

J. T. JANETTE.
 MULTIPLE SWITCH STARTER.
 APPLICATION FILED MAY 20, 1907.

911,592.

Patented Feb. 9, 1909.

3 SHEETS—SHEET 1.

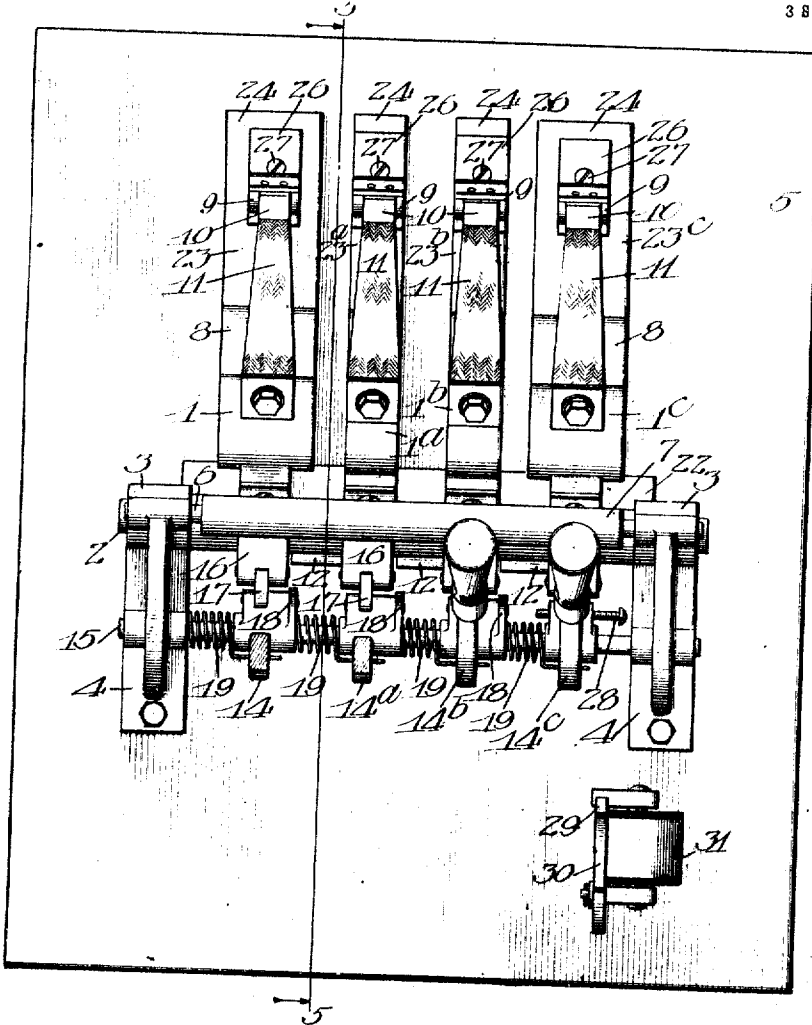


Fig. 1.

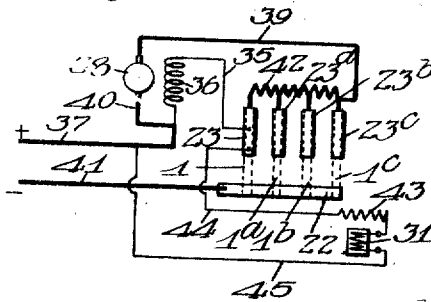


Fig. 2.

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3 SHEETS—SHEET 2.

Fig. 3.

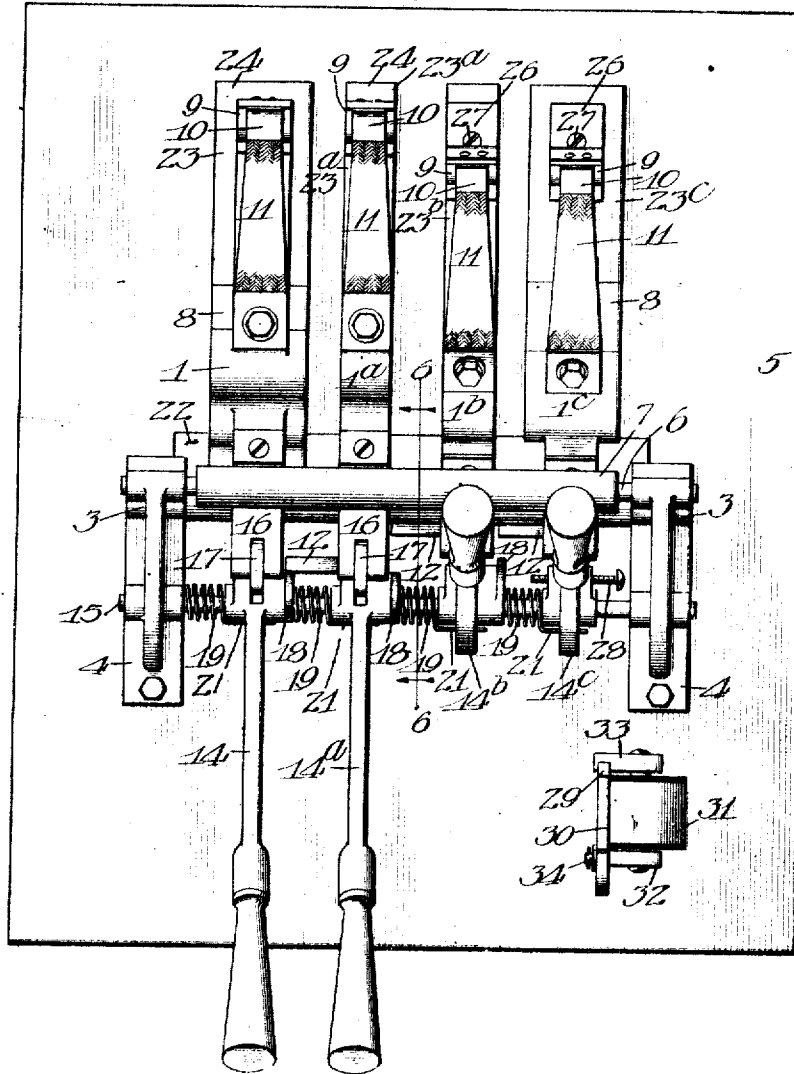
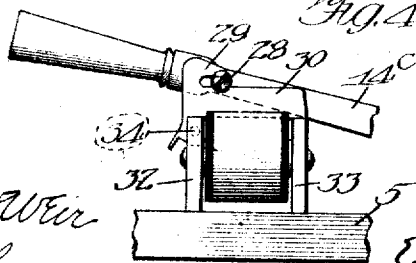


Fig. 4.



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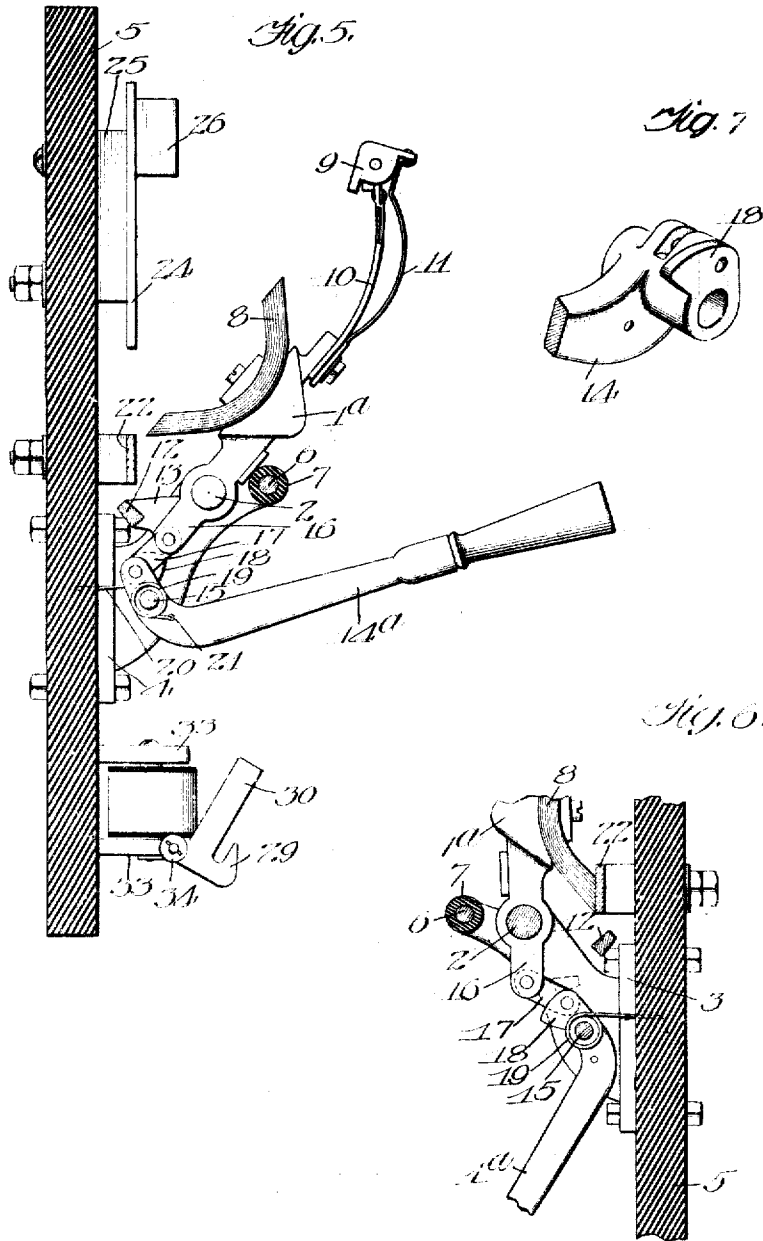
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MULTIPLE SWITCH-STARTER.

No. 911,592.

Specification of Letters Patent.

Patented Feb. 9, 1909.

Application filed May 20, 1907. Serial No. 374,636.

To all whom it may concern:

Be it known that I, JOHN T. JANETTE, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Multiple Switch-Starters, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to improvements in multiple switches. It is particularly applicable to motor controllers.

One of the objects of the present invention is to provide means whereby each switch after the first serves to hold closed the preceding switch, so that the operator may let go of each switch after he closes the succeeding switch.

Another object of my invention is to provide means whereby the motor circuit will be opened unless all the resistance is removed from circuit.

According to the preferred form of my invention I provide a plurality of switches which are adapted to be closed in a definite sequence to remove the starting resistance from circuit. Interlocks are provided between the switches whereby each switch, after the first, serves to hold the preceding switch in a closed position. The operator may, therefore, close the switches hand over hand, that is, he may close the first switch with one hand, then close the next switch with the other hand, and then remove his hand from the first switch, and pass it over to the third switch, and so on until all the switches are closed. The last switch after it has been closed is adapted to be retained in that position. If for any reason the operator fails to close all the switches and removes his hand from the switch he has last closed, all the switches will be opened, and consequently the starting resistance will be reinserted in circuit and the motor circuit will be opened. It will, therefore, be seen that it will be impossible for the operator to leave in circuit a part of the starting resistance.

Of course the features of my invention may be embodied in various different forms and the structure which I prefer to employ, and described particularly herein, may be changed in many ways without eliminating the characteristics that I seek to patent.

For the purpose of more particularly ex-

plifying my invention, I have assumed the structure illustrated in the accompanying drawings.

In said drawings: Figure 1 is a front elevation of one form of device embodying my invention, the handles of two of the switches being broken away in order that certain features of the construction may be more readily understood. Fig. 2 is a diagrammatic view of one circuit arrangement therefor. Fig. 3 is an elevation of my invention showing the first two of the switches closed. Fig. 4 is a detailed elevation showing the retaining means for holding the last switch closed. Fig. 5 is a sectional view taken on the line 5—5 of Fig. 1, looking in the direction of the arrows. Fig. 6 is a sectional view taken on the line 6—6 of Fig. 3, and Fig. 7 is a perspective view of a portion of one of the operated handles for the switches.

In the embodiment of my invention illustrated, the switch arms 1, 1^a, 1^b and 1^c are suitably pivoted or journaled, at one end, upon a shaft or rod 2, mounted in bearings 3, formed upon suitable brackets 4 which are secured to a suitable base or panel 5. This panel may be formed from any insulating material such as soapstone, slate or the like and provides a base upon which the various parts of the switch are mounted. The brackets 4 also support a rod 6 threaded through a rubber tube 7, which serves as a cushion or buffer for switch arms to impinge against when thrown open.

Each switch arm carries a contact device 8 which may be formed from a number of strips of copper, laid face to face, the free ends being adapted to engage contact surfaces and complete the circuit therethrough. The arms also carry arcing contacts 9, which are preferably supported upon a spring arm 10 bolted or otherwise secured to the upper end of the switch arm. In order that the current which passes from the arcing contact 9 to the switch arm may not affect the spring of the arm 10, the arcing contact is electrically connected by preferably braided copper conductors 11 with the switch arm. The contacting members 8 of the first and last switch arms are preferably made wider than the contacting members of the intermediate arms as the circuit is made and broken at these points, and as it is desirable to have a larger contact. Each of the switch arms with the exception of the first carries a

transversely extending lug 12 mounted on an inwardly extending projection 13, the purpose of which lug will be more fully hereinafter disclosed.

- 5 The switch arms are operated by levers 14, 14^a, 14^b and 14^c respectively, suitably journaled upon a shaft or rod 15, also secured in the brackets 4. The lower end of each of the levers is preferably L shaped and the 10 pivot point thereof is preferably in the center of the base of the L. The end of each lever is connected to an extension 16 on each of the switch arms, by an intermediate link 17, which is pivotally connected to the lever 15 and the extension. Each lever, preferably 15 on its hub, carries a stop 18, which when the lever is in its open position, lies in the path of the lug 12 of the succeeding switch arm in such a position that if it is attempted to 20 close the succeeding switch before the preceding switch is closed, the lug 12 will engage the stop 18 and prevent the lever from being moved far enough to close the switch. For maintaining each of the levers 14 in their 25 normal or open position and with them the switch arms, a coiled spring 19 for each arm is provided, which has one end 20 thereof projecting into the base of panel 5 and the other end 21 connected to the lever, whereby the spring will maintain the lever in its open position.

- Upon the base board or panel 5 is mounted a contact bar 22 with which one end of the 35 contact device 8 of each arm is adapted to engage, the other end of said device being adapted to engage contact terminals 23, 23^a, 23^b and 23^c, one for each switch arm. Each contact terminal preferably comprises a copper strip 24 suitably secured upon a base 25 40 in turn secured to the panel 5, and a carbon contact block 26 which is secured upon the copper strip by suitable screws or bolts 27. The carbon block 26 and the contact 9 form arcing contacts which close the circuit before 45 and open the circuit after the main contacting devices 8, thereby preventing a deteriorating arc from forming at the main contacts. Near the upper end of the operating lever 14^c is provided a laterally extending 50 projection 28, which may take the form of a screw and which is adapted, when the lever is moved to close the last switch arm, to engage a catch 29 formed on the armature 30 of a magnet 31. The armature 30 is pivoted 55 at 34 to the bottom pole piece 32 of the magnet and when the arm is thrown downward, the projection 28 moves the armature into proximity into the upper pole piece 33, and at the same time engages behind the catch 60 29 and retains the arm in its closed position as long as the magnet is energized.

- Referring now to Fig. 2 the contact 23 is connected by a conductor 35 with one terminal of the field winding 36 of the motor, 65 the opposite terminal of which is connected

to the positive side 37 of the supply main. One terminal of the armature 38 of the motor is connected by conductor 39 with the contact 23^c and the opposite terminal thereof is connected by a conductor 40 with the 70 positive side 37 of the supply main. The negative side 41 of the supply main is connected with the contact bar or strip 22. A resistance 42 is divided into sections which are connected with the contacts 23 to 23^c 75 respectively. One terminal of the winding of the magnet 31 is connected through a resistance 43 by a conductor 44 with the contact 23 and the opposite terminal is connected by a conductor 45 with the positive 80 side 37 of the supply main.

The operation of closing the switches is as follows: The operator, say by his left hand, moves the operating lever 14 downwardly, thereby throwing the switch arm 1 inwardly, 85 causing the arcing contact 9 and the main contact 8 to respectively engage their stationary contact members. The downward movement of the first operating lever swings the stop 18 thereof outward and out of the 90 path of the lug 12 on the switch arm 1^a to permit the switch arm to close when the operator, still holding the first switch lever by his left hand, with his right hand moves the lever 14^a downward to close the switch arm 95 1^a. When, however, the switch is closed, the lug 12 thereof will be moved into engagement with the stop 18 of the operating lever 14 and hold the switch 1 closed. It will be noted, however, that until the first lever is 100 moved to close the first switch, the stop 18 thereof is in a position to prevent the closing of the next switch, that is, in event it is attempted to close the next switch, the lug 12 will engage the stop too soon to permit the 105 switch to be closed. The first switch being now held by the lug 12 of the second switch, the operator may remove his hand from the lever thereof, and while holding the lever of the second switch with his left hand, operate 110 the third switch with his right hand, the stop 18 of the second switch having been moved by the closing thereof, a sufficient distance to permit the third switch to be closed. The closing of the third switch causes the lug 12 115 thereof to engage the stop 18 of the second switch and hold the second switch closed, whereby the operator may remove his left hand therefrom and while holding the third switch, close the fourth. The closing of the 120 fourth switch causes the projection 28, carried by the lever thereof, to engage the catch 29 and, as the magnet is energized, the catch will retain the lever of the fourth switch closed as long as the magnet remains ener- 125 gized. It will be noted that each switch with the exception of the first holds the switch immediately preceding it, and in event the operator releases any one of the switches during the closing operation before the suc- 130

ceeding switch is closed, all of the switches which have previously been closed will immediately open. By this arrangement the leaving of a portion of a starting resistance in circuit by the operator is impossible. It will also be seen that due to the interlock between the switches, they must be closed in a definite sequence. If after all the switches are closed the magnet 31 becomes deenergized for any reasons and releases the last switch, the remaining switches will immediately open under the influence of their springs.

I have referred to the members 12 and 18 as l. gs and stops respectively. This designation is adopted for the purpose of distinction rather than for the purpose of description, for, as a matter of fact, their character changes with the operation of the switch, that is, the member 18, when it is attempted to close one of the switches, acts as a stop against which the member 12 impinges and thereby prevents the closing of the switch thereof. On the other hand when the switches are closed in their proper order, the member 12 becomes a stop against which the member 18 bears to hold the switch immediately preceding the one by which the member 12 is carried. It will be therefore seen that the terms "stop" and "l. g." are as a matter of fact interchangeable as applied to these two members.

The electric functions performed by the above operation are as follows:—The closing of the first switch arm closes the circuit from the positive side 37, through the field 36, to the negative side of the line, and at the same time closes the circuit through the winding 31 of the retaining magnet, and also a circuit from the positive side 37 of the line through the armature 38, through all of the resistance 42, thence across the first switch arm to the negative side 41. As the remaining switches are successively closed, the resistance is cut out, step by step, until when the last switch is closed, the motor is operating under full speed.

While I have described my invention as being adapted for controlling a starting resistance, the invention is applicable to other uses where it is desired to provide a plurality of switches of the character described. Also while I have shown the sequence of closing the switches as being one after the other in mechanical series, it will be understood that this particular sequence may be varied without departing from the invention.

The retaining magnet 31 forms what is known in the art as a no voltage release device, that is, in event of failure of current or a drop in voltage below a predetermined point the magnet will release the switches and open the circuit. It is obvious, however, that any other retaining means may be substituted for that shown and described.

It is also obvious that the electrical cir-

cuits and connections may be varied to suit varying conditions, and that various other means than those illustrated and described may be provided to prevent the switches from being operated except in a definite sequence and to hold the switches after the same have been closed.

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

1. The combination with a plurality of switches, of means operated by the closing of each switch for holding closed the switch which immediately precedes it.

2. The combination with a plurality of switches, of means operated by the closing of each switch for holding closed the switch which immediately precedes it, and means for holding the last switch closed.

3. The combination with a plurality of switches, of means operated by the closing of each switch for holding closed the switch which immediately precedes it, and a retaining magnet for holding the last switch closed.

4. The combination with a plurality of switches, of means tending to move said switches to an open position, said means being rendered inoperative with respect to each switch when the succeeding switch is closed.

5. The combination with a plurality of switches adapted to be closed in a definite sequence, of means necessitating the manual holding of each switch in a closed position until the next succeeding switch of the sequence is closed.

6. The combination with a plurality of switches adapted to be closed in a definite sequence, of means necessitating the manual holding of each switch in a closed position until the next succeeding switch of the sequence is closed, and means for holding the last switch closed.

7. The combination with a plurality of switches arranged to be closed in a definite sequence, of means for causing the opening of the switches closed in event the last switch closed is released before the next succeeding switch is closed.

8. The combination with a plurality of switches adapted to be closed in a definite sequence, of means for causing the opening of all of the switches closed in event the last switch closed is released before the next succeeding switch of the sequence is closed, and means for holding the last switch of the series closed.

9. The combination with a plurality of switches adapted to be closed in a definite sequence, of means whereby each switch after it is closed is adapted to hold another switch in a closed position.

10. The combination with a plurality of switches adapted to be closed in a definite

sequence, of means whereby each switch after it is closed is adapted to hold another in a closed position, and means for holding closed the last switch of the sequence.

11. The combination with a plurality of switches, of a plurality of levers adapted to close said switches in a definite sequence, a toggle connection between each lever and its corresponding switch, a stop carried by each lever for preventing the closing of the succeeding switch except when the lever is in a closed position, and a stop carried by each switch except the first for holding in a closed position the lever which immediately precedes it.

12. The combination with a plurality of switches, of a plurality of levers for operating the same, a toggle connection between each lever and its switch, and an interlock between the switches which prevents the levers from closing the same except in a definite sequence and which serves to hold the preceding switch closed, and a retaining magnet for holding the last lever in a closed position.

13. In a motor controller, the combination with a resistance, of a plurality of hand operated switches for controlling the same, an interlock between said switches whereby each switch except the first holds closed the switch which immediately precedes it, and a low voltage device for retaining the last switch of the series closed.

14. In a motor controller, the combination with a resistance, of a plurality of hand operated switches for controlling the same, means operated by each switch except the first for holding closed the switch which immediately precedes it, and a low voltage device for holding the last switch of the series closed.

15. In a motor controller, the combination with a resistance, of a plurality of switches controlling the same having a tendency to move to open position, of means for causing said switches to be closed in a definite sequence, means operated by each switch for retaining the switch which immediately precedes it closed, and a low voltage device for holding closed the last switch of the series.

16. In a motor controller, the combination with a resistance, of a plurality of hand operated switches for controlling the same, one of said switches being adapted to control the motor circuit, means whereby each switch maintains closed the switch which immediately precedes it, and a low voltage device for holding closed the last switch in the series.

17. In a motor controller, the combination with a plurality of switches tending to stand in open position, a plurality of sections of resistance controlled thereby, means insuring the closure of said switches in a definite sequence; means carried by each switch, except the first, for holding a preceding switch closed and means for holding the last switch of the sequence closed, said last mentioned means being adapted to automatically release all of said switches.

18. In a motor controller, the combination with a plurality of switches tending to stand in open position, a plurality of sections of resistance controlled thereby; stops carried by said switches for insuring the closure thereof in a definite sequence and providing means whereby each switch, except the first, will hold a preceding switch closed and means for holding the last switch of the sequence closed, said last mentioned means being adapted to automatically release all of said switches.

19. In a motor controller, the combination with a plurality of resistance switches tending to stand in open position, a plurality of sections of resistance controlled thereby, stops carried by said switches for insuring the closure thereof in a definite sequence and providing means whereby each switch, except the first, will hold a preceding switch closed, and a retaining magnet for holding the last switch of the sequence closed, said magnet being adapted to automatically release all of said switches.

20. In a motor controller, the combination with a plurality of resistance switches tending to stand in open position, a plurality of sections of resistance controlled thereby, a plurality of levers adapted to actuate said switches, a toggle connection between each lever and its corresponding switch, stops carried by said lever for insuring the closure of said switches in a definite sequence, and a stop carried by each of said switches, except the first, for holding the last switch of the sequence in closed position and a retaining magnet for holding the last switch of the sequence closed, said magnet being adapted to automatically release all of said switches.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

JOHN T. JANETTE.

Witnesses:

T. E. BARNUM,

R. H. MANSFIELD, Jr.