March 12, 1968 G. E. WINGNE 3,372,609

METHOD FOR DRILLING HOLES IN ARTICLES, ESPECIALLY IN BOOKS, AND APPARATUS FOR UTILIZING THE METHOD

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Fig. 1

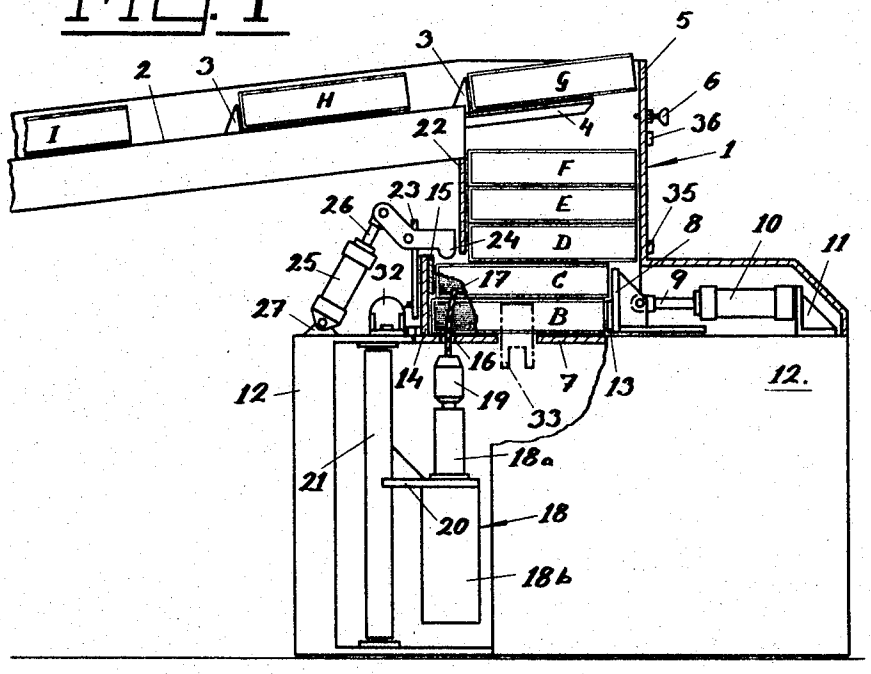
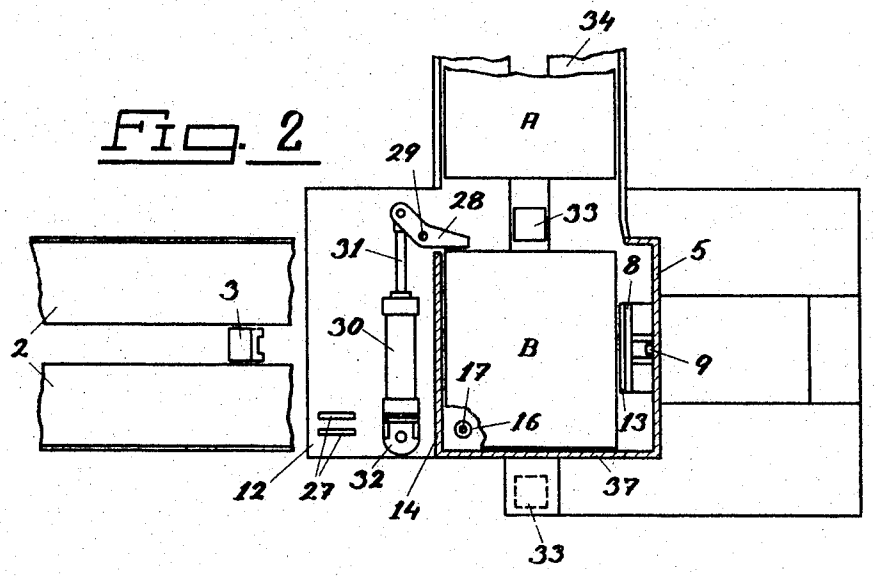


Fig. 2



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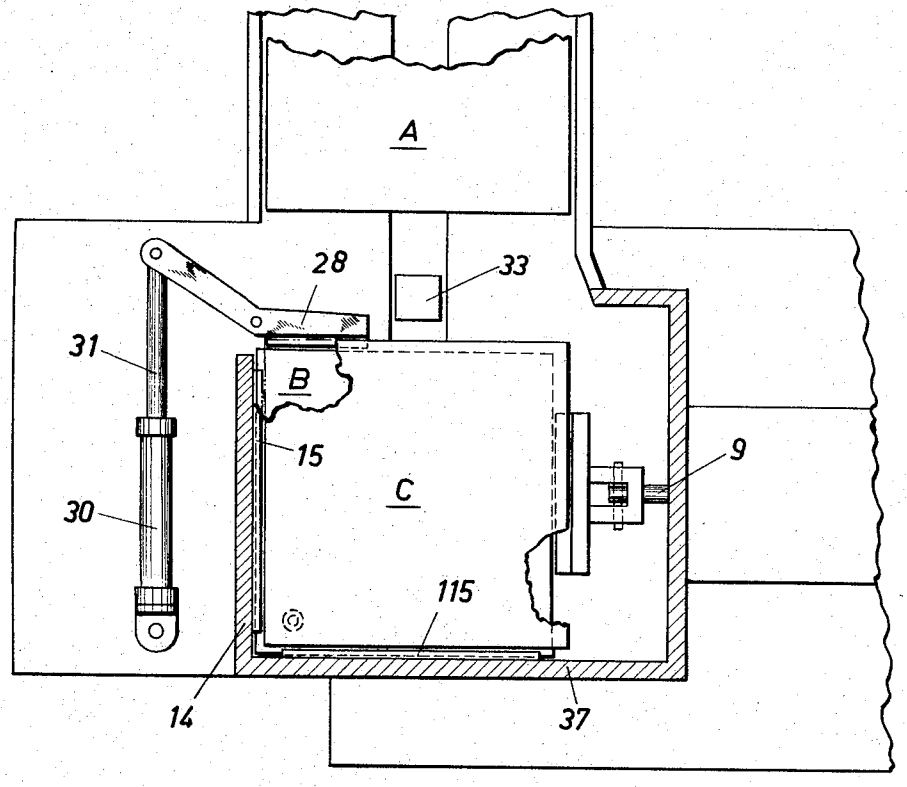
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Fig 3



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METHOD FOR DRILLING HOLES IN ARTICLES, ESPECIALLY IN BOOKS, AND APPARATUS FOR UTILIZING THE METHOD

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ABSTRACT OF THE DISCLOSURE

Apparatus for drilling holes in uniform articles such as thick books in which a number of books are stacked in a collecting zone or hopper and allowed to fall downwardly by gravity with further books being fed to the zone as the lowermost book, after drilling, is discharged from the zone or hopper. The drill is introduced into the lowermost book from below in a position diagonally inwards from one corner of the bottom of the zone or hopper and when drilling is initiated into the bottom of the lowermost book that one and the immediately superposed book are locked in stepped or offset relation relative to the corner so as to compensate for any drill deflection during drilling, whereby when the drill issues through the upper side of the lowermost book and penetrates initially into the bottom side of the superposed book and is then withdrawn from the zone and the superposed book then falls into the bottom of the zone so that during a subsequent drilling operation through said book the drill will enter the hole initially formed therein.

This invention relates to a method for drilling holes in uniform articles, especially in books, and apparatus for utilizing the method.

The object of the invention is to make it possible to drill such holes in a simple and efficient way and to prevent undercutting of the back side of the drilled article, which may be a telephone directory or similar thick book in which the drilled hole is intended for a suspension wire.

The new method which makes rational handling and careful drilling possible is essentially characterized in that at least two books are stacked on each other in a collecting hopper or the like and that the drill is entered into the lowermost article from below and that during the drilling the superimposed article is pressed downwards onto the lowermost article, such lowermost article after the drilling has been completed being discharged transversely from the hopper, whereupon said superimposed article by gravity will fall to the drilling position.

The apparatus for carrying out the new method is essentially characterized therein that it comprises a substantially vertical collecting hopper which is to be filled with articles from the upper end, means for feeding the articles to said end of the hopper and a drilling machine comprising a drill which is arranged to be movable in vertical direction upwardly through a corresponding hole in the bottom of the hopper.

Further objects of the invention will be apparent from the accompanying drawings wherein:

FIGURE 1 is a view partly in side elevation, partly in section and with parts broken away illustrating an apparatus for drilling holes in books,

FIGURE 2 is a view partly in top plan and partly in horizontal section illustrating the apparatus in FIGURE 1, and

FIGURE 3 is a fragmentary view similar to FIGURE 2 with the section being taken above the next to the bottom book in the stack.

In the drawing a number of books A–I are illustrated, FIGURE 1 illustrating books B to I the books B–I, FIGURE 2 showing books A and B and FIGURE 3 illustrating books A, B and C. In the shown example of the apparatus the books are fed to a vertical collecting hopper 1 by a conveying equipment 2 which feeds the books intermittently in the manner as disclosed in an application filed by me of even date herewith, Ser. No. 441,777, entitled, "Apparatus for Intermittent Feeding of Especially Books," said application being now abandoned. The conveying equipment intermittently pushes the books forward by dogs 3 on a reciprocating feed member. As disclosed in said application, the dogs are spring loaded to their upper active position. However, when the feed member performs a return stroke the dogs fold downwardly so as to be withdrawn below a book to a position where they can engage a following book. In order to prevent the front edge of the book to fall down prior to the rear end when the book is fed to a position above the hopper, the feeding member comprises two supporting arms 4, which are movable in their longitudinal direction to said position above the collecting hopper in which position they are carrying a book G as is illustrated in FIGURE 1. These supporting arms are preferably arranged to move forwards and backwards simultaneously with the dogs 3 they may for instance be formed by the two L-shaped bars forming extensions of the feed members carrying the dogs 3.

The supporting arms 4 are intended to be returned comparatively rapidly from the position shown in FIGURE 1 but there is yet a risk that the front edge of the book G can be tilted downwards too rapidly. In order to prevent this, means are arranged in the side wall 5 of the collecting hopper 1 opposite the feed equipment. These means consist of screws 6, which can be screwed through the wall 5 to an extent in which their braking effect on the books is adapted to the actual size of the books so that every book will be kept in a substantially horizontal position when it starts to fall through the collecting hopper.

In the form of the apparatus illustrated in the drawing the collecting hopper is intended to contain not more than five books of the illustrated size but a hopper of this kind may be formed to contain any number of books. In the collecting hopper the books B–F are stacked one on the other and the lowermost book B is lying on the bottom 7 of the hopper. However neither the book B nor the book C is positioned exactly under the remaining books D–F, but these two books B, C have by action of a device 8, which is movable in the transverse direction of the hopper, been pushed to the left in the drawing. In order to perform this transverse movement the device 8 is connected to a piston rod 9 of a pneumatic or hydraulic cylinder 10. This cylinder is by intermediation of a bracket 11 rigidly connected to the frame 12 of the apparatus. As is shown in FIGURE 1 the lowermost book B is moved a short distance further to the left than the book C. This is attained by a spacing block 13 which is detachably connected to the device 8 so that said device will be stepped. The books B and C are in the shown position moved into contact with a vertical abutment 14, which along its uppermost edge is provided with a corresponding spacing block 15, which is detachably connected to the abutment and arranged to act as a stop for the book C which is lying on the book B.

As can be seen from the FIGURES 1 and 2 there is a hole 16 in the bottom 7 of the collecting hopper 1 through which hole a drill 17 can be moved from the underside of the hopper. The hole 16 is positioned in the part of the bottom 7 adjacent the abutment 14 and slightly off-set the upper part of the collecting hopper 1. Under said hole 1 is arranged a preferably pneumatic drilling machine 18 to which the drill 17 is connected. The drilling machine comprises two parts, one part 18*a*, of which is provided with a chuck 19 for the drill 17 and is vertically movable

relatively the other part 18*b*. This part is rigidly connected by a bracket 20 to a rotary vertical shaft 21 by which it is possible to swing the drilling machine out from the apparatus in order to change the drill.

Between the abutment 14 and the wall 22 of the hopper, which is opposite to the wall 5 of said hopper there is formed an upwardly open recess extending along the upperside of the back-part of the book C. In the apparatus illustrated in FIGURE 1 a bearing bracket 23 is arranged vertically movable along the abutment 14 and this bracket carries a member 24 which is connected to the piston rod 26 of a pneumatic or hydraulic cylinder 25 in order to be turned and pressed downwardly against said part of the book C. The lower end part of the cylinder 25 is pivotally connected to a bracket 27 which is arranged on the frame 12. These parts 23–26 are not illustrated in FIGURE 2, which only shows the bracket 27.

FIGURE 3 illustrates that book B is also moved laterally relatively the book C to approximately the same extent as the book B is moved to the left in FIGURE 1 relatively the book C. This displacement laterally, i.e. downwardly relative to the position illustrated in FIGURE 2 is attained by a member 28 which is angularly movable about a pivot 29 and which is connected to a piston rod 31 of a pneumatic or hydraulic cylinder 30. By the cylinder 30 the member 28 can be swung essentially 90° counter clockwise from or clockwise to the position shown in FIGURE 2. The cylinder 30 is pivotally connected to the frame 12 by a bracket 32.

Exactly under the book B there is provided a slot in the bottom 7 of the hopper 1, which slot is parallel to the walls 5 and 22 and intended for a number of dogs 33 of preferably the same kind as dogs 3. These dogs 33 are intended to be moved reciprocally in order to discharge a drilled book from the hopper along a discharge track 34. The conveying equipment for discharging of books can be of the same kind as the conveying equipment which is arranged for feeding books to the collecting hopper.

When the apparatus is in use the books will be fed to the collecting hopper 1 along the conveying track 2 by the dogs 3 so that the books just before they fall down into the hopper they will be carried by the arms 4. By action of these arms and the screws 6 which are arranged in the wall 5 the actual book will assume a substantially horizontal position during the fall into the hopper. Provided that at least two books already have been fed to the hopper the feeding of more books can take place irrespective of the working position of the remaining parts of the apparatus. In order to register the number of books in the hopper there are arranged particular feeling members 35 and 36 at different levels in the hopper 1. The feeling member 35 is intended to register that there is a required number of books in the hopper and the feeling member 36 is intended to register that not too many books are fed to the hopper. Consequently when the book G, which in FIGURE 1 is carried by the arms 4, will be dropped into the hopper 1 by returning the arms the book will be recorded by the feeling member 36 and this will prevent the next book H to be fed to the hopper before the undermost book B is discharged there from and the stack of books C–G is lowered in an extent corresponding to the thickness of the discharged book.

In order to make it possible to arrange a dolly for the two undermost books B and C in a simple manner, which dolly is intended to press the book downwardly during the drilling of the book B, these two books are moved transversally to the hopper by the device 8 and as is already described the undermost book B will be moved a short distance further than the book C by action of the spacing block 13. During this displacement the books B and C are urged to bear with their backs against the abutment 14 and the spacing block 15 respectively. During this displacement of the books B and C the part of the upper side of the book C adjacent its back will be positioned just under the recess between the abutment 14 and the side wall 22 of the hopper 1, so that the member 24 can be pressed towards the book C and thus hold the books B and C pressed down against the bottom 7 of the hopper.

However, just before the pressing down of the member 24 the undermost book B is moved a short distance in its longitudinal direction relative to book C by the action of the member 28. During this displacement of the book B the book C is held in its earlier position under the action of a further spacing block 115 which is arranged on the inside of the upper broken part of wall 37 of the hopper. As is shown in FIGURE 3, due to the presence of spacing block 15 on wall 14 and a similar spacing block 115 on wall 37, book C will be maintained in the position which is offset relative to book B. When the member 24 is pressed down against the book C the drilling machine 18 is started and its movable part 18*a* is moved upwardly during rotation of the drill 17 which is connected to the chuck 19. As is greatly exaggerated in FIGURE 1 the drill 17 during the drilling of the hole in the book B, will follow a path which is curving essentially diagonally inwards the book. Because the book C is intended to act as a dolly for the undermost book B when the drill is breaking through the upper side of the book B it is of great importance that the drill is put into the book C exactly at the point where the drill will hit the book during the drilling of the book C in the next cycle. In order to ensure this the spacing blocks 13 and 15 and the spacing block 115 which are arranged on the wall 37 are so positioned and dimensioned as to compensate for the exaggeratedly shown curved drilling path. This compensation can be adapted to the actual book dimension by exchange of the spacing blocks.

When the drilling process is ended the drill 17 is withdrawn from the drilled hole in the book B by lowering of the movable part 18*a* of the drilling machine 18. At the same time or immediately after said lowering of said part, the device 8, the member 28 and the member 24 are returned to their inoperative positions. When said device and members are returned the discharge equipment comprising the dogs 33 is actuated in order to feed the books A and B one step in a forward direction so that the book B is discharged from the collecting hopper 1. The dogs 33 are similar to the dogs 3 in the conveying equipment 2 and can be swung to a position below the discharged track by action of the books when said dogs are returned to their starting positions. As soon as the book B is discharged from the hopper 1 the book C will drop to the position in which the book B is illustrated in the drawing. This will permit the remaining books D, E and F and also the book G, which now will be fed into the hopper to be lowered and then the hereinbefore described operation will be repeated. When book C during a subsequent operation will fall to the bottom of the hopper the stepped lower portion of ram 8 will push this book into contact with wall 14 below spacing block 15, and the other and laterally operable pushing mechanism 28, 30, 31 will now push book C into contact with wall 37 below spacing block 115. Thus, the spot where the drill enters the next superimposed book D will be offset from walls 14 and 37, respectively.

It is therefore clear that the invention discloses a method and apparatus for drilling holes in articles such as thick books in the nature of a telephone directory, wherein at least two such books are stacked in a collecting zone in superimposition with the uppermost book offset in relation to the lowermost book in a diagonal direction from the corner of the zone, feeding a drill from beneath the zone into the lowermost article at a position diagonally inwards from the corner of such zone, while pressing the superposed article or book downwards against the lowermost book during drilling, removing the lowermost book after drilling in a direction transversely of the zone and away from such corner so as to permit the superposed book to fall by gravity to a drilling position in which the aperture formed in the under side thereof when the drill broke through the upper side of the lowermost

book is in alignment with the path of movement of the drill for subsequent drilling operation.

The invention is not limited to the described and in the drawing illustrated form but can to its details be varied within the scope of the invention defined in the claims. Thus also other articles than books can be drilled by the apparatus for instance articles of wood or plastic.

What I claim is:

1. A method for drilling holes in articles including stacking at least two articles on each other in a collecting zone, entering a drill from below into the lowermost article, pressing the superposed article downwards upon the lowermost article during drilling, removing the lowermost article after drilling has been completed transversely from said zone to permit said superposed article to fall by gravity to drilling position, and feeding a new article to the top of the zone.

2. A method according to claim 1 in which the collecting zone contains a plurality of articles in stacked relation and moving the two articles at the bottom of the stack prior to the drilling operation transversely in relation to the main stack in such zone and pressing said two articles downwards against the bottom of the zone during the drilling operation.

3. A method according to claim 2 for drilling holes in books and including moving the lowermost book a short distance further in said transverse direction than the superposed book in order to compensate for distortion of the drilled hole.

4. An apparatus for drilling holes in articles including an essentially vertically arranged collecting hopper having wall means capable of containing at least two articles, means for feeding the articles to the top of said hopper, said hopper including a bottom having a drill-accommodating hole therein, a drilling machine comprising a drill arranged to be movable in vertical upwards direction through the hole in the bottom of the hopper, and means to withdraw drilled articles from the bottom of the hopper.

5. Apparatus according to claim 4 and including a pushing device located at the lower part of the collecting hopper, said pushing device being constructed and arranged

to push the two articles at the bottom of the stack in the transverse direction of the hopper to bring part of said two articles outside the main stack and a member arranged beside the hopper and just above the drill and intended to press said articles downwards against the bottom of the hopper during the drilling operation.

6. An apparatus according to claim 5 as used for drilling holes in books in which said pushing device carries a step surface to permit the lowermost book to be pushed a short distance further than the superposed book in order to locate said books in the proper relative position to compensate for distortion during the drilling operation.

7. An apparatus according to claim 4 in which the means for feeding articles to the top of the collecting hopper comprises means for intermittent feeding of articles and a support member adapted to be pushed inwardly over the collecting hopper simultaneously with said feeding means, and said support member being adapted to be returned to inactive position beneath the feeding means after each feeding operation.

8. An apparatus according to claim 7 and including brake means in the wall of the collecting hopper opposite to the feeding means, said brake means extending a short distance into the hopper and cooperating with the juxtaposed part of an article carried by said carrying members to limit the downward movement of said part of the article during the initial return movement of said carrying member.

9. An apparatus according to claim 7 in which said brake means consists of threaded pins adjustably mounted in the wall of the hopper.

10. An apparatus according to claim 4 and further including movable means adapted to discharge the drilled article transversely of the hopper and to return after such discharging along a path below the bottom of the collecting hopper.

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