Dec. 7, 1937. A. RAMBOLD 2,101,753

METHOD OF PRODUCING PERFORATIONS OF SMALL DIAMETER IN BANDS OF CELLULOSE FOIL, METAL FOIL, AND THE LIKE

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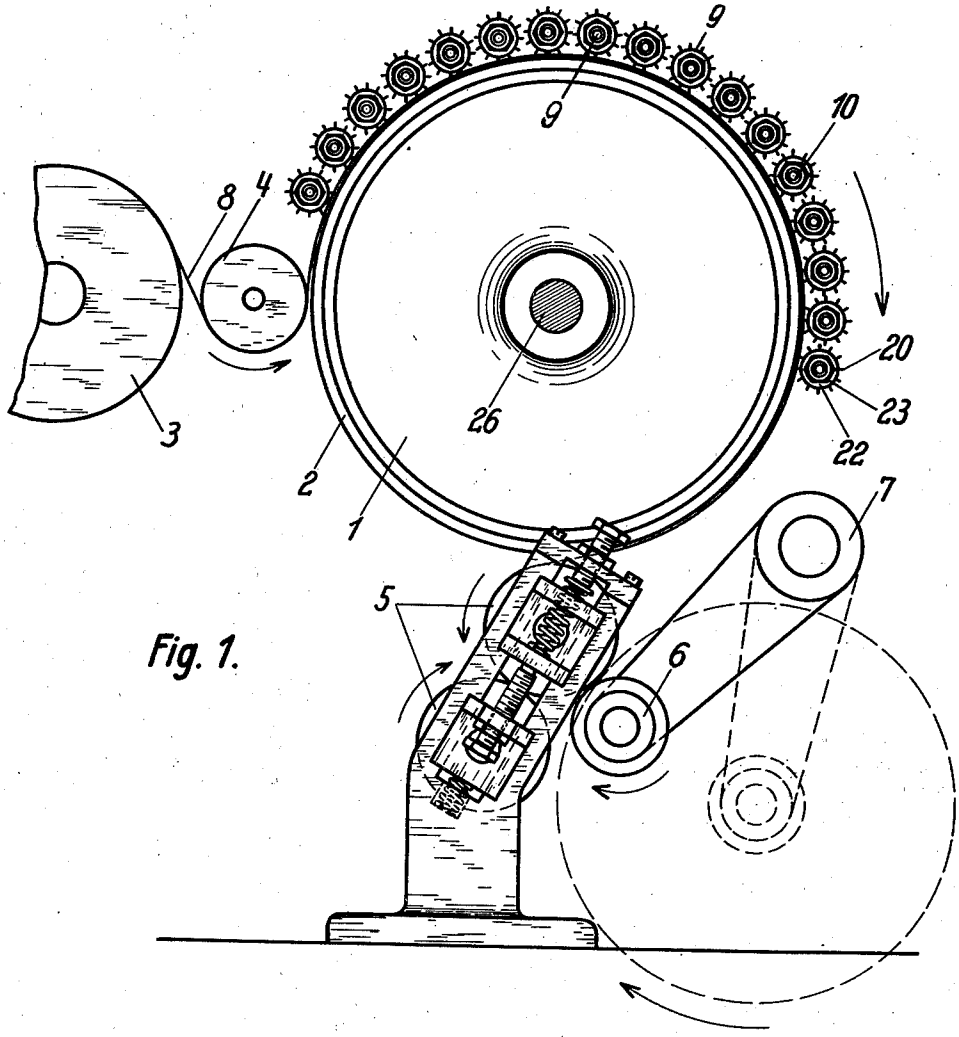
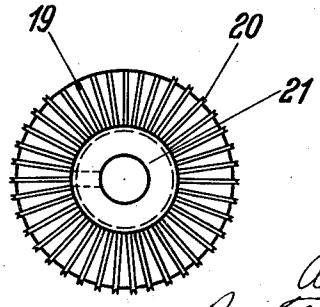


Fig. 1.

Fig. 4.



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Fig. 2.

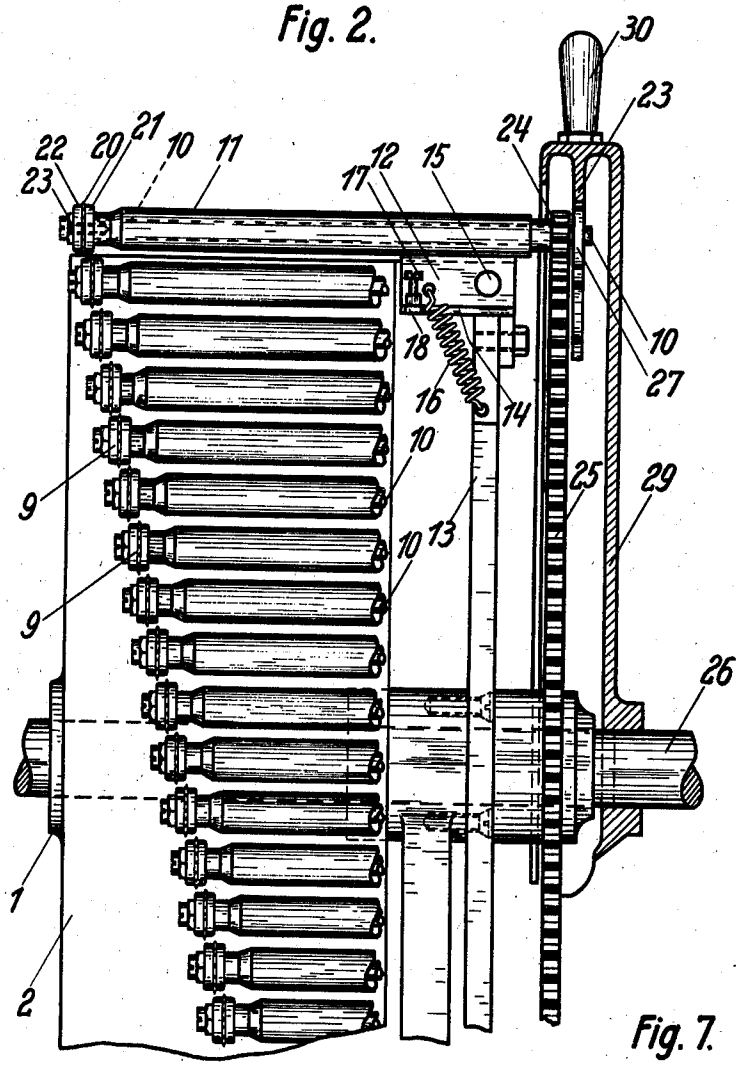


Fig. 3.

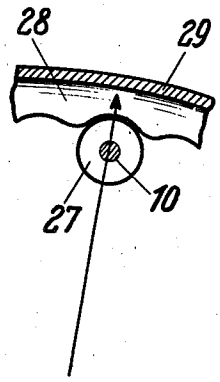


Fig. 7.



Fig. 6.

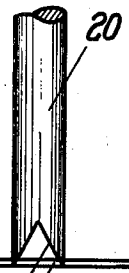


Fig. 5.

Fig. 8.

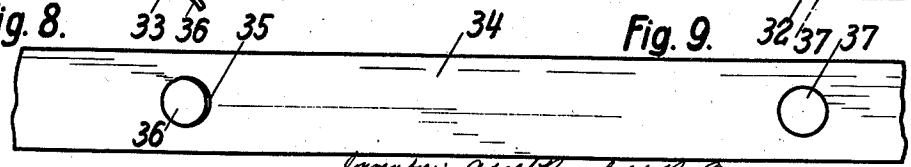


Fig. 9.

Inventor: Adolf Rambold By Hauke & Spellman Atty

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UNITED STATES PATENT OFFICE

2,101,753

METHOD OF PRODUCING PERFORATIONS OF SMALL DIAMETER IN BANDS OF CELLULOSE FOIL, METAL FOIL, AND THE LIKE

Adolf Rambold, Dresden, Germany

Application August 8, 1935, Serial No. 35,390
In Germany September 17, 1934

4 Claims. (Cl. 164—125)

The problem of perforating bands of cellulose foil, metal foil or the like by means of machinery has not yet been satisfactorily solved. For example, the attempt to employ a roller fitted with steel pins as a perforating tool has proved unsuitable on account of the costs and also the technical difficulties. The wear of the pins is excessive as may be appreciated from the fact that in the case of a roller about 150 mm. wide 60 pins disposed in one row all act at once and the total power flux is distributed upon a very small area. This produces too great a strain on the band of material itself and the perforation is not satisfactory and uniform, particularly in the case of small perforations of from ½ mm. diameter downwards. There is also considerable waste of time since the loss of one pin is sufficient to put the tool out of action.

The results obtained with stamping tools have also proved unsatisfactory, since in practice these permit of only small feed movements. These tools were, furthermore, much too weak and delicate for such small holes and therefore too sensitive.

In machines used for forming a plurality of creases or scores parallel with or longitudinal to the run of the sheet, the combination of a rotary sheet carrier provided with sheet moving devices having a supporting surface against which the material is creased is a part of the prior art, and in such prior art, a plurality of creasing devices mounted in staggered relation to one another longitudinally of the carrier for creasing the material in lines at right angles to the axis of the carrier are known.

As distinct from these previous attempts, the present invention makes it possible to effect the required perforation satisfactorily in a very short time and at little cost.

It is an object of the present invention to produce rows of perforations of small diameter in bands of thin cellulose, metal foil and the like which consists in perforating the band along several rows at stepped points in its length, each row during its formation terminating in advance of the next succeeding row, the spacings longitudinally of the band between the several pairs of adjacent rows being uniform throughout all the rows, and each of said perforations being formed by cutting the material in such a way that the point of the hollow-ground needle which is nearest the moving line cuts first to the middle, and the rear point of the needle then completes the cutting process in such a manner that it also cuts toward the center.

According to the invention a plurality of perforating wheels, relatively displaced in step formation, are employed for effecting the perforation, so that the tools are distributed over the longest possible stretch of the band for a given hole spacing.

Furthermore, it is of importance that the cutting edges of the individual cutting tools are ground back.

An embodiment of apparatus in accordance with the invention is illustrated diagrammatically in the accompanying drawings by way of example.

Fig. 1 is a side elevation of the apparatus.

Fig. 2 is a fragmentary plan view, partly in section, corresponding to Fig. 1.

Fig. 3 shows part of a cam means hereinafter described.

Fig. 4 shows the disposition of the perforating tools on one of the tool holders, their clamping disc being omitted.

Fig. 5 illustrates a known form of cutting tool.

Fig. 6 shows a novel cutting tool in side elevation.

Fig. 7 is a front view of the new cutting tool.

Fig. 8 shows a perforation as made with the known tool.

Fig. 9 shows a perforation as made with the new tool.

In the drawings, 1 indicates a cylinder which has a sleeve or covering 2 of hard rubber or the like. 3 is a reel of cellulose foil to be perforated, 4 a tensioning roller for the band 8 of the cellulose material, 5 a pair of pull-rollers, and 6 a take-up roller for the perforated material. The take-up roller is rotatably carried by arms pivotally mounted at 7.

The band of material 8 passes over the cylinder 1 which is fixed on its shaft 26. Grouped about the cylinder 1 are tool-holders 9, these being successively offset across the cylinder and thereby distributed over the whole width of the band, as shown in Fig. 2. Each holder 9 is constituted by a bush which is keyed or clamped on a shaft 10 disposed in a tubular guide 11. The guide has webs 12 which engage, after the manner of a saddle, a guide member 14 fixed to the machine frame 13. The members 12 and 13, 14 are pivotally interconnected by a pin 15, so that the sleeve 11 and holder shaft 10 can be rocked to move the perforating tools carried by the holder 9 towards or away from the cylinder 1. A spring 16 fixed to the frame 13 and to the guide 11 tends to press the holder 9 to the cylinder. Adjustment is provided by a screw

17 fitted to the guide 11 and abutting against a stop 18 of the guide member 14.

The lateral spacing of the individual tool holders may be varied by interposing rings (not shown).

As shown in Fig. 4, each bush-shaped holder 9 presents a ring surface 19 having radial grooves in which the perforating tools 20 are fitted. The tools 20 are centered by a screw bolt 21 (Fig. 2) and are firmly clamped to the holder, by a disc 22 engaged by a nut 23 threaded on the bolt 21, to form a perforating wheel rotatable with the shaft 10.

The other end of each shaft 10 carries a pinion 24 which meshes with a gear 25 secured to the shaft 26 of the cylinder 1. Loosely mounted by the side of the pinion 24 on each shaft 10 there is a cam roller 27 which engages a cam disc 28 (Fig. 3). Preferably this cam disc is disposed in the gear casing 29 which is fitted with a handle 30.

As already mentioned, the cutting tools in each holder 9 are radially disposed and form a perforating wheel, which rotates around its axis, that is about the axis of its shaft, no relative motion taking place between the perforating wheel and the work to be perforated by motion of the latter and simultaneous rotation of the perforating wheel about its axis.

If a cutting tool 31 (Fig. 5) of circular section having a cutting edge 33 plane ground at right angles to its longitudinal axis were used, satisfactory perforation would not be obtained with the apparatus described, because of the manner in which the tool is applied to the work. Manifestly, at the beginning of the cutting or perforating action, the tool is applied to the work 34 in such a way that it increasingly penetrates into the work, but at the end it is again lifted off; consequently, a cutting tool with a cutting edge as stated is unable to produce a clean and complete cut. Usually the cut away piece 36 (Figs. 5 and 6) forming the perforation 35 remains hanging on the work.

For this reason, and in accordance with the invention, the cutting edge of each tool 20 (Figs. 6 and 7) is ground back, whereby it becomes possible to produce a satisfactory cut; moreover, the tool is recessed, as by grinding, transversely to the cutting direction so that the cutting edge 32 is obtained. With such tools perfect perforation as denoted by 37 in Fig. 9 is attained.

The operation of the apparatus is as follows:—

The band of material 8 is pulled off the reel 3 over the tensioning roller 4 and the cylinder 1 by the pull rollers 5 and wound upon the take-up roller 6. In its passage over the cylinder 1 the band 8 is engaged by tools carried by the holders 9 and is perforated. The tool holders, as has been mentioned above, are positively rotated. The pressure with which the tools act upon the band of material may be accurately adjusted with the aid of the adjusting screw 17 in co-operation with the spring 16. In order that all tool holders may be thrown out of action at once, the engagement and disengagement device comprising the cam rollers 27 and the cam disc 28 is provided. For its operation it is only necessary to displace the lever 30 slightly so as to bring the crests of the cam disc into engagement with the rollers 27.

In order that the band of material 8 may always be guided in a tensioned condition over the cylinder 1, the pair of rollers 5 is positively driven at a speed of rotation which is slightly greater than that of the cylinder 1.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. That method of producing rows of perforations of small diameter in bands of thin cellulose, metal foil and the like which consists in perforating the band along the several rows at stepped points in the length, each row during its formation terminating in advance of the next succeeding row, each of said perforations being formed by cutting the material in such manner that the forward edge of each perforation is first cut and the cutting proceeds from front to rear of the perforation with respect to the front and rear of the band.

2. That method of producing rows of perforations of small diameter in bands of thin cellulose, metal foil and the like which consists in perforating the band along the several rows at stepped points in the length, each row during its formation terminating in advance of the next succeeding row, the spacings longitudinally of the band between the several pairs of adjacent rows being uniform throughout all the rows, each of said perforations being formed by cutting the material in such manner that the forward edge of each perforation is first cut and the cutting proceeds from front to rear of the perforation with respect to the front and rear of the band.

3. That method of producing rows of perforations of small diameter in bands of thin cellulose, metal foil and the like which consists in passing the bands through a zone, subjecting the bands in that zone to the action of perforating tools arranged along the bands at several rows of stair-like stepped points in the length of said bands, each of said tools having a cutting edge which is ground rearwardly in a concave manner whereby the forward end acted upon by each tool is primarily cut at its forward point and thereafter cut around the perforation.

4. That method of producing rows of perforations of small diameter in bands of thin cellulose, metal foil and the like which consists in passing the bands through a zone, subjecting the bands in that zone to the action of perforating tools arranged along the bands at several rows of stair-like stepped points in the length of said bands, which cutting tools effect a cutting of the band at the forward point of the cut and thereafter cut around the perforations.

ADOLF RAMBOLD.