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PATENTED APR. 25, 1905.

D. A. YODER.

REGISTERING APPARATUS FOR TELEPHONE EXCHANGES.

APPLICATION FILED AUG. 25, 1904.

Fig. 1.

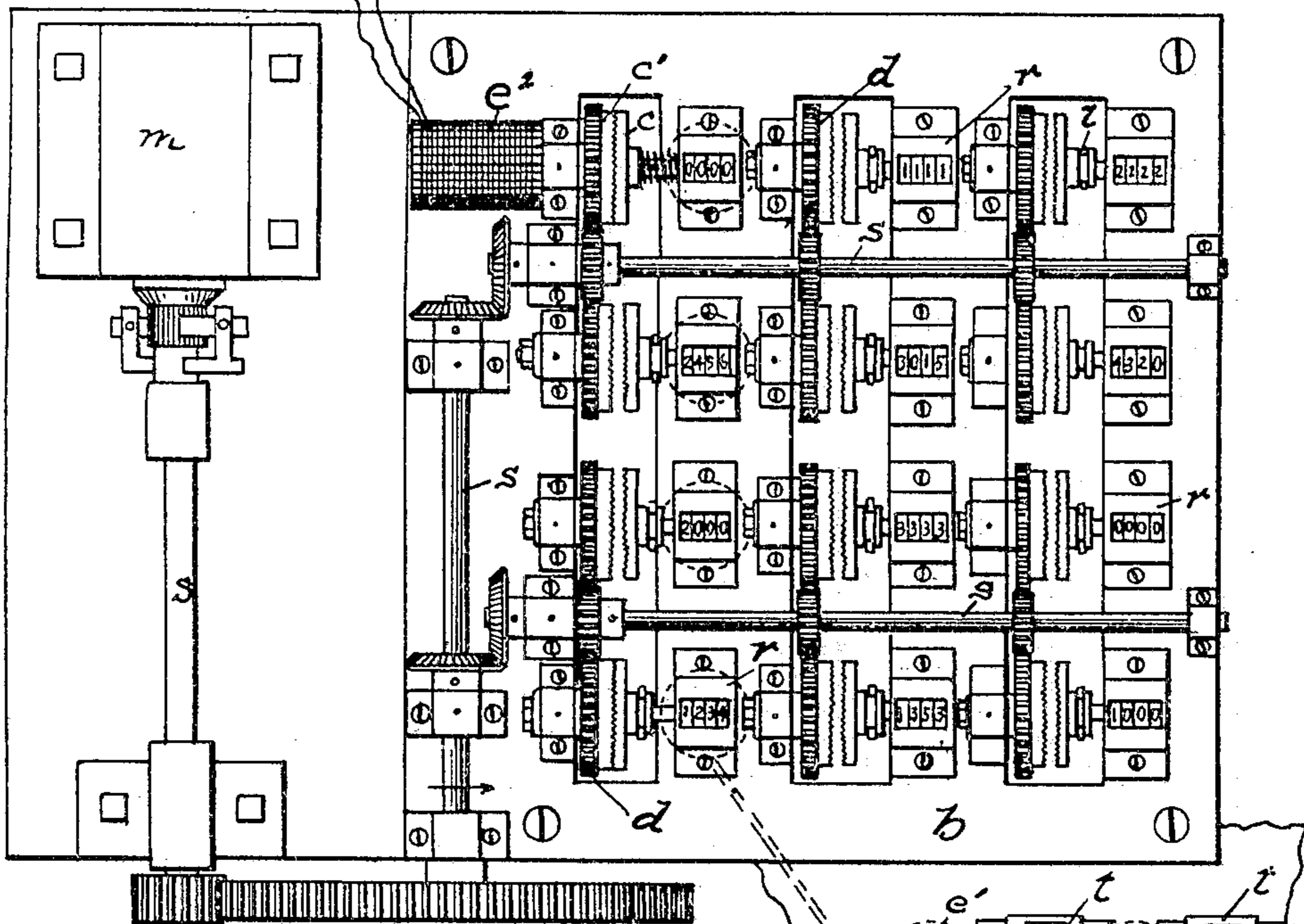


Fig. 2.

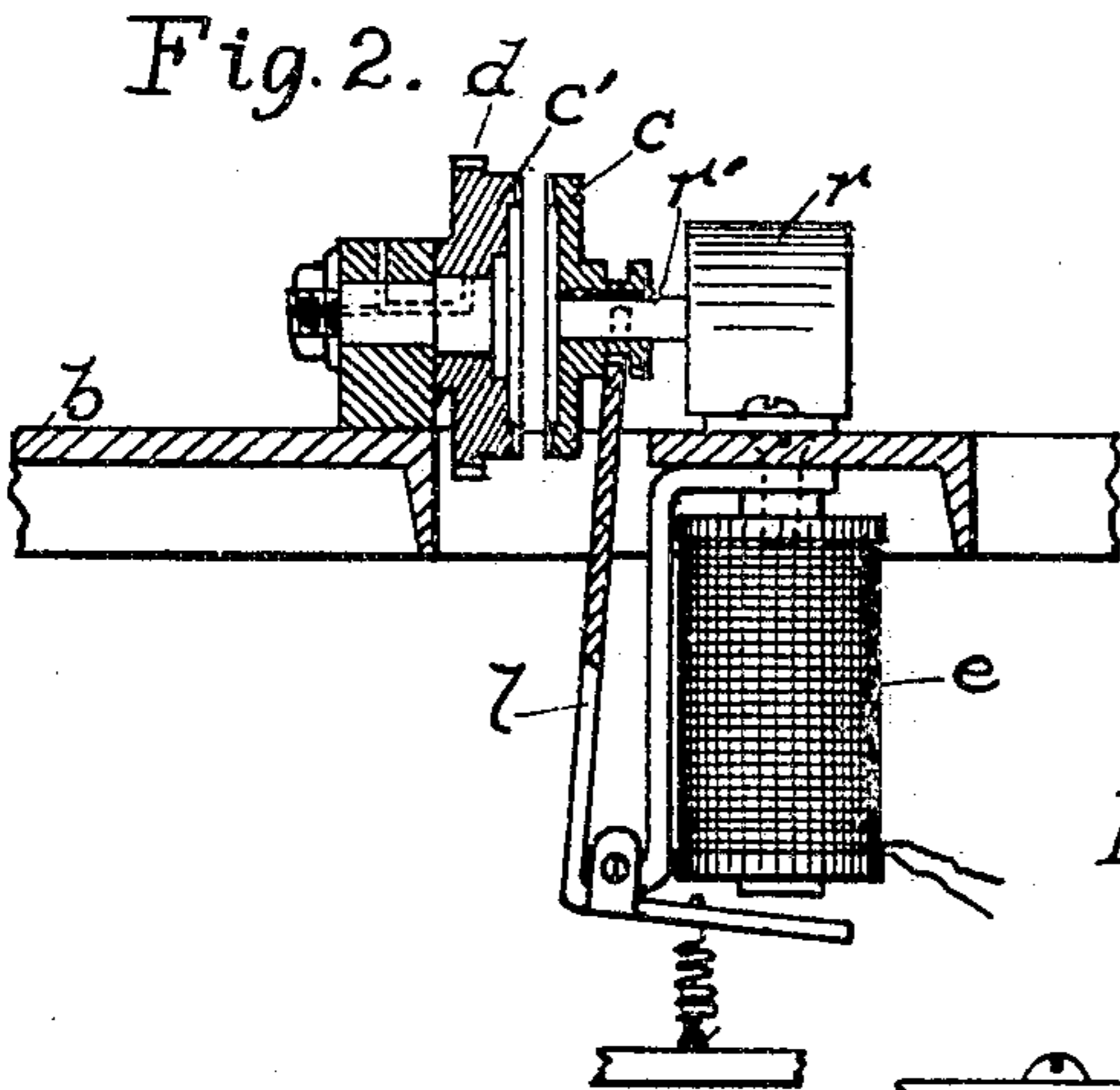


Fig. 3.

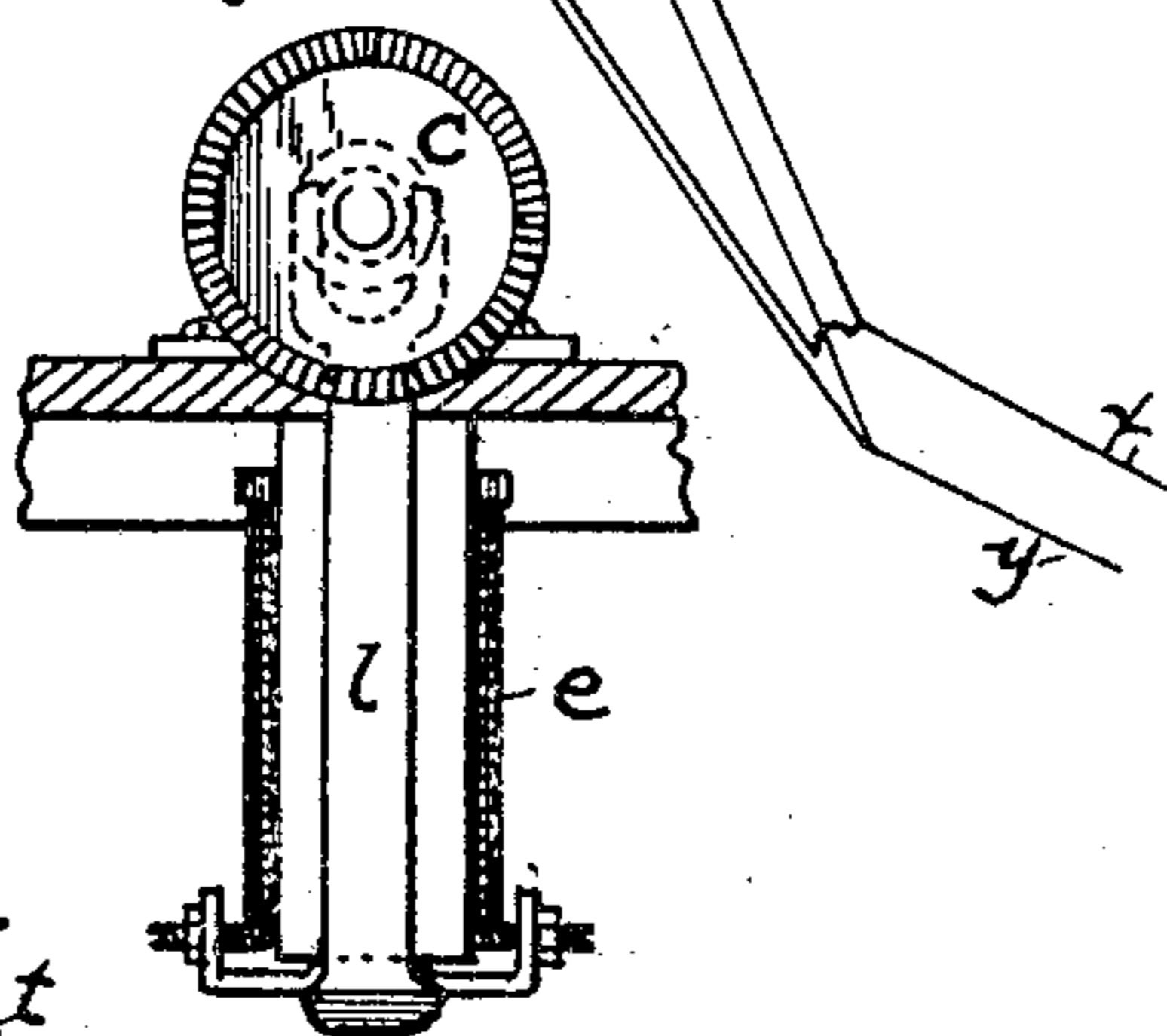
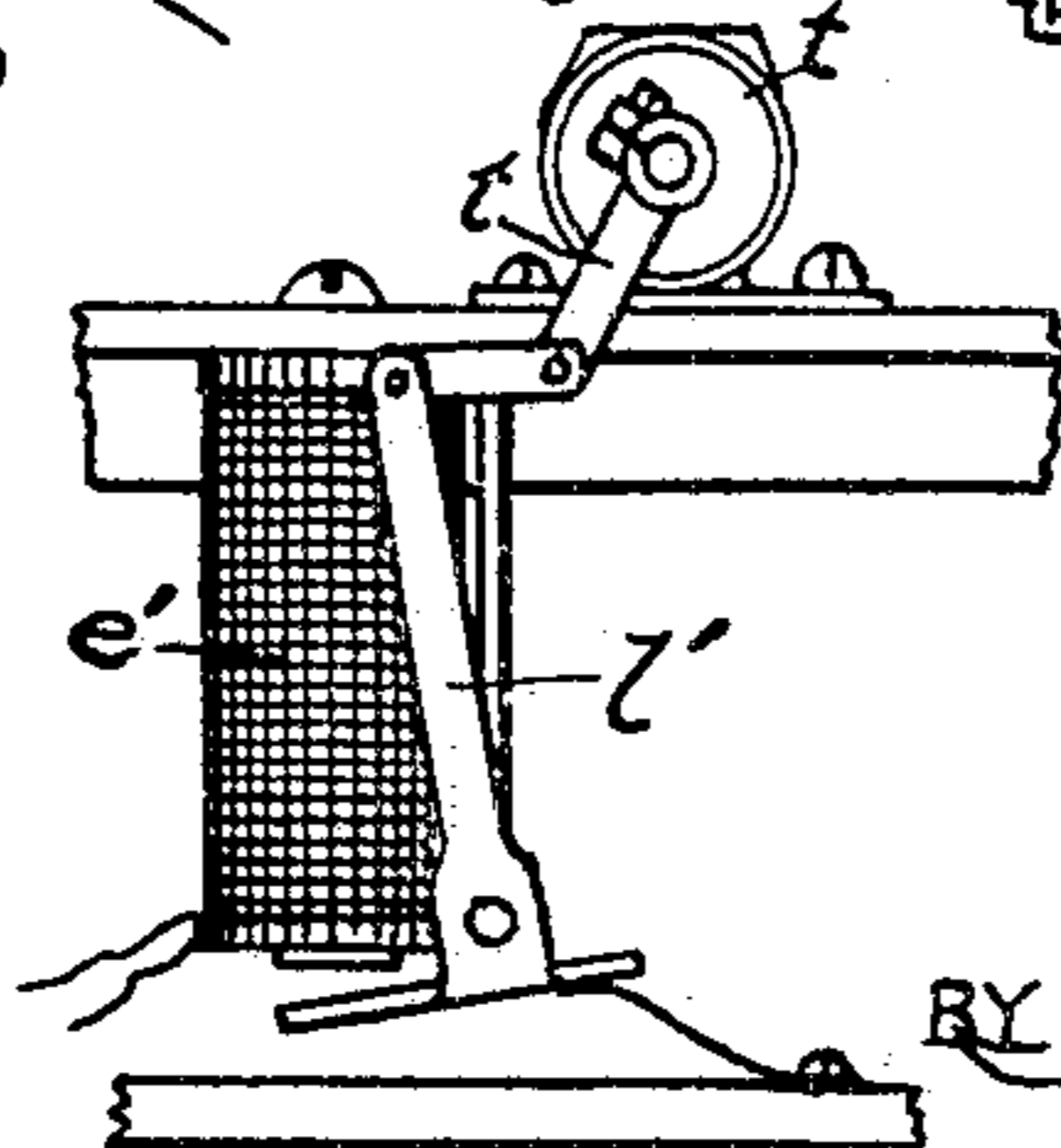


Fig. 4.



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# UNITED STATES PATENT OFFICE.

DAVID A. YODER, OF TOLEDO, OHIO.

## REGISTERING APPARATUS FOR TELEPHONE-EXCHANGES.

SPECIFICATION forming part of Letters Patent No. 787,969, dated April 25, 1905.

Application filed August 25, 1904. Serial No. 222,065.

*To all whom it may concern:*

Be it known that I, DAVID A. YODER, a citizen of the United States of America, and a resident of Toledo, in the county of Lucas and State of Ohio, have invented certain new and useful Improvements in Registering Apparatus for Telephone-Exchanges, of which the following is a specification.

My invention relates to registering apparatus for telephone-exchanges, and has for its object the provision of means whereby an accurate record is automatically kept concerning the calls and connections made at the exchange to the end that the service not only may be improved, but the operating expenses may also be materially reduced.

My improvements when applied to any telephone-exchange fully advise the traffic department and the operating department concerning the conditions of service, particularly as to the number of calls and those handled by each operator, the time required by said operators in answering such calls, and, if desired, the time required as well in making the disconnections. With this data accurately collected the work can be more evenly distributed and the relative efficiency of each operator positively determined and actually increased under the stimulus of competition and of additional pay dependent upon the amount and rapidity of the work performed. This in turn permits, of course, of the reduction in the operating force and the decrease of expense therefor.

My present invention is directed toward the provision of thoroughly practical and accurate mechanism of simplified character for automatically collecting and registering the desired data at the telephone-exchange.

Briefly stated, the embodiment of my invention will be seen to comprise a motor device driven at practically constant speed, with which registering or counting trains are adapted to be connected during the intervals to be measured (as the periods required by each operator for answering her calls and for making the disconnections) and also counting trains or mechanism for automatically registering each call as made.

This apparatus is so constructed that it is

directly connected with the motor device in a manner to insure the accurate registry of the exact interval to be designated each time, although dispensing with all forms of clock, timing, or other delicate mechanism and requiring no accurate and careful adjustments.

The foregoing will be more fully explained by making reference to the accompanying drawings, wherein—

Figure 1 is a plan view of the motor and associated registering mechanism for some twelve operators' positions and also showing a fragmental view of two of the connection counting devices. Fig. 2 is a side view, partially in section, showing one of the registering devices and its controlling-electromagnet. Fig. 3 is a view of the same at right angles to that of Fig. 2 and with the driving-clutch omitted, and Fig. 4 is a view in side elevation of the counting mechanism.

The same character of reference has been employed in each of the several figures to indicate similar parts.

Referring first to Fig. 1, it will be understood that *m* is a small electric motor adapted to be driven at practically constant speed by the central battery at the telephone-exchange. Connected therewith by means of gear-wheels and beveled pinions is a system of shafting *s*, extending across the mounting plate or base *b* and connected by small pinions directly with the driving-gears *d* for the several registering devices *r*. These driving-gears accordingly are constantly driven at a uniform speed and are designed to actuate the respective registering or counting trains *r* whenever the latter are connected therewith. I have shown twelve of these registering-trains, which are of well-known construction, being adapted to register consecutively by units up to nine thousand nine hundred and ninety-nine, or in reverse order, if desired. Upon the shaft *r'* of each train is a clutch wheel or member *c*, having a serrated face designed to be actuated into engagement with a similar member *c'*, rotated at constant speed by its driving-gear. Each of these clutches *c* is splined upon its shaft, and when moved to the left thereon by its controlling-

electromagnet *e* it will be rotated by the driving-gear, meanwhile actuating in turn its registering mechanism *r*.

Two forms of controlling apparatus are shown. That in Figs. 2 and 3 has a pivoted bell-crank lever *l* acting from its upper end upon the clutch *c* when the magnet is energized, while the magnet *e*<sup>2</sup>, Fig. 1, is associated directly with soft-iron clutch members adapted magnetically to be drawn together upon the excitation of said magnet. Small retractile springs serve in each case to separate normally the respective portions of each clutch device.

The connection counting-trains *t* are somewhat similar, except that these register by units whenever directly actuated by their respective magnets *e*'. Connected with the armature of each magnet is a vertical lever *l'*, adapted to actuate the lever *t'* of the counting-train through the medium of a short connecting-link. Thus each time magnet *e*' is excited sufficiently its counting-train registers one unit or connection, commencing with zero. Said electromagnets *e*', however, preferably are made of sluggish character in any well-known manner, so that more than a momentary current through their coils is required to effect such registration. This is desirable in order to prevent the false recording of calls when a subscriber is rapidly moving his switch-hook up and down to obtain the attention of the operator.

It will now be understood that with the magnets *e* *e*' *e*<sup>2</sup> connected with any circuit desired (the motor and shafting being in motion) the respective registering-trains *r* will be steadily advanced throughout the period or periods said circuit is closed, while the counting-train *t* will record each of such closures of the circuit. While said circuit is open the clutch devices will be held out of engagement, and the registering-trains must remain inert. This connected circuit, as *x y*, may well be that of the pilot line-signal at the corresponding operator's position, or if the time required for disconnection should be wished magnet *e*<sup>2</sup>, for example, might be in circuit with the pilot supervisory signal. Such connections, however, may be made with any circuit individual or common to many telephone-lines just as required.

The registering-trains *r* may be so driven as to record seconds or fractions thereof through careful regulation of the speed of the motor, thus insuring timed results proper; but I prefer to avoid this refinement, with its attendant regulation, since with a practically uniform speed of the motor the arbitrary units of time recorded by the registering-trains are sufficient to exactly gage the efficiency of each operator when referred to the number of connections made. Thus the readings of the different registering-trains may be taken daily or hourly, for ex-

ample, which will show the total number of units recorded or elapsing before the several connections were made, while the readings of the corresponding counting-trains will respectively indicate how many of such connections there were. The disconnections may be similarly treated, if desired; but I need not attempt to exhaust the utilities of my improvements.

Doubtless it is unnecessary to point out that any suitable motor device may be employed in this connection instead of the electric motor shown for actuating the registering-trains and that suitable registering or counting mechanism of different types can readily be supplied in lieu of the well-known and compact form of mechanism set forth herein for recording the number of calls and the units of duration. The structures herein shown, however, are what I deem best adapted for the purpose.

A reverse indicating registering-train will be found of a little more convenience in keeping the records, since the computations may then be made from reading to reading just as taken down.

I have now described the preferred embodiment of my invention and indicated some of its utilities; but it is not limited to the precise details set forth, being claimed by me as follows:

1. In apparatus of the class described, the combination with a substantially constant speed motor device, of shafting driven thereby, a registering-train, electromagnetic means for positively connecting it temporarily to be driven by the shafting, and an electrically-controlled counting appliance associated with the said registering-train, substantially as set forth.

2. In apparatus of the class described, the combination with a motor device operated at substantially constant speed, of a registering-train associated therewith, clutch mechanism, and electrically-controlled means for connecting the registering-train temporarily with the motor through the clutch mechanism, substantially as set forth.

3. In apparatus of the class described, the combination with a motor device operated at practically constant speed, of a registering-train associated therewith, intermediate clutch mechanism, an electromagnet adapted temporarily to connect the said clutch, and an electrically-controlled counting appliance operated in conjunction therewith, substantially as set forth.

4. In apparatus of the class described, the combination with a motor operated at practically constant speed, of shafting driven thereby, a plurality of registering-trains, clutch mechanism for each adapted to connect them with the shafting for positive actuation thereby, electromagnets controlling the latter, electrically-controlled counting ap-

pliances, and telephone-exchange circuits respectively connected to actuate the latter and control the former recording-trains, substantially as set forth.

5 5. In apparatus of the class described, the combination with a suitable motor device actuated at practically constant speed, registering mechanism adapted to be connected therewith for actuation, counting mechanism associated with the latter, electromag-  
10 netic means for connecting the registering mechanism temporarily to be driven by the motor, and for intermittently actuating the counting mechanism, and a controlling elec-  
15 tric circuit associated with said electromagnetic means, substantially as set forth.

6. The combination with a controlling telephone-exchange circuit, of a sluggish electro-  
20 magnet connected therewith, a counting-train actuated thereby, a substantially-constant-speed motor device, a registering-train, clutch mechanism adapted temporarily to connect the same positively with the motor, and an electromagnet connected with the  
25 above-named circuit for controlling the clutch mechanism, substantially as set forth.

7. The combination with a constantly-driven motor, of shafting driven thereby, a plurality of registering-trains, intermediate  
30 clutch devices for each adapted positively to connect them temporarily for actuation by the motor, electromagnetically-controlled means for governing each of the clutch devices, counting-trains associated with the  
35 registering-trains each to each, electromagnetically-controlled means for actuating the counting-trains, and telephone-operators' circuits respectively connected electrically to control a registering and a counting train  
40 together, substantially as set forth.

8. In apparatus of the class described, the

combination with a motor device actuated at practically constant speed, of registering-trains associated therewith, means for intermittently driving the same by the motor, 45 electrically-actuated counting-trains respectively associated with the registering-trains, and electromagnets in circuit therewith and with a telephone-exchange circuit, whereby the calls are accurately recorded on the reg- 50 istering-trains and counted, substantially as set forth.

9. In apparatus of the class described, the combination with an electric motor actuated at substantially constant speed, a series of 55 registering-trains one for each operator's position, corresponding counting-trains, electromagnets respectively connected in circuit at the operators' positions, one series thereof associated with the counting-trains and the 60 others with the registering-trains, and means controlled by the latter for positively connecting the registering-trains individually with the motor, substantially as set forth.

10. In apparatus of the class described, the 65 combination with a motor device actuated at practically constant speed, of registering and counting trains, electromagnets respectively associated therewith, means for connecting the former with the motor device during the 70 excitation of the controlling-magnet, means for actuating the latter train upon the excitation of its magnet, and a controlling electric circuit wherein the electromagnets are connected, substantially as set forth. 75

Signed at Toledo, this 22d day of August, 1904, in the presence of two subscribing witnesses.

DAVID A. YODER.

Witnesses:

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ESTELLA M. DAUGHERTY.