P. B. KLUGH.

METHOD OF MARKING AND PERFORATING SHEETS.

APPLICATION FILED MAR. 10, 1915.

1,310,420.

Patented July 22, 1919.

2 SHEETS—SHEET 1.

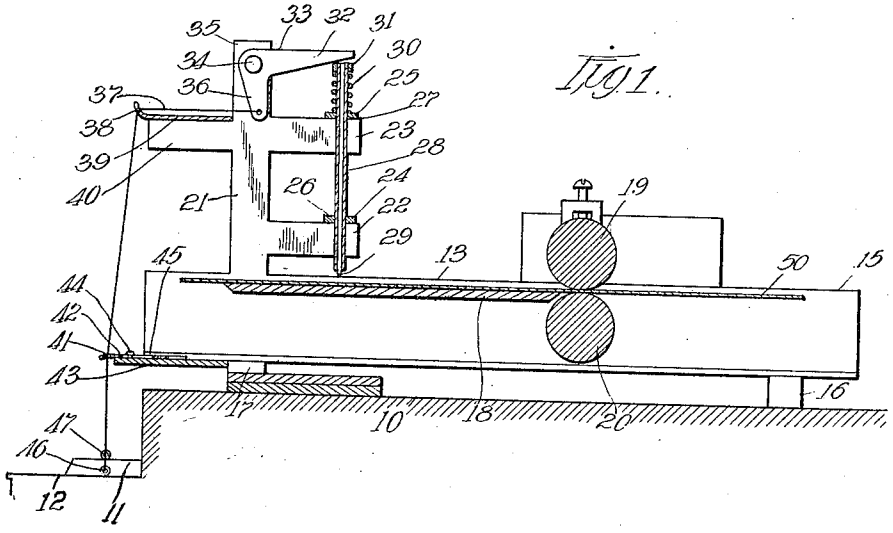


Fig. 1.

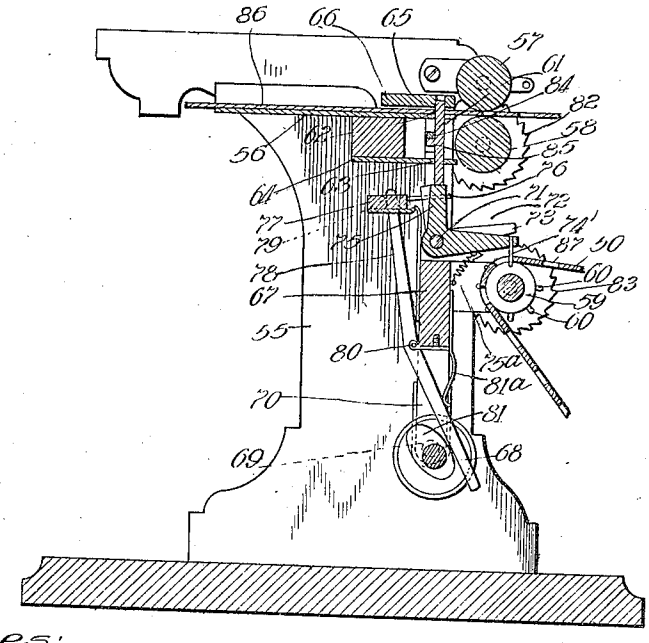


Fig. 2.

Witnesses:
Robert F. Irwin
Willard L. Pollard

Inventor:
Paul B. Klugh.
By Jones, Addington, Ames & Seibold
Attys.

THE COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

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2 SHEETS—SHEET 2.

Fig. 3.

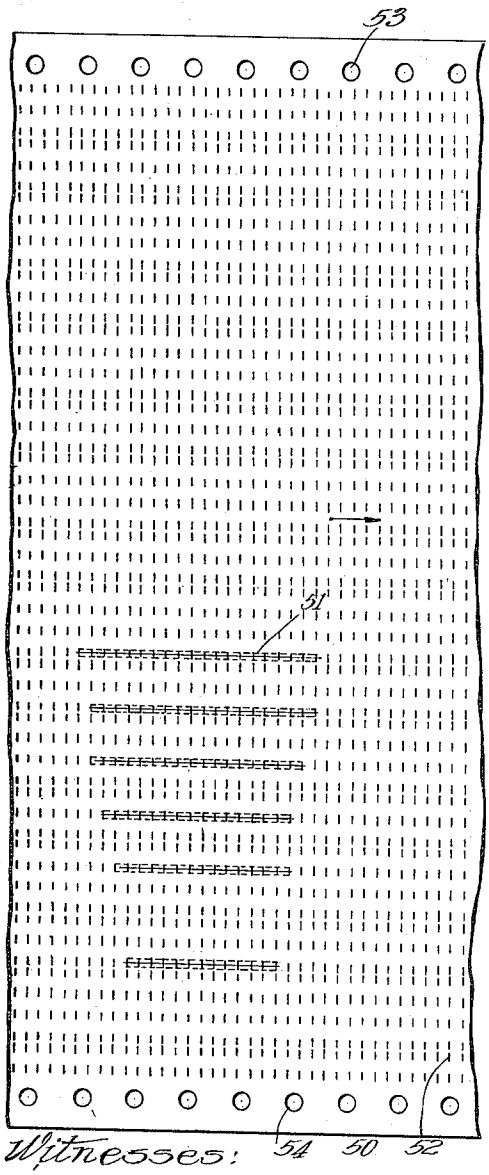
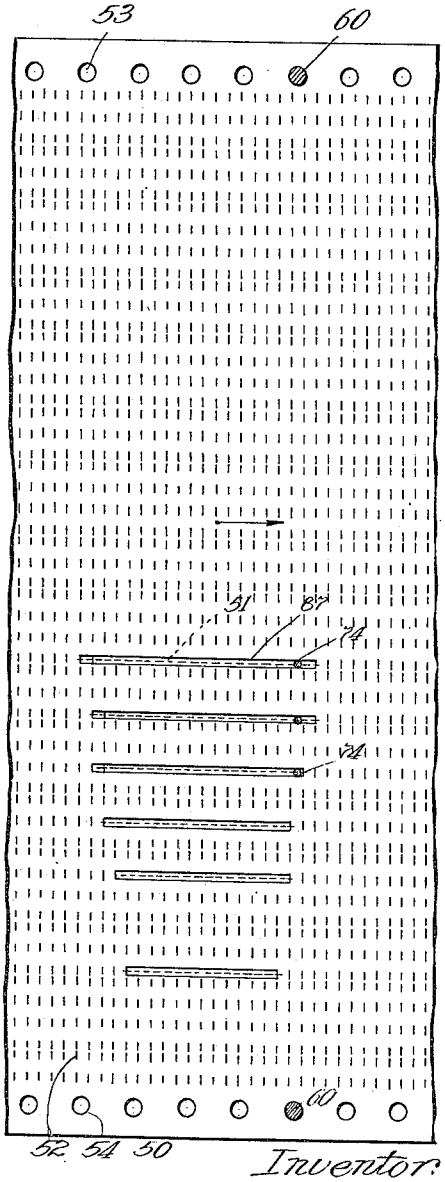


Fig. 4.



Witnesses:

Robert H. Weir

Willard L. Pollard

Inventor:

Paul B. Klugh.

By Jones, Addington, Ames & Seibold

Atty.

THE COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

PAUL B. KLUGH, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE CABLE COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

METHOD OF MARKING AND PERFORATING SHEETS.

1,310,420. Specification of Letters Patent. Patented July 22, 1919.

Application filed March 10, 1915. Serial No. 13,516.

To all whom it may concern:

Be it known that I, PAUL B. KLUGH, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented new and useful Improvements in Methods of Marking and Perforating Sheets, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to a method of marking and perforating sheets, and more specifically to the making of master-sheets for use in automatic perforating-machines for making music-rolls for automatic musical instruments.

One of the objects of my invention is to provide a method of marking and perforating these sheets which shall be simple and direct and which can be used in the preparation of what are known as "hand-played music-rolls," that is, music-rolls which will reproduce a selection according to the player's interpretation, rather than in strict accordance with the music as it is written.

Further objects will appear from the detailed description to follow and the appended claims.

In the drawings, in which I have illustrated apparatus for carrying out my method,

Figure 1 is a vertical section, showing part of a musical instrument, such as a grand piano, and showing also a recording-device, operatively connected with the musical instrument, for making a record on a master-sheet of a musical selection as it is being played;

Fig. 2 is a vertical section, showing an automatic perforating-machine, controlled by a perforated master-sheet, for use in making perforated note-sheets;

Fig. 3 is a face-view of a part of a master-sheet, made according to my invention, showing, in full lines, the marks made by the recording-device and showing, in dotted lines, the outlines of the perforations which are to be made in the master-sheet to correspond to the markings;

Fig. 4 is a face-view of the master-sheet, showing, in full lines, the perforations made to correspond to the recorded markings, and showing, in dotted lines, the extent of the corresponding recorded markings, and showing also, in section, certain of the reader-fingers which have dropped into the perforations in the master-sheet, and showing also, in section, the spurs on the feed-wheel of the automatic perforating-machine.

In carrying out my method, the master-sheet is placed in position in the recording-device, which is so connected with a musical instrument that, when a selection is played on the musical instrument, a record will be automatically marked on the master-sheet, showing what notes were sounded and the duration of the notes. The master-sheet is then removed from the recording-machine and perforated in any suitable manner (as by a hand-punch or perforating-machine) in substantial correspondence with the markings made by the recording-device. The master-sheet is then placed in position in an automatic perforating-machine to control the operation of the punches which make the perforations in the note-sheets.

Referring now to the drawings in detail, and first to the musical instrument and recording-device shown in Fig. 1, a musical instrument (indicated in general by 10), which may be a grand piano and which has the usual black and white keys 11 and 12, has suitably supported thereon a recording-device (indicated in general by 13), comprising a frame 15 supported on the instrument 10 by means of legs 16 and 17, a platen 18 for supporting the master-sheet, and a pair of feed-rolls 19 and 20 for causing the master-sheet to travel over the platen 18. Supported on the frame 15, are a pair of standards 21, each having a pair of horizontal arms 22 and 23 for supporting cross-bars 24 and 25, respectively, having guide-openings 26 and 27, respectively, in which are slidably mounted the marking-devices 28, which are provided with marking-points 29 for engaging the master-sheet as it travels beneath them. Coil-springs 30 surround the marking-devices 28 above the bar 25 and engage nuts 31, threaded on the upper end of the marking-devices, to hold the marking-devices normally in raised position out of engagement with the master-sheet. The upper ends of the marking-devices 28 are located directly beneath horizontal arms 32 of bell-crank-levers 33, which are pivotally mounted on a shaft 34, which extends trans-

versely of the marking-device and is mounted in vertical extensions 35 of the standards 21. Connected to the vertical arms 36 of the bell-crank-levers 33, are cords 37, which extend through openings 38 in a guide-plate 39 mounted on horizontal arms 40 extending from the standards 21. The cords 37 extend farther, through guide openings 41 in a guide-plate 42, which is adjustably mounted on a plate 43, extending across the front of the recording-device, by means of screws 44 extending through slots 45 in the plate 42. The ends of the cords 37 are secured to screw-eyes 46 and 47, which are screwed into the keys 11 and 12.

The use and operation of the recording-device is as follows: A master-sheet 50 is placed in position upon the platen 18 and in position to be engaged by the feed-rolls 19 and 20. The feed-rolls 19 and 20 are then set in operation to cause the master-sheet to travel over the platen, beneath the marking-points 29, and, at the same time, a selection is played on the musical instrument. The depression of the various keys 11 and 12 of the musical instrument will cause corresponding marking-devices 28 to be depressed to bring the marking-points 29 into engagement with the master-sheet, through the instrumentality of the bell-crank-levers 33 and the cords 37. The extent of the recorded markings will correspond exactly to the duration of the corresponding notes. These markings are shown at 51 in Figs. 3 and 4.

Either before or after the record has been made on the master-sheet, as above described, the master-sheet is provided with transverse markings 52, as shown in Figs. 3 and 4, the distance between adjacent transverse markings being equal to the feed-step of the step-feed-device of an automatic perforating machine, which the master-sheet is to control. The transverse markings 52 are for use as a guide in punching the master-sheet after it has been marked, so that the ends of the perforations in the master-sheet can be properly located with respect to the reader-fingers of the perforating-machine, with which the master-sheet is to be used. Either before or after the record is made on the master-sheet, it is also provided with a series of holes 53 and 54 on its opposite edges for engagement with the spurs of the feed-wheels of the automatic perforating-machine. After the record has been made on the master-sheet, as above described, it is perforated in substantial correspondence with the recorded markings, with this slight variation, however, that the perforations, instead of being exactly co-extensive with the recorded markings, are made so that their front ends coincide with those transverse markings 52 which are nearest the ends of the recorded markings 51. This variation, however, is so slight that it will be imperceptible to the ear when the note-sheets, prepared from the master-sheets, are played.

In practice, the master-sheet may travel about six inches per second, and the transverse marks on the master sheet may be placed about $\frac{1}{4}$ of an inch apart, in which case, the distance between the transverse markings will correspond to $\frac{1}{24}$ of a second. With such a spacing of the transverse markings, the front end of the recorded mark on the record-sheet can never be more than $\frac{1}{8}$ of an inch distant from one of the transverse markings 52, so that the variation of the front end of a perforation from the end of a recorded mark should never be more than would correspond to $\frac{1}{48}$ of a second in the time of playing the selection. By this method of making master-sheets, the individuality of the performer is brought out, that is, the perforated master-sheet will correspond to the player's interpretation of the selection, rather than to the music as it is written. Thus, in Figs. 3 and 4, the music, as written, may indicate that the notes, corresponding to the markings 51 shown, are to be sounded simultaneously and are to be of equal duration. As it was actually played, however, the record shows that certain of the notes were sounded before others, and the sheet is punched to correspond to this marking.

After the master-sheet has been perforated, as above described, it is placed in a suitable automatic perforating machine (such as that shown in Fig. 2) which comprises a frame 55, on which is supported a platen 56 and in which are mounted a pair of feed-rolls 57 and 58 for causing the note-sheets to travel over the platen 56. A feed-wheel 59, for the master-sheet, is also mounted in the frame 55 and is provided with spurs 60 for engagement with the openings 53 and 54 of the master-sheet 50, as shown in Fig. 4.

A series of punches 61 are slidably mounted in openings 62 and 63 in the platen 56 and guide-plate 64, respectively. The upper ends of these punches are positioned to extend into openings 65 in a die-plate 66, located above the platen 56. A cross-bar 67 is mounted for vertical sliding movement in the frame 55 and is driven from the shaft 68 by means of a crank 69 and connecting-rod 70. Mounted on the cross-bar 67, is a transverse rod 71, on which are pivotally mounted a series of punch-controlling-devices (indicated in general at 72), each comprising a horizontal arm 73, provided with a reader-finger 74 positioned in the line of travel of the perforations in the master-sheet, and a vertical arm 75 which engages the lower end of the punches 61 when the reader-finger 74 drops into an opening in

the master-sheet. Each of the punch-controlling-devices 72 is provided with a spring 75ª to normally hold the reader-finger 74 in engagement with the master-sheet 50. Means are provided for withdrawing such of the reader-fingers 74 as have dropped into perforations in the master-sheet, comprising a yoke 76, extending in front of the arms 75 and secured to a slidably mounted cross-bar 77. This cross-bar is actuated by means of a lever 78, which engages within an opening 79 in the cross-bar and is pivotally mounted at 80 on the cross-bar 67. The lever 78 is actuated by means of a cam 81, mounted on the shaft 68 and engaging the lower end of the lever. A spring 81ª holds the lever 78 in engagement with the cam 81. Suitable step-by-step feed-mechanisms are provided for the note-sheet and master-sheet, comprising ratchet-wheels 82 and 83 actuated by any suitable mechanism (not shown). Suitable mechanism is provided for withdrawing the punches 61 after they have been operated, including a cross-bar 84, extending above lugs 85 secured to the punches 61, the cross-bar 84 being mounted to move with the cross-bar 67.

The operation of the yoke 76 and cross-bar 84 is so timed, with respect to the operation of the ratchet-wheels 82 and 83 which feed the master-sheet and note-sheets, that the reader-fingers 74 and punches 61 will be withdrawn from engagement with the master-sheet and music-sheet, respectively, when the ratchet-wheels are advanced to feed the sheets forward.

The use and operation of the perforating-machine is as follows: A suitable perforated master-sheet 50 is placed in position in the machine, with the spurs 60 engaging the openings 53 and 54 in the master-sheet, and the blank note-sheets 86 are placed in position to be engaged by the feed-rolls 57 and 58. The machine is then put in operation to cause the master-sheet and note-sheets to be advanced, and the cross-bar 67 to be reciprocated vertically. The reader-fingers 74 will ride on the master-sheet 50 until an opening 87 in the master-sheet comes into position beneath a reader-finger. As long as the reader-fingers 74 ride on top of the master-sheet, the reciprocation of the cross-bar 67 will not cause the operation of any of the punches 61, as the arms 75 will not be in position to engage the punches. When, however, a reader-finger 74 drops into an opening in the master-sheet, the corresponding arm 75 will move into position beneath one of the punches 61, and the subsequent reciprocation of the cross-bar 67 will cause the corresponding punch 61 to be raised to make perforations in the note-sheet 86.

A further operation of the machine will result in a withdrawal of the reader-finger 74 from the opening in the master-sheet and the withdrawal of the corresponding punch 61 from the punch-holes in the note-sheets, after which the feed-mechanisms for the master-sheet and note-sheets will be advanced a step.

As previously set forth, the perforations 87 in the master-sheet are so cut that, when the master-sheet is placed in position in the perforating-machine with the spurs 60 in engagement with the openings 53 and 54, the ends of the perforations 87 will be properly positioned with respect to the reader-fingers 74, that is, the perforations will either permit the reader-fingers to enter freely, or the master-sheet will completely block the path of the reader-finger.

While, in some of the claims, certain steps of the method (such as the making of the record on the master-sheet and the placing of the transverse lines on the master-sheet) are recited in a certain order, it is obvious that the steps of the method need not be carried out in the order in which they are recited, as the transverse marks can be placed on the master-sheet either before or after the record is made.

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

1. A method of making a master-sheet for use in an automatic step-feed perforating-machine, which method comprises marking on the master-sheet blank a record of a musical selection as it is being played on a musical instrument, and perforating said master-sheet blank in substantial correspondence with said marking but to conform to the step-feed of the perforating-machine.

2. A method of making a master-sheet for use in an automatic step-feed perforating-machine, which method comprises placing a master-sheet blank in position to be operated on by a device which will automatically mark a record of a musical selection as it is being played on a musical instrument, playing a selection on a musical instrument to cause a record to be marked on said master-sheet blank, and perforating said master-sheet blank in substantial correspondence with said marking but to conform to the step-feed of the perforating-machine.

3. A method of making a perforated note-sheet, comprising placing a master-sheet blank in position to be operated on by a device which will automatically mark a record of a musical selection as it is being played on a musical instrument, playing a selection on a musical instrument to cause a record to be marked on said master-sheet blank, perforating said master-sheet blank in substantial correspondence with said marking

but to conform to the step-feed of an automatic perforating-machine, placing said master-sheet in position to control the operation of an automatic step-feed perforating-machine, and operating said perforating-machine to cause it to make perforations in the note-sheet.

4. A method of making a master-sheet for use in an automatic perforating-machine having a step-by-step feed, which method comprises placing a series of transverse markings on the master-sheet blank spaced to correspond to the feed-step of the step-feed, placing on said master-sheet blank longitudinal marks corresponding in length to the duration of the notes of a musical selection as it is being played on a musical instrument, and making longitudinal perforations on said master-sheet blank, one of the ends of which perforations coincides with those transverse markings nearest one of the ends of the longitudinal markings.

5. A method of making a master-sheet for use in an automatic step-feed perforating-machine, which method comprises placing a master-sheet blank in position to be operated on by a device which will automatically mark on said master-sheet blank a record of a musical selection as it is being played on a musical instrument, said record comprising longitudinal markings the length of which corresponds to the time the respective notes are held, playing a selection on a musical instrument to cause a record to be marked on said master-sheet blank, and perforating said master-sheet blank so that the front ends of the perforations coincide substantially with the front ends of the markings, but so that the perforations conform to the step-feed of the perforating-machine.

6. A method of making a master-sheet for use in an automatic step-feed perforating-machine, which method comprises marking on the master-sheet blank a record of a musical selection as it is being played on a musical instrument, which record comprises longitudinal markings the extent of which corresponds to the time the respective notes are held, and perforating said master-sheet blank so that the front ends of the perforations coincide substantially with the front ends of the markings but so that the perforations conform to the step-feed of the perforating-machine.

7. A method of making a perforated note-sheet, comprising placing a master-sheet blank in position to be operated on by a device which will automatically mark on said master-sheet blank a record of a musical selection as it is being played on a musical instrument, said record comprising longitudinal markings the length of which corresponds to the time the respective notes are held, playing a selection on a musical instrument to cause a record to be marked on said master-sheet blank, perforating said master-sheet blank so that the front ends of the perforations coincide substantially with the front ends of said markings but to conform to the step-feed of an automatic perforating-machine, and operating said perforating-machine to cause it to make perforations in the note-sheet.

8. A method of making a master sheet for use in an automatic perforating-machine having a step-by-step feed, which method comprises placing a series of transverse markings on the master-sheet blank spaced to correspond to the feed-step of the step-feed, placing said master-sheet blank in position to be operated on by a machine which will automatically make longitudinal marks thereon corresponding in length to the duration of the notes of a musical selection as it is being played on a musical instrument, playing a selection on a musical instrument to cause a record to be marked on said master-sheet blank, and making longitudinal perforations in said master-sheet-blank, the front ends of which coincide with those transverse markings nearest the front ends of the longitudinal markings.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

PAUL B. KLUGH.

Witnesses:
J. B. HECKLER,
J. CLARKE HAGEY.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."