E. M. JOHNSON.

SIGNALING SYSTEM FOR MINES.

APPLICATION FILED SEPT. 9, 1907.

1,004,879.

Patented Oct. 3, 1911.

2 SHEETS—SHEET 1.

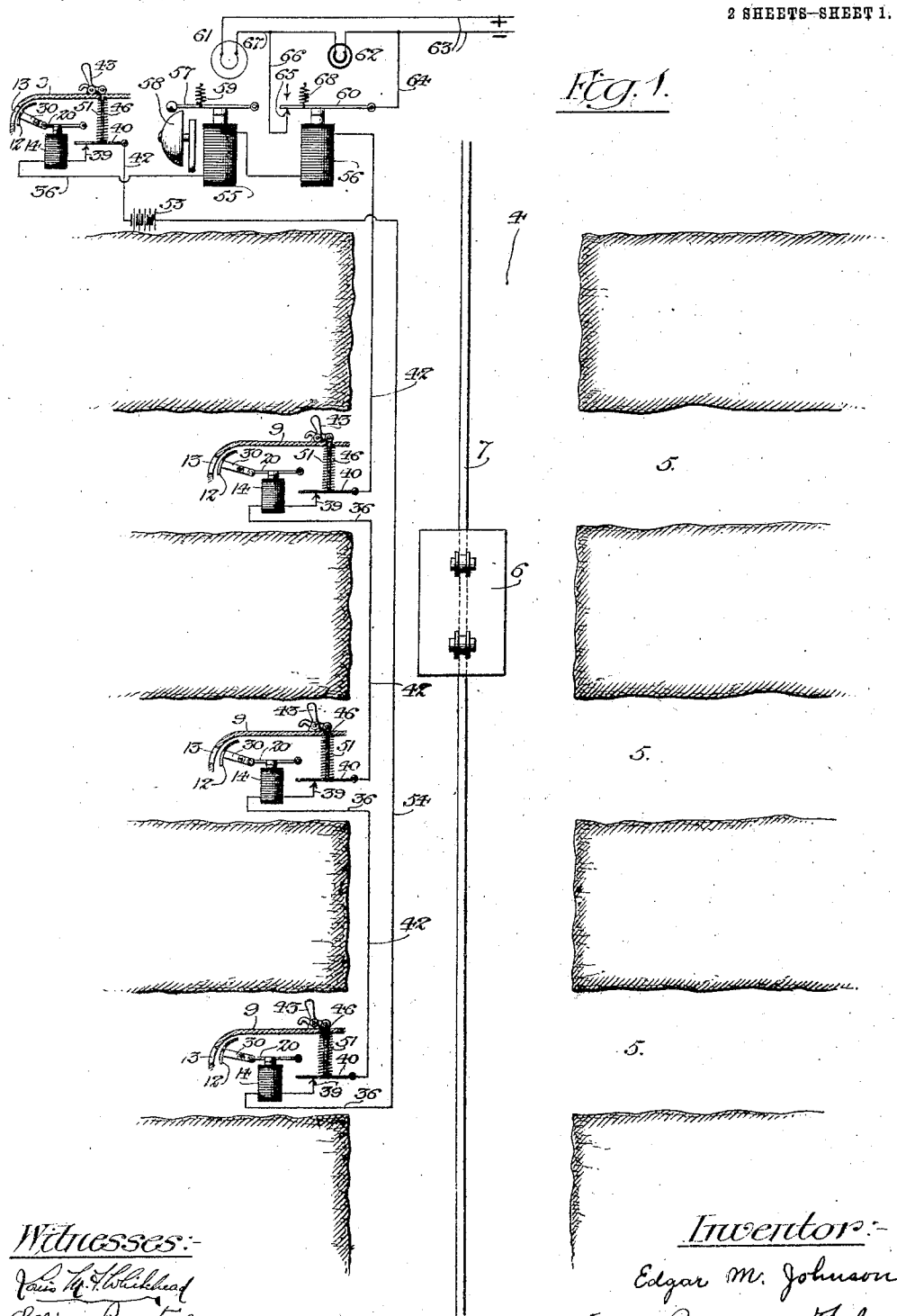

FIG. 1.

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2 SHEETS—SHEET 2.

Fig. 2.

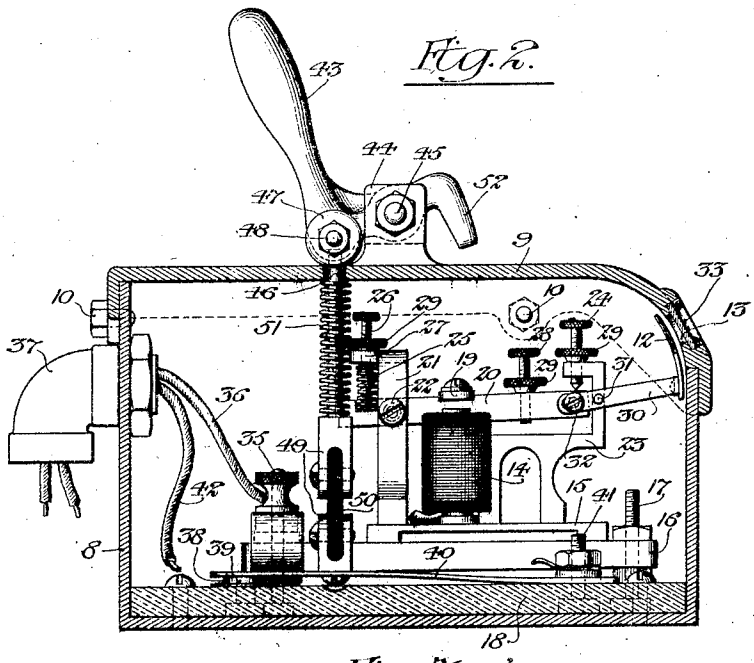
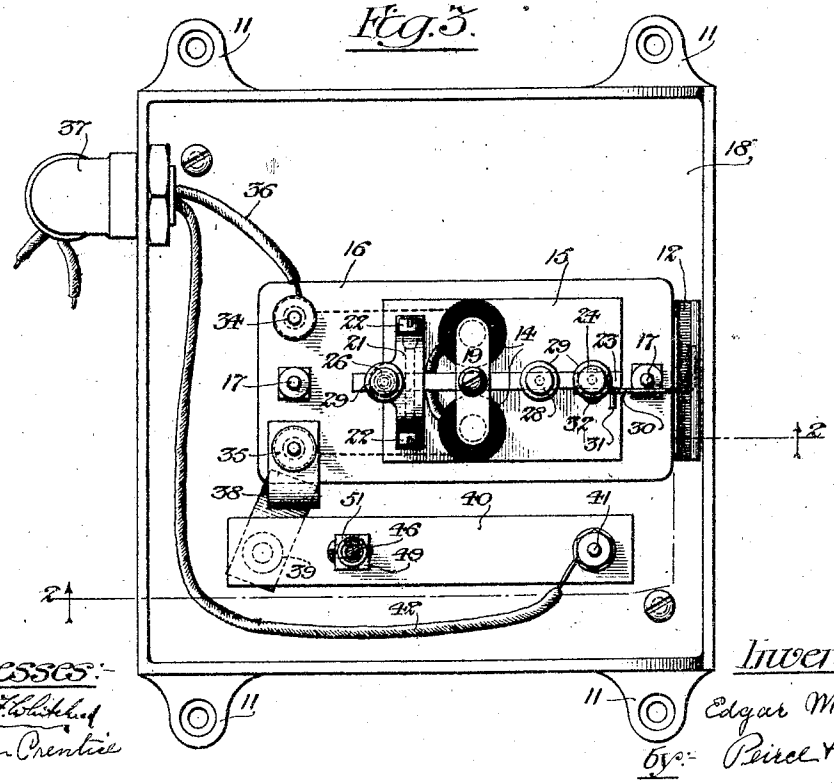


Fig. 3.



Witnesses:-

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UNITED STATES PATENT OFFICE.

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SIGNALING SYSTEM FOR MINES.

1,004,879. Specification of Letters Patent. **Patented Oct. 3, 1911.**

Application filed September 9, 1907. Serial No. 391,924.

To all whom it may concern:

Be it known that I, EDGAR M. JOHNSON, a citizen of the United States, and a resident of Hancock, in the county of Houghton and State of Michigan, have invented certain new and useful Improvements in Signaling Systems for Mines, of which the following is a specification.

The invention relates to mine signal systems and seeks to provide a simple and effective electrically operated system by which the signals transmitted from any level to the engineer in charge of the hoisting machinery for the cage or skip, will be indicated at all of the other levels.

A further object of the invention is to provide an improved form of signaling device and an improved station or signal box for the mine system.

The invention consists in the features of construction, combinations and arrangements of parts hereinafter set forth, illustrated in the accompanying drawings and more particularly pointed out in the appended claims.

In the drawings, Figure 1 is a diagrammatic view of the improved mine signaling system. Fig. 2 is a cross section of one of the signal boxes or stations, taken on the line 2—2 of Fig. 3. Fig. 3 is a plan view of the signal box with the cover removed.

In Fig. 1, the shaft 4 and the separate levels 5 of the mine are indicated. A skip or cage 6 is mounted to shift on guide rails 7 and is raised and lowered by a suitable hoisting engine at the mouth of the mine. The mine shafts are frequently of great depth and the levels at a considerable distance apart and the hoisting engines usually operate the skips or cages at high speed. In many mines it has been customary to employ the so-called "Cornish" bell as a signaling means between the several levels of the mine and the engineer in charge of the hoisting engine. This consists of a bell at the engineer's station and a rope therefor extending down the mine shaft and having an operating lever or handle at each of the levels or stations in the mine. By shifting one of the levers up and down, one or more strokes are sounded on the bell at the engineer's station to inform him, in accordance with a suitable signal code, for what purpose the skip or cage is to be used, *i. e.* for passengers, ore or for poor rock. As the skip or cage approaches the desired level at high speed, the operator at that level holds the hand lever down and "hangs the bell" or gives what is called "a half signal," and the engineer slows down, and then stops when the signal is completed and the bell struck.

In accordance with the present invention, suitable electric signaling means are employed, the operation of which is similar to that of the old "Cornish" bell and which may therefore be readily operated without instruction by miners familiar with that form of signaling means. A signaling device is also employed at each station or level so that the operators at different parts of the mine, as well as the engineer, may know the purpose for which the skip or cage is being used, and confusing signals will not be transmitted to the engineer from different levels.

In accordance with the present invention, a series of signaling devices, one at each of the different levels or stations, are arranged on a common circuit that is preferably normally closed and in which circuit the engineer's signal is interposed. A signaling switch for opening and closing the circuit is provided at each station. Pivoted operating handles for the several switches are preferably provided at each station and are shifted by the operators in the same manner as the hand levers of the old "Cornish" bell to open and close the circuit and transmit the desired signals to the engineer's station. The signaling devices at all levels are at the same time actuated so that the operators in different parts of the mine are kept informed as to the purposes for which the cage or skip is employed, and so that there will be no improper confusion of signals. For example, if an operator in one of the upper levels of the mine, together with the engineer is notified that the skip or cage is to be used to raise passengers or poor rock from one of the lower levels of the mine, he would know that he could not put good ore onto the skip or cage on that trip. On the other hand, if ore was placed on a skip or cage in one of the lower levels, the operator would stop it at his own level if he wished to have ore carried to the mouth of the mine shaft.

The station or signaling box and the signaling means at each level are preferably of the form shown in Figs. 2 and 3 and comprises a box 8 of cast iron having a cover 9 which snugly fits the box and is secured thereto by bolts 10 so that the station box is practically water tight. The box is provided with projecting perforated lugs 11 by which it may be secured in any desired position at the mine level. The signaling means is preferably in the form of a visual signal or target 12 which is shifted behind a view-opening 13 in the box by an operating magnet 14. The spools of this magnet, in the form shown, are mounted upon a brass plate 15 fixed to a wooden base plate 16 and the latter is secured by bolts 17 to an insulating support 18 of slate or the like. The armature 19 of the magnet is carried upon a lever 20 which is pivoted to an upright 21 on the brass plate 15 by pivot pins or screws 22. An upright 23 on the plate 15 carries an adjustable back stop 24 toward which the armature lever 20 is pressed by a spring 25 extending between the inner end of the armature lever and a screw 26 that is adjustably threaded through a lug 27 on the end of the upright 21. A screw 28 threaded through the armature 20 near its free end is arranged to strike a portion of the upright 23 and form an adjustable front stop. Lock nuts 29 are provided on the stop screws 24 and 28 and on the spring-adjusting screw 26. The magnet and the parts associated therewith are similar in construction to the ordinary telegraph sounder, but this construction may be widely varied without departure from the invention.

The signal target 12 is fixed upon an arm or lever 30 which is pivotally connected adjacent its inner end to the upright 23 by a pin 31. A screw 32 extends through a slot in the inner end of the arm or lever 30 and connects the same to the free end of the armature lever 20 so that the lever 30 and target 12 thereon are vibrated back and forth by the armature lever 20 as the circuit through the magnet 14 is made and broken. The face of the target, that is viewed through the opening 13, has its upper and lower portions differently colored. Preferably, the upper portion of the target face is red while its lower portion is white, and the parts are so adjusted that when the circuit through the magnet is broken, as indicated in Fig. 2, the red portion of the target will be exposed through the opening 13, but the white will be exposed when the circuit is closed through the magnet, which is the normal condition of the signaling device when arranged, as is preferable, upon a normally closed circuit, as indicated in Fig. 1. The view-opening 13 is arranged, in the form shown, in the rounded edge of the box cover 9 and is preferably made water tight by means of a plate 33 of glass or other transparent material secured therein. The coils of the magnet 14 are connected between a pair of binding posts 34 and 35 on the wooden base plate 16. An insulated conductor 36 extends from the binding post 34 outwardly through an elbow 37 inserted in the rear portion of the signal box and which forms a part of the piping in which all of the conductors of the signaling system of the mine are preferably arranged. A strip of brass, copper or other suitable conducting material is secured to the other binding post 35 and the end of this strip is bent down into engagement with the slate support 18 and is secured thereto. The strip is also provided with a contact button 39 which is engaged by a copper strip 40 secured to the slate bed by a binding post 41 and forming a normally closed switch for opening the circuit through the magnet 14. An insulated conductor 42 is connected to the binding post 41 and extends outwardly through the elbow 37.

The switch blade 40 is preferably operated by means of an L-shaped handle 43 which is pivoted between a pair of lugs 44 on the box cover by a bolt 45. A rod 46 extends vertically through an opening in the cover 9 and is threaded into a head portion 47 which in turn is connected to the handle 43 by a bolt 48. The rod 46 is connected to the switch blade 40, preferably by means of a pair of clevises 49 of brass or like material, secured respectively to the rod and to the switch blade and connected together by an intermediate strip 50 of insulating fiber. A spring 51 coiled about the rod is compressed between the cover 9 and the upper brass clevis 49 so that the handle is normally held in the position shown, with the switch blade 40 pressed snugly into engagement with the contact 39. By shifting the handle 43, the switch blade 40 may be moved to opened position. The movement of the handle is limited by a stop lug 52 thereon which is arranged to strike the upper face of the cover 9.

As indicated in Fig. 1, one of the stations or signal boxes is arranged at each of the mine levels and preferably also, one is arranged at the engineer's station at the mouth of the mine shaft. The several stations are arranged in series in a common circuit, the switch of each one being connected to the magnet of the next adjacent station by the conductors 42 and 36. Current for the signaling circuit is derived from a small battery 53 and the ends of the circuit are grounded to the rails or piping of the mine shaft or connected by a return wire 54, as diagrammatically indicated in Fig. 1.

At the engineer's station a pair of magnets 55 and 56 are interposed in the signaling circuit. The armature of magnet 55 is

fixed to a tapper 57 which is arranged to strike a signal bell 58. A spring 59 retracts the tapper 57 when the circuit through the magnet 55 is broken. The arrangement thus forms a single-stroke electric bell, that is to say, one stroke is sounded each time the signaling circuit is opened and closed. The armature of the magnet 56 is secured to a pivoted switch lever 60 which controls the flow of current through a pair of lamps 61 and 62. These lamps are preferably arranged in series between the current supply wire 63 and the lamp 61 is a high candle power lamp emitting white light, while the lamp 62 is a low candle power lamp emitting the red light. Switch lever 60 is connected by a conductor 64 to one of the current supply wires 63 and the contact 65, which is normally engaged by the lever 60, is connected by a conducter 66 to a conductor 67 which joins two of the terminals of the lamps 61 and 62. The switch 60 thus normally closes a shunt around the low power, red lamp 62 so that the high power white lamp 61 alone glows. When the circuit through the magnet 56 is broken and the switch 60 shifted to opened position by a spring 68 connected thereto, the current flows through the lamps 61 and 62 in series and is so cut down in amount that the high resistance, low power red lamp 62 alone glows, while the white lamp 61 is dark. Other arrangements could be employed whereby the shift of the switch 60 alternately lighted lamps of different colors, but the arrangement shown is preferred since the switch 60 merely serves to open and close a shunt around a red lamp and there is practically no sparking as it makes and breaks engagement with the contact 65.

As stated, the several stations and the signaling means at the engineer's position are preferably arranged upon a normally closed circuit, as shown, which however, requires but little current. The several targets 12 at the different stations are thus normally held in position to expose their white portions through the view-openings 13, and the switch 60 is held closed so that the white lamp 61 at the engineer's station, normally glows while the red lamp 62 is dark. The operator at any level, by shifting the hand lever 43, opens and closes the circuits of the magnets 14, 55 and 56 to strike one or more strokes upon the signal bell 58 and alternately flash on and off the red and white lamps 62 and 61 and thus notify the engineer that he desires to use the skip or cage and for what purpose he intends to use it. At the same time the targets 12 at the different levels of the mine are vibrated and the operators throughout the mine informed for what purpose the skip or cage is to be employed so that confusing signals will not be transmitted from different parts of the mine. As the car approaches the desired level the operator will give a half signal by shifting the lever and holding it in shifted position. The red light at the engineer's station will thus be caused to glow for a considerable length of time and the engineer notified that he should run slow. Moreover, the targets at the different portions of the mine all show red so that the operators are notified that the skip or cage is being used. At the same time the bell at the engineer's station is "hung" by the half signal. When the car reaches the level the operator releases the handle and the bell at the engineer's station is sounded to notify him that the movement of the skip or cage should be arrested. If the normally closed circuit should be broken or the system get out of order in any way, the red lamp will glow at the engineer's station and the red portions of the targets be exposed at the station boxes of the several levels so that the operators in the different portions of the mine and the engineer are notified, when this condition persists for any appreciable length of time, that the signaling system is out of order and immediate steps may be taken to remedy the defect.

It has been found that a normally closed system of this sort is particularly advantageous for mines, since as stated, warning is at once given if for any reason the system gets out of order and since the small amount of heat generated by the current flowing through the coils of the several magnets prevents the moisture from having a deteriorating effect upon the magnets.

If necessary, to exclude moisture, corroding gases and the like, the signal boxes may be filled with insulating oil to protect the apparatus contained therein.

It is obvious that numerous changes may be made in the details set forth without departure from the essentials of the invention.

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

1. In signaling systems for mines, a series of station boxes, one at each of a number of different levels, each having a magnet therein, a target operated by the magnet and visible through an opening in the box, an energizing circuit for the magnets of the several station boxes, a signaling switch in each box for controlling the flow of current through said circuit and an operating handle for the switch mounted on the box.

2. In signaling systems for mines, a series of station boxes, one at each of a number of different levels, each having a magnet therein, a vibratory signal target connected to and operated by the armature of said magnet and visible through a view-opening in said box, a normally closed operating cir-

cuit wherein said magnets are arranged in series, a normally closed, spring-held switch in each of said boxes for opening and closing said circuit, a pivoted operating handle for said switch mounted on the box and an engineer's signal interposed in said circuit.

3. In signaling systems for mines, a series of signaling devices at each of a number of different levels arranged in series in a closed circuit, two electric lamps at the engineer's station, a switch for alternately lighting said lamps, a magnet for operating said switch interposed in the signaling circuit and a signaling switch at each level for opening and closing the circuit.

4. In signaling systems for mines, a series of station boxes, one at each of a number of different levels, each having a magnet therein, a target operated by the armature of the magnet and having differently colored portions visible through a view-opening in the box, a pair of electric lamps of different colors at the engineer's station, a switch for alternately lighting said lamps, a magnet for operating said switch, an energizing circuit for said station and lamp magnets and a signaling switch in each station box for controlling the flow of current through said circuit.

5. In signaling systems for mines, a series of station boxes, one at each of a number of different levels, each having a magnet therein and a target operated by the magnet and visible through a view-opening in the box, a single-stroke gong and a pair of lamps at the engineer's station, a switch for alternately lighting said lamps, magnets for operating said gong and said switch, a normally closed circuit in which said gong and lamp magnets and said station magnets are arranged in series, a spring-held, signaling switch in each station box for opening and closing said circuit and an operating handle for the switch mounted on the box.

6. A station box for mine signaling systems having a magnet therein, an armature therefor, a vibrating target operated by said armature, a signaling switch normally spring-held in closed position and arranged in said box and connected in series with said magnet and an operating handle for said switch mounted on the box.

7. A closed waterproof station box for mine signaling systems, a magnet therein, a pivoted armature for said magnet, a vibratory target connected to and operated by said armature and visible through a view-opening in said box, a signaling switch normally spring-held in closed position and arranged in said box and connected in series with said magnet and an operating handle pivoted on the box and projecting exteriorly thereof and connected to but insulated from said switch.

8. In signaling systems for mines, a series of station boxes, one at each of a number of different levels, each having a magnet therein, a signal operated by each magnet, a normally closed operating circuit wherein said magnets are arranged in series, a normally closed, spring-held switch in each of said boxes for opening and closing said circuit, an operating handle for each switch mounted on the box, and a signal at the engineer's station interposed in said circuit.

9. In signaling systems for mines, a series of station equipments at a number of different levels, each of said station equipments comprising a magnet, a signaling device operated thereby, and a signal operating switch normally spring-held in closed position, a magnet at the engineer's station, a single-stroke electric bell operated by said last mentioned magnet, a signaling switch at the engineer's station normally spring-held in closed position, and an energizing circuit in which all of said magnets and switches are arranged in series, substantially as described.

10. In signaling systems for mines, a number of station magnets at a number of different levels and at the engineer's station, all of said station equipments having a magnet, a vibrating visible signal or target operated by said magnet, and a signaling switch normally spring-held in closed position, an additional magnet at the engineer's station, an engineer's signal operated thereby, and a normally closed energizing circuit in which all of said magnets and switches are arranged in series, substantially as described.

11. In signaling systems for mines, a series of station boxes, one at each of a number of different levels, an electric signal in each of said boxes, a normally closed operating circuit wherein said signals are arranged in series, a normally closed spring-held switch in each of said boxes for opening and closing said circuit, an operating handle for each switch mounted on the box and connected to but insulated from the switch, and an electric signal at the engineer's station interposed in said circuit, substantially as described.

12. In signaling systems for mines, a series of station equipments at a number of different levels, each of said station equipments comprising an electric signal and a signal operating switch normally spring-held in closed position, a magnet at the engineer's station, a single-stroke electric bell operated by said magnet, a signaling switch at the engineer's station normally spring-held in closed position, and an energizing circuit in which all of said signals and switches and said magnet are arranged in series, substantially as described.

13. In signaling systems for mines, a number of station equipments at a number of

different levels and at the engineer's station, each of said station equipments having an electrically operated signal arranged to indicate danger when the circuit therethrough is broken, and a signaling switch normally spring-held in closed position, an additional signal at the engineer's station, and a normally closed energizing circuit in which all of said signals and switches are arranged in series, substantially as described.

EDGAR M. JOHNSON.

Witnesses:
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LILLIAN PRENTICE.