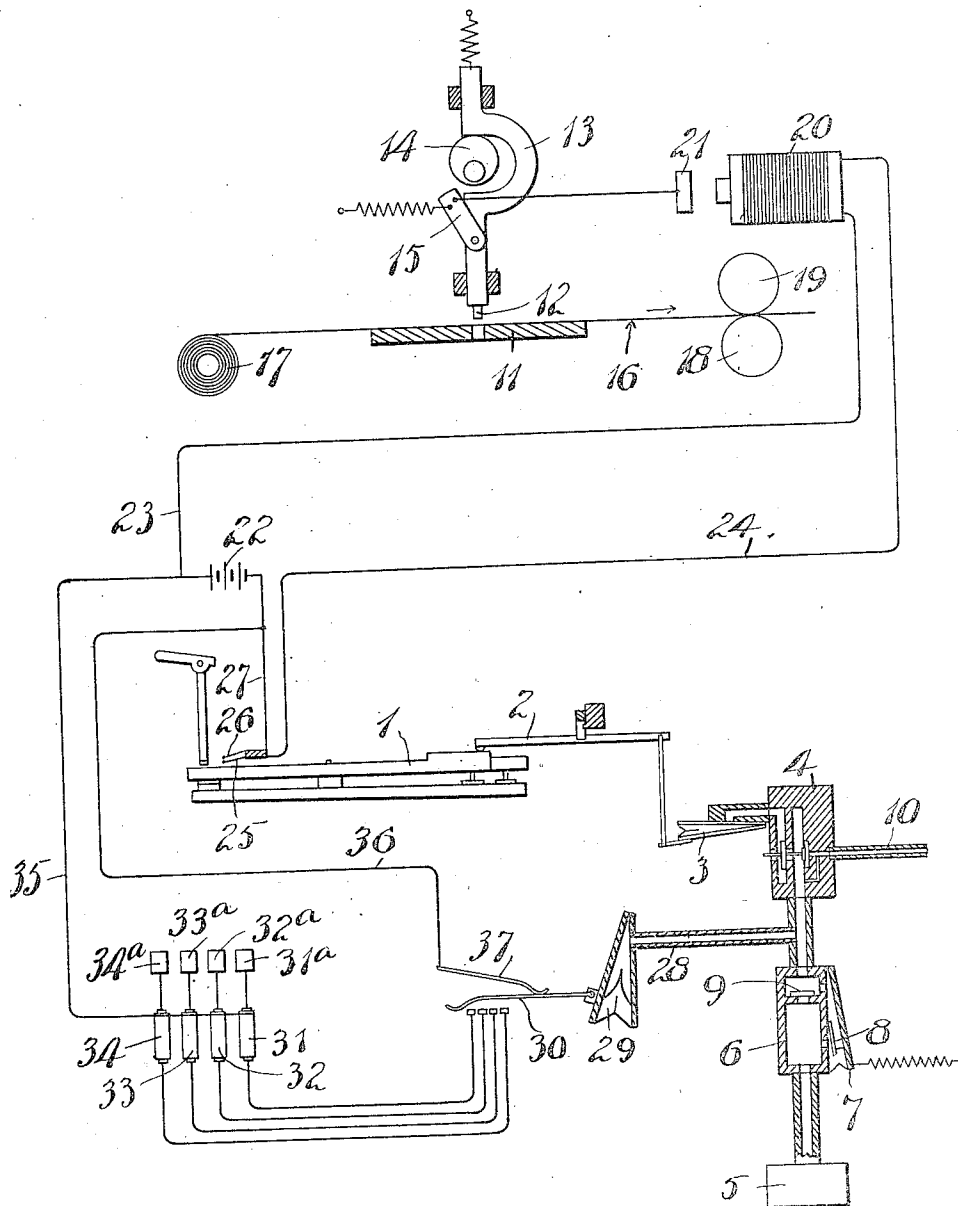


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 APPARATUS FOR PRODUCING PERFORATED NOTE SHEETS.  
 APPLICATION FILED JULY 21, 1911.

1,016,862.

Patented Feb. 6, 1912.



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# UNITED STATES PATENT OFFICE.

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## APPARATUS FOR PRODUCING PERFORATED NOTE-SHEETS.

1,016,862.

Specification of Letters Patent.

Patented Feb. 6, 1912.

Application filed July 21, 1911. Serial No. 639,755.

*To all whom it may concern:*

Be it known that I, FRANK C. WHITE, a citizen of the United States, residing at Meriden, New Haven county, Connecticut, have invented certain new and useful Improvements in Apparatus for Producing Perforated Note-Sheets, of which the following is a full, clear, and exact description.

My invention relates to apparatus for producing perforated music sheets, which sheets are so perforated that when used in connection with a suitable music playing instrument the composition will be reproduced as to tempo changes, volume shading, etc., precisely as originally rendered by the artist.

To make the perforated sheet, I employ in connection with the proper cutting machine a mechanical music playing apparatus such as a piano-player or player-piano or organ, and I so associate the expression controlling apparatus of the said music playing instrument with the cutting apparatus that said controlling apparatus simultaneously with controlling the expression of the music being rendered by said player, controls the cutting of certain perforations whereby when the playing of the composition is finished, the note sheet produced may be put into a suitable music playing instrument and will reproduce the composition as played during the cutting of said sheet. In the present stage of development of this art, the control of the ordinary piano-player or player-piano is mainly a manual control, with certain few minor exceptions; for example, it has been provided, by means of a marginal perforation and marginal ducts in the tracker-board, that the pedal will be operated automatically. It has also been provided that a solo note may be struck with more vigor than the accompanying notes, but beyond such minor details the rendering of a composition upon a mechanical player depends wholly upon manual control. The typically automatic instrument of the present day is an instrument which of necessity is so relatively complex and the cost of producing music sheets therefor is so relatively high, that such instruments are very costly, with the result that by comparison with the ordinary piano-player or player-piano there are comparatively few in use, since the price by contrast is comparatively prohibitive.

It is my aim to make it possible to produce with such accuracy and at such comparatively small cost note sheets which are so perforated as to automatically control the entire expression that the same may be used in connection with the high grade and well developed piano-playing apparatus so that such apparatus will perform with an efficiency equal to the costly automatic instruments above referred to. While I have spoken of the instruments as piano-playing instruments, it will be obvious that the note sheets may be employed with equal efficiency with an organ.

In the accompanying drawing I have shown diagrammatically such parts of a mechanical player apparatus and the cutting apparatus and the intermediate associated parts as will be necessary for a clear understanding of my invention.

1 represents a piano key.

2 represents a mechanically controlled striker, in this instance operated by an action pneumatic 3.

4 conventionally represents an action chest with the usual passages and valves therein characteristic of the usual pneumatic player action.

5 conventionally represents an exhaustor.

6 conventionally represents a tension regulator casing having a regulator pneumatic 7 controlling a valve 8. The valve 8, strictly speaking, is the equalizer valve.

9 represents a valve, which, when open, puts the exhaustor 5 in direct communication with the interior of the action chest 4, and, when closed, shuts off direct communication, leaving the only communication through the passage controlled by the valve 8. It may be assumed that both of these valves are of any well known type which are capable of mechanical control by pneumatics which are in turn controlled by the opening and closing of marginal perforations in the well known tracker-board, although one or both of said valves may be manually operated.

10 represents a pipe or duct which leads to the aforesaid tracker-board (not shown). In this instance, this duct 10 is one of the regular end ducts which controls the moment of operation of the pneumatic 3.

Thus far I have described in a general way apparatus which is well known and the particular construction of which I lay no

claim to in the present case, it being found in several of the well known well developed player mechanisms now generally in use.

I will now proceed to describe generally the preferred note sheet cutting apparatus.

In the drawing I have shown in detail one unit or one cutter, it being understood that for each perforation required a similar cutter unit should be employed. This apparatus includes a die plate 11 and a cutter or punch 12. In this particular instance the punch is arranged to be vibrated rapidly whenever it is desired to cut a perforation. At other times, said punch remains idle. The punch is carried by a combined guide and yoke 13.

14 is a constantly revolved cam or eccentric, which is located within the bow of the yoke.

15 is a coupler. In this instance the coupler is a swinging member pivoted on the yoke guide 13, the opposite end being normally out of the range of movement of the eccentric 14. Whenever it is desired to operate the punch 12, this coupler is moved so that its upper end will extend into the zone of rotation of the eccentric 14, whereby, as said eccentric revolves, it will rapidly reciprocate the punch 12, so as to cut the paper 16 traveling over the die 11. The paper 16 is carried on rolls 17—18, which are driven intermittently preferably at a uniform rate of speed. In this particular instance 19 is a friction driving roll, which holds and grasps the paper 16 between it and the roller 18. The particular means for driving the roll 19 is immaterial. While some means might be provided for cutting the sheet, if said sheet moved steadily ahead instead of intermittently, it should be understood that in this type of a cutting apparatus it is customary to drive the sheet intermittently so as to cause the paper to pause at the instant it is being cut by the punch 12, the forward movement being between the successive punching operations.

I will now proceed to describe the means by which the moment of operation of the cutting apparatus is controlled for the purpose of producing a note perforation, as distinguished from a marginal expression perforation. This means comprises an electromagnet 20, the armature 21 of which is suitably connected with the coupler 15 so that when the magnet 20 is energized the coupler will connect the cutter 12 with the cam or eccentric 14 so as to reciprocate the cutter as aforesaid and form the perforation in the advancing paper 16. The energizing of the magnet 20 is secured by closing a battery circuit through said magnet.

22 represents a battery.

23 is a wire leading from one pole of said battery to the magnet 20.

24 is a return wire from the magnet 20 to

one part 25 of a circuit closer. 26 is the other part of said circuit closer, which is connected by wire 27 to the other pole of the battery 22. The circuit closer 25 is so associated with the key 1 that when said key is depressed, and so long as said key is depressed, the battery circuit will be closed through the magnet 20, from which it follows that so long as said key is depressed, the cutter 12 will be cutting, in the advancing paper, a note perforation corresponding to the particular key struck. In this particular instance the spacing between the note perforations will determine the tempo. In other words, if the note sheet perforations, say as to a single note, occur frequently, one tempo will prevail, and if they occur less frequently, a slower tempo will prevail, given the same speed of travel to the sheet in both instances. Therefore, if this same sheet is transferred to a music playing instrument within which the note sheet will travel at a uniform rate, it follows that the particular note controlled by that perforation will be struck at a speed determined by the spacing of the note sheet perforations, hence that kind of expression (determined by the tempo) is at once taken care of.

Having cared for expression due to tempo, it remains to provide for means to control the expression due to changes in volume, and to that branch of my invention I will now direct attention. It may be assumed that the note sheet is to be employed with a player apparatus in which the tracker has marginal perforations so associated with the apparatus which controls the tension of air in the action chest, and by which the action pneumatic 3 are operated, that is a composition is being rendered, the proper variations in dynamic effect will occur. My purpose is, therefore, in the present invention, to provide the note sheet with marginal perforations at such places and so spaced as to cooperate properly with such a player instrument, and to cause said marginal perforations to be produced in the proper number, at the proper spacing and of the proper length. I associate the cutter apparatus directly with the regulated air tension of a player so that the variations in tension within the player will cause various marginal perforations to be produced. By this means I am permitted to use successfully in the production of note sheets a piano-player which is in the main manually controlled by an operator sufficiently experienced to render artistic music, employing the ordinary note sheet of the present day, and with or without marginal perforations. It will at once become apparent that the danger of producing faulty note sheets is materially reduced, because if such note sheets are to be made by an artist playing directly

upon the piano, there is always grave danger that the artist may strike a false note, whereas when the note sheets are being produced by the use of a player apparatus, the danger of striking a false note is entirely eliminated, because a properly cut note sheet is always employed with the player apparatus, thereby relieving the operator entirely of that responsibility. The operator, therefore, has simply to operate the piano-player in such a way as to secure the desired expression. By reason of this it follows that the cost of producing note sheets for the rendering of artistic music automatically is greatly reduced.

Now turning to the drawing, it will be seen that the interior of the action chest is connected by a duct 28 with a pneumatic 29. The pneumatic 29 carries a brush 30.

31, 32, 33 and 34 represent magnets corresponding to magnet 20 (on a reduced scale), which operate respectively cutter units corresponding to cutter 12, these cutter units being employed for forming marginal perforations at one or both edges of the note sheet and in any desired number, length and spacing, depending upon the number of magnets employed, four magnets 31—32—33—34 being employed in this instance. 31<sup>a</sup>—32<sup>a</sup>—33<sup>a</sup>—34<sup>a</sup> conventionally represent the cutter units, for the magnets 31 to 34 respectively, for forming said marginal perforations. The circuit arrangement in this case may be coupled with the battery 22 aforesaid. The magnets 31 to 34 are wound in the usual manner, and one pole of each magnet is provided with a contact head arranged to be swept by the brush 30, as shown in the drawings. The other pole of each magnet is directly connected by wire 35 to one pole of the battery 22. The other pole of the battery 22 is connected by wire 36 to the brush 30, in this instance through the medium of a spring contact 37.

From the foregoing it will be seen that as the player apparatus is being operated, variations in the regulated and effective air tension within the action chest will control, through the pneumatic 29, the position of the brush 30. In the drawings it may be assumed that in the position shown, the lowest tension (or pianissimo effect) is occurring, in which event the brush 30 is not in engagement with any of the terminal ends of the magnets 31 to 34. If this tension is increased sufficiently, the magnet 29 will collapse somewhat and bring the brush into contact with the terminal end of the magnet 31, energizing the same to bring into operation one of the marginal cutters. If the tension is still further increased, the second, third, or fourth, or two or more of said marginal cutters, will be brought into the circuit, thereby causing the operation of the proper marginal perforation cutter, or the

proper number of marginal perforation cutters. Thus a note sheet will be produced which can be put into a suitable player instrument and which, by reason of the marginal perforations, will control the dynamic or volume variations employed in securing different changes in expression.

While I have shown a pneumatically controlled player apparatus and electric intervening mechanism between said player apparatus and the cutter apparatus, it is obvious that, broadly speaking, whether the player is a pneumatic player or the intervening mechanism electric in operation, is immaterial so long as the player apparatus is so associated with the cutter that the controlling element of the player apparatus by which dynamic changes are produced is so associated with the cutter apparatus as to cause said cutter apparatus to operate at the proper time, it being entirely new to employ in the production of note sheets a mechanical player apparatus. By this unique method of producing note sheets great economies are attained.

What I claim is:

1. In an apparatus for producing perforated note sheets for music playing instruments, a cutter apparatus including cutters for forming in a sheet note perforations, and a separate cutter for forming in said sheet expression controlling perforations, a manually controllable player apparatus, said cutter apparatus and said player apparatus being so arranged as to operate simultaneously and coöperatively, the speed of one being variable relatively to the speed of the other, the speed of the latter being substantially uniform, means between said player apparatus and said cutter apparatus for controlling the moment of and duration of operation of the cutters for forming note perforations in the sheet being perforated, and means between the player apparatus and the cutter apparatus for controlling the moment of and duration of operation of the cutter for forming the expression controlling perforations in the sheet being perforated.

2. In an apparatus for producing perforated note sheets for music playing instruments, a cutter apparatus including a plurality of cutters for forming note perforations in a note sheet, and also a plurality of cutters for forming perforations in said sheet to control the power of the instrument with which said note sheet is to be used, a mechanical player apparatus manually controllable as to power, means for driving said cutter apparatus to feed a note sheet there-through at a substantially uniform speed, and manually controllable means for driving said player apparatus at a variable speed, means between said player apparatus and said cutter apparatus for controlling

the moment of and duration of the operation of the cutters for cutting note perforations, and other means between said player apparatus and said cutter apparatus for controlling the operation of the cutters for forming the power controlling perforations.

3. In an apparatus for producing perforated note sheets, a mechanical cutter apparatus, including a plurality of cutters, some for forming note sheet perforations and some for forming expression controlling perforations, in combination with a manually controllable mechanical player piano having elements therein for controlling speed of operation thereof, and having other elements therein for controlling the power thereof, connections between said mechanical player piano and said mechanical cutter apparatus for determining the moment of and duration of operation of the cutters for forming the note perforations, and other means between the power controlling elements of the mechanical player piano and the cutters for the expression controlling perforations for controlling the operation of said expression controlling perforation cutters, said cutter apparatus having means for feeding a sheet to be perforated there-through at a substantially uniform speed.

4. In an apparatus for producing perforated note sheets for music playing instruments, a cutter apparatus including a plurality of cutters for forming perforations in a note sheet to control the selection of notes and also a plurality of cutters for forming perforations in said sheet to control expression, a mechanical piano-player apparatus including a pneumatic system for operating the note producing mechanism of a piano with which said player apparatus may be associated, and means of connection between

said pneumatic system and the cutters for producing said expression controlling perforations whereby said cutters will be controlled by variations in air tension in said pneumatic system.

5. In an apparatus for producing perforated note sheets for music playing instruments, a cutter apparatus including mechanically operated and controlled cutters for forming note perforations in a sheet, means for driving a sheet to be perforated across the path of movement of said cutters, in combination with a piano player apparatus the latter being controllable as to speed, note striking means in said player apparatus and coupler mechanism between said note striking means and said cutters respectively for controlling the selection of cutters as well as the moment of and period of operation of said cutters on said sheet.

6. In an apparatus for producing perforated note sheets for music playing instruments, a cutter apparatus including cutters for forming note perforations in a sheet, means for moving a sheet to be perforated through said cutter apparatus, in combination with a player apparatus, said cutter apparatus and said player apparatus being arranged to operate simultaneously and co-operatively and means for manually varying the speed of the player apparatus relatively to the speed of travel of the sheet to be perforated, and mechanical means between said player apparatus and said cutter apparatus for controlling the moment of and duration of the cutting operation of said cutters on said sheet.

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