

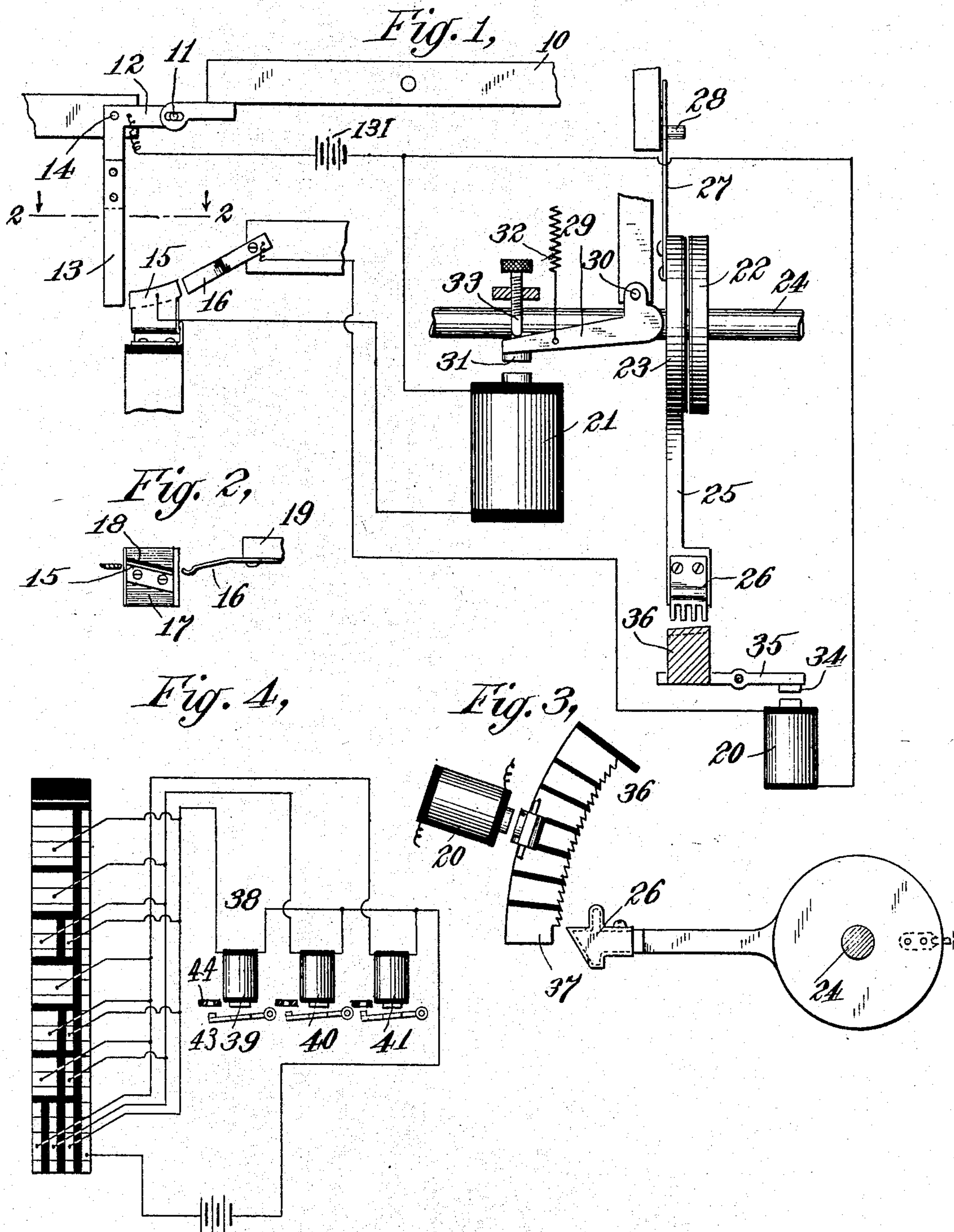
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REGISTERING AND RECORDING MEANS FOR MUSICAL INSTRUMENTS.

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930,739.

Patented Aug. 10, 1909.



WITNESSES:

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# UNITED STATES PATENT OFFICE.

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## REGISTERING AND RECORDING MEANS FOR MUSICAL INSTRUMENTS.

No. 930,739.

Specification of Letters Patent.

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*To all whom it may concern:*

Be it known that I, BENJAMIN S. DEAN, a citizen of the United States of America, and a resident of San Francisco, county of San Francisco, State of California, have invented certain new and useful Improvements in Registering and Recording Means for Musical Instruments, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

My invention relates to improvements in registering and recording means for musical instruments, and particularly to means controlled in its operation by a musical instrument when played to perforate music record sheets, such music record sheets being afterward employed for producing the melody thus played.

The particular class of music record sheet is one which is arranged to have several perforations therein for each tone to be produced, differently located widthwise of the sheet in accordance with the expression desired.

In a co-pending application Serial No. 344,362, filed simultaneously herewith, I have shown and claimed recording means in which a movable part is given a movement, the extent of which is proportionate to the force of the blow delivered, to produce the initial tone; and, in combination with this, I have shown recording means variously controlled in accordance with the extent of movement of the said movable part. Specifically I disclosed in such application an inertia device with means for yieldingly opposing its movement, the yielding means being employed to measure the force of the blow. In the present application I employ means which is timed in its movement in accordance with the time expended in imparting a movement to the finger key of a musical instrument (or to some other movable part of the musical instrument action), such means controlling the recording means in accordance with the distance to which it moves, so that while, in the specific mechanism of the co-pending application I measure the force of the blow, in the present application I measure the time in which it takes to complete the movement produced by the blow.

The object of my invention is similar in the present case to the object of the invention in the said co-pending application, be-

ing to produce a musical record, in which there is not only a record of the tones to be reproduced, but also of the expression intensity thereof, so that, when the record sheet is employed in a musical instrument or musical instrument player to reproduce the melody originally played, it will not only cause the reproduction of the actual tones but also reproduce the proper expression of the same.

In order that my present invention may be thoroughly understood, I will now proceed to describe the same with reference to the accompanying drawings which illustrate an embodiment thereof, and will then point out the novel features in claims.

In the drawings: Figure 1 is a view in side elevation of such parts of the apparatus in which the same is embodied as are necessary for a complete understanding of the invention. Fig. 2 is a detail sectional view taken substantially upon the plane of the line 2—2 of Fig. 1. Fig. 3 is a detail view in end elevation of certain parts. Fig. 4 is a diagrammatic view illustrating the electric circuits employed between the circuit closing means and the perforating or recording devices.

Reference character 10 designates a musical instrument finger key, or other movable part of a musical instrument action, the same being moved with different degrees of speed in the production of a tone. The said finger key 10 is connected through a pin and slot connection with one arm of a bell crank lever 12, the other arm of which carries a contact member 13. The bell crank lever 12 is suitably pivoted at 14 to a stationary support. When the key 10 is operated, the end connecting with the bell crank lever 12 rises and swings the contact member 13 from left to right as viewed in Fig. 1. Two circuit terminals 15, 16, are arranged in the path of movement of the said contact member 13, the contact member 15 being secured to a stationary part 17, and provided on its rear face with insulating material 18, while the circuit terminal 16 is secured at one end to a stationary part 19, its free end being arranged to yield by reason of the fact that the terminal as a whole is composed of a piece of thin spring metal. In its movement from left to right, as above described, the contact member will first engage the circuit terminal 15. The circuit terminal is arranged at a slight angle across the path of

movement of the contact member 13, as will be readily understood by reference to Fig. 2, so that the said contact member will be slightly deflected as it moves forward, the said contact member being made of flexible material to permit of this. Finally the said contact member will pass over the end of the said circuit terminal, and will then engage the circuit terminal 16. The said circuit terminal 16 is made of thinner material than is the contact member 13, and will yield much more readily, so that, as the contact member passes completely away from the circuit terminal 15, it will, in dropping over the end thereof, force the circuit terminal 16 slightly rearward. The contact member 13 reaches the limit of its movement almost directly it leaves the circuit terminal 15, and, in springing rearward in the manner described, it will be in a position to pass to the rear of the said contact terminal 17 upon its return movement. During this return movement it will engage the insulated part 18, by which it will be still further deflected until, in reaching its normal rest position (as shown in Fig. 2), it will be again permitted to swing back to a position in which, in its forward movement, it will once more engage the circuit terminal 15. It will not so engage the said terminal, however, until it is again moved forward, as, during its entire rearward movement it was insulated therefrom by the part 18.

The circuit terminals 15 and 16 are connected, respectively, with electro-magnets 20, 21, said electro-magnets being connected through a common return with the contact member 13, and the said electro-magnets 20 and 21 operate, the latter for the purpose of controlling a clutch by means of which movements are imparted to a moving contact carrying member, and the former to a means for arresting the movement of the said member and locking it in a position to which it has been so moved. A suitable source of electrical energy is indicated at 131. Means are also provided, whereby the said locking movement operates also to close circuit so as to control the recording means in accordance with the position to which the said moving part is moved. The clutch controlled by the electro-magnet 21 comprises two friction disks 22, 23, the said friction disk 22 being rigidly secured to a continuously rotating shaft 24, while the disk 23 is loosely mounted upon the said shaft and carries an arm 25, at the outer extremity of which is a circuit closing member 26. The said disk 23 is held in its normal position by means of a flexible spring 27, which extends therefrom and rests against a stationary pin 28. The disk 23 is arranged to be engaged by a lever 29, fulcrumed to a stationary support at 30, said lever carrying the armature 31 for the electro magnet 21.

Normally a spring 32 holds the armature and lever up against a stop 33, and, in this position, the disk 23 is free from engagement with the disk 22. If, however, the electro-magnet 21 be energized so as to attract its armature, the lever 29 will be rocked upon its pivotal support 30 against the influence of the spring 32 to press the disk 23 against the disk 22. When this takes place, the disk 23 will be rotated with the disk 22, and such movement of rotation will continue for so long a time as the electro-magnet 21 is energized unless such movement is stopped positively by some other means.

The armature 34 for the electro-magnet 20 is carried by a lever 35, and to the said lever is also secured a segment 36, the face of which is provided with a plurality of notches arranged substantially concentrically with the axis of rotation of the shaft 24. The segment 36 as a whole comprises, or includes a number of contact pieces 37, the said contact pieces being arranged in circuit with recording devices 38, which may conveniently comprise electrically operated sheet perforating means. Such perforating means may comprise, as indicated conventionally in Fig. 4, punches 43 carried by the armature levers and co-acting with dies 44 secured in suitable fixed positions. The arrangement of electric circuits in the present instance is such as to connect seven groups of contact pieces 37 with three electro-magnets 39, 40, 41 in such a way as to cause the energization of the said magnets individually, collectively or permutatively in accordance with the particular group of contact pieces through which circuit is closed at the time. Specifically the contact pieces 37 are connected with electro magnets 39, 40 and 41 as follows: The lowermost group comprises four contact pieces, three of which are connected, respectively with the said magnets 39, 40 and 41, and the other of which forms a part of a common return which leads through the generator to the opposite side of the said magnets. The set immediately thereabove comprises three contact pieces, one of which is connected with the electro magnet 40, the second with the electro magnet 41, and the third constituting a part of the common return. The third group from the bottom also comprises three contact pieces, one of which, however, is connected with the electro magnet 39, another with the electro magnet 41, and the third with the common return. The next or middle set comprises two contact pieces, one of which is connected with the electro magnet 41 and the other with the common return. The next or fifth group comprises three contact pieces, one of which is connected with the electro magnet 40, another with the electro magnet 39, and the third with the common return. The sixth group comprises

two contact pieces, one of which is connected with the electro magnet 40, and the other with the common return, and the seventh or uppermost group comprises two contact pieces, one of which is connected with the electro magnet 39 and the other with the common return. As a result of this, it will be apparent that when circuit is closed through the lowermost group by the circuit closing member 26, all three of the electro magnets will be operated and three perforations will be made by the perforating means; when circuit is closed through the second group from the bottom, the perforating devices of the electro magnets 40, 41 will be operated and two perforations in a selected position will result; and when the circuit is closed through the third set, the electro magnets 39 and 41 will be caused to operate and to make two perforations, but the relative locations thereof will differ from the relative locations of those made by the electro magnetic devices 40 and 41 which were operated when the circuit was closed through the second set of contact pieces. In a similar manner a single perforation will be made by operation of the electro magnet 41 when the circuit is closed through the middle set, two perforations by the operation of the electro magnetic devices 39 and 40 when circuit is closed through the fifth set and a single perforation by operation of the electro-magnets 40 and 39 respectively when circuit is closed through the sixth and seventh sets of contact pieces.

The mechanism operates as follows: When a finger key 10 is depressed, contact, as before mentioned, is first made with the circuit terminal 15, so as to close circuit through the electro-magnet 21. The clutch disks 22, 23 will then be caused to engage each other, and the arm 25 carried by the disk 23 will be moved around with the disk 22 until circuit is once more broken by the fact that the contact piece passes away from the circuit terminal 15 and engages the circuit terminal 16. Engagement of the latter circuit terminal will cause the immediate energization of the electro-magnet 20, by which the segment 36 will be drawn toward the arm 35, causing the same to engage the circuit closing member 26, and locking the part against further movement in either direction. In the engagement of the parts as thus described, the circuit closing member 26 will be caused to close circuit through the particular group of contact pieces 37 which are opposite it at the time. This will cause the proper electro-magnet or electro-magnets of the recording devices 38 to be operated, so as to produce the proper record, as will be well understood. The group of contact pieces 37 selected by the circuit closer 26 upon the arm 25, will, of course, be selected in accordance with the amount of

movement which has been imparted to the arm, and this amount of movement will be directly proportional to the time which the contact member 13 took to pass across the circuit terminal 15. But this time depends upon the rapidity with which the finger key 10 is operated, so that the recording means will be variously controlled in direct relation to the speed of movement of the finger key. The expression intensity of any tone produced by operating the finger key 10 is likewise governed by the speed of movement of the finger key 10, so that, by this means, the expression intensity will be registered or recorded, and may be reproduced by the employment of the proper reproducing means in an automatic musical instrument or musical instrument player designed to be controlled by the record sheet produced by the means herein described.

What I claim is:

1. In apparatus of the class described, the combination with a movable element and recording means comprising a plurality of recording members for said movable element, of selecting means for selecting recording members to be employed in accordance with the length of time during which the said element is moving.
2. In apparatus of the class described, the combination with an element arranged to be moved in the production of musical sounds, of music-record sheet perforating means comprising a plurality of punches for the said element, and selecting means for selecting the punches to be employed in accordance with the length of time the said element is moving in order to produce the musical sound.
3. In apparatus of the class described, the combination with an element arranged to be moved in the production of musical sounds, of a part arranged to travel a distance proportionate to the length of time during which said element makes such a movement, recording means comprising a plurality of recording members for said element, and a selecting device operated in accordance with the distance of travel of said part for selecting the recording members to be employed.
4. In apparatus of the class described, the combination with an element adapted to be moved in the production of musical tones, of a continuously operating member, a part adapted to be engaged thereby during the time the said element is moving, and recording means controlled in accordance with the distance said moving part is thus caused to travel.
5. In apparatus of the class described, the combination with an element adapted to be moved in the production of musical tones, of two electric circuits arranged to be consecutively closed by the said element in its movement, means adapted to travel during

the closing of the first said circuit, means engaging the same to prevent further movement when the second circuit is closed, and recording means operated by the said engagement, and variously controlled in accordance with the relative positions of the parts when they were so engaged.

6. In apparatus of the class described, the combination with an element adapted to be moved in the production of musical tones, of two electric circuits closed successively by said element in its movement, a movable arm, electro-magnetic means included in the first said circuit for causing the said arm to travel, circuit closing means, an electro-magnetic means included in the second said circuit producing the operation of said circuit closer, the particular circuits controlled thereby being governed in accordance with the position of said movable arm at the time of operation of said circuit closer, and music record sheet perforating means controlled by the said circuit closer.

7. In apparatus of the class described, the combination with an element adapted to be moved in the production of musical tones, of a contact arm controlled in its movement by said element, two circuit terminals ar-

ranged to be engaged successively thereby, a movable arm, means producing the movement of said arm during the time contact is made with the first said circuit terminal, means engaging said arm and preventing further movement thereof upon the engagement of the second said circuit terminal, said means comprising a plurality of circuit terminals through which circuit is closed in accordance with the position of the said arm when engagement is made thereby, and music record sheet perforating means controlled by the last said circuit closing means.

8. In apparatus of the class described, the combination with an element adapted to be moved in the production of musical tones, of a plurality of music record sheet perforating devices, and means for operating the said music record sheet perforating devices singly, collectively or permutatively in accordance with the duration of time within which the said arm is caused to make such a movement.

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Witnesses:

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