A. BRUNN.

PROCESS AND APPARATUS FOR MAKING PERFORATED BANDS.

APPLICATION FILED APR. 6, 1915.

1,192,747. Patented July 25, 1916.

Fig. 1.

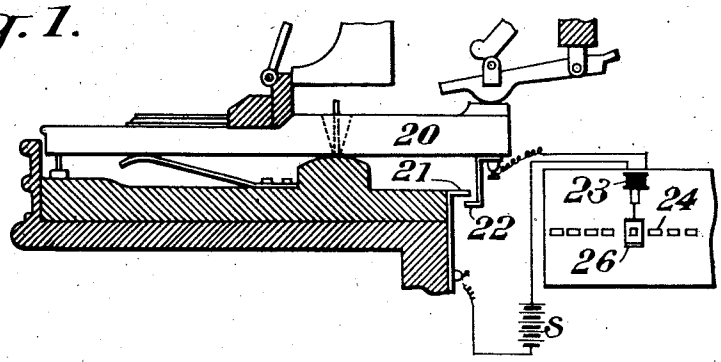


Fig. 2.

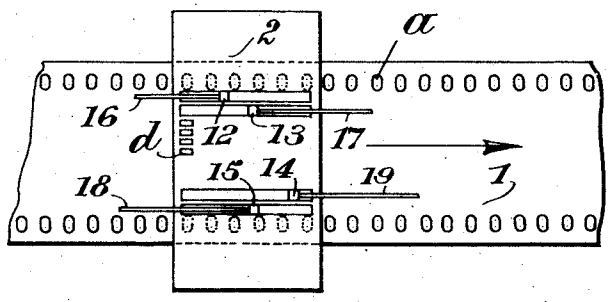
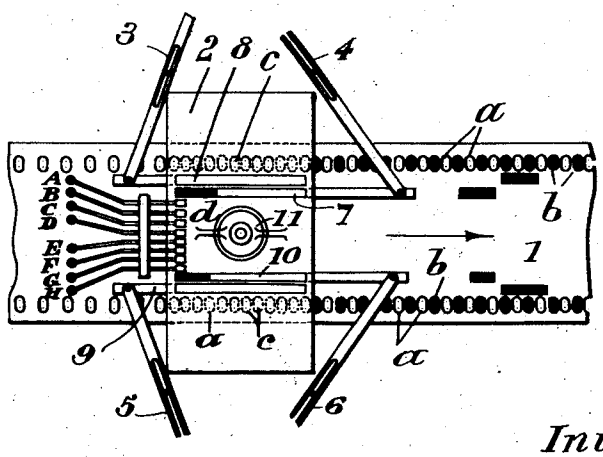


Fig. 3.



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PROCESS AND APPARATUS FOR MAKING PERFORATED BANDS.

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Application filed April 6, 1915. Serial No. 19,600.

To all whom it may concern:

Be it known that I, ALFRED BRUNN, a subject of the German Emperor, and resident of Berlin, Germany, have invented certain new and useful Improvements in Processes and Apparatus for Making Perforated Bands, of which the following is a specification.

This invention has relation to methods and apparatus for recording and reproducing perforated bands, cards or the like which are used in automatic pianos, Jacquard looms, etc.

The object of the invention is to provide a method of recording certain marks in the form of circles, or rectangles upon a strip of transparent material, and subsequently photographing the images of the marks upon a metallic band in the same identical order in which they appear upon the original transparent bands and then treating the metallic band in such a way that openings will be formed entirely through the thickness of the band corresponding in size to the original image on the transparent strip.

Another object is to provide apparatus for accomplishing the above, which apparatus is reduced to its simplest form consistent with the accurate results desired to be obtained.

With these and other objects in view, this invention consists in the novel methods arranged in the steps hereinafter described and apparatus consisting in the novel construction and arrangement of parts to be hereinafter set forth and fully claimed.

In the drawings accompanying the specification: Figure 1 is a detail section through one form of my apparatus illustrating diagrammatically a method of recording images. Fig. 2 is a diagrammatic view illustrating another method; and Fig. 3 is a diagrammatic view illustrating more in detail the principle outlined in Fig. 2.

In carrying out my process I provide a strip of transparent material such as celluloid or the like, coated on one or both sides with an emulsion sensitive to light.

I further provide an apparatus which comprises a key indicated at 20, and which is pivoted at an intermediate portion and provided with a resilient member for keeping the manually operated end in a raised position as indicated in the drawings. A contact 22 is provided on the other end of the key and is adapted to engage a co-acting contact 21, mounted on a stationary portion of a suitable frame. Superposed above the celluloid transparent strip which may be moved continuously by a mechanism (not shown) above the slide 26, is a constantly burning electric lamp (not shown). A solenoid 23 is provided, whose core is connected with the slide 26. The slide is provided with a rectangular or other shaped opening which is adapted to register with a similar opening in a diaphragm located beneath the light so that when said openings are in registration owing to the energization of the magnet and the consequent attraction of the color, light is permitted to pass through the registered openings and fall upon the surface of the sensitive strip, and the impression thereon photographically recorded.

The contacts 21 and 22 and the solenoid 23 are electrically connected with a circuit which contains a source of energy designated *s*, whereby upon depressing the key 20, the solenoid 23 is energized and the slide 26 reciprocated so as to cause the registration as above described.

After the sensitive strip has received its quota of impressions it is developed and a series of opaque spots or broad lines are found which correspond in length longitudinally of the strip to the time in which the key has been held depressed. These impressions are arranged transversely of the strip in a relative position corresponding to the key which has been depressed. After the strip has been dried, it is then superposed upon a metallic strip which is sensitized with bichromated gum or the like, and the whole exposed to actinic light, whereby the opaque impressions on the transparent film prevent the light from acting upon the surface of the metallic film. After sufficient exposure has been secured the metallic film is developed by washing the water or any other developer which may be used, depending upon the nature of the sensitive film, these portions of the sensitive surface lying beneath the opaque impressions will be washed out, thereby exposing the metallic surface. By flowing dilute acid over the contact side of the metallic film, the exposed surface of the metallic strip will be corroded and dissolved until the strip has become entirely perforated, whereby a replica of the original film is obtained which differs therefrom in

that perforations are found in the metallic film, where opaque impressions were obtained in the original transparent film.

The above described process and apparatus is best adapted for the manufacture of records used in the playing of automatic pianos, and I have therefore altered my invention to make it more applicable to the manufacture of pattern cards or strips used in Jacquard looms.

In Fig. 2 of the drawings I have illustrated diagrammatically a sensitive strip, designated 1, and which may be coated with some emulsion sensitive to light. A screen 2 is superposed upon the band and is provided with relatively long slots extending parallel with the direction of movement of the band 1. Each of these slots is covered by a reciprocating slide designated 12, 13, 14 and 15, which are provided with contacting arms 16, 17, 18 and 19.

The band 1 is intended to be moved beneath the screen 2 by certain mechanism (not shown) which will impart an intermittent uniform motion to the band, and a plurality of perforations *a* are provided adjacent each end of the band for engagement with a suitable sprocket wheel of the intermittent mechanism.

In operation the slides 12, 13, 14 and 15 are moved so as to uncover the slots in various degrees, and light is caused to fall upon the screen 2, whereby the portion of the sensitive film upon the screen 2 is subjected to the action of the light admitted through the uncovered portions of the slots. After suitable exposure the slots are closed and the strip intermittently moved, and the succeeding portion again exposed through the slots which are again uncovered, presumably in a different degree.

The sensitive strip when fully exposed is superposed upon a sensitive metallic strip, as above described, and a metallic strip or a series of cards are obtained, having perforated slots which correspond in dimensions to the original impressed image upon the sensitive strip. These long slots are adapted to cause the actuation in the Jacquard loom of the embroidery frame in lateral or vertical directions, both for the advancing and restricting motion of the frame. I also provide a series of shorter slots *d* which are adapted to record impressions to subsequently provide slots in the metallic film for causing the actuation of various devices in the Jacquard loom, such as festoon apparatus, drilling mechanism or the like.

While the herein described method is essentially photographic in its action, I nevertheless desire to modify my invention in a small particular by recording the impressions mechanically upon the original strip, as shown in Fig. 3 of the drawings. I employ the same apparatus as that just described, but instead of the lamp for photographically recording the impression I provide a spraying machine or the like, indicated at 11, which projects a supply of finely divided coloring matter so that the coloring matter is projected through the exposed portions of the slot and a strip of transparent material beneath the screen 2 is provided with bands of color corresponding in length and width to the uncovered portions of the slots. Obviously this transparent strip when dried is applicable equally well to be superposed upon the metallic strip and the whole printed in the manner hereinbefore described. Openings *c*—*c* are provided in screen 2, so that during each exposure of a portion of the strip 1 to the spray of color, an image will be printed in the space between adjacent perforations, as indicated in Fig. 3 at *d*, so that the registration and operation of the intermittent mechanism may be constantly observed. For reciprocating slides which cover the slots 12, 13, 14 and 15, there are provided pantograph arms 3, 4, 5 and 6, which are actuated by moving a stylus (not shown) over the face of the pattern card or the like, which it is desired to reproduce upon the strip 1. The slides for the short slots *d* are also actuated by a series of levers A to H.

It will thus be seen that I have provided a method comprising two modifications for primarily forming an opaque image upon a transparent strip and subsequently transferring the impressed images upon a sensitized metallic surface which, when developed, will cause the surface of the metal to be exposed at points, and of a size corresponding in area to the size of the original opaque images so that the metallic surface may be etched through for the purpose specified.

Having thus described my invention what I claim is:

1. A process for reproducing perforated bands which consists in exposing a restricted area of a moving transparent film to an impression producing agent whereby opaque marks are formed thereon, transferring the images to a sensitized metallic plate to form a positive, and finally etching the metallic plate to cause perforations corresponding in size and number to the marks on the original film.

2. A process for reproducing perforated surfaces for use in Jacquard looms which consists in exposing restricted portions of a transparent strip to a spray of color whereby marks are formed on the strip of the desired size, transferring the opaque images thus formed to an emulsified metallic film in a photograhpic manner, and subsequently etching the metallic film to produce perforations therethrough corresponding in number and size to the originally formed images.

3. An apparatus for recording images to be used in the manufacture of perforated bands which consists in a reciprocating slide provided with a perforation, a solenoid for reciprocating the slide, and a circuit closer.

4. An apparatus for recording images to be used in the manufacture of jacquard pattern cards which consists in an opaque screen provided with relatively long and short slots, slides adapted to cover the slots, a pantograph for reciprocating the slides whereby the slots are uncovered in various degrees, and independently operable slides for covering the relatively short slots.

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

ALFRED BRUNN.

Witnesses:
WOLDEMAR HAUPT,
HENRY HASPER.