No. 852,261. PATENTED APR. 30, 1907.

H. N. CROSS.

MECHANISM FOR MAKING MASTER SHEETS OF MUSICAL INSTRUMENTS.

APPLICATION FILED MAR. 12, 1906.

3 SHEETS—SHEET 1.

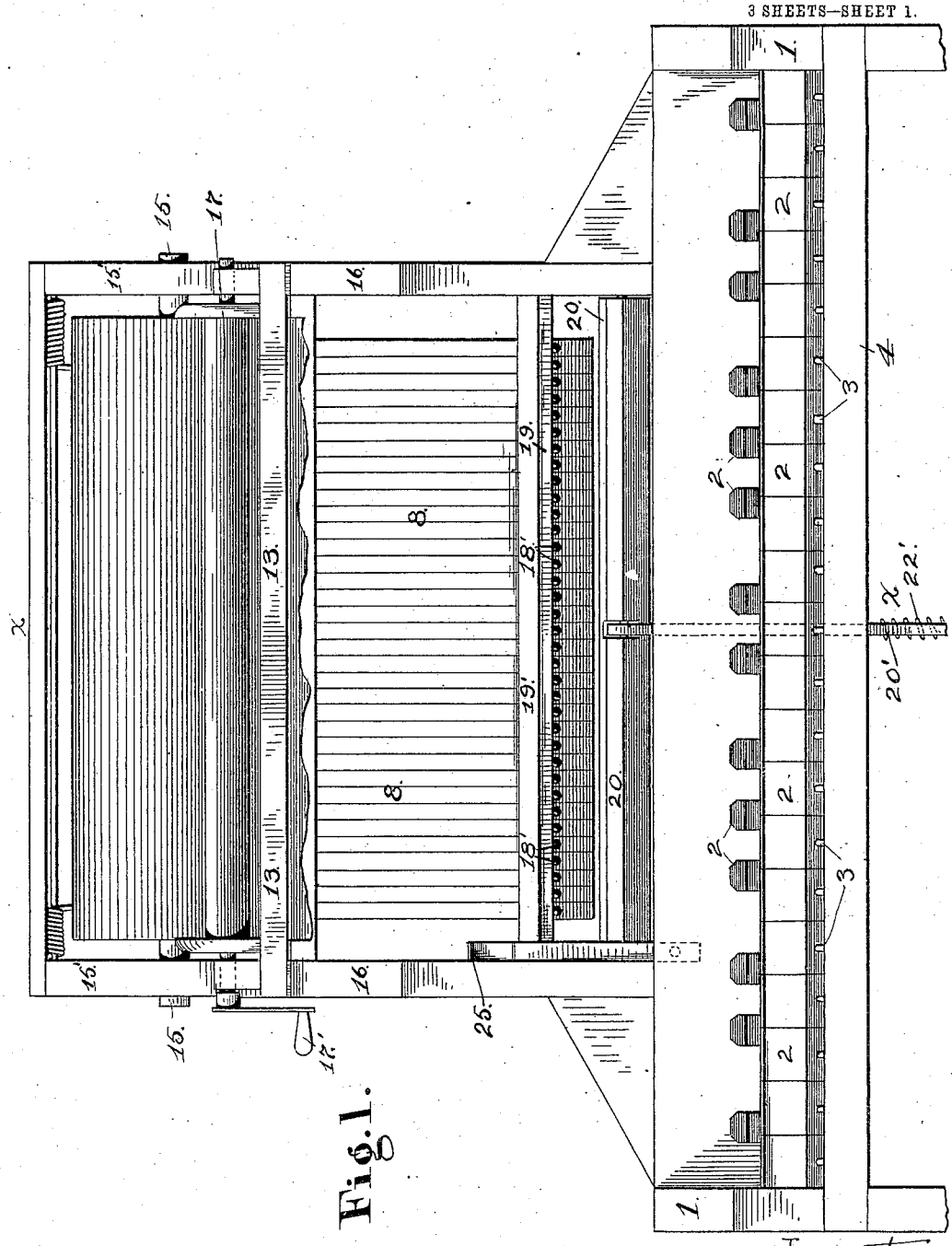

Fig. 1.

Witnesses.
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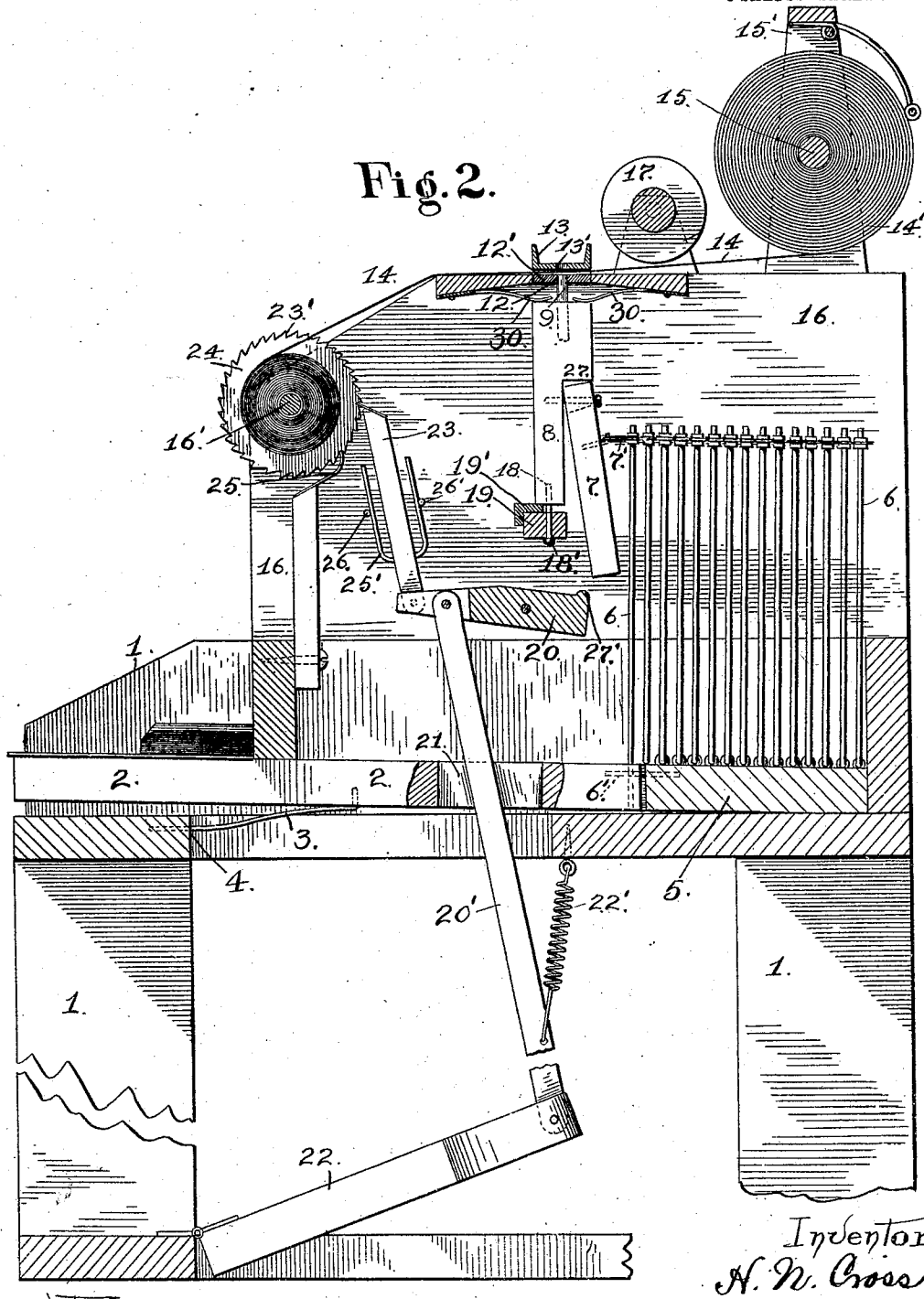
3 SHEETS—SHEET 2.

Fig. 2.



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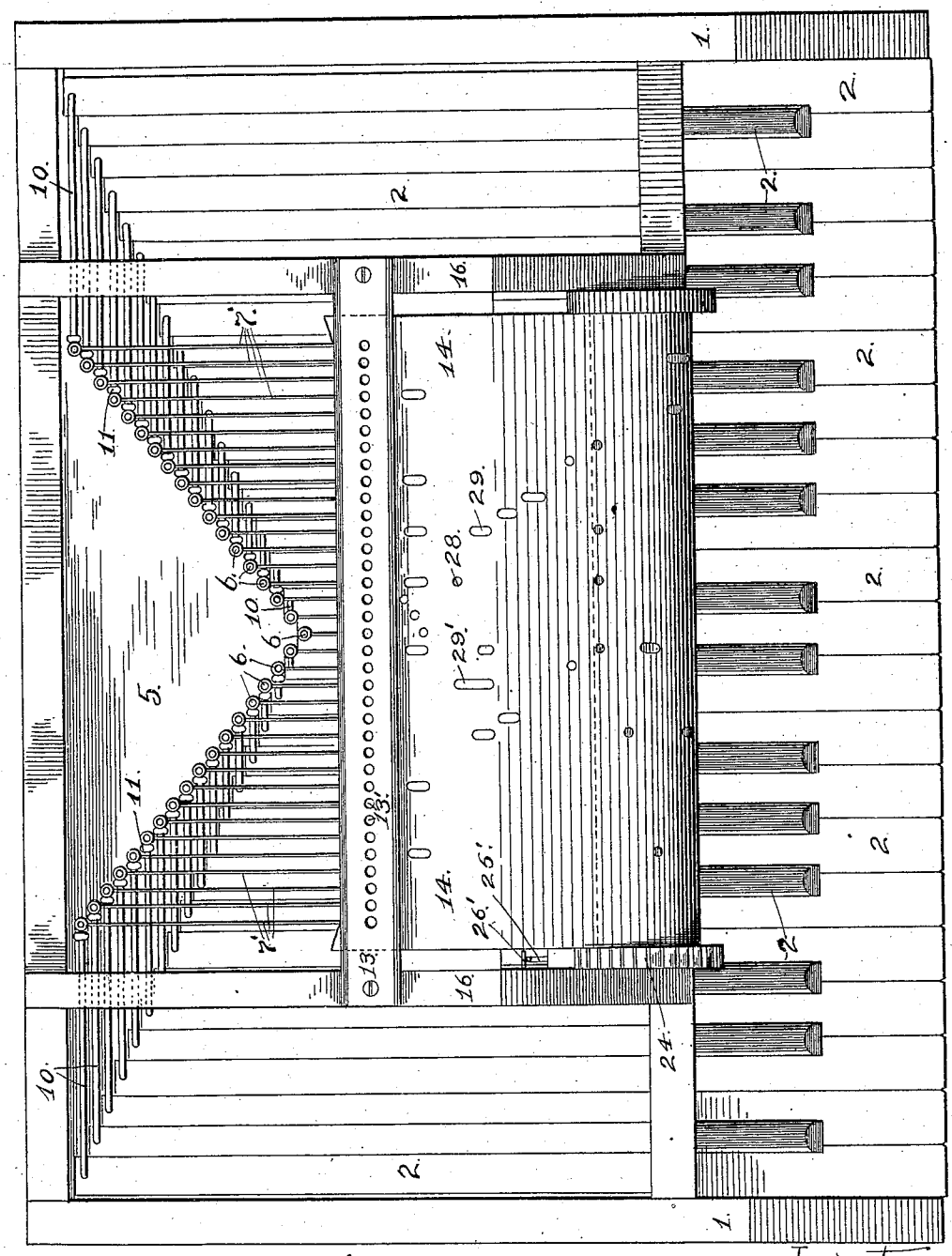

Fig. 3.

Witnesses.
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UNITED STATES PATENT OFFICE.

HARRY N. CROSS, OF SAN FRANCISCO, CALIFORNIA.

MECHANISM FOR MAKING MASTER-SHEETS OF MUSICAL INSTRUMENTS.

No. 852,261. Specification of Letters Patent. Patented April 30, 1907.

Application filed March 12, 1906. Serial No. 305,670.

To all whom it may concern:

Be it known that I, HARRY N. CROSS, a citizen of the United States, residing at the city and county of San Francisco, State of California, have invented certain new and useful Improvements in Mechanism for Making Master-Sheets for Musical Instruments; and I do hereby declare the following to be a full, clear, and exact description of the same.

The present invention is designed for the making of master sheets used for the reproduction of sheet music for use in connection with any of the well known pneumatic musical playing instruments, such as the angelus, pianola, and machines of a similar character, such as organs, in fact any instrument wherein the music is produced through the medium of a perforated sheet of music, the object of the invention being to provide simple and effective means for the perforating of the master sheet while operating keys corresponding to the notes of the music to be reproduced.

To comprehend the invention reference should be had to the accompanying sheets of drawings, wherein—

Figure 1 is a front view in elevation of the apparatus with its receiving roll for the music sheet removed, the lower portion of the casing being broken away, the foot pedal for actuating the punch for perforating the sheet which is to constitute the master sheet being removed; Fig. 2 is a vertical sectional view taken on line *x*—*x*, Fig. 1 of the drawings, the receiving roll for the perforated sheet being illustrated in position, the foot pedal for actuating the punches for perforating the sheet of paper being shown, also the means for advancing the receiving roll by a step rotation for exposing an unperforated portion of the sheet to the action of the perforating punches; and Fig. 3 is a top plan view of the mechanism disclosed by Fig. 2 of the drawings, the paper holding roll for the web of paper to be perforated and the roll onto which the master sheet is wound being removed, the web or strip of paper being broken away for clearness in illustrating the disposition of the actuating means for controlling the movement of the hinged jack blocks for raising the punches which perforate the sheet or web of paper in accordance with the note to be reproduced on the master sheet.

The numeral 1 is used to designate any suitable style of case for the hereinafter described mechanism, the keys 2 of which project beyond the face of the casing in the same manner as the keys of a piano. Any number of keys are employed, in fact the arrangement is that of an ordinary key board of a piano, the outer end of each key being normally held upward by the pressure of a spring 3 inserted at one end within the transverse frame plate 4, its opposite upwardly turned end being inserted within the under face of the key upheld by said spring.

The keys 2 vary in length, the shortest key being preferably the center key of the keyboard, see Fig. 3 of the drawings. Each key at its inner end is connected to a common key plate 5 by means of a spring rod 6, which rod serves as spring joint for the key, Fig. 2 of the drawings.

Each key 2 of the keyboard has connected thereto a vertically extending rod 6, in the present case constructed of stiff steel wire, and each of said rods is in turn connected to a jack block 7, by means of a longitudinally extending wire 7′, said jack blocks being hinged to the stem 8 of the series of vertically movable punches 9. There is a vertically movable punch for each key 2, hence any one key has connected therewith a vertically extending rod 6, longitudinally extending connecting wire 7′, a hinged jack block 7, and a vertically movable punch 9, to the stem 8 of which the jack block 7 is hinged. Any given key with its connected parts may be said to constitute a unit of the device for perforating the sheet or web of paper to constitute a master sheet of perforated music, as many of such units being employed as desired for the perforating a master sheet capable of being used in connection with any of the playing instruments employing perforated sheet music in connection with musical instruments, such as pianos and organs.

Inasmuch as each unit is a repetition of the remaining units, it will only be required in the present specification to describe the action of any one unit in order that the working of the device may be understood. There is a slight difference in the connecting of the parts for actuating the punch for the perforation of the sheet or web to represent the note of the shortest or center key of the keyboard, for in this case, the vertically extending rod 6 is connected at its lower end directly to the inner end of the said key, whereas with each of the other keys of the keyboard, the vertically extending rods 6 connect at their lower ends to a series of transverse parallel

wires 10, each wire at its outer end connecting to the inner end of one of the keys 2, Fig. 3 of the drawings. The purpose of these transversely disposed parallel wires is to permit of a sufficient reach to be given the respective keys at each side of the center key of the keyboard to enable the series of punches to be operated within a limited space, for the perforated sheet or web of paper cannot be of over a given width. Thus, although the total number of keys of the keyboard may occupy considerable room, still, by the employment of the gradual lengthening reach wires, the punches to be controlled by the keys require but small space in comparison to the length of the keyboard, which, in a standard piano, usually comprises about eighty-eight keys. In order that these reach wires may be maintained in alinement, they work at their inner end portion through guide staples or eyes 11, secured to the key plate 5.

Each of the vertically movable punches 9 works through a guide opening 12, formed in a transverse punch plate 12′, Fig. 2 of the drawings, a slight distance above said plate 12′ being arranged a die plate 13, which plate has a series of openings 13′ therein which register with the openings 12 in the punch plate 12′. Between these plates travels the sheet or web 14 to be perforated, which sheet or web is fed from the roll 14′, mounted in suitable bearings 15 of the brackets 15′ secured to the side walls of a super-structure 16 attached to the casing 1, Figs. 1 and 2 of the drawings. The free end of the sheet or web 14 is attached to the rotatable receiving roll 16′, which roll is mounted at the front in suitable bearings of the said super-structure, a step rotation being imparted to said roll by the hereinafter described mechanism.

Immediately above the sheet or web 14, intermediate the roll 14′ and the die plate 13, there is located a roll 17, which roll, while serving during the working of the apparatus as an idler for the holding of the traveling sheet or web, also acts to receive the completed master sheet from the roll 16′, which, when formed is severed from the web or sheet 14 and the free end thereof attached to the roll 17, which is then rotated so as to wind thereon the master sheet of perforated music, which is unwound from the receiving roll 16′. For this purpose a handle 17′ is provided by which to rotate the roll 17. After the master sheet of perforated music has been unwound onto the roll 17, the said roll is removed and another roll inserted in its place.

The lower end of the stem 8 of each punch 9 has a socket 18 formed therein, which enables the same to fit onto a guide pin or stud 18′ upwardly projecting from a fixed transversely arranged supporting plate 19. These pins or studs 18′ hold the lower end of the stems 8 against lateral displacement, the upper end being held by the punch carried thereby resting a slight distance within the guide openings 12 of the punch plate 12′. In order that the punches may be held within the punch plate and prevented from falling therefrom, there is secured to the supporting plate 19 beneath the lower end of each punch stem 8, after the punch has been properly adjusted, a filling block 19′, which blocks resting on the face of the supporting plate 19 prevent the punches 9 moving downward beyond a given distance. Any suitable means may be utilized for regulating the downward movement of the punches, the filling blocks 19′ simply serving as a convenient means to this end.

Below the series of supporting plates 19 there is arranged what shall be termed a hammer bar 20, Figs. 1 and 2 of the drawings, which hammer bar is pivoted within the super-structure 16. This hammer bar is common to all the punches, and acts to raise any one or more of the punches for the perforation of the sheet or web 14, through the medium of the jack blocks 7, when said blocks have been swung forward through the action of the keys 2 into vertical alinement with the stems 8 of the punches 9.

To the hammer bar 20 is pivoted the upper end of a depending rod 20′, which rod, in the present case, passes through a slot 21 in the center key of the key-board, Fig. 2 of the drawings, the lower end of said rod being pivoted to the inner end of a foot pedal 22. The outer end of said pedal 22 is hinged to the frame 1 of the apparatus, its inner end being held upward by the tension of a spring 22′.

To the hammer bar 20, at one end thereof is connected the lower end of an actuating pawl 23, the upper end of which pawl engages the teeth 23′ of a ratchet wheel 24, secured to one end of the receiving roll 16′. This actuating pawl 23 is moved upwardly to impart a step rotation to the receiving roll 16′ as the outer portion of the hammer bar 20 is raised by the tension of the spring 22′, which throws upward the hinged pedal 22, said spring acting against the pedal rod 20′. During the downward movement of these parts, the ratchet wheel 24 is held against back rotation by means of the spring retaining pawl 25.

Through the actuating pawl 23 is fitted a stirrup spring 25′, the free end portions of which slide between and against the fixed guide pins or studs 26—26′ and serve to maintain the actuating pawl in proper position relative to the ratchet wheel 24.

A brief description of the operation of any one unit for perforating the sheet or web 14 to represent a note of music will suffice for an understanding as to the formation of a master sheet of music, for the action of the remaining units is a mere repetition as to the working of the following described unit, reference being had to Fig. 2 of the drawings in

the following of the description. Where a printed piece of music is to be reproduced, the sheet of music is so placed as to be read by the operator. The end of the sheet or web 14 to be perforated is first attached to the receiving roll 16′, when the same is positioned for the action of the perforating punches 9. One of the keys 2 of the keyboard, representing the note to be reproduced is then depressed by the operator, which acts to throw its rod 6, constituting a vertical extending arm of the key, forward, the movement of which, through the medium of its connected longitudinal wire 7′, acting to swing the jack block 7 forward against the punch stem 8 of such unit, and setting, so to speak, the punch 9 of such unit for movement. The jack block 7 will then stand in vertical alinement with the stem 8 of the punch 9, the lower end portion of such jack block extending a slight distance below the supporting plate 19, while the upper end thereof will rest beneath the shoulder 27 of the punch stem 8. With the parts thus positioned by the depressed key indicative of the note to be represented on the master sheet, the operator then depresses the pedal 22, which draws downward the pedal rod 20′ and swings the hammer bar 20 to throw its head 27′ upward. This hammer head as swung upward, bears against the lower end of the jack block 7 and raises the same, which, carrying therewith the stem 8 and punch 9, forces the punch 9 upward its full distance. As the punch is moved into the opening of the die plate 13, an opening or perforation 28, indicative of the desired note is made in the sheet or web 14 held between the plates 12′ and 13. The moment the pedal 22 is released, the same is raised by the tension of the spring 22′, forcing the pedal rod 20′ upward, which restores the hammer bar 20 to normal position, at the same time lifting the actuating pawl 23 so as to rotate the ratchet wheel 24, thus rotating the receiving roll 16′ so as to slightly advance the sheet or web 14. It will be understood that simultaneously with the releasing of the pedal 22, the operator relieves the key 2 of pressure, when the said key and its connected parts are restored to normal position by the action of its spring 3. With the upward movement of the said key, its rod 6 is moved rearward, drawing therewith, through the medium of its connecting wire 7′, the hinged jack block 7. The jack block is thus swung out of line with the hammer bar, and the punch 9 moved to normal position to clear the sheet or web 14 by the pressure of the springs 30.

The movement or stroke of the actuating pawl 23 is such that the perforated sheet or web 14 is only advanced a distance a fraction less than the diameter of the punches. The reason for this is due to the fact that perforations or openings of varying length must be made in the master sheet, corresponding to the duration of the note to be reproduced, such varying notes on the sheet or web being designated by the numerals 29—29′, Fig. 3 of the drawings. The length of the note is produced by repeating the action of the punch, one or more times, thus producing an opening in the sheet of any desired length, for the punch will continue the cutting of the paper for any size opening so long as its action is repeated, the key representing the desired note being held downward during such repeated action of the punch.

It will be understood that the hammer bar 20 serves as a common hammer for all the punches, and that the same will act to force upward all punches whose jack blocks stand in vertical alinement with the punch stems.

After the master sheet has been formed, the sheet or web 14 is severed, and the sheet wound onto the roll 17, as before described.

The previously described reach wires 10, may be treated as an angle extension of the vertical rods or wires 6, inasmuch as they simply serve to connect the said rods or wires 6 to their respective keys.

Having thus described the invention, what is claimed as new and desired to be protected by Letters Patent is—

1. In an apparatus for the described purpose, the combination with a series of keys, of a perforating punch for each key of the series, of means actuated by the movement of a key for setting parts connected to the punch designated by such key in operative position, of devices for holding a sheet or web to be perforated above the line of punches, of mechanism including a pivoted bar for actuating the punch of any depressed key to perforate the sheet or web to correspond with the note represented by such key, and means for advancing the perforated sheet or web on the actuated punch or punches being restored to normal position, including a receiving roll for the sheet or web, and a reciprocatory actuating arm operatively associated with said roll and actuated by the aforementioned mechanism for actuating the punch.

2. In an apparatus for the described purpose, the combination with a stem, of a punch secured thereto, of a jack block pivoted to said stem and adapted when brought into alinement therewith to be engaged by instrumentalities including a pivoted hammer bar for operating the stem and punch carried thereby, and means for bringing the jack block into alinement with said stem including a depressible key and connections between said key and the before mentioned jack block.

3. An apparatus for the described purpose, the same comprising a suitable casing, of a series of keys working therein, a movable perforating punch for each key of parts connected to said punch, connection between

each key and such parts by which such parts corresponding to any key of the series are brought into operative position when the said key is actuated to designate a note, of means for holding a sheet or web to be perforated above the series of punches, of mechanism for actuating any punch of an operated key to perforate the sheet or web, and devices actuated by said mechanism on its return movement for advancing the sheet or web a given distance.

4. In an apparatus for the described purpose, the combination with a stem, of a punch secured thereto, of a jack block pivoted to said stem and adapted when brought into alinement therewith to be engaged by mechanism including a pivoted hammer bar for elevating the stem and punch carried thereby, of means for bringing said jack block into such alinement including a depressible key, and connections between said key and the before mentioned jack block, of devices for holding a sheet or web to be perforated above the punch, and instrumentalities for advancing said web or sheet, said instrumentalities being brought into operation by the return movement of the said mechanism for elevating the punch.

5. In an apparatus for the described purpose, the combination with a series of independently operable keys, of a movable punch for each key, of the said series, of connections between each key and its punch by which the said punch is brought into operative relation with the actuating mechanism when the said key is depressed to designate a note, of mechanism for elevating said punch, said mechanism including a pivoted hammer bar, of means for holding and advancing a sheet to be perforated above the punch, said means including a feeding roll and a receiving roll, a ratchet wheel carried by said receiving roll, and instrumentalities for turning said ratchet wheel and advancing said sheet, said instrumentalities being brought into operation on the return movement of the mechanism for elevating the punch.

6. In an apparatus for the described purpose, the combination with a series of independently movable perforating punches, of parts connected to said punches, of means for operatively positioning said parts on the striking of a note to be designated on a master sheet, of a pivoted device common to all for actuating any number of punches operatively related to the actuating mechanism, of foot operated means for moving said punch actuating device, means for holding the sheet to be perforated above the line of punches, the movement of said sheet being produced by the return movement of the aforesaid foot-actuating device.

7. In an apparatus for the described purpose, the combination with a series of independently movable keys, of a perforating punch for each key, of devices for holding a sheet to be perforated above the line of punches, of a jack block hinged to the stem of each punch, of connection between each key and the jack block carried by the punch to be operated to perforate the sheet to designate the note struck by the key of such punch, a pivoted hammer bar common to all the punches for actuating such punches of the series as may be operatively connected by the movement of its key in the striking of a note, of foot-operated means for actuating the hammer bar for the punches, and devices actuated by the return movement of the foot operated means for advancing the perforated sheet to expose an unperforated surface to the action of the punches.

8. In an apparatus for the described purpose, the combination with a series of perforating punches, of means actuated by the striking of a note of music for operatively connecting the punch to designate such note, including a pivoted member carried by the punch of devices for holding a sheet to be perforated in advance of the series of punches, of foot operated mechanism for actuating the operatively connected punch or punches to perforate the sheet to form a master sheet of perforated music, and means for advancing the perforated sheet to expose an unperforated surface to the action of the punches, said means being actuated by the return movement of the said foot operated mechanism.

In witness whereof I have hereunto affixed my signature in the presence of witnesses.

HARRY N. CROSS.

Witnesses:
N. A. ACKER,
D. B. RICHARDS.