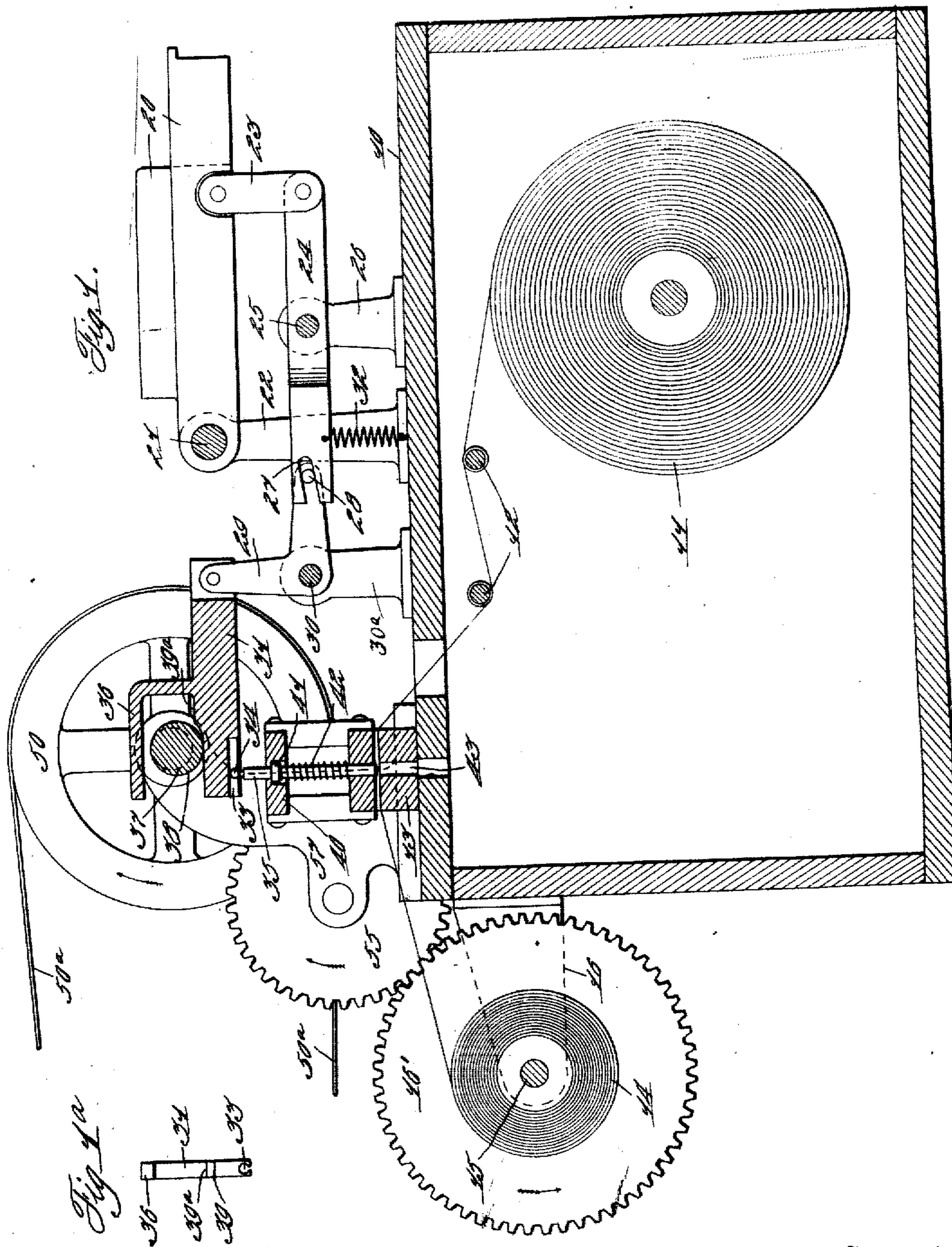


No. 811,816.

PATENTED FEB. 6, 1906.

H. S. BERGEN.  
PERFORATING MACHINE.  
APPLICATION FILED MAY 31, 1904.

2 SHEETS—SHEET 1.



Witnesses  
W. M. McLeath  
H. M. Henderson

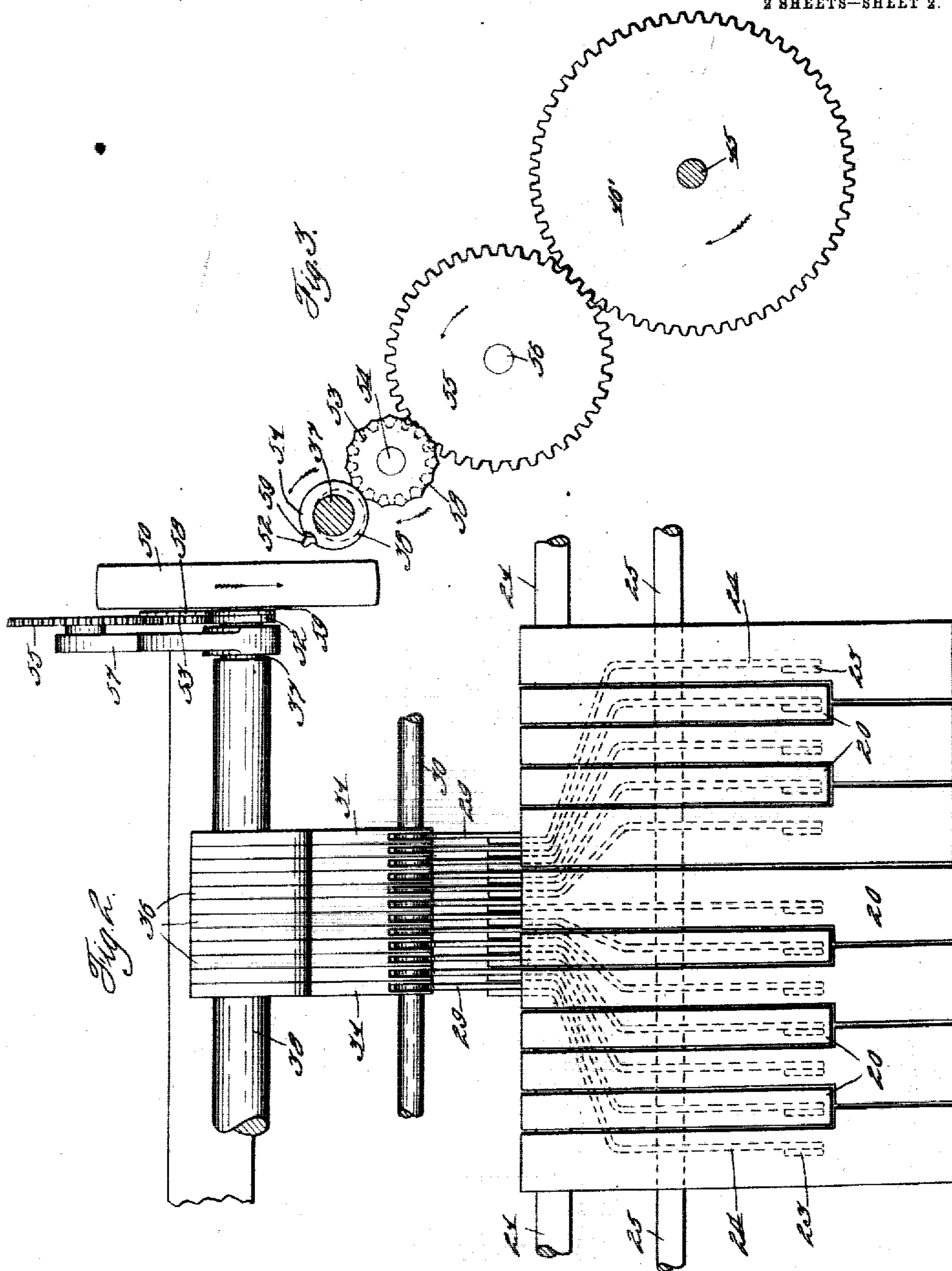
Inventor  
Harry S. Bergen  
by J. B. Hayward  
Attorney

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2 SHEETS—SHEET 2.



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# UNITED STATES PATENT OFFICE.

HARRY S. BERGEN, OF DAYTON, OHIO.

## PERFORATING-MACHINE.

No. 811,816.

Specification of Letters Patent.

Patented Feb. 6, 1906.

Application filed May 31, 1904, Serial No. 210,364.

*To all whom it may concern:*

Be it known that I, HARRY S. BERGEN, a citizen of the United States, residing at Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Perforating-Machines, of which I declare the following to be a full, clear, and exact description.

This invention relates to improvements in perforating-machines, more particularly to that class of such machines which are used to reproduce the so-called "perforated music-sheets" which are used in pianolas and analogous mechanical playing instruments.

In general construction my machine embodies a series of keys which control the operativeness of a corresponding series of punches, which punches when operated perforate the music-sheet which is fed between the punches and the corresponding dies, so as to produce in said music-sheet a series of perforations corresponding to the various keys which have been depressed; and if it is desired to reproduce a particular music-sheet which is being used in a pianola the pianola is simply moved up to the keyboard of my machine and the operation of the pianola will cause the depression of the various keys of my machine, and with the proper speed of feed of the paper to be perforated there will result a reproduction of the pianola music-sheet in perfectly duplicate form. Such machines are at present well known as far as the general mode of operation of the same is concerned; but it is the object of my invention to simplify the mechanism of such machines and to insure a possibility of rapid and accurate movement of the various punches, and thereby secure an absolute reproduction copy of the music-sheet, which of course is most essential in the manufacture of music-sheets in this manner.

Referring to the accompanying drawings, Figure 1 represents a vertical cross-section of my machine. Fig. 1<sup>a</sup> represents a detail end elevation of one of the punch-controlling arms. Fig. 2 represents a top plan view of a portion of my machine, showing only a portion of the keyboard. Fig. 3 represents a detail elevation of the gears for feeding the music-sheet.

The keyboard of my machine is mounted upon any suitable casing 10, within which casing is contained the supply-roll 11 of the music-sheet, said music-sheet being led over guide-rollers 12 and across a transversely-

extending die-block 13 and then fed onto a winding-roll 14, which is mounted upon a shaft 15, supported by brackets 16, extending from the casing 10, the feed of this paper being produced in the manner later to be described.

The keyboard of the machine is made in the regular pianoforte style, and since the construction of all the keys is practically the same I shall describe only one key. The key 20 is pivoted upon a transverse shaft 21, which is supported by upright standards 22, extending upward from the casing 10. On the under side of the key is a link 23, which is pivoted at its lower end to a lever 24, pivoted at its middle portion upon a transverse shaft 25, supported between supports 26, extending upward from the casing 10. The rearward end of this lever 24 is formed with a slot 27, in which plays a pin 28, formed on the forward end of a bell-crank lever 29, which is pivoted upon a transverse shaft 30, extending between supports 30<sup>a</sup>, extending upward from the casing 10. The upper end of this bell-crank lever 29 has attached to it a punch-controlling arm 31, this bell-crank lever 29 and the punch-controlling arm 31 being normally drawn forward by means of a spring 32. The rearward and lower end of the arm 31 is formed with a cylindrical slot 33, the shape of which is shown in Fig. 1<sup>a</sup>, and into this slot projects the rounded head 34 of the reciprocatory punch 35, the shape of this head and the slot obviously being such that the arm 31 can be reciprocated forward and rearward independently of the punch; but the vertical movements of the arm 31 will carry with it the punch. Extending upward from the arm 31 is a retracting-arm 36, which is bent horizontally rearward and extends over the transverse shaft 37, which shaft is formed with an elongated eccentric portion 38, the purpose of which is to serve in reciprocating the arms 31, and thereby the various punches 35, in the manner to be later described. The rearward upper surface of the arm 31 is cut away slightly, as at 39, so that in the normal forward position of the arm 31 this cut-away portion rests in under the eccentric-shaft 38; but when the arm 31 is carried rearward in the manner to be described the raised upper surface 39<sup>a</sup> of the arm 31 will now be in the path of the eccentric-shaft 38, so that the rotation of the shaft 38 in the manner to be described will cause the arm 31 to be carried downward. The punch 35 is suitably seated



in a punch-block 40 and is provided with a small collar 41, against which presses a spring 42 for holding the punch normally in upward position, and below the punch is the die-block 5 13, formed with the die 43, into which the punch penetrates when reciprocated to perforate the music-sheet.

Fast to the right-hand end of the shaft 37 (see Fig. 2) is a pulley-wheel 50, which is arranged to be driven by a belt 50<sup>a</sup>, so as to impart movement to the wheel 50 in the direction shown by the arrow in Figs. 1 and 2. Also fast to this shaft 37 and adjacent to the wheel 50 is a single-tooth disk 51, the tooth 15 52 of which engages the teeth of the locking-gear 53, suitably journaled on a stub-shaft 54, and this gear 53 meshes with a larger gear 55, journaled upon a stub-shaft 56, which extends laterally from the support 57, in which 20 support 57 one end of the shaft 37 is journaled, the other end of the shaft 37 being journaled in a similar support extending upward from the opposite side of the casing 10, so that these two supports act as bearings for the rotary shaft 37. The gear-wheel 55 in 25 turn meshes with the larger gear-wheel 16', which is journaled upon the shaft 15 and carries the winding-roller 14 for the music-sheet. As shown in Fig. 3, when the shaft 37 is rotated in the direction of the arrow the tooth 30 52 engages the gear-wheel 53 at each revolution and through the intervening gears turns the gear 16' in the direction shown by the arrow, so as to advance the paper a certain distance at each revolution of the shaft 37, the 35 feed being of course intermittent and the gears being locked, so as positively to prevent movement of the paper during the period of time in which no feed is taking place, this 40 locking effect being produced by the rotating of the disk 51 upon the locking-surfaces 58 of the locking-gear 53, and the notch 59 of the disk 51 permitting the rotation of the gear 53 by the single tooth, it being understood, of course, that at the time the single 45 tooth 52 is brought into position to engage the gear 53 the notch 59 is simultaneously brought into position opposite one of the points of the star-wheel-locking surfaces 58, 50 so that this point will project into the notch 59 when the gear 53 begins to be turned by the tooth 52, the notch 59 thus affording sufficient space for the turning of this star-wheel upon its axis, and as soon as the tooth 55 52 has passed from engagement with the gear 53 the locking-disk 51 again engages closely upon the periphery of the locking-surface 58, which is adjacent to the point of the surface which has previously entered the notch 59. 60 As will be seen from the position of the cam-shaft 38 in Fig. 3, the feed of the paper will take place while the cam-shaft is in its upper position, during which time no reciprocation of the punches is taking place, since the 65 punches are reciprocated by the cam-shaft

being rotated to its lower position to strike the controlling-arms 31 in case such arms are reciprocated rearward by the keys.

In the operation of the machine a pianola 70 containing the music-sheet to be reproduced is moved up to the keyboard of my machine and the pulley 50 and shaft 37 are given a rotary movement by any suitable mechanical or electrical means, so as to feed the paper of the music-sheet to be reproduced at practically the same speed as the pianola music-sheet. Then when any hammer of the pianola strikes the key 20 and depresses the same the depression of the link 23 rocks the lever 24 75 about its pivot 25, and thereby actuates the bell-crank lever 29 to carry the controlling-arm 31 rearward, and thereby the raised portion 39<sup>a</sup> of the upper surface of the arm 31 is carried into the path of movement of the eccentric-shaft 38, so that said shaft in its rotary 80 movement strikes the arm 31 and forces the same downward, thereby carrying downward the punch 35 and causing the same to perforate the paper, and when the eccentric-shaft 38 has rotated far enough to withdraw 85 its eccentric portion from contact with the raised portion 39<sup>a</sup> the spring 42 of the punch 35 forces the punch upward and withdraws the same from the paper, of course also carrying upward the arm 31; but in case the 90 punch should for some reason stick and tend to remain in its depressed position the eccentric-shaft in its continued rotation upon reaching its upper position strikes the retracting-arm 36 of the arm 31 and positively 100 restores the arm and punch to normal upward position. If the key 20 still remains depressed during the continued rotary movement of the shaft 38, the shaft upon again coming to its downward position will of 105 course again strike the raised portion 39<sup>a</sup> and will again reciprocate the punch downward through the paper, and since the paper in the meantime has been fed along by the intermittent feed above described the punch 110 now makes a new perforation in the paper slightly in advance of the previous perforation, the extent of the intermittent feed being such that with these successive reciprocations of the punch caused by holding the 115 key 20 depressed the punch will cut out a slight portion of the paper each time in advance of the previous perforation, so that the resultant effect is the cutting of a slot in the paper similar to the slot contained in the pianola-music. Of course when the key 20 is released to return to normal position the 120 spring 32 pulls the arm 31 forward, so that the cut-away portion 39 is in the path of movement of the shaft 38, and the shaft operates neither upon the arm 31 to rock the same downward, nor upon the retracting-arm 36, so that the arm remains stationary without there being any reciprocation of the 125 punch.



It will be observed that the rotation of the eccentric-shaft 38 is such that there is no possibility of blocking of the arm 31 against said shaft when the arm is forced forward by the movement of a key, but that as a matter of fact the direction of rotation is such that when the shaft 38 strikes the raised portion 39<sup>a</sup> the frictional contact of the shaft with this portion will serve to assist in this rearward movement of the arm 31, so that the punch will be sure to be reciprocated, and this effect is very important in that it produces extreme sensitiveness without the possibility of missing a perforation due to the blocking of the arm 31 against its reciprocating eccentric-shaft 38, this sensitiveness and accuracy being of course of prime importance in securing the exact reproduction of a music-sheet, and, furthermore, the manner of connection of the arm 31 with the punch 35—that is, permitting horizontal reciprocation of the arm independent of the punch, but securing the enforced movement of both the punch and arm together during the vertical reciprocation of the arm 31 is of importance in securing rapid action of the punch and in insuring the withdrawal of the punch from the paper at each operation, as heretofore explained, so that there is practically no opportunity for lost motion, and in case the spring-return of the punch is not operative the punch will be positively retracted at each revolution of the shaft 38 when the key is depressed.

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

1. In a perforating-machine, the combination with a series of keys, a series of reciprocatory punches corresponding thereto, and means for feeding paper below said punches; of a corresponding series of punch-controlling arms, said arms being formed on the upper side with a cut-away portion adjacent to a raised portion, and formed on the lower side with a slot for engaging the respective punch; an eccentric-shaft extending transversely above said arms; means connected with said keys for operating said arms to carry said raised portion thereof into the path of movement of said eccentric-shaft; and means for rotating said shaft in such direction that the frictional contact of the shaft with said arm assists the key movement of the arm in carrying the raised portion thereof into operative position.

2. In a perforating-machine, the combination with a series of keys, a series of reciprocatory punches corresponding thereto and normally spring-retracted, and means for feeding paper below said punches; of a corresponding series of punch-controlling arms, said arms being formed on the upper side with a cut-away portion adjacent to a raised portion, and formed on the lower side with a

slot of such shape as to permit movement of the arm at right angles to the punch independently of the punch, but engaging the punch to cause the latter to follow the arm during its reciprocatory movements in the direction of the reciprocatory movements of the punch; an eccentric-shaft extending transversely above said arms; means connected with said keys for operating said arms to carry said raised portion thereof into the path of movement of said eccentric-shaft; and means for rotating said shaft to cause the reciprocation of the punches when said raised portion of the controlling-arms is in the path of movement of said shaft.

3. In a perforating-machine, the combination with a series of keys, a series of reciprocatory punches corresponding thereto and normally spring-retracted, and means for feeding paper below said punches; of a corresponding series of punch-controlling arms, said arms being formed on the upper side with a cut-away portion adjacent to a raised portion, and formed on the lower side with a slot of such shape as to permit movement of the arm at right angles to the punch independently of the punch, but engaging the punch to cause the latter to follow the arm during its reciprocatory movements in the direction of the reciprocatory movements of the punch; an eccentric-shaft extending transversely above said arms; means connected with said keys for operating said arms to carry said raised portion thereof into the path of movement of said eccentric-shaft; means for rotating said shaft to cause the reciprocation of the punches when said raised portion of the controlling-arms is in the path of movement of said shaft; and a retracting-arm connected with the punch-controlling arm and extending over the upper side of said eccentric-shaft at such distance from the controlling-arm as to permit the free rotation of said shaft between the retracting-arm and the cut-away portion of the controlling-arm without causing the reciprocation of said controlling-arm, but when the controlling-arm is operated by the key, the distance between the retracting-arm and the raised portion of the controlling-arm being such that the said eccentric-shaft will strike both the said raised portion and the said retracting-arm successively in its rotary movement.

4. In a perforating-machine, the combination with a series of keys, and a series of reciprocatory punches corresponding thereto; of a corresponding series of punch-controlling arms, said arms being formed on the upper side with a cut-away portion adjacent to a raised portion, and formed on the lower side with a slot of such shape as to permit movement of the arm at right angles to the punch independently of the punch, but engaging the punch to cause the latter to follow the arm during its reciprocatory movements



in the direction of the reciprocatory movements of the punch; an eccentric-shaft extending transversely above said arms; means connected with said keys for operating said  
5 arms to carry said raised portion thereof into the path of movement of said eccentric-shaft; means for rotating said shaft to cause the reciprocation of the punches when said raised portion of the controlling-arms is in the path  
10 of movement of said shaft; and an intermittent feed and locking device for feeding paper

below said punches only when the punches are withdrawn from the paper and for locking the feed while the punches are perforating the paper.

In testimony whereof I affix my signature  
in the presence of two witnesses.

15

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Witnesses:

J. B. HAYWARD,

WM. O. HENDERSON.