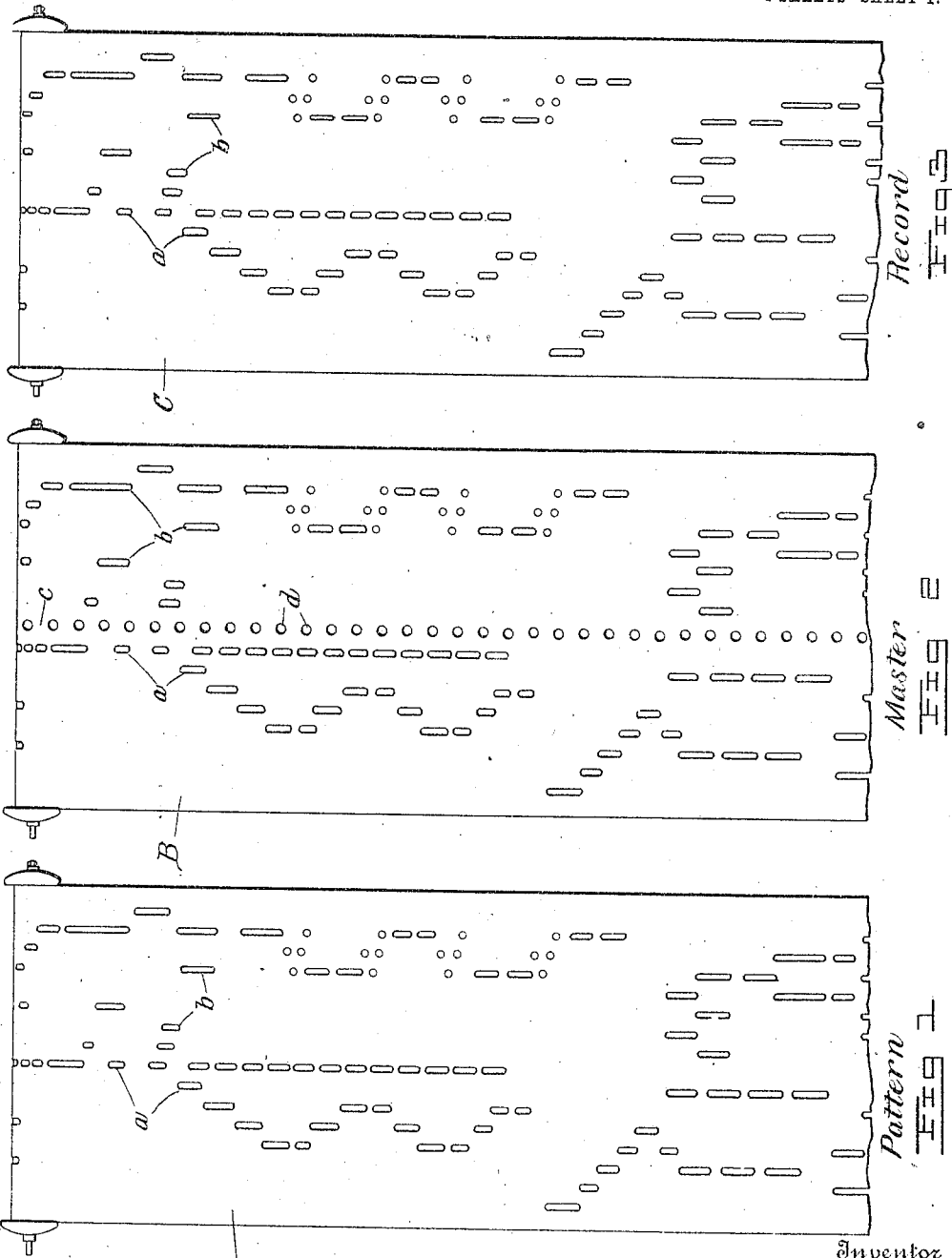


G. H. DAVIS.
METHOD OF PERFORATING MUSIC SHEETS.
APPLICATION FILED FEB. 2, 1910.

964,404.

Patented July 12, 1910.

3 SHEETS—SHEET 1.



Witnesses

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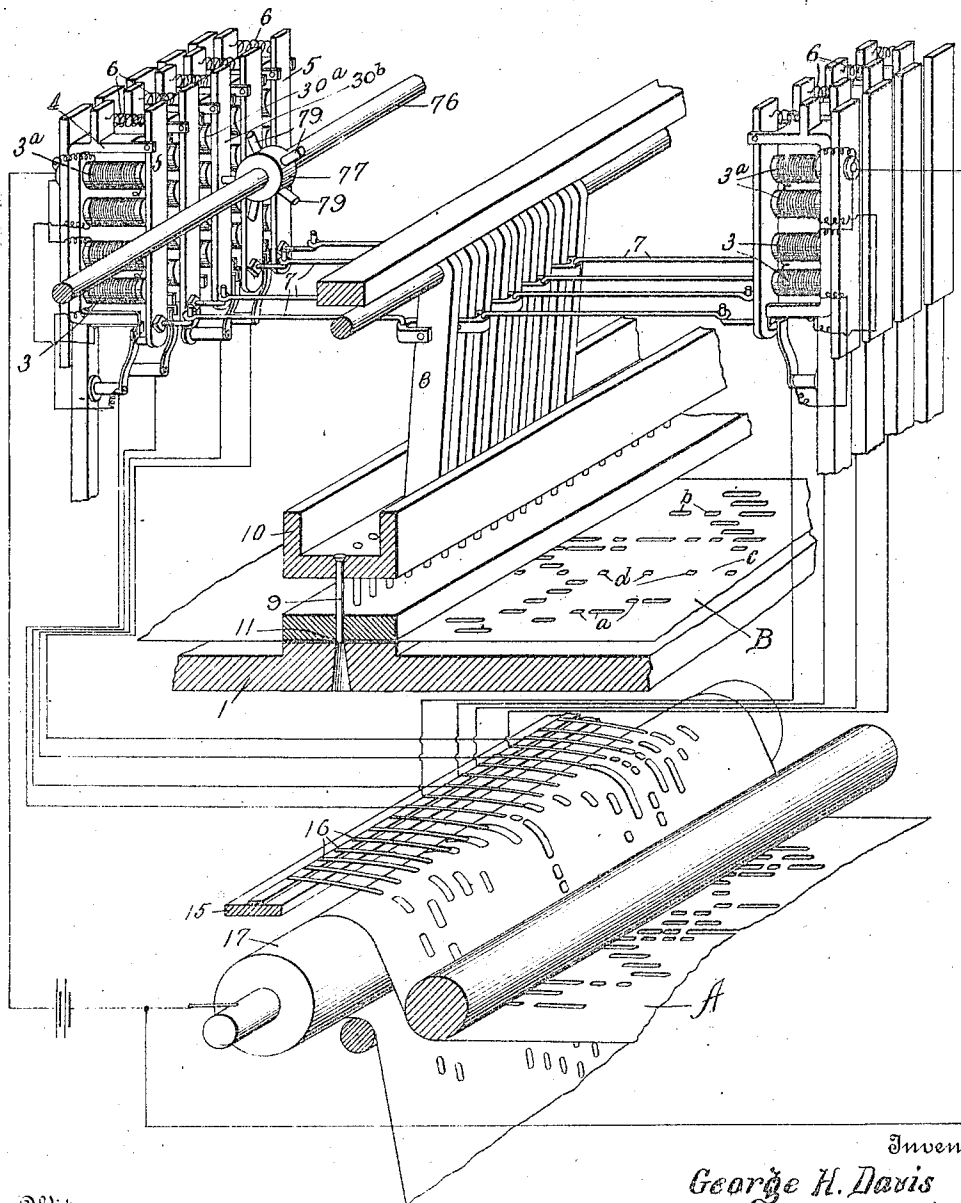
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3 SHEETS—SHEET 2.

Fig 4



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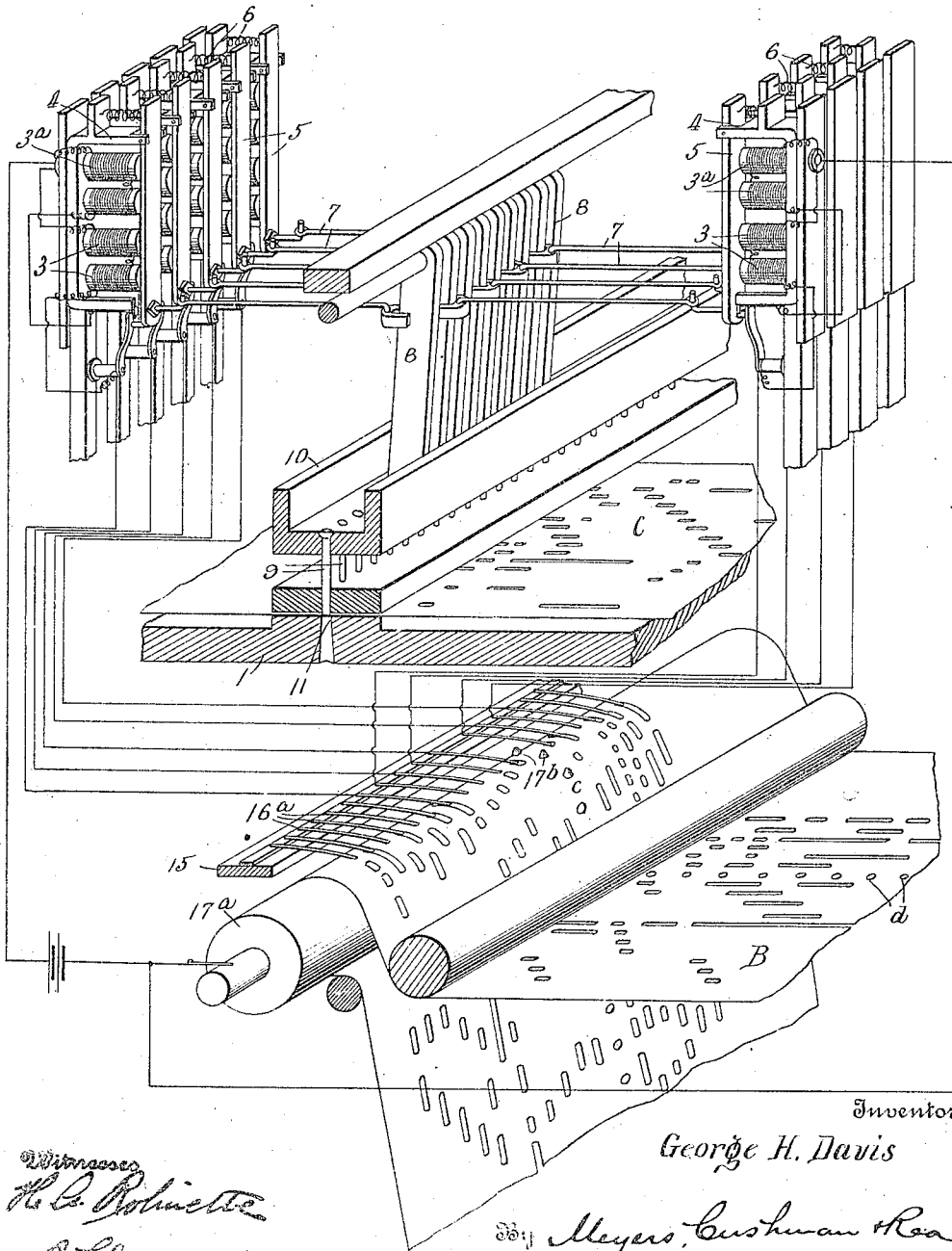
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3 SHEETS—SHEET 3.

FIG 5



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METHOD OF PERFORATING MUSIC-SHEETS.

964,404.

Specification of Letters Patent.

Patented July 12, 1910.

Application filed February 2, 1910. Serial No. 541,566.

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 Perforating Music-Sheets, of which the following is a specification.

My present invention relates to a certain new and improved method of making perforated music sheets or rolls such as are employed to control the operation of the sound producing devices of self-playing musical instruments, and is in the nature of an improvement upon the method set forth in my allowed application Serial No. 390,395, filed August 27, 1907.

In carrying out the method according to my aforesaid allowed application, I first make a "master" from an ordinary commercial perforated music roll by passing the latter through the reader or selecting mechanism of a pattern-controlled, punch-selecting perforating machine, which reader 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 longitudinally throughout its length with the note perforations that would ordinarily appear in this central zone transposed along one edge of the sheet. Equidistant 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 a copying perforator, must result, to the end that the music records or rolls cut from said "master" will be exact duplicates thereof so far as the note perforations are concerned. The "master" thus formed with its central row of rack-holes and row of transposed perforations arranged along one edge thereof, is then run through the reader mechanism of a perforating machine, which 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 perforations in the master. This transposed reader element controls the central punch in the gang of punches so that the perforated sheets or records cut from the "master" will agree exactly with the original commercial music roll or pattern. It will be seen therefore, according to the method of my said former application, (as far as the specific embodiment therein illustrated is concerned) that the row of transposed perforations in the "master" has its position changed or altered relatively to the other rows of perforations, and this may not, in some instances, be entirely desirable, and herein is where the present method differs materially from the former.

According to the present method, which forms the subject-matter of this application, I do not change or alter, in the master, the relative arrangement of the different rows of note perforations, the arrangement of the different rows of perforations relatively to each other being the same in the master as in the pattern, the only difference being that one or more rows of the perforations are transposed or shifted laterally one or more punch space or spaces, or a distance equal to the space between one or more punches, and this without in any manner altering the arrangement of the different rows of perforations relatively to each other.

Briefly and generally stated the present invention resides in the herein described method of making perforated music records from a pattern having note perforations, which method consists in making a "master" from the pattern, in which master one or more rows of the note perforations running longitudinally of the pattern is or are transposed or shifted laterally without altering the arrangement thereof relatively to the other rows of perforations, whereby to provide a rack-hole zone between two adjacent rows of note perforations; forming equidistant rack-holes in the said zone of the master, then cutting a record from the master and retransposing in the record the said laterally shifted or transposed perforations to cause them to occupy the same position in the record that they occupied in the pattern.

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 marginal edges beyond the outer-

most rows of note perforations; whereas according to my present method and arrangement only a single row of rack-holes is employed and this row is preferably arranged in the longitudinal center of the sheet instead of at its extreme opposite edges. I find this new arrangement to have marked advantages over the old for several reasons. First, the master is not weakened by numerous perforations along its edges; and second, the master is not nearly so sensitive to atmospheric changes.

I will now proceed to describe my improved method in connection with the accompanying drawings, in which—

Figure 1 is a plan view of a portion of a pattern from which the "master" is made. Fig. 2 is a similar view of a portion of the "master", showing the rack-holes formed therein. Fig. 3 is a similar view of the record formed from the master and corresponding with the pattern. Fig. 4 is a diagrammatic view showing in perspective one form of mechanism for making a master according to my improved method, and Fig. 5, is a similar view showing one form of mechanism for making a record from said master.

In carrying my improved method into practice I first take an ordinary commercial perforated music sheet, such as A, Fig. 1, which I shall hereinafter refer to as the pattern, and from this pattern I cut a "master" B, Fig. 2, in which "master" some of the rows of note perforations *a*, are shifted or transposed laterally one punch space, without altering the position or arrangement thereof relative to the other rows of perforations *b* so as to leave an imperforate rack-hole zone *c*, between two adjacent rows of perforations, said zone being preferably located centrally of the master sheet. In this rack-hole zone *c*, I cut a row of equidistant rack-holes *d*, running longitudinally of the sheet and which occupy the position formerly occupied by a row of the transposed or laterally shifted note-perforations. I then cut a record C, Fig. 3, from the master thus formed, employing the master as the pattern from which the record is cut, and retranspose in the record the said rows of transposed perforations so that they will occupy the same position in said record that they occupied in the pattern A, it being understood that the rack-holes are entirely eliminated from the record, these being employed only in the master to insure a true and accurate feed thereof.

In the illustrated embodiment of the invention I have shown the rack-hole zone and row of rack-holes as located exactly centrally of the sheet, and I prefer this arrangement, but obviously this is not absolutely necessary and they may be otherwise located without departing from the spirit of the invention. I have further indicated that the

transposed perforations are preferably shifted laterally one punch space, but obviously they may be shifted more than one punch space.

In Figs. 4 and 5, I have illustrated in a somewhat diagrammatic way one manner of means for practicing my improved method through the aid of mechanism, the showing being sufficient to enable those skilled in the art to understand the invention. In practicing the invention in this manner I prefer to make use of a pattern-controlled punch-selecting perforating machine of the type illustrated in my prior Patent No. 900,151, dated October 6, 1908, and my allowed co-pending application Serial No. 390,395, filed August 27, 1907; although with slight alterations and additions any punching machine of the pattern-controlled punch selecting type may be employed. I will first describe so much as is necessary of the perforating machine and its associated reader mechanism for making the "master" B from an ordinary commercial music sheet; and will then describe the copying perforating machine and its associated reader with which the master coöperates, but will preface this description with the statement that so far as the punching instrumentalities are concerned, these are substantially the same in both mechanisms.

Referring to Fig. 4, the reference numeral 1, designates a suitable table or bed-plate above which are arranged several series or rows of electromagnets 3, 3^a, said magnets being supported in U-shaped frames 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 armatures for the magnets. To the upper end of each armature 5, is connected a coil spring 6, which tends to draw the lower end of its armature away from the magnet poles when the magnet 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. The lower end of each dog or toggle 8 is arranged to engage and lock in position for operation one of a series or gang of punches 9, which are loosely carried in a vertically reciprocating punch-block 10, which block also carries the dogs or toggles as is usual in constructions of this type. The punches 9, co-acting with the die-block 11, form the perforations in the web or sheet to be punched, whether said web be the "master" or the record or final product of the machine. The punch-block 10, is reciprocated in any suitable manner, (not shown.)

In the operation of the machine, as the pattern sheet passes between the reader elements, or fingers, presently to be described,

the said elements find their way through the note perforations in the pattern and complete the electric circuit or circuits through the punch-selecting magnets 3, 3^a, causing an attraction of the armatures 5, and through the rod connections 7, move the punch-locking dogs 8, in position to lock their correlated punches 9, and cause them to pass through the material of which the master is to be formed, which master is represented by the reference letter B, Figs. 2 and 4.

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 patent and pending application.

The reader mechanism when of the electrical type herein shown, comprises essentially a rail 15, carrying a series of selector fingers 16, that are arranged to bear upon a contact bar or roller 17, the said fingers and bar or roller being in circuit with the electro-magnets 3, 3^a, as shown. The pattern A, is caused to travel, by any suitable means, (such as shown in my aforesaid patent,) between the fingers 16 and contact roller 17, and in so doing as the ends of the fingers pass through the note-perforations *a* and *b* in the pattern they will bear upon the contact roller 17 and thus complete the circuit through the electro-magnets 3, 3^a, causing their armatures to actuate the punch-locking dogs 8, so as to lock the punches 9, for operation.

In order that the "master" B, may be fed with absolute accuracy through the reader mechanism of the copying perforator presently to be described, I provide the master with equidistant rack-holes *d*, which rack-holes in the instance shown, are arranged centrally of the sheet throughout the length thereof as shown in Fig. 2. 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 A, I transpose or shift laterally in the master, but without altering their relative arrangement, all the rows of note-perforations *a*, to one or both sides of the rack-hole zone *c*, said rows of transposed perforations being shifted at least one punch space, so as to leave an imperforate zone (imperforate so far as note perforations are concerned) between two adjacent rows of note perforations, and in this zone the rack-holes are formed. In order to make this transposition I cut out of circuit one magnet as 30^a that is to control the locking of the punches that forms the rack-holes in the master, and

shift the circuit connections from the selector fingers of all the other magnets, to one side of the magnet so cut out, at least one punch space laterally, so that they will lead to the magnets 3, 3^a removed at least one punch space to one side of the said cut out magnet 30^a. It will be apparent therefore, with this arrangement of the circuits, the master B, that is cut from the pattern A, will have a central imperforate zone *c*, extending throughout the length thereof, and will also have its row of note-perforations to one side of said zone shifted laterally, at least one punch space, but without altering the arrangement of said rows of shifted or transposed note-perforations relatively to the other rows of note perforations.

In order to form the equidistant rack-holes *d*, in the master simultaneously with the note punching operation and in exact alinement with the note perforations, I provide mechanical means for locking at regular intervals the rack-hole forming punch of the gang, said punch being locked say at every sixth reciprocation of the punch block. This mechanical punch-locking means may be the same as that shown and described in my aforesaid pending application, and consists of a rotary shaft 76, arranged in front of the armature 30^b of magnet 30^a, said shaft carrying a hub 77, provided with a plurality of equally spaced pins 79, said pins being arranged to successively engage the armature 30^b at regular intervals and thus cause its correlated punch-locking dog to lock the rack-hole forming punch and form the row of rack-holes in the master. The shaft 76, is given a step-by-step rotation by any suitable means not shown, but preferably the means shown and described in my aforesaid allowed application. Inasmuch as the pins 79, are equally spaced and the shaft upon which they are mounted is regularly operated, and inasmuch as the rack-hole forming 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 the note-perforations, hence an absolutely accurate feed of the master, when associated with 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 therefrom will result in a distorted or imperfect record. After the master has been formed in the manner described, it is placed in the reader of the copying perforator, Fig. 5, to make the records therefrom, it being understood that so far as the perforating instrumentalities are concerned these are the same as the mechanism heretofore described, except that

the mechanical means for locking the rack-hole forming punch is put out of commission by removing the pins 79 from the hub 77, and connecting the magnet 30^a in circuit with a reader element, or if desired the shaft carrying the hub and pins may be eliminated entirely.

The reader mechanism for the copying perforator has its contact roller 17^a provided on its periphery with a plurality of equidistant studs or sprockets 17^b, arranged on the roller in position to take into the row of rack-holes *d*, in the master, whereby to cause the latter to feed in a true and accurate manner. The contact roller is of course rotated in any suitable manner.

It is obvious that the electromagnets 3, 3^a, if placed in circuit as illustrated diagrammatically in Fig. 5, 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 or record C, which represents the final product of the machine, or in other words the perforated music roll to be used in the self-playing musical instruments now found upon the market. If, however, an insulating strip is interposed between the contact fingers 16^a and cylinder 17^a, such as the web of the master B, the electromagnets will be deenergized, except those in circuit with such of the fingers as may register with the note-perforations in the master.

In making the final perforated music roll or record C, from the master B, heretofore described, it will be apparent that the rows of note-perforations in the master that have been shifted laterally or transposed must be re-transposed to their original position, or the position they occupied in the pattern A, for it will be understood the record C, has no rack-holes therein. To accomplish this the selector fingers of the reader mechanism associated with the master are transposed or shifted laterally one punch space so that they will track with the rows of transposed perforations in the master and the circuit connections from these fingers lead in regular order to the electromagnets 3, 3^a that control the locking of the gang of punches. In this manner the rows of transposed perforations in the master are re-transposed in the record C, so that they will occupy the same position in said record that they occupied in the pattern.

In the construction herein shown and described I have provided for the transposition of a plurality of rows of note perforations so that the rack-holes will appear in the longitudinal center of the master B, because I have found in practice that one of the perforations representing what is known as the 29th note is seldom used, and further, because better results are secured

in the feed and life of the master when the rack-holes are located in the center thereof. I wish it understood however, that I do not desire to be limited to the transposition of any specific number of rows of note perforations or any particular location of the rack-holes, as obviously, according to the present method I may transpose any desired number of rows of note perforations without altering their arrangement relatively to the other rows of note perforations, and this latter result is one of the prominent features of the invention.

What I claim is:

1. The method herein described of making perforated music records from a pattern having note-perforations, which consists in making a master from a pattern in which master a row of the note-perforations running longitudinally thereof is transposed or shifted laterally without altering its arrangement relative to the other rows of perforations so as to leave a rack-hole zone between two adjacent rows of note perforations, forming equidistant rack-holes in the master in said zone, then cutting a record from the master and re-transposing in the record the said row of transposed perforations to cause the latter to occupy the same position in the record that they occupied in the pattern.

2. The method herein described of making perforated music records from a pattern having note-perforations, which consists in making a master from a pattern, in which master a plurality of rows of note-perforations running longitudinally of the pattern are transposed laterally so as to leave a rack-hole zone between two adjacent rows of said perforations, forming equidistant rack-holes in the master in the said zone, then cutting a record from the master and retransposing in the record the said plurality of rows of transposed perforations to cause them to occupy the same position in the record they occupied in the pattern.

3. The method herein described of making perforated music records from a pattern having note-perforations, which consists in making a master from a pattern, in which master a plurality of rows of note-perforations running longitudinally of the pattern are transposed laterally one punch space so as to leave a rack-hole zone between two adjacent rows of said perforations, forming equidistant rack-holes in the master in the said zone, then cutting a record from the master and retransposing in the record the said plurality of rows of transposed perforations to cause them to occupy the same position in the record they occupied in the pattern.

4. The method herein described of making perforated music records from a pattern having note-perforations, which consists in

making a master from a pattern, in which
master all the rows of note-perforations cor-
responding to those occupying a position
between one longitudinal edge of the pat-
tern and the center thereof are transposed
laterally one punch space without altering
their arrangement relative to the other rows
of note-perforations, so as to provide a cen-
tral rack-hole zone in the master, forming
equidistant rack-holes in said zone, then cut-
ting a record from the master and retrans-

posing therein the said rows of transposed
perforations to cause them to occupy the
same position in the record that they occu-
pied in the pattern.

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

GEORGE HOWLETT DAVIS.

Witnesses:

EDWIN H. VOLCKMANN,
HARVEY M. ROBERTS.