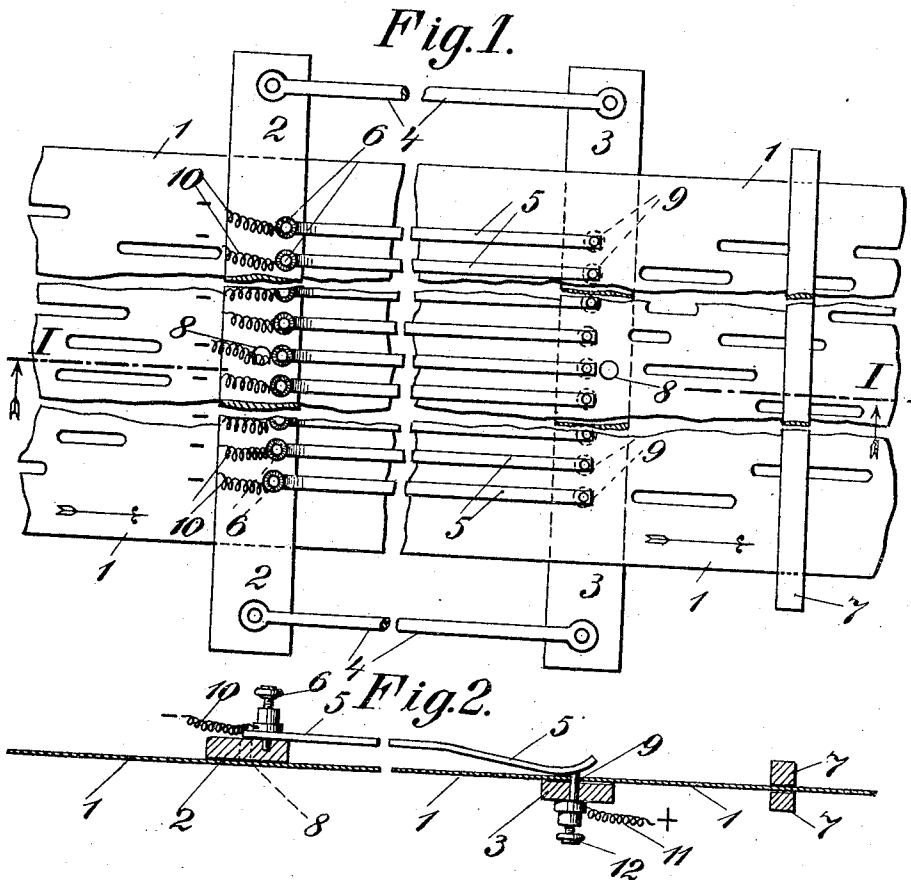


J. C. BUNGE.
 APPARATUS FOR PERFORATING MUSIC SHEETS.
 APPLICATION FILED JAN. 22, 1907.

935,737.

Patented Oct. 5, 1909.
 3 SHEETS—SHEET 1.



Witnesses:

E. Gros
 J. Woelff.

Inventor:

Julius Carl Bunge
 by *Wm. H. Bunge*
 his Attorney

935,737.

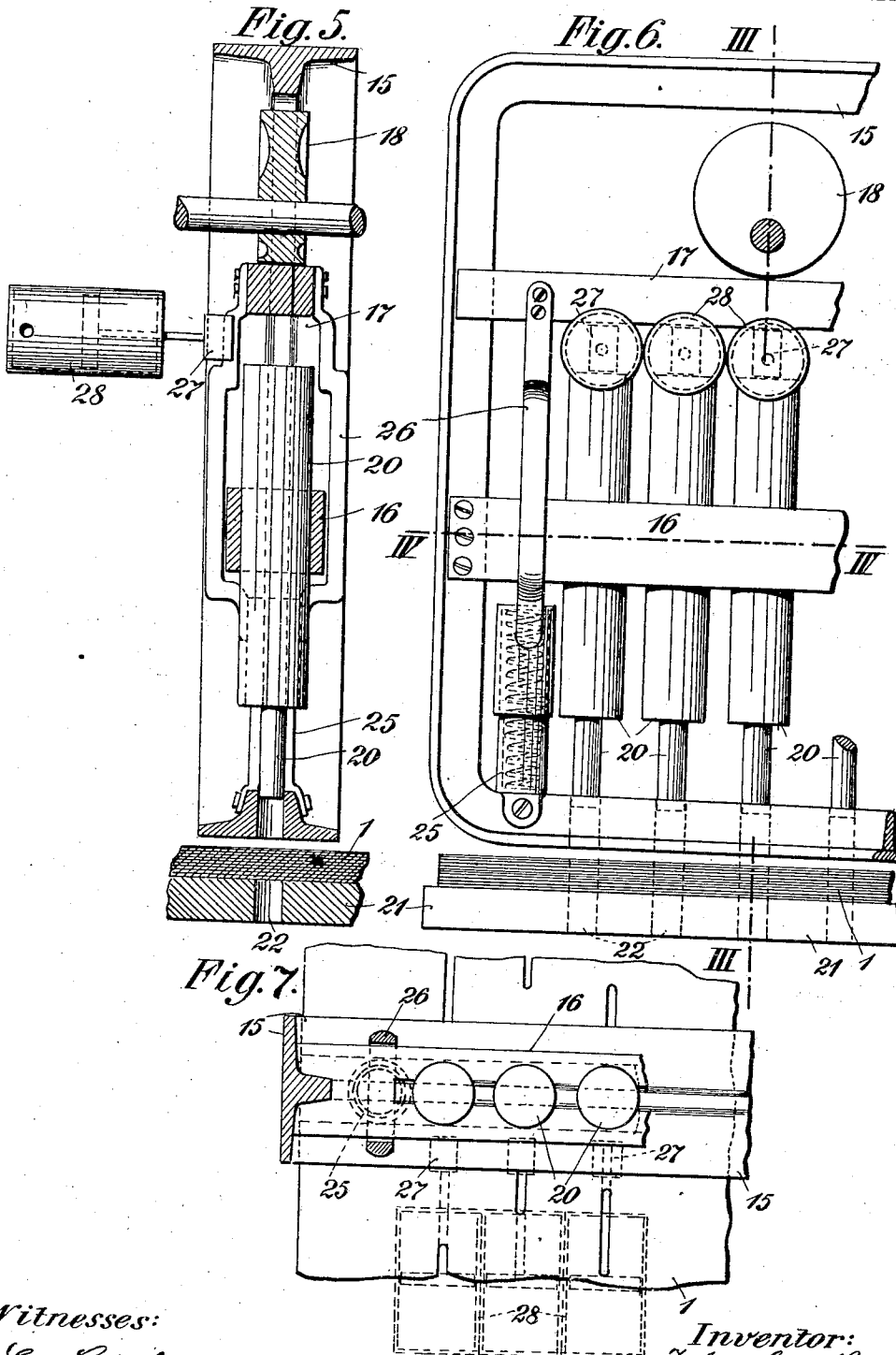
E. Gros
J. Wolff.

Julius Carl Bunge
by William A. A. 1
his attorney

J. C. BUNGE.
 APPARATUS FOR PERFORATING MUSIC SHEETS.
 APPLICATION FILED JAN. 22, 1907.

935,737.

Patented Oct. 5, 1909.
 3 SHEETS—SHEET 3.



Witnesses:
E. Gros
J. Wolff

Inventor:
Julius Carl Bunge
 by *William A. A. A.*
 his Attorney

UNITED STATES PATENT OFFICE.

JULIUS CARL BUNGE, OF AMSTERDAM, NETHERLANDS.

APPARATUS FOR PERFORATING MUSIC-SHEETS.

935,737.

Specification of Letters Patent.

Patented Oct. 5, 1909.

Application filed January 22, 1907. Serial No. 353,437.

To all whom it may concern:

Be it known that I, JULIUS CARL BUNGE, subject of the Queen of the Netherlands, residing at Amsterdam, in the Kingdom of the Netherlands, have invented certain new and useful Improvements in Apparatus for Perforating Music-Sheets, for which the following is a full, clear, and exact description.

This invention relates to apparatus for producing perforated strips of the kind employed in mechanically-actuated musical instruments, such as the pianola, the phonola and the like. For the purpose of reproducing these perforated strips the sheet to be copied, (which may be produced by means of any suitable apparatus, such for instance as that for which the present applicant has claimed patent protection in the Patent No. 899,238, September 22, 1908), is moved below a controlling mechanism that whenever a perforation occurs in the pattern sheet actuates that punch of a continuously-actuated punching mechanism which punch corresponds to the same note. By means of this latter apparatus the copies to be produced are moved beneath the controlling mechanism, at a speed which may be smaller, equal to, or greater, than that of the pattern sheet, in such manner that the punching mechanism produces in the copies for each perforation of the pattern sheet a corresponding perforation of less, equal, or greater length. By means of this arrangement there can be manufactured, by means of a single apparatus, strips which are suitable for actuating mechanical musical instruments moving at different speeds.

The apparatus possesses the further advantage that by means of it, pattern sheets of various widths, corresponding to any number of notes, can be produced, and that the length and spacing of the perforations in the copies can be varied in accordance with the requirements of instruments of various types.

The accompanying drawings illustrate by way of example the construction of apparatus in accordance with this invention, wherein—

Figure 1 is a plan view of the controlling mechanism; Fig. 2 is a transverse section of the same on the line I—I; Fig. 3 is a front view of the punching mechanism; Fig. 4 is a transverse section of the same on the line II—II; Fig. 5 is a transverse section through an example of punching mechanism with a

frame of modified construction, the pneumatic actuating mechanism being diagrammatically represented; Fig. 6 is a front view of the frame shown in Fig. 5; and Fig. 7 a horizontal section through the punching mechanism on the line IV—IV of Fig. 6.

The apparatus consists of two parts, the controlling mechanism (Figs. 1 and 2) and the punching and ratio-changing mechanism (Figs. 3 to 7).

The controlling mechanism (Figs. 1 and 2) comprises a frame 2, 2, 3, 3, by means of which the pattern sheet 1, which is provided with longer or shorter apertures and is gripped by clamps during the punching operation, is moved forward intermittently. This frame is arranged with its part 2, 2 above the strip, and its part 3, 3, below it. Upon one half of the frame, for instance upon the lower half 3, 3, there are arranged a number of metallic contact studs 12 and upon the other half for instance, upon the upper part 2, 2, there are provided a corresponding number of metallic springs 5 which are held in position by means of pins 6 and which press against the contact studs 12 provided no other substance is interposed between them. The number of contact studs 12 and springs 5 corresponds to the compass of the pattern sheet which is usually from 5 to 7½ octaves. For the sake of simplicity a few only of the studs and springs are shown in the accompanying drawings. The apparatus may be actuated by electric means or by compressed air.

Figs. 1 to 4 of the accompanying drawings show an example of apparatus having an electrically-operated actuating mechanism; Figs. 5, 6 and 7 show an example of apparatus actuated by pneumatic means. Each spring 5 and contact stud 12 is connected with the poles of an electric current source. As the pattern sheet is moved forward by the controlling mechanism, whenever an aperture passes in front of the stud 12 the corresponding circuit is closed and an electro-magnet 19 (Figs. 3 and 4) included therein is energized. The energizing of the electro-magnet actuates the bent lever which is attracted by the magnet and is thereby caused to engage with the beam 17 of the frame 15. This beam is continuously operated by the eccentric 18, and its engagement by the lever 24 consequently actuates the corresponding punch and this stamps in the strip of paper or cardboard an aperture,

the position of which corresponds with that of the aperture in the pattern sheet which at that instant lies above the contact stud and the length of which is determined by the speed of the intermittent movement.

The punching mechanism (Figs. 3 and 7) consists of a number of punches 20 corresponding with the compass of the pattern sheet which are movably mounted in a beam 16 rigidly connected with the frame 15, and are returned to and normally maintained in their highest positions by the action of springs 20'.

It is obvious that the number of the electro-magnet must correspond with that of the punches.

Below the punches 20 the strip of paper or cardboard from which the copies are to be manufactured is intermittently moved over a table 21 provided with holes 22 at a speed which may be equal to, greater than, or less than that of the pattern sheet. As means for intermittently moving such sheets are well known, they need not be here specifically described. According to the speed the length of the perforations in the copies will be equal to, less than, or greater than, that of the pattern sheet. The movement of the strip is intermittent, to enable the punches to be withdrawn from the strips during the period when the strips are at rest. To prevent the strips from being carried along by the punches the frame 15 has been so arranged as to press against the strips while they are at rest but to be out of contact with them when moving, the strips being thus enabled to move freely. The punches 20 are actuated by the beam 17 which reciprocates in the frame 15 and which makes a single up and down movement during the period of rest of the strip. In the construction of apparatus illustrated in the accompanying drawings the movement is effected by means of the eccentric 18.

The beam 17 and the punches 20 are not normally in connection with each other; they are connected only when one of the bent levers 24 under the action of its electro-magnet 19 engages with the upper end of a recess 36 in the beam 17. When this occurs the punch 20 participates in the full movement of the beam 17 and when the electromagnet is no longer energized the bent lever 24 is by means of a spring 24' caused to return to its initial position; when no aperture passes in front of the contact stud, the corresponding punch does not participate in the movement of the beam. The punching mechanism may, however, also be actuated by compressed air as in the example of apparatus illustrated in Figs. 5 and 6. If the mechanism is actuated by pneumatic means as may be done by devices of conventional type, which need not be specifically described the contact studs 12 of the controlling mechanism are replaced by

a similar number of valves or slides, the spindles of which are by means of springs pressed against the pattern sheet.

The intermittent feeding of the pattern sheet, and the sheets in which the perforations of the former are to be reproduced may be accomplished by any suitable mechanism, conventionally represented by a pair of rollers in each apparatus on which the sheets are wound, one from the other. These rollers are moved, rotary movement being imparted to the winding rollers of the controlling apparatus and reproducing apparatus by means of a crank or other device.

The valves open at the instant when the spindle enters one of the perforations of the pattern sheet. Air supply pipes lead from the valves to small cylinders which interpolate small blocks 27 between the punch and the beam and by this means effect the necessary connection.

To enable the apparatus to be used for perforating strips of different widths the frame of the controlling mechanism has been arranged to be turned upon pivots 8. By thus turning the frame the distance between adjacent sets of studs 12 and the springs 5 may be varied and by suitably inclining the frame with respect to the pattern sheet, the distances between the studs and studs can be brought into correspondence with those between the apparatus in the pattern strip. In this manner the notes can in the strip to be punched be arranged more or less closely in the direction of its width. One and the same controlling mechanism may consequently be used for pattern sheets of different widths. In the making of strips, moreover, a number of the laterally actuated contact studs and springs may be rendered inoperative by the use of an insulating material.

To render the apparatus suitable for the reproduction of strips 50 centimeters wide and having a compass of 80 notes, it is necessary that the contact pins and springs should be arranged at an interval of $\frac{500 - 20}{80} = 6$ mm. apart; it being assumed

that the outermost apparatus are each 10 mm. from the edge of the strip. If it is desired to produce a narrower strip having the same compass it will suffice to rotate the controlling mechanism round the pivots 8 till the outermost contact studs and the outermost line of perforations are in alinement. If, on the other hand, it is desired to reproduce a narrower strip the distance between the lines of perforations of which correspond to the above mentioned interval of 6 mm. it is necessary to insulate a suitable number of contacts.

The frame 15 of the punching mechanism is arranged rotatably around its vertical axis. To obtain accurate copies it should be ad-

justed parallel with the frame of the controlling mechanism by any suitable means. For this purpose the frame 15 is provided with bearings 14, 14 at top and bottom 5 which receive pivots 13, 13 the latter being mounted in the main frame of the apparatus.

According to the ratio of speed the strip of paper to be perforated to that of the pattern sheet, that is to say, according as it 10 moves at an equal, a less, or a greater speed, the length of the perforations of the copies will be equal to, less than, or greater than, those of the pattern sheet.

In the apparatus to which this invention 15 relates all the punches are arranged on one side of the strip to be perforated, that is to say, all the punches are arranged either above or below it, the punches being moreover arranged not alternately but in a continuous line adjacent to each other. 20

The controlling and punching mechanisms are so connected by means of suitable transmission gear, such, for instance as toothed wheels or belt pulleys, as to cause the strip 25 to be perforated to be moved forward inter-

mittently and at a speed which corresponds with the reproductions to be made, that is to say, which is equal to, less than, or greater than, that of the pattern sheet according as it is desired to reproduce perforations of an 30 equal, less or greater length.

What I claim is:

In an apparatus for perforating music sheets, the combination with punching mechanism of controlling mechanism operatively 35 connected therewith and adapted to transmit thereto impulses corresponding to the perforations in a pattern sheet, said controlling mechanism comprising a pivoted frame carrying contact studs and springs, said 40 frame being adapted to be inclined at a greater or less angle to the line of travel of the pattern sheet.

In witness whereof, I subscribe my signature, in presence of two witnesses.

JULIUS CARL BUNGE.

Witnesses:

LOUIS LENDREU,
FRITZ FALLENSTEIN.