

(No Model.)

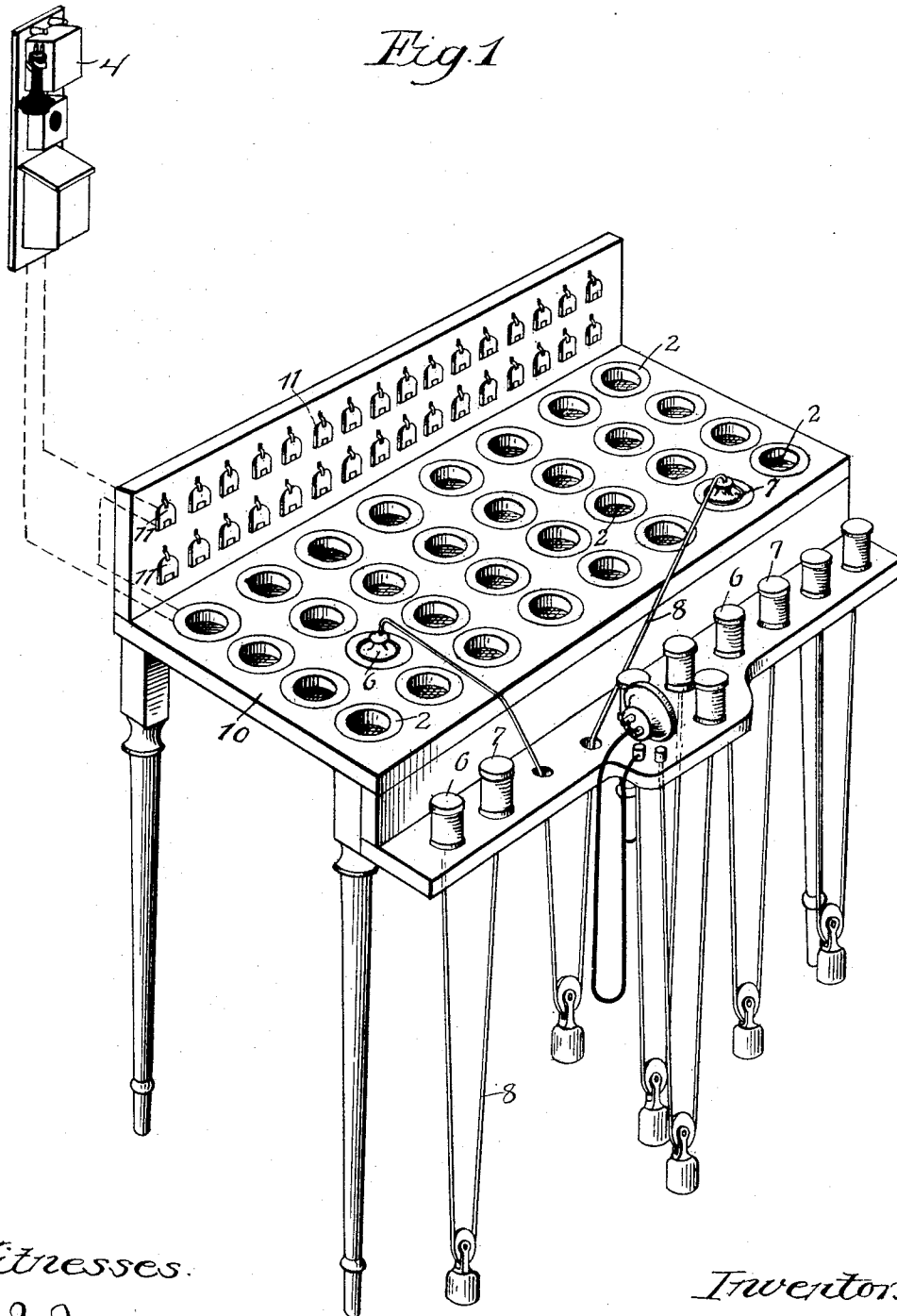
3 Sheets—Sheet 1.

M. BROOKS.
TELEPHONE EXCHANGE.

No. 533,785.

Patented Feb. 5, 1895.

Fig. 1



Witnesses.

J. J. J. J.
H. H. H. H.

Inventor.

Morgan Brooks.

By

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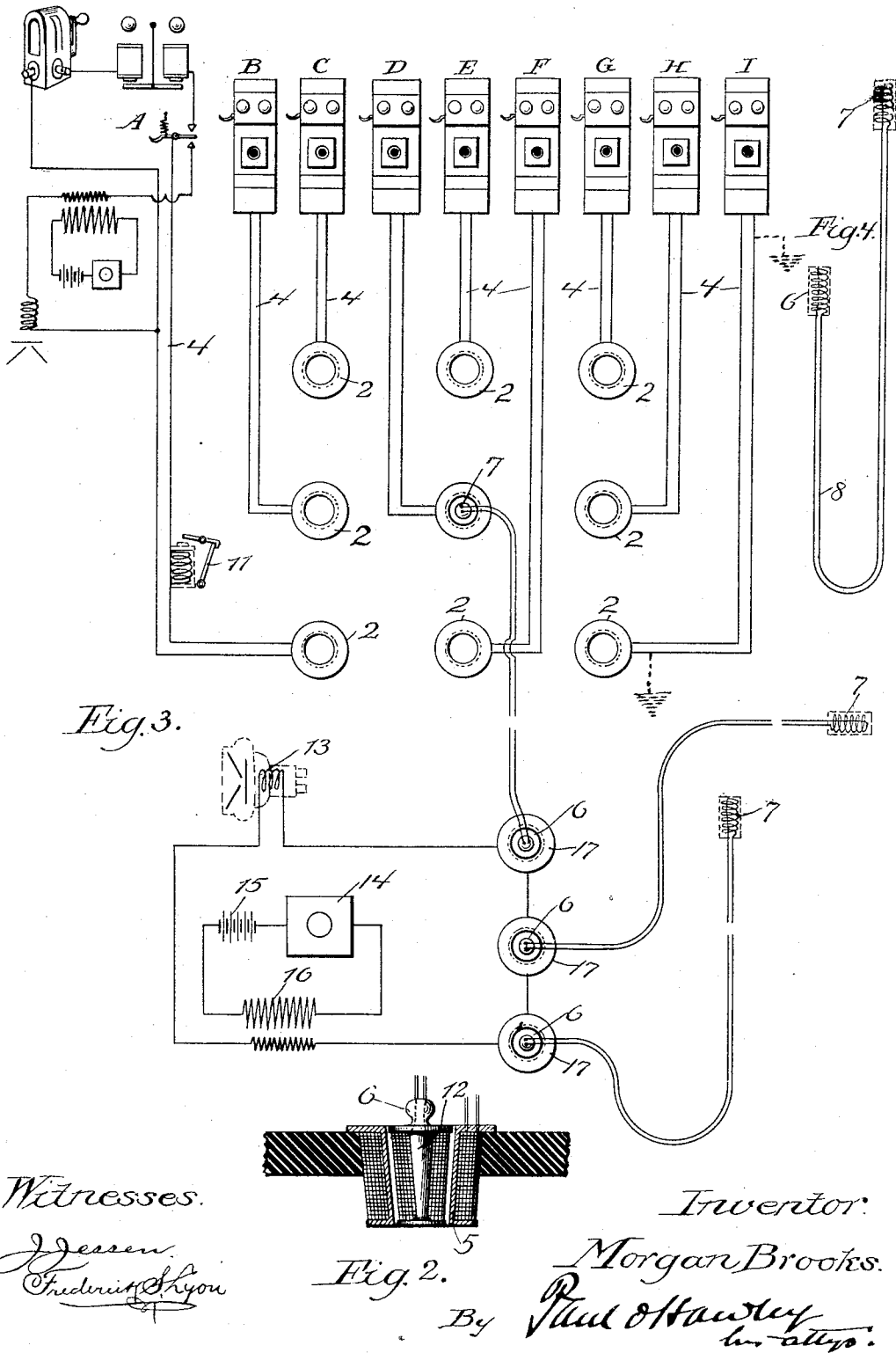
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3 Sheets—Sheet 2.

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3 Sheets—Sheet 3.

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Fig. 6.

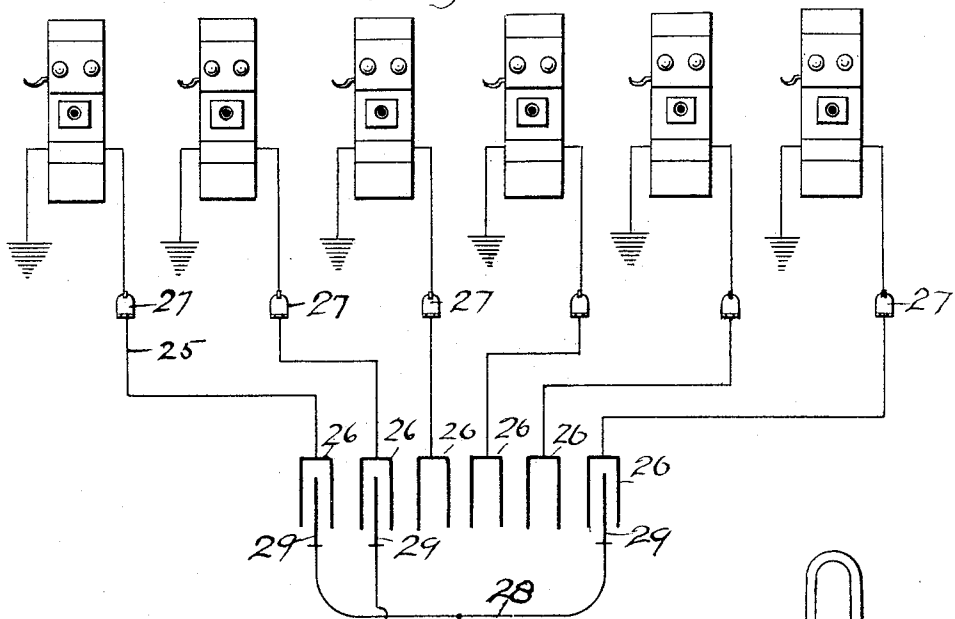
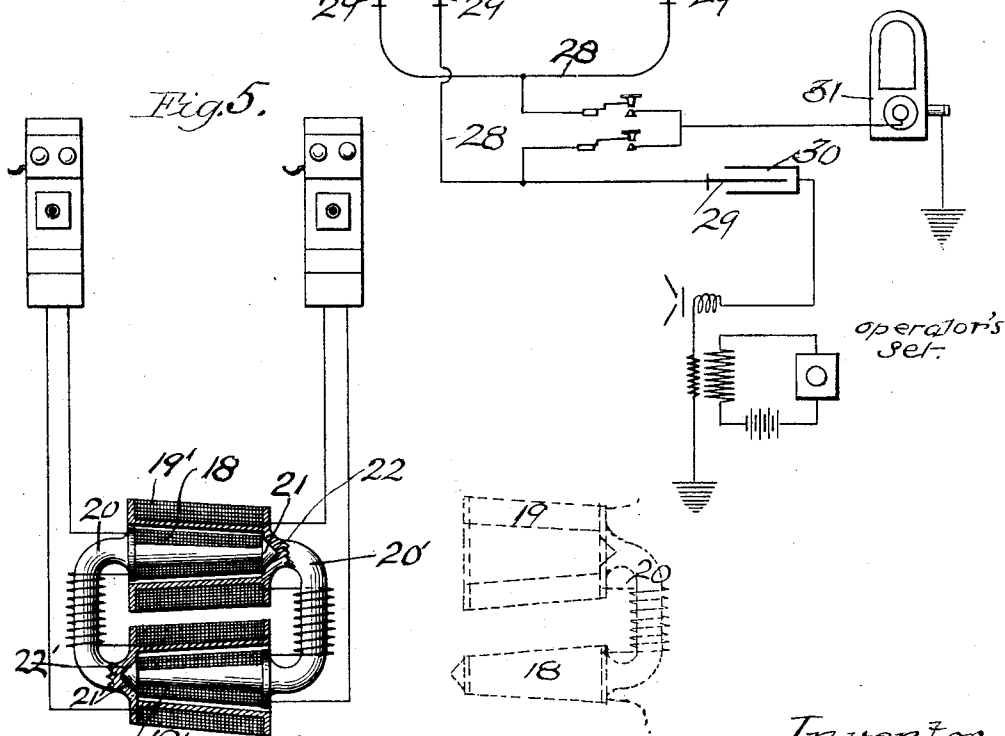


Fig. 5.



Witnesses. 19

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UNITED STATES PATENT OFFICE.

MORGAN BROOKS, OF MINNEAPOLIS, MINNESOTA.

TELEPHONE-EXCHANGE.

SPECIFICATION forming part of Letters Patent No. 533,785, dated February 5, 1895.

Application filed October 17, 1894. Serial No. 526,188. (No model.)

To all whom it may concern:

Be it known that I, MORGAN BROOKS, of Minneapolis, in the county of Hennepin and State of Minnesota, have invented a certain new and Improved Telephone-Exchange, of which the following is a specification.

My invention relates to telephone exchange methods and systems and has for its object the provision of means whereby the lines of distant subscribers may be connected without actual metallic contact, thereby at once simplifying exchange apparatus and avoiding the annoying features of the present metallic contact systems.

A further and more particular object of the invention is to provide means for connecting several different lines or circuits by induction, and a further object is to cheapen the construction of central station apparatus and lessen both the cost of operation and maintenance thereof.

To these ends my invention consists in the method of and apparatus for connecting two or more electric circuits or more particularly telephone circuits, all as hereinafter described and particularly pointed out in the claims.

My invention will be more readily understood by reference to the accompanying drawings, forming a part of this specification, and in which—

Figure 1 is a general perspective view showing a switch-board provided with apparatus embodying my invention. Fig. 2 is an enlarged sectional view of one of the induction connectors or pair of terminals. Fig. 3 is a diagrammatic view illustrating my method and system. Fig. 4 is a similar diagrammatic view of one of the induction bridges or loops. Fig. 5 is a sectional view illustrating a modified form of the electrical terminals or switches. Fig. 6 is a diagrammatical view illustrating the use of condensers as induction terminals.

The invention may be best understood by reference to Fig. 3, wherein A, B, C, D, E, F, G, H, I represent nine subscribers' telephone outfits in the circuit 4 of each of which a simple coil 2 of wire is included, all of the coils being upon the switch board in the central station. As shown in Fig. 2 the wire making up these coils is wound upon suitable shells 5 and as shown in Fig. 1 these several terminals or permanent coils are closely arranged

upon a suitable board or table 10. An annunciator 11 of any desired form may be included in the central station end of each subscriber's line. The permanent coils are adapted to receive other independent and movable coils or plugs which are preferably arranged in pairs 6 and 7 joined by conductors incased in suitable cords 8. These plug-coils are preferably wound upon an iron core 12 and both the plug-coils and the permanent coils are preferably tapered, as shown in Fig. 2, to facilitate the introduction of the one into the other.

The subscriber's outfit may be of any desired form, say the ordinary set, as shown at A, wherein the battery transmitting circuit is strictly local. The telephone operator's set may be similar, comprising the receiver 13, transmitter 14, battery 15 and induction coil 16.

17 represent permanent coils included in the circuit of the telephone operator's set and one of these coils is preferably provided for each pair of loop-plugs, one of the plugs of each loop or bridge normally resting in an operator's permanent coil. A subscriber wishing a connection with another line operates the magneto in his set, and, the receiver being on the hook, sends current over the line and releases the drop 11 whereupon the operator places one of the loop plugs in the permanent coil belonging to the calling subscriber, while the other plug remains in the operator's permanent coil 17. The subscriber, taking the receiver from the hook, completes the circuit through the receiver and transmitter cutting out the magneto and bell and bringing the battery into use, thereby energizing the coil 2 included in the line, which, through its field of force induces a current in the plug-coil within the same, the plug-coil becoming the secondary of a completed induction coil. The subscriber may then talk over the line, energy being transmitted through the coil 7 and thus through the other plug-coil, which, becoming the primary coil in the secondary or permanent coil within the operator's circuit, transmits current or energy thereto for the operation of the receiver. The operator may talk back over the line by virtue of battery in the transmitter circuit and thus inquire the number of the subscriber called

for. Obtaining the same the plug 6 will be withdrawn from the operator's permanent coil and placed in the permanent coil 2 belonging to the subscriber with whom connection is desired by subscriber A, after which these subscribers may talk as freely and satisfactorily as if connected in direct circuit, current or electrical energy being induced from one circuit to another through the induction bridges formed by the connected plug-coils.

In some cases I prefer to dispense with the use of the induction bridge, or connecting circuit, and employ permanent coils, any two of which upon the switch-board may be placed together or within respective fields, electrical energy being induced from one to the other directly. Devices adapted for this use are shown in Fig. 5, where separable parts when placed together form a closed-magnetic-circuit induction-coil. The devices are similar to that shown in Fig. 2 except that the coils are doubled or duplicated and are rendered interchangeable by the arrangement of both the inner coil 18 and an outer coil 19 upon each U-section or yoke 20 of the iron ring or link. The wire is wound upon suitable spools or shells supported upon the iron parts 20, which parts are extended to form the cores of the smaller coils and are provided with the taper heads 21 which fit snugly into the recesses 22 provided in the butts of the opposite yoke-pieces, the two pieces of iron in each case making a firm contact to render the magnetic circuit as complete as possible. The two coils upon each yoke-piece or U 20 may be connected in series with one another and in the circuit of the telephone and when the double coils are brought together it is obvious that current or energy in one pair will induce current in the other and in its circuit. It is obvious that these double coils may be substituted for the single permanent coils 2 and loop-cords provided with similar terminals employed in connection therewith. The principal advantage, however, lies in their interchangeability, which enables the two similar parts, when mounted with cords, to be placed together thereby avoiding the second repetition otherwise made in the bridge.

I have not thought it necessary to illustrate means whereby the operator may ring up the several subscribers as many calling systems may be employed equally well with my apparatus.

It is obvious that other forms of induction terminals may be used and to illustrate this I have shown, in Fig. 6, condensers employed in place thereof, and further to show that my system is perfectly flexible as regards the use of grounded or metallic circuits, I have shown a diagram of grounded circuits. The subscriber's circuit 25 terminates in ground at the instrument and in a condenser 26 at the central station and includes an annunciator 27 on the switch-board. Loop-plugs are preferably employed each end of the loop 28

being provided with a condenser plate 29, which being inserted between the plates belonging to different subscribers' circuits connect such circuits through induction. The operator is here again provided with a permanent terminal 30 in the form of a condenser wherein one of the plug condenser plates may be inserted, for the purpose of conversing with the calling subscriber. By means of key-controlled connections with the loops or bridges current may be sent from an alternating current machine 31 to ring the bells of the subscribers' sets.

One of the principal advantages which I claim for my system is that it permits of the adjustment of each induction terminal to the peculiar conditions of the circuit in which it is included. Thus, for instance, a subscriber's line or a "trunk" line, longer than others would be given more turns of wire in its permanent coil, while a shorter line would have fewer turns. Thus each circuit would be arranged always to the best advantage. I believe that the same advantage may be acquired in the use of the condensers by the comparison and adjustment of relative surfaces in the condensers belonging to the different circuits. For the purpose of listening in by the operator it may be found desirable to provide an additional induction connector in each pair of coils. It is obvious that by thus connecting the different circuits by means of induction, all of the many annoyances of actual metallic contact systems are avoided. Further it is obvious that there are many equivalents for the several portions of my apparatus and which would really suggest themselves to one skilled in the art and I therefore do not confine my invention to the specific constructions and arrangements herein specified.

Having thus described and ascertained the nature of my said invention and the manner in which it is to be performed, I claim as new and desire to secure by Letters Patent—

1. The combination, in a telephone system, of a subscriber's circuit, with a permanent coil included therein, a movable second subscriber's circuit, and a second coil connected therewith and adapted to be placed within the field of said permanent coil whereby electrical energy is induced upon the second line or circuit, substantially as described.

2. The combination, in a telephone system, of two subscribers' circuits, with induction terminals in said circuits respectively, and a bridge circuit including movable induction terminals to be placed in proximity to or within the fields of force of the first mentioned terminals, whereby an inductional connection is completed between said subscribers' circuits, substantially as described.

3. The combination, in a telephone system, of a number of subscribers' circuits, with a primary induction terminal included in each of said circuits at the central station, a source of electricity included in each of said lines,

and a movable secondary induction terminal at the central station, whereby two of said primary terminals may be inductively connected, substantially as described.

5 4. The combination, in a telephone system, of a number of subscribers' circuits, and permanent coils included in said circuits respectively, said permanent coils being arranged in proximity to one another, a source
10 of electricity included in each of said circuits, and plug-coils included in short circuits, said plug-coils adapted to be inserted or arranged respectively in proximity to any two of said permanent coils, as and for the purpose specified.

15 5. The combination, in a telephone system, of a series of subscribers' circuits, with induction terminals included in the same respectively, movable means for connecting
20 said subscribers' circuits by induction, an operator's circuit and movable inductive means for connecting the same with either of said subscribers' circuits, substantially as described.

25 6. The combination, in a telephone system, of a series of subscribers' circuits, with induction terminals included in said circuits respectively, a bridge circuit including independent and movable induction terminals
30 adapted to be placed in the fields of the first mentioned terminals, a telephone operator's set, and means whereby the subscribers' instruments are connected therewith, substantially as described.

35 7. The combination, in a telephone system, of a series of subscribers' circuits, each including a movable induction terminal, with

an operator's circuit, also including such a movable terminal whereby said circuits may be connected with one another or with the operator's circuit, substantially as described. 40

8. The induction terminals or connectors comprising each a hollow coil and an iron core coil together mounted upon an iron yoke, the two terminals being adapted to be placed
45 together to form a closed magnetic circuit induction coil, substantially as described.

9. The combination, in a telephone system, of a series of subscribers' circuits, with means for connecting the same, each of said subscribers' circuits including an induction coil or terminal, an operator's telephone set, the circuit thereof, and a movable induction coil or terminal included therein and adapted to be placed within the field of a subscriber's
55 induction terminal, whereby talking or signaling circuits are established.

10. The combination, in a telephone system, of a subscriber's circuit, with a primary induction terminal included therein, a second subscriber's circuit, and a secondary induction terminal operatively connected with the second subscriber's circuit, said terminal being movable to the end that the same may be placed within the field of said primary
65 terminal to inductively connect said subscribers' circuits, substantially as described.

In testimony whereof I have hereunto set my hand this 9th day of October, A. D. 1894.

MORGAN BROOKS.

In presence of—

C. G. HAWLEY,
F. S. LYON.

It is hereby certified that in Letters Patent No. 533,785, granted February 5, 1895, upon the application of Morgan Brooks, of Minneapolis, Minnesota, for an improvement in "Telephone Exchanges," an error appears in the printed specification requiring correction, as follows: In line 115, page 2, the word "movable" should be stricken out and inserted before the word "second" in line 116 same page; 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 March, A. D. 1895.

[SEAL.]

JNO. M. REYNOLDS,
Assistant Secretary of the Interior.

Countersigned:

JOHN S. SEYMOUR,
Commissioner of Patents.

Correction in Letters Patent No. 533,785.

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