No. 685,308. Patented Oct. 29, 1901.

A. D. THOMAS.

CONTROLLER REGULATOR.

(Application filed May 10, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

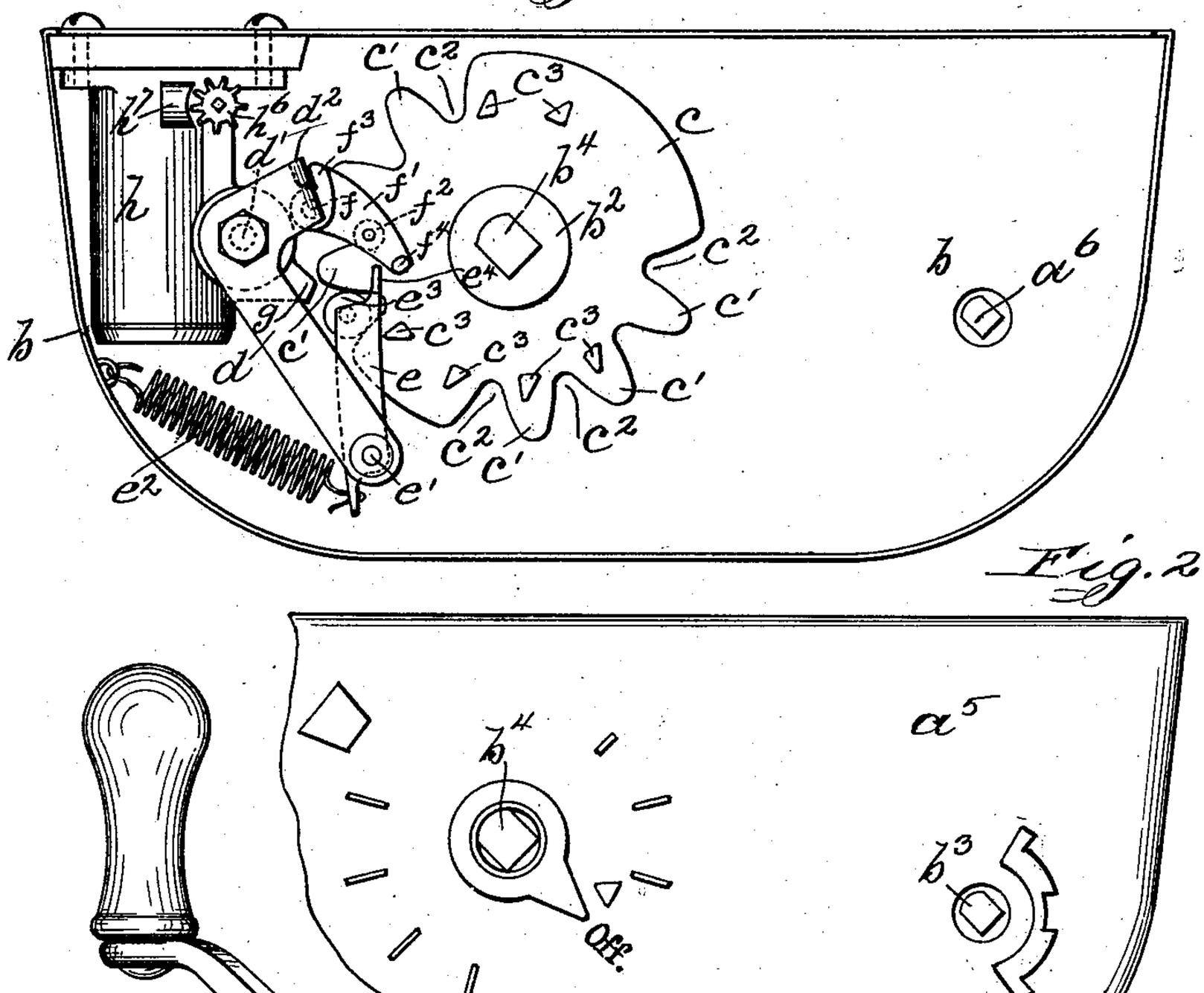
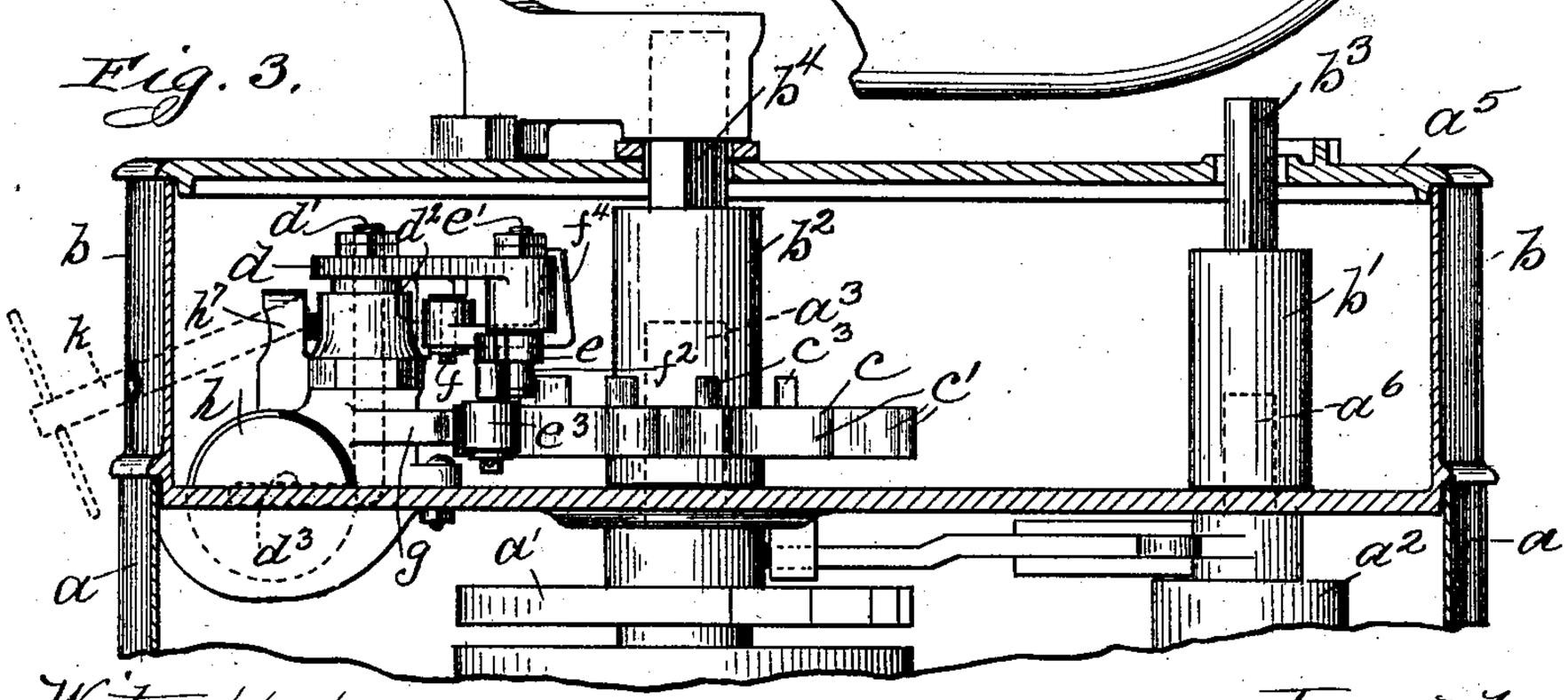


Fig. 2.

Fig. 3.



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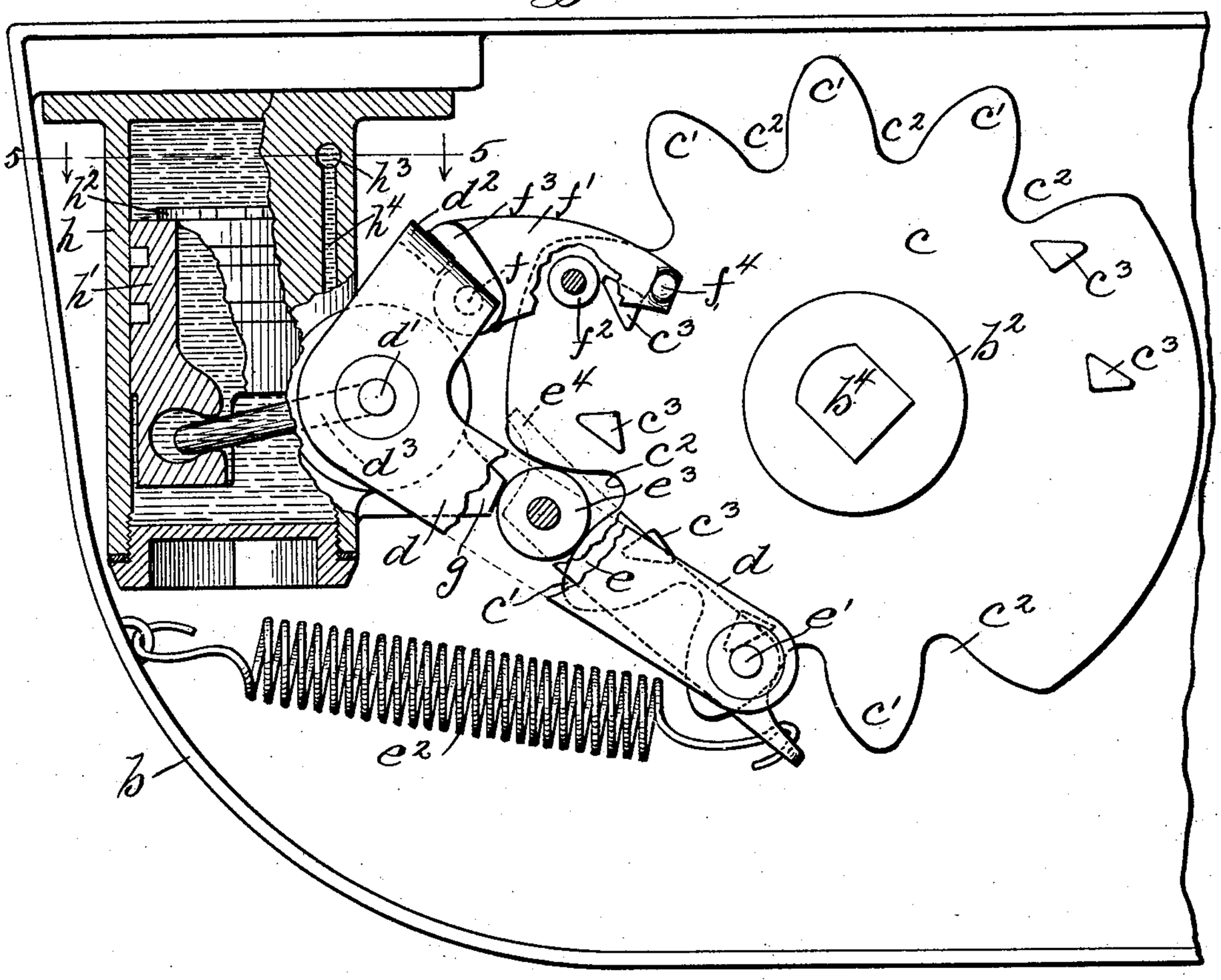
(No Model.) 2 Sheets—Sheet 2.

Fig. 4.



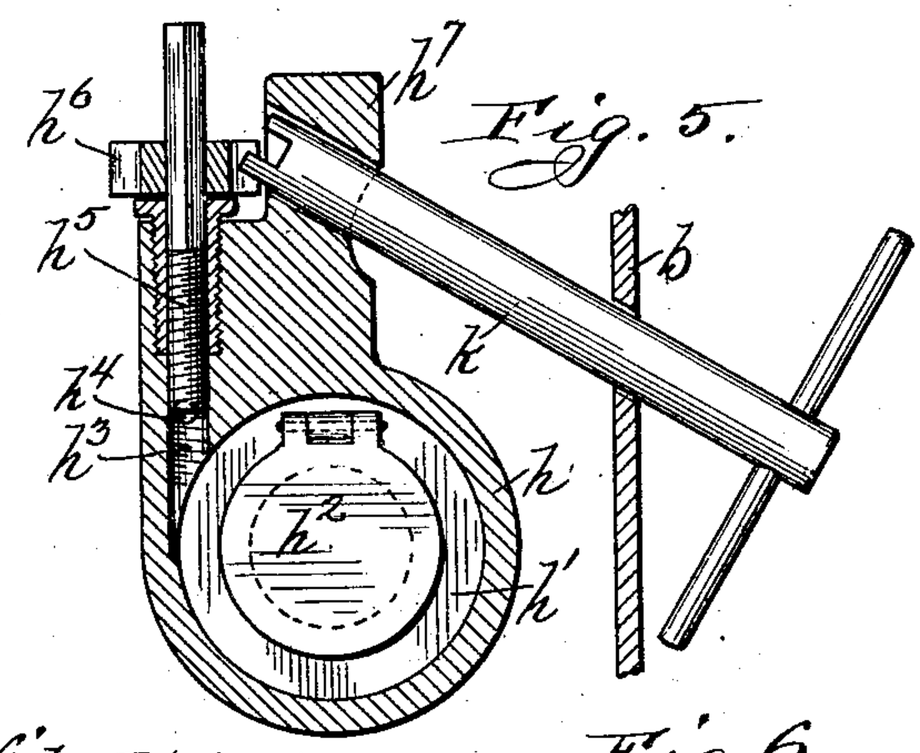
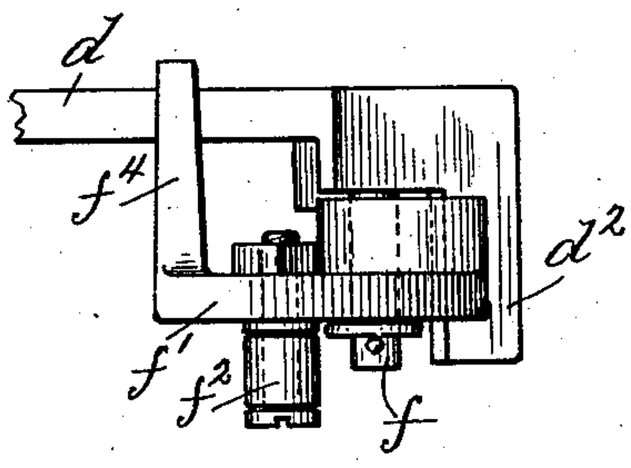


Fig. 5.

Fig. 6.

Fig. 7.



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UNITED STATES PATENT OFFICE.

ALBERT D. THOMAS, OF KEOKUK, IOWA, ASSIGNOR TO THE CARTON-DANIELS COMPANY, OF KEOKUK, IOWA, A CORPORATION OF IOWA.

CONTROLLER-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 685,308, dated October 29, 1901.

Application filed May 10, 1900. Serial No. 16,163. (No model.)

To all whom it may concern:

Be it known that I, ALBERT D. THOMAS, a citizen of the United States, residing at Keokuk, in the county of Lee and State of Iowa, have invented a certain new and useful Improvement in Controller-Regulators, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to a controller-regulator for electric motors and the like, my ob-

to undue electrical strains, thereby causing rapid deterioration of the electrical apparatus and frequently resulting in the burning out of the same.

In accordance with the present invention I provide a regulator for the controller which permits the movement of the controller-handle from step to step only after an enforced pause, the length of which may be prearranged by suitable adjustment of the apparatus. With the employment of this regulator, therefore, it is impossible to move the

of the casing a, which surrounds the controller, as commonly employed on street-railway cars, this casing being mounted upon the platform of the vehicle, and within the casing I have illustrated the upper end a' of the controller-roller and the upper end a^2 of the reversing-switch mechanism. The controller-roller a' carries at the upper end a shank a^3, which as constructed is adapted to receive the operating-handle a^4, the cover a^5 being adapted to rest upon the top of the casing a. In applying my invention to controllers of this type I remove the cover a^5 and place upon the top of the casing a the casing or box b, which contains the regulating mechanism of my invention. The cover a^5, which in controllers as now constructed is adapted to rest upon the top of the casing a, is then placed upon the top of the box b. The spindle b', having a recess in the lower end, is adapted to fit over the shank a^6 and carries upon the upper end a shank b^3. The shank b^3 extends above the cover a^5 in the same manner that the shank a^6 would extend above the cover in the original construction of the controller. Likewise a spindle or hub b^2 is provided in the lower end with a recess adapted to receive the shank a^3 and is provided at the upper end with a shank b^4, which extends through the opening in the cover a^5 and is adapted to receive the handle a^4 in the same manner that the shank a^3 would receive the handle in the original construction of the controller. The regulating mechanism of my invention may thus be applied to controllers in common use without any change whatever in the construction thereof, the regulating mechanism being readily applied to such controllers by lifting the cover from the casing and inserting the box b with its mechanism between the top of the controller-casing and the cover. Upon the spindle or hub b^2 is mounted a cam-wheel c, provided around its periphery with teeth c' c', separated by recesses c^2 c^2, extending inward from the outer periphery of the cam. Upon the upper face of said cam c upwardly-extending projections or lugs c^3 c^3 are provided and arranged at intervals, as shown. A bell-crank lever d is mounted upon a rocking spindle d', and to the longer arm of said lever d is pivoted at e' an arm e, said arm carrying at one end a projection, between which and the casing or box b a coiled spring e^2 is connected. The free end of the arm e carries a friction-roller e^3 on the under face thereof, which roller is in the plane of the cam c and is adapted to engage and roll along the toothed periphery thereof. To the shorter arm of the bell-crank lever d is pivoted at f the short arm f', which carries on the lower face a friction-roller f^2, which is normally in position to be engaged by the lugs c^3 c^3 as the cam rotates. The arm f' carries a lug or shoulder f^3, which in one position of the arm is adapted to engage the lug d^2 on the end of the short arm on the bell-crank d. The arm f' carries at the end an upwardly-extending projection or finger f^4, while the arm e carries at the end a forwardly-projecting finger e^4, the function of which fingers will be hereinafter described. A stationary abutment g is provided against which the roller e^3 is adapted to rest at certain times, as will hereinafter be described.

Within the cylinder h (shown in section in Fig. 4) moves a piston h', and the spindle d' carries at the lower end a laterally-extending arm d^3, the end of which is adapted to engage a recess carried on the inner face of the piston h', so that as the lever d is rocked, carrying with it the spindle d', the arm d^3 is oscillated, thereby reciprocating the piston h'. The piston h' is hollow and carries at the end a hinged valve h^2, which normally seals the passage through the interior of the piston. One end of the cylinder communicates with an upwardly-extending duct h^3, while the other end of the cylinder communicates with a horizontal duct h^4, and the cylinder and ducts are filled with oil, and as the piston reciprocates within the cylinder the oil is pumped from one end of the cylinder through the ducts h^3 h^4 around to the other end of the cylinder, and thence during the return stroke of the piston through the interior of the piston, the valve h^2 being raised from its seat. The duct h^3 is threaded and a screw or spindle h^5 fits therein and is adapted to be rotated to move the same upward or downward to close the end of the duct h^4 to a greater or less extent, to thereby vary the facility with which the oil can be pumped through the ducts. The upper end of the spindle h^5 is formed of square cross-section, and splined thereto is a toothed wheel h^6, with the teeth of which the toothed end of a key k is adapted to engage, the key k being adapted to pass through an opening in the wall of the box b and through a suitable bearing h^7, whereby the teeth on the end of the key may be brought into engagement with the teeth on the gear-wheel h^6. The axis of the key being at an angle to the plane of the gear-wheel, the rotation of the key imparts rotation to the gear-wheel, thereby rotating the spindle h^5 as desired. This key will not be in the possession of the car operator, but will be in the possession of some overseer, who will adjust the mechanism to the desired speed of operation, and it will be thus beyond the means of the operator to vary the speed of operation of the regulator during the running of the car.

I will now describe the operation of the regulator. In starting the vehicle the handle a^4 is moved in clockwise direction, thereby rotating the cam c in the same direction as indicated by the arrow. As the cam c rotates the first projection c^3 comes in contact with the friction-roller f^2, and as the lugs f^3 and d^2 are in engagement to prevent the rocking of the arm f' relatively to the lever d the further movement of the cam rocks the lever d upon its pivot and carries the end of

the longer arm thereof inward toward the cam until the longer arm of the lever d occupies a position within the tangent drawn between the outer periphery of the cam c and the pivot d', about which the lever d rocks, Fig. 4. The spring e^2 forces the friction-roller e^3 inward, so that the same rests within one of the recesses c^2, and thus occupies a position between the tooth c' and the stationary abutment g. Any pressure exerted upon the operating-handle tending to rotate the cam c has the effect of compressing the friction-roller e^3 between the tooth c' and the stationary abutment g, and the further movement of the cam c is thus prevented. If, however, the pressure on the handle be eased, the spring e^2 will react to move the end of the lever d beyond the tangential position shown in Fig. 4—that is, toward the position shown in Fig. 1—and the pivot of the roller e^3 being thus carried outside of the line between the pivot e' and the spindle d' any pressure exerted upon the friction-roller e^3 by the tooth c' will cause the lever e to rock upon and be forced outward by the tooth c', the further movement of the cam c being thus permitted. It will thus be seen that the roller e^3 cannot be moved out of the recess in the periphery of the cam c until the end of the lever d is carried beyond the tangential position, and this movement of the lever beyond the tangential position is due to the reaction of the spring e^2. The spring e^2 cannot react to produce such movement suddenly, due to the fact that the lever d is connected with the piston in the oil-cylinder, and the movement of the piston is limited by the facility with which the oil can flow through the ducts h^3 and h^4, connecting the opposite ends of the oil-cylinder. The time during which it is impossible to rotate the cam c thus depends upon the time required by the spring e^2 to move the lever d beyond the tangential position against the resistance of the oil in the cylinder, and, as above stated, this time may be prearranged by varying the area of the oil-passage. When the lever d has been moved beyond the tangential position and the cam c rotated to cause the tooth c' thereof to force the roller e^3 outward and permit the passage of the tooth c', the roller falls into the next succeeding recess in the periphery of the cam, due to the tension of the spring e^2, which tends continuously to move the roller inward toward the axis of the cam c. While the roller e^3 is passing into the next succeeding recess the next succeeding lug c^3 has engaged the roller f^2, thereby again rocking lever d into a position within the tangential line, as shown in Fig. 4, and the next succeeding tooth c' now exerts pressure upon the roller e^3, and this engagement of the tooth with the roller prevents the further movement of the cam until the spring has had time to move the arm d outward beyond the tangential position, when again the cam may be moved over another step. While I have employed the abutment g, against which the roller e^3 may react, it will be understood that the abutment g may be omitted, and in this case the engagement of the tooth c' with the roller e^3 will prevent the further movement of the cam c and there will be no tendency of the roller e^3 to move out of this position, since the pivot of the roller e^3 is in line with the pivots e' and d', so that the effect of the engagement of the tooth c' with the roller e^3 is to subject the arm e to a tension or pull, there being no tendency to rock arm e upon its pivot. This construction, however, would necessitate the pivots d' and e' and the pivot of the roller e^3 withstanding the pressure exerted upon the handle, which when the handle is moved suddenly is considerable. For this reason the abutment g is preferably employed, so that the pressure or shock is removed entirely from the pivots, and the only effect is to tend to crush the rollers e^3 between the tooth c^3 and the abutment g, and these parts may be made of material which is sufficiently strong to withstand the pressure.

In stopping the car the cam c is turned in contra-clockwise direction and the backward movement of the cam is not retarded by the regulating mechanism, since the arm f' is pivoted in such a manner that the engagement of the lugs c^3 therewith will merely rock the same upon its pivot without affecting the lever d. Likewise the engagement of the teeth with the roller e^3 will always serve to rock the same upon its pivot regardless of the position of the arm d. The cam c may thus be moved backward from any position with a single sweep and without retardation.

It may sometimes happen that the spring e^2 will get broken or become weakened from some cause, and in order to insure the return of the lever d to its position beyond the tangential line the finger f^4 on the arm f' is provided, which finger f^4 extends upward a sufficient distance, Fig. 7, to engage the edge of the arm d. As the cam c is moved in contra-clockwise direction, thus rocking the arm f', the finger f^4 is thus caused to engage the arm d and move the same beyond the tangential position.

When the arm f' is rocked in a clockwise direction by the return of the cam c, the roller f^2 is carried outward beyond the path of the projections c^3, and in order to insure the return of the arm f' to a position where the roller f^2 will be in the path of the projections c^3 the finger e^4 is provided on the end of the arm e, so that when the arm e is moved inward, due to the tension of the spring e^2, the finger e^4 will engage the finger f^4 and carry the arm f' into the position wherein the roller f^2 will be engaged by the projections c^3.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination with a controller and the casing thereof, of a box or casing fitting upon the top of said controller-casing and

containing a controller-regulator, the top of said box being constructed to receive the cover of the controller-casing, substantially as described.

2. The combination with a controller and the casing thereof, of a box containing the controller-regulating mechanism and adapted to fit upon the top of said casing, substantially as described.

3. The combination with a controller and the casing thereof, of a box containing the controller-regulating mechanism and adapted to fit upon the top of said casing and to receive the cover of the casing, and an extension device for extending the upper end of the shaft of the controller above the cover as the same rests upon the box to thereby be in position to receive the handle, substantially as described.

4. The combination with the controller having at the upper end a shank for the reception of the handle, of a casing for said controller, a box adapted to fit upon the upper end of said casing and having a suitable cover, and an extension within said box having a socket to receive the shank of the controller and carrying upon the upper end a shank adapted to receive the handle, substantially as described.

5. The combination with the controller adapted to receive the operating-handle, of the regulating mechanism for said controller, and the extension adapted to engage the portion of the controller which would otherwise receive the handle and carrying a part adapted to receive the operating-handle, substantially as described.

6. The combination with the casing a containing the controller, of the box b fitting therein and containing the controlling mechanism, the cover a^5 fitting upon the top of said box, and the extension b^2 fitting the upper end of the controller-shaft and carrying an extension adapted to pass through an opening in said cover a^5 and to receive the operating-handle, substantially as described.

7. The combination with a controller, of a part rotating therewith, a lever or part adapted to be moved into a tangential position relatively to said rotating part by motion derived from said controller, a device carried thereon and movable relatively thereto for locking said rotatable part against further rotation when the lever is in the said tangential position, and means for moving said lever out of the tangential position to release said rotating part, substantially as described.

8. The combination with a controller, of a rotating part moving with said handle and having limiting-walls at intervals, a lever adapted to be moved into a tangential position relatively to said rotating part by motion derived from said controller, a device carried thereon and movable relatively thereto for engaging said limiting-walls when the lever is in the tangential position to check the movement of said rotating part, and means independent of said controller for moving said lever out of the tangential position to release said rotating part, substantially as described.

9. The combination with a controller, of a part rotating therewith and having limiting-walls at intervals, a lever adapted to be moved into a tangential position relatively to said rotating part by motion derived from the controller, an arm pivoted to the free end of said lever and adapted to engage said limiting-walls to lock said part against rotation when the lever is in the tangential position and to permit said part to freely rotate when the lever is moved out of the tangential position, and means for moving said lever out of the tangential position, substantially as described.

10. The combination with a controller, of a rotating part having limiting-walls at intervals and moving with said controller, a lever moved in one direction by said controller, an arm pivoted to the free end of said lever and adapted to engage the limiting-walls in said part and to lock said part against further rotation when the arm and lever are in alinement and to permit the part to freely rotate when said lever and arm are out of alinement, and means independent of said controller for moving said lever out of the tangential position, substantially as described.

11. The combination with a controller, of a cam rotating with said controller and having a recessed periphery, of a pivoted lever adapted to be moved into a tangential position relatively to said cam by motion derived from the controller, an arm pivoted to the free end of said lever, a roller carried upon the end of said arm and adapted to ride upon the periphery of said cam and to lock the said cam against further movement when the pivots of said lever and arm and said roller are approximately in alinement and to permit said cam to freely rotate when the same are out of alinement, and means independent of said controller for moving said lever out of said position of alinement, substantially as described.

12. The combination with a controller, of a rotating part moving with said controller, a lever adapted to be moved in one direction by motion derived from said controller, an arm pivoted to said lever, a device carried upon the end thereof and adapted to interlock with said rotating part when the lever and arm rest in alinement to prevent further rotation thereof, an abutment against which said device is adapted to rest when said lever and arm are in alinement, and means for moving said lever out of the position of alinement to release said rotating part, substantially as described.

13. The combination with a controller, of a cam rotating therewith and having recesses at intervals on the periphery thereof and projections at intervals on the face thereof, of a locking device adapted in one position to engage said recesses to check the movement of said cam, means operated by said projections for moving said locking device into the lock-

ing position and independent means for moving said locking device out of the locking position, substantially as described.

14. The combination with a controller, and a cam moving therewith and having recesses at intervals on the periphery thereof and carrying projections at intervals on the face thereof, of regulating mechanism coacting therewith to enforce a gradual and step-by-step movement of the cam in one direction, while permitting the cam to be freely moved in the opposite direction, substantially as described.

15. The combination with a controller, of a part rotating therewith carrying limiting-walls at intervals, an arm pivoted at one end and adapted to engage said limiting-walls at the other end, and means for moving the pivoted end of said arm back and forth whereby in one position the arm may be rocked upon its pivot to permit the rotating part to freely move, while in the other position of the pivoted end of said arm the same serves as a lock to check the further movement of said rotating part, substantially as described.

16. The combination with a controller, of a cam having recesses at intervals on the periphery thereof, an arm pivoted at one end and carrying at the other end a roller adapted to engage said recessed periphery, means for resiliently pressing said roller against said periphery, and means for moving the pivot of said arm whereby in one position of said pivot the arm may be rocked to permit the rotation of said cam and in the other position of said pivot the arm serves to lock the rotating part in position, substantially as described.

17. The combination with a controller, of a part rotating therewith and carrying limiting-walls at intervals, an arm pivoted at one end and carrying at the other end a part adapted to engage said limiting-walls, means operated by the movement of the controller for moving the pivot of said arm into position wherein the arm locks the rotating part against further movement, and independent means for moving said pivot into a position wherein the arm will rock upon said pivot and permit the rotating part to freely move, substantially as described.

18. The combination with a controller, of the cam rotating therewith having recesses at intervals on the periphery thereof and carrying projections upon one face, of a pivoted lever, an arm pivoted to the end of said lever and having a part adapted to yieldingly press against said recessed periphery, a pivoted arm carried upon said lever and adapted to be engaged by said projections to move said lever into position wherein said first-mentioned arm will lock said cam against further movement, and independent means for retracting said lever to permit said cam to freely rotate, substantially as described.

19. The combination with a controller, of a cam c having recesses c^2 c^2 at intervals and projections c^3 c^3 at intervals on the face thereof, of a pivoted lever d, an arm e pivoted at one end thereof and carrying a roller adapted to engage the recessed periphery of said cam, the spring e^2, the pivoted arm f', carrying a roller adapted to be engaged by said projections c^3 and a retarding device for regulating the movement of said lever d, substantially as described.

20. The combination with a controller, of a cam c having recesses c^2 c^2 in the periphery thereof at intervals and carrying the projections c^3 c^3 at intervals, of the pivoted lever d, the arm e pivoted at the free end thereof and carrying the roller e^3, the stationary abutment g, the spring e^2, the pivoted arm f carrying the roller f^2, and the lug f^3 adapted to coact with the lug b^2 and the regulating device for regulating the movement of said lever d, substantially as described.

21. The combination with a controller, of the cam c carrying the recesses c^2 c^2 and projections c^3 c^3, the lever d, arms e and f', said arm e being provided with an upwardly-extending finger f^4 adapted to engage said lever d, substantially as described.

22. The combination with a controller, of the cam c having recesses c^2 c^2 and projections c^3 c^3, of the lever d, arms e and f' pivoted thereto, arm f' carrying an upwardly-extending finger f^4 adapted to be engaged by the end of arm e, substantially as described.

23. The combination with the oil-cylinder and the piston moving therein, of the spindle h^5 for regulating the size of the oil-passage, the gear-wheel h^6 splined thereto and the key k having teeth in the end adapted to engage and rotate said gear-wheel, substantially as described.

24. The combination with a rotating part, of a gear-wheel splined thereto and a key or part having teeth at the end adapted to engage the teeth of said gear-wheel and a support for said key adapted to maintain the same at an angle to the plane of said gear-wheel, substantially as described.

25. The combination with the threaded spindle h^5, of the gear-wheel h^6 splined thereto, the key k, the bearing h^7 and the casing b provided with an opening or keyhole for the passage of said key, substantially as described.

In witness whereof I have hereunto subscribed my name in the presence of two witnesses.

ALBERT D. THOMAS.

Witnesses:
ADA M. WORTHEN,
LUCRETIA MATHENEY.

Correction in Letters Patent No. 685,308.

It is hereby certified that the name of the assignee in Letters Patent No. 685,308, granted October 29, 1901, upon the application of Albert D. Thomas, of Keokuk, Iowa, for an improvement in "Controller-Regulators," was erroneously written and printed the "Carton-Daniels Company," whereas the name should have been written and printed the *Garton-Daniels Company;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 19th day of November, A. D., 1901.

[SEAL.]

F. L. CAMPBELL,
Assistant Secretary of the Interior.

Countersigned:

F. I. ALLEN,
Commissioner of Patents.