

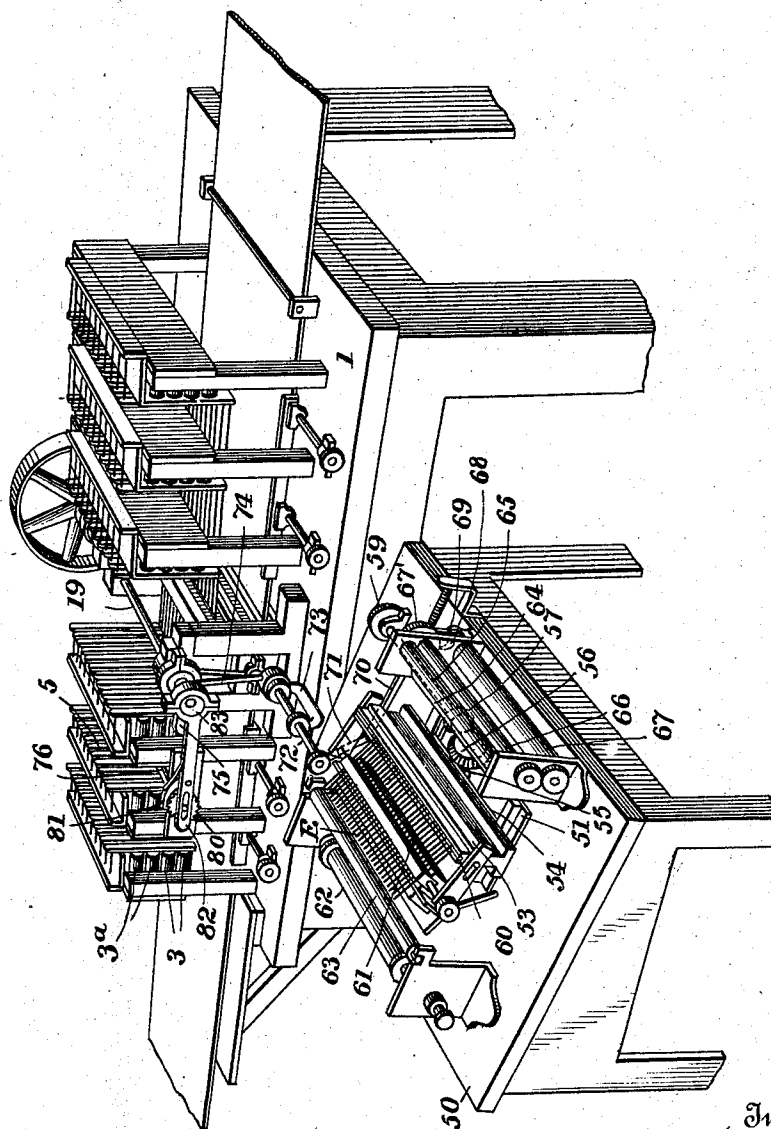
G. H. DAVIS.
METHOD OF AND APPARATUS FOR PERFORATING MUSIC ROLLS.
APPLICATION FILED AUG. 27, 1907.

964,403.

Patented July 12, 1910.

6 SHEETS—SHEET 1.

Fig. 1.



Witnesses

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6 SHEETS—SHEET 2.

Fig. 3.

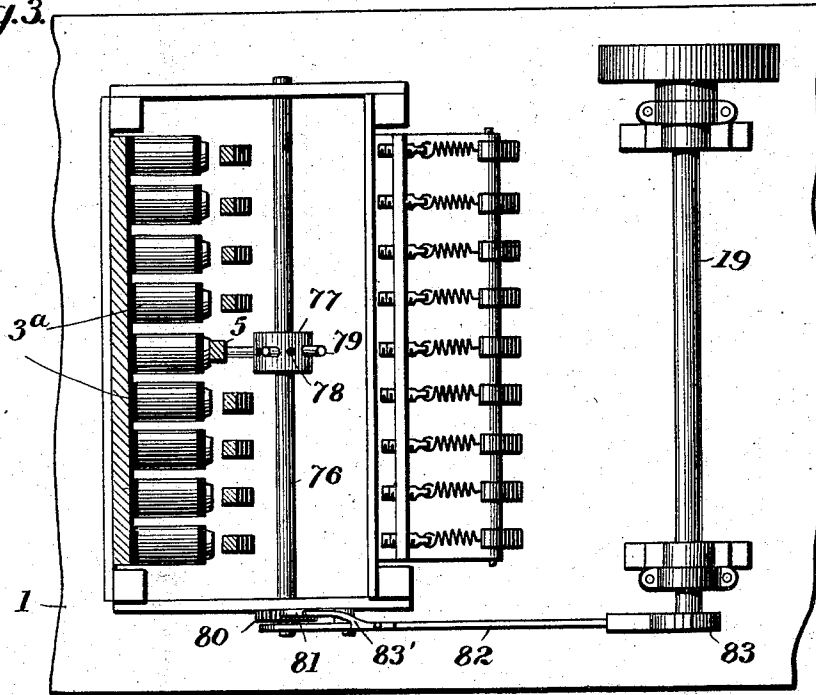


Fig. 2.

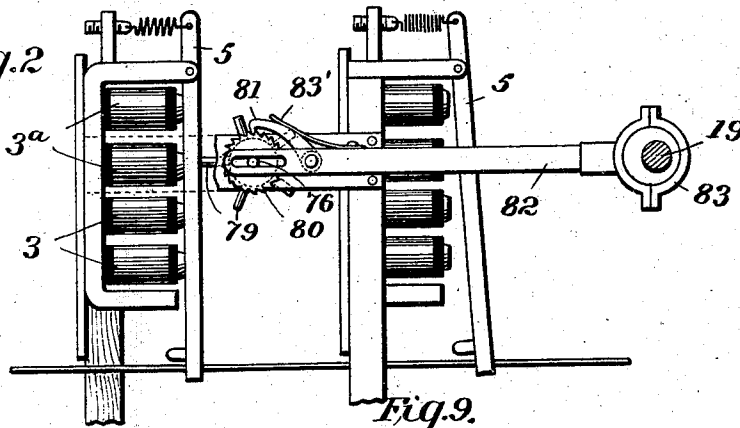


Fig. 9.

Fig. 8.

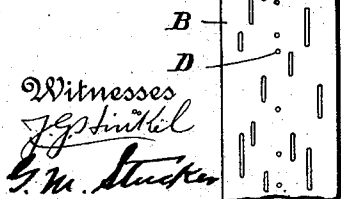


Fig. 9.

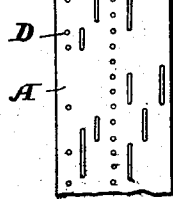


Fig. 10.



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6 SHEETS—SHEET 3.

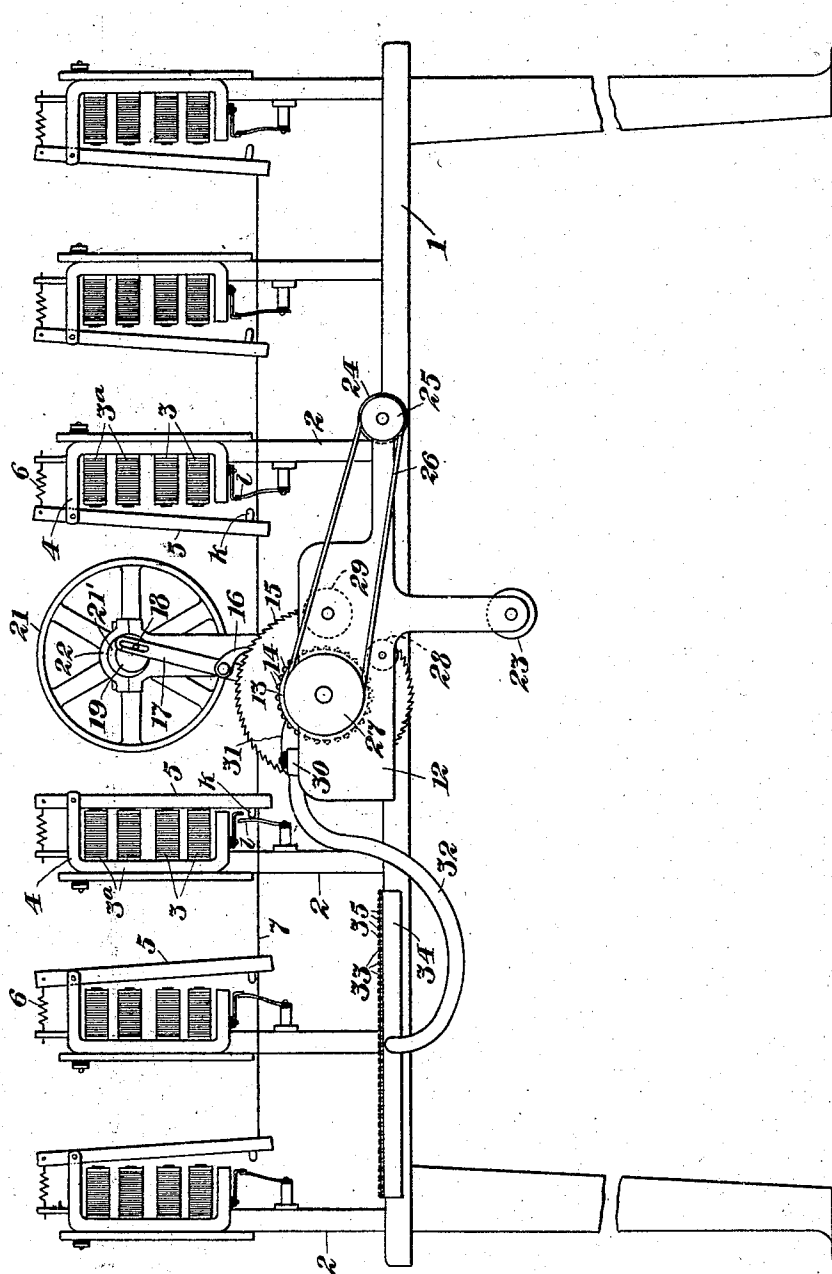


Fig. 1.

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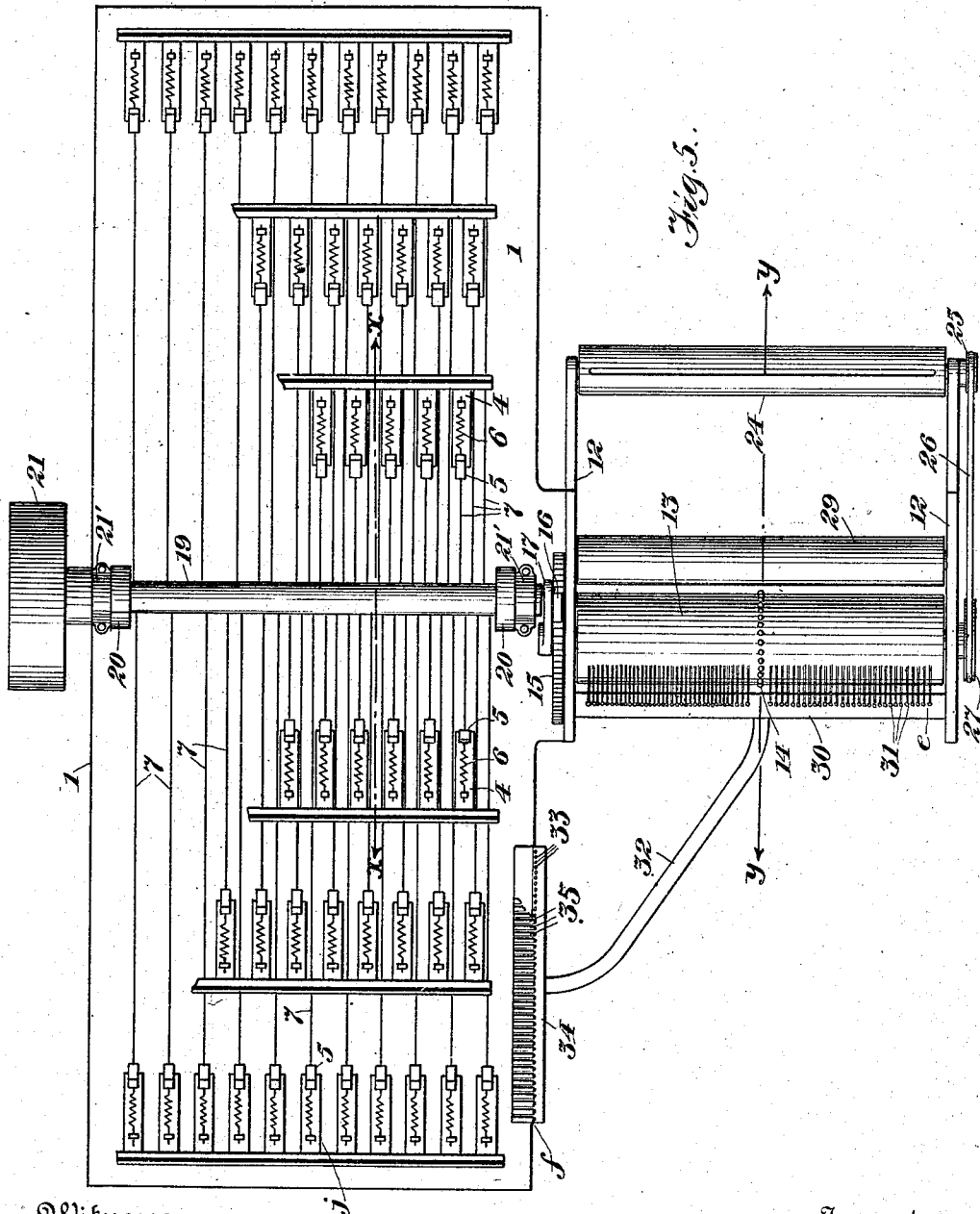
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6 SHEETS—SHEET 4.



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8 SHEETS—SHEET 5.

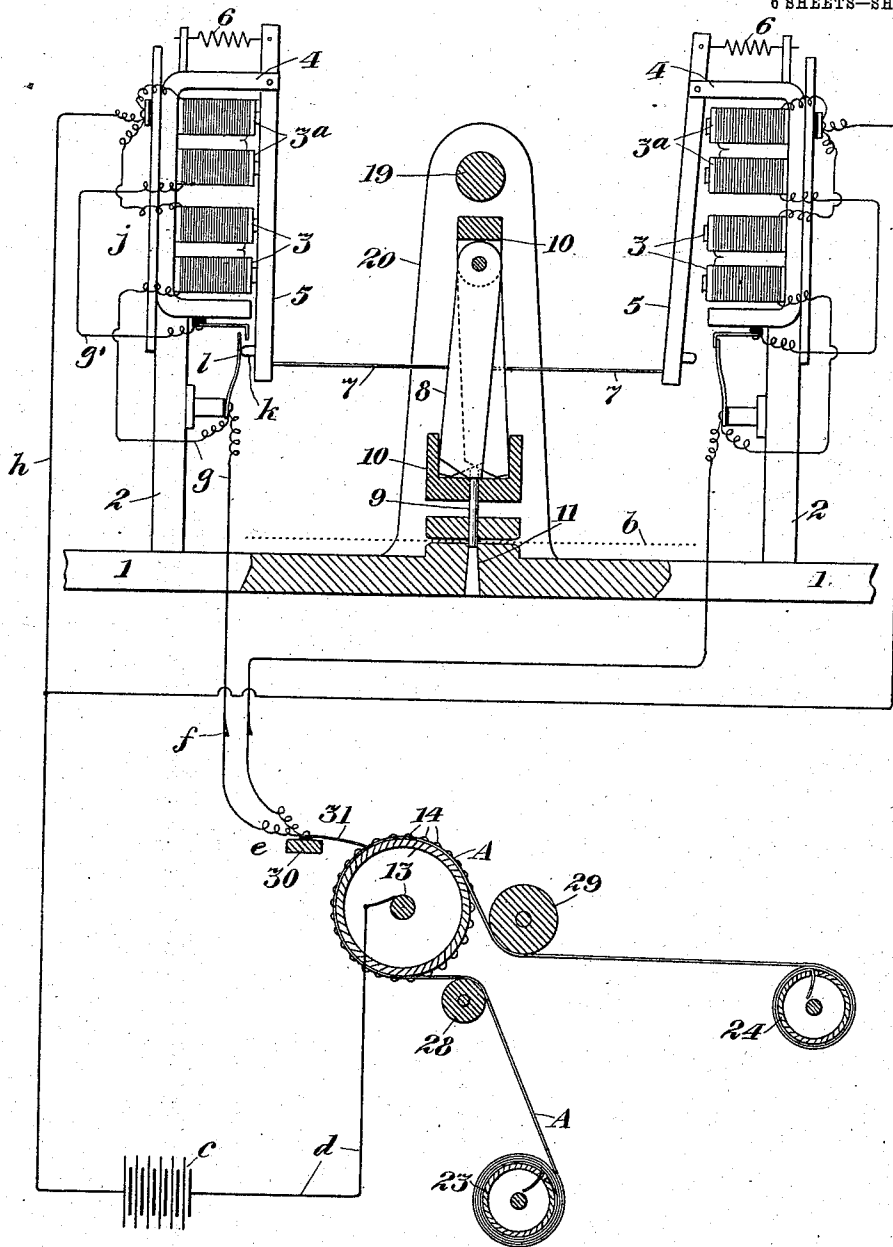


Fig. 6

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6 SHEETS—SHEET 6.

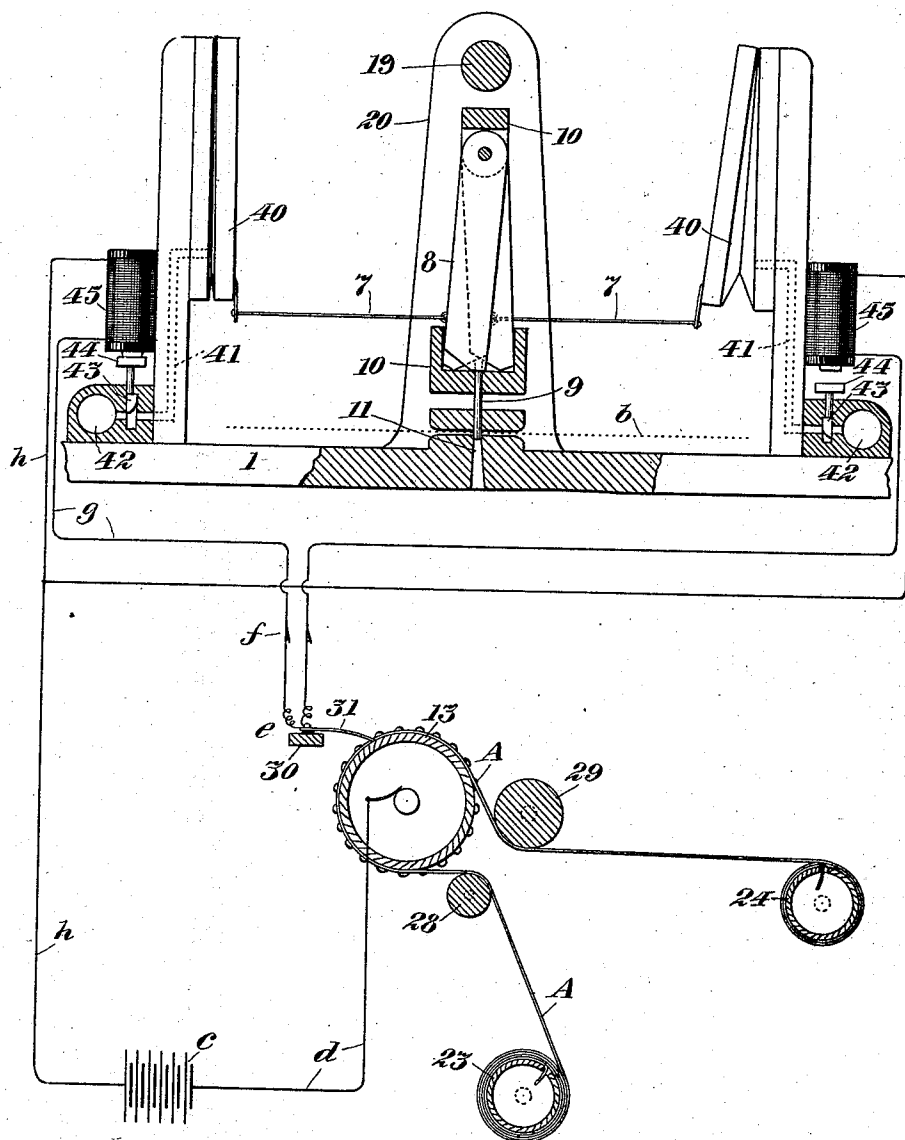


Fig. 7.

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UNITED STATES PATENT OFFICE.

GEORGE HOWLETT DAVIS, OF WEST ORANGE, NEW JERSEY.

METHOD OF AND APPARATUS FOR PERFORATING MUSIC-ROLLS.

964,402.

Specification of Letters Patent. Patented July 12, 1910.

Application filed August 27, 1907. Serial No. 390,395.

To all whom it may concern:

Be it known that I, GEORGE HOWLETT DAVIS, a citizen of the United States, residing at West Orange, in the county of Essex and State of New Jersey, have invented new and useful Improvements in Methods of and Apparatus for Perforating Music-Rolls, of which the following is a specification.

My present invention relates to certain new and useful improvements in method of and machines for perforating music rolls and in an improved "master" and method of making the same.

The machine is of that type wherein a plurality of rolls of paper may be simultaneously perforated by punches controlled either electrically or pneumatically by what is known in the art as a "pattern" or "master."

The prime object of the invention is to provide an improved method of and machine for making a novel "master" from an ordinary commercial music roll, provision being made for correcting in the master, any errors found to exist in the said commercial roll, and to provide copying perforating mechanism for making perforated music rolls which shall have exact duplicates of the note perforations found in the corrected master.

In carrying my improved method into practice with the aid of mechanism, such for instance as hereinafter shown and described, I first make a "master" from an ordinary commercial perforated music roll by passing the latter through the reading or selecting mechanism of a perforating machine which reading mechanism has one of its reader or selector elements (say the central one of the series) arranged to control the outermost punch of the gang of punches on either side of the perforating machine, instead of the central punch, as is customary. The "master" thus cut will have an imperforate zone arranged centrally thereof extending throughout its length with the note perforations that would ordinarily appear in this central zone transposed along one edge of the sheet. Equi-distant rack-holes are formed in this central zone in the "master" during the operation of punching the note-perforations, which rack-holes are formed by the central punch of the gang of punches, so that said rack-holes must be in exact alinement with the note perforations and thus an absolutely accurate feed of the

"master" when used in the copying perforator, must result, to the end that the music rolls cut from said "master" will be exact duplicates thereof so far as the note perforations are concerned.

From the foregoing it will be apparent that my improved "master" comprises a web having a central series of equi-distant rack-holes, with note perforations arranged at either side thereof, and the position of some of the note-perforations being transposed. This new "master" is then run through my improved perforating machine whose reader mechanism has its central reader element transposed from its regular position to a position alongside one of the outermost reader elements of the series so that it will track with the transposed perforation in the master. This transposed reader element controls the central punch in the gang of punches so that the perforated sheets cut from the "master" will agree exactly with the original commercial roll.

In my prior Patent, No. 659,053, dated October 2, 1900, I show and describe a perforating machine wherein the controlling master is provided with rack-holes along its opposite edges, whereas according to my present method and arrangement only a single row of rack-holes is employed and this is arranged in the center of the sheet instead of at the edges. I find this new arrangement to have marked advantages over the old for several important reasons—First, the master is not weakened by the numerous perforations along its edges and—second, the master is not nearly so sensitive to atmospheric changes.

I will now proceed to describe my improvements in connection with the accompanying drawings, wherein—

Figure 1 is a perspective view of a complete perforating machine constructed according to the present invention and designed to cut a "master" from an ordinary commercial music roll. Fig. 2 is a detail view of the mechanism for actuating the rack-hole punch. Fig. 3 is a detail plan view of said mechanism. Fig. 4 is a side elevation partly in section, of the copying perforating machine equipped with a special reader to cooperate with my improved master. Fig. 5 is a plan view of the copying perforator and its reader mechanism. Fig. 6 is a diagrammatic and sectional view taken approximately on the lines $x-x$ and $y-y$

of Fig. 5. Fig. 7 is a view similar to Fig. 6, showing a modified form of my invention as applied to a pneumatic machine. Fig. 8 is a plan view of a portion of an ordinary commercial perforated music sheet from which my improved master is to be copied. Fig. 9 is a plan view of a portion of my improved master. Fig. 10 is a plan view of a portion of a completed music roll copied from the master.

I will first describe the perforator mechanism and its associated reader mechanism for making my improved "master" or pattern from an ordinary commercial music roll; and will then describe the copying perforator mechanism and its associated reader with which the master or pattern cooperates, but will preface the description with the statement that so far as the punching instrumentalities are concerned, these are substantially the same in both mechanisms.

The perforator mechanism for making the master and its associated reader are practically the same as the corresponding mechanism shown and described in my pending application, Serial No. 347,231, filed December 10, 1906, except as to certain necessary improvements and these latter will be described in detail, while the other parts will be set forth in a more general way, a detailed description not being necessary to a complete understanding of the invention.

Referring to the drawings, Figs. 1 and 4, the reference numeral 1 represents a suitable table or support upon opposite sides of which a number of posts 2 are secured, said posts carrying cross-pieces, upon each of which a series of electro-magnets 3, 3^a are mounted, within a U-shaped frame 4. Pivotaly connected to one leg of each U-shaped frame and suspended immediately in front of the pole pieces of each magnet is an iron bar 5 constituting the armature for the magnet. To the upper end of each armature 5 is connected a coil-spring 6 which tends to draw the lower end of the armature away from its magnet poles when the same is demagnetized. To the lower end of each armature 5 is attached a rod or wire 7 which transmits the motion of the armature to one of a series of punch locking dogs or toggles 8, more clearly shown in Fig. 6. The lower end of each toggle or dog 8 is arranged to engage and lock in position for operation one of a series of punches 9 which are loosely carried in the vertically reciprocating punch block 10, which block also carries the dogs or toggles. The punch 9 co-acting with the dies 11 form the perforations in the web to be punched, whether said web be the "master" or the final product of the machine. A shaft 19 is journaled in suitable bearings 20 supported upon standards rising from the table 1, and carries a drive pulley

21 keyed thereto and two eccentrics 21' which impart a rapid reciprocating motion to the punch-block and its punches by reason of the connecting rods 22.

In the operation of the machine, as the pattern sheet passes between the reader elements, presently to be described, the said elements find their way through the perforations in the pattern and complete the electric circuit or circuits through the punch selecting magnets 3 and 3^a causing an attraction of the armatures 5 and through the rod connections 7 move the punch-locking dogs in position to lock the punches and cause them to pass through the material of which the master is to be formed, which master is represented by the reference letter A, Fig. 9.

Having briefly described the perforating machine the reader mechanism associated therewith and its advantages will now be set forth, it being understood that the said mechanism as employed in the master forming perforator is substantially the same in all essentials as the corresponding mechanism shown and described in my aforesaid pending application.

The reference numeral 50 designates a base plate having a pair of guide ways 51 between which is slidably and adjustably mounted the reader frame or support which comprises a transverse bar 53 having a base 54 guided between said guide ways and having depending therefrom a lug provided with a screw-threaded aperture in which a screw 55 passes. This screw 55 has fixed to one end thereof a beveled gear 56 meshing with a beveled pinion 57, the latter being fixed to a shaft 58 having at its free end a manually operable head 59. It will be apparent from the foregoing that operation of the shaft 58, through finger engagement of the operator with the head 59 will cause a rotation of the screw 55, which will result in a movement of the reader mechanism either forward or backward depending upon the direction of movement given the shaft 58, the purpose of which will be presently explained in detail. The upper face of the rail 53 carries a return conductor 60 over which the pattern B passes and upon which rest the reader elements, consisting of a series of selector fingers 61, said selector fingers being in circuit with the magnets 3 and 3^a. The pattern B passes from a delivery spool 62 over an idler 63, thence between the reader elements, under idler 63, between feed rollers 65 and 66 and is finally wound upon the take-up roller 67. The shaft which carries the feed roller 65 also carries a ratchet wheel 67' operated by a pawl 68, which pawl is mounted upon an oscillating arm 69 having a link connection 70 with an arm 71 mounted upon a rock shaft 72, said rock shaft being journaled in a bracket 73 mounted upon

the base plate 1 of the perforating machine. This rock shaft has an upwardly extending arm 74 that is regularly and intermittently actuated by means of a cam 75 mounted upon the power shaft 19 of the perforator. By this arrangement, it will be seen that at each revolution of the said power shaft the rock shaft will be actuated and through the mechanism described impart a step-by-step feed movement to the pattern B.

Inasmuch as the reader elements are manually adjustable to any degree in the direction of feed of the pattern B it will be apparent that any inaccuracies found in the pattern may be corrected in the master and this is accomplished by the operator momentarily stopping the operation of the punching mechanism by depressing the foot treadle referred to in my aforesaid pending application, and then adjusting the reader elements so that they may be caused to enter one or more of the perforations in the pattern earlier or later as the case may be, than they would have entered said perforations if the reader element had not been shifted or adjusted.

In order that the master sheet A may be fed with absolute accuracy through the reader mechanism of the copying perforator presently to be described, I provide the master with equi-distant rack-holes C which rack-holes are arranged centrally of the master and which extend throughout the length thereof as shown in Fig. 9. In order to prevent the said rack-holes in the "master" from intersecting any of the note perforations that would ordinarily appear in the center or middle zone of the pattern, I transpose on the master such central perforations as would be formed by the center punch of the gang of punches in the perforator from their central position to a position along one edge of the master as indicated by the reference letter D, Fig. 9. In order to make this transposition I arrange the circuit connections leading from the central reader element E of the series so as to cause said element to actuate the magnet controlling the outermost punch at one side of the gang of punches. It will be apparent therefore that with this arrangement the master that is cut from the pattern B will have a central imperforate zone extending throughout the length thereof and will also have along one margin the transposed note perforations that correspond to the central perforations in the pattern, which, except for the transposition referred to, would appear in the center of the "master".

In order to form the equi-distant rack-holes in the pattern simultaneously with the punching operation and in exact alignment with the note-perforations, I provide mechanical means for locking the central punch of the gang at regular intervals, say

at every 6th reciprocation of the punch block. This mechanical punch locking means is more clearly shown in Figs. 2 and 3 and consists of the rotary shaft 76 arranged in front of the armature 5 of the magnet that controls the locking of the central punch of the gang, said shaft having a hub 77 provided with equally spaced apertures 78 in which are detachably secured radial pins 79, said pins being arranged to successively engage the said armature 5 at regular intervals to cause the punch locking dog to lock the central punch and thus form the central row of rack-holes in the master. The shaft 76 has mounted thereon at its outer end a ratchet wheel 80 that is given a step-by-step movement through the movement of the pawl 81 mounted upon the pitman 82 having an eccentric connection 83 with the power shaft 19 of the perforating machine. The pawl 81 is normally held into contact with the ratchet wheel 80 by means of a leaf spring 83'.

Inasmuch as the pins 79 are equally spaced and inasmuch as the shaft upon which the pins are mounted is regularly operated through direct connection with the power shaft 19 of the perforator and inasmuch as the rack-hole punch is in line with the punches that form the note perforations, it will be apparent that the rack-holes must be in accurate alinement with said note-perforations, hence an accurate feed of the master when associated with the reader elements of the copying perforator must necessarily result and this is a most important consideration in perforating machines of this type, for it will be apparent that any variation between the feed of the master and the feed of the sheets being cut will result in a distorted or imperfect record.

After the master has been formed in the manner described the same is placed in the copying perforator which will now be described, it being understood that so far as the perforating mechanism is concerned this is the same as the mechanism heretofore described, except as to the reader and this comprises essentially a frame 12 attached to one side of the table 1 and having journaled therein a metal contact and feed cylinder 13 provided with a number of equi-distant studs or sprockets 14, upon its periphery, which studs or sprockets are arranged midway between the ends of the cylinder so as to take into or enter the rack-holes in the master. A ratchet wheel 15 is keyed to one end of the shaft of the cylinder 13 and is operated by the pawl 16 carried on the oscillating lever 17 which is loosely journaled on the shaft of the cylinder 13. The free end of the lever 17 is slotted and engages a crank pin 18 set on the end of the driving shaft 19. Journaled within the frame 12 are two slotted

spools or rollers 23 and 24, the latter being provided with a grooved pulley 25 which is connected by means of a friction belt 26 to a similar pulley 27 keyed to the shaft of the cylinder 13. The rollers 28 and 29 are also journaled in the frame 12.

A suitable brush piece 30 is adjustably secured to the frame 12 in any suitable manner and carries a set of insulated brushes or fingers 31 constituting the reader elements which are adapted to bear against the periphery of the cylinder 13. These brushes each constitute one terminal of a series of insulated wires forming the cable 32, the opposite ends of the wires terminating in stud-like points 33 which are mounted on an insulated strip 34 at one edge of the table as clearly shown in Figs. 4 and 5 of the drawing. The strip 34 is adjusted in such manner as to cause the points 33 to contact the faces of the insulated leaf springs 35 which in turn are electrically connected with the electro-magnets 3 and 3^a.

It is obvious that the electro-magnets if placed in a circuit as illustrated diagrammatically in Fig. 6, will become active and attract their respective armatures 5, thereby causing the punches 9 to become operative resulting in a row of perforations across the paper web *b* which represents the final product of the machine or in other words the perforated music roll to be used in the ordinary self-playing instruments now found upon the market. If, however, an insulating strip is interposed between the brushes 31 and the cylinder 13 such as the web of the master music roll *A* the electro-magnet 3 and 3^a will be deenergized excepting those in circuit with such of the brushes 31 as may register with the perforations in the master.

In making the final perforated music roll from the master heretofore described it will be apparent that the note-perforations *D* that have been transposed to one side of the master must be re-transposed to their original position, which is at the center of the web *b* where they originally appeared in the pattern, and to accomplish this I arrange the outermost reader element *e* of the reader mechanism in circuit with the central punch of the gang of punches so that as the transposed perforations at the margin of the master register with the said reader element *e* the central punch of the gang will be locked and the note perforations represented thereby formed in the center of the sheet where they originally appeared in the commercial roll from which the master was made.

I have described and shown the perforations as they originally appeared in the center of the sheet, as being those that are transposed because I have found in practice that one of the perforations representing what is

known as the 29th note is seldom used. I wish it understood, however, that I do not desire to be limited to the transposition of any particular perforation as obviously I may transpose any of the note perforations.

The operation of the copying perforator will be readily understood from the foregoing description and the accompanying drawing and particularly by referring to Fig. 8 wherein the web of the master *A* is shown having been previously wound upon the spool 23 is carried upward and over the idler 28 with the center row of perforations meshing with the sprockets 14. The master is then placed under the idler 29 and onto the take-up spool 24 where the end of the master is inserted into the slot 7, of the spool 24 upon which the web is re-wound.

The webs *b* to be cut and which represent the final product of the machine are inserted between the die and die-block and are intermittently fed in any well known manner chronological with the master *A*. Power being applied to the pulley 21 a reciprocating motion is imparted to the frame 10 and the lever 17 is caused to oscillate and by reason of the pawl 16 and ratchet 15 conveys to the cylinder 13 an intermittent step-by-step motion which accurately feeds the master *A* over the periphery of the cylinder 13 until one or more of the readers 31 register with the perforations in said master. The insulation between the cylinder 13 and certain of the reader elements 31 being broken an electric circuit is established with one or more of the electro-magnets 3 and 3^a in the following manner, reference being had to Fig. 6: from the battery *c* along the line *d* to the cylinder 13 then to one of the brushes 31 at *e* for example through one of the insulated wires in the cable 32 to one of the contacts 33—35 at *f* thence along the lines *g*—*g'* and through the magnets 3 and 3^a at *j* and over the return wire *h* to the battery *c*. The armature 5 being drawn to the poles of its magnet, the end of the dog 8 controlled thereby locks one of the punches 9 and causes a perforation to be made in the web *b* corresponding in length to the one in the master *A* which, at that period, registers with the brush or reader 31 at *e*. The electro-magnet 3^a is automatically cut out of the circuit by the detent *k* on the armature 5 which opens the spring leaf switch *l* all as shown and described in my prior patents.

In Fig. 7 I have illustrated my invention in a slightly modified form wherein I employ power pneumatics 40 to operate the punch locking dogs or levers 8. Normally the power pneumatics are inflated and have a port on one side communicating with the channel 41 which in turn communicates with a conduit 42, in which a vacuum is created by exhausting the air in any well-known manner. Interposed between the channel 41 and

the conduit 42 is a valve 43 normally closed, and carrying on the upper end of its stem a metal plate or armature 44 placed in close proximity to the pole of an electro-magnet

5 45. In operation, an electric-current passes from the battery *c* along the line *d* to the cylinder 13, thence to the brush 31 and along the line *g*, through the coil of the magnet, and returns over the line *h* to the battery *c*, thus energizing the magnets. The armature 10 44 being attracted to its magnet, lifts the valve 43 and thereby permits the air in the pneumatics 40 to be exhausted into the conduit 42 and so collapses the pneumatics and 15 locks the punches.

It will be apparent that in the modified form of invention just described that the movable member of the power pneumatics operates in substantially the same manner as the pivoted armatures 5 in the electrical construction, hence it is possible with the 20 pneumatic arrangement to associate with the power pneumatic that operates the center punch of the gang of punches, the mechanical rack-hole forming mechanism heretofore described, and when so associated the 25 pins 79 on the hub 77 will engage the movable member of the power pneumatic in the same way that it engages the armature in the electrical construction.

In the description and the drawings, I have, for the sake of clearness, illustrated the "master" forming perforator and the copying perforator with their associated 35 reader mechanisms as two separate and distinct machines, although it will be apparent, that so far as the perforating mechanisms are concerned, they are substantially the same. Obviously, the rack-hole forming 40 mechanism may be put out of service by removing the pins 79 from the apertures 78 in the hub 77, said pins being removable and interchangeable for this purpose and for the purpose of varying the distance between adjacent rack-holes.

It will be apparent that certain changes and modifications may be made to the invention without departing from the spirit thereof and I do not, therefore, desire to be understood as limiting myself to the exact construction shown and described, but reserve the right to all modifications that may fairly come within the scope of the appended claims.

55 1. In a perforating machine, the combination of a gang of punches, continuously operating means for causing one of the punches intermediate the ends of the gang to operate at regular time intervals to form equidistant rack-holes intermediate the edges of the sheet being punched, and means controlled by a pattern for causing the operation of the other punches of the gang.

60 2. In a perforating machine, the combination of a rapidly reciprocating punch block,

of a gang of punches loosely mounted in said block, continuously operating means for setting one of the punches intermediate the ends of the gang to operate at regular time intervals to form equidistant rack-holes intermediate the edges of the sheet to be punched, and means controlled by a pattern for setting the other punches for operation.

3. In a perforating machine, the combination of a gang of punches, punch-locking dogs for locking the punches for operation, electro-magnets and armatures therefor having operative connections with the punch locking dogs, mechanical means cooperating with the armature of one of said electro-magnets to actuate the same at regular time intervals to operate its co-related punch-locking dog, and pattern-controlled reader mechanism in circuit with the other electro-magnets.

4. In a perforating machine, a gang of punches, and pattern-controlled, reader mechanism for controlling the operation of said punches, one of said reader elements intermediate the ends of the series having operative connections with the outermost punch of the gang.

5. In a perforating machine, a gang of normally inactive punches, means for setting said punches for operation, and a series of pattern-controlled reader elements for controlling the action of the punch setting means, one of said reader elements intermediate the ends of the series being arranged to control the outermost punch of the gang.

6. In a pattern-controlled punch-selecting perforating machine, a gang of independently operable punches, and a series of pattern-controlled reader elements for controlling the action of said punches, one of said reader elements and one of said punches being transposed for the purpose specified.

7. In a pattern-controlled, punch-selecting perforating machine, the combination of a gang of punches and locking dogs therefor, separate means for setting each dog, continuously operating mechanical means for operating at regular time intervals, the setting means for the central punch of the gang, and pattern-controlled reader mechanism for operating the setting means for the other punch locking dogs.

8. In a pattern-controlled, punch-selecting perforating machine, the combination of a gang of punches and punch-locking dogs therefor, electro-magnets having connections between their armatures and said dogs, mechanical means cooperating with one of said armatures for regularly operating the same at fixed time intervals to set one of the locking dogs that controls one of the punches intermediate the ends of the gang, and pattern controlled electrical reader mechanism in circuit with all said electro-magnets, except the

one whose armature is mechanically actuated.

9. In a pattern controlled, punch-selecting perforating machine, the combination of a gang of punches and punch-locking dogs therefor, devices for setting each dog, a rotary element cooperating with one of said devices to regularly operate the same at fixed time intervals to lock one of the punches intermediate the ends of the gang, and pattern-controlled reader mechanism for controlling the operation of the other dog setting devices.

10. In a pattern-controlled, punch-selecting perforating machine, the combination of a gang of punches and punch-locking dogs therefor, devices for setting each dog, a rotary element carrying a plurality of equidistant pins arranged adjacent to and adapted to periodically engage and actuate one of said setting devices, means operated from a movable part of the perforating machine for imparting rotary motion to said rotary element, and pattern-controlled reader mechanism for controlling the operation of the other dog setting devices.

11. In a pattern controlled punch-selecting perforating machine, the combination of a gang of punches and their locking dogs, pattern controlled reader mechanism for controlling the setting of said dogs, said reader mechanism comprising a series of selector fingers and a cooperating contact-roller having sprocket teeth on its periphery intermediate the ends of the roller adapted to register with corresponding rack-perforations in a master, and means for feeding a master between the selector fingers and contact roller.

12. In a punch-selecting perforating machine, the combination of a gang of punches, punch locking means therefor, and pattern-controlled reader mechanism for controlling the operation of said punch-locking means, said reader mechanism embodying a series of reader elements, the element at one end of the series being arranged to control one of the punches intermediate the ends of the gang.

13. In a punch selecting perforating machine, the combination of a gang of punches, punch locking means therefor, pattern-controlled reader mechanism for controlling the operation of said locking means, said reader mechanism embodying a series of selector fingers and a contact roller having a plurality of centrally arranged sprocket teeth, the finger at one end of the series being arranged to control one of the punches intermediate the ends of the gang.

14. The method herein described of making perforated music records from a pattern having note-perforations, which consists in making a master from the pattern in which master the position of some of the note-perforations are transposed, forming rack-holes in the master in the zone corresponding to that occupied by the transposed perforations in the pattern, then cutting a record from the master and re-transposing in the record the said transposed perforations to cause them to occupy the same position they occupied in the pattern.

15. The method herein described of making perforated music records from a pattern having note perforations, which consists in making a master from the pattern, in which master a row of the note perforations corresponding to a row occupying a position intermediate the edges of the pattern are transposed to a position different from that they occupy in the pattern, forming equidistant rack-holes in the master in the zone corresponding to that occupied by the said transposed note perforations in the pattern, and then cutting a record from the master and retransposing in the record, the said transposed perforations to cause them to occupy the same position relatively to the other note perforations that they occupied in the pattern.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

GEORGE HOWLETT DAVIS.

Witnesses:

J. FRED. BERSTECHER, Jr.,
 MARIAN P. BARRADALE.