No. 692,208. Patented Jan. 28, 1902.

J. McTAMMANY.

MECHANICAL MUSICAL INSTRUMENT.

(Application filed Aug. 4, 1898.)

(No Model.) 3 Sheets—Sheet 1.

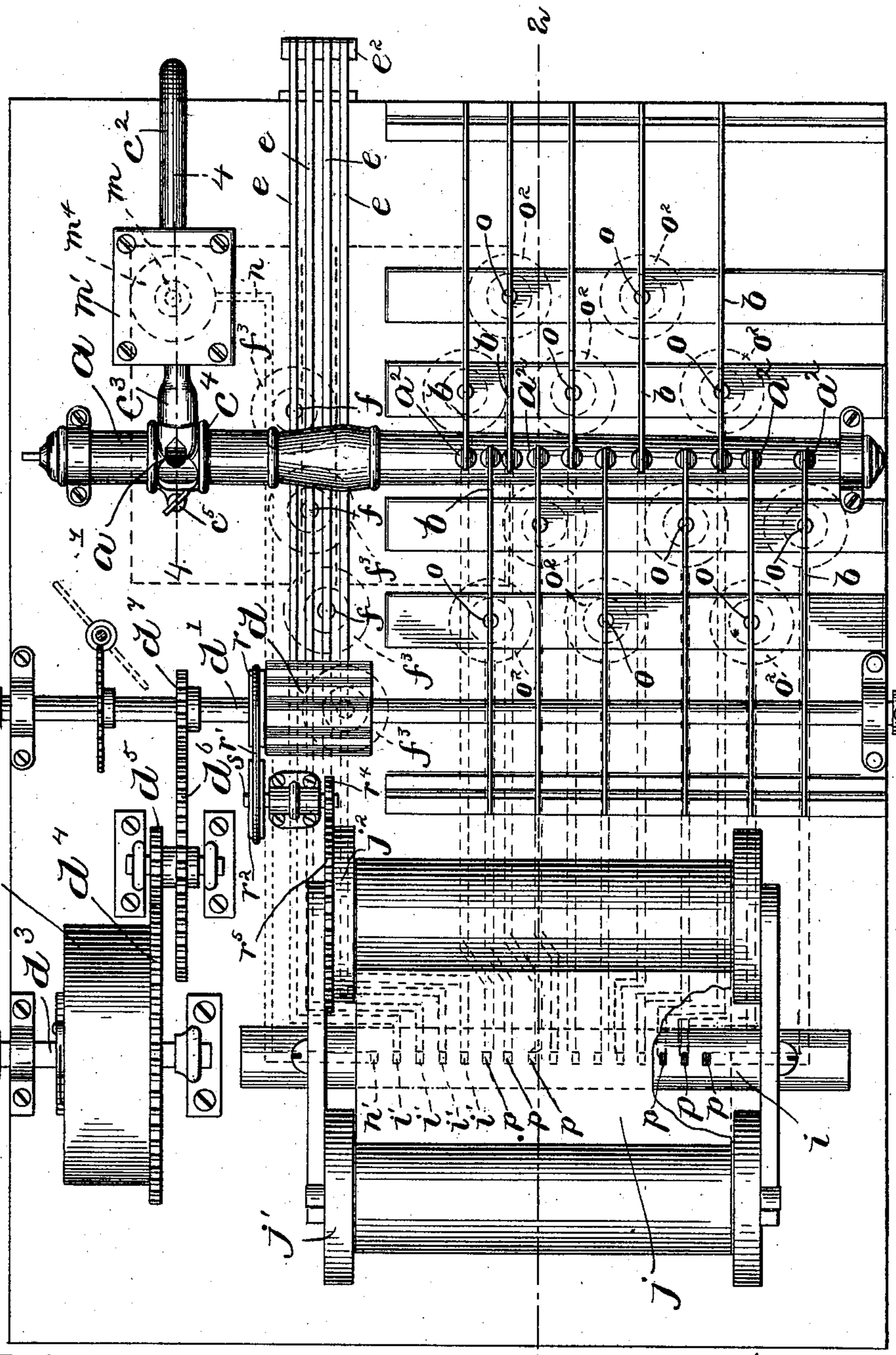

FIG. 1.

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(No Model.) 3 Sheets—Sheet 2.

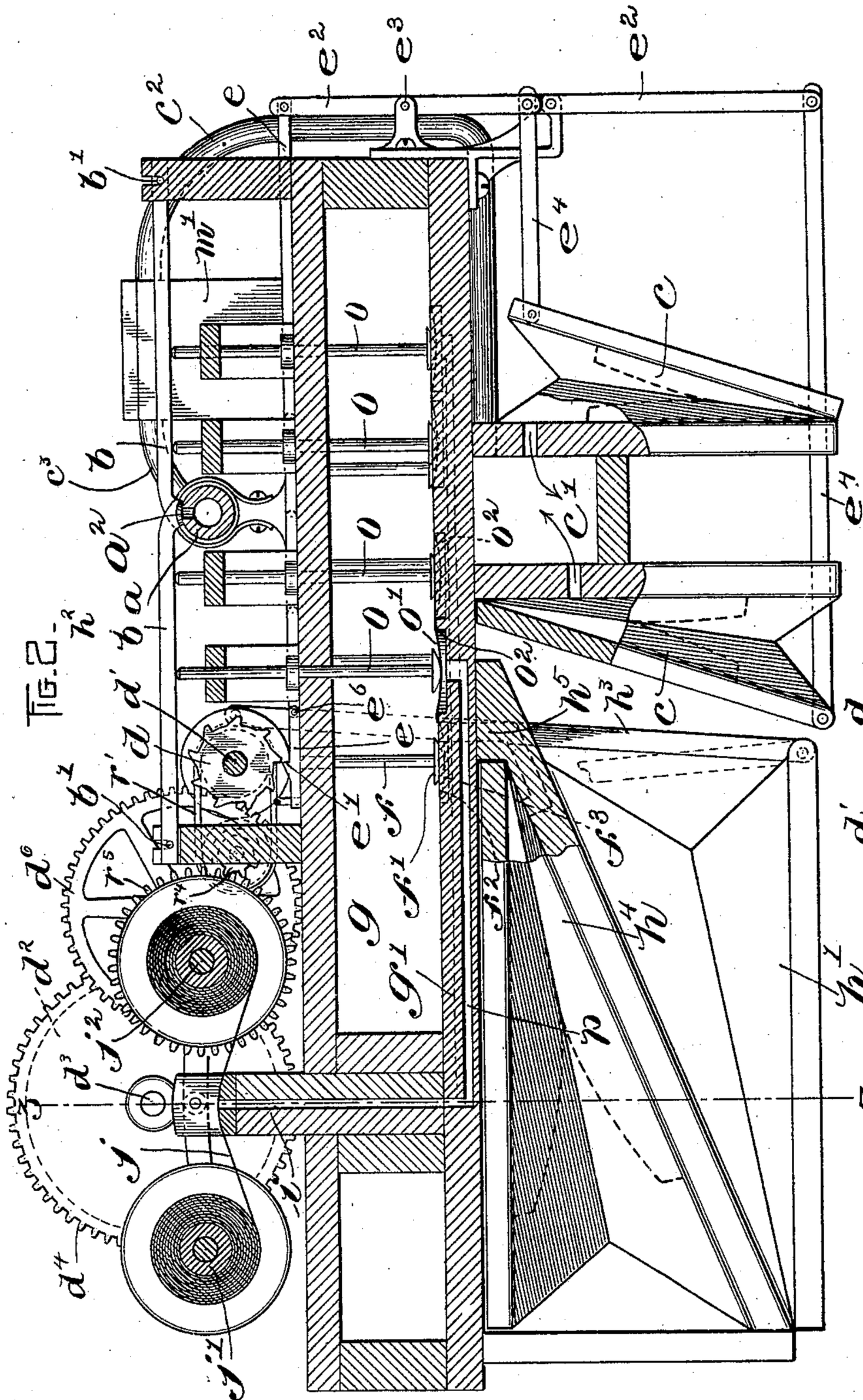

FIG. 2.

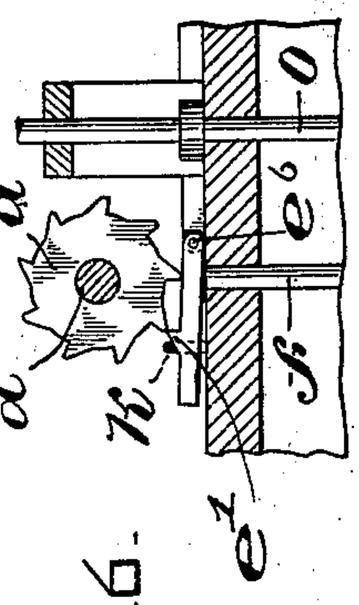

FIG. 6.

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(No Model.) 3 Sheets—Sheet 3.

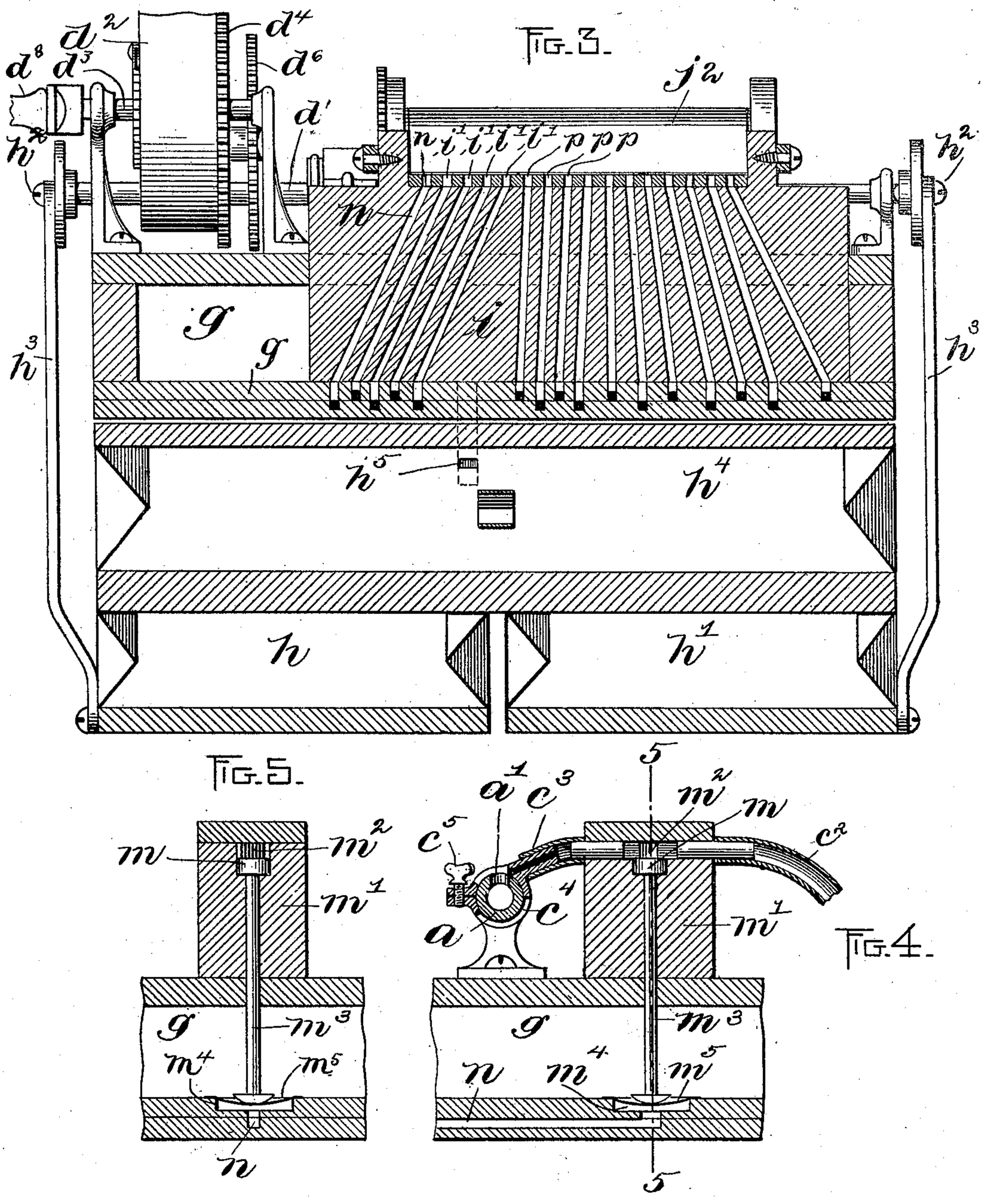
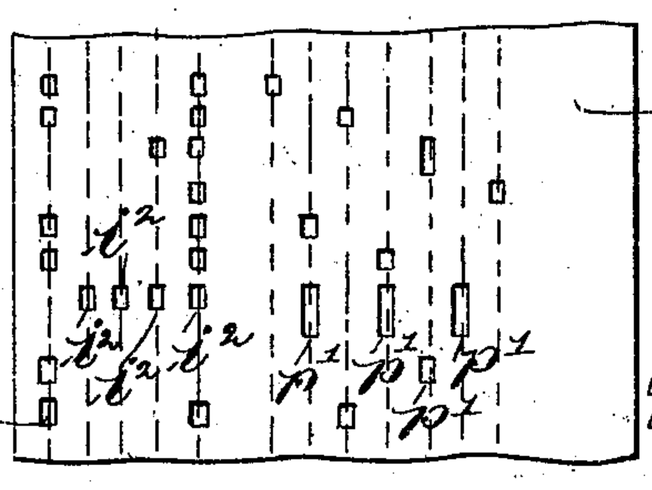


FIG. 3.

FIG. 5.

FIG. 4.

FIG 7



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UNITED STATES PATENT OFFICE.

JOHN McTAMMANY, OF SPENCER, MASSACHUSETTS.

MECHANICAL MUSICAL INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 692,208, dated January 28, 1902.

Application filed August 4, 1898. Serial No. 687,688. (No model.)

To all whom it may concern:

Be it known that I, JOHN McTAMMANY, of Spencer, in the county of Worcester and State of Massachusetts, have invented certain new and useful Improvements in Mechanical Musical Instruments, of which the following is a specification.

This invention relates to the automatic operation of wind musical instruments—such as flutes, piccolos, flageolets, clarinets, cornets, and each and all of the wind instruments heretofore performed on by the human lungs, lips, and fingers. While specifying certain instruments to which I regard my invention as more especially applicable, nevertheless many of its features are sufficiently comprehensive to apply to other automatic musical instruments. Consequently I do not limit myself to its application to the instruments above mentioned.

In order to illustrate the application of my invention, I have shown a flute or piccolo which differs from the ordinary instrument in that the usual keys are dispensed with and the holes are in a single straight line instead of being distributed in the ordinary way to suit the arrangement of the fingers of the human hand, the said holes being eleven in number and taking the place of the normally open finger-holes and the key-controlled holes of an ordinary flute. There are six open finger-holes and six key-controlled holes in an ordinary flute; but as two of the latter are used interchangeably to produce the same effect there are only eleven holes which modify the tone. These holes, as already stated, I arrange in a straight row which extends longitudinally of the flute. Each hole is controlled by a valve which acts as a substitute for a human finger in opening and closing the holes. Hence the said valves are hereinafter referred to as "fingers." They are operated automatically in accordance with the arrangement of perforations in a perforated music-sheet, hereinafter described. A blowing mechanism, the operation of which is also governed by the perforated music-sheet, is also employed, said mechanism including a nozzle which presents a blast of air to the usual mouthpiece of the flute. To produce the lower tone D of the scale, all the eleven holes are closed. D-sharp is produced by opening the first hole, leaving the others closed. E-natural is produced by opening the first and second holes, and in like manner all the other tones can be produced by opening and closing the holes. It must be borne in mind that the keys are employed and the holes arranged out of alinement in the common flute to enable the human fingers to compass or control the necessary number of holes; but there being no limit to the combinations that can be made by a music-sheet it follows that it may be likened to a musician having a finger for every hole necessary, the fingers being arranged to cover the holes when the latter are arranged in a single straight row. The flute has several special characteristics that must be dealt with in order to produce a satisfactory automatic instrument. In the first place, a difference in tone may be produced by increasing or diminishing the amount of air entering the mouthpiece, and another difference may be produced in the pitch of tones by the manipulation of the finger-holes of the instruments or by both agencies combined. Still another difference may be produced by obstructing the conduit that presents the blast of air to the mouthpiece, this being ordinarily accomplished by the tongue of the operator and known as "tonguing."

My invention has mechanical provisions for the accomplishment of the above-mentioned results and will now be described in detail, and pointed out in the claims.

Of the accompanying drawings, forming a part of this specification, Figure 1 represents a plan view of a mechanical musical instrument embodying my invention. Fig. 2 represents a section on line 2 2 of Fig. 1. Fig. 3 represents a section on line 3 3 of Fig. 2. Fig. 4 represents a section on line 4 4 of Fig. 1. Fig. 5 represents a section on line 5 5 of Fig. 4. Fig. 6 represents a view of parts of the mechanism. Fig. 7 represents a view of a part of the perforated sheet.

The same letters of reference indicate the same parts in all the figures.

In the drawings, a represents a flute which has the usual mouthpiece a', against which a blast of air is directed, and a series of eleven holes a^2, corresponding to the usual key and finger controlled holes of the flute. The holes

a^2 are arranged in a single straight row, as shown in Fig. 1. b b represent the fingers which open and close the said holes, each finger being a lever fulcrumed at one end at b' and having at its outer end a suitable face or washer of yielding material adapted to tightly close the corresponding hole a^2 when the finger is depressed thereon. A blast of air is supplied to the mouthpiece by a blowing mechanism which comprises a plurality of pressure-bellows c, which are preferably four in number, a wind-chest c', which receives air from all the bellows, a tube or conduit c^2, preferably flexible, extending from the wind-chest to a point adjacent to the mouthpiece, and a nozzle c^3 at the outer end of the conduit c^2, said nozzle being adjustably connected with the flute and adapted to deliver a blast of air in appropriate relation to the mouthpiece to sound or blow the flute in the same manner that it is blown by the lungs and lips of a human being. The nozzle c^3 is provided with a compressible clamp c^4, which surrounds the flute and is tightened and loosened by a set-screw c^5, so that the nozzle can be readily adjusted relatively to the mouthpiece a'. When the clamp is loosened, it can be turned on the flute to vary the position of the air-delivering end of the nozzle relatively to the mouthpiece a'. The pressure-bellows c are operated by a continuously-driven motor, which includes an elongated spur or ratchet-wheel d, attached to a shaft d', which is journaled in bearings on the supporting-frame, a driving-spring engaged at one end with a barrel d^2, which is mounted loosely upon a shaft d^3, with which the other end of the spring is engaged, a gear-wheel d^4, affixed to the barrel, and gearing d^5 d^6 d^7, connecting the wheel d^4 with the shaft d'. Suitable provisions are made for winding the motor-spring, the same including a crank d^8 on the shaft d^3, and a ratchet-and-pawl connection between the said shaft and the barrel d^2. Each pressure-bellows c is connected with the spur-wheel d of the motor by a normally inoperative coupling device, which comprises a longitudinally-movable bar e, having a tooth or projection e', adapted to engage the teeth of the spur-wheel d, said projection e' being normally out of the path of the teeth of the spur-wheel, as shown in Fig. 2, a lever e^2, pivoted to one end of the sliding rod e and fulcrumed at e^3 to a fixed support, and a rod or link e^4, connecting the lever e^2 with the bellows. Said coupling device is made operative to connect the bellows c with the spur-wheel d by the following means: Under the tooth or projection e' of each of the sliding bars e is a vertical rod or spindle f, having at its lower end a button f', which bears on a diaphragm f^2, which covers a cell or depression f^3 in one of the walls g' of a suction-box g. The depression f^3, diaphragm f^2, and rod f constitute a well-known form of pneumatic operating mechanism and will be hereinafter referred to as a "pneumatic."

h h' represent suction-bellows, which communicate with and draw air from the suction-box g, said bellows being operated by the motor above described through wrist-pins h^2, attached to disks on the shaft d', and rods h^3, connecting said wrist-pins with the bellows h h'. The communication of the bellows h h' with the suction-box is through an intermediate bellows h^4, which communicates with the suction-box through a channel h^5.

i represents a channel-board which projects above the suction-box g and has a series of channels i', four in number, each channel communicating with one of the depressions f^3, covered by the diaphragms f^2, there being four of these depressions and diaphragms and four of the corresponding rods f, one for each of the coupling devices which connect the motor with the pressure-bellows c.

j represents the perforated music-sheet, which is mounted on a supply-roll j' and a winding-roll j^2 and passes from one roll to the other over the channel-board i, as shown in Fig. 2. The sheet j has perforations which are arranged to admit air to the channels i', said perforations being arranged on the four lines i^2, (shown in Fig. 7,) the arrangement of the perforations depending upon the composition to be played. When a perforation on one of the lines i^2 coincides with the corresponding channel i', air is admitted to the cell or cavity f^3, and thus permits the corresponding diaphragm f^2 to be raised by the atmospheric pressure caused by the rarefaction of air in the suction-box g, the diaphragm being thus caused to raise the rod f resting on it, and thus raise the bar e resting on said rod, so that the projection e' on said bar is engaged by one of the teeth of the spur-wheel d. The rotation of the spur-wheel moves the bar e endwise and imparts motion through the lever e^2 and connecting-rod e^4 to the corresponding pressure-bellows, one bellows being operated singly or more than one simultaneously, according to the arrangement of perforations on the lines i^2. When a channel i' is obstructed by the sheet j, air is cut off from the depression f^2 under the diaphragm f', and the weight of the bar e and rod f causes the diaphragm to sink into the cavity f^3, the projection e' being thus disconnected from the spur-wheel. Each cavity has a leak or small vent to allow the escape of the contained air when the diaphragm sinks. I prefer to joint the bar e at e^6, so that only a small portion of the bar has to be raised by the rod f, as indicated in Fig. 6. A fixed knock-off device k, Fig. 6, is arranged to strike the beveled side of the projection e' and force the same out of engagement with the tooth of the wheel d after the rod e has been sufficiently moved by said tooth.

There are three registers or degrees of pitch to the flute, or, in other words, there can be three different tones produced by simply varying the pressure of the air at the mouth-

piece. Two of the pressure-bellows *c*, acting alternately, will produce the lower or normal pitch, commonly known as the "lower register," which includes all the tones from lower D, as represented by D below middle C. The addition of a third bellows will give a higher or medium tone, known as the "middle register," while the addition of a fourth bellows will produce the highest tone of the upper register. It will be seen, therefore, that by the means described I have provided for the different pressures of air that are produced by the action of the lungs when the flute is played in the ordinary manner. I have also provided means for obstructing or cutting off the blast of air at the nozzle c^3, thus performing the operation of tonguing the flute. To this end I provide a cut-off valve *m*, Figs. 4 and 5, which is movable in a chamber m^2, formed in a fixed block m', which contains a part of the blast-conduit leading to the mouthpiece c^3, said chamber being a part of the said conduit. The valve *m* is attached to a rod m^3, forming a part of a pneumatic, such as that above described, the depression m^4 under the diaphragm m^5 of said pneumatic being connected with a channel *n*, extending through the wall g' of the suction-box and through the channel-board *i*. The music-sheet *j* has perforations arranged on a line n', said perforations moving over the channel *n* and admitting air to the cavity m^4 to raise the valve *m*. When the valve *m* is raised, it cuts off the air from the nozzle c^3, either wholly or in part, thus producing the tonguing effect.

The fingers *b* are operated by a series of pneumatics similar to those above described, each of said pneumatics comprising a rod *o*, bearing against one of the fingers *b*, and a diaphragm o', supporting said rod. Cavities o^2 under the diaphragms o' are connected with channels *p* in the wall g' and channel-board *i*, there being as many channels *p* as there are fingers *b*. Consequently in the present case there are eleven of the channels *p*. The music-sheet is provided with perforations arranged in a series of eleven lines p', said perforations admitting air to the channels *p*, and thus causing the pneumatics connected with said channels to raise and release the fingers *b* in accordance with the arrangement of perforations in the sheet.

I do not limit myself to the arrangement and construction of parts here shown and described and the same may be variously modified without departing from the spirit of my invention.

The winding-roll j^2 is rotated to move the sheet *j* over the channel-board by a pulley *r* on the shaft d', a belt r' connecting said pulley with a pulley r^2 on an intermediate shaft *s*, and gears r^4 r^5 connecting the shaft *s* with the roll j^2.

The series of rows of perforations p' in the sheet *j*, which cause the actuation of the fingers, may be termed "fingering" perforations. The series of rows of perforations i^2, which cause the actuation of the bellows *c*, supplying air to the mouthpiece, may be called "blowing" perforations, while the single row of perforations n', which operate the tonguing-valve *m*, may be called "tonguing" perforations.

Having thus explained the nature of my invention and described a way of constructing and using the same, although without having attempted to set forth all the forms in which it may be embodied or all the modes of its use, I declare that what I claim is—

1. A mechanical musical instrument comprising a stationary sound-producing body having a blowing-nozzle, a mouthpiece, and finger-holes, an automatic fingering mechanism, and a blowing mechanism comprising a plurality of air-forcing devices connected with the blowing-nozzle, a motor normally disconnected from said air-forcing devices, and means for automatically connecting one or more of the air-forcing devices with the motor.

2. In a mechanical musical instrument, a blowing mechanism comprising an air-forcing device, a motor normally disconnected therefrom, and automatic means for connecting the motor with the air-forcing device and disconnecting it therefrom.

3. In a mechanical musical instrument, a blowing mechanism comprising an air-delivering conduit, a series of air-forcing devices connected therewith, a motor common to all the air-forcing devices, a series of normally inoperative connecting or coupling devices between the air-forcing devices and the motor, pneumatically-controlled actuators for said coupling devices, and a perforated sheet adapted to control said actuators.

4. In a mechanical musical instrument, the combination of an air-pressure mechanism to form an air-blast, a mechanical motor therefor, a series of sound-regulating fingers, an air-exhaust mechanism, and devices operated by the exhaust mechanism to make the air-pressure mechanism operative by its motor and to operate the fingers.

5. In a mechanical musical instrument, the combination of a blowing mechanism comprising pressure-bellows and a motor therefor, the said bellows being normally disconnected from the motor, normally inoperative coupling devices between the bellows and motor, a series of fingers formed to close sound-regulating holes, a series of pneumatics engaged with the said coupling devices, another series of pneumatics engaged with the fingers, and air-exhausting means for operating said pneumatics.

6. A flute or its equivalent having an air-delivering nozzle adjustably mounted relatively to the mouthpiece of the flute.

7. The combination of a stationary flute having a mouthpiece and a series of holes representing the chromatic scale, a music-sheet having rows of primary or fingering perfora-

tions corresponding in number with the holes of the flute, and a series of rows of secondary or blowing perforations, a series of pnuematics and fingers controlled by the primary perforations, and a series of air-forcing devices controlled by the secondary perforations, for supplying air to the mouthpiece.

8. A mechanical musical instrument, comprising a series of pneumatically-operated fingers, a series of pressure bellows or feeders to force air to a mouthpiece, a series of windways controlling the fingers, a series of windways controlling the said bellows, and a single channel-board common to both series of windways.

In testimony whereof I have affixed my signature in presence of two witnesses.

JOHN McTAMMANY.

Witnesses:
C. F. BROWN,
A. D. HARRISON.