(No Model.) 4 Sheets—Sheet 1.

C. H. RUDD.

CONDENSER TELEGRAPH SYSTEM.

No. 504,367. Patented Sept. 5, 1893.

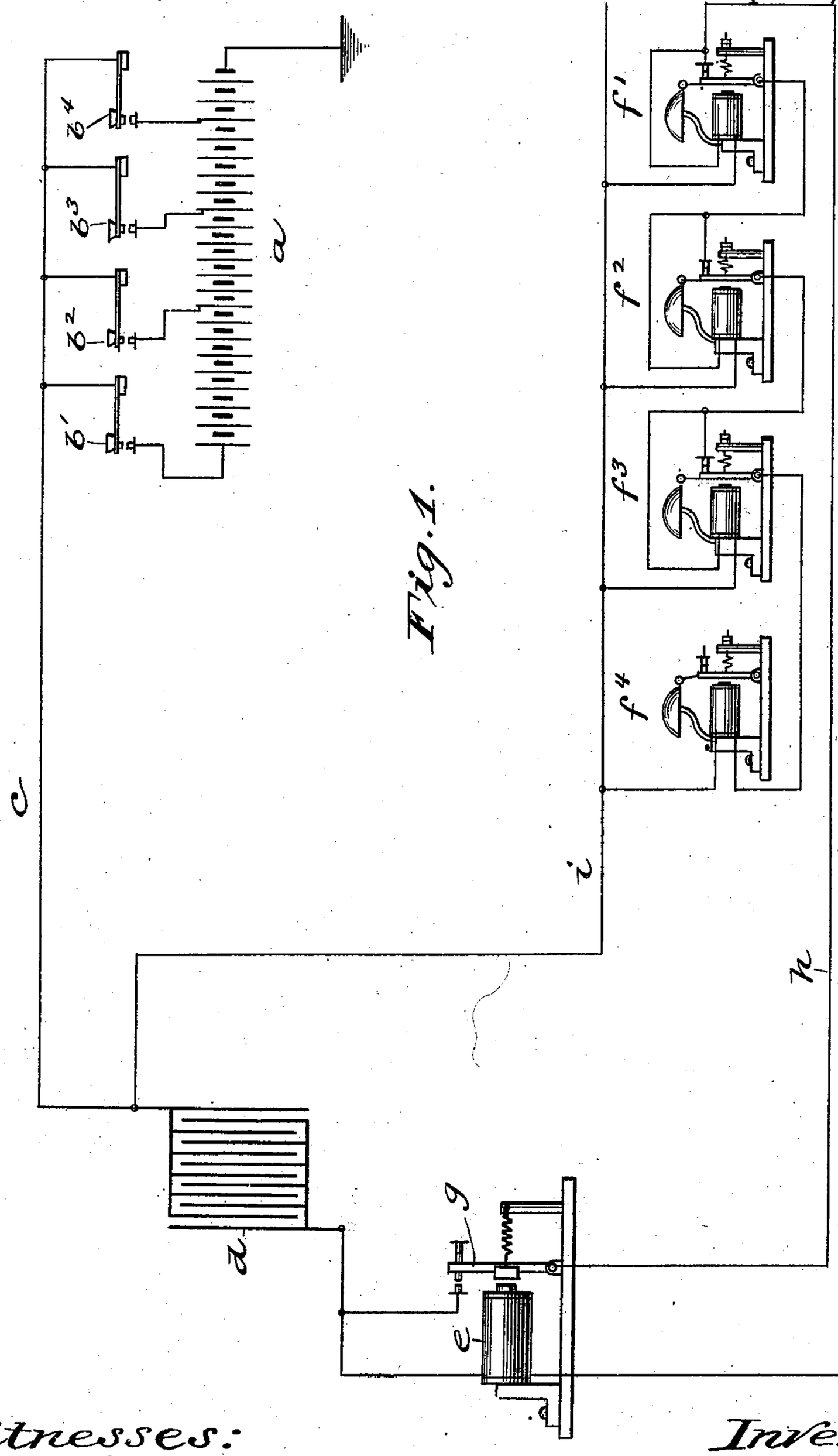

Fig. 1.

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Geo. R. Parker

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(No Model.)

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C. H. RUDD.

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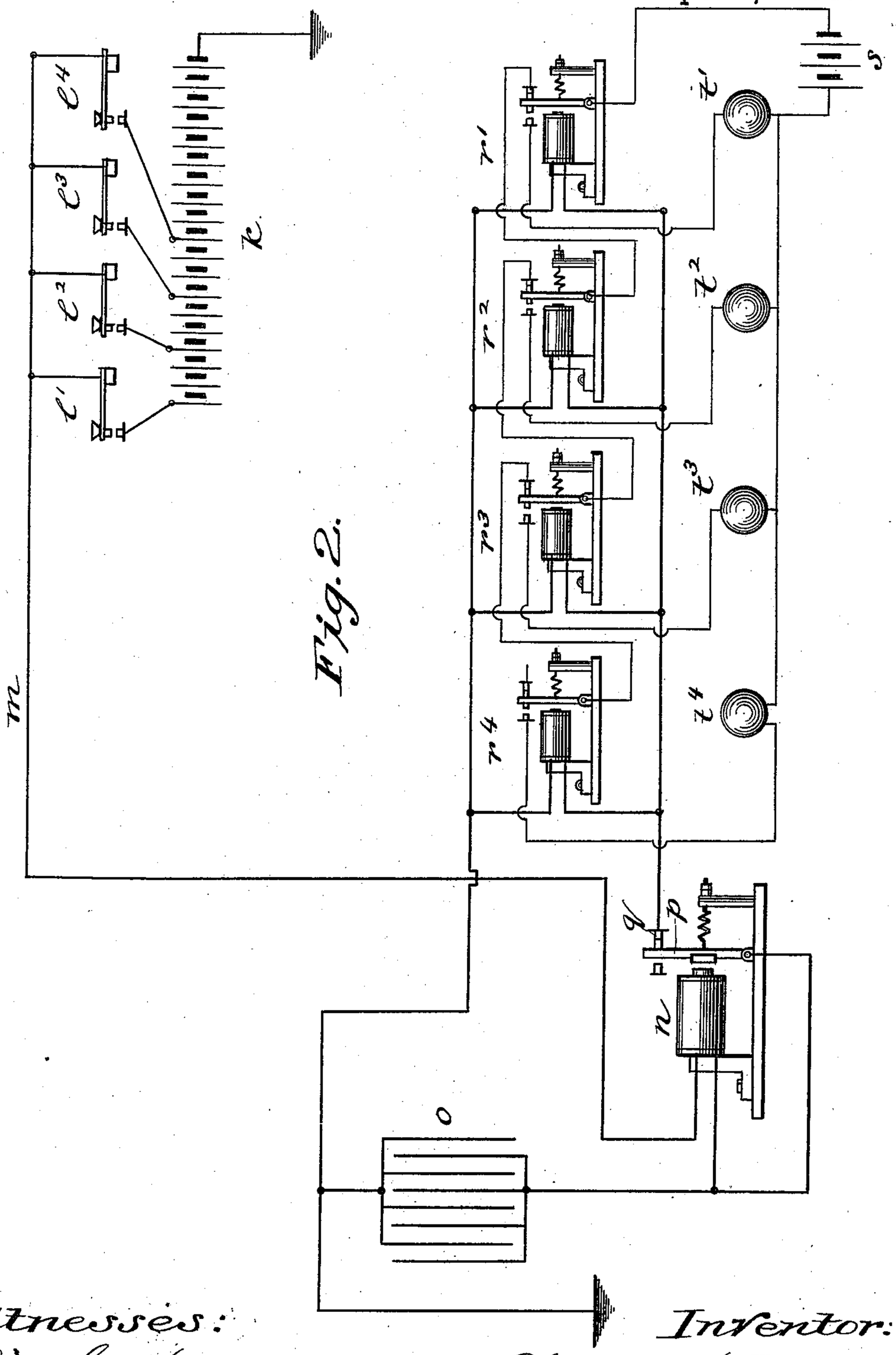

Fig. 2.

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(No Model.) 4 Sheets—Sheet 3.

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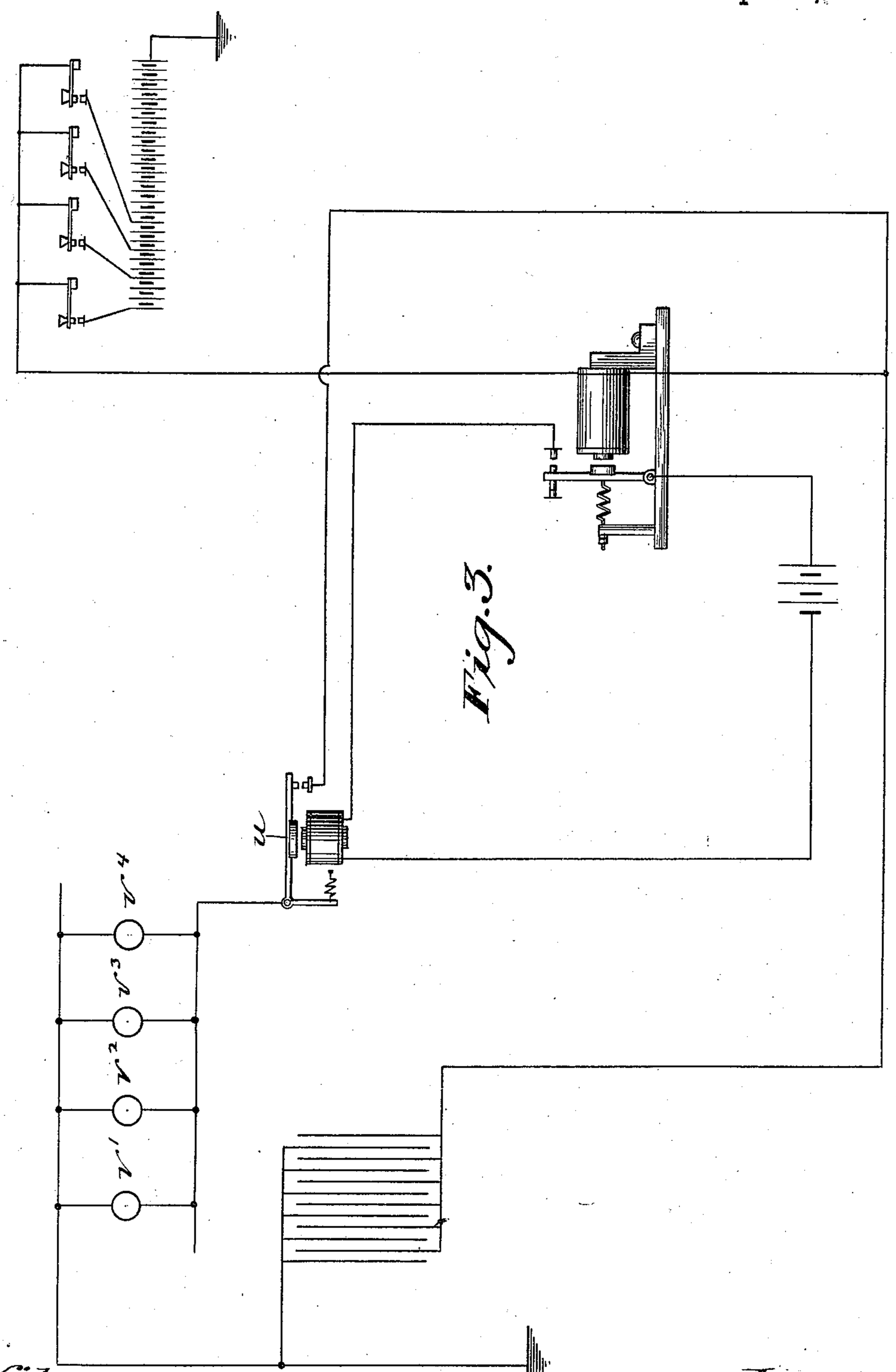

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(No Model.) 4 Sheets—Sheet 4.

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CONDENSER TELEGRAPH SYSTEM.

No. 504,367. Patented Sept. 5, 1893.

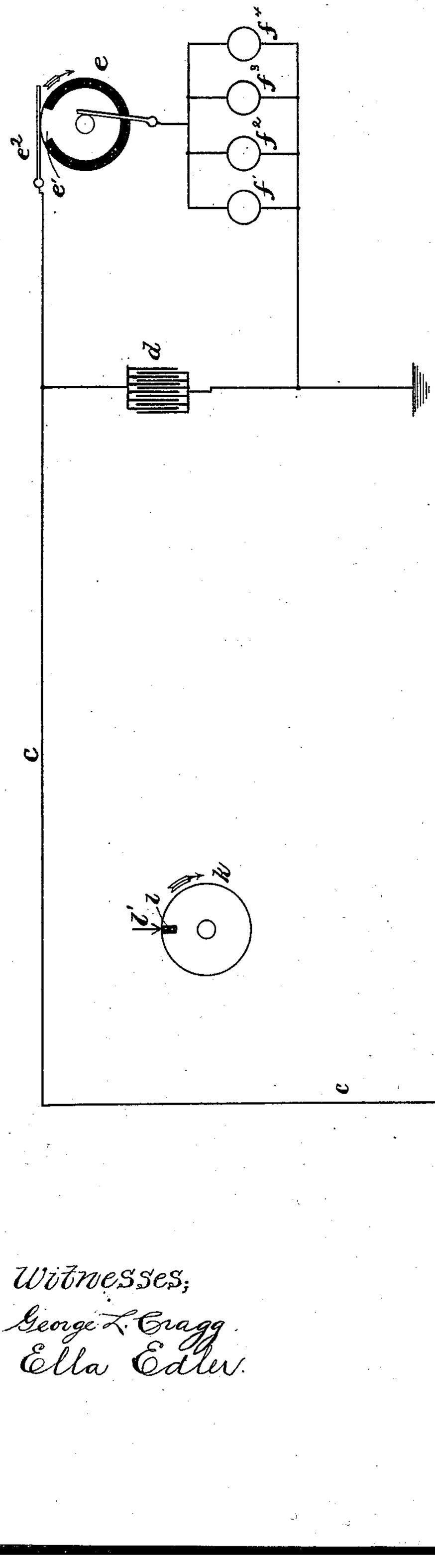

Fig. 4.

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Inventor;
Charles H. Rudd,
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UNITED STATES PATENT OFFICE.

CHARLES H. RUDD, OF EVANSTON, ASSIGNOR TO THE WESTERN ELECTRIC COMPANY, OF CHICAGO, ILLINOIS.

CONDENSER TELEGRAPH SYSTEM.

SPECIFICATION forming part of Letters Patent No. 504,367, dated September 5, 1893.

Application filed February 8, 1889. Serial No. 299,140. (No model.)

To all whom it may concern:

Be it known that I, CHARLES H. RUDD, a citizen of the United States, residing at Evanston, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Condenser Telegraph Systems, (Case No. 8,) 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 telegraphing by sending currents of different strengths to operate different signal devices at the distant point, the operation of the different signaling devices being dependent each upon the current strength.

My invention consists in a battery and keys placed at the transmitting station, a circuit extending therefrom to the receiving station, a condenser at the receiving station with which this circuit is connected, a condenser discharging device controlled by the current sent over said circuit and signal receiving instruments connected in circuit with the condenser discharger and the condenser so arranged that a particular strength of current will operate a particular signal receiving device by discharging the condenser after it has been charged to the voltage of said particular current. The object of the condenser as thus used is to get rid of variations which might be caused in the current when sent over a long circuit. The voltage being of a definite amount and the time being sufficient to charge the condenser the current afterward caused by discharging the condenser will be definite and not subject to variations which would be caused by the static capacity of the wire and the variable resistence of the battery in case the current were sent directly without using the condenser as a medium. By this arrangement of circuits and apparatus different signals may be indicated at the receiving station according to the voltage of the current sent over the line from the sending station.

I have already referred to and shall have occasion hereinafter to refer to a device which I have termed a condenser discharger; it will be understood that by this term I mean a device which operates to discharge the condenser at the desired time through the local circuit; this condenser discharger may be actuated either occasionally, by the action of the current through the condenser, or periodically, by independent means.

My invention will be readily understood by reference to the accompanying drawings, in which—

Figure 1 is a diagram showing the means for sending currents of different strengths from the transmitting station to the receiving station together with the condenser, the condenser discharger and the signal receiving devices at the receiving station. Fig. 2 is a diagram showing a modification of my invention whereby a local battery is closed by the discharge of the condenser to operate different signal devices according to the strength of the current discharged. Fig. 3 shows a modification of the condenser discharging device, a local circuit including a second relay which is operated after the closing of the relay included in the telegraph circuit. Fig. 4 shows still another form of the condenser discharger, which discharges the condenser at regular intervals, the time of each discharge being made known to the sender by a visual or other signal from a second device operating synchronously with the condenser discharger.

I will first describe my invention in detail as illustrated in Fig. 1, in which the main battery a is placed at the sending station, keys b' b^2 b^3 b^4 being provided for closing all or different portions of said battery to the telegraph line c. This line c is connected at the receiving station through a condenser d and the coil of a relay magnet e to ground. Connected with this relay is a local circuit including the condenser and the different specific signal receiving devices f' f^2 f^3 f^4. These signal receiving devices are shown in the form of bells; it is evident that any other indicating devices might be used in place of the gongs; various examples of devices which might be thus substituted for the bells shown, will readily occur to one skilled in the art to which my invention pertains. Without further description it will be readily seen that the closing of key b' will send one strength or voltage of current, while the closing of any other of the keys will result in sending

current of a different strength or voltage and it is evident that the number of keys may be increased or diminished as required for the particular service intended. The current being closed through the condenser d, the condenser will be charged to the voltage of the current; if sufficient time be given, the time required I have found to be very brief, as brief as the time required to strike the different keys of a typewriter in ordinary work. The current sent into the condenser to charge the same will excite the electro magnet e of the condenser discharger; the armature g is thus attracted so as to close the local circuit including the individual signal receiving devices f' f^2 f^3 f^4. One instrument or the other will be operated according to the current discharged from the condenser on closing this local circuit. This local circuit may be considered as consisting of two sides or limbs h and i. We will suppose the signal receiving devices the same except that their retractile springs are adjusted differently, that is, of different tensions; suppose the tension of the retractile spring of bell f' the greatest and that the tension of the retractile springs of devices f^2 f^3 and f^4 decrease each in the order named. The object is to cause key b' when depressed to send current to ring bell f' only, while current sent by depressing key b^2 will ring bell f^2 only and so on. It will be seen that the circuits are so arranged that this action will take place. Suppose key b' depressed; the condenser d is charged, the relay armature g is operated to close the local circuit h i through the different signal instruments, we will say, in the order f' f^2 f^3 f^4. The current being strong enough to cause each instrument f^2 f^3 f^4 to attract its armature, their magnets, that is, the magnets of all except f' will be opened and the entire current will pass through the magnet of instrument f'. It will be understood that the retractile springs of the several instruments are to be adjusted to obtain this effect; the charges necessary to operate consecutive instruments in the series must differ by amounts sufficient to permit of such an adjustment of the retractile springs that the lever of any relay in the series shall separate from its back contact, before the lever of the succeeding relay of feebler adjustment shall have time to give its signal, or to close upon its front contact. The different adjustments of the retractile springs have not been shown in the drawings, it being deemed sufficient to show them as capable of adjustment; the specific adjustments of the several springs are determined by the varying conditions to be met, and will be readily made by one ordinarily skilled in the art to which my invention pertains. The movement of the armature of instrument f', opens the circuit including the coils of all the other instruments, thus robbing them of current before they have time to act, that is to say, before they have time to give a signal. Thus the signal will be indicated by instrument f', but no signal will be indicated upon either of the other signal receiving devices. Suppose, however, the key b^2 were depressed the charge of the condenser will be less than when key b' was depressed, and hence the discharge will send less current through the signal receiving devices; this current will not be sufficient to operate instrument f' but will be sufficient to operate instrument f^2. As soon as the armature of instrument f^2 is separated from its back contact the instruments in the series having the lesser adjustment, that is to say, the instruments f^3 f^4, will be disconnected from the circuit by the opening of the circuit between the armature of instrument f^2 and the back contact of said armature. The current then will be divided through instruments f' and f^2. This current will be strong enough to operate f^2 but not to operate f'. In general then it may be said that a current caused by the discharge of the condenser sufficient to operate an instrument of a specific adjustment will start the instruments of the lesser adjustment, but before the instruments of the lesser adjustment will have time to give their signal their electro magnets will be deprived of current by the opening of the circuit caused by the movement of the armature of the instrument which is designed to give the signal. It should be noted that with the circuits arranged as shown in Fig. 1 the current which passes through any coil at a given time will be the same, that is to say, when the resistance of one magnet is taken out of the circuit or when the number of paths is reduced, the resistance of the system is increased and the proportion of the entire current sent through a particular instrument will be greater. Suppose the resistance of each electro magnet of the instruments f' f^2 f^3 f^4 should be one hundred ohms; if all were in circuit the resistance of the four paths would be twenty-five ohms. Suppose the electro motive force five volts and we should have one fifth of an ampère, of which each magnet would get one fourth, that is to say, one twentieth of an ampère. Suppose now all open but instrument f', the resistance would be one hundred ohms, the electro motive force being five volts we should have a current equal to five divided by one hundred, that is to say, one twentieth and all of this current would pass through the electro magnet of the instrument in circuit. It will be seen that this is a law of my system when the connections are made as illustrated in Fig. 1. My invention, however, is not limited to this specific mode of operation as will be hereinafter explained.

My invention as illustrated in Fig. 1 admits of various applications. Thus as shown in Fig. 2, I have provided apparatus and circuit connections in connection with a local battery arranged to operate different indicating devices, each signal device being adjusted to be operated when current is discharged from the condenser of the particular strength

to which the instrument is adjusted. As shown in Fig. 2 the battery k is placed at the sending station and keys $l' l^2 l^3 l^4$ provided for closing said battery, or a portion thereof, as the case may be to the telegraph wire m; this wire m is connected through the electro magnet n of a relay and thence through the condenser o to ground. Current sent over line m causes magnet n to attract its armature p to separate the same from contact q; thus the whole current is sent into the condenser and the condenser is charged to the voltage of the battery used. Just as soon as the condenser is charged so that the current ceases to flow through magnet n the armature p falls back against contact q, thus completing a local circuit from the different sides of the condenser and thereby discharging the condenser. In this local circuit I have placed relays connected in substantially the same manner as described with respect to devices $f' f^2 f^3 f^4$. The armatures of these relays $r' r^2 r^3 r^4$ are adjusted differently, that is to say, more current is required to operate relay r' than to operate relay r^2 and more to operate r^2 than r^3 and so on. As described with respect to Fig. 1 the relay of a higher adjustment robs all relays of a lower adjustment of their current. The circuit of the local battery s is connected through the armature and back contact of each of the relays in series, except the one of lowest adjustment. A branch from the front contact of each armature extends through a different translating device to the other pole of the battery. Therefore, whenever an armature is attracted so as to close upon its front contact the local battery will be closed through the translating device of that particular relay. The relays are each operated by a different current strength. It is, however, sometimes desirable that the different signaling instruments or translating devices as $t' t^2 t^3$ and t^4 should be each operated by the same current strength. By my system as shown in Fig. 2 it will be seen that translating devices requiring high electro motive force and different translating devices requiring the same electro motive force may be operated by the use of my invention, the operation of each being determined by the voltage of the current sent to line at the sending station. That is to say, the devices or relays $l' l^2$, &c., which are operated by variations in the current strength are caused to operate translating devices t' t^2, &c., by a constant current strength or pressure. As shown in Fig. 3 the second relay u is included in a local circuit and arranged to discharge the condenser through the receiving devices $v' v^2 v^3 v^4$ included in circuit therewith. The time for charging the condenser is thus prolonged since both relays must have time to act before the two sides of the condenser will be connected together. It is evident that the receiving devices might be arranged in series if desired. If the circuit is very long and the relay not sufficiently sensitive I provide a condenser discharger which is driven in unison with a similar device placed at the transmitting end; in this manner the condenser is arbitrarily discharged at stated periods, the time of its discharge being known to the sender. This form of discharger I have shown in Fig. 4. A battery a is shown, and keys $b' b^2 b^3 b^4$ adapted to connect different portions of the battery to line c; a condenser d is included between line c and earth. A metallic segment e' fixed to the circumference of a revolving wheel e makes contact periodically with the brush e^2, and discharges the condenser d through the signaling devices $f' f^2 f^3 f^4$, whose contacts and circuits are arranged in the same manner as in the corresponding signaling devices of Figs. 1 and 2, so that only that signaling device adapted to the particular strength of current sent shall respond. At the sending station a second wheel k is provided, revolving in exact synchronism with wheel e; the mark l is so disposed as to have at any particular instant the same position relative to the pointer l' that the segment e' has to the contact e^2. The sending operator, watching the progress of the mark l, depresses one of his sending keys immediately or soon after the mark has passed the point l' which is simultaneous with the discharge of the condenser at the receiving station. The two wheels e and k are kept in synchronism by any of the well known means for effecting this result.

My invention admits of various other modifications which would readily suggest themselves to those skilled in the art and I therefore do not limit myself to the constructions shown.

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

1. The combination with a telegraph line and means for transmitting current of varying voltage over the same, of a condenser at a distant station included in said telegraph line, means adapted to discharge said condenser through a local circuit, and signaling devices in said local circuit, each adapted to respond to a different current strength, substantially as described.

2. The combination with a battery at the sending station, of a telegraph line connected with keys, each of which when depressed, acts to close a different portion of said battery to said line, said line extending to a distant station and there being connected to a condenser, a condenser discharger included in circuit with the condenser, and adapted to discharge the condenser through several electro magnetic signaling devices included in a local circuit and each adapted to respond to a different current strength, substantially as and for the purposes described.

3. The combination with a battery at the sending station, of a telegraph line connected with keys adapted to close different portions of said battery to said line, said line extend-

ing to a distant station and there being connected with a condenser, a condenser discharger included in said circuit, electro magnetic devices included in the circuit which is closed by the condenser discharger, said electro magnetic devices being connected in a local circuit including a battery, said local circuit being branched through different translating devices, whereby on varying the voltage of the current sent to line from the transmitting station the different translating devices may be operated one at a time at the will of the operator at the sending station, substantially as and for the purpose specified.

4. The combination, with a battery at the sending station, of a telegraph line connected with keys adapted to close different portions of said battery to said line, said line extending to a distant station and there being connected to a condenser, a condenser discharger included in said line and adapted to be actuated by the current flowing into said condenser, and when actuated, to discharge said condenser through a local circuit, and electro magnetic signaling devices adapted each to respond to a different current strength included in the circuit through which the condenser is discharged, as and for the purpose specified.

In witness whereof I hereunto subscribe my name this 8th day of January, A. D. 1889.

CHARLES H. RUDD.

Witnesses:
GEORGE P. BARTON,
ELLA EDLER.