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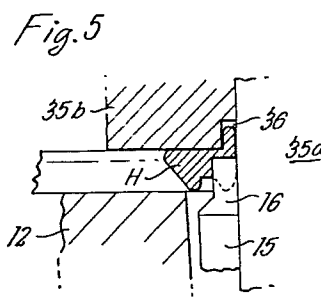
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54 **Method and apparatus for forming clips on ferrous horseshoes.**

57 The method comprises the steps of cold pressing an indentation in the under surface of the shoe in an appropriate outer edge portion of the shoe to raise an appropriate volume of metal for the clip at the top surface and cold rolling the raised metal to form the clip. The preferred apparatus includes one or more hydraulic presses. In forming the indentation, a stationary punch is used and the horseshoe is clamped between a press head (35) and a resiliently depressable shoe support (12) and moved passed the punch. The preferred rolling press has an active roller and a reaction roller and the shoe is placed upon a bed having a platform sloping downwardly away from a die surface.



METHOD AND APPARATUS FOR FORMING CLIPS ON FERROUS HORSESHOES

The present invention relates to a method and apparatus for forming clips on ferrous horseshoes.

5        Ferrous horseshoes are conventionally prepared for the farrier or blacksmith without clips but are in other respects ready for fitting except for final working by the blacksmith either hot or cold to fit the particular horse's hoof. Clips are upward projections from the upper faces of the shoes adjacent their outer  
10       edges which are conventionally fitted in recesses formed by the blacksmith in the horn to prevent backward movement of the shoe in use. To suit the conformation of the fore and rear hooves, front shoes normally contain a single central clip and rear shoes contain two clips symmetrically  
15       disposed on each side of the fore-and-aft plane of symmetry of the shoe.

      The preparation of the clips constitute an unnecessary workshop preparation for the blacksmith and requires the use of a hot forge. The operation  
20       involves heating the shoe to red heat and then punching an indentation in the under surface of the shoe in the appropriate outer edge portion of the shoe to raise an appropriate volume of metal for the clip at the top

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surface, and then beating out the volume of metal on an anvil to form the clip. The preparation of the shoe therefore represents a significant proportion of the blacksmith's working time.

5           Attempts have been made in the past to prepare ferrous horseshoes with clips during the manufacture of the shoes, but with very limited success. Such methods have always involved hot working of the shoe by methods simulating the action of the blacksmith. In particular,  
10 shoes have been made by forming the indentation by hot punching on a mechanical power press and subsequently rolling out the displaced metal with the shoe again at red heat, again by a mechanical power press. The handling of the hot shoes for these comparatively intricate machine  
15 operations requires a disproportionate amount of time and skill and the hot rolling produces a thin and flexible lip of metal which tends to adhere to the roller on its return stroke, with the result that it curves outwardly and forwardly from the shoe with the wrong orientation  
20 and requires subsequent working before the shoe can be fitted to the horse. One such method and apparatus for forming clips by hot working is described in lapsed British Patent No. 1,442,456.

25           The invention is based upon the discovery that, contrary to expectation, clips can be economically

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produced by cold working techniques.

In accordance with one aspect of the invention there is provided a method of forming a clip in a ferrous horseshoe in which an indentation is formed in the undersurface of the shoe in an appropriate outer edge portion of the shoe to raise an appropriate volume of metal for the clip at the top surface of the shoe and subsequently working the raised metal to form the clip characterised in that the said indentation is formed by cold pressing and the subsequent working is performed by cold rolling.

The invention also includes an apparatus for forming a clip on a ferrous horseshoe comprising:

- means for forming an indentation in the underside surface of the shoe in an appropriate on edge portion of the shoe to raise an appropriate volume of metal for the clip at the top surface, and
- means for working the raised metal to form the clip, characterised in that the said forming means comprises a cold-working press and the said working means comprises a cold-rolling means.

It is preferred to use a hydraulic press for both the pressing and rolling operations. Less capacity is required for rolling than for pressing and therefore different presses may be employed, but

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both operations may be carried out using a press of about 18 tons capacity. In general a pressure of from 16 to 20 tons may be required for pressing and from 4 to 8 tons for rolling.

5           , The advantage of a hydraulic press is, inter alia, that the speed of working can be more easily controlled and the movement halted as and when desired. Thus in cold working generally slower speeds are necessary if cracking or weakening of the metal is  
10 to be avoided and the preferred speed of operation is not greater than 2 feet per second (0.16 m/sec) and more preferably from 6 inches to 1ft. 6 inches per second (0.15 to 0.46 m/sec). Although a hydraulic press is preferred, it is of course possible to  
15 simulate the necessary conditions using other forms of press including mechanical or pneumatic presses.

The preferred form of apparatus used in the pressing or punching operation includes:

a stationary punch member having a shoe  
20 locating surface and an indenting tool projecting laterally under the locating surface,

a pressing bed having a resiliently depressable shoe support extending at least partly around the stationary member with its normal surface  
25 level allowing positioning of a shoe over the

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indenting tool,

a press head guidingly located over the pressing bed and punch member, and

stop means for limiting the pressing stroke.

5           The preferred form of apparatus used in the rolling operation includes:

a rolling head normally arranged for a vertical downward rolling stroke,

10           a bed for the shoe having a vertical rolling surface, a platform sloping downwardly away from the rolling surface, a rest projecting from the platform for abutting the inside edge of the shoe, and a die surface interconnecting the platform and rolling surface, the die surface having a vertical dimension  
15           corresponding to the height of the clip above the top surface of the shoe and subtending an angle with the vertical corresponding to the taper of the clip, and an angle with the support surface corresponding to the desired angle of projection of the clip rear  
20           surface from the plane of the shoe.

An embodiment of suitable apparatus illustrating the various preferred method steps is hereafter described with reference to the accompanying drawings, in which:-

Figure 1 is a vertical cross-section viewed  
25           from the front of apparatus used in the pressing operation, along the line I-I of Figure 1,

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Figure 2 is a horizontal cross-section along the line II-II of Figure 1,

Figure 3 is a vertical cross-section along the line III-III of Figure 2,

5        Figure 4 is a horizontal cross-section along the line IV-IV of Figure 3,

Figure 5 is an enlarged vertical cross-section of a portion of the apparatus, viewed generally as in Figure 3, showing the action on the shoe,

10       Figure 6 is a side elevational view of apparatus used in the rolling operation,

Figure 7 is a plan view of the apparatus of Figure 6, and

15       Figures 8 and 9 are perspective views of a shoe after pressing and after rolling.

The apparatus of Figures 1 to 5 includes a pressing bed 10 having a stationary base 11 and a resiliently depressable shoe support platform 12. Partially embedded and bolted in the base 11 is a  
20       stationary punch member 13 which is cylindrical in shape and stands up vertically from the base 11. The upper portion of the punch member is cut away to provide a planar vertical shoe locating surface 14. Mounted below the shoe locating surface is an indenting tool 15  
25       having a working end portion 16 projecting upwardly

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against the locating surface 14. The end portion 16 is upwardly tapered as viewed in Figure 1.

Mounted in the base 11 of the pressing bed are four guide spindles 17 each of which is a sliding fit within a sleeve 18 mounted in the shoe supporting platform 12 and which extends upwardly to slide within a corresponding sleeve (to be described), of the press head. The spindles 17 are mounted adjacent the corners of the pressing bed as viewed in plan (Figure 2). Secured between the base 11 and the platform 12, respectively adjacent the spindles 17 are spring members 19 consisting of spring mounting spindles 21 mounted in the base 11 and projecting upwardly into bores in the platform 12, and each having slidably fitted thereto a stack of washers 20 of truncated conical shape and composed of resilient steel. The washers deform resiliently when the platform 12 is pressed downwardly by the press head. Also mounted to the base 11 respectively on two sides of the punch member are two stop members 22 which limit the final downward stroke and are of appropriate height for this purpose. As shown in the figures, the platform 12 is at the bottom of its downward stroke with no horseshoe engaged so that the platform is in abutment with the stop members 22.

Slidably fitted over the pressing bed 10 is



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a press head 30 comprising a base 31 to which is mounted a central connecting piece 32 for attachment to the ram of a hydraulic press (not shown). The guide spindles 17 are slidably engaged in sleeves 33 in the base 31, and two stop members 34 are mounted to the base 31 so as to project downwardly therefrom in alignment with the stop members 22 attached to the base 11. As shown in Figure 1 these are in abutment with the platform 12 of the pressing bed but would not engage if a horseshoe were located in position. Centrally mounted to the base 31 is a die member 35 comprising a support portion 35a which contains a part-cylindrical vertical bore to slidably receive the punch member 13. Bolted to the portion 35a is a die portion 35b of suitable tool steel and containing a generally horizontally elongate rectangular die recess 36 for receiving the displaced metal from the horseshoe as shown more particularly in Figure 5.

In the pressing operation a horseshoe H is arranged the normal way up on the platform 12 with its end surface in contact against the locating face 14 of the punch member, the horseshoe making contact at the position where the clip is to be formed.

(Broken lines, Figure 5.) The ram is then energised to bring the press head 30 down upon the horseshoe

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to clamp it between the lower surface of the die member 35b and the platform 12. Continued movement of the ram depresses the platform 12 against the force of the spring washers 20 until at the end of the stroke the tool end 16 has indented the metal as shown in Figure 5 to displace part of the metal into the die cavity 36. In this position the platform 12 would normally be in engagement with the stops 22. Throughout the pressing stroke, correct alignment of the press head, platform 12 and base 11 is maintained by means of the spindles 17. The stops 34 do not come into operation unless the ram is operated without a horseshoe in place, in which case they prevent undesirable contact between the die member 35b and the platform 12.

At the end of this pressing operation the horseshoe will be indented to the configuration shown in Figure 8. It will be apparent that different sizes of horseshoe will require different pressing strokes which may be adjusted by corresponding alteration of the stops 22 and the active stroke length of the hydraulic piston. Normally also the speed of pressing is adjustable to the preferred speed mentioned. Using the press illustrated within the operation conditions mentioned, no difficulty is caused in this step through cracking or weakness in the worked portion of the shoe.

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The apparatus used for rolling may employ the same hydraulic press and ram, although less pressure is required, and the speed of operation is generally similar to that used in pressing. The apparatus for this stage is shown in Figures 6 and 7 and comprises a rolling head 40 which has an inverted U-shaped base 41, the web of which is attached to a connecting piece 42 for attachment to the ram of the hydraulic press. Mounted between the limbs of the U-shaped base 41 are a pair of parallel rollers 43, 44 each mounted on a spindle 45 which in turn are mounted in bearings in the limbs of the U-shaped 41. The roller 43 is an active roller and roller 44 is a reaction roller which prevents lateral displacement of the rolling head 40 during the rolling operation. Figure 6 illustrates the rolling head 40 at the end of its rolling stroke.

The apparatus includes a bed 50 in which a reaction tool 51 is integrated with an active tool or die member 52 through a base 53, brackets 53a, 53b and tie bars 54, 55. A shoe supporting platform 56 slopes downwardly away from the die member 52. The die member 52 comprises a vertical rolling surface 57, a support surface 58 continuous with the surface 56, and a die surface 59 which interconnects the surfaces 57 and 58 and has a vertical dimension

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corresponding to the height of the clip above the top surface of the horseshoe and which subtends an angle with the vertical corresponding to the taper of the clip. In other words the surface 59 extends downwardly  
5 obliquely towards the rolling head.

A rest 60 is mounted so as to project upwardly from the surface 56 for supporting the curved inner surface of the horseshoe and consists of a wheel slidingly mounted on a spindle 61 fitted to the platform  
10 56 so as to be replaceable by wheels of different size to suit different dimensions of horseshoe. For this purpose the rest could alternatively be eccentrically mounted so as to swivel to alter the length between the rest and the die surface, suitable clamping bolts  
15 being provided.

In the rolling operation, a horseshoe which has been indented during the pressing step and as shown in Figure 8, is located upside-down on the platform 56, over the rest wheel 60, so that the raised  
20 edge opposite the indentation is located over and against the die surface 59, in which position the inside curved edge of the shoe should rest against the wheel 60. The ram is then engaged to bring the rolling head down, during which the active roller 43 rolls  
25 out the displaced metal against the die surface 59 to

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form a tapered clip as illustrated in Figure 9, the clip tapering in thickness from the root, adjacent the top surface of the shoe where the metal may be for example up to an 1/8th inch (3.18 mm) thick, to substantially a knife-edge at the point. At the same time the clip has a smooth ellipsoidal configuration from the front and rear. The finished clip has a much higher standard of finish and can be obtained by hand forging or hot rolling.

10                   The horseshoe H is indicated in Figure 5 in broken lines before the pressing step and in section at the end of the pressing step, and in Figure 6 in broken lines after the rolling step.

15                   It is an important preferred feature of the method that the horseshoe is removed from the rolling bed at the end of the downward rolling stroke and before the return stroke. Not only does this save time, but there is no risk of the formed clip being distorted during the return stroke. If a slow acting  
20                   mechanical press is substituted, provision should be preferably arranged for a delay cycle to intervene when the head is in the bottom-most position, in order to allow time for removal of the shoe.  
While the drawings of the pressing apparatus show two  
25                   pairs of stop members respectively 22 and 34, at least

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the upper stop members 34 can be omitted to avoid the need for altering the stop members in accordance with the different thicknesses of shoe. Thus it is only necessary for the bottom stop members 22 to be  
5 positioned so as to come into contact with the platform 12 after e.g.  $\frac{1}{2}$  inch (12.7 mm) of travel of the platform, which corresponds to the maximum thickness of horseshoe normally treated.

The pressure used in the pressing step may be  
10 from 16 to 20 tons (17.92 to 22.40 tonnes). It is preferred to use a hydraulic press of not less than 16 tons (16.92 tonnes) capacity.

The pressure used in the rolling step may be from 4 to 8 tons (4.48 to 8.96 tonnes).

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## CLAIMS:

1. A method of forming a clip on a ferrous horseshoe in which an indentation (Fig. 8) is formed in the undersurface of the shoe in an appropriate outer edge portion of the shoe to raise an appropriate volume of metal for the clip at the top surface of the shoe and subsequently working the raised metal to form the clip (Fig. 9), characterised in that the said indentation (Fig. 8) is formed by cold pressing and the subsequent working (Fig. 9) is performed by cold rolling.
2. A method according to claim 1 wherein the pressing step is carried out using a hydraulic press (Figs. 1-4).
3. A method according to claim 2 wherein a pressure of from 16 to 20 tons (17.92 to 22.40 tonnes) is used.
4. A metal according to any preceding claim wherein the rolling step is carried out using a hydraulic press (Figs. 6,7).
5. A method according to claim 4 wherein a pressure of from 4 to 8 tons (4.48 to 8.96 tonnes) is used.

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6. A method according to any preceding claim wherein the cold pressing and rolling are carried out at a speed not greater than 2 feet per second (0.61m/sec).
7. A method according to claim 6 wherein the speed is from  $\frac{1}{2}$  to  $1\frac{1}{2}$  feet per second (0.15 to 0.46 m/sec).
8. A method according to any preceding claim wherein the rolling stroke is carried out from the underside of the shoe and the shoe is removed following the rolling stroke and prior to the return stroke.
9. Apparatus for forming a clip on a ferrous horseshoe comprising:
- means for forming an indentation in the underside surface of the shoe in an appropriate on edge portion of the shoe to raise an appropriate volume of metal for the clip at the top surface, and
  - means for working the raised metal to form the clip, characterised in that the said forming means comprises a cold-working press (Figs. 1-4) and the said working means comprises a cold-rolling means (Figs 6,7).



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10. Apparatus according to claim 9 including a hydraulic press of not less than 16 tons (16.92 tonnes) capacity.

11. Apparatus according to claim 9 or claim 10 including:

a stationary punch member (13) having a shoe locating surface (14) and an indenting tool (15) projecting laterally under the locating surface,

a pressing bed (10) having a resiliently depressable shoe support (12) extending at least partly around the stationary member (13) with its normal surface level allowing positioning of a shoe (H) over the indenting tool (15).

a press head (30) guidingly located over the pressing bed and punch member, and

stop means (22,34) for limiting the pressing stroke.

12. Apparatus according to any of claims 9 to 11 including:

a rolling head (40) normally arranged for a vertical downward rolling stroke,

a bed (50) for the shoe having a vertical rolling surface (57), a platform (58) sloping downwardly

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away from the rolling surface, a rest (60) projecting from the platform for abutting the inside edge of the shoe, and a die surface (59) interconnecting the platform and rolling surface, the die surface having a vertical dimension corresponding to the height of the clip above the top surface of the shoe and subtending an angle with the vertical corresponding to the taper of the clip, and an angle with the support surface corresponding to the desired angle of projection of the clip rear surface from the plane of the shoe.

13. Apparatus according to claim 12 wherein the rolling head (40) includes an active roller (43) and a reaction roller (44) and the bed includes a reaction surface (51) parallel to the rolling surface.

14. Apparatus according to claim 12 or claim 13 wherein the rest is adjustable in distance from the die surface.

15. Apparatus according to claim 12 or claim 13 wherein the rest is replaceable to allow the shoes of different thickness.

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Fig. 1

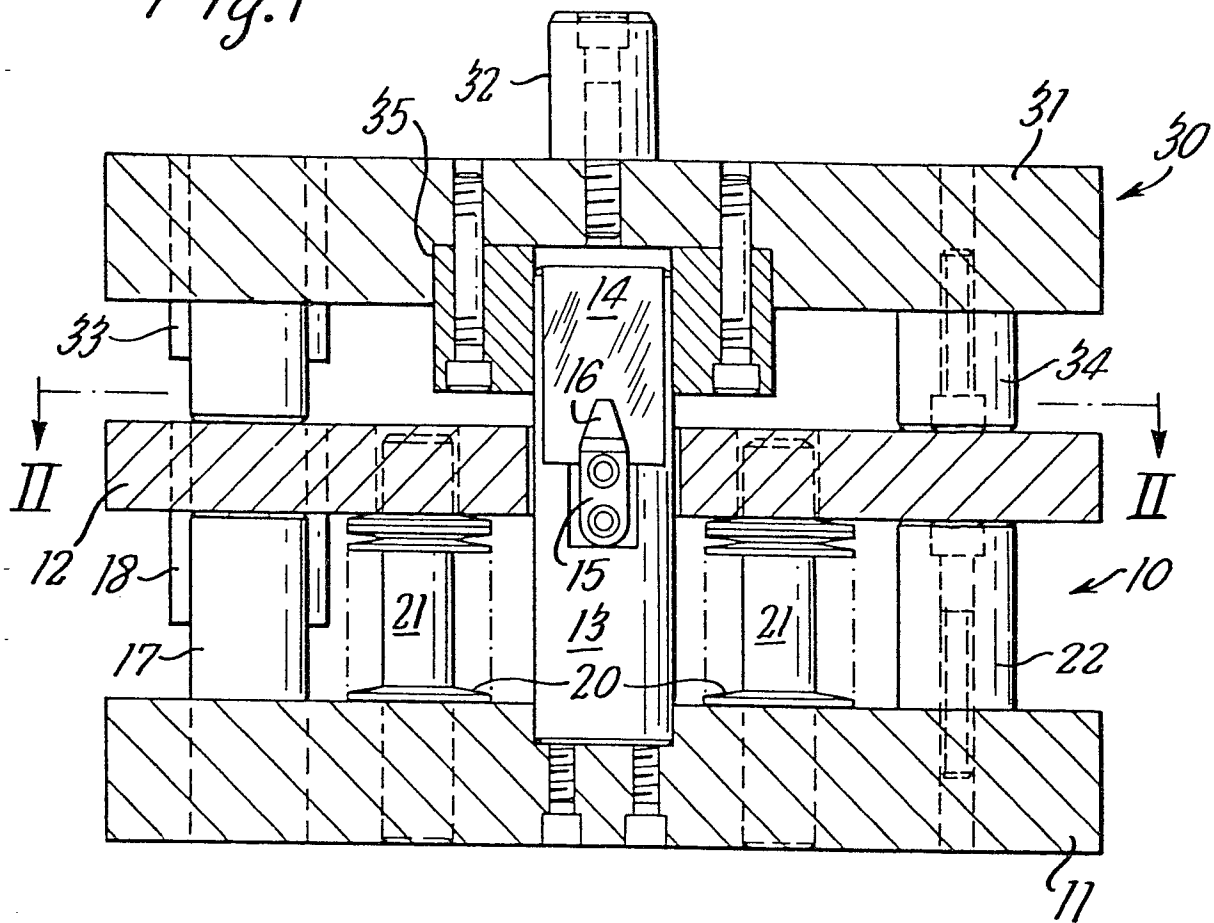


Fig. 2

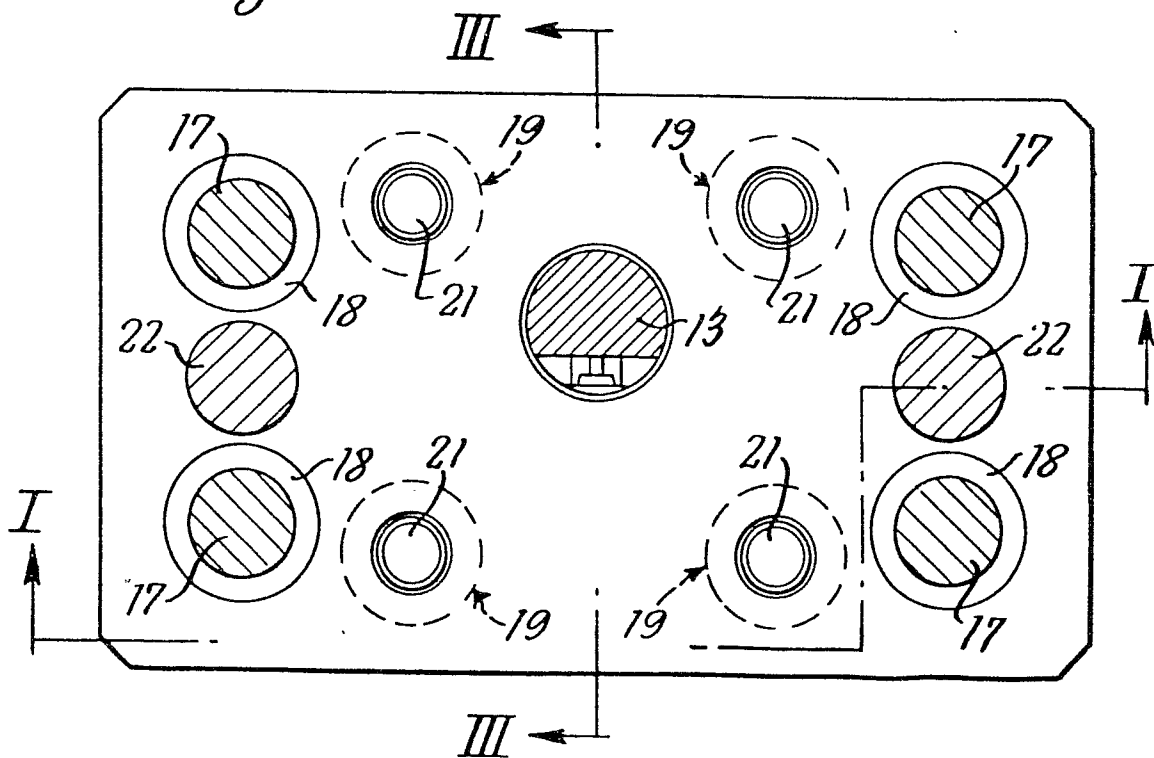


Fig. 4

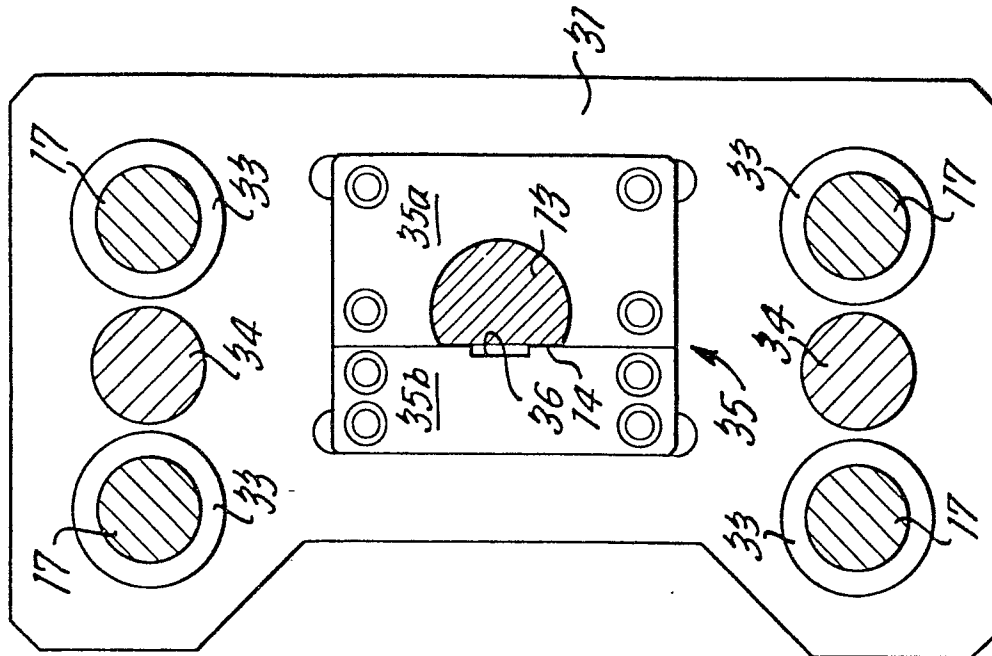
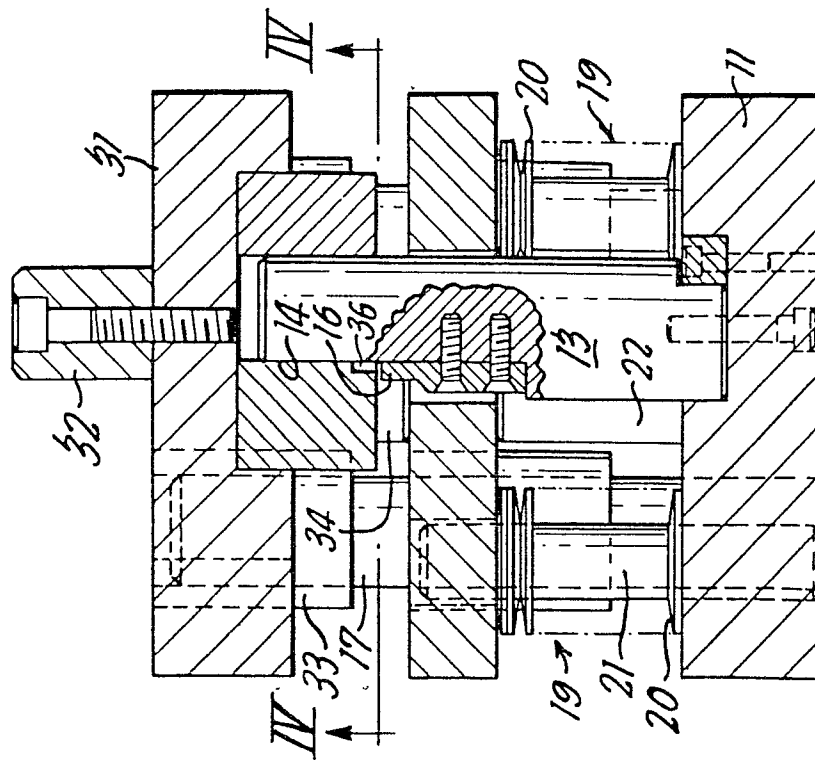


Fig. 3



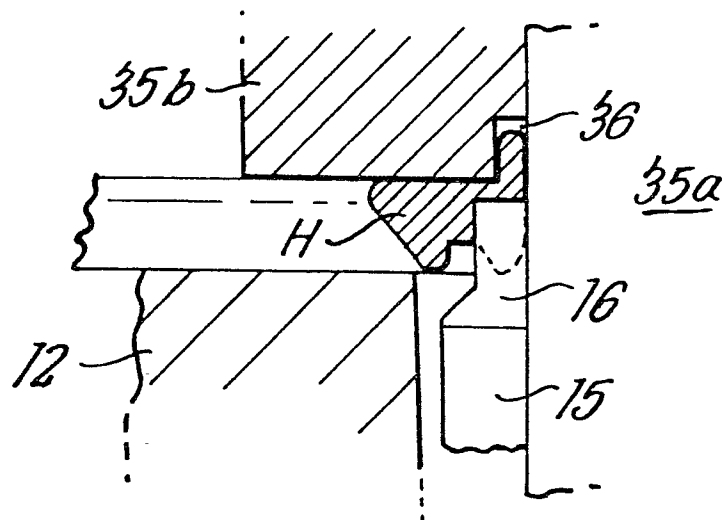
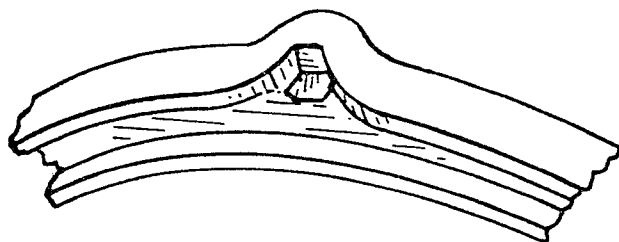
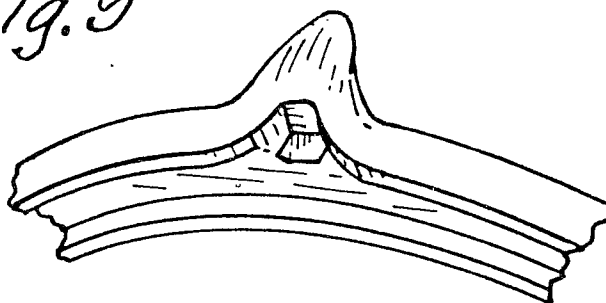
*Fig. 5**Fig. 8**Fig. 9*

Fig. 6

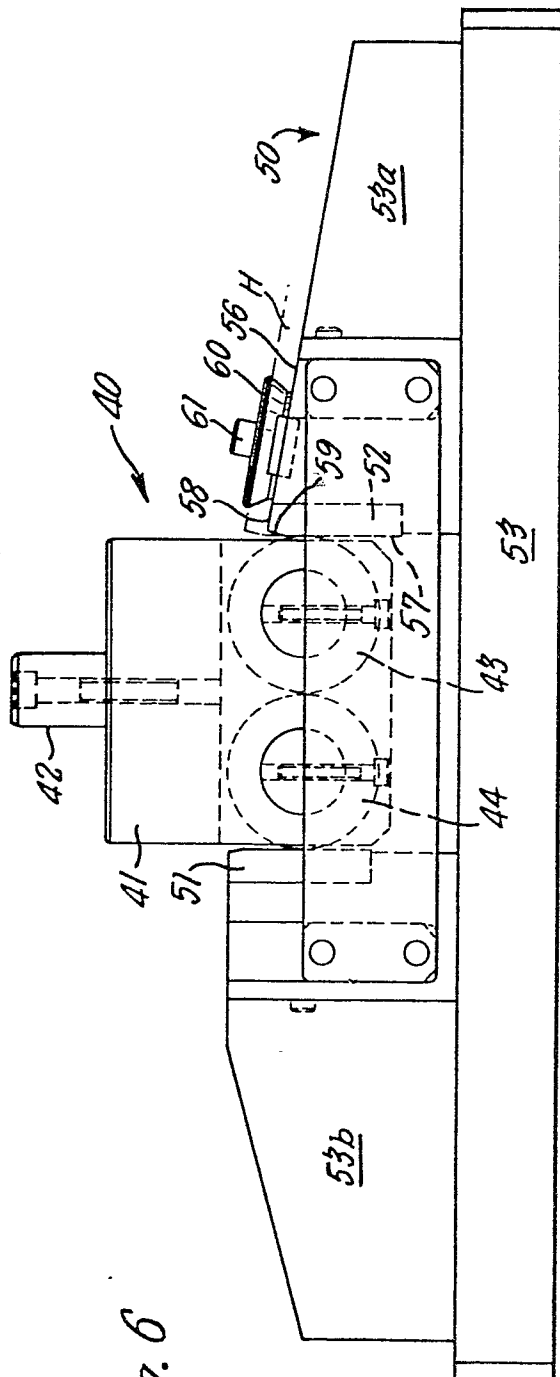
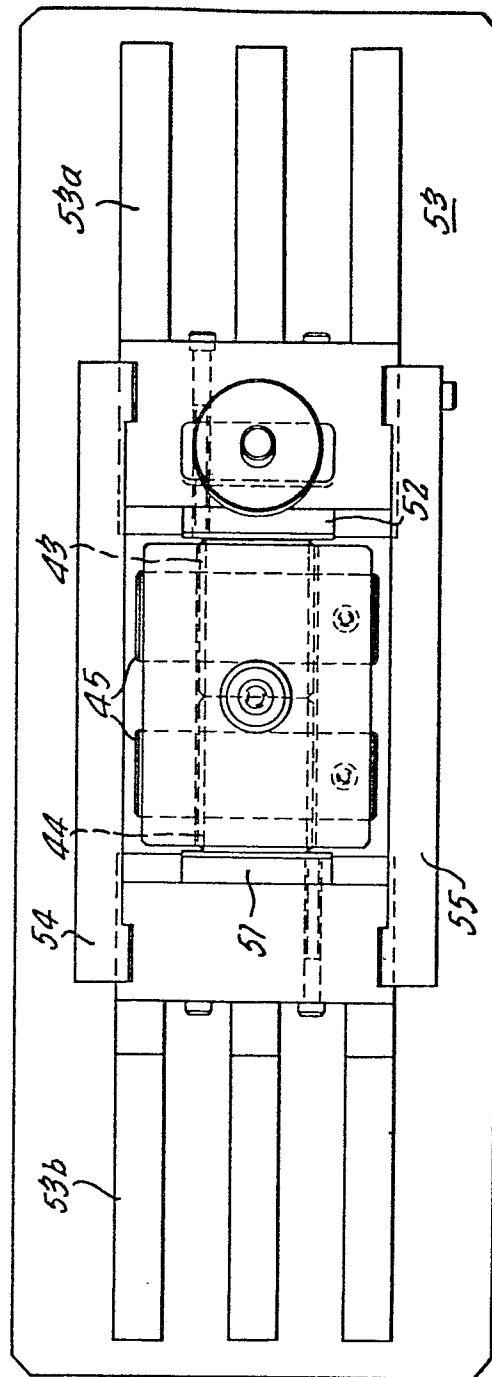


Fig. 7





European Patent  
Office

# EUROPEAN SEARCH REPORT

0023143

Application number

EP 80 30 2442.1

| DOCUMENTS CONSIDERED TO BE RELEVANT                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                  | CLASSIFICATION OF THE APPLICATION (Int. Cl.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Category                                                            | Citation of document with indication, where appropriate, of relevant passages                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Relevant to claim                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                                                                     | <p>US - A - 1 198 647 (MARSKELL)</p> <p>* claims 1, 2; page 1, line 103 to page 2, line 15; fig. 7 to 11 *</p> <p>--</p> <p>DE - C - 187 282 (JANSENS)</p> <p>* page 3, lines 14 to 24 *</p> <p>--</p> <p>DE - C - 426 484 (MÜCKLICH)</p> <p>* claim 1; fig. 3 *</p> <p>--</p> <p>A DE - C - 164 647 (HOPPE &amp; HOMANN)</p> <p>* complete document *</p> <p>--</p> <p>A AT - B - 13 668 (CHEHET et al.)</p> <p>* complete document *</p> <p>--</p> <p>A US - A - 1 078 345 (GARDNER)</p> <p>* complete document *</p> <p>-----</p> <p>D GB - A - 1 442 456 (WOOD)</p> <p>* complete document *</p> <p>-----</p> | <p>1</p> <p>1</p> <p>1</p>       | <p>B 21 K 15/02</p> <p>B 21 H 7/12</p> <p>TECHNICAL FIELDS SEARCHED (Int. Cl.)</p> <p>A 01 L 1/00</p> <p>B 21 H 7/12</p> <p>B 21 K 1/00</p> <p>B 21 K 15/00</p> <p>CATEGORY OF CITED DOCUMENTS</p> <p>X: particularly relevant</p> <p>A: technological background</p> <p>O: non-written disclosure</p> <p>P: intermediate document</p> <p>T: theory or principle underlying the invention</p> <p>E: conflicting application</p> <p>D: document cited in the application</p> <p>L: citation for other reasons</p> <p>&amp;: member of the same patent family, corresponding document</p> |
| <p>X The present search report has been drawn up for all claims</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Place of search                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Date of completion of the search | Examiner                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Berlin                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 22-10-1980                       | SCHLAITZ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |