

No. 642,564.

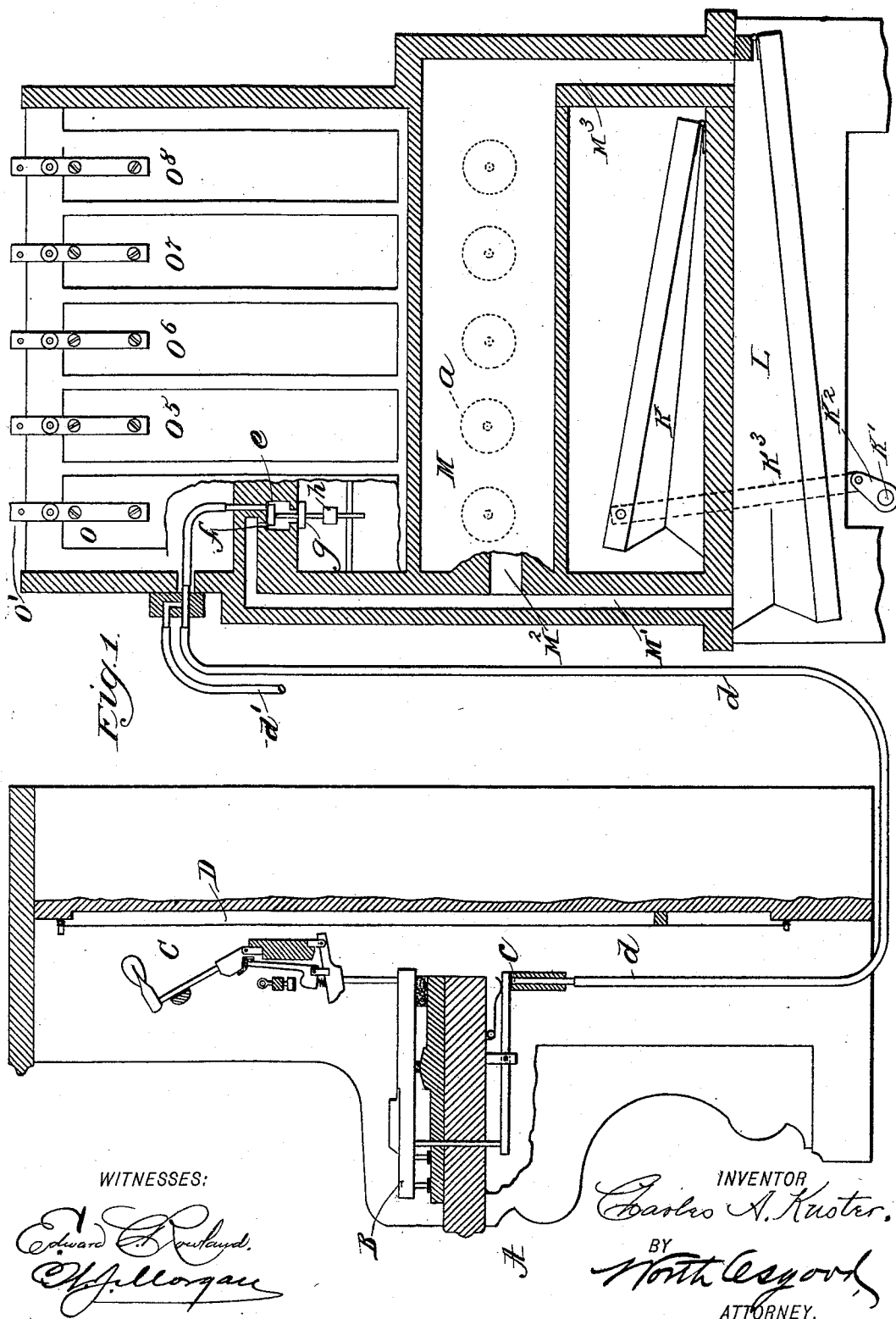
Patented Jan. 30, 1900.

C. A. KUSTER.
MUSIC SHEET PERFORATOR.

(Application filed Sept. 12, 1895.)

(No Model.)

2 Sheets—Sheet 1.



No. 642,564.

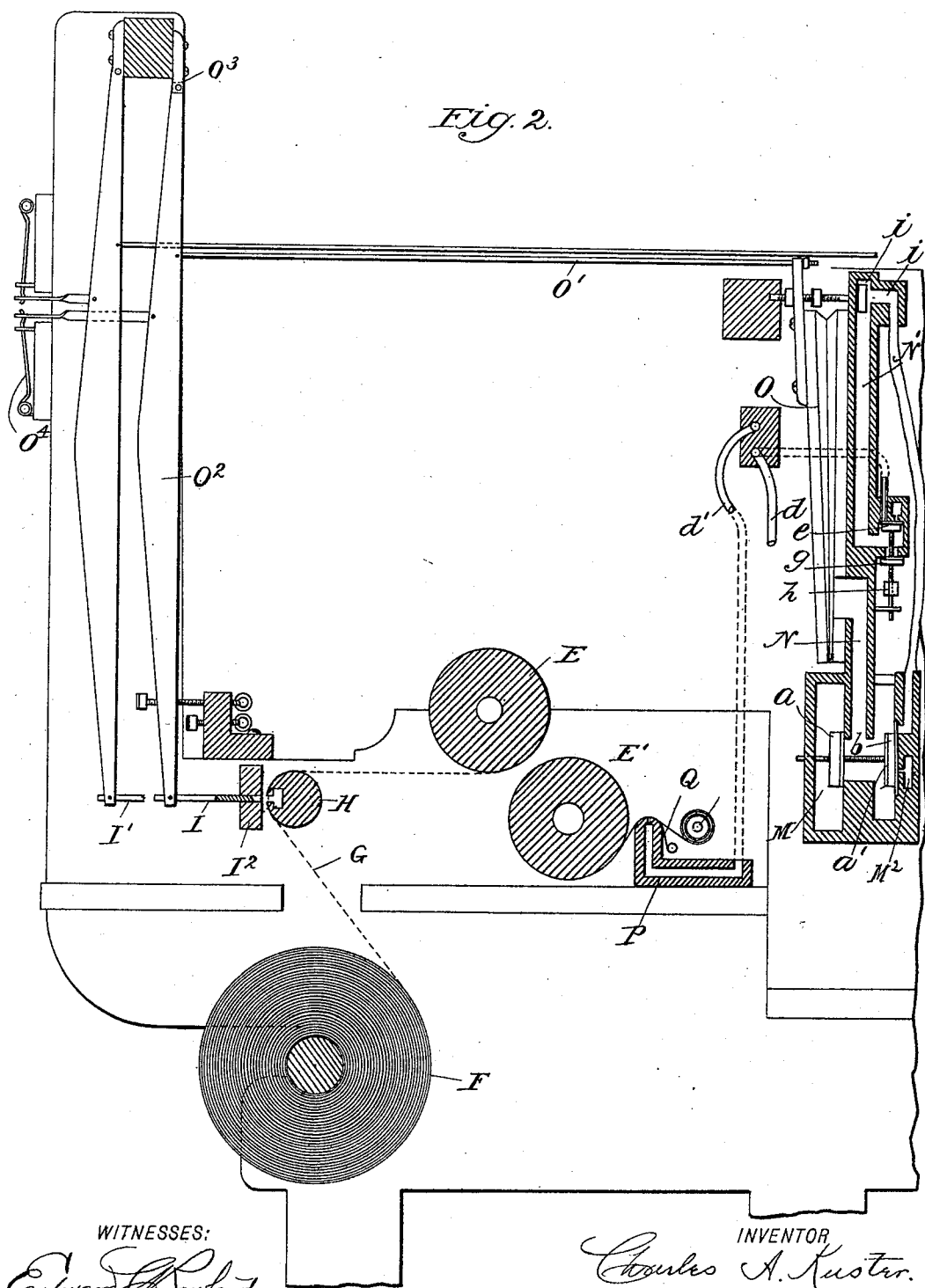
Patented Jan. 30, 1900.

C. A. KUSTER.
MUSIC SHEET PERFORATOR.

(Application filed Sept. 12, 1895.)

(No Model.)

2 Sheets—Sheet 2.



WITNESSES:

Edward C. Rowland,
Ph. J. Morgan

INVENTOR

INVENTOR
Charles A. Kuster.
BY
North Esmond
ATTORNEY.

UNITED STATES PATENT OFFICE.

CHARLES A. KUSTER, OF NEW YORK, N. Y., ASSIGNOR TO THE WELLINGTON MANUFACTURING COMPANY, OF SAME PLACE.

MUSIC-SHEET PERFORATOR.

SPECIFICATION forming part of Letters Patent No. 642,564, dated January 30, 1900.

Application filed September 12, 1895. Serial No. 562,231. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. KUSTER, a citizen of the United States, and a resident of New York, (Brooklyn,) in the county of Kings and State of New York, have invented certain new and useful Improvements in Means for Producing Perforated Music-Sheets, of which the following is a specification.

My invention has relation to the production of perforated paper or other sheets for use in mechanical musical instruments, the object being to produce and reproduce the sheets accurately, rapidly, easily, and economically for future use as well as to establish a faithful record capable of reproduction of any *extempore* playing, practice, or other execution. To accomplish all of this and to secure other and further advantages in the operation and use of the invention my improvements involve new and useful features of invention, as will be herein first fully described, and then pointed out in the claim.

In the drawings, Figure 1 is an end view, partly in elevation and partly in section, indicating a piano and perforator-operating apparatus connected therewith in accordance with my invention; and Fig. 2 is a like view at right angles to Fig. 1, omitting the piano, but indicating the perforating and operating apparatus.

In both figures like letters of reference, wherever they occur, indicate corresponding parts, and in either figure only so much of the apparatus is shown as is necessary for an understanding of the whole, the parts for recording one note being similar to those for recording any other note.

A represents a piano, of which B is one of the finger-keys, C the corresponding hammer, and D the corresponding string, and it should be understood that this stands in the place of any keyed musical instrument like a piano or organ or any other kind of instrument employing finger-keys and may be replaced by such, if desired.

E and F are rolls carrying the sheet G, of paper or other suitable material, which it may be desired to perforate. The sheet is made to travel at a regular or uniform rate of speed and is wound from one roll upon the other, passing over a die H.

I is one of the perforators or punches, and the others are like unto it, I' being another in close proximity, but shown broken away.

As any key, as B, is depressed, the corresponding punch I passes instantly through the sheet G and is immediately retracted, leaving the desired perforation.

I² is simply a guide for the punches, which are arranged in a line, one for each separate note capable of being produced by the keyed instrument.

For the power to operate the punches I employ air-pressure as being most suitable and most rapid and certain in effect, and the finger-keys are each supplied with an easily-acting valve, by opening or closing of which the power is invoked or cut off, the operation of these valves being so easy as not to interfere in any material degree with the proper or usual use of the musical instrument.

K is a pump shown in the form of a bellows, but which may be in any other form, and this is driven by any power-shaft, as K', through the medium of a suitable crank, as K², and a suitable connecting-rod, as K³, or in any other desired way. The pump is employed to exhaust the air from a main chamber, (usually called a "reservoir,") as L, which is also shown in the form of a bellows. The chamber L communicates with chambers, as M, of which there are others similar. The trunk M³ communicates with the chamber M and the trunk M' and the channels M² lead to the diaphragms *e* and *b*. Chambers M are boxes, of suitable material, size, and form, made air-tight, except at the perforations or passages herein referred to. In the boxes which contain the chambers M are valves, as *a* and *a'*, and diaphragms, as *b*, governing ports and passages, as indicated. The valve *a*, as shown, is in the form of a simple disk, and it closes or opens the port adjacent to it. It is shown arranged to be guided by a stem passing through it and connected with another valve *a'*, the latter being also connected with a flexible diaphragm *b*, which covers or extends across the ports adjacent to it and prevents the passage of air operated through it, but is flexible enough to allow the two valves *a* and *a'* to move. The particular construction of these valves and

diaphragms is not essential, so long as they perform the work intended.

Out of the box containing the chamber M leads a passage N from between valves *a* and *a'*, and this passage communicates with the interior of bellows O, upon which is applied a rod O', connected with a lever O², carrying the punch I. For each punch similar connections are made.

The lever O² is hinged, as at O³, and is connected with a light spring, as O⁴, which holds it so that the punch will rest normally out of contact with the sheet G.

The passage N extends down into chamber M, as indicated, and has ports on each side, which are covered or uncovered by the valves *a* and *a'*, the valve *a* when open establishing communication between chamber L and bellows O and the valve *a'* when open admitting exterior air to bellows O. When valve *a* is open, valve *a'* is closed, and vice versa.

Upon the structure which contains the passages N is mounted another, which contains the passages N'; but this particular arrangement is only for convenience and need not be adhered to. The passages N' are usually made of wood and of pieces glued together, but they may be otherwise formed. Out of one part of passage N'—say the upper part—is a passage *i'*, which may be opened or closed by a valve *i*, and from passage *i'* leads a tube to the closing face of diaphragm *b*, and out of another part of passage N'—say the lower part—is a channel leading to an opening to the exterior air, which opening is governed by a valve *g*. The valves *i* and *g* are preferably in the form of simple disks, as indicated.

To set the punches in motion at the proper time and to govern their movements according to the playing, I employ the air-valves and their connections, substantially as above indicated. Upon depression of any finger-key B the connected corresponding valve *c* is opened and admits air to tube *d*, leading to and over a diaphragm *e*, the latter covering the two passages adjacent to it. The air-operated valves being in the position shown, valve *a* is exposed on one face to exhaustion from chamber L and on the other (its seating-face) to ordinary air-pressure, valve *a'* and diaphragm *b* are exposed to ordinary air-pressure on the side toward the channel N and being connected are exposed to exhaustion from chamber L on the other side, diaphragm *e* is exposed to exhaustion on its bearing-face and to the air within the passage N' on the other face, and valve *g*, connected with diaphragm *e*, is exposed to ordinary air-pressure on the exterior face and to the air within passage N' on the other face. The interior of bellows O is open to ordinary air-pressure through channel N and the port therein which valve *a'* will (when shifted from the position shown) close. Exhaustion of air from the bearing-faces of the diaphragms *e*

and *b* permits the air on the other side to force them to their seatings, and they hold the connected valves in the position shown. Valve *i* is held open by the action of the spring O⁴, which opens bellows O, being connected with that bellows, as shown, and is closed by the action of the air on the bellows.

To move the parts, the air-pressure must first be shifted from one side to the other of the valves *a a'* and diaphragms *b* and *e*, when they will move and open the ports desired and close those necessary to be closed.

Supposing the tracker (to be hereinafter referred to) to be closed against admission of air, the air admitted through tube *d* on opening valve *c* vents the space above the diaphragm *e*, and thus allows that diaphragm to drop away from the port *f*, which it otherwise closes under the influence of the exhaustion produced in trunk M' and the consequently greater external air-pressure. Attached to diaphragm *e* is the valve *g*, and this is supplied with a light weight *h*. As soon as the diaphragm *e* is allowed to drop, as above explained, valve *g* opens and admits air from the exterior through channel N' and through passage *i'* and its connected tube to that face of diaphragm *b* which is nearest the port which it closes, allowing said diaphragm to leave its seat, (under the influence of air-pressure,) and thereby to open valve *a*, at the same time closing valve *a'* over its port at its left in Fig. 2. The opening of valve *a* establishes communication between the chamber L and bellows O through trunk M³, chamber M, and passage N. Under the effect of the exhaustion then produced in bellows O (really by external air-pressure) the bellows O is closed instantly upon the unseating of valve *a*, and this carries rod O' and effects the punching of the sheet. Next as soon as bellows O closes valve *i* is carried to its seat, closing the passage *i'*, when the exhaustion through channel M² on the bearing-face of diaphragm *b* permits the air-pressure to force that diaphragm to its seat, which will close valve *a* and open valve *a'*, and then the spring O⁴ retracts the punch and all the parts assume the position shown in Fig. 2, ready to be again moved. The operation of these "pneumatics" is so quick and so simple that the holding down of finger-key B (which keeps valve *c* open) will operate to keep the punch I in rapid motion, thereby cutting instead of one independent hole in sheet G an oblong perforation, as is necessary for reproducing not only the note, but the dwell thereon, of whatever length it may be.

What I term the "pneumatics" are three in number—first, the single valve *i*; second, the valve *g* and diaphragm *e*, which are connected together and move simultaneously, and, third, the two valves *a* and *a'* and diaphragm *b*, also connected together so as to move as one.

The pneumatics arranged and operating to afford continuous rapid movement of the punch in the automatic manner specified is an important feature of my invention.

O⁵ O⁶ O⁷ O⁸ are other bellows like unto the one O, all similarly operated, one for each punch employed.

With the improved machine the player or
5 composer performs upon the instrument in
the usual way, and while manufacturing the
reproducing-sheet accomplishes the desired
work precisely as rapidly and with the same
individuality as he plays and without addi-
10 tional effort or attention. Compared with any
hand-cutting of the stencil or sheet and any
mechanical measurements thereon the superi-
ority of this method will be recognized.

The perforated sheet having been produced
15 it serves as a pattern, by use of which others
can be produced precisely like it.

The finished sheet should be rewound upon
another roll, as E'. It is then carried over a
tracker P, having perforations, one for each
20 note, and supplied with tubes, as d', leading
to the pneumatics, same as tubes d. As the
sheet is wound over the tracker the perfora-
tions in the sheet register with the openings
in the tracker, and they admit air to the pneu-
25 matics in the same manner as did the finger-
keys upon being depressed, and the punches
are operated to produce another sheet, an ex-
act duplicate of the first, and so on, as many
duplicates may be produced as may be de-
30 sired. These sheets are used, as is well known,
for the reproduction of musical pieces in me-
chanically-operated musical instruments of
various kinds.

At Q is an apron, which when the tracker
35 is not in use is thrown over it to prevent ad-
mission of air at the ports therein; otherwise
the pneumatics would not operate.

The machine may be employed to keep a
record of practice and composition, and for
40 this purpose is of value, as will be readily un-
derstood.

The operation of the device for opening or
closing the communication between the air-
exhausting apparatus and the bellows which
45 moves the punch is quite simple. It is plain
from the foregoing that whenever diaphragm
b is vented valve a will open and permit the
required exhaustion to take place through
the port which this valve ordinarily closes.
50 The venting of diaphragm b is not directly

from the valve on the end of the piano-key,
but indirectly by use of another diaphragm
e, which is connected with valve g, the latter
arranged to open or close an air-passage into
the passage N'. When diaphragm e is vent- 55
ed, as it is when the corresponding piano-key
is depressed, it allows valve g to drop and
open the port which it governs, and then dia-
phragm b becomes vented through passage N'.
This passage of air for venting diaphragm b 60
is interrupted by valve i just as soon as bel-
lows O closes, and when it is thus interrupted
the exhaustion will cause the air-pressure to
close the diaphragm on its seat, thus closing
valve g. If the piano-key remains depressed, 65
then diaphragm e is again vented, and it causes
diaphragm b to be vented with the effect of
operating the punch as before described. The
passage N' is nothing but a channel for the
communication of air-pressure from the exte- 70
rior to the seating-face of diaphragm b, and
it is supplied only with the valve g and at-
tachments and valve i for interrupting the
passage, as before explained. The movements
of the diaphragms referred to depend upon 75
the difference in pressure on opposite sides
of them.

Having now fully described my invention,
what I claim as new, and desire to secure by
Letters Patent, is— 80

In an apparatus for punching music-sheets,
the combination of the main chamber and
means for exhausting air therefrom, with
punches and pneumatic means for operating
said punches, air-passages communicating 85
with said chamber and pneumatic means,
valves and diaphragms controlling the air-
passages, and venting means, all arranged
substantially as described whereby the valves
and diaphragms automatically open and close 90
to control the punch-operating means as long
as the venting continues.

Signed at New York, in the county of New
York and State of New York, this 3d day of
September, A. D. 1895.

CHAS. A. KUSTER.

Witnesses:

W. J. MORGAN,
WORTH OSGOOD.