

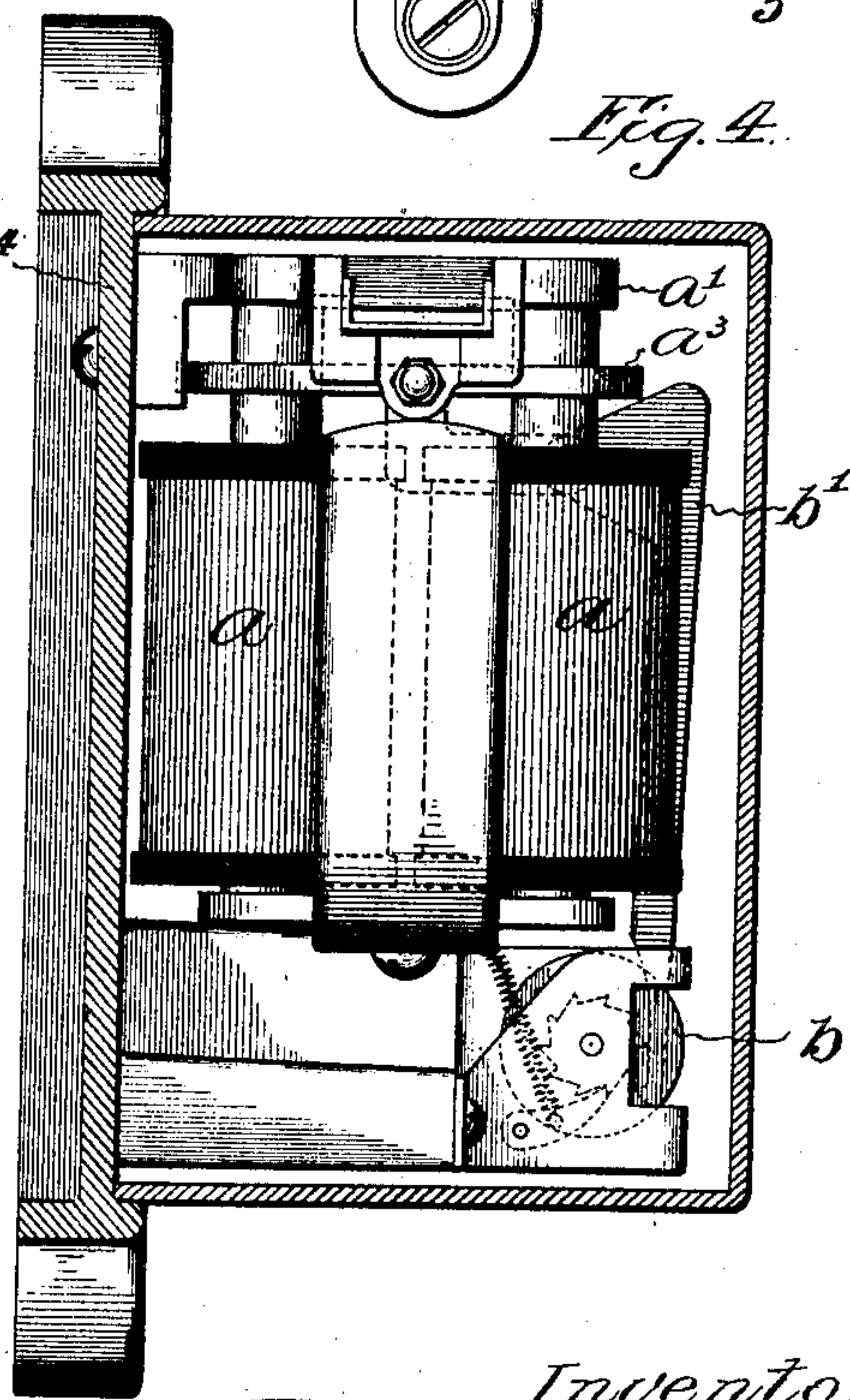
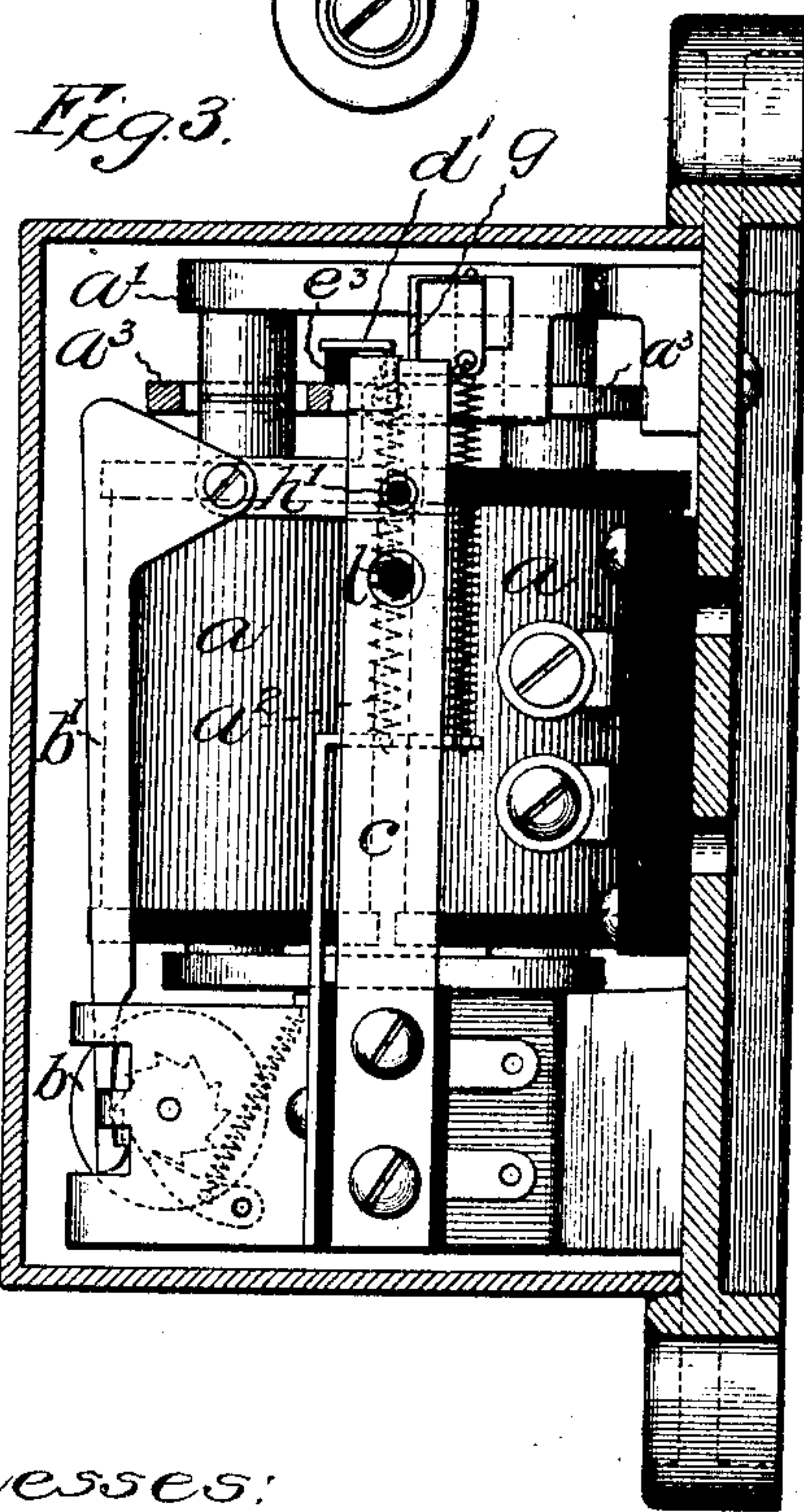
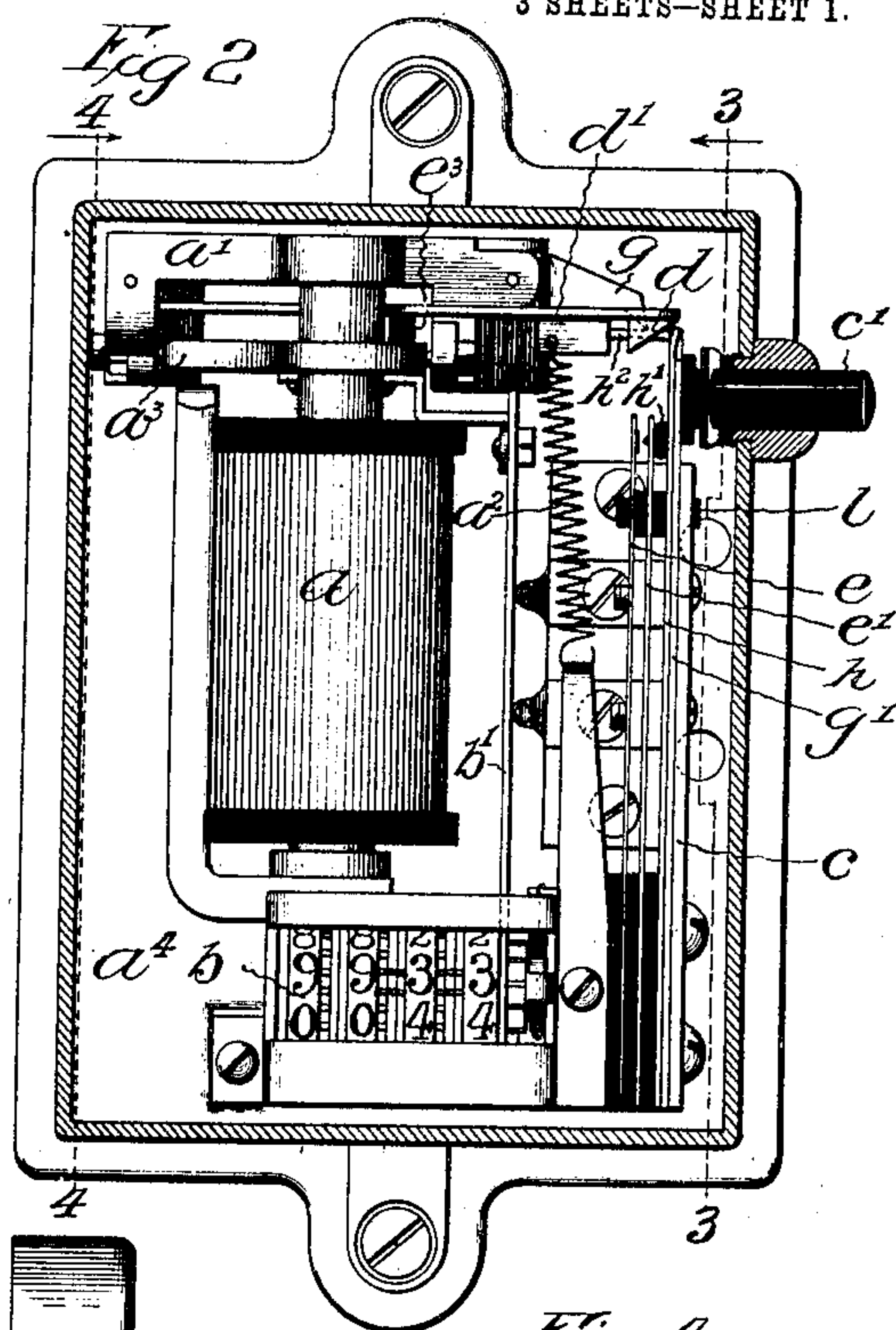
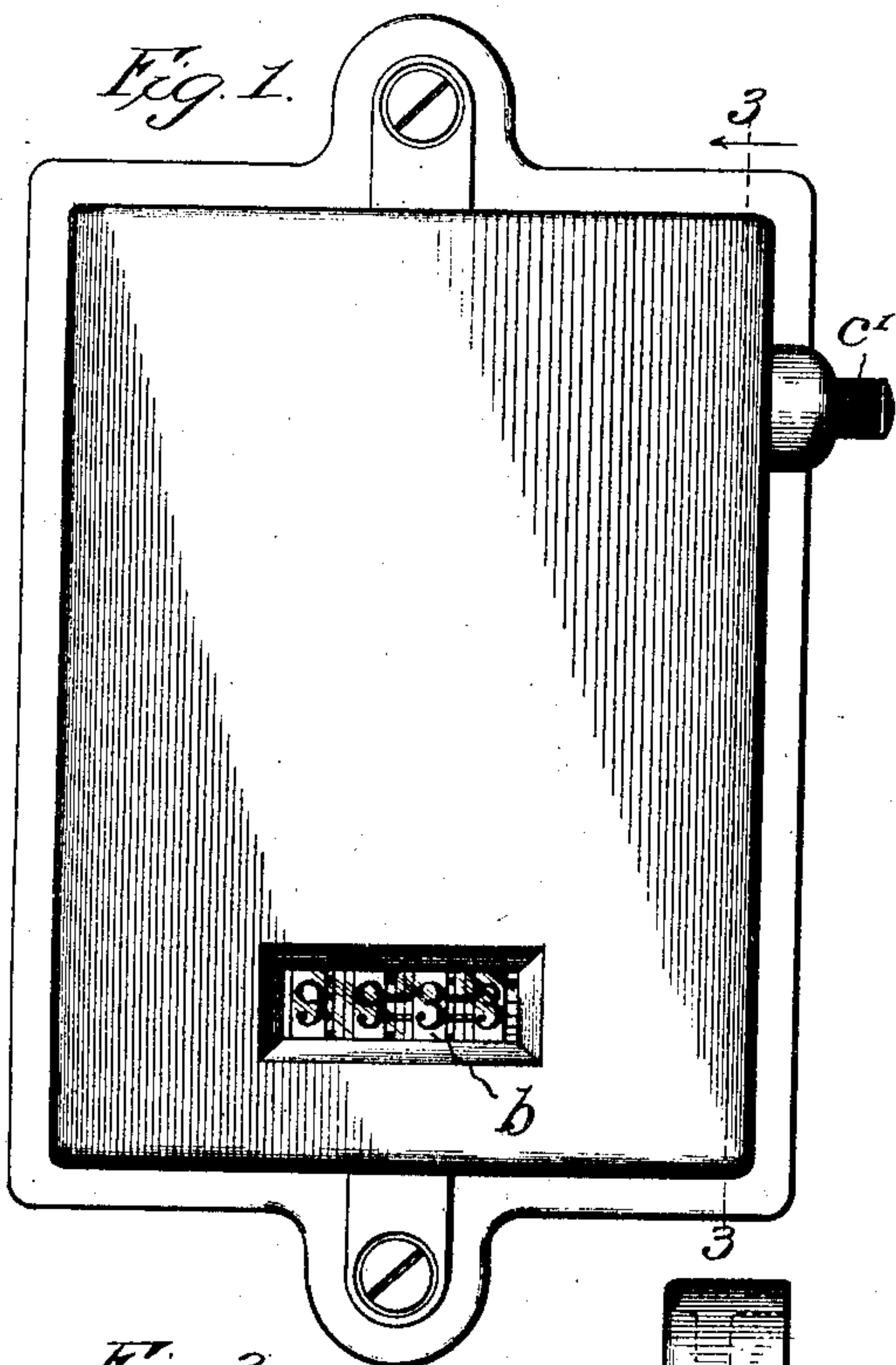
No. 813,230.

PATENTED FEB. 20, 1906.

F. R. McBERTY & E. B. CRAFT:  
SERVICE METER FOR TELEPHONE EXCHANGES.

APPLICATION FILED JUNE 10, 1905.

3 SHEETS—SHEET 1.



Witnesses:  
Alfred H. Moore.  
Irving Mac Donald

Inventors  
Frank R. McBerty  
Edward B. Craft  
By Barton & Tanner  
Attys.

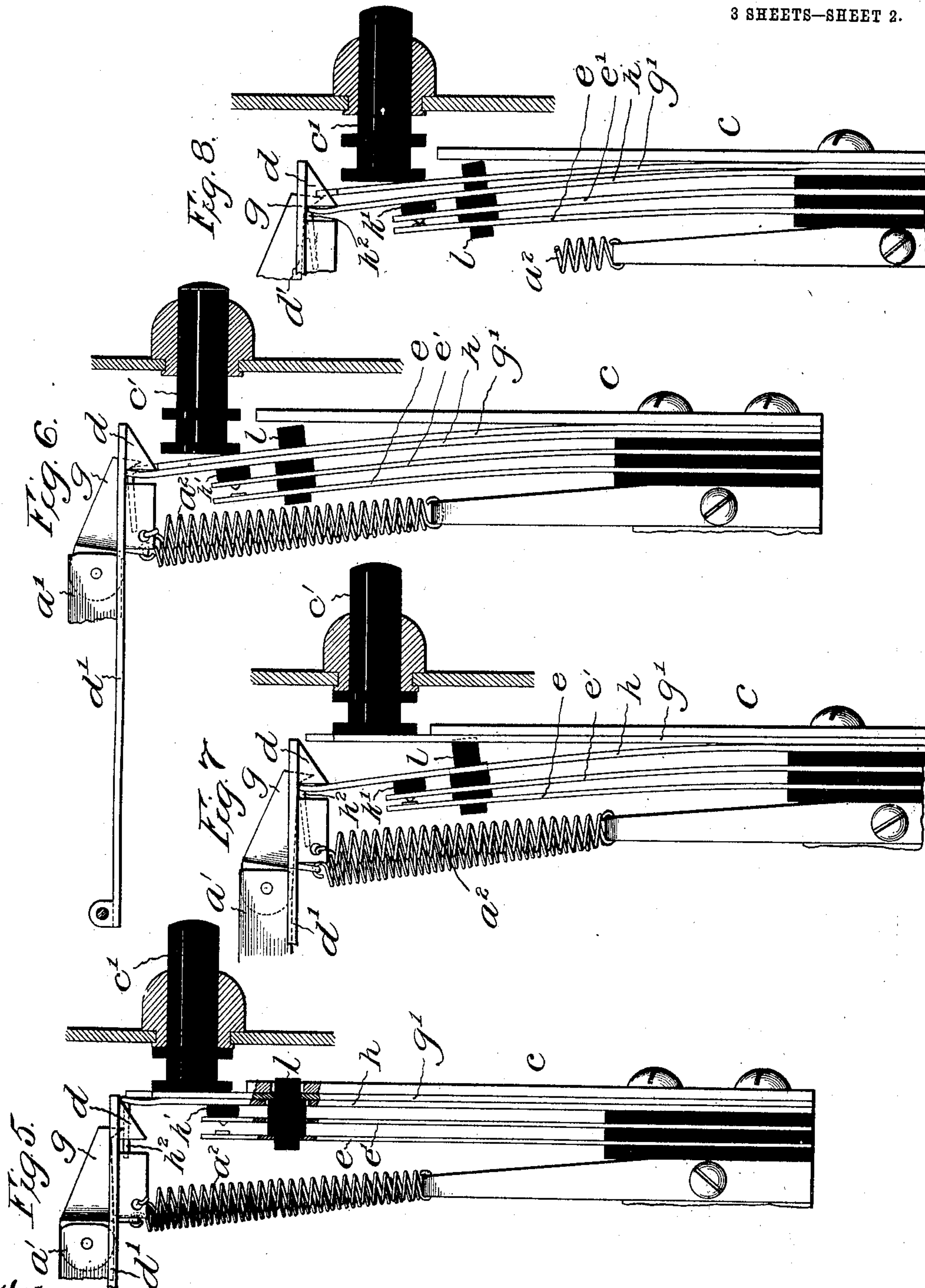
No. 813,230.

PATENTED FEB. 20, 1906.

F. R. McBERTY & E. B. CRAFT.  
SERVICE METER FOR TELEPHONE EXCHANGES.

APPLICATION FILED JUNE 10, 1905.

3 SHEETS—SHEET 2.



Witnesses:  
Alfred H. Moore  
Irving Mac Donald

Inventors  
Frank R. McBerty  
Edward B. Craft  
By Barton Tanner Attys.



No. 813,230.

PATENTED FEB. 20, 1906.

F. R. McBERTY & E. B. CRAFT.  
SERVICE METER FOR TELEPHONE EXCHANGES.

APPLICATION FILED JUNE 10, 1905.

3 SHEETS—SHEET 3.

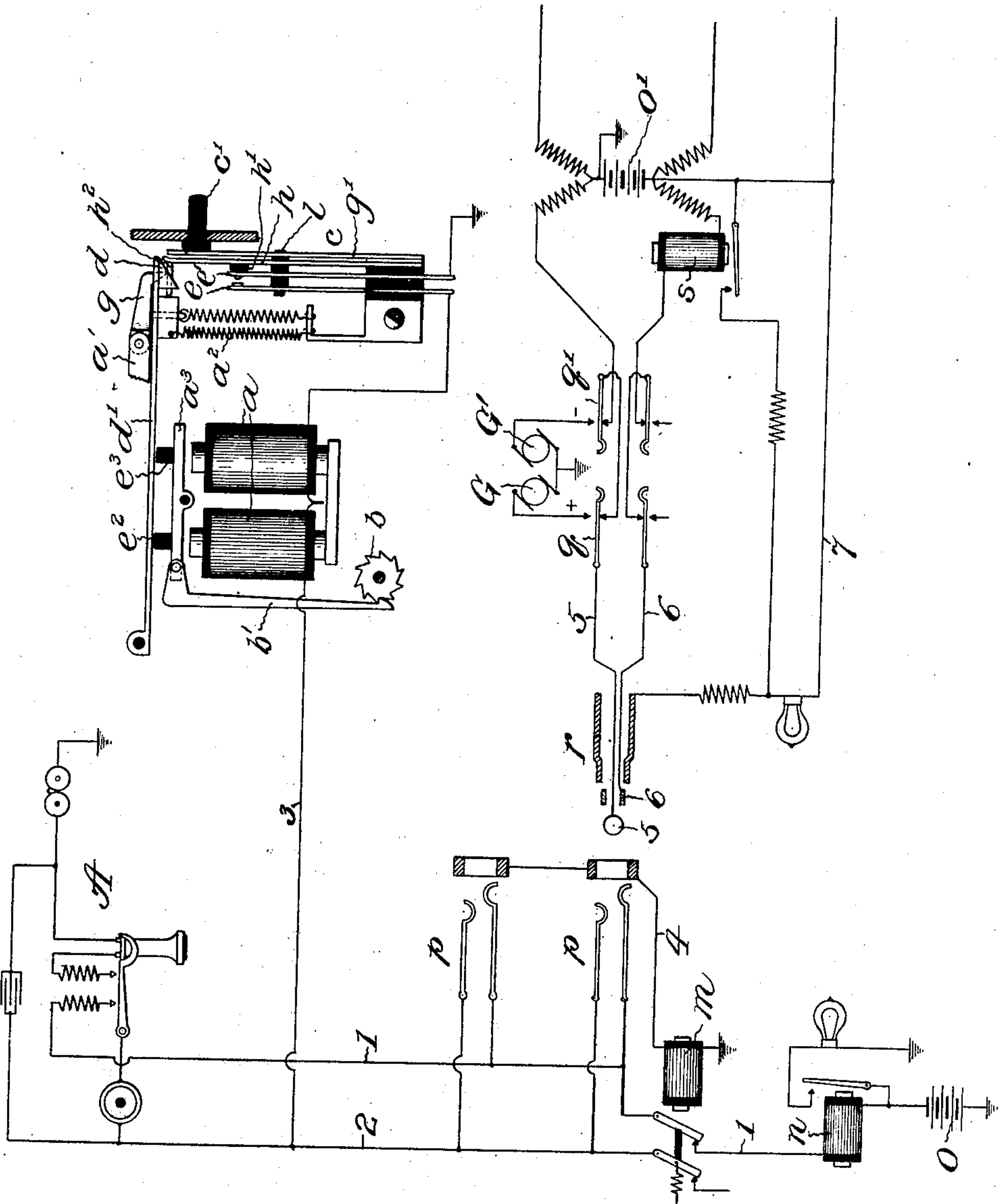


Fig. 9.

Witnesses:  
Alfred S. Moore.  
Irving Mac Donald.

Inventors  
Frank R. McBerty  
Edward B. Craft  
By Burton Tanner  
Att'ys.



# UNITED STATES PATENT OFFICE.

FRANK R. McBERTY, OF EVANSTON, AND EDWARD B. CRAFT, OF CHICAGO, ILLINOIS, ASSIGNORS TO WESTERN ELECTRIC COMPANY, OF CHICAGO, ILLINOIS, A CORPORATON OF ILLINOIS.

## SERVICE-METER FOR TELEPHONE-EXCHANGES.

No. 813,230.

Specification of Letters Patent.

Patented Feb. 20, 1906.

Application filed June 10, 1905. Serial No. 264,565.

*To all whom it may concern:*

Be it known that we, FRANK R. McBERTY, residing at Evanston, and EDWARD B. CRAFT, residing at Chicago, in the county of Cook and State of Illinois, citizens of the United States, have invented a certain new and useful Improvement in Service-Meters for Telephone-Exchanges, of which the following is a full, clear, concise, and exact description.

Our invention relates to a service-meter for telephone-exchanges, and has for its object to provide an improved and simplified structure for recording calls for connections which are actually established which will be proof against fraudulent manipulation.

The service-meter of our invention is of the type wherein a subscriber in order to initiate a call is required to operate a manual key or plunger, thereby bringing the device into operative relation to the telephone-line and completing a circuit for the line-signal at the central office and in addition surrendering to the central-office operator the complete control of the instrument. In case the desired connection is obtained the operator may at the proper time apply suitable current to the line to operate the registering-train and restore the device to normal condition; but if for any reason the connection cannot be obtained the operator may by the application of the proper current to the line restore the device to normal condition without effecting a registration.

Our invention contemplates a service-meter comprising a tilting lever whose movement is controlled by a suitable electromagnet. A switch is employed for controlling the circuit connections of the electromagnet, together with a catch adapted to lock the switch in its operated condition. A manual key or plunger is provided to be operated by the subscriber in initiating a call, which effects the closure and locking of said switch, thereby connecting the magnet with the line and completing a circuit for the central-office signal. This act upon the part of the subscriber removes the service-meter from his control and vests the same in the central-office operator. A registering-train is arranged to be advanced by the said tilting lever when moved in one direction, the lever when so moved serving to operate the catch

and release the switch. The lever is adapted when tilted in the opposite direction to move the catch in a similar manner and release the switch without effecting a registration. The operator is provided with means for applying suitable current to the line to energize the said magnet and effect the movement of the lever in either direction, as desired.

Our invention also contemplates an improved construction of the switch above referred to and mechanism associated therewith whereby after the switch has once been closed and locked subsequent improper manipulation thereof is rendered impossible. We preferably provide a device for moving said switch until it is locked by said catch, said switch closing upon the withdrawal of the operating device. After said device is withdrawn a guard is interposed between the switch and operating device, whereby a subscriber is prevented from fraudulently manipulating said switch after his desired connection is obtained in order to prevent the operator from registering his call.

We will describe our invention particularly by reference to the accompanying drawings, wherein—

Figure 1 is a view in front elevation of a service-meter embodying our invention with the cover in place. Fig. 2 is a similar view with the cover in section. Fig. 3 is a sectional side elevation on line 3 3 of Figs. 1, 2. Fig. 4 is a similar view on line 4 4 of Fig. 2. Figs. 5-8 are detail views of the circuit-controlling mechanism of the service-meter magnet, showing the same in alternative positions; and Fig. 9 is a diagram illustrating a circuit with which our improved service-meter may be advantageously employed.

The same characters of reference are used to designate the same parts wherever shown.

The service-meter shown is provided with a polarized electromagnet *a*, the core whereof is secured to a supporting-post *a'*, mounted upon a suitable base *a''*. A centrally-pivoted tilting armature *a'''* is supported by said post in position to be acted upon by said magnet and swung in either direction, according to the polarity of the current flowing through said magnet. The armature is adapted when tilted in one direction to advance a registering-train *b* by means of a pawl *b'*, secured to



the armature; but when tilted in the opposite direction the armature does not effect the operation of the register.

A switch *c* is provided for controlling the circuit connections of magnet *a* and is adapted to be moved through the agency of a plunger *c'*, projecting through the cover of the service-meter, until closed and locked by a catch *d*. The catch is arranged to be unlocked by the armature in either movement thereof, so that whether or not a registration is effected the apparatus is returned to normal condition upon the energization of magnet *a*. The catch is preferably carried on the end of an arm *d'*, pivoted to said post *a'*, and the armature carries studs *e<sup>2</sup>* *e<sup>3</sup>* upon either side of its pivotal center, adapted to engage and operate the arm *d'*, according to the direction of movement of the armature, a spring *a<sup>2</sup>* normally holding said arm against said studs.

We preferably provide mechanism in association with the switch *c* whereby after the same has been closed and locked it cannot be tampered with and improperly actuated, being completely beyond the control of the subscriber until the catch has been operated to release the switch. As the switch is moved by the plunger or push-button *c'* it is maintained open until locked by the catch and until the push-button is withdrawn, whereupon the switch is allowed to close and a guard is interposed between the springs and the tension member or operating device *g'* moved by the push-button in actuating the switch. After the interposition of said guard further manipulation of the switch by the operating device *g'* is prevented until the switch is released.

The switch *c* may comprise a pair of switch-springs adapted to be engaged and moved into contact with each other by an insulating-button *h'*, carried by an idler-spring *h*, as shown most clearly in Figs. 5-8. The idler-spring is adapted to be engaged and moved by the tension member or operating device *g'* to actuate the switch-springs and when so moved is engaged by said catch to maintain the switch-springs closed. (See Fig. 7.) An insulating-spacer *l* is adapted to be engaged by the operating member *g'* and maintain the springs separated, Fig. 6, until the idler-spring *h* is locked and the operating member *g'* withdrawn, when said spring is moved by the tension of the outer switch-spring *e* to allow said switch-springs *e e'* to lie in contact. The guard *g* may comprise a spring-actuated stop-finger pivoted to the post *a'* with its free end normally resting upon a lip *h<sup>2</sup>*, carried at the end of the idler-spring, said finger being adapted upon the movement of said spring into its locked position to fall into a position to prevent the device *g'* from engaging the spring *h* or operating the spacer *l*. (See Fig. 8.)

Referring now to Fig. 9 we will describe a telephone-exchange system equipped with a service-meter embodying our invention. The telephone-line extends in two limbs 1 2 from substation apparatus of well-known character to a central office, where said limbs pass through the armature and back contacts of the usual cut-off relay *m*, limb 1 extending therefrom through the usual line-signal-controlling magnet *n* to the free pole of a grounded battery *o*, while the other limb is open. The magnet of the service-meter is included at the substation in a normally open ground branch 3 from limb 2 of the line controlled by the switch-springs *e e'* of the meter.

The telephone-line is provided with multiple spring-jacks *p p* at the central office, each having long and short springs connected with the limbs 1 2 of the line, respectively, and a test-ring forming the terminal of a conductor 41, extending to earth through the winding of said cut-off relay *m*. The operator is provided with the usual plugs and plug-circuit for making connection with the line. We have for convenience shown simply the portion of the plug-circuit associated with the answering-plug. Link conductors 5 6 extend from the tip and ring contacts of the answering-plug *r* through the contacts of switch-keys *q q'* to the poles of a grounded battery *o'*, the conductor 6 including a supervisory relay *s*, which controls a shunt around a supervisory signal-lamp included in a conductor 7, extending from the free pole of battery *o'* to the sleeve-contact of the plug *r*. The switch-keys *q q'* control the application of positive and negative current from generators *G G'*, respectively, to the link conductor 5 and to the limb 2 of the line.

The operation of the system is as follows: A subscriber at station A in order to transmit a call first removes his telephone-receiver from its switch-hook and operates the plunger or push-button *c'* to close and lock the switch-springs *e e'*. A circuit is thereby completed for the line-signal-controlling magnet *n*, such circuit extending from the free pole of battery *o* over line conductor 1, through magnet *n*, armature and back contact of cut-off relay *m*, through the contacts closed by the telephone switch-hook to limb 2 of the line, branch conductor 3, winding of polarized magnet *a*, switch-springs *e e'* to earth. The control of the subscriber over his meter is by the depression of the push-button and the consequent locking of the switch in its closed position delivered to the operator. The service-meter magnet *a* is of course arranged to be unresponsive to current from battery *o* in said circuit. The central-office operator upon observing the display of the line-signal inserts the answering-plug *r* into the spring-jack *p* of the line and inquires of the subscriber at station A the number of the subscriber with whom he desires connection.



The insertion of the answering-plug *r* completes a circuit for the cut-off relay, including conductors 7 4 and battery *o'*. After the establishment of the desired connection, and preferably after the "disconnect" signal is received by the operator—that is, when the supervisory lamp controlled by relay *s* is illuminated upon the hanging up of the subscriber's receiver at the termination of the conversation—the operator depresses the proper one of the switch-keys *q q'* to apply current of suitable direction to the line to energize the magnet *a* of the service-meter and tilt the armature *a'*, so as to operate the register and release the switch. Assuming the current required for the work to be current of positive polarity, the operator would actuate switch *q*, thereby completing a circuit from the grounded generator *G* of positive current by way of link conductor 5, tip of plug *r*, short spring of jack *p*, limb 2 of the telephone-line, branch conductor 3, through winding of magnet *a*, switch-springs *e e'* to earth. The magnet would thereupon tilt the armature in such a way as to advance the registering-train and operate the catch, thereby restoring the switch to normal condition. In case the desired connection could not be obtained the operator would actuate the switch *q'*, whereupon a similar circuit would be completed for the generator *G'* of negative current, causing the magnet *a* to tilt its armature in the opposite direction to release the switch-springs without effecting a registration.

While we have for convenience shown two batteries in the drawings, (marked *o o'*,) it will be understood, of course, that in practice these may be one and the same battery.

We claim—

1. The combination with an electromagnet, of a tilting armature therefor, a circuit for said magnet, a switch controlling said circuit, a catch adapted to lock said switch in its actuated position, a registering-train operated in the movement of the armature in one direction, said catch being operated in such movement of the armature to release the switch, the armature being adapted when moved in the opposite direction to operate said catch and release the switch without effecting a registration, and means for applying current in the circuit of said magnet to effect the movement of said armature in either direction.

2. In a service-meter, the combination with a tilting lever, of electromagnetic mechanism for moving said lever in either direction, a switch controlling the circuit connections of said mechanism, a catch adapted to lock said switch in its actuated position, and a registering-train operated in the movement of said lever in one direction, said lever being adapted in such movement to operate said catch to release the switch, said lever

when moved in the opposite direction releasing said switch without effecting a registration.

3. In a service-meter, the combination with an electromagnet, of a centrally-pivoted armature therefor, switch-springs controlling the circuit connections of said magnet, a pivoted arm, a catch carried thereby adapted to lock said switch-springs in their actuated position, and a registering-train operated by said armature when moved in one direction, said armature when so moved operating said pivoted arm to withdraw the catch and release said switch-springs, said armature when moved in the opposite direction moving said arm to release the switch-springs without effecting a registration.

4. In a service-meter the combination with a polarized electromagnet, of a centrally-pivoted armature therefor, switch-springs controlling the circuit connections of said magnet, a pivoted arm carrying a hook at its outer end adapted to engage the ends of said springs when the same are operated to lock them in such position, studs upon said armature on either side of the pivot thereof, a spring normally holding said pivoted arm adjacent to said studs, a registering-train, a pawl carried by said armature adapted when said armature is tilted in one direction to operate said train, one of said studs in such movement of the armature moving said pivoted arm to withdraw the hook thereof and release said switch-springs, said armature when tilted in the opposite direction acting through the agency of the other stud to move said arm and release the switch-springs without affecting the registering-train.

5. In a service-meter, the combination with an electromagnet, of an armature therefor, a registering-train controlled by said armature in its movement, a switch controlling the circuit connections of said magnet, a catch, means for closing said switch and effecting the locking thereof by said catch, and means for preventing actuation of the switch after the same is closed and while locked, said armature being adapted when moved to operate said catch and release the switch.

6. In a service-meter, the combination with an electromagnet, of an armature therefor, a registering-train controlled by said armature in its movement, a switch controlling the circuit connections of said magnet, a catch, a device for moving said switch until locked by said catch, said switch closing upon the withdrawal of said device, and a guard for preventing subsequent movement of said switch by said device while the switch is locked, said armature being adapted when moved to operate said catch and release the switch.

7. In a service-meter, the combination with an electromagnet, of a tilting armature therefor, a switch controlling the circuit con-



nections of said magnet, a pivoted arm, a catch carried thereby, a device for moving said switch until locked by said catch, said switch closing upon the withdrawal of said device, a guard for preventing subsequent actuation of the switch by said device while the same is locked, and a registering-train operated by said armature when moved in one direction, the armature when so moved operating the pivoted arm to release said switch, the armature when moved in the opposite direction moving said arm to release the switch without effecting a registration.

8. In a service-meter, the combination with an electromagnet, of an armature therefor, a registering-train controlled by said armature in its movement, switch-springs controlling the circuit connections of said magnet, a tension member adapted when operated to move said springs, a catch adapted to hold said member in such position, a device for operating said tension member, an insulating-spacer adapted to be engaged by said device to hold said springs apart as the same are moved by said tension member, said spacer upon the withdrawal of said device moving to permit the springs to close, and means for preventing subsequent actuation of said springs by said device while the switch is locked, said armature being adapted when moved to operate said catch and release the switch-springs.

9. In a service-meter, the combination with an electromagnet, of a tilting armature

therefor, switch-springs controlling the circuit connections of said magnet, an idler-spring carrying an insulating-button adapted upon the operation of said spring to move said switch-springs, a pivoted arm, a catch carried thereby adapted to lock said idler-spring in its operated position, a device for moving said spring, an insulating-spacer engaged by said device when moved adapted to maintain said switch-springs apart, said spacer upon the withdrawal of the device moving to permit said switch-springs to close, a lip carried by said idler-spring, a spring-actuated stop-lever normally resting against said lip, said lever upon the movement of the idler-spring being interposed between said spring and the operating device to prevent subsequent actuation of the switch-springs by said device, and a registering-train operated by said armature when moved in one direction, said armature when so moved operating the said pivoted arm to release the switch-springs, said armature when tilted in the opposite direction moving said arm to release the catch without operating the registering-train, as described.

In witness whereof we hereunto subscribe our names this 6th day of April, A. D. 1905.

FRANK R. McBERTY.  
EDWARD B. CRAFT.

Witnesses:

R. T. ALLOWAY,  
F. P. McINTOSH.