

5 The present invention relates to an automatic screw-cutting device on a punching or blanking press, comprising a first block fixedly mounted on the lower tool carrier of the press, supporting a first unit of a reversible screw-nut system, whether a nut or a screw, mounted to be solely free to rotate, and at least one rotatable threading-tap carrier kinematically linked in rotation to the said first unit without slipping. A second block, fixedly mounted on the upper tool carrier of the press, supports the second unit of the screw-nut system, maintained fixed both in rotation and axially.

10 In a known automatic screw-cutting device of this kind, such as that described in document FR-A-2 495 979, each rotatable threading-tap carrier is slidably mounted in an individual spindle which is mounted in the first block by means of at least one ball-bearing, and each individual spindle is rigidly locked to a chain sprocket ensuring, by means of chains and other chain-sprockets, its rotating relationship with the first unit of the screw-nut system. Such a device is relatively complex and bulky, for the external diameters of the ball-bearings and the chain-sprockets, which cannot be greatly reduced, prevent sufficiently close spacing of adjacent spindles and the simultaneous threading of holes with small spacings of less than about 40mm. from one another, the space occupied by such a first block, in the direction of displacement of the strip, being generally greater than one forward step, which makes the presence of several tapping stations necessary and thus a large increase in bulk of the press-tool as a whole. In addition, and apart from the inconvenience caused by its bulk, such a device comprises components each of which has considerable mass (chain-sprockets, chains, ball-bearings) which makes it difficult to operate the press at high speed for the large inertia of these components hinders high-speed reversal of their directions of rotation, at two or three times per second, for example.

25 Moreover, engagement of the tap into the hole to be tapped is ensured by a spring of comparatively small strength which continually pushes this tap carrier into the hole to be tapped; the tap-carrier initially moves backwards relatively to its spindle, compressing the spring, and from this moment the advance of the tap in the hole that it is in course of tapping is only ensured by the threading of the tap itself. Such engagement of the tap is not positively ensured, which makes it difficult to perform the tapping of holes of relatively small diameters (1.6 or 2mm. for example) at a high repetition rate, and makes it impossible to produce precise lengths of tapping, notably to tap a dead-end hole to its base, all the more because the tip of the tap necessarily has to be conically ground to facilitate engagement of the said tap into the hole that is to be tapped.

40 In addition, during tapping the length of path of the threading-tap carrier is equal to the descent path of the sliding block of the press, even if the length of the hole to be tapped is relatively reduced, the tapping operation being performed practically at the end

of the path of the sliding block. Such a tapping device presents certain difficulties in its operation, which may be more easily shown by an example. Let us consider for example the case of a hole provided in a sheet 2mm. thick, intended to be tapped by a 3 x 0.5mm. tap designed to work by deformation, this tapping being effected on a press having a 50mm. length of descent of the sliding block and operating at 60 strokes per minute. The speed of the sliding block is not constant. The sinusoidal curve that this speed follows during the displacement of the sliding block is represented by Fig. 1. Tapping is intended to start at 4mm. from the lower dead point of the sliding block. The path length of the tap is 50mm. as is that of the sliding block. If one considers that for tapping by deformation the maximum speed of cutting is about 45 metres/minute or 45000mm/min the rotational speed of the tap should be $\frac{45000}{3 \times 3.14} = 4780$ r.p.m. to conform to this cutting speed. But it is seen on the graph of Fig. 1 that in the case where the press operates at 60 strokes per minute the four turns of the tap necessary to tap at a pitch of 0.5mm. the 2mm. long hole are effected, starting at 4mm. from the lower dead point of the sliding block, in approximately 1/36 second, thus with the tap rotating during this period at $(4 \times 36 \times 60) = 8640$ r.p.m., which is much greater than the allowable cutting speed of 4780 r.p.m. To conform with that cutting speed it is necessary for the press to operate at a slower rate of $\frac{4780}{8640} \times 60 = 33$ strokes per minute. It thus turns out to be necessary to slow down the cutting or embossing rate of the press in order that tapping may simultaneously be effected at the same rate, which abolishes part of the economic benefit existing in performing the tapping on the same machine as the cutting or embossing. Finally, such a device of the previous type only enables tapping to be performed in a direction parallel to the direction of displacement of the sliding block of the press.

The automatic screw-cutting device that is the subject of the invention is characterized in that the threading-tap carrier or carriers are rotatably mounted parallel to one another in a single support that can be displaced parallel to the axes of the threading-tap carriers, but fixed in rotation, by reference to which support they are maintained in a fixed axial direction, and in that it is equipped with kinematic means enabling an axial displacement of the said single support and a rotation of each threading-tap carrier to be simultaneously produced in such a way that during each total descent of the sliding block of the press the support is axially displaced through a lesser distance corresponding exactly to the length necessary to perform the screw-cutting and in such a way that each threading tap-carrier performs one rotation whilst it is displaced axially by the amount of one thread pitch.

According to a construction that is particularly advantageous, although it is not obligatory, each threading-tap carrier is maintained axially fixed relatively to the single support by at least

one elastic means constantly maintaining upwards a portion of the threading-tap carrier, pressing against a portion of the support, this elastic means having sufficient force to oppose any backward movement of the threading-tap carrier in relation to its point of application during the tapping of the corresponding hole.

The present invention sets out to enable an automatic screw-cutting device to be produced that is capable of operating at a relatively high repetition rate, without slowing down the rate of operation of the press, whilst making it possible to tap holes of relatively small diameter (1.6mm.), limiting the risks of breaking the taps because it conforms to their normal cutting speeds, it being possible to tap several holes simultaneously even if they are comparatively close to one another (10mm. for example), engagement of each tap being positively ensured during its advance, so that the hole is necessarily tapped for an exact length, notably when it is a dead-end hole, without it being necessary to grind the point of each tap to assist its engagement into the corresponding hole. In addition the present device enables tapping to be performed in a direction other than that of the movement of the sliding block of the press.

Finally the structure of the device is such that the mass of its component parts can be low enough for the said device to be able to operate at a high repetition speed without the inertia of the constituent parts being troublesome. In addition the compact structure of the first block of the screw-cutting device and its positioning on the lower tool carrier of the press facilitate easy and rapid exchange of the said device.

The construction of the automatic screw-cutting device according to the invention has the additional advantage of preventing the breakage of taps in the case where production of the holes to be tapped has accidentally been omitted.

The attached drawings illustrate, by way of example, various forms of construction in accordance with the present invention.

Fig. 1 represents the curve followed by the rotational speed of the threading-tap carriers at each moment during the course of descent of the sliding block according to the cited previous art.

Fig. 2 represents the curve followed by the rotational speed of the threading-tap carriers, at each moment of descent of the said threading-tap carriers during the simultaneous descent of the sliding block, in one example of construction of the present invention.

Fig. 3 represents, as seen in section along III-III of Fig. 4, the first form of construction of the invention.

Fig. 4 partly represents, as seen in section along IV-IV of Fig. 3, the same form of construction.

Fig. 5 represents, as seen following a section similar to that of Fig. 3, a second form of construction of the invention.

Fig. 6 partly represents, as seen from above and in section, a third form of construction of the invention.

Fig. 7 represents, as seen following a section similar to that of Fig. 3, but only partial, a variation of construction of the device of

Fig. 3, constituting a fourth form of construction of the invention.

Fig. 8 represents, as seen following a section similar to that of Fig. 3, a fifth form of construction of the invention.

Fig. 9 partly represents, as seen following the same section, the same form of construction with the threading-taps at the end of the tapping process.

Fig. 10 represents, as seen following a section similar to that of Fig. 3, a sixth form of construction of the invention.

As it is represented in Figs 3 and 4, the automatic screw-cutting device comprises a first block 1 fixedly mounted on the lower tool carrier 3 of the press, and a second block 2 fixedly mounted on the upper tool carrier 4 of the said press.

The first block 1 supports a first unit of a reversible screw-nut system, consisting in this example of a nut 5 mounted free to rotate but not to move axially on the first block 1 by means of ball-bearings 6, 7, 8 for example.

The second block 2 supports the second unit of the reversible screw-nut system, a unit that consists of a screw 25 that is constantly in mesh with nut 5 and that is maintained fixed both in rotation and axially with reference to this second block 2.

The first block also supports a certain number of threading-tap carriers, four in this example, 11, 12, 13, 14 (Fig. 4), kinematically linked in rotation without slipping to nut 5. These threading-tap carriers 11 to 14 are rotatably mounted parallel to one another by means of ball-bearings 22 in a single support 10 that can be displaced along 16-17 parallel to the axes of the said threading-tap carriers, but fixed in rotation by the action, for example, of a cotter pin 15 fixing it to the body of the first block 1. Each threading-tap 11 to 14 is maintained axially fixed in relation to the common single support 10. In this example it is a compression spring 20 that constantly maintains forwards, in direction 16, a portion 21 of each threading-tap that presses against a part of support 10 consisting for example of the corresponding ball-bearing 22 the outer race of which is accommodated in this support 10. Each compression spring 20 is maintained compressed between the extremity of the corresponding threading-tap carrier that is opposite to the tap itself, 23, and a portion of a square plate 24 rigidly fixed to support 10. This spring 20 has a strength sufficient to oppose any backward movement in direction 17 of the corresponding threading-tap carrier relatively to its point of application during the tapping of the corresponding hole. Each spring 20 is a means provided to be compressed and allow backward movement of the threading-tap carrier solely if, by accident, the hole to be tapped does not exist. Each threading-tap carrier comprises axially a dead-end cylindrical recess 18, of diameter just sufficient to receive the shank of a threading-tap, and ending in a square recess 19 intended to receive the square head of the threading-tap to prevent the rotation of the said tap. A closing plate 23a, placed on the front face of support 10, maintains all the threading-taps axially in their respective recesses 18. In this example, the cylindrical recesses 18

open out upwards and the active threaded portions of the threading-taps are thus directed upwards. The strip 60 comprising the holes to be tapped moves above the threaded portions of the threading-taps.

The external periphery of the single support 10 comprises an external thread 26 which is constantly in mesh with an internal thread 27 provided on the internal periphery of a single hollow spindle 30 surrounding support 10. This hollow spindle 30 is mounted so that it can rotate in the body of the first block 1 by means of two ball-bearings, 31, 32 for example. Each threading-tap carrier 11 to 14 is firmly fixed to a toothed pinion 33 concentric with its axis of rotation. Each toothed pinion 33 is constantly in mesh with a toothed ring 34 provided on the internal periphery 28 of the hollow spindle 30 which is itself kinematically linked in rotation to the nut 5 of the screw-nut system by a transmission mechanism. This mechanism comprises for example a toothed pinion 40 that is an integral part of nut 5, in mesh with a toothed wheel 41 with ball-bearings 410 and 411, itself in mesh with a toothed pinion 42 of a moving body comprising a toothed wheel 44 and ball-bearings 420 and 421. This toothed wheel 44 is in mesh with a toothed ring 45 provided on the external periphery of the hollow spindle 30.

The speed ratio supplied by this transmission mechanism and the pitch of the internal screw thread 27 of hollow spindle 30 are determined in such a way that, during each descent of the sliding block which is not shown in the drawing, support 10 may be axially displaced by a lesser distance corresponding solely to the length necessary to effect the tapping. In our example, the hole 50 to be tapped having a length of about 2mm., the distance necessary to effect the tapping may be equal to about 5mm.: 1mm. before tapping, 2mm. of tapping, and 2mm. after tapping.

On the other hand the respective numbers of teeth of the toothed pinion of each tap carrier 11 to 14 and of the toothed ring 34, and the pitch of the internal screw thread 27 of hollow spindle 30 are determined in such a way that each tap carrier 11 to 14 performs one rotation whilst it is displaced axially by the amount of one thread pitch.

Each time that the sliding block of the press performs its descent path it carries screw 25 along downwards in direction 17, which causes rotation of nut 5 which itself sets the hollow spindle 30 into rotation by means of the transmission mechanism 40-44. In the same period the hollow spindle 30 causes, by its internal screw thread 27, axial displacement in direction 16 of the single support 10 and of the tap carriers 11-14, and by its internal teeth 34 the rotation of the said tap carriers 11-14. As soon as the sliding block effects its subsequent ascent path, all the above units operate in the reverse direction.

Let us take by way of example the case of screw-cutting described in the introduction: tapping at a diameter of 3 x 0.5mm. with a tap working by deformation. Whilst the sliding block, with screw 25, performs its 50mm. descent path, the support 10 and its threading-tap

carriers being displaced axially by 5mm only, the threading-tap carriers make only ten revolutions of which four are actually used to thread a length of 2mm at a pitch of 0.5mm. The graph of Fig. 2 represents the sinusoidal curve representing the speed of the threading-tap carriers at each instant of the 5mm. long path of the taps, the commencement of the 2mm. tapping taking place at 4mm. from the lower dead point of the moving block. It is seen on this graph of Fig. 2 corresponding to a case where the press operates at 60 strokes per minute that the four useful turns of the taps take place in about 1/8 second, i.e. at $4 \times 8 \times 60 = 1920$ r.p.m. It has previously been determined that in conformity with the cutting speed of the taps (45 metres/minute) the admissible rotational speed of the threading-tap carriers is 4780 r.p.m., which corresponds to a rate of operation of the press equal to $\frac{4780}{1920} \times 60 = 149$ strokes per minute. It is seen that such a rate is 4.5 times as great as that allowable in the case of the cited previous art.

In a second form of construction of the invention represented on Fig. 5 it is the screw 25 and its cylindrical extension 25' that are mounted free to rotate but not to move axially on the first block 1 by means of ball bearings 6 and 7. The toothed pinion 40 is firmly fixed to the cylindrical extension 25'. It is the nut 5 that is maintained fixed both in rotation and axially in relation to the second block 2. A clearance 2' in the second block 2 permits passage of screw 25 during the descent of this second block 2.

Moreover the whole of the first block 1 is inverted by 180° in relation to the case of Fig. 3, the active portion of the taps being directed downwards, the strip comprising the holes to be tapped moving below the first block 1 and the active portions of the taps. In addition, each threading-tap carrier 11-14 is constantly maintained forward in direction 16, not by a compression spring but by a rigid extension 24' of each threading-tap carrier 11-14 the free end of which constantly presses against a square plate 24.

All the other component parts are identical to those of the first form of construction (Figs. 3 and 4), and the operation of the assembly remains unchanged, rotation of the first toothed wheel 40 being brought about by the descent, and subsequent ascent, of nut 5 that is rigidly fixed to the second block 2.

As represented when viewed from above in Fig. 6, the third form of construction comprises, as does the first form of construction (Fig. 3), an endless screw 25 constantly in mesh with a nut 5. However in the third form of construction this nut 5 is not itself rigidly fixed to the toothed pinion 40 but to a conical toothed wheel 40a in mesh with a conical toothed pinion 40b that is rigidly fixed to a rotatable support 5a. It is this rotatable support 5a that is rigidly fixed to the toothed wheel 40 which is itself in mesh with the toothed pinion 42, etc. All the other constituent parts are identical to those of the first form of construction (Figs. 3 and 4). In this third form of construction the threading-tap carriers 11 to 14 are orientated

perpendicularly to screw 25 in the direction of displacement of the sliding block. Thus such an appliance allows tapping to take place in a direction perpendicular to this displacement direction of the moving block. In other respects the operation of the device is identical to that of the first form of construction previously described (Figs. 2 to 4).

Fig. 7 represents, in partial section, a variation of the device of Fig. 3. According to this variation the hollow spindle 30 of the device of Fig. 3 is replaced by a hollow spindle 30m comprising a base 30b supporting an extension 30c, the assembly constantly tending to move axially in direction 16 under the repelling action of a spring 30d.

Displacement of the hollow spindle 30m in direction 16 is limited by a shoulder 30e of body 30c, forming an abutment in the lower tool carrier 3, as shown, until it reaches a maximum advance position represented in Fig. 7, an axial distance d then separating the top surface 1a of first block 1 and the upper extremity of the hollow spindle 30m. A supplementary plate 1b is also provided, intended as a support for the strip 60 to be tapped, this plate 1b being carried in sliding manner in a vertical direction by several feet 1c sliding in block 1, the displacement of which in the axial direction 16 is limited by a shoulder 1e, each foot 1c tending to be displaced axially in direction 16 by the repelling action of a spring 1d. All the other component parts are identical to those of the device of Fig 3 and thus not all of them are represented in this drawing.

The existence of such a spacing d is necessary in certain cases, for example when it is needed to tap pieces that are subsequently bent, embossed or the like on the same tool, for example during the operation that follows tapping. In such cases the strip needs to be withdrawn by a distance d corresponding to the dimension of the portion that is bent, embossed or the like.

With the device represented in Fig. 7 the axial displacement in direction 16 of threading-tap carriers 11-14 commences as soon as a press blank 2a supported by the second block 2 comes into contact with the strip 60 in which the tapping is to be performed, and it continues after the hollow spindle 30m, pushed back by the strip 60, has occupied its low position. Withdrawal of the taps takes place in a similar manner until the strip 60 and the press blank 2a once more occupy their high position of Fig. 7.

Such a variation of construction enables the tapping of a strip to be commenced actually during its vertical displacement before it is brought to rest against the upper face 1a of the first block 1, this tapping continuing and finally ending as described previously with reference to Fig. 3. It is thus possible to make use for tapping of the whole usable portion of the path of the sliding block, the portion that corresponds to the period during which the strip is not being displaced longitudinally from one working station to the next.

Fig. 8 represents another form of construction of the invention, in which the rotatable hollow spindles 30 and 30m of Figs. 3 and 7

respectively are eliminated and replaced by a solid axial rotatable unit 30a, arranged parallel to the threading-tap carriers 11-14. This rotatable unit 30a comprises, on its external periphery and in its upper portion, an external thread 27a which is constantly in mesh with an internal thread 26a that is provided on the internal periphery of a hollow cylindrical recess 70 pierced in the single support 10. Moreover the solid rotatable unit 30a likewise comprises on its external periphery a toothed wheel 34a which is constantly in mesh with the respective toothed pinions 33 of threading-tap carriers 11-14. Another toothed wheel 35a of the rotatable unit 30a is kinematically linked in rotation to the first unit 5 of the reversible screw-nut system by a transmission mechanism consisting of toothed wheels and pinions 40a, 41a, 41b and 42a.

All the other component parts are identical with those represented on Fig. 3. In other respects and optionally the device of Fig. 8 may be equipped with the same means 30c, 30d, 30e and 1b to 1e, shown on the drawing, as those that are described in connection with Fig. 7 using the same reference numbers, enabling a safety distance d to be ensured, as previously described. In this case it is the lower part of the rotatable unit 30a that can comprise an extension 30c acting in conjunction with the repelling spring 30d or some other equivalent elastic device. The operation of the assembly is similar to that of Figs 3 or 7 as the case may be. Fig. 8 represents the device before commencement of the tapping operation, whilst Fig. 9 represents it at the end of tapping. In the case represented, where an extension 30 with a shoulder 30e is used, enabling the distance d to be brought about as previously explained, tapping may commence as soon as the press blank 2a comes into contact with the strip 60 (Fig. 8), although the strip is in course of being displaced vertically from above to below. Tapping ends when the single support 10 occupies its high position of Fig. 9.

In the form of construction according to Fig. 8 the bulk of the assembly is reduced compared with the constructions of Figs. 3 and 7 on account of the elimination of the hollow spindle (30 and 30m respectively). Moreover the machining of the rotatable unit 30a is easier than that of the internally-toothed wheel 34 of the devices in accordance with Figs. 3 and 7. Also the guidance of this toothed rotatable unit 30a is better than the guidance of a unit of greater diameter such as the hollow spindle 30 of Fig. 3 or the hollow spindle 30m of Fig. 7.

Finally, Fig. 10 represents a last form of construction of the invention that, in the form in which it is shown, may be considered a variation of the device of Fig. 3, but that can equally well be applied to the constitution of a variation of the device of Fig. 8 without its optional system of extension 30c, shoulder 30e, spring 30d, and associated units 1b to 1d.

As represented in Fig. 10, the single support 10 no longer comprises an external thread (26, Fig. 3) on its external periphery, and the corresponding external thread (27 of Fig. 3 or 27a of Fig. 7

in the case of application to this latter device) of hollow spindle 30 (or of the rotatable unit 30a in the case of application to the device of Fig. 7) is similarly eliminated. Support 10 thus becomes axially displaceable by sliding, and this axial displacement, in direction 16 or 17, is obtained by a control unit separate from the hollow spindle 30 (or the rotatable unit 30a respectively).

This control unit consists, in the non-limiting example represented in Fig. 10, of a pusher 30f comprising a ramp 30g provided to act in conjunction with the end of an extension 30h provided on the lower portion of the single support 10. Elastic means, such as a repelling spring 30j, constantly tend to keep pusher 30f pressing against a cam 30k that forms part of a transmission mechanism also comprising a toothed wheel 41c in mesh with a toothed pinion 40c forming part of the first unit 5 of the reversible screw-nut system. Cam 30k and toothed wheel 41c are coaxial and firmly fixed to one another. Thus this mechanism ensures, in a manner sufficient to perform the functions of the invention as previously described, the kinematic linkage between the control unit (pusher 30f) and the first unit 5. A spring 10a constantly tends to push the single support 10 in the direction 17 which is the direction of the ramp 30g against which the end of extension 30h of this support 10 is constantly pressing. When cam 30k allows pusher 30f to move backwards under the action of spring 30j the single support 10 occupies its low position as represented in Fig. 10.

Moreover kinematic linkage between a toothed wheel 45b forming part of the hollow spindle 30 (or of the rotatable unit 30a respectively) and the first unit 5 is ensured by a transmission system similar to those previously described, comprising a toothed wheel 44a firmly fitted to a toothed pinion 44b that is itself in mesh with a toothed wheel 40d supported by the first unit 5 of which it forms part. The functions performed are the same as those previously defined in relation to, for example, Fig. 3. As a variation, the ramp 30g could be replaced by any means of mechanical displacement acting positively against the end of stem 30h of single support 10 at a specified speed corresponding, as in all the previous cases, to the tooth pitch to be obtained. This means of mechanical displacement could even be operated, not by the first unit 5 but by a unit directly connected to sliding block 4 of the press.

In comparison with the previous constructions this form of construction, whilst fulfilling the same functions, offers the following advantages:

- No wear of external threads (26, 27 and 26a, 27a respectively), these having been eliminated and replaced for example by a ramp 30g that resists wear better,
- Further movement path reduction of the threading-tap carriers 11-14, the displacement of which in empty space before tapping may be eliminated, because the axial displacement of the single support 10 is not directly linked to the rotational movement of the taps, which is permanent,

- Less wear of the mechanical assembly, the displacements of certain units being reduced.

Without departing from the scope of the present invention the threading-tap carriers 11 to 14 and their common support could, in constructions according to Figs 7, 8, 9 and 10 be orientated in the reverse direction, as is shown in Fig. 5.

With the above-described forms of construction of the invention it is also possible to tap several holes simultaneously, two for example, of different diameters and with different pitches. Thus for example it is possible to tap one hole of diameter 3 x 0.50mm. and simultaneously another hole of diameter 4 x 0.75mm. To do this it is sufficient for the toothed pinions 33 firmly fixed to the threading-tap carriers 11 to 14 respectively to be chosen with appropriate numbers of teeth having the same ratio as that of the pitches

$\frac{0.75}{0.50} = 1.5$. For example, if the toothed pinion 33 of threading-tap carrier 11 supporting the 3 x 0.5mm. tap comprises 10 teeth it is necessary for the toothed pinion of threading-tap carrier 12 supporting the 4 x 0.75mm. tap to comprise 10 x 1.5 teeth. Thus, whilst the two taps simultaneously advance axially by 2mm., the first will execute four turns at a pitch of 0.5mm. whilst the second will execute 2.66 turns at a pitch of 0.75mm.

It should be mentioned that in the forms of construction described above the ball bearings 22 may have greatly reduced dimensions, much smaller than in the case of previous art, and thus have a greatly reduced mass, for they only ensure the rotation in the single support 10 of a threading-tap carrier 11-14 which may have a greatly reduced external diameter. The wear in course of time of such ball bearings 22 is for this reason greatly reduced, for in normal operation each threading-tap carrier of reduced mass executes at each descent of the sliding block a greatly reduced number of turns, without there being simultaneously an axial displacement of the threading-tap carrier in the single support 10. The rapid changes in direction of rotation of the threading-tap carriers are thereby greatly facilitated. It should also be noted that the relatively large inertia of the single hollow spindle 30 or 30m respectively, or of the solid rotatable unit 30a, and of the ball bearings 31, 32 is not troublesome because each of these hollow spindles 30 or 30m, or unit 30a, rotates at a relatively slow speed.

It should also be mentioned that the tapping device in accordance with the invention may very easily be replaced at will by another device prepared in advance to effect a tapping that differs from the previous set, as it is very compact and reduced in bulk, and is fitted to the surface of the lower tool carrier, which makes it easy to manipulate.



CLAIMS:

1. An automatic screw-cutting device on a punching or blanking press, comprising a first block (1) fixedly mounted on the lower tool carrier (3) of the press, supporting a first unit (5, 25) whether a nut or a screw, mounted solely for free rotating of a reversible screw-nut system, and at least one rotatable threading-tap carrier (11 to 14) kinematically linked in rotation to the said first block (1) without slipping, a second block (2) fixedly mounted on the upper tool carrier (4) of the press, supporting the second unit (25, 5), maintained fixed both in rotation and axially, of the screw-nut system characterized
- in that the threading-tap carrier or carriers (11 to 14) are rotatably mounted parallel to one another in a single support (10) displaceable (along direction 16, 17) parallel to the axes of the threading-tap carrier but fixed in rotation, by reference to which support they are maintained in a fixed axial direction.
 - and in that it is equipped with kinematic means (40 to 45, 33, 34, 26, 27; 40a to 45a, 33, 34a, 26a, 27a; 40d, 44b, 44a, 45b, 34, 33 and 40c, 41c, 30k, 30f, 30g, 30h) enabling an axial displacement of the said single support (10) and a rotation of each threading-tap carrier (11 to 14) to be simultaneously produced in such a way that during each total descent of the slide of the press the support (10) is axially displaced through a lesser distance corresponding exactly to the length



necessary to perform the screw-cutting and in such a way that each threading tap carrier (11 to 14) performs one rotation whilst it is displaced axially by the amount of one thread pitch.

2. An automatic screw-cutting device according to Claim 1, characterized in that each threading-tap carrier (11 to 14) is maintained axially fixed relatively to the single support (10) by at least one elastic means (20) constantly urging upwards in direction (16) a portion (21) of the threading-tap carrier, and pressing against a portion (22) of the support (10), this elastic means (20) having sufficient force to oppose any backward movement of the threading-tap carrier from its point of application during the tapping of the corresponding hole.

3. A device according to Claim 1 or Claim 2, characterized in that the external circumference of the said single support (10) comprises a screw thread (26) that is in constant mesh with a screw thread (27) provided on the internal circumference (28) of a single rotatable hollow spindle (30) surrounding the support (10), each threading-tap carrier (11 to 14) being integral with a toothed pinion (33) concentric with its axis of rotation and in constant mesh with a toothed crown wheel (34) provided on the internal circumference (28) of the hollow spindle (30) which is itself kinematically linked in rotation with the first unit (5) of the screw-nut system by a transmission mechanism (40 to 45), the speed ratio supplied by the transmission mechanism and the pitch of the internal thread (27) of the hollow spindle (30) being so determined that during each total descent of



the slide, the support (10) is axially displaced through a lesser distance corresponding exactly to the length necessary to perform the screw-cutting, the numbers of teeth on the toothed pinion (33) of each threading-tap carrier (11 to 14) and on the crown wheel (34) of the hollow spindle (30) respectively, and the pitch of the internal thread (27) of the hollow spindle (30) being determined in such a way that each threading-tap carrier (11 to 14) performs one rotation whilst it is displaced axially by the amount of one thread pitch.

4. A device according to Claim 3, characterized in that the hollow spindle (30m) comprises a base (30b) supporting a prolongation (30c) that is constantly pushed back in the direction of the piece to be tapped by an elastic device (30d), an abutment device (30e) or its equivalent, limiting the displacement of the hollow spindle (30m) in the direction of the piece to be tapped to a position that leaves a predetermined free spacing (d) between the top (1a) of the first block (1) of the press and the upper extremity of the hollow spindle (30m).

5. A device according to Claim 1 or Claim 2 characterized

- in that the said single support (10) comprises an axial cylindrical recess (70) parallel to the threading-tap carriers (11 to 14), its interior circumference being supplied with screw thread (27a),

- in that the said internal screw thread (27a) is constantly in mesh with a screw thread (26a) provided on



the external circumference of a rotatable unit (30a) coaxial with the said cylindrical recess (70),

- in that each threading-tap carrier (11 to 14) is integral with a toothed pinion (33) concentric with its axis of rotation and constantly in mesh with a first set of teeth (34a) provided on the external circumference of the said rotatable unit (30a),

- and in that the said rotatable unit (30a) is provided with a second set of teeth (45a) enabling it to be kinematically linked in rotation with the first unit (5) of the screw-nut system by a transmission mechanism (40a, 41a, 41b, 42a), the speed ratio supplied by the transmission mechanism and the pitch of the external thread (26a) of the rotatable unit (30a) being so determined that during each total descent of the slide, the support (10) is axially displaced through a lesser distance corresponding exactly to the length necessary to perform the screw-cutting, the numbers of teeth on the toothed pinion (33) of each threading-tap carrier (11 to 14) and on the first set of teeth (34a) of the rotatable unit (30a) respectively, and the pitch of the external thread (26a) of the rotatable unit (30a) being determined in such a way that each threading-tap carrier (11 to 14) performs one rotation whilst it is displaced axially by the amount of one thread pitch.

6. A device according to Claim 5, characterized in that the lower part of the rotatable unit (30a) comprises a



prologation (30c) that is constantly pushed back in the direction of the piece to be tapped by an elastic device (30d), an abutment device (30a), or its equivalent, limiting the displacement of the rotatable unit (30a) in the direction of the piece to be tapped to a position that leaves a predetermined free spacing (d) between the top (1a) of the first block (1) of the press and the upper extremity of the rotatable unit (30a).

7. A device according to Claim 1 or Claim 2, characterized

- in that the said single support (10) is displaceable axially by sliding and is connected to the mechanical device (30g, 30f, 30j, 10a, 30k) enabling an axial displacement to be imposed on it, the said mechanical device being governed by means (40c, 41c) connected to the displacement of the slide of the press in such a way that during each total descent of the slide, the support (10) is axially displaced through a lesser distance corresponding exactly to the length necessary to perform the screw-cutting,

- and in that each threading-tap carrier (11 to 14) is integral with a toothed pinion (33) concentric with its axis of rotation and enabling it to be kinematically linked in rotation with the first unit (5) of the screw-nut system by a transmission mechanism (34, 45b, 44a, 44b, 40d), the speed ratio supplied by the said transmission mechanism and the numbers of teeth respectively being determined, in accordance with the



mechanical control (30g, 30f, 30j, 10a, 30k, 40c, 41c) of axial displacement of the single support (10) in such a way that each threading-tap carrier (11 to 14) performs one revolution whilst it is axially displaced by the amount of one thread pitch.

5