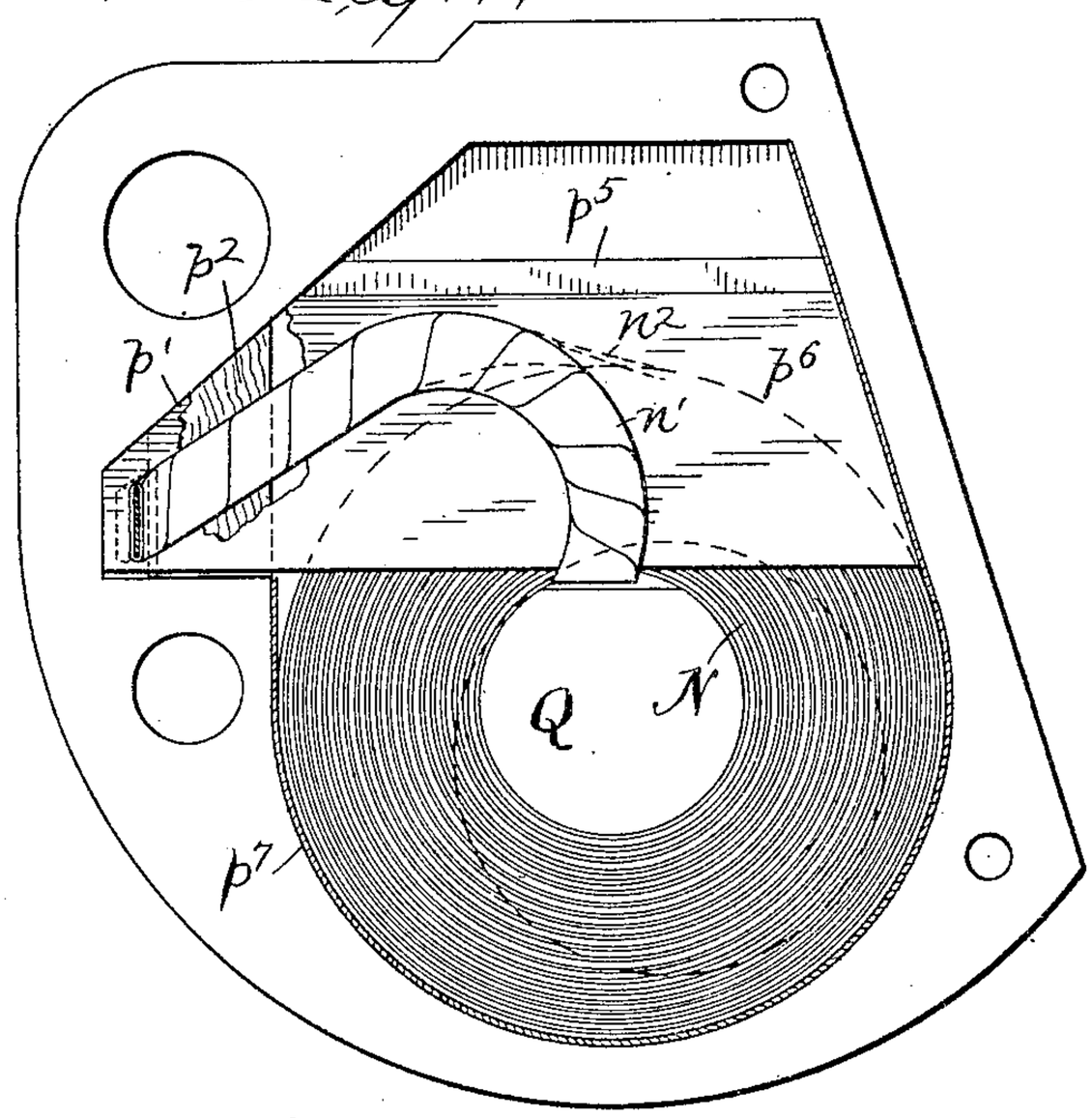


Fig. 9,

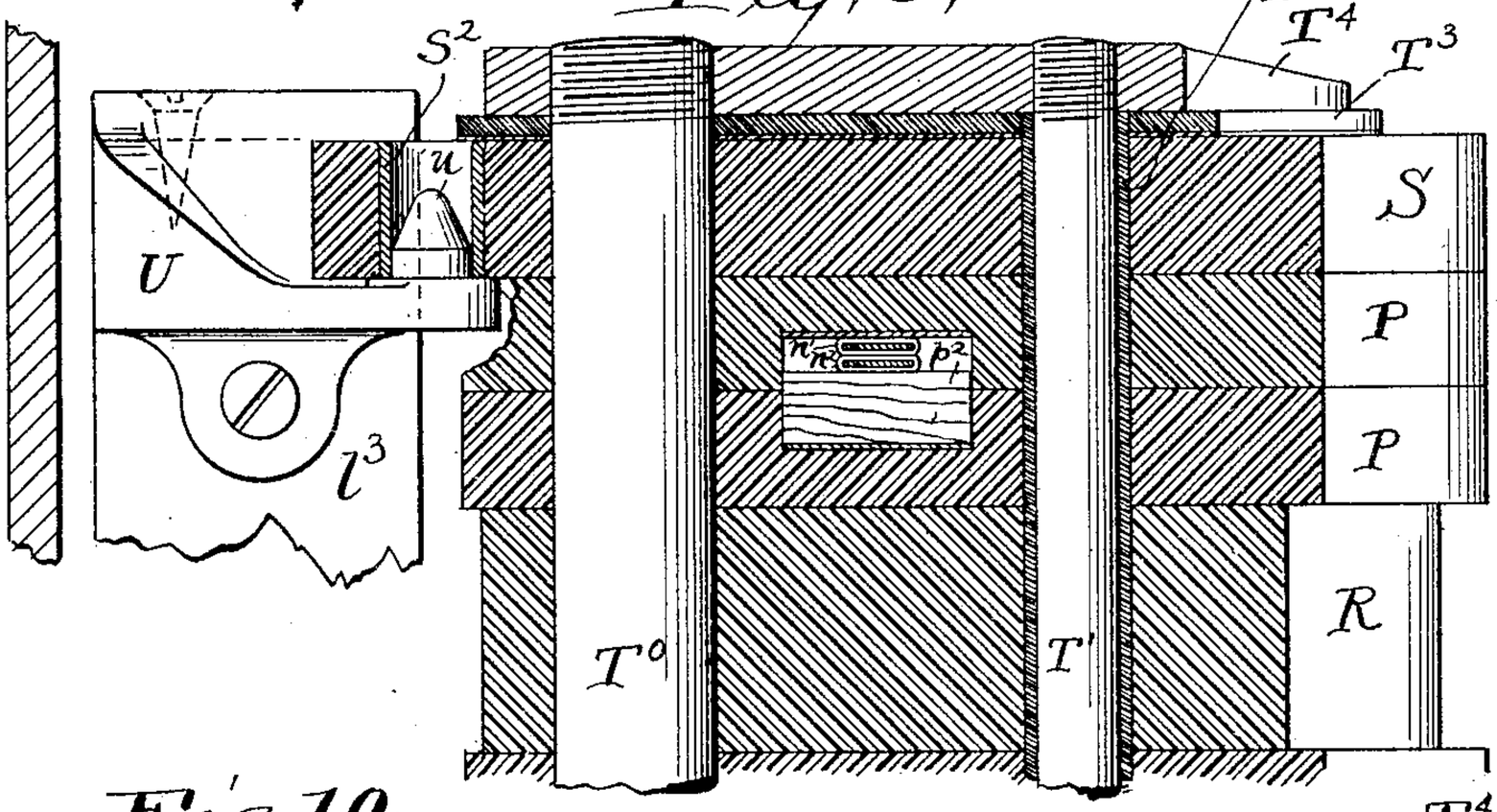
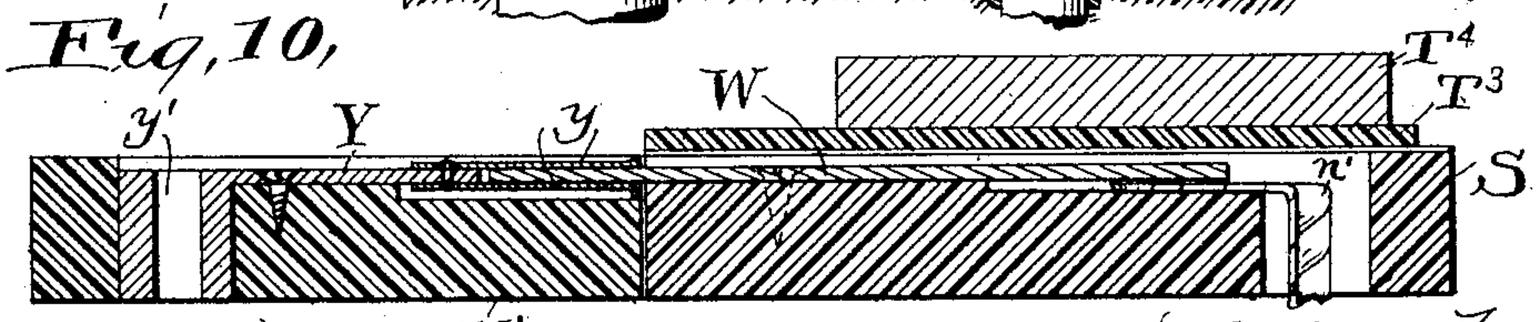


Fig. 10,



V'

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(Application filed Jan. 23, 1902.)

(No Model.) 4 Sheets—Sheet 4.

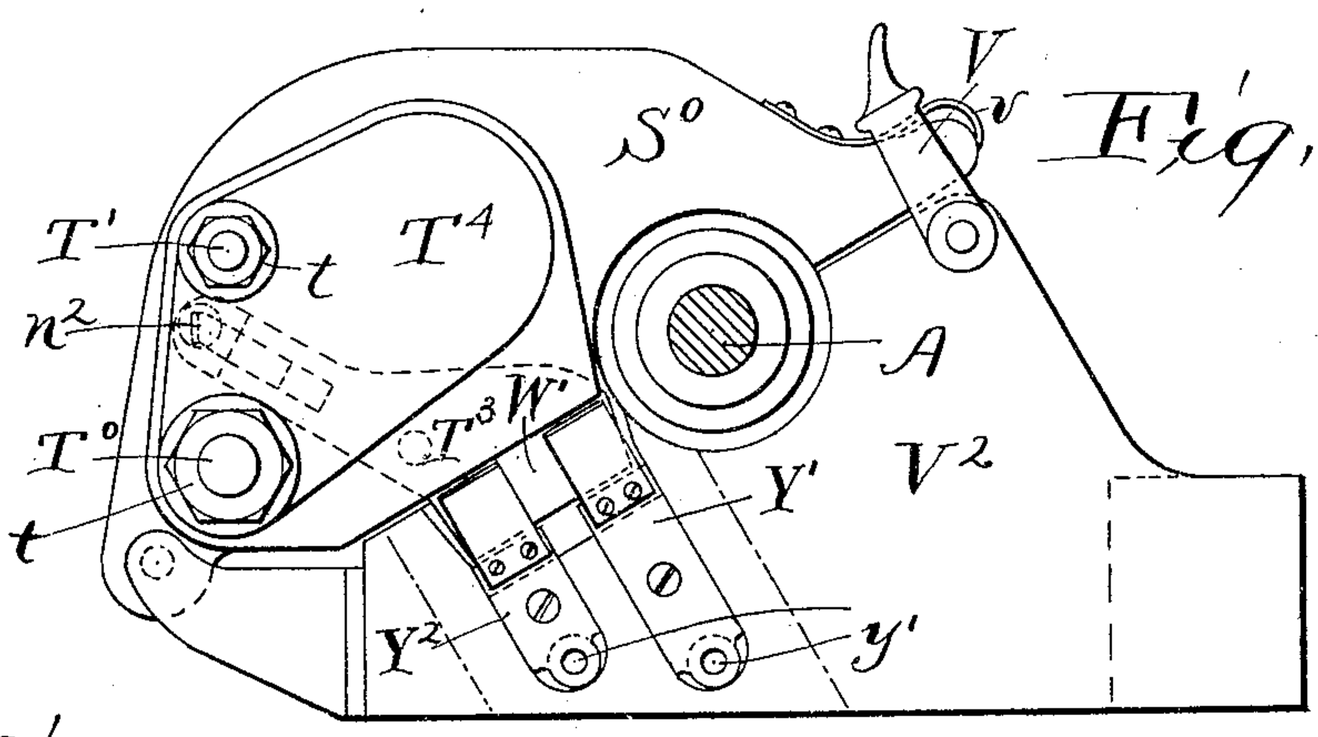

Fig. 11.

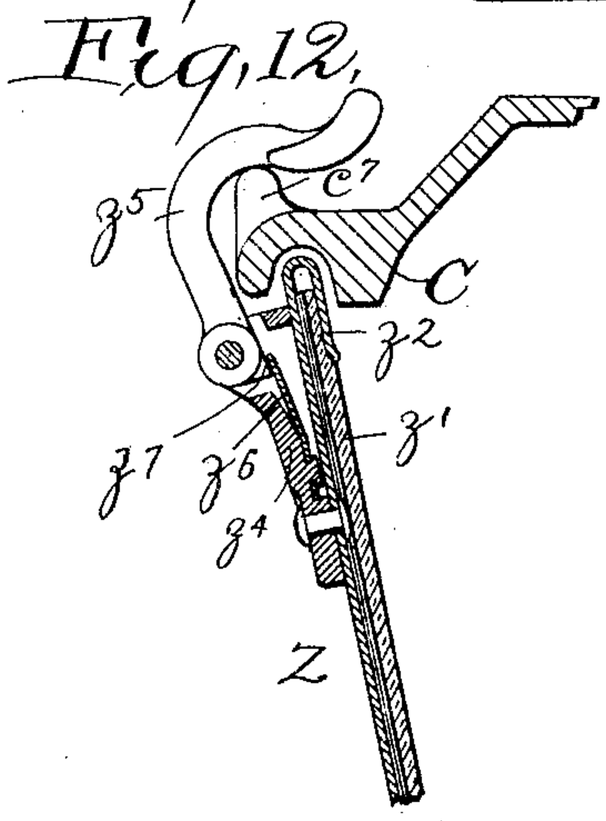

Fig. 12.

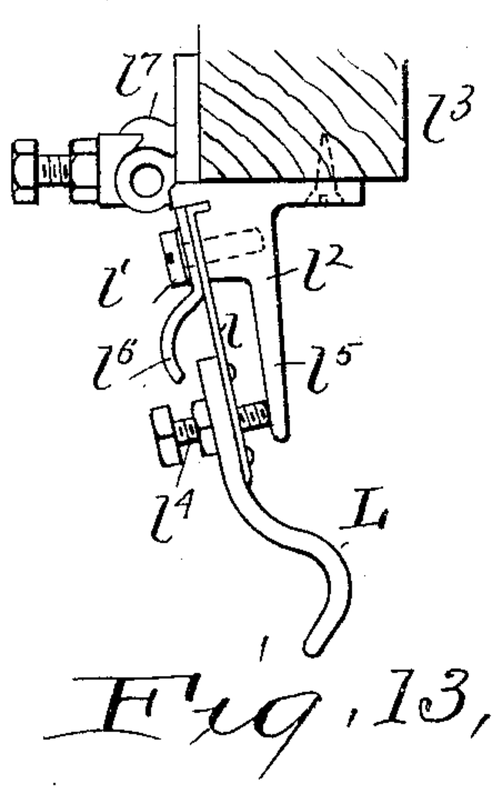

Fig. 13.

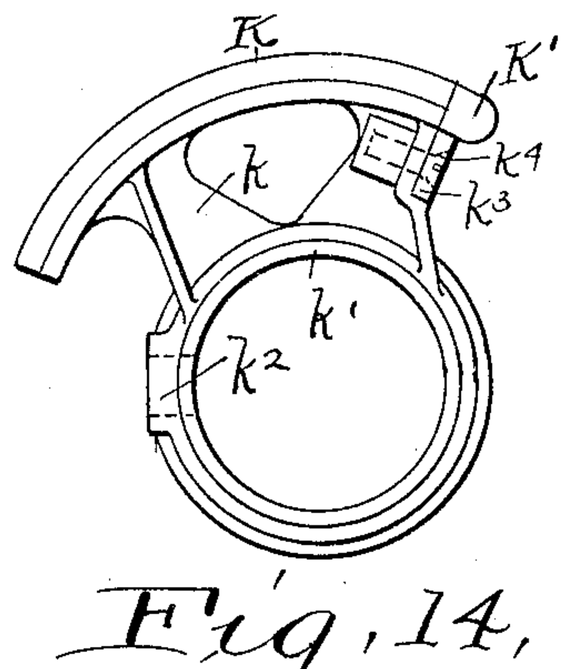

Fig. 14.

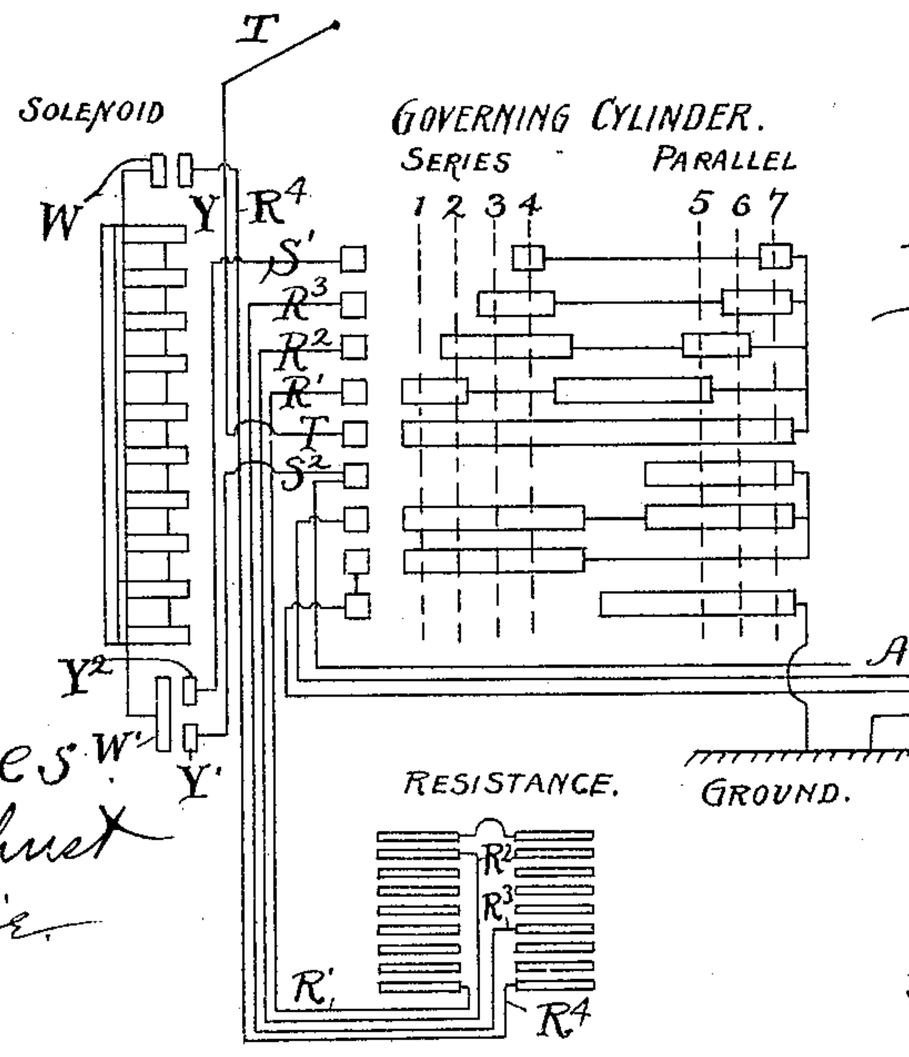

Fig. 15.

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UNITED STATES PATENT OFFICE.

THORSTEN VON ZWEIGBERGK, OF PRESTON, ENGLAND.

CONTROLLER.

SPECIFICATION forming part of Letters Patent No. 701,455, dated June 3, 1902.

Application filed January 23, 1902. Serial No. 90,992. (No model.)

To all whom it may concern:

Be it known that I, THORSTEN VON ZWEIGBERGK, a citizen of the United States, residing at Preston, in the county of Lancaster, England, have invented a certain new and useful Improvement in Controllers, (Case A,) of which the following is a full, clear, and exact description, reference being had to the accompanying drawings.

This invention relates to controllers designed especially for railway use, the object being to render them more efficient and durable and at the same time to cheapen the construction. In accomplishing this I have invented improvements in the following features of the controller: first, the moisture-protectors; second, the contact-segments; third, the contact-fingers; fourth, the solenoid blow-out; fifth, the cover-clamp.

The particular nature of the improvements which I have made in these features and the advantages I gain by such improvements will be hereinafter fully shown and described, and summarized in the claims.

The drawings clearly illustrate the invention.

Figure 1 is a side elevation, with the cover-plate cut away, of a series-parallel solenoid-controller embodying my invention. Fig. 2 is a front elevation thereof. Figs. 3 to 6, inclusive, are horizontal sections of the same, being taken on the correspondingly-numbered lines of Fig. 2. Fig. 7 is an enlarged plan of one of the solenoid-boxes with the upper half of the box removed. Fig. 8 is a vertical section through the box. Fig. 9 is a vertical section through the solenoid on the offset line 9 9 of Fig. 4. Fig. 10 is a vertical section on the line 10 10 of Fig. 4, showing the electrical connection from the upper end of the solenoid to the rigid part of the controller. Fig. 11 is a bottom plan of the solenoid and adjacent parts, showing the connections at the lower end of the solenoid. Fig. 12 is a horizontal section showing the locking-clamp. Fig. 13 is a plan of the contact-finger. Fig. 14 is a detail view of one of the contact-segments alone. Fig. 15 is a diagram illustrating the operation of the controller and particularly the connection of the solenoid therewith.

The controller shown is of the series-parallel type, consisting of a governing switch or "cylinder" and a reversing-cylinder and contact-fingers therefor. The governing-cylinder is carried by the shaft A and the reversing-cylinder by the shaft B, by which they are turned by suitable handles (not shown) to vary the control, as is well understood.

The shaft A of the governing-controller extends vertically across the controller box or casing C, being journaled in bearings D at the lower end of the casing and D′ at the upper end, the upper bearing being carried at the front flanged edge of a plate *c*, which extends from the back of the casing near the upper end. Formed on the upper side of the bearing D′ is a U-shaped trough *d*, which extends rearward over the plate *c*, and shrunk on the shaft A, overhanging this U-shaped trough, is a collar *a*. My prior patent, No. 605,304, granted to me June 7, 1898, shows the construction above described, wherein moisture or water draining down the shaft is caused by the collar to drip into the U-shaped groove, from which it drains onto the plate and passes out of the controller at the back.

Inasmuch as the controller-handles now largely in use cover over the upper end of the cylinder-shaft A, the water which drains around the shaft takes place mostly when the handle is removed—as, for example, with a controller at the rear of the car to be used when the car runs in the other direction; but this removal of the controller-handles always takes place with the shafts at the "off" position. In the present invention I have provided a groove *a′* in the collar *a*, which has an opening a^2 in it which is at the rear when the shaft is at the off position. Thus when most of the moisture is admitted it will pass directly onto the plate *c* and out through the opening *c′* without the intervention of the groove *d* and the consequent chance to work around the shaft. Moreover, by having this groove *a′* and the single opening a^2 the moisture is collected together and discharged at one point and may thus be a comparatively large stream, preventing the water working over the edge of the collar and working in toward the shaft by capillary attraction, as results when the stream is very at-

tenuated. The same arrangement is provided for the shaft B of the reversing-switch. In either case the opening a^2 in the collar is arranged to come at the rear when the shaft is in the off position. This appears clearly in Fig. 3, wherein the governing-controller is at the "off" position and the reversing-switch at the "ahead" position.

The two cylinders are provided with the usual indicator-wheels E and E', with which engage rollers carried by arms F and F^0, which have interlocking toes, as is well understood.

To prevent oil from the journal-bearing D' working downward to the segments, I provide below the indicator-wheel a cup G, rigidly surrounding the shaft, which is adapted to catch the oil-drippings, from whence they are occasionally removed, the cup being integral with the hub g, on which the indicator-wheel is secured.

The shaft A throughout the most of its length is flattened on one side—as appears at a^3, Fig. 5, for example—and surrounding this shaft are wooden half-sleeves H H', and over these sleeves are brass tubes J, an occasional screw j passing through the brass tube into the wooden half-sleeves or fillers to hold the parts in place. These sleeves J serve the double purpose of holding the wooden fillers around the shaft and also of making the electrical connection between the segments. The segments, which are designated K, have the integral arms k and hubs k', which snugly surround the brass tubes and are clamped thereto by screws k^3, passing through the hub at k^2 into the brass sleeve.

As appears from the diagram, the segments on the governing-controller are connected together into three groups, the lower group consisting of one segment, which is grounded. This separation into groups is provided, as will be seen in Fig. 2, by insulating-bushings I' I^2 I^3, which surround the shaft A between the different sleeves J and separate them, there being three of these sleeves. This makes a very simple and cheap construction and avoids the necessity of an additional electrical connection between the segments.

The segment-hubs act as reinforcing-collars around the brass sleeves, and the sleeves and hubs thus tightly bind the wooden filling half-sleeves against the shaft A, the whole making a very rigid construction and at the same time one in which the insulation into groups is very perfect, and the connection between the different members of the group is likewise excellent, and this notwithstanding the fact that the segments are very easily removable for repair or otherwise, as desired.

In use the arc which forms between the contact-fingers and a segment which is just breaking contact therewith burns away the end of the segment, and to prevent this destroying the whole segment or interfering with its most efficient operation I provide copper tips K', adapted to be removably carried by the segments at such points, and these tips have arms k^3, which seat within an offset in the corresponding arm k of the segment, the tips being held in place by screws k^4, passing through the arm k^3 and threaded into a boss in the segment-arm k. This not only provides for the very convenient removal of the tip and its replacement by a new tip, but the securement of this tip in no way interferes with the contact-surface thereof—that is, the screw is placed on the side and not on the periphery of the segment or tip.

It has happened in the use of railway-controllers that they have been rendered inactive by the contact-fingers becoming bent so far backward from the segments as to cause a permanent set in the finger-spring preventing its return, such displacement being sometimes accidental and sometimes done with design when labor troubles give the old operators a desire to render the controller inactive in the easiest and quickest manner they can. To provide against this disarrangement, I have devised a safety-stop for the contact-fingers. This appears clearly in Figs. 5 and 13. The contact-finger L is carried by the leaf-spring l, secured by a screw l' to the bracket l^2, carried on a wooden vertical bar l^3. A screw l^4, passing through the finger and bearing against a projection l^5 on the bracket, limits the approach of the finger toward the segment. My safety-stop consists of the bracket l^6, carried by the same screw l' which holds the spring l. This bracket stands a little behind the contact-finger, as shown, and allows free movement of it caused by the controller-cylinder, but prevents it being bent back so far as to set the spring.

In order to blow out the spark formed by the separation of the contacts, I provide a solenoid blow-out which has a series of coils occupying fireproof boxes and adapted to lie between successive contact-fingers. Such solenoids, broadly considered, are well known. My invention in this particular resides in providing the whole series of coils in a hinged structure, which may be swung out and removed for convenience of inspection and repair, in arranging the connection to the solenoid so that such swinging out itself breaks the connection, which allows the binding-posts l^7, carried by the contact-finger brackets, to be used as terminals for the leading-out wires, and in the more specific arrangement of the various part of the complete solenoid, all of which will be now explained.

Each solenoid-coil consists of a spiral of naked copper ribbon N, with interposed strips of insulating-paper n. This coil is preferably wound in a circular form, and it occupies an elongated recess provided by alined recesses p p in the two portions P P of a fireproof box, preferably made of vulcabeston. The terminals n' n^2 of each coil N are suitably wound with insulation and pass into a lateral recess

p' in the box, which is partially closed by a wooden filling-block p^2, and then pass up and down, respectively, the ends of successive coils being connected together by suitable sleeves n^3, as appears in Fig. 1. Within the recess $p\ p$ are plates of mica $p^4\ p^5$ on opposite sides of the coil, a plate p^6 beneath the terminal n', and a strip p^7, lying in a portion of the vertical wall of the recess $p\ p$.

A metal core Q is provided within the coil N, and on the outer sides of the mica plates $p^4\ p^5$ are a pair of thin iron plates $Q'\ Q^2$, preferably having thin mica plates $p^8\ p^9$ outside of them. This provision of the iron core intensifies the lines of force, and the sheet-iron disks bring these lines directly against the flame, and this results in the sweep of the arc being largely increased and the arc snapped off more quickly.

The various boxes P, with their inclosed coils, are separated by spacing-blocks R, and at the upper and lower ends are fiber plates S and S^0, respectively. This whole construction is clamped by a pair of rods T^0 and T', which pass through the various parts just mentioned and through pieces of insulation T^3 and metal blocks T^4, above and below the plates S and S^0, respectively. These rods are above threaded into the block T^4, while below they have threads on which screw nuts t. To prevent any possible exposure of the rod T', (which is comparatively near the spark,) between the adjacent boxes P and fillers R, I provide an insulating-sleeve T^2, surrounding the rod T' throughout its length.

Set into the rear corners of the fiber plates S and S^0 are metal bushings s^2, which take freely over the upwardly-extending studs u, carried by the brackets U. The solenoid is locked in position by hooks V, pivoted to stationary horizontal fiber plates $V'\ V^2$ and taking over the projecting end of the plates S and S^0, springs v, carried by the edges of those plates, as shown, insuring a snug engagement. It will thus be seen that the whole solenoid is tightly held in position in use; but the simple turning back of the catches V allows the solenoid to be swung out and lifted up off the studs u and entirely removed. The studs have conical upper faces to allow the convenient replacement of the solenoid.

In order that the removal of the solenoid may itself open the lines of the controller, so that the same may be turned idly to any position for inspection without effect on the motors, I secure the ends of the series of coils in the solenoid to terminals respectively carried by the upper fiber plate S and the lower fiber plate S^0. These terminals when the solenoid is in position contact with terminals connected with the proper contact-fingers or binding-posts. As soon as the solenoid is swung away from position this contact is thereby broken and the circuit of the controller is left open. Now, as will appear from the diagram, the connection at the upper end of the solenoid is directly to the return-wire from the governing resistance, while at the lower end the connection divides and passes to two contact-fingers, the terminals of these divided lines being bridged by the solenoid connection. The mechanical means for making these connections are illustrated most clearly in Figs. 4, 10, and 11. As will there be seen, the upper end of the solenoid carries in a recess in the upper surface of the fiber plate S (covered by the insulating-plate T^3 and the screw-plate T^4) a brass or copper plate W, which is the terminal of the metal ribbon n' from the uppermost coil. This terminal extends beyond the edge of the fiber plate S, and when the solenoid is in position lies snugly between the arms y and y, carried by the plate Y, which has a sleeve y' for the securement of the wire from the resistance. Thus when the solenoid is in the operative position the connection is automatically made from one end thereof to the return-wire from the resistance, (designated R^4 on the diagram.)

At the lower end of the solenoid on the under side of the fiber plate S^0 the construction is similar, except the plate W' there employed is of double width and is adapted to engage with the two plates $Y'\ Y^2$, one of which is the terminal of a line leading to a contact-finger, and thence through the reversing-switch to the motor, and the other of which is a line leading to another contact-finger of the controller adapted to be brought into engagement at the last series or parallel position and cut out the solenoid. The swinging of the solenoid on its hinge therefore not only breaks its contact, but breaks the contact between these terminals $Y'\ Y^2$ themselves, leaving the controller itself absolutely open whatever the condition of the cylinder.

The diagram clearly illustrates the connection of the solenoid. The line T is supposed to come from the trolley, the lines $S'\ S^2$ to go to the two ends of the solenoid, the lines R' $R^2\ R^3$ to go to corresponding portions of the resistance, the line R^4 to return from the resistance. The lines designated A', A^2, and F' lead to the reversing-switch and to the motors, the lines $A'\ A^2$ leading through the reversing-switch to the armatures of the respective motors, the lines F' directly to the field of the first motor, the return-line F^2 from the second motor being connected to the ground, as is the controller-frame. The connections of the lines between the motors and reversing-switch are well understood and it is not deemed necessary to show them here in detail. Now it will be seen that as the controller is turned on the solenoid is in series with the other resistance passing from the line R^4 via the contact-terminals Y and W through the solenoid to the contact-strip W', and thence to the strip Y' and via line S^2 to the line A'. In the fourth and seventh positions the resistance and the solenoid are cut out entirely and the current will pass from the trolley T directly to the line S', and thence from the terminal Y^2 to the terminal Y' by the

bridge supplied by the terminal plate W′ to the line S^2, and thence to the reversing-switch and motors. Thus the removal of the solenoid not only breaks the circuit through it, so that in positions 1, 2, 3, 4, and 6 the circuit is open, but it breaks the connection between the lines S′ S^2, so that even in the last positions 4 and 7 the circuit is also open.

The whole controller is inclosed within a suitable casing made by a hinged front and stationary frame comprising the back plate C, with the integral bottom plate c' and the removable top plate c^2. This top plate rests upon suitable lugs c^3, projecting upward from the cross-plate c, and is held in place by screw-bolts c^4, screwing up from the under side of the plate c into threaded bosses c^5 on the under side of the plate c^2. The curved front Z is hinged at one side to lugs projecting from the edge of the back C, as at z. The front is made of sheet metal and has on the inner side a protection of asbestos x', which is held in place by the front being curved around at its extreme edges, clamping the asbestos, as at z^2.

In order to secure the front closed, but allow its convenient opening as desired, I have devised a peculiar form of hook carried by the cover near its free edge and adapted to take behind lugs on the frame. This hook (shown in detail in Fig. 12) comprises a housing z^4, secured by a rivet to the plate Z and having pivoted to it the projecting hook z^5, which is adapted to extend beyond the end of the front and take behind a lug c^7 on the back C. A spring z^6, contained within the housing, (carried by a riveted integral stud of the housing,) bears against a toe z^7 of the hook z^5, pressing it, as shown in Fig. 12, in position to maintain the front locked. When it is desired to open the controller, however, the free end of the hook z^5 is grasped and a pull outward thereon allows the toe z^7 to force the spring back, the hook swinging clear of the lug c^7 until the spring bears on the other face of the toe z^7. In this position the spring will hold the hook until it is desired to relock the front.

I claim—

1. In a controller, in combination, a shaft, a collar tightly surrounding the shaft and having an annular groove in its upper surface, with an outlet through the peripheral wall of the groove, and a trough or discharge-plate directly beneath said opening when the shaft is at the off position, substantially as described.

2. In a controller, in combination, a frame, a cover therefor, a vertical shaft within the frame and extending through the cover, a substantially horizontal plate carried by the frame beneath the cover, a bearing carried at the front edge of said plate in which said shaft is journaled, there being a flange along the front edge of said plate, and a collar rigid on the shaft having in its upper surface an annular groove or recess discharging when the shaft is in the off position to the rear above said plate, substantially as described.

3. In a controller, the combination of a shaft, a metal tube carried by the shaft and surrounding the same and insulated from it, and metal segments having hubs snugly embracing said tube and electrically connected thereby, substantially as described.

4. In a controller, the combination of a shaft, metal tubes carried by the shaft and surrounding the same and insulated from the shaft and from each other, and metallic segments having hubs snugly embracing said tubes, substantially as described.

5. In a controller, the combination of a metal shaft, insulating-fillers surrounding the same, metal tubes surrounding the fillers, insulating-washers between the tubes, and metal segments having hubs snugly embracing the metal tubes, substantially as described.

6. In a controller, in combination, a shaft, wooden sectional sleeves collectively surrounding the same, metal tubes surrounding the wooden sleeves, and segments carried by the tubes, substantially as described.

7. In a controller, in combination, a flattened shaft, wooden sectional sleeves collectively surrounding the same and presenting a cylindrical exterior, metal tubes snugly embracing such sectional sleeves, insulating-washers between the tubes, and segments having metal hubs snugly surrounding said metal tubes, substantially as described.

8. A segment for a controller including a peripheral portion, a hub portion, and an arm connecting them, combined with a removable tip having a rubbing portion, an inwardly-extending lug, and a screw clamping said lug to said arm, substantially as described.

9. A segment for a controller comprising a hub portion, a rubbing portion and an arm connecting them, and a threaded boss carried by said arm, combined with a removable tip having a rubbing portion adapted to aline with the rubbing portion of the segment, and having an inwardly-extending lug, and a screw passing through said lug into said threaded boss, substantially as described.

10. In a controller, the combination with a segment-cylinder, of a stationary bracket, a contact-finger having a spring-shank carried thereby, a stop for limiting the outward movement of the finger, and a screw securing both said stop and finger to the bracket, substantially as described.

11. In a controller, in combination, a stationary bracket, a contact-finger having a spring-shank, a stop in the form of a bent plate, and a screw passing through both said stop and shank into the bracket, the free end of said bent plate standing a short distance behind said finger, substantially as described.

12. In a controller, in combination, a stationary bracket, a contact-finger having a spring-shank, a safety-stop bracket for limit-

ing the outward movement of the contact-finger, a screw passing through said stop-bracket and said spring-shank into the stationary bracket for holding said finger to the stationary bracket, an inward stop-lug carried by the stationary bracket, and an adjusting-screw carried by the contact-finger and adapted to engage therewith, substantially as described.

13. In a controller, the combination with contact segments and fingers, of a hinged and removable solenoid blow-out, substantially as described.

14. In a controller, the combination with contact segments and fingers, of a hinged blow-out, and means whereby the swinging of said blow-out on its hinge breaks the electrical connection thereto, substantially as described.

15. In a controller, the combination, with contact segments and fingers, of a hinged and removable solenoid blow-out comprising coils within separated insulating-boxes and connected in series and terminals for the collective coils carried by the blow-out, and other terminals with which these automatically disengage when the blow-out is swung on its hinge, substantially as described.

16. In a controller, the combination of blow-out coils contained within insulated boxes, insulating spacing-blocks between the boxes, metallic rods passing through the boxes and spacing-blocks, hinges for supporting the whole construction, and a lock for holding it in place, substantially as described.

17. In a controller, the combination of blow-out coils contained within insulated boxes, insulating spacing-blocks between the boxes, metallic rods passing through the boxes and spacing-blocks, hinges for supporting the whole construction, and metal strips carried by the solenoid and forming the terminals of the coils thereof, and stationary members with which they are adapted to contact when the solenoid is in a closed position, substantially as described.

18. In a controller, the combination of a series of coils contained within insulating-boxes, insulating distance-blocks between the boxes, rods passing through the boxes and blocks, a fiber plate above the top box, and a fiber plate below the bottom box, said rods passing through said plates and clamping the whole together, a pair of hinge members carried stationary with the controller-frame, said hinge members being pivotally connected to said fiber plates, terminals of the solenoid carried by said plates respectively, and coöperating terminals adapted to engage the same when the solenoid is in a closed position, substantially as described.

19. In a controller, a movable blow-out, combined with three terminals, and means whereby one terminal is connected with one end of the blow-out and the other two terminals are connected with the other end of the blow-out when the blow-out is in place, all of said terminals being automatically disconnected from each other and from the blow-out when the blow-out is removed, substantially as described.

20. A controller and its circuits presenting three terminals adjacent to a blow-out, combined with such blow-out which is a solenoid composed of a series of coils in a hinged structure and having two terminals in the form of metallic plates, one adapted to engage one of said circuit-terminals the other adapted to engage both of the remaining terminals mentioned in one position of the solenoid, said terminals being all disconnected in another position of the solenoid, substantially as described.

21. A series-parallel controller, including a pair of contact-fingers, one adapted to be in engagement at the final series position, and both in engagement at the final parallel position, conductors leading from said fingers to adjacent terminals, combined with a movable solenoid having its coils terminating in contact members, one of which is adapted to engage and bridge said two adjacent terminals, and the other of which is adapted to engage a terminal from the governing resistance, substantially as described.

22. A controller having contact segments and fingers, and circuits leading from the fingers, combined with a blow-out consisting of a series of coils contained in boxes adapted to project between the fingers, said boxes being rigidly held apart in a hinged structure, means for locking said hinged structure in position, a pair of contact-strips carried by said hinged structure to form terminals for the two ends of the series of coils, and contact members carried by the controller to form the terminals of some of its circuits and adapted to be engaged by said strips, whereby when the solenoid is swung on its hinges the electrical connection to each end thereof is broken, substantially as described.

23. In a solenoid blow-out, the combination of a coil of conductor, and sheet-metal plates of magnetic material on opposite sides of the conductor out of contact therewith, substantially as described.

24. In a solenoid blow-out a recessed insulating-box, a coil of metallic ribbon within said box, a pair of sheet-metal plates of magnetic material within said box on opposite sides of the coil, and parallel with the opposite sides of the boxes, said plates being insulated from the coil, substantially as described.

25. In a controller, the combination of a frame and a cover therefor, of a hook for locking the cover to the frame, which hook comprises a housing portion secured to the cover near the edge thereof, a hook pivoted thereto, and a spring carried by the housing and tending to force the hook into either of its extreme positions, substantially as described.

26. In a controller, the combination of a frame, a hinged sheet-metal cover therefor, a housing riveted to the cover near the free

edge thereof, a hook pivoted in said housing and adapted to engage a lug on the rear side of the frame, said hook having a projecting toe, and a leaf-spring within the housing and secured to it and bearing against said toe, said toe being adapted to have either of two surfaces in contact with the spring according to the position of the hook whereby the hook is given a tendency to assume either of its extreme positions, substantially as described.

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

THORSTEN VON ZWEIGBERGK.

Witnesses:

ARTHUR TAYLOR,

PERCY ROBINSON.