April 6, 1943. C. O. DAVIS ET AL 2,316,054

PERFORATING APPARATUS

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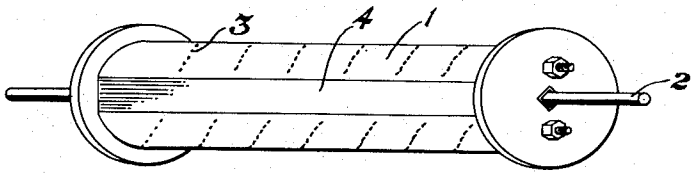


Fig. 1

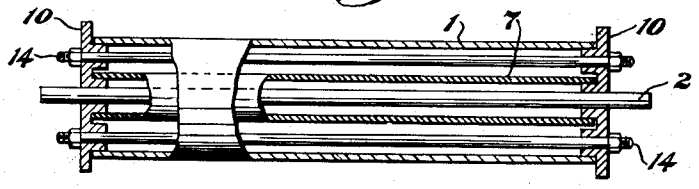


Fig. 6

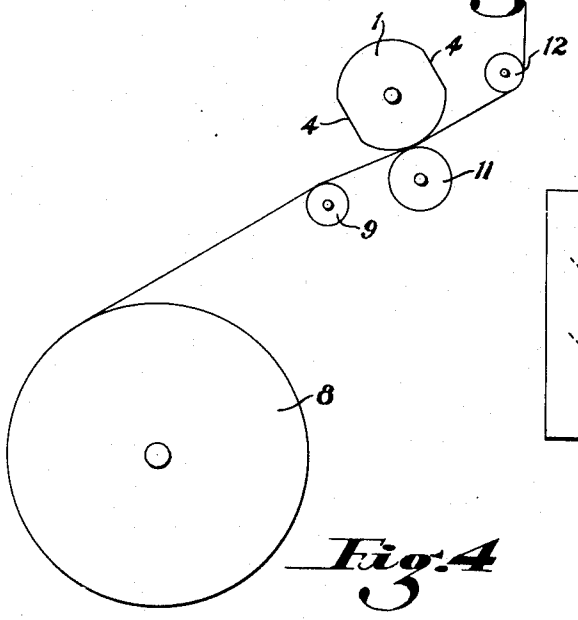


Fig. 4

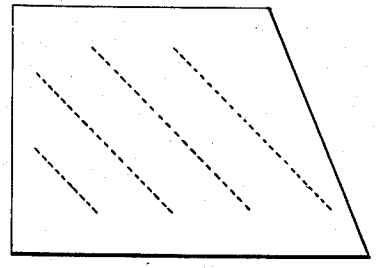


Fig. 5

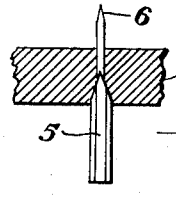


Fig. 2

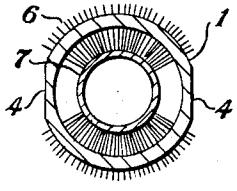


Fig. 3

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PERFORATING APPARATUS

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Application May 20, 1942, Serial No. 443,734

1 Claim. (Cl. 164—99)

This invention relates to an apparatus for perforating sheets of material, and more particularly to an apparatus assembly for perforating paper shells adapted to contain explosive charges.

The controlled perforation of paper articles and sheets is important for a number of uses where it is desired to make possible the easy tearing of paper along predetermined lines. For such a result, it is necessary that the perforations, whether long slits or a succession of circular holes, be relatively close together and that a high ratio of removed to retained paper be maintained along the line of perforations.

An object of the present invention is an improved apparatus arrangement for perforating sheets along predetermined lines. A further object is such an apparatus assembly adapted to yield uniform perforations such that rupture of the material will take place readily along the desired line. A further object is an apparatus so arranged as to form rows of perforations on paper sheets at an oblique angle with the sides of said sheets. A still further object is an apparatus assembly for perforating dynamite shell papers, whereby said papers will rupture in the desired manner under pressure. Additional objects will be disclosed as the invention is disclosed more at length hereinafter.

We have found that the foregoing objects are accomplished when we cause the paper or other material to be perforated to pass over a substantially cylindrical roll having an outer surface of metal or other firm material, said perforating roll having regularly aligned pointed perforators projecting from its external surface in such manner as to effect perforation of the paper as it passes over said roll.

In order that the invention may be understood more clearly, reference is made to the accompanying drawing, which illustrates one embodiment of the invention, though this should in no way be taken as limiting the scope thereof. Figure 1 shows a view of the perforator roll with rows of perforating pins. Figure 2 is a vertical elevation of a single pin. Figure 3 shows a cross-sectional view of the perforating roll with pins projecting past the surface. Figure 4 is a diagrammatic representation of the perforating assembly. Figure 5 illustrates a dynamite shell paper having three rows of perforations as prepared by the apparatus of Figure 1. Figure 6 is a side elevation.

Considering the drawing in more detail, 1 in Figure 1 represents a substantially cylindrical roll, preferably a hollow cylinder, having a metal surface. A number of small holes have been drilled through the drum surface along a number of helical lines, and through each of these holes projects the pointed end of a metal pin or perforator adapted to punch a hole through any paper sheet passed over the roll. A single metal pin is represented in Figure 2 and may desirably be about 1¼" in length. The various pins are mounted on the perforating roll in the manner shown in Figure 3, the base of the pin 5 being mounted on an inner annular surface 7, while the point 6 of said pin projects beyond the external surface of the roll. We have found that pins projecting $\frac{3}{32}$" above the surface of the roll function satisfactorily.

The apparatus assembly for perforating paper according to the invention is shown in Figure 4. The paper to be perforated is fed from the paper roll 8 past the surfaces of guide rolls 9 and 12 in the manner shown, whereby it passes over the surface of the revolving perforating roll 10, whose projecting pins push the fibers aside and make small holes in the paper and extend slightly into the backing roll 11, whose surface comprises a resilient material. The perforator roll revolves as the paper passes, and is driven in synchronization with the feeding roll and subsequent apparatus elements to which the perforated shells pass. The two guide rolls 9 and 12, the first ahead of the perforator and the second following it, are preferably idler rolls. These two guide rolls should be so positioned that they maintain the paper substantially tangent to the rounded portions of the perforating roll and the auxiliary roll when passing therebetween. Since the perforating pins do not remove the paper but merely push small portions of it aside, we may desire to include an additional roll or other arrangement for smoothing down the burrs.

While the perforating roll may be made of any desired diameter, or of such diameter as to allow one or more lengths of shell paper to be perforated in one revolution, the apparatus shown in the drawing is adapted to accommodate two lengths of shell papers in one revolution. In Figures 3 and 4, the roll surface is shown in the preferred form, flattened on two opposite sides, these flattened areas being the portions of the cylinder surface where no pin points project. One of these flat areas is shown at 4 in Figure 1. By reason of the two flat areas on the otherwise cylindrical surface, automatic correction and synchronization of the apparatus take place after each half-revolution of the perforating roll and

correct placement of the perforator on the paper is assured.

The perforating points projecting through the metal surface of the roll are regularly arranged in rows about said surface, preferably in helical lines. While we do not wish to be limited thereto, there will desirably be sufficient discontinuous helical rows of perforating points that rows of perforations will be present on each finished and cut sheet of cartridge paper. Preferably, also, the rows of pins will be so arranged as to form an acute angle with the line along the roll surface parallel to the axis of said roll of between 35 and 70°. The most favorable angle lies between 35 and 55°. This will assure a similar angle between the rows of perforations and the parallel sides of the cut shell paper. Such an angle has been found to give the most favorable results in dynamite cartridges, as pointed out in the copending case of Claude L. Barker, Serial No. 305,631, filed November 22, 1939. The pins are so arranged as to be replaceable, so that broken or defective pins can be removed and new pins inserted in their place.

In operating the apparatus of the present invention, we prefer to perforate two shell papers simultaneously, these being cut apart in a subsequent operation. A single perforated sheet is shown in Figure 5, after separation by cutting from a sheet of similar size and shape. As has been described, the paper, one-half of which is represented in Figure 5, was perforated during half a revolution of the perforating roll.

While we do not wish to be limited as to the shape of the perforations made by the projecting pins, these will preferably be substantially circular in shape and the pins will be sufficiently sharp and pointed to penetrate the paper and the backing roll readily. We have found that a desired shape for the pins is one in which said pin has a relatively broad base and a shoulder from which the pointed portion projects. The angle on the perforating pin point has been carefully selected so that the paper is perforated cleanly and not torn as the perforating roll revolves.

The perforating assembly of our invention is applicable to the perforation of paper sheets generally, but we find it particularly advantageous in the case of paper sheets for wrapping explosive cartridges. In such case, the perforated paper will ordinarily pass to subsequent steps in its preparation for use, for example to cutting knives, printing rolls, and the like. These subsequent operations, however, form no part of the present invention.

We have described our invention at length in the foregoing. It will be understood, however, that many variations may be adopted in forms of apparatus and operating procedures without departure from the spirit of the invention. We have described our invention, for example, in connection with the perforation of paper. It may be applied, however, in the perforation of any penetrable material, paper, fabrics, sheets of regenerated cellulose and other cellulose products, resinous materials, and even metals. We intend to be limited, therefore, only by the following patent claim.

We claim:

In a paper perforating assembly the combination of a substantially cylindrical perforating roll having a metal surface, pointed perforators projecting from said external metal surface, and helically arranged thereon, said perforating roll having at least one flattened portion longitudinally along its surface, said flattened portion being free from projecting perforators, means for feeding paper to said perforating roll, and means for rotating said perforating roll while the paper is passing thereover.

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