

Oct. 21, 1941.

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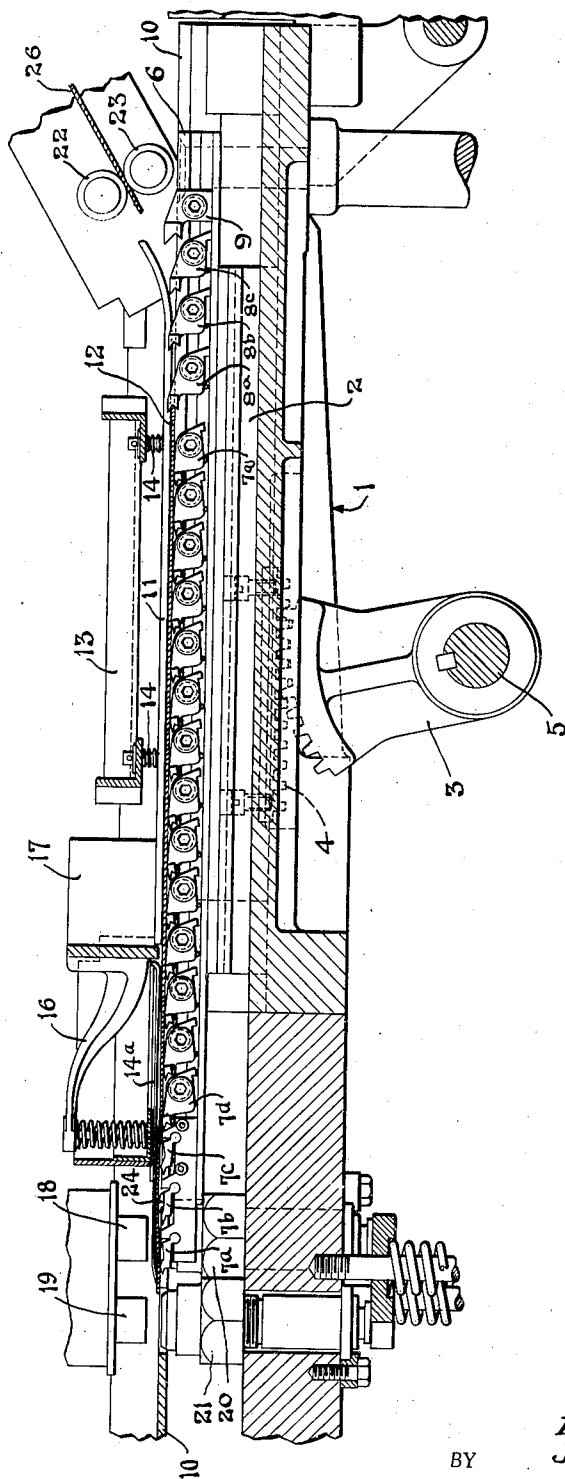
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PUNCH PRESS

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3 Sheets-Sheet 1

Fig. 1



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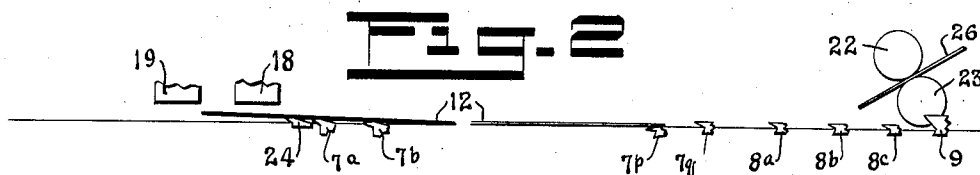
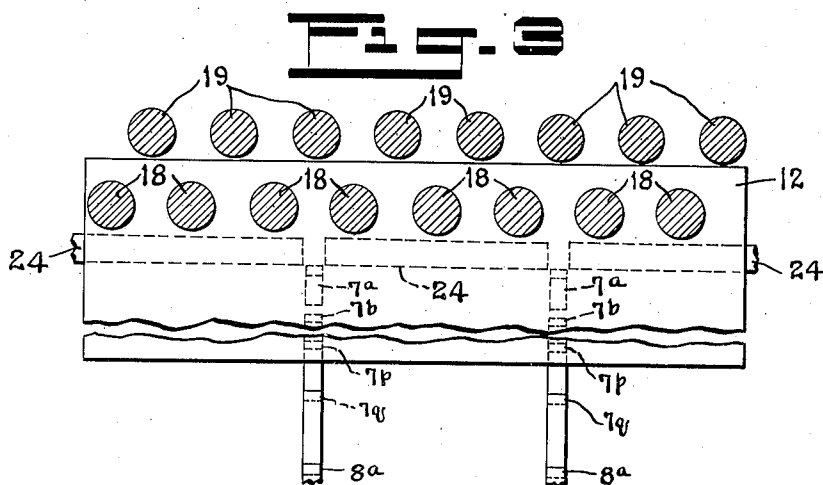
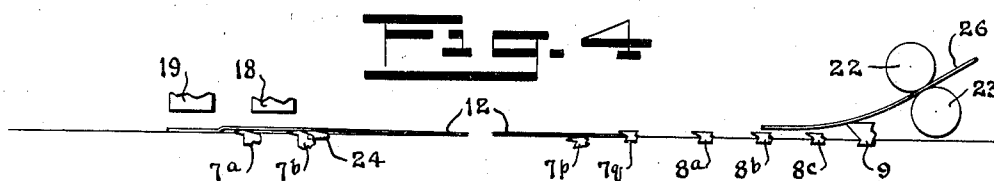
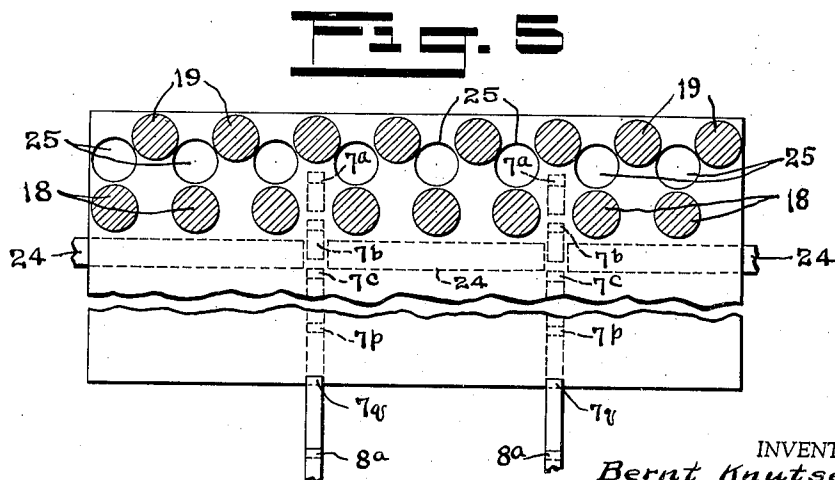
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3 Sheets-Sheet 2



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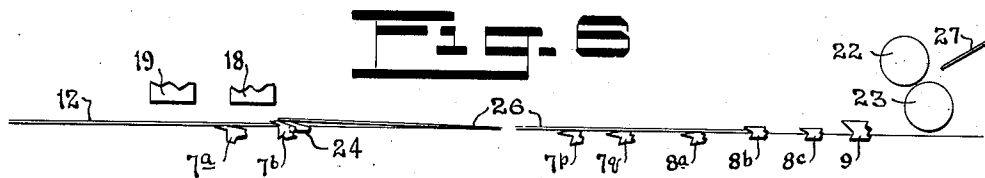
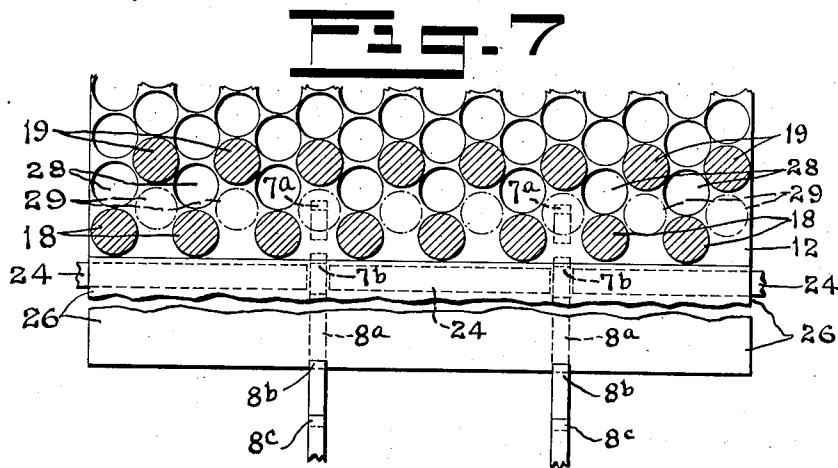
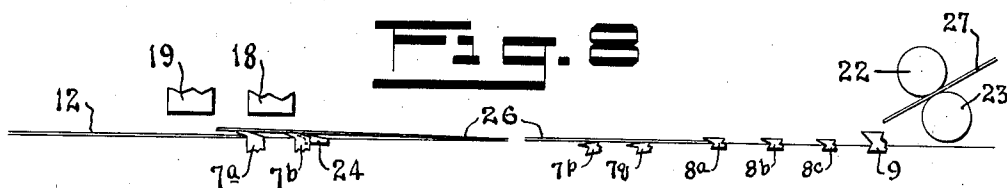
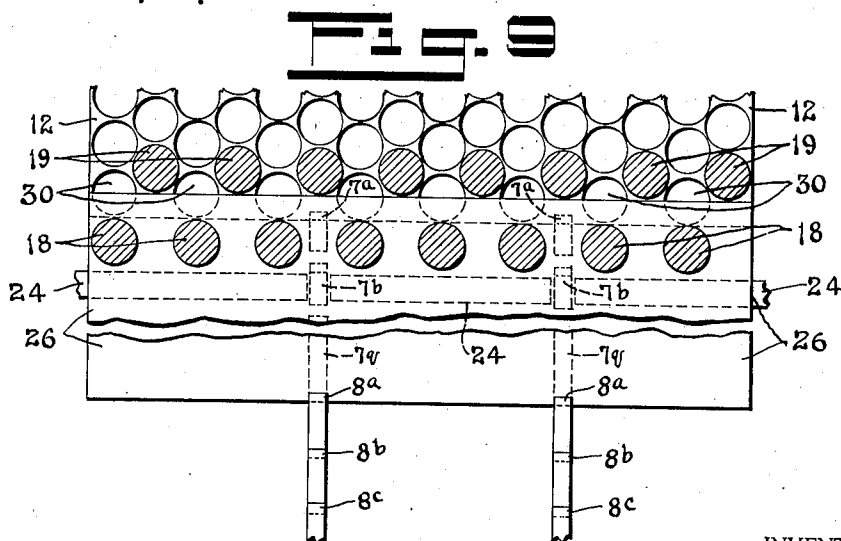
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3 Sheets-Sheet 3



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## UNITED STATES PATENT OFFICE

2,260,182

## PUNCH PRESS

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6 Claims. (Cl. 164—88)

This invention relates to a new and useful improvement in a punch press designed particularly for the punching of disks for bottle caps and other purposes from sheets of thin metal or other sheet material.

One of the most common uses of such a press is in the making of the universally-known and used crown caps, and for this reason a press suitable for this purpose is illustrated and described herein, but it will be understood that the invention is not limited to this particular type of press, or this particular use.

As a general rule, punch presses of this type are provided with a plurality of punches and dies so arranged that an equivalent number of disks are simultaneously punched and formed into caps in a single operation.

The material employed is usually thin metal in the form of rectangular sheets of a size suitable for the punch press employed and for the feeding mechanism. It is fed progressively, sheet by sheet, to the punches in such a way as to leave a minimum of scrap.

As this method has been practiced, the initial punching operation upon the entering end of the sheet of metal employs only the first row of punches, the second row operating idly. When this operation is completed, the sheet is fed forward so that it is positioned under both rows of punches, which, upon the next punching operation, punch out two rows or twice as many as produced by the initial punching operation. Thereafter two rows of disks are punched simultaneously until the following edge of the sheet is reached, where the last row of disks is punched by the second row of punches, the first row operating idly. Therefore, at both ends of the sheet there is a loss of 50% in the punching capacity of the press, and, since it has been the practice not to start the punching operation upon one sheet until the previous sheet has been completely punched, this loss is repeated for each sheet and may result in a total capacity loss per day of as much as 300 or 400 gross of disks and caps.

The object of this invention is to substantially eliminate this loss and to make available substantially the full punching capacity of the press.

As heretofore stated, a press suitable for the punching and forming of crown caps is shown in the drawings, of which:

Figure 1 is a plan view of a part of such a press; showing in particular the sheet-feeding mechanism;

Figures 2 and 3 are diagrammatic illustrations

of one stage of the feeding of the sheets into the press;

Figures 4 and 5 are similar illustrations of a second stage;

Figures 6 and 7 are similar illustrations of a third stage; and

Figures 8 and 9 are similar illustrations of a fourth or final stage.

As shown in Figure 1, the punch press consists in part of a frame or bed 1, which supports a slide 2, which can be reciprocated longitudinally by means of gear-segment 3, the teeth of which mesh with a rack 4 on slide 2. Gear-segment 3 is keyed to a shaft 5, which is so connected to a source of power (not shown) that the reciprocation of slide 2 is synchronized with the operation of the punches, as will hereinafter be explained in detail. Upon slide 2 is mounted a rack bar 6, which carries three series of feed dogs 7a—7c, 8a—8c, and 9. Slide 2 also carries a second identical feed rack parallel to the feed rack 6 and provided with an identical series of identically-positioned dogs, which have been similarly numbered in Figures 2—9, to insure that the sheet is fed to the punches in accurate alignment.

The jaws of the feed dogs operate in longitudinal slots in a bed-plate 10, the upper surface of which is at the same elevation as the upper edge of slide 2 so that the jaws normally project above it to substantially the same extent as above the upper edge of slide 2. This bed-plate supports the sheet of metal 12 during its progress through the press. Each feed dog, with the exception of dogs 9, is pivotally mounted so that the jaws of those which are under the sheet of metal will swing downwardly below the surface of bed-plate 10 to permit the sheet to rest upon the bed-plate.

Above the bed-plate 10 is a hold-down 11 of any suitable design which frictionally holds the sheet of metal 12 against bed-plate 10 in the positions to which it is moved by the feed dogs. This may consist of a plate or grid of any suitable design supported from a convenient part 13 of the frame and caused to exert pressure upon sheet 12 by springs 14. A second hold-down 14a for a similar purpose is provided adjacent the punches. This is maintained in frictional engagement with the sheet of metal 12 by means of a spring 15 between it and arm 16 mounted on a suitable part 17 of the frame of the press.

Two rows of 8 punches each are diagrammatically shown in the drawings, the front row being numbered 18 and the second row 19. The sec-

ond row is staggered with respect to the first so that when the punching of the sheet of metal is completed, practically no waste metal will be left between the holes as will be seen from Figure 9. Below the two rows of punches are positioned corresponding rows of dies, two of which are shown at 20 and 21 designed to produce bottle caps of the crown type, or whatever shape is desired, from the disks cut by the punches.

The sheets of metal are fed onto bed-plate 10 of the press by any suitable feeding mechanism, diagrammatically illustrated by a pair of rolls 22 and 23.

The press is also provided with a transverse sheet over-lapping step 24, set into bed-plate 10, so that its rear edge is flush therewith and its front edge projects above the bed-plate somewhat more than the thickness of the sheet of metal. The front edge is also substantially tangential to the first row of punches. The purpose of this step is to lift the entering edge of one sheet of metal over the following edge of the preceding sheet so that they can be overlapped, as will be hereinafter explained.

Over-lapping step 24 is broken, as shown, for example, in Figure 5, so as not to interrupt the slots in bed-plate 10 in which the jaws of the feed dogs operate.

The press operates as follows: Assume that a sheet of metal 12 has been fed by the feeding device diagrammatically indicated by rolls 22 and 23 onto bed-plate 10 under hold-down 11, and is finally positioned with its following edge in front of feed dogs 8a. When slide 2 is moved to the left, the entering edge of sheet 12 will be moved by dog 8a into position under the first row of punches 18 for the first punching operation, as shown in Figure 1. When the punches descend the first row of disks is punched out, leaving holes 25 in sheet 12, as shown in Figure 5. It will be noted that only one row of disks is punched, the second row of punches 19 operating idly. In this respect this invention follows the old practice. Meanwhile slide 2 is moved to the right, carrying rack bar 6 and the feed dogs with it, so that dog 7q is positioned beyond the following edge of sheet 12 in readiness to feed the sheet forward again after this first punching operation, as shown in Figures 2 and 3.

The next sheet-feeding motion positions sheet 12 under both rows of punches, as shown in Figures 4 and 5, and the ensuing punching operation will produce 16 disks and will leave 16 holes in the sheet corresponding in position to the punches 18 and 19, as shown in Figure 5. The feeding and punching sequence is repeated, the sheet being fed forward step by step by successive dogs, 7p-7o, etc., until sheet 12 is positioned for the last possible two-row punching operation. As shown in Figures 6 and 7, sheet 12 has been fed forward by dog 7b and has slipped off the front edge of step 24. When the punches descend they will produce two rows of disks, and will leave in sheet 12 holes corresponding in position to the punches 18 and 19, as shown in Figure 5.

Sheet 12 is again fed forward, as described, this time by feed dogs 7a, as shown in Figure 8, so that its entering edge lies beyond the row of punches 18. Consequently, as far as sheet 12 is concerned, the succeeding punching operation will punch only a single row of disks from the sheet, corresponding in position to that of punches 19, as shown in Figure 8.

However, while sheet 12 has been fed into the punches by the feed dogs as described, the next sheet 26 has been gradually fed onto bed-plate 10 by rolls 22 and 23, as indicated in Figures 2-5, its entering edge being some distance behind the following edge of sheet 12. Finally, the following edge of sheet 26 will be ejected by rolls 22 and 23 and will fall in front of feed dogs 9, when slide 2 is in its extreme right position. The next move to the left of slide 2 will cause feed dogs 9 to move sheet 26 towards the punches. The next reciprocation of slide 2 to the right and then to the left will permit dogs 8c to engage the following edge of sheet 26 and to feed it again towards the punches. Dog 8b then assumes the task, as shown in Fig. 6, followed by dog 8a as shown in Figure 8.

The distances between centers of feed dogs 8a-8c are all greater than the distances between centers of the feed dogs 7a-7q, and the reciprocating motion of slide 2 is greater than that required by the feed dogs 7a-7q. The result is that when slide 2 is at its extreme right position there is a considerable space between the operating feed dogs of the 7a-7q series and the following edge of sheet 12, as will be seen in Fig. 2, for example, with respect to dog 7q, whereas there is no such space between the following edge of sheet 26, and the operating feed dogs of the 8a-8c series. Therefore, the feeding of sheet 26 by the dogs 8a-8c series is faster than the feeding of sheet 12 by the feed dogs of the 7a-7q series. In other words, sheet 26 gradually catches up with sheet 12 as sheet 12 is fed through the punches. The spacing of the feed dogs 8a-8c is such that when sheet 12 is positioned as shown in Figure 6 to receive its final double punching, its following edge lies substantially directly under the entering edge of sheet 26. These edges are not in contact because, also as shown in Figure 6, the following edge of sheet 12 has slipped from the front edge of sheet overlapping step 24 and the entering edge of sheet 26 is lying upon the top of step 24.

The next movement of slide 2 to the right will bring feed dogs 8a into position to move sheet 26 under the first row of punches 18, and dogs 7a to move the following edge of sheet 12 into position for its final single row punching by punches 19. Since, as stated, the feeding motion of the feed dogs 8a-8c is greater than that of the feed dogs 7a-7q, and since the entering edge of sheet 26 already overlies the following edge of sheet 12, the next motion of slide 2 to the left will cause the entering edge of sheet 26 to overlap the following edge of sheet 12, as shown in Figures 8 and 9. Consequently, when the punches descend, punches 19 will punch the last row of holes in sheet 12 and punches 18 will simultaneously punch the first row of holes in sheet 26.

Thereafter sheet 12 is removed from the press by any suitable ejecting device, and sheet 26 is fed through the punches by the feed dogs 7a-7q in the same manner as described with respect to sheet 12. During the punching of sheet 26, the third sheet 27 is fed into the press, and finally caused to overlap sheet 26, so that the final punching operation of sheet 26 and the initial punching of the third sheet 27 is simultaneously performed.

In each case the entering edge of one sheet is lapped over the following edge of the preceding sheet at the proper time and to the proper dis-

tance by being fed over step 24 after the following edge of the preceding sheet has slipped off the edge of this step. Since, as stated, the step is slightly higher than the thickness of the sheet, contact between the edges of the sheets is effectively prevented.

It will be noted from the several figures that the two rows of punches are not only staggered with respect to each other, but are separated by a distance between their centers of a little more than a diameter and a half, so that alternate rows are punched by each double punching operation. Therefore, for the last double punching operation on a sheet, sheet 12, for example, as shown in Figures 6 and 7, the punches 18 are positioned substantially at the following edge of sheet 12, whereas punches 19 are separated from them by the intervening row of holes 28 already formed by the punches 18 in the preceding punching operation. This leaves a space 29 to the left and below each hole 28 of unpunched metal large enough for another row of disks. The final punching operation on sheet 12 produces a row of disks from these spaces 29 to the right and below each hole 28. That is to say, the row of disks nearest the following edge of sheet 12 is punched before the entering edge of sheet 26 is caused to overlap sheet 12, or, in other words, to overlap the row of holes nearest the edge of sheet 12 indicated by the numeral 30 of Figure 9.

In the next punching operation the two rows of punches straddle the overlap, as shown in Figure 9, to produce the last row of disks actually punched out of sheet 12, although the next to the last row in location, and the first row of disks punched out of sheet 26, although, in position, the second row.

It will be realized, of course, that the punches may vary in number and arrangement and in number of rows, the major requirement being that they be arranged so that no punching will occur through the overlap portions of two succeeding sheets.

It will also be realized, of course, that the application of this invention to presses of different design may require more or less alteration in the operations described in order to meet the essential requirement that successive sheets of material be overlapped at the proper time and to the correct amount to permit the punches to operate upon the sheets simultaneously substantially as described.

We claim:

1. The method of punching sheet material, which consists of simultaneously punching alternate rows of holes therein until the following edge is reached, then lapping the leading edge of another sheet over the last row of holes punched in the first sheet and then simultaneously punching the next to the last row of holes in the first sheet and the initial row of holes in the second sheet.

2. The method of punching sheet material, which consists of simultaneously punching alternate rows of holes therein until the following edge is reached, then lapping the leading edge of another sheet over the following edge of the first sheet and then simultaneously punching the next to the last row of holes in the first sheet and the initial row of holes in the second sheet.

3. The method of punching sheet material in a punch press provided with two or more rows of simultaneously-operated punches spaced so as to punch alternate rows of holes in sheet material, which consists of feeding sheet material intermittently and progressively under said punches until the last row of holes has been punched by the first row of punches, then feeding said sheet so that its following edge lies behind the first row of punches and simultaneously feeding a second sheet of material so that its leading edge lies below said first row of punches and overlaps the following edge of said first sheet between the first and second row of punches, and then punching a final row of holes in the first sheet by the second row of punches and an initial row of holes in the second sheet by the first row of punches.

4. In a punch press, means for intermittently and progressively feeding a sheet of material under the punches, means for similarly feeding a second sheet of material towards the punches at a rate sufficiently fast to cause said second sheet to overlap said first sheet between the next to last and last punching operations on said first sheet, and means for guiding the leading edge of said second sheet over the following edge of said first sheet at the beginning of said overlapping.

5. In a punch press provided with punches and means for feeding a plurality of sheets of sheet material to the punches one after the other so that the leading edge of one sheet overlaps the following edge of the preceding sheet before the punching of the first-mentioned sheet is completed, means for guiding the leading edge of said first-mentioned sheet over the following edge of said preceding sheet at the beginning of the overlapping of said sheet.

6. In a punch press provided with punches, a bed-plate and means for feeding a plurality of sheets of sheet material along said bed-plate to the punches one after the other so that the leading edge of one sheet overlaps the following edge of the preceding sheet before the punching of the first-mentioned sheet is completed, means for guiding the leading edge of said first-mentioned sheet over the following edge of said preceding sheet at the beginning of the overlapping of said sheets, consisting of a step sloping upwardly from the bed-plate to a height greater than the thickness of a sheet.

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