

P. B. KLUGH.
 PUNCHING MACHINE.
 APPLICATION FILED AUG. 23, 1910.

1,195,477.

Patented Aug. 22, 1916.

2 SHEETS—SHEET 1.

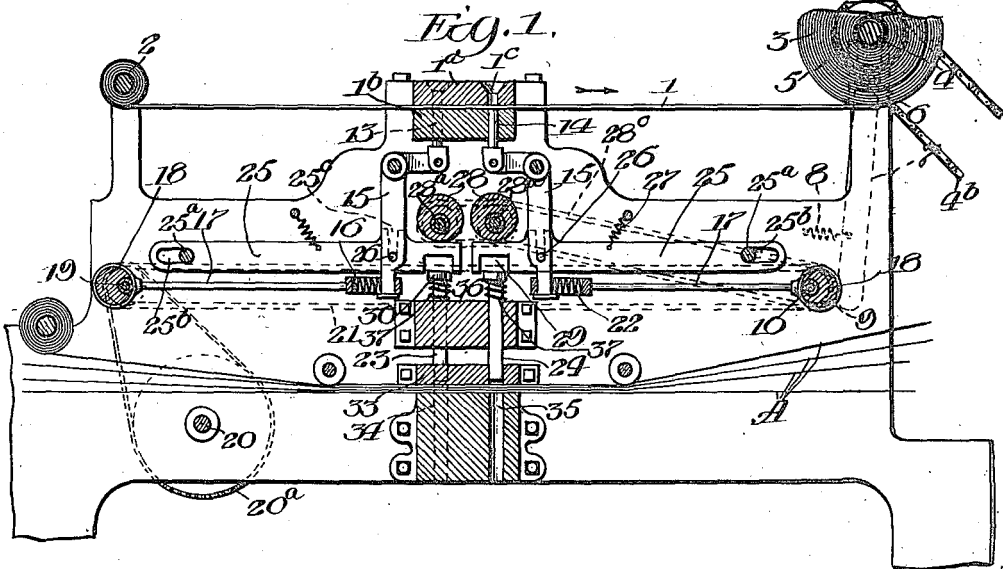


Fig. 2.

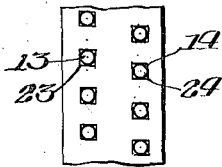


Fig. 3.

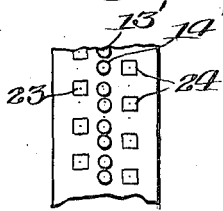


Fig. 4.

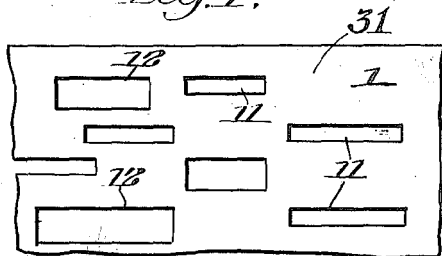
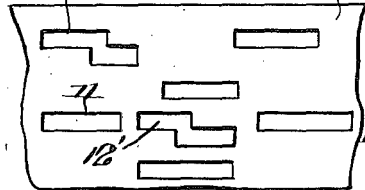


Fig. 5.



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2 SHEETS—SHEET 2.

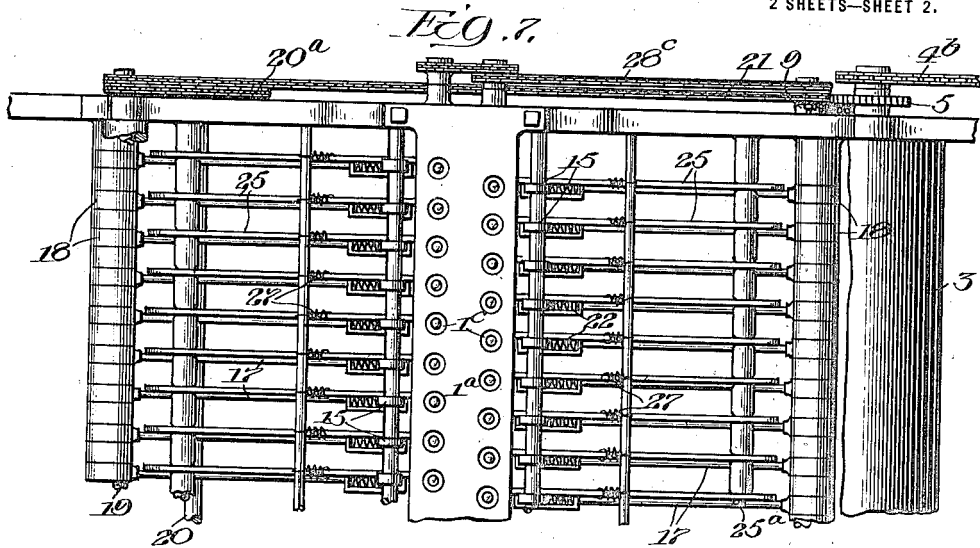


Fig. 8.

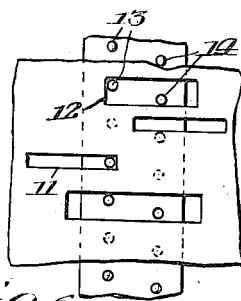


Fig. 6.

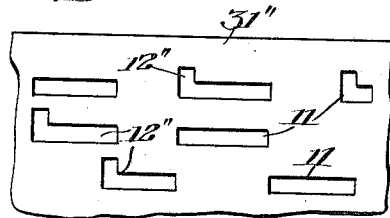
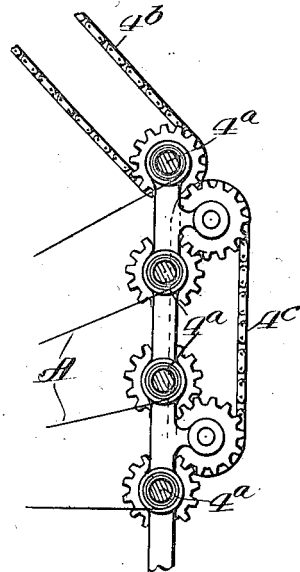


Fig. 9.



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PUNCHING-MACHINE.

1,195,477.

Specification of Letters Patent. Patented Aug. 22, 1916.

Application filed August 23, 1910. Serial No. 578,578.

To all whom it may concern:

Be it known that I, PAUL BROWN KLUGH, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Punching-Machines, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to machinery for manufacturing or preparing certain articles such as records for player pianos, piano players or like instruments. Records of this character usually are in the form of long sheets or strips of thin material such as paper or a paper composition perforated at intervals and in proper places to produce a musical composition when used in connection with instruments such as above mentioned. The invention, however, is not limited to use in connection with records of this character. When used for the production of such particular records, however, and especially of perforated records, the invention contemplates the preparation of the same with perforations or openings of irregular character or arrangement, such as perforations of various or different widths, in contradistinction to the usual form of records with regular perforations for the notes. Such perforations would naturally be separated from one another at various desired or predetermined intervals, according to the result to be obtained, and the perforations of different width would probably be located irregularly with reference to one another, narrow and wide ones being interspersed in various fashions. Certain forms of such irregular perforation records may be used to accent a melody or theme, or some desired set or group or collection of notes. In such case the records may be made with two different styles or kinds of perforations, one narrow and the other wide, the narrow perforations being for unaccented or accompaniment notes, and the wide perforations being for accented or solo notes. I have devised and applied for Letters Patent of the United States upon instruments capable of operation in this way, using such records. Records of this sort can be advantageously produced by the apparatus or machinery of my present inven-

tion; but it is perfectly obvious, and I desire it clearly understood that the invention is not to be limited to this use alone.

In the machine herein set forth for illustrating the invention, I arrange for the production of the perforated records by the use of a master record, which may be previously prepared by hand or in some other way. In such case the machine evidently is a duplicating or reproducing machine, operating to produce duplicates or copies of an original record. This particular method of operation is not, however, essential as the invention can obviously be applied in other ways. The machine herein set forth also contemplates the use of a number of sets of perforating devices, such as punches, with a plurality of such devices or punches in each set. The various sets of perforating devices are for use in connection with the various notes, one set constituting a plurality of punches for each note. The several punches in each set, or the multiple punches as they may be called, are so arranged and mounted that any one or more of them may be operated alone, or all may be operated together. They are also so located and mounted that they will produce a narrower or wider perforation according as one or more of them is used. Thus by the use, individually or collectively, of the punching devices of the various sets, or multiple punches, perforations of various width, as desired, may be made in the record being produced.

As an arrangement for controlling the operation of the various sets of punches, I show in the machine herein set forth, the control of such punching or operating members by a master record having perforations of different width, and mechanism cooperating with such record to produce the desired control of the multiple punches, but of course the result desired could be accomplished by other arrangements lying within the scope of the invention.

In the accompanying drawings Figure 1 is an end view partly in section of a machine embodying my present invention; Fig. 2 is a view, diagrammatic in character, of a portion of such machine; Fig. 3 is a view similar to Fig. 2 of a modified form of machine; Figs. 4, 5 and 6 are views of perforated records, in some cases master records,

and in others the records produced by the machine, as will be more fully pointed out hereinafter; Fig. 7 is a plan view of a portion of the machine of Fig. 1; Fig. 8 is a view of a portion of the machine and the master record in it; and Fig. 9 is a view of a train of mechanism in the machine.

Referring first to Fig. 1, I have shown a master record or sheet 1, which is to be used as an original or guide from which copies of other perforated records are to be made. The master sheet 1 is shown rolled upon a roll 2 and extended to a take-up roll 3, upon which the record is to be wound. As a convenient arrangement for winding the master sheet upon the roll 4, the latter is provided with a ratchet wheel 5, the roll and ratchet wheel being loose upon the shaft 4, and a pawl 6 is mounted upon a lever 7, which is subject to a spring 8 and adapted to be actuated back and forth by a cam 9 and a shaft 10, so as to cause the intermittent turning of the roll 3 and the consequent intermittent advancement of the record sheet 1 in the direction of the arrow Fig. 1.

The master sheet 1 shown in the drawings for illustrating the invention is the type of record hereinbefore referred to as being adapted for use for solo effects, and to such end is provided with wide and narrow perforations, the wide ones for the solo or accented notes and the narrow ones for the accompaniment or unaccented notes. In Fig. 4 I have shown such a record, which is illustrated as provided with narrow perforations 11 for unaccented or accompaniment notes, and wide perforations 12 for solo or accented notes. It will be understood, of course, that the invention is not limited to this particular type of record, as it can be used in connection with others.

The record 1, referring again to Fig. 1, is arranged to pass between upper and lower guiding or holding members, 1^a and 1^b, which are understood to be sufficiently long crosswise of the machine, to accommodate the width of the music sheet. These members 1^a and 1^b are provided with vertical apertures 1^c which are adapted to receive vertically disposed styli or fingers 13 and 14. The latter are arranged so that they are held and guided by the member 1^b, and so that their upper ends are below the record 1, but in case an aperture comes opposite one of the styli 13 or 14, either one of the latter may be pushed up through such aperture and in such case will project through the record and more or less into the corresponding apertures in the member 1^a.

In accordance with the arrangement herein set forth the styli 13 and 14 are arranged in sets with a plurality of styli in each set, in the machine shown there being two in each set, 13 and 14. Each set is intended to be used in connection with one

note of the master record 1, and to cooperate with the perforation therefor, be the same wide or narrow. In the arrangement shown the two styli of each set are shown displaced transversely of the master sheet, that is to say transversely of the direction of movement of the master sheet, as shown in Fig. 2. In such case a narrow opening 11 in the record 1 will register with the stylus 13 of the set of styli corresponding to that opening 11, and the stylus 13 will therefore be free to come up through that opening 11 when the same is in register with such stylus; but the corresponding stylus 14 will not be free to come up through said perforation 11 because being out of alinement with the stylus 13, the perforation 11 does not register with 14 and the material of the music sheet or record is above the same. However, when a wide opening 12 comes along, it will first register with and uncover the stylus 13, and then register with and uncover the corresponding stylus 14, referring to the arrangement of Fig. 2, so that these two styli 13 and 14 of this set are both uncovered and free to be pushed up through said wide opening 12. Thus it will be seen that the narrow openings 11 uncover and as it were release only one of the corresponding set of styli, whereas the wide openings uncover or release more than one of said set of styli, in the arrangement shown, both or all of the same.

The machine shown contemplates an arrangement for automatically operating the styli 13 and 14 when uncovered or released, or to be more explicit, an arrangement by which such styli will be projected into the record sheet perforations when the same come into register with the styli. The arrangement shown comprises bell crank levers 15, upon whose upper ends the styli 13 and 14 are mounted, and reciprocating rods 17, 17 actuated by eccentrics 18, 18, carried one by the hereinbefore referred to rotary shaft 10, and the other by a corresponding shaft 19 at the other side of the machine. The two shafts 10 and 19 are connected by a suitable chain or belt 21, so as to rotate in unison, the shaft 19 being driven by a main drive shaft 20 through the medium of a belt 20^a. As an arrangement for preventing undue or improper actuation of the styli 13 and 14, they are supplied with yielding or elastic connections with the reciprocating shafts 17, 17, as for example springs 16 and 22, arranged in slots at the inner ends of the shafts 17, 17, into which the lower ends of the bell cranks 15, 15 are confined. Thus it will be seen that the action of the shafts 17, 17 tends to project the styli 13 and 14 intermittently in an upward direction, but that this is prevented except when a perforation registers with said styli

by the material of the record sheet 1, the springs 16 and 22 giving or yielding at such times so that the styli remain stationary. When, however, a perforation registers with and uncovers either or both of the styli 13 and 14, such stylus is projected upwardly into such perforation and this upward projection is repeated at close intervals so that there is a vertical reciprocation of such stylus or styli during the entire time that it or they are uncovered by such perforation. Thus the master record or sheet controls the various sets of styli, it being understood that there are sets of styli for the various notes so far as desired, and that these styli are released and their mechanism controlled or governed according to the perforations in the master record or sheet.

In the lower part of the machine I show other records or sheets A, which are to be prepared into proper records by the operation of the machine. A number of such sheets can be acted upon simultaneously by the machine. In the drawings I have shown four, although of course that number can be varied. These sheets are understood to be mounted upon suitable rolls and advanced as required, preferably in correspondence with the advancement of the master record 1, as by the train of gearing shown in Fig. 9, the rolls 4^a being driven in unison by the chains 4^b and 4^c. The records A are shown as passing between guiding and holding members 33, 34, which are provided with apertures 35, adapted to receive reciprocating punches 23 and 24. Above the member 33 is a punch holding member 36, in which the punches 23 and 24 work. Springs 37 hold the punches 23 and 24 normally in their upper or elevated positions. Above the punches are reciprocating members 25, 25, which are pivotally mounted upon pins 25^a, confined in slots 25^b in the ends of said members, so that the member 25 may not only vibrate up and down about said pins 25^a, as axes, but may also slide a limited extent toward and away from one another as permitted by the slots 25^b. Cams or eccentrics 28, 28 carried by suitable driving shafts 28^a are arranged above the inner ends of the reciprocating members 25, and adapted to act upon the ends of said members, so that they will continually vibrate the inner ends of the same up and down, the shafts 28^a being driven by belt or chain connection 28^c with the shaft 10. The members 25, 25 are provided with sockets 29, 29, in their lower edges when their inner ends and these sockets are adapted to receive the heads 30 of the punches 23 and 24. The members 25 are also provided with slots 25^c, formed in their upper edges, and these slots contain pins 26, 26 on the bell cranks 15, 15. Thus it will be seen that the vibratory members 25, 25 will be actuated continuously by the

eccentrics 28, 28, so that their inner ends will vibrate continuously up and down and that while said members 25 are in the position shown in Fig. 1, the sockets 29 at their inner ends will receive the heads of the punches 23, 24, and thus the vibratory movement of said members 25 will not produce any action on the part of the punches 23, 24. If however, either or both of the members 25 is shifted longitudinally it or they will come into such position that the heads of the punches 23 and 24 will not enter the sockets 29, but instead a portion of the members 25 will be interposed between the eccentrics 28, and the punches, and will serve as an abutment or connection between the same, so that instead of the punches remaining stationary as before, they will in such shifted position of the members 25, be actuated by the same and will perform a continuous vertical reciprocation as long as such member or members 25 are in a shifted position.

The punches 23 and 24 are in the machine shown arranged in sets corresponding to the styli 13 and 14, and the corresponding styli and punches interconnected by the mechanism illustrated so that the operation will be as follows: The master sheet 1 in uncovering the styli 13 and 14, or one of them, releases such stylus or styli so that it or they can be projected through the record sheet perforation, and when so projected the corresponding punch or punches 23, 24 will be operated by the action of the intervening mechanism, the bell crank 15 through the action of the eccentric rod 17 shifting the member 25 so as to interpose the same between the eccentric and punch, and to cause the reciprocation of the latter. The punches will be reciprocated, of course, as many times as the corresponding styli are reciprocated. Thus the record sheets A will be acted upon and perforated in accordance with the perforations in the master record 1; narrow perforations in the master sheet 1 will cause the operation of the punch 23 through the stylus 13 and cooperating mechanism, and thus produce narrow perforations in the sheets A, and correspondingly wide perforations in the master 1, will cause the operation of both punches 23 and 24, or multiple punches as they may be called, through the operation of both styli 13 and 14, and cooperating mechanism, and thereby produce wide perforations in the sheets A. Thus it will be seen that with the machine as constructed and the styli and punches located as shown, more particularly in Figs. 1 and 2, the records produced will be the same as the master record; for example if the record shown in Fig. 4 is used as a master record, records like it will be made by the machine, and the same holds true of other forms of record used as masters. This is due to the corresponding ar-

rangement or location of the styli 13 and 14, and punches 23 and 24, the styli and the punches in the corresponding set lying in the same note zone and being displaced correspondingly both longitudinally and transversely of the records, so that the longitudinal displacement of the styli of the same set, or multiple styli, made for convenience of independent operation of the same, is compensated for by a corresponding longitudinal displacement of the corresponding multiple punches.

In Fig. 3, I have shown the styli 13' and 14', arranged side by side, this modification of the arrangement previously described being advantageous in some respects, there being no longitudinal displacement of the styli as in said other arrangement. In this modified arrangement it will be seen that the records made by the machine will not be identical with the master record used, assuming that the punches are longitudinally displaced as shown in the drawings, and also in Fig. 3 illustrating this modification. The reason is of course, clear, that there is no longitudinal displacement of the styli to correspond with the longitudinal displacement of the punches.

If the record of Fig. 4 is run through the machine records such as shown in Fig. 5 will be produced. This is obvious from the fact that a wide perforation 12 for example, in Fig. 4, will cause the simultaneous operation of the two side by side styli 13' and 14', and this operation will cause the simultaneous operation of the corresponding punches 23 and 24, which being longitudinally displaced will cause longitudinally displaced perforation portions such as shown as going to make up the irregular wide perforations 12' in Fig. 5. Conversely the record 31' of Fig. 5 when used as a master with the arrangement of Fig. 3, will produce the record 31, Fig. 4. The making and use of master records for the type of records produced by the machine will of course be carried on accordingly.

In Fig. 6 I have shown a still different type of record 31'', in which the wide perforations 12'' are of still different shape from those of the records previously described. This record 31'' can, of course, be used as a master to reproduce exactly similar records by the arrangement of Fig. 2. If used as a master with some other machine arrangement the produced records would vary accordingly; and if to be produced by some other machine arrangement the master would have to be made out according to the stylus and punch arrangements. Thus it will be seen that the kind or type of records used as masters and to be produced can be varied without limit, and that the machine arrangement can be varied also, the master

and records to be produced being figured 65 accordingly.

It will be understood, especially in view of what has previously been said, that the machine herein is merely illustrative of the invention and that a wide variation in practically an unlimited number of respects can be made without departing from the spirit of the invention.

What I claim as my invention is:

1. A machine of the class specified, having a plurality of sets of punches, one set for each note, the punches in each set being transversely displaced.

2. A machine of the class specified, having a plurality of styli adapted for use in connection with a single perforation or depression.

3. A machine of the class specified having a plurality of punches arranged for use in connection with the same perforation, and also having means for actuating one only or more than one of said punches in connection with said perforation.

4. A machine for producing records of the kind specified, having means for forming openings or perforations for the various notes at different transverse positions for the same notes.

5. A machine of the class specified having a plurality of sets of punches, one set for each note, each set having a plurality of punches, and also having mechanism by which one or more punches in each of the several sets can be operated.

6. A machine of the class specified, having a plurality of punches in combination with a plurality of styli adapted to operate in connection with a single perforation.

7. A machine of the class specified, having a plurality of sets of styli, one set for each note, the styli in each set being transversely displaced.

8. A machine of the class specified having means for utilizing a perforated record as a master, and also having punching mechanism and means whereby said punching mechanism can be operated through the instrumentality of said master record to produce other records having perforations differently located transversely of the record for the same notes.

9. A machine of the class specified having a set of punches comprising several punches associated together and displaced transversely of the direction of motion of the record, but having at least their adjacent edges in alinement, said machine also having mechanism for actuating one or more of said punches.

10. A machine of the class specified having a set of punches comprising several punches associated together and displaced transversely of the direction of motion of

the record, but having at least their adjacent edges in alinement, said machine also having means whereby a master perforated record can actuate one or more of said punches.

11. A machine of the class specified having a plurality of sets of punches with several longitudinally and transversely displaced and partially alined punches in each set, said machine also having mechanism for operating one or more punches in the various sets.

12. A machine of the class specified having a plurality of sets of punches with several longitudinally and transversely displaced but partially alined punches in each set, and mechanism whereby a perforated record can actuate one or more of the punches in the various sets.

13. A machine of the class specified, having means for utilizing a perforated record as a master record, and also having a plurality of sets of punches for punching other records with a plurality of punches in each set, the punches in each set being arranged for use in connection with the same perforation to produce various kinds of perforations in the records being produced according to the punch or the number of punches used, and means whereby the punches of the various sets can be actuated through the instrumentality of the master record.

14. A machine of the class specified having a set of styli adapted for use in connection with a single perforation of a master record, a set of punches arranged and adapted so that all, or less than all of the same can be used in connection with a single perforation in records to be produced, and mechanism whereby said styli can be controlled by the master record so as to cause the operation of said punches.

15. A machine of the class specified, comprising means for carrying and advancing a master record, a plurality of sets of styli with several transversely displaced styli in each set, a corresponding number of sets of punches with several punches in each set, mechanism whereby said punches are actuated by the control of the corresponding styli by a master record, and means whereby one or more punches of a set may be caused to produce a perforation in other records.

16. A machine of the class specified comprising styli 13 and 14, bell cranks 15 carrying said styli, reciprocating rods 17, 17 having spring connections with said bell cranks 15, rotary shafts 10 and 19, provided with eccentrics for actuating said rods 17, 17, punches 23, 24 controlled by springs 37, 37, and mounted in a punch holding member 36, reciprocating members 25, 25 having a slot and pin connection with the bell cranks 15, 15 and mounted for vibratory movement on

pins 25^a, 25^a, and slotted to permit a shifting movement upon said pins, said members 25, 25 having sockets 29, 29 to receive the heads 30 of the punches 23 and 24; rotary shafts 28^a carrying eccentrics 28, adapted to act upon the pocketed ends of the members 25, 25, and means for holding other records in position to be acted upon by the punches 23 and 24.

17. In a machine of the class specified the combination with means for holding and advancing a master record, of styli 13 and 14, adapted for use in connection with the same perforation in the record, and displaced transversely of the movement of the master record, and means for independently actuating said styli.

18. In a machine of the class specified the combination of independently mounted transversely displaced associated styli 13 and 14 for use with the same perforation, reciprocating members for independently reciprocating said styli and means for independently actuating said reciprocating members.

19. In a machine of the class specified the combination of independently mounted transversely displaced associated styli 13 and 14 for use in connection with the same perforation, reciprocating members for independently reciprocating said styli, means for independently actuating said reciprocating members, a set of punches corresponding in number to the styli, and means whereby the reciprocation of either stylus will automatically cause the reciprocation of the corresponding punch.

20. In a machine of the class specified the combination of independently mounted transversely displaced styli 13 and 14 for use in connection with the same perforation, reciprocating members for independently reciprocating said styli, means for independently actuating said reciprocating members, a set of punches corresponding in number to the styli, vibratory members with means for vibrating the same, said members being connected with said styli so that the vibration of a stylus will shift the corresponding member and said members being arranged to actuate the corresponding punch when shifted, but not to actuate said punch when not shifted.

21. In a machine of the class specified a set of styli displaced both transversely and longitudinally of the direction of movement of a master record in the machine and arranged for use in connection with a single perforation, a set of correspondingly displaced punches and mechanism whereby said styli are effective in producing the actuation of said punches.

22. A machine of the class specified having a set of styli, a corresponding set of punches, the punches and styli being simi-

- larly displaced transversely and longitudinally of the direction of movement of the master record in the machine and each being arranged for use in connection with a single aperture, and mechanism for operating said punches through the instrumentality of said styli.
23. A machine of the class specified having a set of styli, a corresponding set of punches, the punches and styli being dissimilarly displaced transversely and longitudinally of the direction of movement of the master record in the machine, and mechanism for operating said punches through the instrumentality of said styli.
24. A machine of the class specified having a set of styli for use in connection with the same perforation of a master record, said styli being side by side, a set of punches corresponding to said styli, said punches being also for use in connection with the same perforation in records to be produced, and mechanism for operating said punches.
25. A machine of the class specified having a set of styli for use in connection with the same perforation of a master record, said styli being side by side, a set of punches corresponding to said styli, said punches being also for use in connection with the same perforation in records to be produced and being displaced transversely and longitudinally of the direction of movement of the master record, and mechanism for operating said punches.
26. A machine of the class specified, having in combination a plurality of punches for use in connection with a single perforation and mechanism for reciprocating one only or more than one of said punches.
27. A machine of the class specified, having in combination a plurality of punches for use in connection with a single perforation, mechanism for reciprocating one only or more than one of said punches, and means for controlling said reciprocating mechanism.
28. A machine of the class specified, having in combination a plurality of punches for use in connection with a single perforation, mechanism for reciprocating one or more of said punches, and means, including styli, for controlling said reciprocating mechanism.
29. Apparatus for producing from a master sheet, perforated music sheets having perforations of different effective area, the different effective areas corresponding to the different intensities of sound required to be produced in playing.
30. Apparatus for producing from a master sheet, perforated music sheets having perforations of different effective areas, consisting of perforations of varying width, the different effective areas corresponding to the different intensities of sound required to be produced in playing.
31. Apparatus for producing from a master sheet, perforated music sheets having perforations of different effective areas, comprising in combination a number of groups of punches, each group representing a note, the punches of each group being adapted to produce in a music sheet perforations of different effective area, punch selecting devices for said punches, and differential selectors controlled by the variations in the representation of notes in the master sheet, which represent different intensities of sound.
32. In apparatus of the class specified, a set of associated styli or readers arranged in transverse alinement in the same note zone.
33. In apparatus of the class specified, a set of associated styli or readers arranged out of transverse alinement in the same note zone.
34. In apparatus of the class specified, a plurality of styli or readers arranged out of longitudinal alinement in the same note zone.
35. In apparatus of the class specified, a plurality of styli or readers arranged out of transverse alinement and also out of longitudinal alinement in the same note zone.
36. A machine of the class specified having a plurality of sets of punches, the punches of each set being associated together and being separated from the punches of adjacent sets by intervening spaces transversely of the record and the punches of each set being displaced transversely with reference to one another, and means for actuating said punches either separately or jointly.
37. In apparatus of the class specified, a plurality of punches arranged out of transverse alinement in the same note zone.
38. In apparatus of the class specified, a plurality of punches arranged out of longitudinal alinement in a single note zone.
39. In apparatus of the class specified, a plurality of punches arranged out of transverse alinement and also out of longitudinal alinement in a single note zone.
40. In apparatus of the class specified, a plurality of readers arranged in transverse alinement in the same note zone in combination with a plurality of punches arranged out of transverse alinement.
41. In apparatus of the class specified, a plurality of readers arranged in transverse alinement in combination with a plurality of punches arranged out of transverse alinement in the same note zone.
42. In apparatus of the class specified, a plurality of readers out of transverse alinement in the same note zone, in combination with a plurality of punches out of alinement with reference to one another.
43. The combination of a plurality of

readers arranged out of longitudinal alinement in the same note zone, and a plurality of punches also arranged out of longitudinal alinement in the same note zone.

5 44. The combination of a plurality of readers arranged in the same note zone and out of longitudinal alinement with one another, and a plurality of punches arranged out of longitudinal alinement with one another.

10 45. In apparatus of the class specified, a plurality of punches of the same size arranged in the same note zone.

15 46. In apparatus of the class specified, a group of readers all arranged in a single note zone, in combination with a group of punches also all arranged in a single note zone.

20 47. In apparatus of the class specified, a plurality of punches for punching a single perforation in a music sheet.

25 48. Apparatus of the class specified having means for forming relatively wide perforations by removing a plurality of relatively narrow connected portions of a music sheet.

49. Apparatus of the class specified pro-

vided with means for forming relatively narrow and relatively wide perforations by the same devices.

50. In apparatus of the class specified, a set of punches of substantially the same size and means whereby said punches may be used to form both relatively narrow and relatively wide perforations. 30

51. In apparatus of the class specified, the combination of a plurality of relatively small punches and means whereby said punches may be used to form relatively wide perforations. 35

52. The combination of a plurality of readers arranged out of alinement with one another and a plurality of punches located in the same note zone and arranged out of longitudinal alinement with respect to one another. 40 45

In witness whereof, I hereunto subscribe my name this 11th day of August A. D., 1910.

PAUL BROWN KLUGH.

Witnesses:

N. D. TOBIN,

J. CLARKE HAGEY.