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54 **A punch.**

57 This invention relates to a punch for making holes in paper. The punch comprises two parallel support plates (1, 3) having aligned holes (5, 6), and a punching means (7) displaceable within the holes. The outer end of the punching means is provided with a round press button (9) which also serves as a spring for the punching means. The punching of paper with punches known from the prior art is heavy due to the great force required for the deformation of the press buttons. The punching can be made considerably lighter by using flexibly buckling press buttons (9).

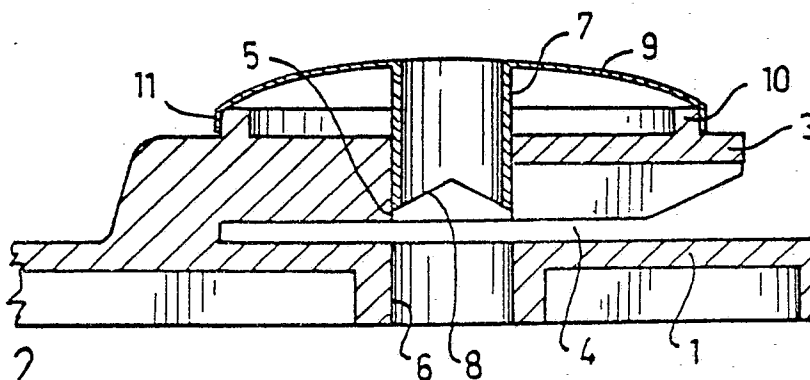


FIG. 2

EP 0 315 190 A2

A punch

This invention relates to a punch for making holes in sheetlike materials, such as paper, comprising a first and a second support plate defining therebetween a gap for a sheet to be punched and comprising holes aligned with each other; a punching means displaceable in the holes of the support plates in the direction of the central axis thereof and having at one end thereof a cutting edge; a cup-shaped press button attached to the other end of the punching means and secured at the edge thereof to the outside of the first support plate, whereby said press button is flexible in the direction of the central axis of the punching means and its spring force tends to displace the punching means away from the second support plate.

British Patent Specification 1,522,991 discloses a punch of the above kind. The press buttons of the punch comprise a round part aligned with the punching means and having branches projecting therefrom, the ends of the branches being provided with a transverse projection. The press buttons are secured to a first support plate by inserting the projections into lugs provided on the outer side of the plate.

This punch, though well-functioning in principle, has certain disadvantages. As distinct from conventional large punching machines, this punch does not utilize the lever effect, wherefore it is very heavy to operate even when making holes in a single sheet of paper. The punching is carried out at two stages: the points of the cutting edge of the punching means penetrate the paper at the first stage while the rest of the cutting edge penetrates the paper at the second stage. The sharp points of the cutting edge penetrate the paper without any major effort, so this stage does not require any greater force. On the contrary, a very great force has to be applied at the second stage, which is due to the fact that it is more difficult for the edges of the grooves of the cutting edge to penetrate the paper than what it is for the points of the cutting edge; furthermore, the position of the press button at the second punching stage deviates from the shape of the button in free state to a greater extent than at the first punching stage, wherefore a greater force has to be applied for the deformation of the press button than at the first punching stage. Still another reason for the fact that a greater force has to be applied is that when the press button is pressed down the branches protruding therefrom are straightened with the result that the free end portions of the branches are displaced outwards along the surface of the support plate, causing friction which has to be overcome during punching.

At the final stage of punching, the press button causes a force resisting the deformation, which force is so great that no marked reduction in the force to be applied can be noticed at the moment when the hole has been made. Since the moment when the hole is formed cannot be clearly noticed, the punching is often interrupted before the hole is completed, whereby the process has to be repeated.

As mentioned above, the radius of the press button according to British Patent Specification 1,522,991 increases when the button is pressed flat. Therefore the edge of the press button cannot be locked to the support plate in any simple way, because the button might come off the support plate when its diameter increases. In the solution of the patent specification, the press buttons therefore have to be locked to the support plate in such a way that they will remain attached thereto even when the branches are straight. A locking system of this kind is relatively complicated and, as a consequence, expensive to manufacture.

The object of the present invention is to provide a punch by means of which a sheet can be punched with less force than previously and which nevertheless is simpler in structure than corresponding punches known from the prior art. The punch according to the invention is characterized in that the press button is of a buckling type known per se, as a result of which the counterforce caused by the deformation of the press button increases at the initial stage but decreases then after the press button has gone beyond its dead point.

It has been unexpectedly discovered according to the invention that the use of press buttons of the buckling type in this kind of punches provides several major advantages. In this well-known type of press button, the force resisting the deformation increases up to the dead point when the button is pressed, whereafter it suddenly decreases and remains at a very low value for some time. As a result, the contribution of the press button to the total need of force is considerably smaller than in known solutions, which makes the punching lighter. Since the press button is pressed up to the bottom, that is, to the support plate, with a very little force, it is easy for the user of the punch to notice when the hole is made, so that practically each punching is successful.

Due to the behaviour of the press button, the diameter of the edge thereof does not change to any greater extent when the button is pressed, wherefore the button can be fastened to the support plate in a simple way. For the same reason, no force is required to overcome friction.

One preferred embodiment of the invention is characterized in that the press button and the punching means are dimensioned so that when the press button has reached its dead point, the cutting edge of the punching means has already partially penetrated the sheet to be punched. In this embodiment, the first stage of punching of the sheet takes place when the press button approaches its dead point when it is being pressed, whereas the second, heavy stage takes place after the press button has gone beyond its dead point, which decreases the need of force at this stage. This principle is preferably applied in such a way that when the press button has reached its dead point, the points of the cutting edge of the punching means are positioned within the hole of the second support plate, while the rest of the cutting edge is still positioned outside said hole.

The above embodiment is to be preferred in most applications. If the press button can be made sufficiently large, both punching stages, however, can be arranged to take place after the press button has gone beyond its dead point during the press, that is, after the buckling has occurred. This has the advantage that the buckling of the press button also makes it easier for the points of the cutting edge to penetrate the sheet.

The press button used in the invention can be fastened to the first support plate in a simple way; for instance, the outer surface of the first support plate can be provided with a protruding cleat surrounding the hole and the press button is fastened therein. The press button can thereby be provided with an edging parallel with the central axis of the punching means, which edging is arranged to be pressed against the outer surface of the cleat.

In the following a preferred embodiment of a punch according to the invention will be described in more detail with reference to the attached drawing, wherein

Figure 1 is a perspective view of a punch according to the invention;

Figure 2 is a sectional view along the line II...II shown in Figure 1; and

Figures 3 and 4 are detailed views of the punch similarly as in Figure 2 at different punching stages.

The punch shown in Figure 1 comprises a rectangular plastic plate 1 provided with two holes 2 adjacent to one of its longer sides so that the punch can be placed in a file. Two lugs 3 protrude from one surface of the plastic plate 1. The main plane of the lugs is parallel with the plastic plate. A gap 4 for a sheet to be punched, such as paper, is defined between the plastic plate and the lugs. The lugs 3 form a first or upper support plate and the plastic plate 1 a second or lower support plate. The

support plates comprise holes 5 and 6 in alignment with each other.

The device further comprises a tubular punching means 7 in which the end facing the lower support plate 1 forms a cutting edge 8 which is bevelled for improving the cutting effect. The outer diameter of the punching means 7 is slightly smaller than that of the holes 5, 6, so that the punching means is displaceable in the holes in the direction of the central axis thereof.

A press button 9 having the shape of a shallow round cup is attached to the punching means 7 at the end opposite to the cutting edge 8. The press button is preferably integral with the punching means and made of a flexible material, such as plastic. The edge of the press button 9 is secured to the upper side of the upper support plate 3. Due to the flexibility thereof, the press button also serves as a spring which tends to displace the punching means to the position shown in Figure 2. An opening communicating with the central opening of the punching means is provided centrally in the press button.

According to the invention, the press button 9 is of a buckling type known per se. This means a press button which after having been pressed down a short distance reaches a dead point which it tends to go beyond. As a result, the force required for the press increases until the button reaches its dead point, whereafter the required force decreases suddenly. A press button of this type can thus be brought to two stable positions: to a free position shown in Figure 2 and to a pressed-in position shown in Figure 4. In the pressed-in position, there is still some upward spring force left for returning the press button to the initial position.

The outer surface of the upper support plate 3 is provided with a ring-shaped protruding cleat 10. The press button is provided with an edging 11 parallel with the central axis of the punching means and arranged to be pressed against the outer surface of the cleat 10 for attaching the press button to the upper support plate. It is essential to the operation of the press button that the edge of the cup-shaped part thereof rests on a point which is spaced from the outer surface of the upper support plate 3 around the punching means 7.

In the following the punching of paper by means of the punch according to the invention will be described in more detail with reference to Figures 2 to 4.

A piece of paper to be punched is inserted into the gap 4 of the punch between the holes 5 and 6. The press button 9 is pressed downwards with a finger so that the cutting edge 8 of the punching means is displaced from the hole 5 via the gap 4 into the hole 6 in the lower support plate 1, thus cutting a hole in the piece of paper.

During the first stage of the punching, the cutting edge 8 is displaced to a position in which its points are positioned within the hole 6 and the rest of the cutting edge is positioned in the gap 4. In the paper there are now two short cuts formed at the moment the points penetrated the paper. The press button 9 is positioned in its dead point at this stage, see Figure 3, and the counterforce caused by the deformation of the press button has been increasing up to this point.

When the press button is further pressed downwards, the cutting edge 8 is wholly displaced within the hole 6, whereby a hole is formed in the piece of paper. During this second stage, the press button is displaced from its dead point to the pressed-in extreme position, see Figure 4. At the moment when the press button goes beyond the dead point, the press force required by the press button is suddenly decreased while the force required for the punching increases. When punching a single sheet of paper, this implies that the required press force remains substantially unchanged throughout the whole punching process and that this force decreases after the punching has been completed. Therefore the user notices clearly when the hole is formed in the paper. This is a decisive difference as compared with the operation of the punch according to British Patent Specification 1,522,991, in which the force required by the press button finally increases so much that the force is not decreased to any noticeable extent after punching.

In the embodiment described above, the punching means 7 is so long that when the press button is positioned in the dead point as shown in Figure 3, the cutting edge 8 is already positioned partially within the hole 6. Accordingly, during the first punching stage, the reduction in the need of force caused when the press button goes beyond the dead point has not been utilized. By shortening the punching means and possibly increasing the diameter of the press button, the punching can be arranged to start not until after the press button has gone beyond its dead point, i.e. the points of the cutting edge are inserted in the hole 6 only after the press button has gone beyond its dead point.

Claims

1. A punch for making holes in sheetlike materials, such as paper, comprising a first and a second support plate (3, 1) defining therebetween a gap (4) for a sheet to be punched and comprising holes (5, 6) aligned with each other; a punching means (7) displaceable in the holes of the support plates in the direction of the central axis thereof and having at one end thereof a cutting edge (8); a

cup-shaped press button (9) attached to the other end of the punching means and secured at the edge thereof to the outside of the first support plate (3), whereby said press button (9) is flexible in the direction of the central axis of the punching means (7) and its spring force tends to displace the punching means (7) away from the second support plate (1), **characterized** in that the press button (9) is of a buckling type known per se, as a result of which the counterforce caused by the deformation of the press button increases at the initial stage while it decreases after the press button has gone beyond its dead point.

2. A punch according to claim 1, **characterized** in that the press button (9) and the punching means (7) are dimensioned so that when the press button is positioned in its dead point, the cutting edge (8) of the punching means has partially penetrated the sheet to be punched.

3. A punch according to claim 2, **characterized** in that when the press button (9) is positioned in its dead point, leading points of the cutting edge (8) of the punching means are positioned within the hole (6) of the second support plate while the rest of the cutting edge is positioned outside said hole.

4. A punch according to any one of claims 1 to 3, **characterized** in that the press button (9) and the punching means (7) are dimensioned so that when the press button is positioned in its dead point, the cutting edge (8) of the punching means is positioned in the gap (4) between the support plates or in the hole (5) of the first support plate.

5. A punch according to any one of claims 1 to 4, **characterized** in that the outer surface of the first support plate (3) is provided with a protruding cleat (11) surrounding the hole, the press button (9) being fastened to said cleat.

6. A punch according to claim 5, **characterized** in that the press button (9) is provided with an edging (11) parallel with the central axis of the punching means and arranged to be pressed against the outer surface of the cleat.

7. Use of a buckling press button as a press button in a punching means.

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