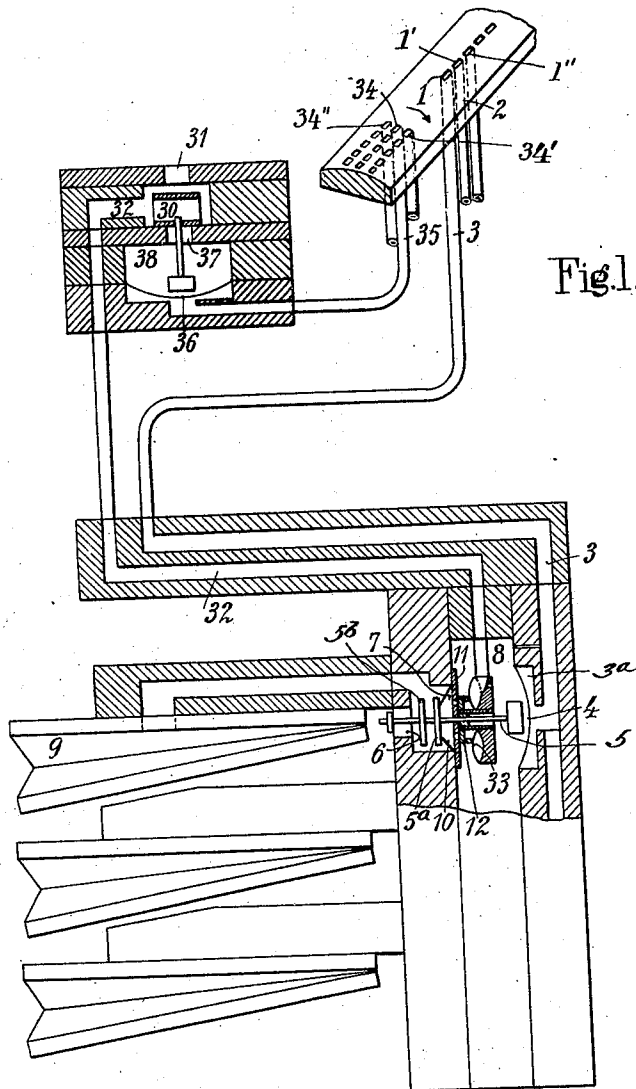


1,055,469.

Patented Mar. 11, 1913.

3 SHEETS--SHEET 1.



Witnesses:
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M. M. KASTNER & C. KATZ.
 EXPRESSION DEVICE FOR AUTOMATIC PIANOS AND SIMILAR MUSICAL INSTRUMENTS.
 APPLICATION FILED AUG. 2, 1910.

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3 SHEETS—SHEET 2.

1,055,469.

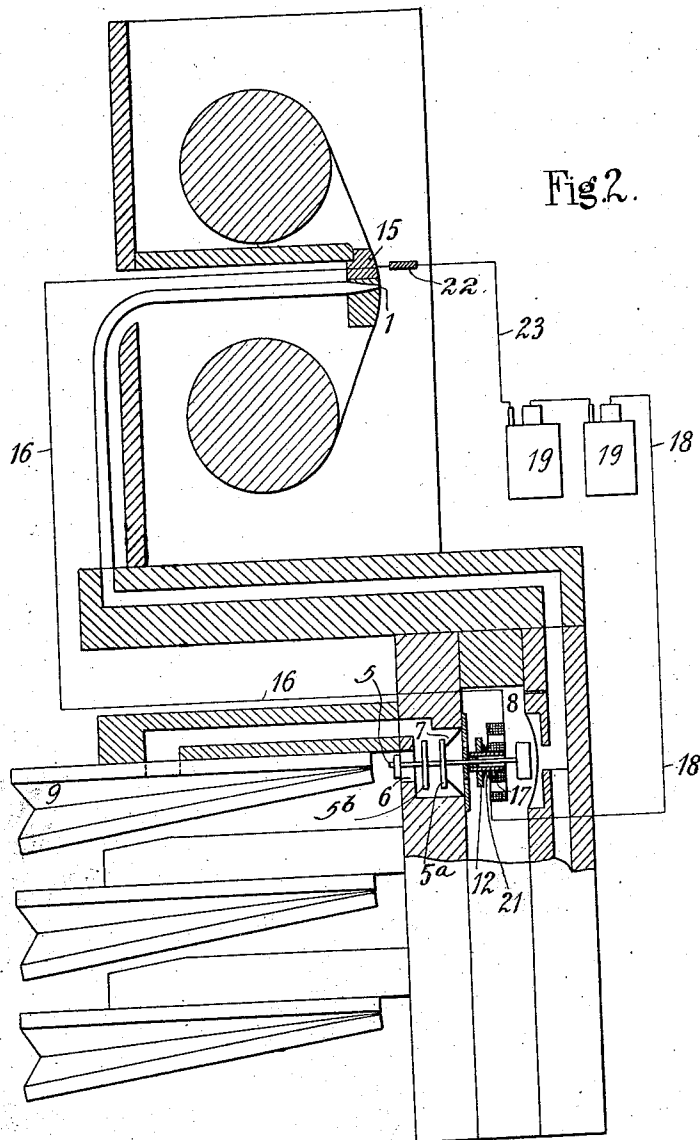


Fig. 2.

Witnesses.

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3 SHEETS-SHEET 3.

1,055,469.

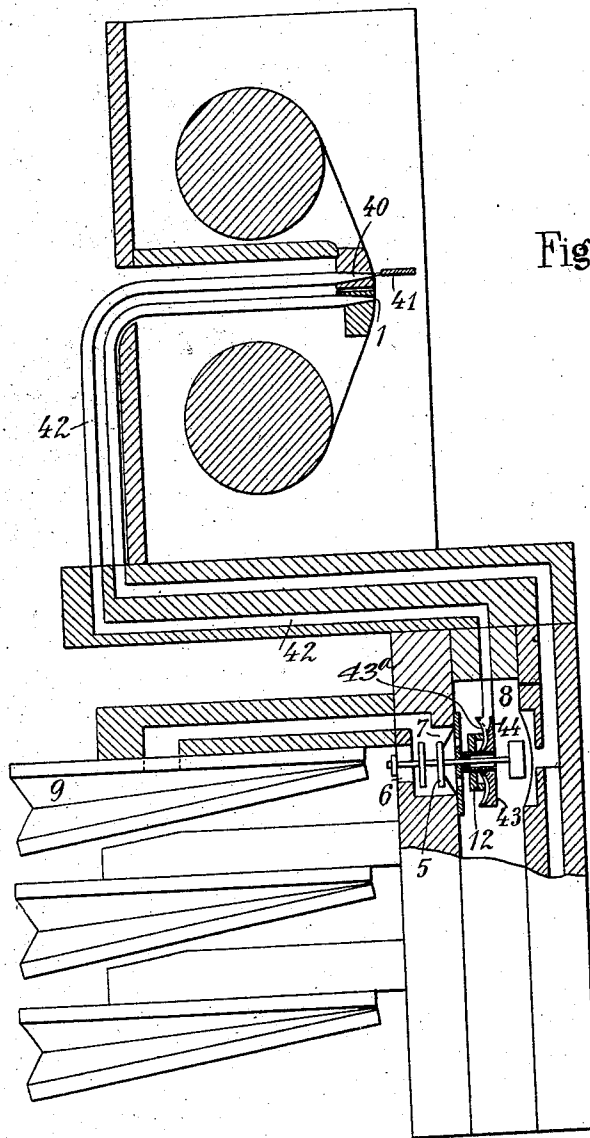


Fig. 3.

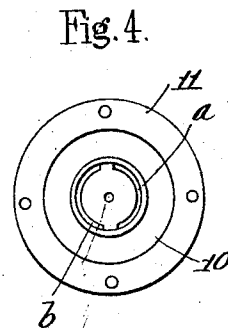


Fig. 4.

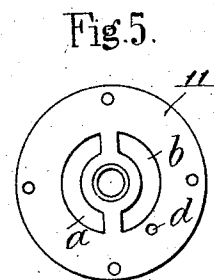


Fig. 5.

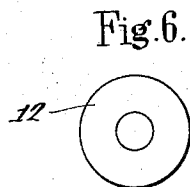


Fig. 6.

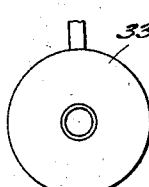


Fig. 7.

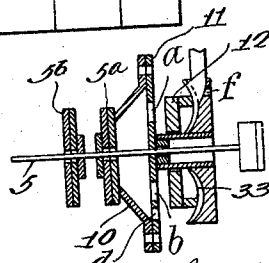


Fig. 8.

Witnesses.

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UNITED STATES PATENT OFFICE.

MACARIUS MAXIMILIAN KASTNER AND CONRAD KATZ, OF LONDON, ENGLAND; SAID
KATZ ASSIGNOR TO SAID KASTNER.

EXPRESSION DEVICE FOR AUTOMATIC PIANOS AND SIMILAR MUSICAL INSTRUMENTS.

1,055,469.

Specification of Letters Patent.

Patented Mar. 11, 1913.

Application filed August 2, 1910. Serial No. 575,076.

To all whom it may concern:

Be it known that we, MACARIUS MAXIMILIAN KASTNER and CONRAD KATZ, both citizens of Germany, and residents of London, England, have jointly invented a new and useful Expression Device for Automatic Pianos and Similar Musical Instruments, of which the following is a specification.

This invention relates to an expression device of novel construction by which any desired note may be emphasized either automatically or manually by increasing the quantity of air exhausted from the bellows.

Our device requires a minimal space and may be readily applied to existing piano players, without necessitating extensive reconstructions.

In the accompanying drawing: Figure 1 is a longitudinal section of our improved expression device showing it to be pneumatically actuated; Fig. 2 a similar section of a modification, showing it electrically actuated; Fig. 3 a similar section of a further modification, showing it manually actuated; Fig. 4 a front view of the valve seat; Fig. 5 a rear view thereof; Fig. 6 a detail of the sound increasing valve-disk; Fig. 7 a detail of the diaphragm controlling said disk, and Fig. 8 a longitudinal section through the valve and cooperating parts.

Each tone producing perforation 1 of a tracker bar 2 is by a duct 3 connected to a chamber 3^a, while an opposed vacuum chamber 8 is separated from chamber 3^a by a diaphragm 4. The latter is adapted to engage a headed stem 5 carrying a pair of valve disks 5^a and 5^b of which disk 5^a normally rests against a coniform shell 10 carried by a stationary circular plate 11, so that a cup is formed on the plate by the shell. Plate 11 is apertured for the passage of valve stem 5 and is provided with a port *d* that establishes permanent communication between chamber 8 and the cup formed by the parts 10, 11. Disk 5^b is normally raised off its seat, so as to open a passage 6 which connects the interior of the hammer-actuating bellows 9 with the atmosphere. If a

perforation 1 is uncovered by a corresponding perforation of the music sheet, air is admitted into chamber 3^a so that diaphragm 4 will advance stem 5 to close passage 6 and open a passage 7 which connects the interior of shell 10 with bellows 9 to collapse the latter and sound the desired tone.

In addition to port *d*, the area of which is such as to cause the sounding of a comparatively soft tone, plate 11 is provided with a pair of preferably curved vents *a*, *b*, which are also adapted to communicate with the cup thereof and which when opened permit the withdrawal of a large quantity of air from bellows 9, to cause a more powerful collapse of the latter, whereby the desired emphasis of the tone is obtained. Vents *a*, *b* are normally closed by an annular or member disk 12 connected in suitable manner to a diaphragm 33 which when collapsed will open said ports while upon the expansion of the diaphragm, disk 12 will close the ports.

Diaphragms 33 are actuated by means of expression ducts 34 of tracker bar 2, the number of ducts 34 being equal to that of perforations 1. In order not to unduly extend the width of the music roll, ducts 34 are arranged in transverse rows, each row being shown to comprise three ducts. To emphasize a tune, the music sheet is provided in addition to the tone-producing perforation, with a tone-emphasizing perforation, which latter uncovers the corresponding duct 34 of the tracker bar slightly prior to the uncovering of perforation 1, so that vents *a*, *b* are opened before stem 5 is advanced. It is obvious that with the arrangement of ducts 34 in transverse rows, the corresponding tone-emphasizing perforations of the music sheet must either be advanced or set back relatively to the cooperating tone producing perforations, so as to simultaneously open the corresponding tracker bar ducts, whereby in each case the tone emphasizing ducts are uncovered slightly prior to the uncovering of the tone producing ducts. So for instance, if the music sheet travels in the direc-

tion of the arrow (Fig. 1), the tone-emphasizing perforation of the music sheet that uncovers duct 34', must be advanced relatively to the cooperating tone producing perforation that uncovers duct 1', for a distance slightly exceeding the division of the tone emphasizing ducts. In like manner, the tone emphasizing perforation of the music sheet that uncovers duct 34'' must be set back relatively to the cooperating tone producing perforation that uncovers duct 1'' for a distance slightly less than the division of the tone emphasizing ducts. Upon the uncovering of a duct 34, air is admitted into a passage 35, so that a diaphragm 36 will lift a valve 30. In this way, an air inlet 31 is closed and a port 37 is opened, thereby connecting a vacuum chamber 38 with diaphragm 33 through duct 32. Diaphragm 33 is thus retracted together with disk 12 to open vents *a, b*, so that upon the subsequent advance of stem 5, the tone is sounded with full force.

It is obvious that each row of ducts 34 may embrace more than three of such ducts, the condition only being that the coacting tone-producing and tone-emphasizing perforations of the tune sheet are relatively so positioned that a duct 34 is opened slightly in advance of its cooperating perforation 1. The uncovering of the remainder of the ducts of the same row causes but an idle play of disk 12 without sounding any tone.

In Fig. 2 the perforations 34 of tracker bar 2 are replaced by similarly arranged conductive segments 15, said segments being, by wires 16, connected to electromagnets 17 which are in turn, by wires 18, connected to a source of electricity 19. Disks 12 constitute the armatures of electromagnets, springs 21 being interposed between the parts 12, 21. Source of electricity 19 is by wire 23 connected to contact bars 22 arranged in front of segments 15, so that if a properly positioned perforation of the tune sheet causes a contact between a segment 15 and a bar 22, the corresponding disk 12 will be attracted by electromagnet 17 to produce the desired loud tone.

In Fig. 3 segments 15 are replaced by ducts 40 connected by passages 42 with chambers 43 closed by diaphragms 43^a and permanently communicating with vacuum chamber 8 through an aperture 44. In front of ducts 40 are manually shiftable bars 41 adapted to close any selected perforation 40. As soon as such perforation is closed by its bar 41, the air will be withdrawn from chamber 43 and passage 42 to collapse diaphragm 43^a, retract disk 12 and open vents *a, b*, thereby emphasizing the tone desired.

The contact bars and controlling bars should be arranged along the duct bridge, so that the player need only finger one or a

small number of said bars. With electric devices, the contacts may obviously be located at a convenient distance from the instrument, so that if desired a number of players may operate one and the same piano.

It will be seen that the player is able to arbitrarily actuate the expression device, in advance of the striking of the note, and is not limited to simultaneously operate the expression and the sound producing means. The invention may obviously be applied to musical instruments other than pianos, such as automatic violins, etc., and the pneumatics may be operated by compressed air instead of by suction.

We claim:

1. A device of the character described, comprising a hammer actuating bellows, a vacuum chamber, an apertured plate within the chamber and having a plurality of ports, a valve having a stem that passes through the apertured plate and controls communication between the bellows and vacuum chamber, means for actuating the valve, a member adapted to close part of the plate ports, and means for actuating said member.

2. A device of the character described, comprising a hammer actuating bellows, a vacuum chamber, an apertured plate within the chamber and having a plurality of ports, some of which are permanently open while others are adapted to be temporarily closed, a valve having a stem that passes through the apertured plate and controls communication between the bellows and the vacuum chamber, means for actuating the valve, a member adapted to close the last named ports, and means for actuating said member.

3. A device of the character described, comprising a hammer actuating bellows, a vacuum chamber, a shell, a plate connected thereto and provided with a plurality of ports adapted to establish communication between the vacuum chamber and shell, a valve controlling communication between the bellows and shell, means for actuating said valve, a member adapted to close part of the plate-ports, and means for actuating said member.

4. A device of the character described, comprising a hammer actuating bellows, a vacuum chamber, a shell, a plate connected thereto and provided with a central aperture and a plurality of ports adapted to establish communication between the vacuum chamber and shell, a valve having a stem that passes through the plate-aperture and controls communication between the bellows and shell, a member adapted to close part of the plate-ports, and means for actuating said member.

5. A device of the character described, comprising a tracker bar provided with a longitudinal row of player holes and with a

plurality of transverse rows of accentuating
holes, a plurality of hammer actuating bel-
lows, means controlled by each player hole
for collapsing by exhaust the coöperable
5 hammer-actuating bellows, and means con-
trolled by the corresponding accentuating
hole for accelerating said exhaust.

In testimony whereof we have affixed our
signatures in the presence of two witnesses.

MACARIUS MAXIMILIAN KASTNER.
CONRAD KATZ.

Witnesses:

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H. D. JAMESON.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents
Washington, D. C."