No. 824,343. PATENTED JUNE 26, 1906.

G. H. DAVIS.

EXPRESSION MECHANISM FOR MECHANICALLY OPERATED MUSICAL INSTRUMENTS.

APPLICATION FILED JAN. 30, 1904.

3 SHEETS—SHEET 1.

Fig. 1.

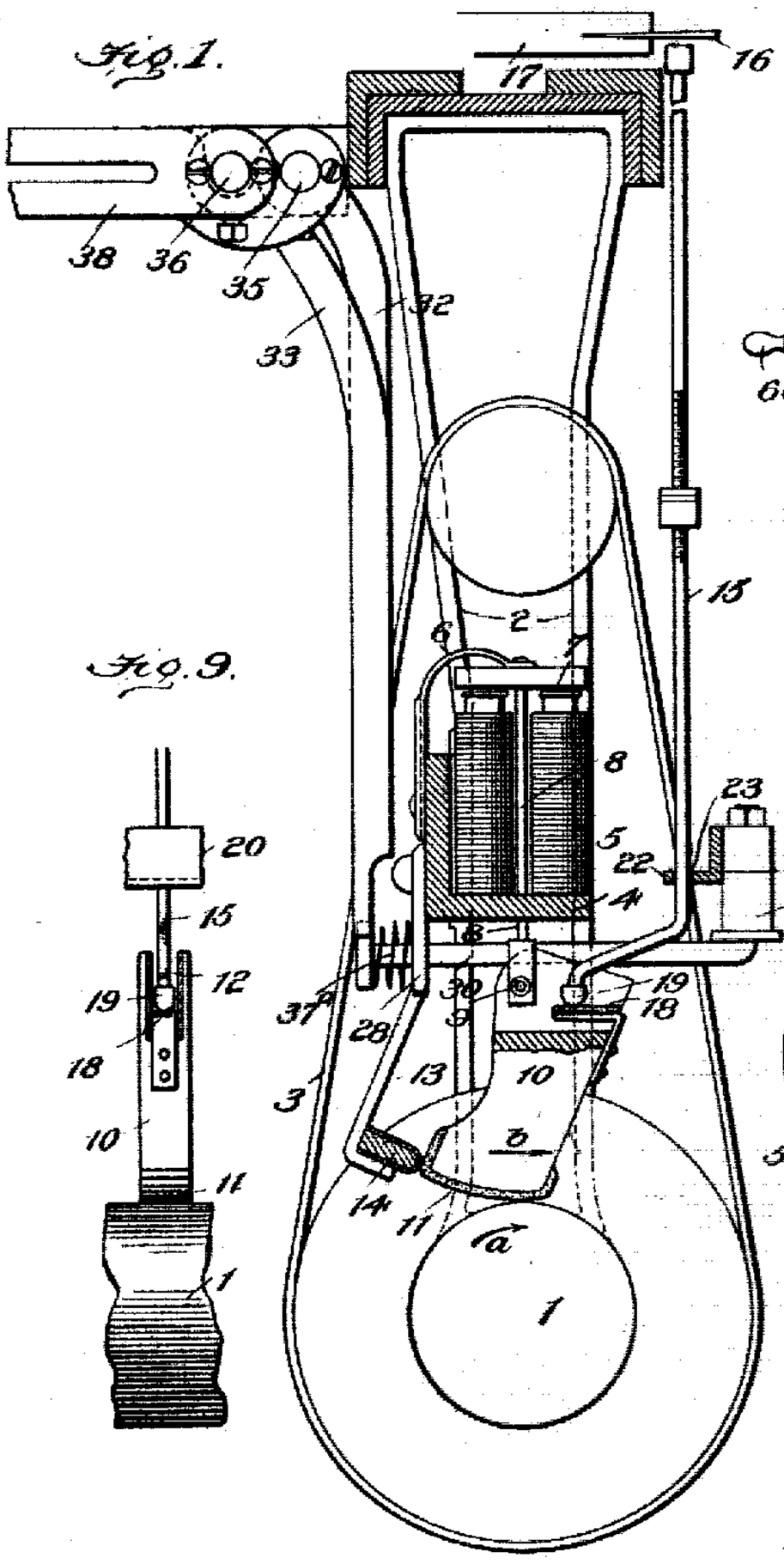


Fig. 12.

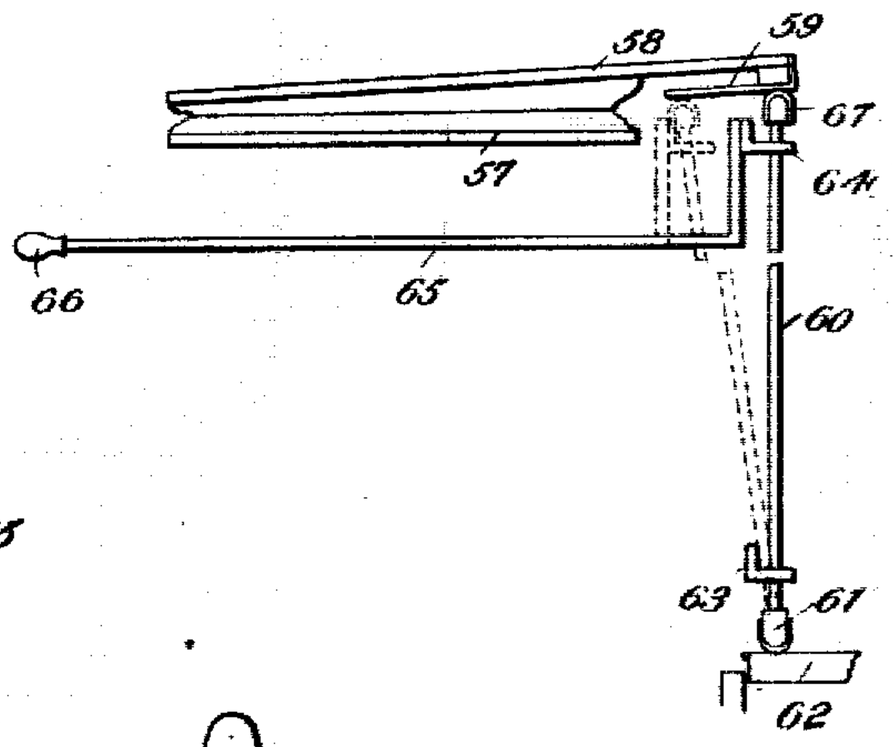


Fig. 9.

Fig. 11.

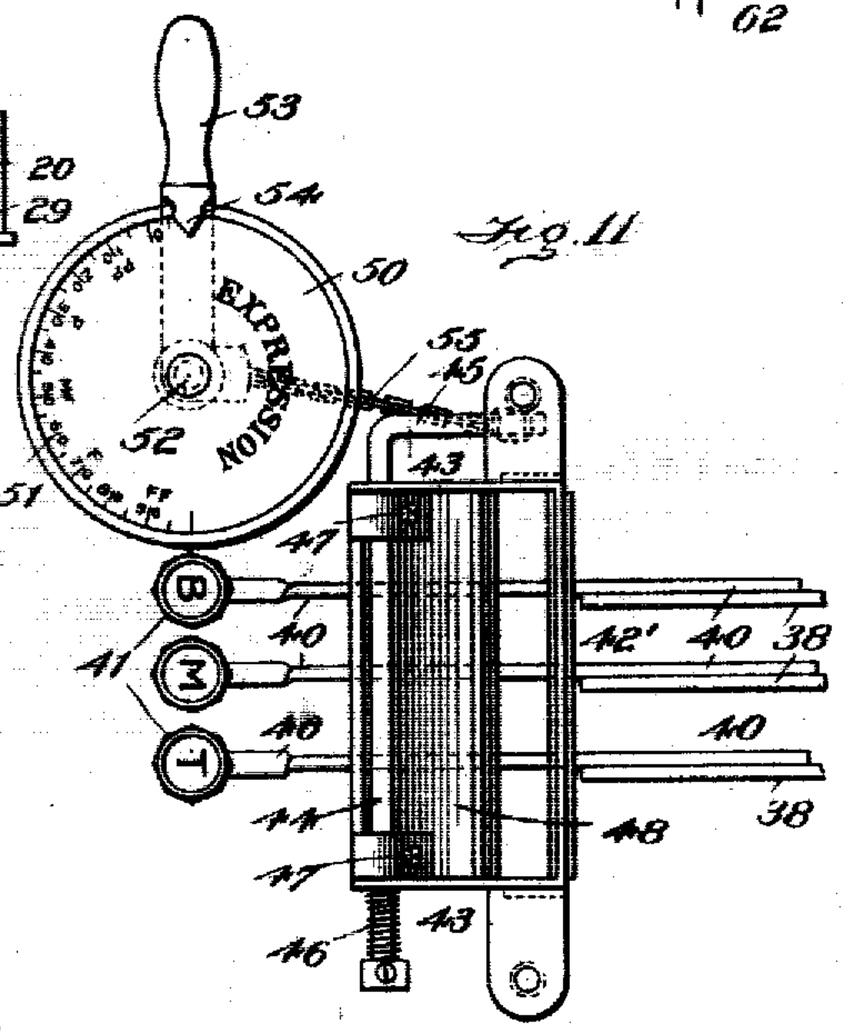
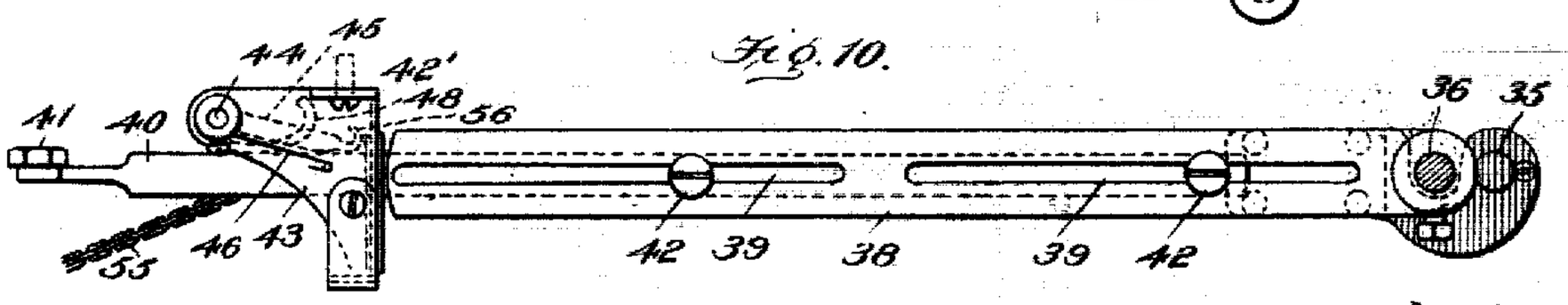


Fig. 10.



Witnesses

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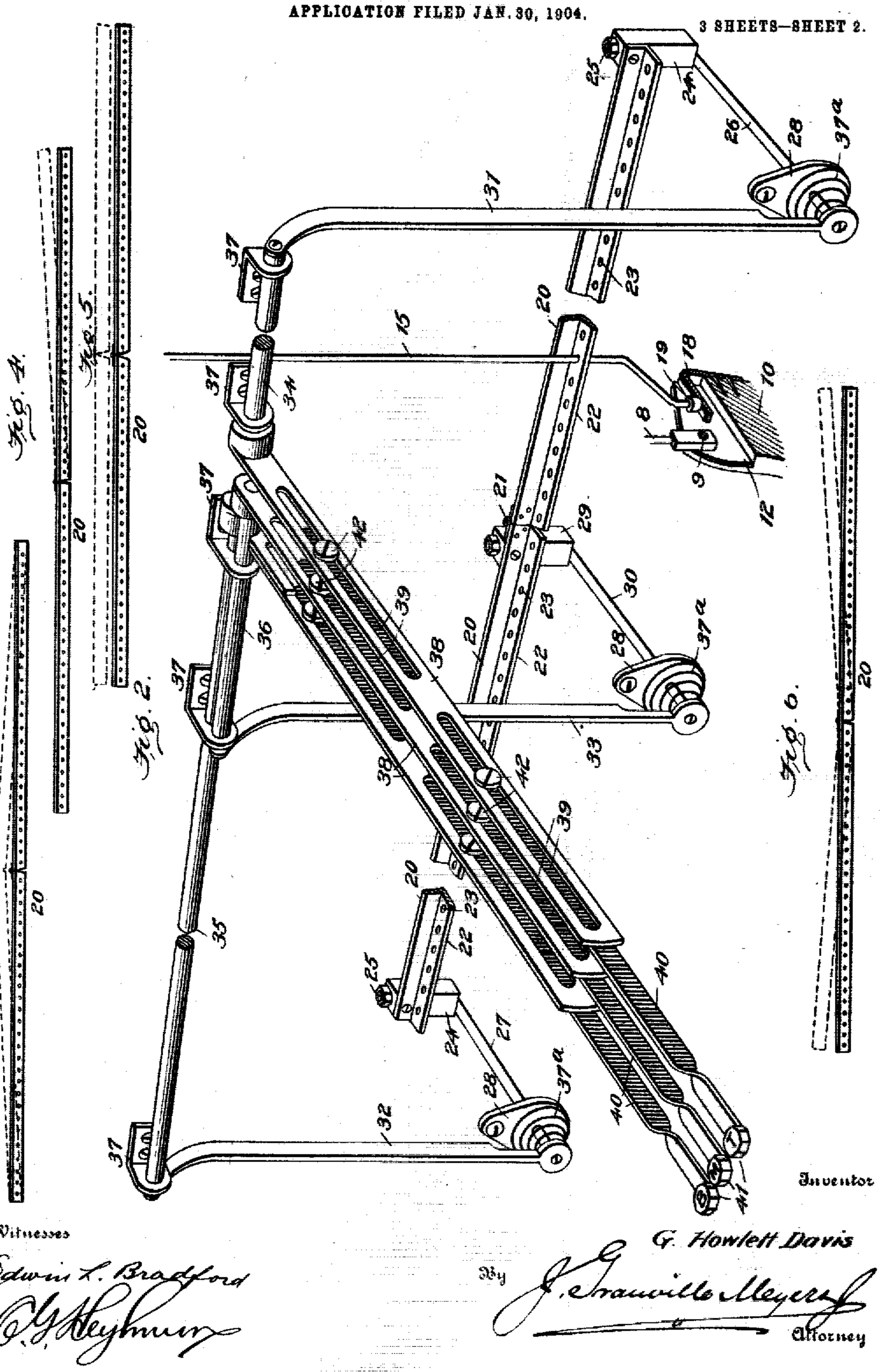
3 SHEETS—SHEET 2.



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3 SHEETS—SHEET 3.

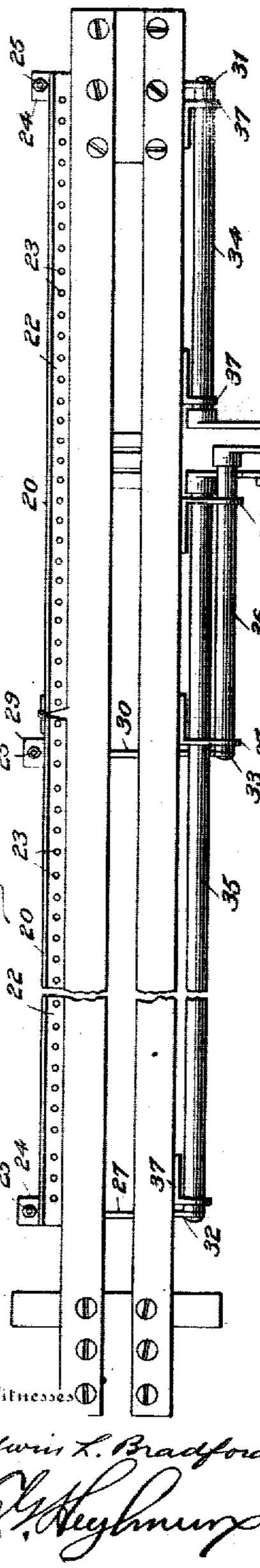

Fig. 7.

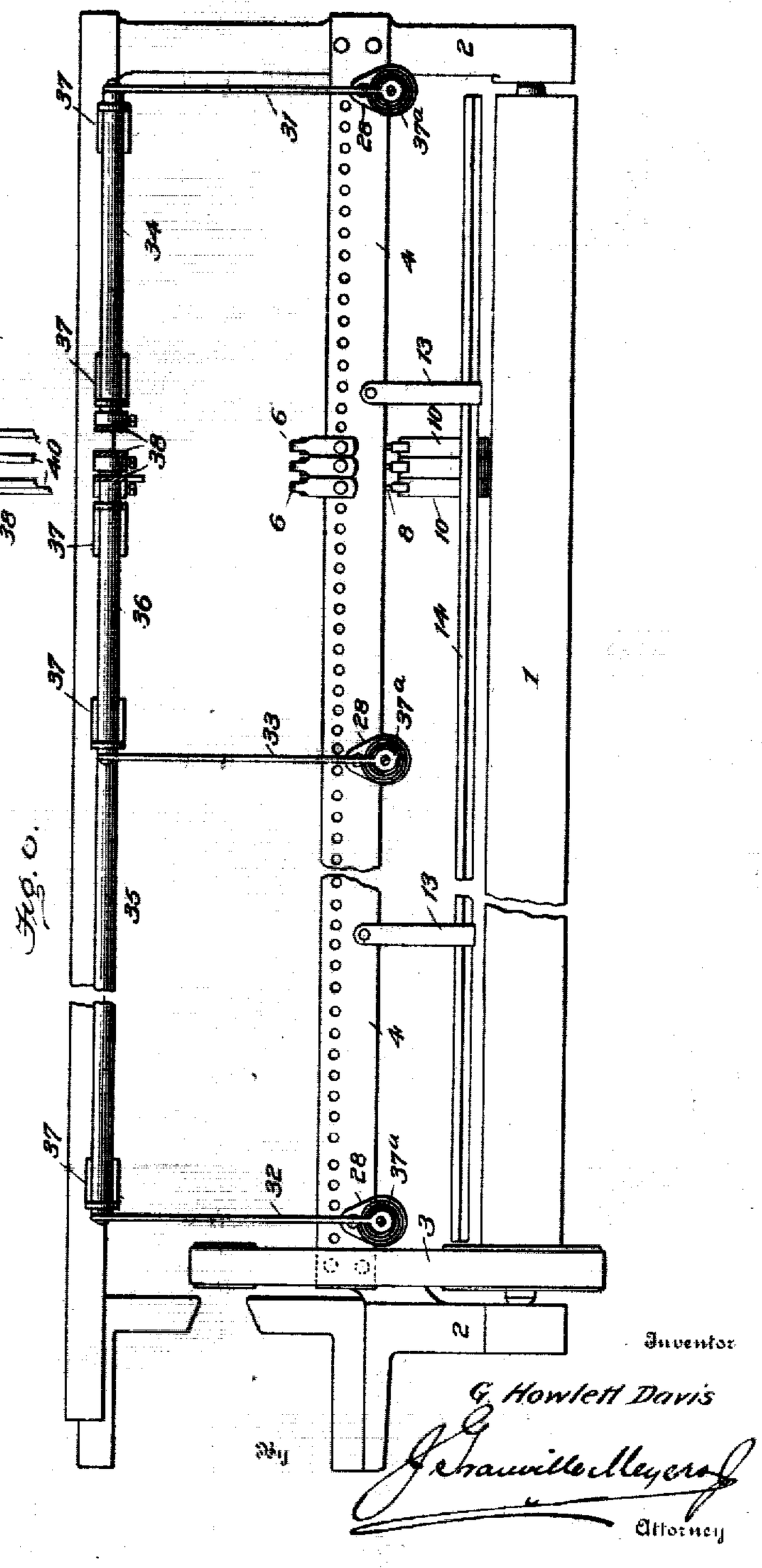

Fig. 8.

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UNITED STATES PATENT OFFICE.

GEORGE HOWLETT DAVIS, OF WEST ORANGE, NEW JERSEY.

EXPRESSION MECHANISM FOR MECHANICALLY-OPERATED MUSICAL INSTRUMENTS.

No. 824,343 Specification of Letters Patent. Patented June 26, 1906.

Application filed January 30, 1904. Serial No. 191,387.

To all whom it may concern:

Be it known that I, GEORGE HOWLETT DAVIS, a citizen of the United States, residing at West Orange, in the county of Essex and State of New Jersey, have invented new and useful Improvements in Expression Mechanism for Mechanically-Operated Musical Instruments, of which the following is a specification.

My present invention relates to expression and phrasing mechanism for mechanically-operated musical instruments.

The prime object of the invention is to provide manually-operable means for giving variations of expression to the musical compositions being rendered and to enable the bass, middle, or treble sound-producing devices of the piano to be independently controlled without causing a sudden or abrupt change in the tone at any point in the musical scale or under any condition of operation.

It is a further object of the invention to provide means for bringing out prominently the melody of the composition and for subduing the other accompanying parts, for waving a trill, accompaniment, or the melody, and for accenting a single note or a chord in any part of the piano.

It is a still further object of the invention to provide means for gradually and progressively varying the force of the blow with which a group or series of sound-producing devices at any point of the scale are struck, whereby a perfect blending of the musical tones may be effected.

A further purpose of the invention is to provide controlling-keys for the aforesaid mechanism slidably attached to the under side of the keyboard of the musical instrument in such manner that they may be drawn out in front of the keyboard to be in easy reach for use and which may be pushed back under the keyboard, where they will be out of view when not in use.

The invention has in view other more or less important objects, all of which will appear hereinafter.

Briefly and generally stated, the invention comprises expression or phrasing mechanism for mechanically-operated musical instruments embodying in the example herein shown an actuating element, such as a shoe-pneumatic or other device, and means operated by said element for actuating a sound-producing device of a musical instrument, said means being movable relatively to the actuating element, or vice versa, whereby to vary the force of the blow imparted to the sound-producing device.

In order to enable others to clearly understand, make, and use my said invention, I will now proceed to describe the same in detail, reference being had for this purpose to the accompanying drawings, in which—

Figure 1 is a sectional elevation illustrating my improved mechanism applied to one type of playing attachments. Fig. 2 is a perspective view of the controlling mechanism for the key-strikers. Figs. 3, 4, 5, and 6 are diagrammatic views illustrating the various positions assumed by the means for shifting the key-strikers in obtaining the different musical effects. Fig. 7 is a top plan view of a part of the mechanism shown in Fig. 2. Fig. 8 is a front elevation of said mechanism. Fig. 9 is a rear end view of one of the friction-shoes, the same being shown in position over the drum. Fig. 10 is a side elevation of the operating-levers shown in Fig. 2 with means for simultaneously operating all of said levers. Fig. 11 is a top plan view of the means illustrated in Fig. 10. Fig. 12 is a side elevation illustrating my improvements applied to playing mechanism of the pneumatic type.

I have shown my improvement as applied to that type of self-playing musical instruments shown and described in my pending application, Serial No. 159,926, filed June 3, 1903. I wish it understood, however, that I do not limit myself to the application of such improvements to the particular type of mechanism herein shown, as they may be applied to various other types of self-playing mechanism without departing from the spirit of the invention.

Referring to Fig. 1 of the drawings, the reference-numeral 1 indicates a shaft journaled at its opposite ends in two hangers 2, pendent from the rear under side of the keyboard of the piano and constituting a drum, said drum being rotated though the medium of a belt 3 or otherwise driven from any suitable motor. Supported between and secured to the hangers 2 is a magnet-supporting rail consisting of an L-shaped bar 4, on which is fixed a plurality of electromagnets 5, one for each key of the piano. Fixed to the said magnet-bar is a plurality of springs 6, one for each magnet, each of which supports an ar-

mature 7 and a pendent rod 8, and to the lower ends of said rods are pivoted, as at 9, suitable actuating devices, such devices in the present instance comprising friction-shoes 10, the arrangement being such that when the magnets are demagnetized and the armatures in their raised positions the lower curved ends 11 of the shoes will be held suspended out of engagement with the drum 1, but in close proximity thereto. The upper ends of the shoes 10 are bifurcated, as at 12, (see Fig. 9,) and the inner faces thereof are lined with felt, canvas, or the like. Secured to and pendent from the magnet-rail 4 by means of brackets 13 is a stop-bar 14, the front face of which is preferably faced with felt. Said bar operates to arrest the movement of the shoes 10 in resuming their normal positions, and the felt facing serves to deaden and absorb the noise of the shoes striking said bar.

The numeral 15 indicates a pusher or striker rod, there being one for each shoe and key, which are vertically movable in rear of the keyboard of the piano and arranged at their upper end to strike the under side of the pins 16 on the rear end of the piano-keys 17, and thus depress the latter to actuate the proper sound-producing device and sound-corresponding notes. The lower end of each rod 15 rests on the upper face of a felt or canvas covered spring 18, which is secured to the front edge of each shoe 10 and which lies in the bifurcated portion thereof, one end of the spring being free, as more clearly shown in Figs. 1 and 2. The said lower ends of the rods 15 are bent forwardly, as shown, and are tipped with felt, rubber, or similar material, as indicated at 19, to prevent noise, said tipped ends resting upon and movable back and forth over the springs 18 to and from the fixed ends thereof. When any one of the magnets 5 is energized, its armature 7 is attracted, thereby forcing the corresponding shoe into contact with the drum 1, which latter is constantly rotated by its motor in the direction of the arrow *a*. (Shown in Fig. 1.) The rotation of the drum in the direction indicated throws the shoe 10 in the direction of the arrow *b*, Fig. 1, thereby thrusting upward the rod 15 and depressing the forward end of the corresponding piano-key 17 and through the coöperating sound-producing device, such as the piano-hammer, (not shown,) sounding the corresponding note. When the magnet is demagnetized, the spring 6 raises the armature and lifts the shoe out of engagement with the drum 1, whereupon the shoe will drop by gravity back against the rail 14.

It will be obvious that the pianissimo or forte effects of the note sounded will depend upon the degree of force with which the piano-key is depressed, and it will also be evident that the greater the distance between the ends 19 of the striker-rods and the pivotal points 9 of the shoes or the position of the ends 19 of the rods relatively to the fixed point of the spring 18 the greater will be the depression of the keys, and consequently the louder the note sounded, and vice versa. In order, therefore, to shift the position of the striker-rods over the shoes to control and vary the pianissimo and forte effects, I provide the following mechanism: The numeral 20 indicates an angle-bar, which in the present instance I have shown as comprising two alined sections hinged together at their abutting ends, as at 21, although I wish it understood here that instead of two sections I may employ any number of sections, or, in fact, may make the bar in a single piece. The horizontal portion 22 of the bar is provided with perforations 23, one for each striker-rod 15, through which the said rods loosely pass. Said angle-bar is secured at its opposite ends to blocks 24, carried by the upturned ends 25 of two separate and independently-operable rods 26 and 27, that are slidably supported in apertured plates 28, attached to the magnet-rail 4. The central or hinged portion 21 of the bar is similarly attached to a block 29, carried by the upturned end of a slidably-mounted rod 30. Secured to the outer end of each of the arms 26, 27, and 30 are the lower ends of three levers 31, 32, and 33, each of which is secured at its upper end to a separate rock-shaft, the lever 31 being secured to a rock-shaft 34, the lever 32 to a rock-shaft 35, and the lever 33 to a rock-shaft 36, each of said shafts being journaled in suitable brackets 37, suitably attached to the frame of the piano directly below the keyboard and preferably within the piano-casing. A spring 37ª surrounds each of the arms 26, 27, and 30 between the plates 28 and the respective levers 31, 32, and 33, said springs normally tending to draw the arms forward, and with them the angle-bar 20, so as to bring the ends 19 of the striker-rods nearest the pivotal point of the shoes, which is the normal position of said rods. Secured to the inner end of each rock-shaft is a forwardly-extending arm 38, each having one or more longitudinal slots 39 therethrough, and arranged in contact with each arm 38 is another arm 40, each having at its forward end a finger-key 41. Each arm 40 is provided with two or more headed screws or pins 42, which pass through and overlie the slotted portions 39 of the arms 38, the arrangement being such that the arms 40 may be slid back and forth upon the arms 38 in such manner that when in use the arms 40 may be drawn out in front of the piano-keyboard or may be pushed back under the same, where they will be out of view. By again referring to Figs. 2 and 11 of the drawings it will be seen that the finger-keys 41 are marked with the characters B, M, and T, respectively, the key B controlling, through the rock-shaft 35, the lever 22, and arm 27, one section of the angle-bar 20 and the

bass-keys of the piano, the key lettered M controlling, through the rock-shaft 36, the lever 33, and the arm 30, the central or hinged part of the angle-bar, and the key lettered T controlling, through the rock-shaft 34, the lever 31, and the arm 26, the other section of the angle-bar and the treble or upper part of the piano. It will be understood, therefore, that if the key lettered T is depressed the right-hand section of the angle-bar will be thrown outward at an angle to the other section from the hinged point 21, as illustrated in Fig. 4; the same with respect to the key B, only that the left-hand section of the angle-bar will be thus thrown out at an angle to the right-hand section. If, on the other hand, both the keys lettered B and T be depressed, both sections of the angle-bar will be thrown outward from the hinged point, as illustrated in Fig. 6, and if only the central key (lettered M) be depressed then the middle portion of the bar will be thrown outward, as indicated in Fig. 3. The operation of this part of the invention is as follows: Let it be assumed that the parts are in the position shown in Figs. 1 and 2, in which position the tips 19 of the striker-rods will be nearest the pivotal points 9 of the shoes, and hence the keys will be struck with a pianissimo effect. By depressing one or the other of the keys 41 lettered B or T one end or the other of the angle-bar 20 will be moved rearwardly, as seen in Fig. 4, thus moving the tips 19 of the striker-rods farther away from the pivotal point of the shoes, thereby increasing the throw of said rods and depression of the piano-keys, and consequently augmenting the sound of the keys struck; so, also, with respect to the middle key (lettered M,) only in this case both sections of the angle-bar 20 will be moved outwardly at a central point. If both the keys lettered B and T are depressed simultaneously, then the outer ends of the two sections of the angle-bar will be moved outwardly from a central point. It will be noted, therefore, that the two sections of the angle-bar 20 are not moved bodily back and forth in a straight line, but they are moved at an angle from one end or the other one section at a time, or from a central point. For example, let it be assumed that the key lettered B is depressed. Then the left-hand section only of the angle-bar will be moved rearwardly from the hinged point 21, the right-hand section remaining fixed. It will be apparent, then, that the bass-notes will be sounded the loudest and that from the lowest bass-note up to the highest treble-note the forte effect will gradually grow less and less. It will be obvious that the converse of this is also true with respect to the key lettered T, and it will be obvious also that if the middle key M is depressed the middle notes will be sounded the loudest, while the treble and bass notes will be subdued. It will also be apparent that by raising and lowering either or all of the keys 41 to a greater or less extent any degree of pianissimo or forte effect desired may be obtained.

The mechanism just described is especially adapted for use by experts or those having a technical musical knowledge, it being apparent that by manipulating the three keys 41 any skilled musician may bring out individual musical effects to suit his pleasure. For those persons less skilled in the art of music I provide means for moving the angle-bar bodily, and with it the position of all the strikers relatively to the shoes or other actuating elements, and provide also a single handle having an operative connection with means for actuating the angle-bar, said handle carrying a pointer that is movable over a dial bearing expression characters corresponding to other characters upon the perforated note-sheet, whereby a novice may give all such expressions to the musical composition being played as are indicated on the musical score. To accomplish this end, I have provided the following means, which is illustrated in Figs. 10 and 11: To the under side of the piano-keyboard I attach a bracket 42', between the opposite sides 43 of which project the arms 40, carrying keys 41, and journaled in the said sides 43 of the bracket is a rock-shaft 44, having at one end a crank-arm 45 and having at its other end a coiled spring 46, so constructed as to exert torsional pull on said shaft to hold the crank-arm 45 in an approximately horizontal position, as clearly shown in Fig. 10. Secured to said rock-shaft by means of screws 47 is a curved cam-plate 48, which lies directly above and in contact with all three of the arms 40 and in the rear of the keys 41, the arrangement being such that by pulling downward upon the crank-arm 45 said curved plate 48 will depress all of the arms 41 simultaneously, and thus shift the angle-bar 20 bodily to move the tips 19 of the striker-rods to and from the pivotal points 9 of the shoes or the fixed points of the springs 18, it being understood that the extent of movement of the angle-bar will be governed by the amount of depression given to the arms by the plate 48. Arranged alongside of the arms 40 and preferably attached to a music-holder—such, for instance, as shown in my aforesaid pending application for patent—is a dial-plate 50, bearing suitable indicator-marks 51, representing effects to be produced in playing, and which marks correspond to other marks as ordinarily placed upon perforated music-sheets. Pivoted at 52 to the under side of the dial 50 is a lever having a handle 53 and a pointer 54, movable over the characters 51 on the dial. The said lever is connected, by means of a chain or other flexible connection 55, to a hook 56 on the crank-arm 45 of the shaft 44, and it will be obvious that by prop-

erly manipulating the handle 53 the curved plate 48 will be caused to push down upon the arms 40 to a greater or less extent, depending upon the extent of movement of the said handle, and impart a corresponding movement to the angle-bar 20 and striker-rods 15, and thus give the desired musical effects. It will be understood from the foregoing that when the mechanism last described is employed the angle-bar 20 will be moved bodily, whereas with the mechanism first described—namely, the three keys 41—the two sections of the angle-bar may be moved independently. Thus a greater variety of musical effects may be produced with the three keys and their coöperating mechanism than with the mechanism actuated by the handle 53; but as said handle coöperates with a dial bearing expression characters a novice may readily follow the same and secure pleasing effects.

In Fig. 12 of the drawings I have shown my improvement as applied to a pneumatic actuating device, and in this figure the reference-numeral 57 indicates an ordinary power-pneumatic to the outer end of the movable member 58 of which is attached a spring 59 in all respects similar to the spring 18, attached to the friction-shoe 10, heretofore described. Numeral 60 indicates a striker-rod, the striking tip or end 61 of which lies directly over the piano-key 62, said rod being guided at its lower end through an apertured rail 63. These striker-rods 60, of which there is one for each piano-key, pass through an angle-bar 64 in all respects similar to the angle-bar 20 of the mechanism hereinbefore described, and this bar is moved back and forth by means of a rod or rods 65, each having a handle 66 at its outer end in order to bring the upper ends 67 of the striker-rods to and from the pivotal end of the movable member 58 of the pneumatic or to and from the fixed end of the spring 59, all as will be clearly understood when reference is had to the mechanism heretofore described.

By employing the blade-springs, as shown at 18 and 59, in connection with the actuating device a more yielding or elastic touch is given to the striker-rods, and consequently to the piano-keys. I do not wish to be understood, however, as limiting myself to the use of these springs, as the mechanism will give fairly satisfactory results without them. Likewise I do not wish to be understood as limiting myself to the mechanism herein shown for actuating the rail 20, that here employed being given only by way of example.

What I claim, and desire to secure by Letters Patent, is—

1. A piano having an expression-controlling device for varying the action of the piano-hammers, said device embodying a flexible bar arranged transversely with respect to the piano-strings, and an operating element having a connection with said bar for flexing the latter intermediate its ends, for the purpose specified.

2. A piano having expression-controlling means for varying the action of the sound-producing devices, said means embodying a flexible bar arranged transversely with respect to the piano-strings, and a manually-operable element having a connection with said bar at a point intermediate its ends, whereby the bar may be flexed at the will of the operator for the purpose specified.

3. A piano having expression-controlling means for varying the action of the sound-producing device, said means comprising flexibly-connected bar-sections arranged end to end and situated transversely with respect to the piano-strings, and a manually-operable element having a connection with the adjacent ends of the bar-sections for flexing the latter at said ends, for the purpose specified.

4. A piano-playing attachment having an expression-controlling device for varying the action of the piano-hammers, said device embodying a flexible bar arranged transversely with respect to the hammer-actuating devices, and a manually-controlled lever having an operative connection with the bar at a point intermediate its ends, substantially as and for the purpose specified.

5. A piano-playing attachment, having means for actuating the piano-hammers, and an expression-controlling device for varying to different extents the action of adjacent hammers, said device comprising a flexible bar arranged transversely with respect to the hammer-actuating means, and an operating element having a connection with said bar for flexing the latter intermediate its ends.

6. A piano-playing attachment, having expression-controlling means for varying the action of the sound-producing devices, said means embodying two connected bar-sections arranged end to end and extending transversely with respect to the said devices, a manually-controlled operating element having a connection with the said bar-sections at the connected ends thereof, and two other manually-controlled operating elements, one having a connection with the free end of one of the bar-sections and the other having a connection with the free end of the other bar-section.

7. In music-playing mechanism, an actuating element, a blade-spring carried thereby and having a fixed and a free end, a striker-rod for actuating a sound-producing device, having its lower end resting upon and movable over the face of said spring, and means for moving said lower end of the striker-rod to and from the fixed end of the spring.

8. In music-playing mechanism, a pivoted actuating device, a blade-spring carried by

said device and having a fixed and a free end, a striker-rod having its lower end supported upon and movable over the face of said spring, and means for shifting the position of the said end of said rod relatively to the fixed end of the spring.

9. In music-playing mechanism, a rotary drum, a pivoted friction-shoe, means controlled by a perforated music-sheet for moving said shoe into and out of contact with the drum, a blade-spring having a fixed and a free end carried by said shoe, a striker-rod resting at one end upon said spring, and means for moving the said end of the striker-rod back and forth over the spring, for the purpose specified.

10. In music-playing mechanism, an actuating device having a grooved way, a spring-blade located in said groove, a striker-rod having one end resting upon said spring, and means for moving the rod back and for over the spring for the purpose specified.

11. In music-playing mechanism, a rotary drum, a pivoted friction-shoe having a grooved upper end, means for throwing the shoe into and out of contact with the drum, a striker-rod having one end movable back and forth in said groove and means for moving said rod as described for the purpose set forth.

12. In music-playing mechanism, a rotary drum, a pivoted friction-shoe having a grooved way in its upper end, a blade-spring located in said groove above the bottom thereof, a striker-rod resting at one end upon said spring, and means for moving the said end of the rod back and forth over the spring for the purpose specified.

13. In a music-playing attachment, the combination with a rotary drum, of a friction-shoe adapted to be brought into and out of contact with the drum, and means operated by the shoe for actuating a sound-producing device, the lower end of said means resting upon and movable relatively to the shoe to vary the force of the blow imparted to the sound-producing device.

14. In a music-playing attachment, the combination with a rotary drum, of a friction-shoe adapted to be brought into and out of contact with the drum, and a striker-rod actuated by the shoe for operating a sound-producing device of the musical instrument, the lower end of said striker-rod resting upon and movable relatively to the shoe to vary the force of the blow upon the sound-producing device and means for shifting the said end of the striker-rod.

15. In a music-playing attachment, the combination with a rotary drum, of a friction-shoe adapted to be brought into and out of contact with the drum, a striker-rod having its lower end supported upon and movable over the face of said spring, and means for shifting the position of the said end of said rod relatively to the fixed end of the spring, and a movable contact therewith at the lower end of the striker-rod.

16. In a music-playing attachment, the combination with a rotary drum, of a pivoted friction-shoe adapted to be thrown into and out of contact with the drum, and a striker-rod actuated by the shoe, the lower end of said rod supported by and shiftable toward and from the pivotal point of the shoe for the purpose specified.

17. In a music-playing attachment, the combination with a rotary drum, of a pivoted friction-shoe adapted to be thrown into and out of contact with the drum, a striker-rod actuated by said shoe and having a movable contact therewith at its lower end, and means for moving the said end of the striker-rod toward and from the pivotal point of the shoe.

18. In a music-playing attachment, the combination with a rotary drum, of a pivoted friction-shoe adapted to be thrown into and out of contact with the drum, a striker-rod having one end disconnected from but movable over the shoe toward and from the pivotal point thereof, and means for moving the said striker-rod.

19. In a music-playing attachment, the combination with a rotary drum, of a pivoted friction-shoe arranged to be thrown into and out of contact with the drum, the upper end of said shoe being channeled, a striker-rod having its lower end disposed within the channel in the shoe, and means for moving the striker-rod toward and from the pivotal point of the shoe.

20. In a musical instrument, the combination with the sound-producing devices, of a sectional bar arranged transversely with respect to said devices and connected to control the action thereof, and a manually-operable lever having operative connections with two adjacent ends of the bar-sections, whereby the position of rest of said ends may be simultaneously shifted to cause the bar-sections to coöperate with the sound-producing devices, to produce tone effects graduated in tone volume from the middle of the keyboard toward the treble and the bass.

21. In a music-playing attachment, the combination with a rotary drum, of a series of pivotal friction-shoes adapted to be thrown into and out of contact with the drum, a bodily-movable bar or support, a series of striker-rods resting at their lower ends upon and operable from the shoes and each passing through an aperture in said support, and means for bodily moving the support to bring the said lower ends of the striker-rods to and from the pivotal points of the shoes.

22. In an automatically-operated piano, the combination with the sound-producing devices, of means for varying the action of a series of said devices in the middle range of the piano, the extent of the action differing

progressively on the different devices of the series both toward the treble and the bass, and a manually-operable controlling device for actuating said means.

23. In music-playing mechanism, a plurality of actuating elements, a flexible bar, a series of striker-rods operable by said elements and each having a connection with said bar, and means for flexing the bar to shift the position of rest of some of said striker rods relatively to others.

24. In music-playing mechanism, a plurality of actuating elements, a flexible bar, a series of striker-rods operable by said elements and each having a connection with said bar, and means for flexing the bar at a point intermediate its ends whereby to shift the position of rest of some of said striker-rods relatively to others.

25. In music-playing mechanism, a plurality of actuating elements, a bar comprising hinged sections arranged end to end, a series of striker-rods operable by said elements and each having a connection with said bar, and means for moving one section of the bar independent of the other.

26. In music-playing mechanism, a plurality of actuating elements, a bar-comprising hinged sections arranged end to end, a series of striker-rods operable by said elements, and each having a connection with said bar, and means for moving the adjacent hinged ends of said bar-sections toward and from the actuating elements.

27. In music-playing mechanism, a plurality of actuating elements, a bar comprising hinged sections, a series of striker-rods operable by said elements and each passing through an aperture in said bar, and means for moving one section of the bar independently of the other.

28. In music-playing mechanism, a plurality of actuating elements, a bar comprising hinged sections, a series of striker-rods operable by said elements and each passing through an aperture in said bar, and means for moving one section of the bar independently of and at an angle to the other.

29. In music-playing mechanism, a plurality of actuating elements, a bar comprising hinged sections, a series of striker-rods operable by said elements and each passing through an aperture in said bar, and means for moving the inner hinged ends of said bar-sections to and from the actuating elements.

30. In music-playing mechanism, the combination with a rotary drum, of a series of friction-shoes adapted to be thrown into and out of contact with said drum, a bar comprising independently-movable hinged sections arranged end to end, a series of striker-rods operable by the shoes and each passing through an aperture in said bar, and means for moving one section of the bar independently of the other to change the position of the striker-rods passing through said section relatively to the shoes.

31. In music-playing mechanism, the combination with a rotary drum, of a series of friction-shoes adapted to be thrown into and out of contact with the drum, a sectional bar, a series of striker-rods operable by the shoes and each passing through an aperture in the said sectional bar, separate rock-shafts having independent connections with said sections of the bar, and means for rocking one of said shafts independent of the others to move a section of the bar and the striker-rods carried thereby relatively to the shoes.

32. In music-playing mechanism, the combination with a rotary drum, of a series of pivoted friction-shoes adapted to be thrown into and out of contact with said drum, a bodily-movable bar, a series of striker-rods operable by and having their lower ends in contact with the shoes and each passing through an aperture in said bar, and means for moving one end of the bar and the lower end of the striker-rods toward or from the pivoted points of the shoes.

33. In music-playing mechanism the combination with a rotary drum, of a series of pivoted friction-shoes adapted to be thrown into and out of contact with the drum, a bodily-movable bar, a series of striker-rods operable by and having their lower ends in contact with the shoes and each passing through an aperture in said bar and means under the control of the operator for moving either end of the bar to shift the position of the lower ends of the striker-rods relatively to the pivotal point of the shoes.

34. In music-playing mechanism, the combination with a rotary drum, of a series of pivoted friction-shoes adapted to be thrown into and out of contact with the drum, a bodily-movable bar, a series of striker-rods operable by and having their lower ends in contact with the shoes and each passing through an aperture in said bar, rock-shafts having connections with said bar and means for rocking said shafts to move the bar and the lower ends of the striker-rods toward and from the pivotal point of the shoes.

35. A musical instrument having a keyboard, a plurality of actuating elements, a series of strikers operated thereby, a sectional bar having a connection with said strikers whereby the latter may be moved relatively to the actuating elements, and separate extensible arms, each having connection with the bar-sections, said arms being attached to the under side of the keyboard in such manner that they may be drawn out beyond the forward edge of the keyboard and may be pushed back under the same.

36. In combination with a piano having a music-playing attachment, comprising a plurality of actuating elements, a series of strikers operated thereby and adapted to ac-

tuate the keys of the piano, a sectional bar having a connection with said strikers whereby the later may be moved relatively to the actuating elements, separate extensible arms each having a connection with the bar, a key bearing a suitable character as described, on the outer end of each arm, said arms being slidably mounted under the keyboard of the piano in such manner that they may be drawn out to expose the keys or pushed back under the keyboard.

37. In music-playing mechanism, the combination with a plurality of actuating elements, of a series of strikers operated thereby, a sectional bar having a connection with said strikers whereby the latter may be moved relatively to the actuating elements, separate arms for operating the bar-sections, a device for simultaneously actuating all of said arms, and means under the control of the performer for operating said device.

38. In music-playing mechanism, the combination with a plurality of actuating elements, of a series of strikers operated thereby, a sectional bar having a connection with said strikers whereby the latter may be moved relatively to the actuating elements, separate arms having connections with the bar-sections, a device for simultaneously moving all said arms, and means under the control of the operator for actuating said device to depress and elevate the arms to different extents.

39. In music-playing mechanism, the combination with the sound-producing devices, of an expression-controlling means to vary to different extents the action of the individual devices, said means comprising a flexible bar arranged parallel to the sound-producing devices, and a manually-operable controlling device having an operative connection with said bar and when operated flexing the bar intermediate its ends.

40. A piano having a self-playing attachment, for actuating the piano-hammers, and an expression-controlling device for varying to different extents the action of adjacent hammers, said device comprising a flexible bar arranged transversely with respect to the piano-strings and normally parallel with their plane, separate levers for actuating different portions of said flexible bar, and means under the control of the performer for engaging and depressing all of said levers simultaneously whereby to move the bar bodily.

41. A piano having a self-playing attachment, and an expression-controlling device for varying the action of the piano-hammers, said device embodying a flexible bar arranged transversely with respect to the piano-strings, separate manually-controlled operating devices each having a connection with said flexible bar at a different point whereby the bar may be flexed, and a manually-operable element for actuating the said separate operating devices in unison whereby to move the flexible bar bodily in parallel planes.

42. The combination with the sound-producing elements of a musical instrument, of separate operating devices for varying the action of some of said elements independent of others, a rocker-arm overhanging all of said operating devices, and means under the control of the performer for rocking said arm to cause the latter to engage and simultaneously actuate all of said operating devices.

43. In automatic music-playing mechanism, the combination with the sound-producing devices, of two alined bar-sections connected to control the action of said devices, two rocker-arms each having a connection with the outer end of a bar-section, a third rocker-arm having a connection with the adjacent ends of the bar-sections, and a separate extensible lever having a connection with each arm, said levers being under the control of the performer.

44. The combination with the sound-producing devices of a musical instrument, of two alined bar-sections connected to control the action of said devices, two rocker-arms each having a connection with the outer ends of the bar-sections, a third rocker-arm having a connection with the adjacent ends of the bar-sections, and separate means under the control of the performer for independently actuating said rocker-arms.

45. Expression-controlling mechanism of the character described, comprising a flexible bar, separate manually-operable devices connected respectively to opposite ends of said bar and a third similar device operatively connected to the bar at a point intermediate its ends, for the purpose specified.

46. Expression-controlling mechanism of the character described, comprising flexibly-connected bar-sections arranged end to end, a separate manually-operable device having a connection with the free end of each bar-section, and a similar device operatively connected to the flexibly-united ends of the bar-sections.

47. Expression-controlling mechanism of the character described, comprising two pivotally-supported bar-sections arranged end to end and hinged together, a manually-operable device operatively connected to the adjacent hinged ends of the bar-sections whereby the latter may be swung on their pivots, and a similar device operably connected to the free end of each bar-section.

48. In combination with a piano, means coöperating with the sound-producing devices to produce different effects in the tone volume of individual adjacent devices throughout the whole range thereof, or separately in the bass, middle or treble ranges, and three depressible finger-keys operatively connected at different points to said means and repre-

senting respectively the bass, middle and treble ranges, said finger-keys being located at the front of the piano-keyboard and arranged closely adjacent to each other.

49. An automatically-operated piano having a keyboard, and the sound-producing devices, and an expression-controlling means to vary to different extents the action of the individual devices, said means comprising a flexible bar arranged parallel to the sound-producing devices, a plurality of arms pivoted to the under side of the piano-keyboard and having operative connections with said bar and when operated flexing the bar intermediate its ends, and a manually-operable extension member slidably connected to each arm, the arrangement being such that the free ends of the said extension members may be drawn out beyond the forward edge of the keyboard and may be pushed back under the same.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

GEORGE HOWLETT DAVIS.

Witnesses:

BURR N. EDWARDS,

J. GRANVILLE MEYERS, Jr.