No. 676,030. Patented June 11, 1901.

C. L. DAVIS.

MECHANICAL PIANO PLAYER.

(Application filed Oct. 20, 1899.)

(No Model.)

3 Sheets—Sheet 1.

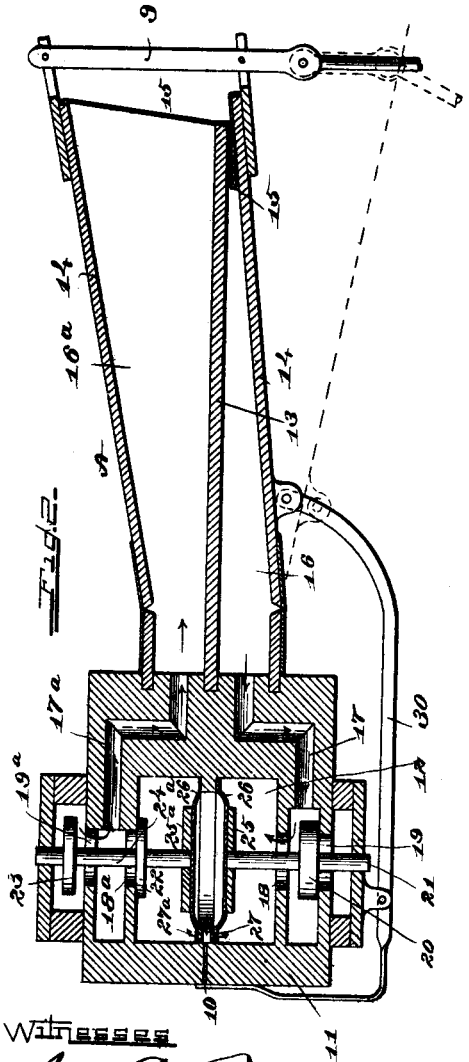


Fig. 2.

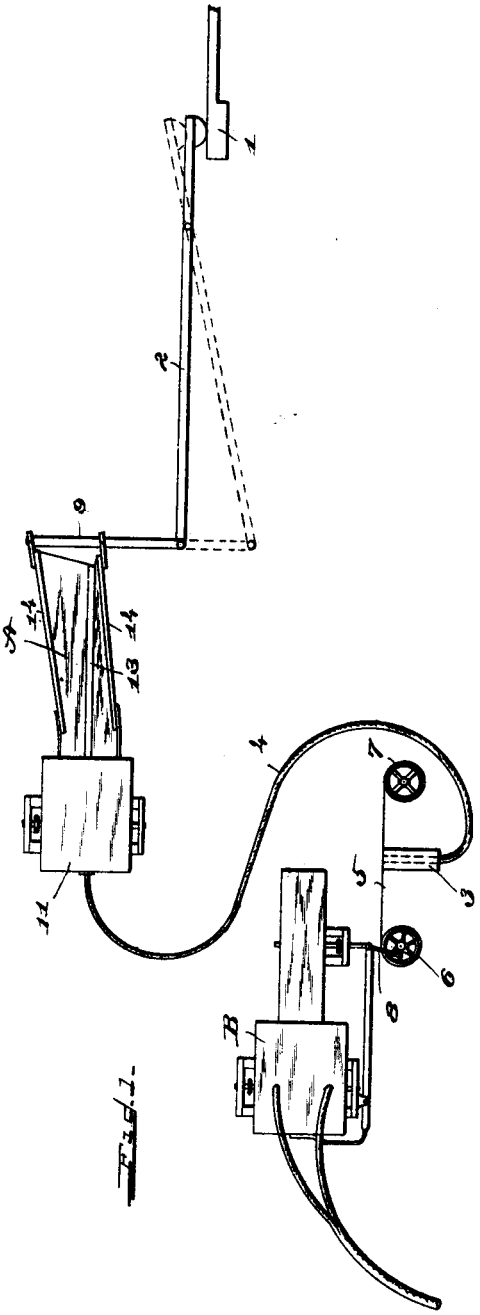


Fig. 1.

Witnesses

Ira D. Perry

Harold B. Barrett

Inventor

Charles L. Davis

by J. A. Miller Belfield,

Atty

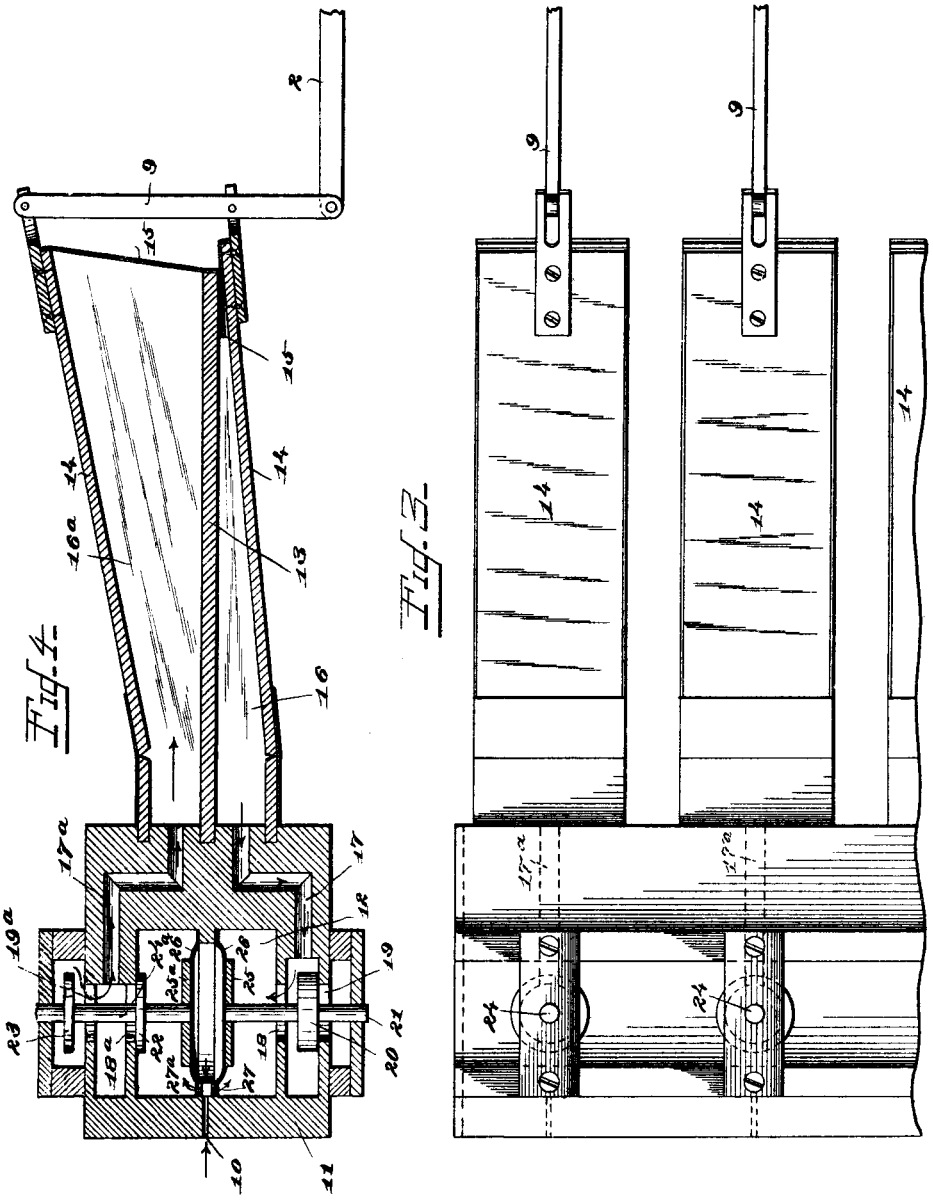
No. 676,030. Patented June 11, 1901.

C. L. DAVIS.

MECHANICAL PIANO PLAYER.

(Application filed Oct. 20, 1899.)

(No Model.) 3 Sheets—Sheet 2.



Witnesses—
Ira D. Perry
Harold M. Barnett.

Inventor—
Charles L. Davis,
by A. Miller Belfield
Att'y.

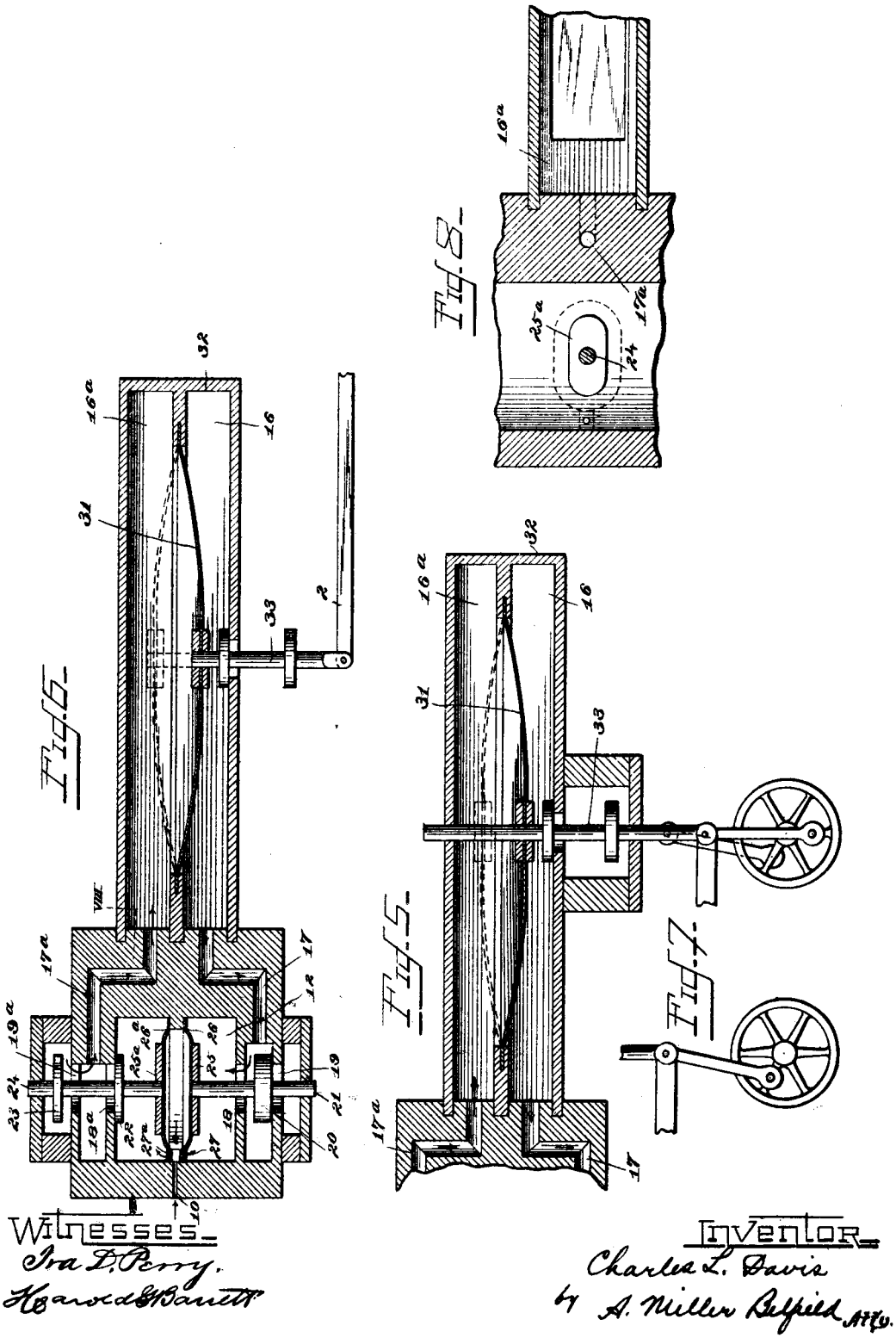
No. 676,030. Patented June 11, 1901.

C. L. DAVIS.

MECHANICAL PIANO PLAYER.

(Application filed Oct. 20, 1899.)

(No Model.) 3 Sheets—Sheet 3.



Witnesses—
Ira D. Perry.
Howard & Barnett

Inventor—
Charles L. Davis
by A. Miller Belfield Atty.

UNITED STATES PATENT OFFICE.

CHARLES L. DAVIS, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO SAID DAVIS AND AUGUST HEUER, JR., OF SAME PLACE.

MECHANICAL PIANO-PLAYER.

SPECIFICATION forming part of Letters Patent No. 676,030, dated June 11, 1901.

Application filed October 20, 1899. Serial No. 734,169. (No model.)

To all whom it may concern:

Be it known that I, CHARLES L. DAVIS, a citizen of the United States of America, and a resident of Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Mechanical Piano-Players, of which the following is a specification.

My invention relates to devices by which a piano or organ or like instrument can be played mechanically, and in particular to a variety thereof in which a roll of paper properly perforated is drawn over the ends of air-passages formed in a board or like device.

Prominent objects of the invention are to provide a simple and improved construction of device of the class specified, to obtain the quickest possible and most reliable and effective action upon the keys, and to accomplish these and other desirable results in a practical and efficient manner.

To the attainment of the foregoing and other desirable ends my invention contemplates matters hereinafter set forth.

In the accompanying drawings, Figure 1 is a diagrammatic view of the piano-player embodying my invention. Fig. 2 is a vertical section of the motor—that is to say, the mechanism employed for moving the music-roll. Figs. 3 and 4 are respectively plan and longitudinal sectional views of the key-actuating mechanism—that is to say, the mechanism which actuates the piano or like keys. Figs. 5 and 6 are longitudinal sections of modified forms of the motor and key-actuating mechanism, respectively; and Figs. 7 and 8 are views of details of construction.

Referring first to Fig. 1 of the drawings, 1 represents a piano-key which is to be operated by the piano-player embodying my invention. It will be understood that the other keys are arranged beside the key 1 and are operated in the same way. The key 1 is depressed by a pivoted lever 2, and this latter is actuated by what I have termed the "key-actuating mechanism" A. This key-actuating mechanism contains important features of my invention; but before describing it in detail I will refer to the other parts of the piano-player shown in Fig. 1.

The tracker or channel board 3 is such as is commonly employed in mechanical piano-players and is connected by tubes 4 with the key-actuating mechanism A, by which air will be admitted into the latter whenever a perforation of the paper 5 comes into register with a port in the channel-board 3 with which the tube 4 communicates. The paper 5 is unrolled from the roller 6 and upon a roll 7. The roll 6 is driven by a link or rod 8, which is actuated by what I term the "motor" B. This motor embodies the novel valve mechanism of the key-actuating mechanism A; but inasmuch as I have embodied in a divisional application, Serial No. 2,928, filed January 26, 1900, for an air-motor the particular novel features of the motor arrangement aside from the valve mechanism I shall refer to this motor structure but briefly herein. The other parts of the player can be those commonly employed in similar devices.

Referring now to the key-actuating mechanism A and considering the same especially in connection with Figs. 3 and 4 of the drawings, it will be seen that the lever 2 is pivotally connected to the end of a reciprocating link or rod 9, which is reciprocated up and down, so as to cause the proper actuation of the piano-key. The link 9 is normally in a lowered condition, as shown in dotted lines in Fig. 1, and is automatically raised, so as to depress the piano-key 1 by the admission of air into the port 10, Fig. 4. This port 10 is formed in the forward end of a box 11, having an interior chamber 12, which is understood to be connected at either or both of its ends in any suitable way with the bellows of the apparatus, so that a vacuum is normally and continuously maintained within it. The rear end of the box 11 carries a rigid tongue 13 and a couple of swinging flaps or leaves 14 14, which are connected at their outer ends and sides with the tongue 13 by flexible material 15, so that there are formed on opposite sides of the tongue 13 separate and distinct air-tight chambers 16 and 16^a. The chambers 16 and 16^a are connected by passages 17 and 17^a with the chamber 12 in the box 11. The passages 17 and 17^a communicate with the chamber 12 by means of the ports 18 and 18^a and with the outside atmosphere by ports 19 and 19^a. The lower ports 18 and 19 are

opened and closed by a valve 20 on a valve-spindle 21. The valve is between the two ports, so that when in an upper position the port 18 will be closed and the port 19 opened, and when in a lowered position the port 18 will be opened and the port 19 closed, as shown in Fig. 4. The upper ports 18^a and 19^a are opened and closed by two valves 22 and 23 on a valve-stem 24, said valves being on opposite sides of the ports, so that when the spindle 24 is in an elevated position the port 18^a will be closed and 19^a opened, and when the spindle is in a lowered position the port 18^a will be opened and the port 19^a closed. The spindles 21 and 24 carry at their inner ends disks 25 and 25^a, attached to diaphragms 26 and 26^a, of flexible material. The diaphragms 26 and 26^a are punctured by small apertures 27 and 27^a, (shown near the inner end of the port 10.) By such arrangement and construction it will be seen that when the port 10 is closed to the atmosphere, as is normally done by the paper passing over the tracker-board, it being remembered that the ports 10 are connected with the tracker-board by tubes 4, as heretofore explained, the spindles 21 and 24 will be pushed inwardly—that is to say, the spindle 21 upwardly and the spindle 24 downwardly—by the atmosphere tending to enter the vacuum-chamber 12. In such condition the atmosphere will enter the lower chamber 16 and will be withdrawn from the upper chamber 16^a. As a result the leaves or flaps 14 14 will be drawn and held in a downward position, both of them being actuated by the atmospheric pressure. When the air is admitted into the port 10, the spindles 21 and 24 are automatically and instantly forced into outward positions, as shown in the figure. The lower port 18 is thereby opened to the vacuum-chamber 12 and the port 19 closed to the atmosphere, and at the same time the port 18^a is closed to the vacuum-chamber and the port 19^a opened to the atmosphere. As a result the air is exhausted from the lower chamber 16 of the bellows arrangement and is admitted to the chamber 16^a thereof, the course of the air being shown by the arrows in the figure. The leaves or flaps 14 14 thereupon instantly rise, thereby lifting the link 9 and the lever 2 and causing the key to play. The air admitted by way of the port 10 is slowly exhausted from the chamber between the diaphragms 26 and 26^a by the apertures 27 and 27^a, so that after the operation of the key and the closure of the port 10 by the passing of the perforation in the paper over the channel-board the mechanism will immediately assume its original position. The ports 27 and 27^a are slightly smaller than the port 10, so that if the air is continually admitted to hold the key down the ports 27 and 27^a will not exhaust all of the air admitted. It will be seen that by this construction and arrangement I secure instantaneous and effective key action, that this action is positive in both directions and is absolutely instantaneous, and that I can make a half or fraction of a stroke without interfering with the apparatus and without having to make a whole stroke before the same will resume its normal condition.

In Fig. 3 I show the manner in which the chambers for the various keys are arranged alongside of one another. It will be understood that the vacuum-chamber 12 is a long chamber extending continuously from end to end of the box 11 and connecting with the various chambers 16 and 16^a. It will be further seen that this arrangement is an improved mechanism for obtaining a reciprocating motion and can be used in any connection for such purpose, whether in a piano-player or other musical instrument or any other device. In Fig. 2 I have shown such an arrangement operated and connected so as to serve as a motor for driving the rollers carrying the music-roll. In such case I merely connect the link 9 with the driving-rod 8, so that the reciprocating motion of the link is converted into the required rotary motion. In order to make this motion continuous, I arrange a valve 30, connected with the lower leaf 14 and operating to open and close the port 10, so that as soon as air is admitted to throw the link 9 one way the port 10 will be closed, so as to allow that air to become exhausted and throw the link in the opposite direction.

In Figs. 5, 6, and 8 I have shown a modified form of the foregoing arrangement. In this form the ports, passages, valves, and so on are the same and operated in the same way as those of the other arrangement. The difference is in the construction of the bellows attachment. In this attachment the bellows-diaphragm 31 will be raised and lowered by the alternate admission and withdrawal of air into and from the bellows-chambers 16 and 16^a, and this diaphragm in turn raises and lowers a connecting-rod 33. In Fig. 6 this rod 33 is shown operating the key-lever 2, just as the same is operated by the rod 9 in Fig. 4. In Figs. 5 and 7 the rod 33 is shown operating a pitman, which drives a wheel understood to be connected with the music-roll wheel for turning the same.

It will be seen that in both arrangements there is a reciprocating member, which is actuated by the simultaneous withdrawal of air from one chamber and admission of air into another chamber, both of which chambers are arranged so that the atmospheric conditions within them are effective upon the reciprocating member.

What I claim as my invention is—

1. The combination with the two air-chambers, and the passages leading thereto, and each having air and exhaust ports; of valves controlling said ports; a couple of valve-stems, each carrying the set of valves for the ports of one passage, and means for actuating said valve-stems simultaneously in opposite directions, one set of valves opening the air-port and closing the exhaust-port of one passage,

as the other closes the air-port and opens the exhaust-port of the other passage, and vice versa.

2. The combination with the two air-chambers; of a couple of passages, one leading to each air-chamber, and each provided with air and exhaust ports; valves for controlling said ports, the valves in the ports of each passage being carried by a separate valve-stem; an exhaust-chamber, with which the said exhaust-ports communicate, and into which the said valve-stems extend; a couple of diaphragms arranged in said exhaust-chamber, and secured to the inner ends of said valve-spindles; and an air-port communicating with the space between said diaphragms.

3. The combination with a reciprocating member, and a couple of air-chambers connected therewith; of a vacuum-chamber; passages leading to the two air-chambers, each having ports respectively communicating with the atmosphere and the vacuum-chamber; valves for closing said ports; the valves for one set of ports being carried by a valve-stem, which, when in an outward position, closes the vacuum-port and opens the air-port, and the valve for the other ports being carried by a stem, which, when in an outward position, opens the vacuum-port and closes the air-port; flexible diaphragms, to which said valve-stems are connected; an air-port communicating with the space between said diaphragms; and small ports establishing communication between the vacuum-chamber and the space between the diaphragms.

4. The combination with swinging leaves or flaps; of a rigid tongue between the same; a vacuum-chamber having an air-port; passages leading into the chambers formed by the leaves or flaps and the rigid tongue, and having ports communicating with the vacuum-chamber and the atmosphere; two reciprocating valve-stems, one having one valve situated between the atmosphere and vacuum-ports of one of said passages and arranged to open the latter port and close the former one when in an outward position, and the other valve-stem having two valves situated on opposite sides of the two ports of the other passage, and arranged to close the vacuum-port and open the atmosphere-port when in an outward position; flexible diaphragms, to which the valve-spindles are connected, said diaphragms being arranged so that the air-port of the vacuum-chamber communicates with the space between them; and small ports establishing communication between the vacuum-chamber and the space between said diaphragms.

5. The combination with the exhaust-chamber provided with an air-port; of a couple of diaphragms arranged in said chamber, so that the admission of air into the said air-port will simultaneously actuate both of them; small ports establishing communication between said exhaust-chamber and said air-port; two air-chambers provided with passages leading thereto, said passages each having air and exhaust ports; valves controlling the ports of said passages; and means whereby the diaphragms, when actuated by the admission of air into said air-port, operate said valves so as to cause the opening of the air-port and the closure of the exhaust-port of one passage, and the simultaneous closure of the air-port and opening of the exhaust-port of the other passage, and also whereby the diaphragms, when in retracted positions, cause the valves to reverse such conditions.

Signed by me at Chicago, Illinois, this 18th day of October, 1899.

CHARLES L. DAVIS.

Witnesses:
A. MILLER BELFIELD,
I. E. MELDRUM.