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Wales et al.

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[54] **METHOD AND APPARATUS FOR MAKING BEARINGS**

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[73] Assignee: **The Glacier Metal Company, Limited**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** ..... **72/331,** 29/149.5 R, 29/149.5 DP

[51] **Int. Cl.** **B21d 7/04**

[58] **Field of Search** ..... 29/149.5 R, 149.5 C, 29/149.5 DP, 149.5 S; 72/331, 341, 324

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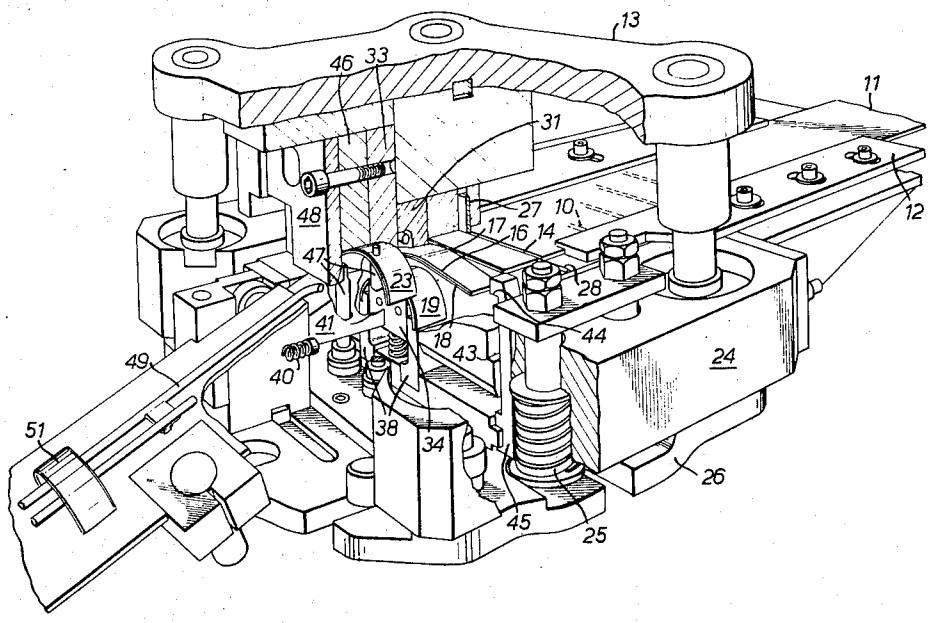
[57] **ABSTRACT**

This invention is a machine and a method for forming part cylindrical half bearing shells from a continuous elongated strip of lined material in which the strip is moved forward into the press in steps and each movement of the press effects a number of different operations on blanks constituted by successive transverse lengths of the strip. In one pressing step a movement of a die perpendicular to the direction of stepping first severs a blank from the rest of the strip and then forms it to shape in a coining operation.

13 Claims, 5 Drawing Figures



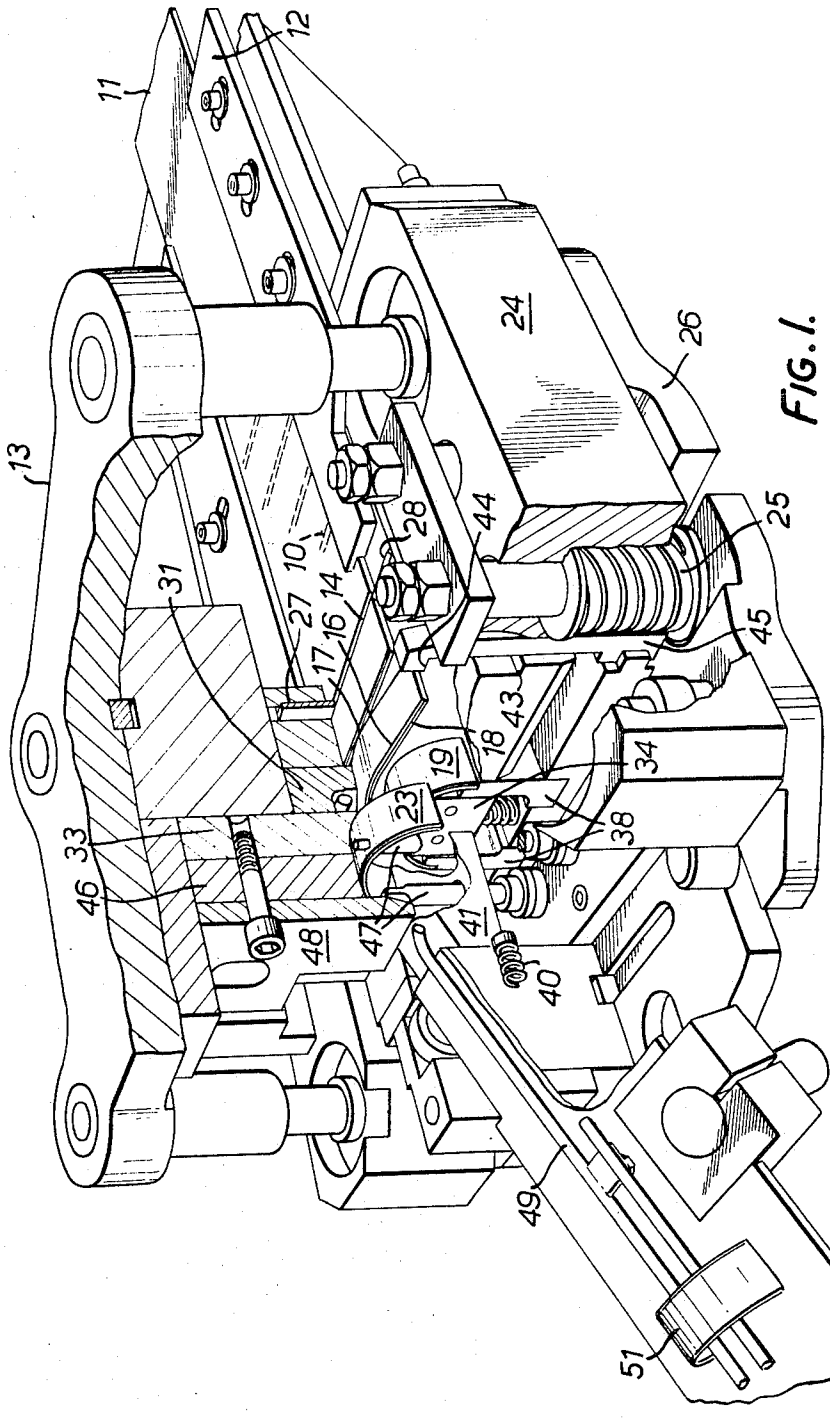

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FIG. 1.

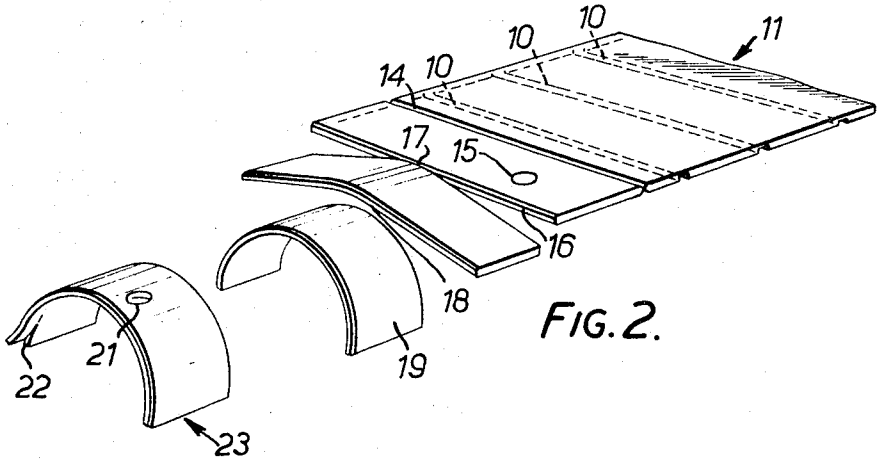


FIG. 2.

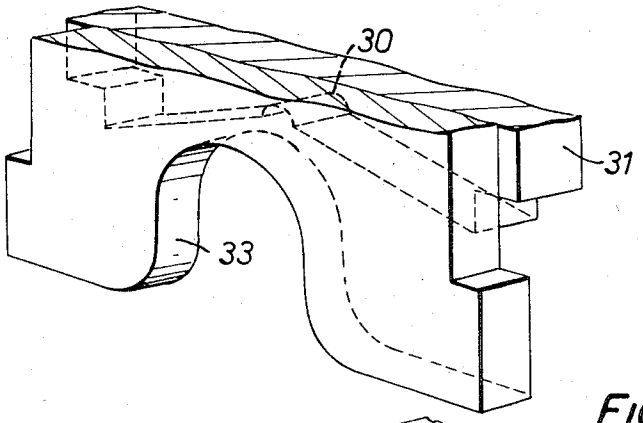
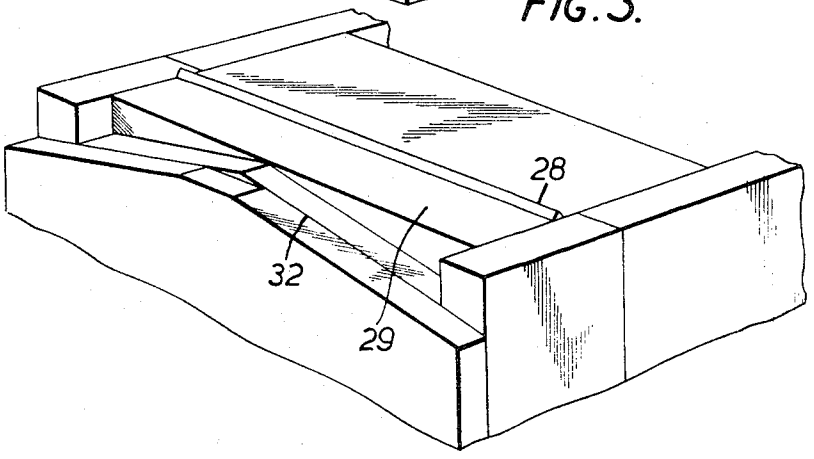


FIG. 3.



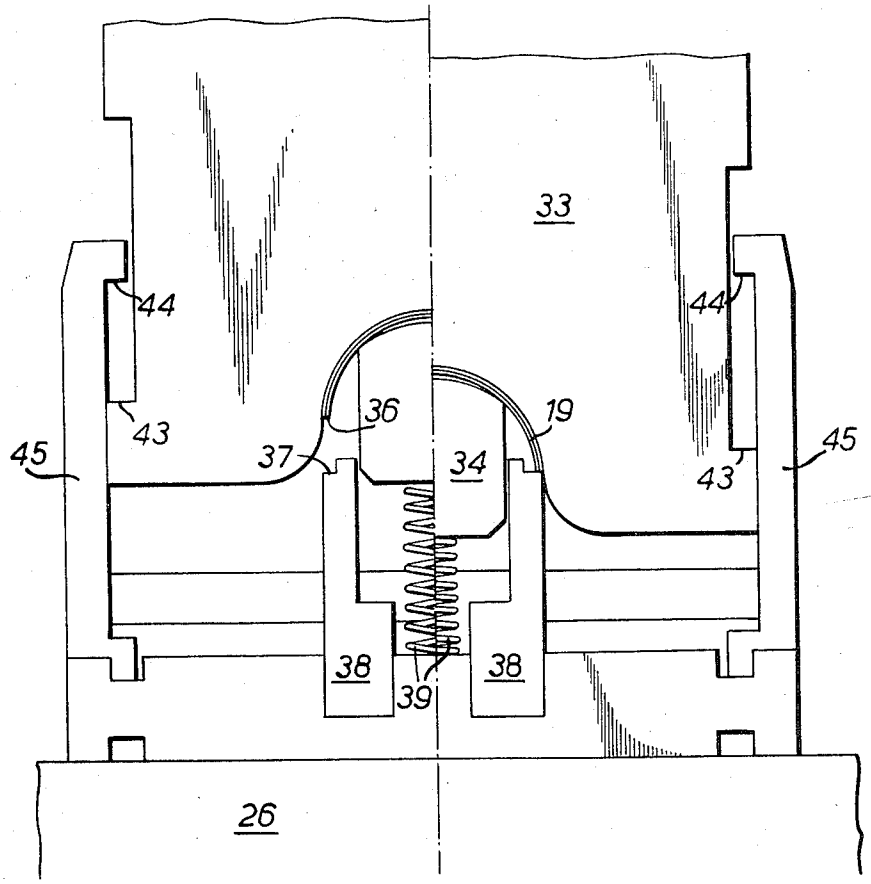


FIG. 4.

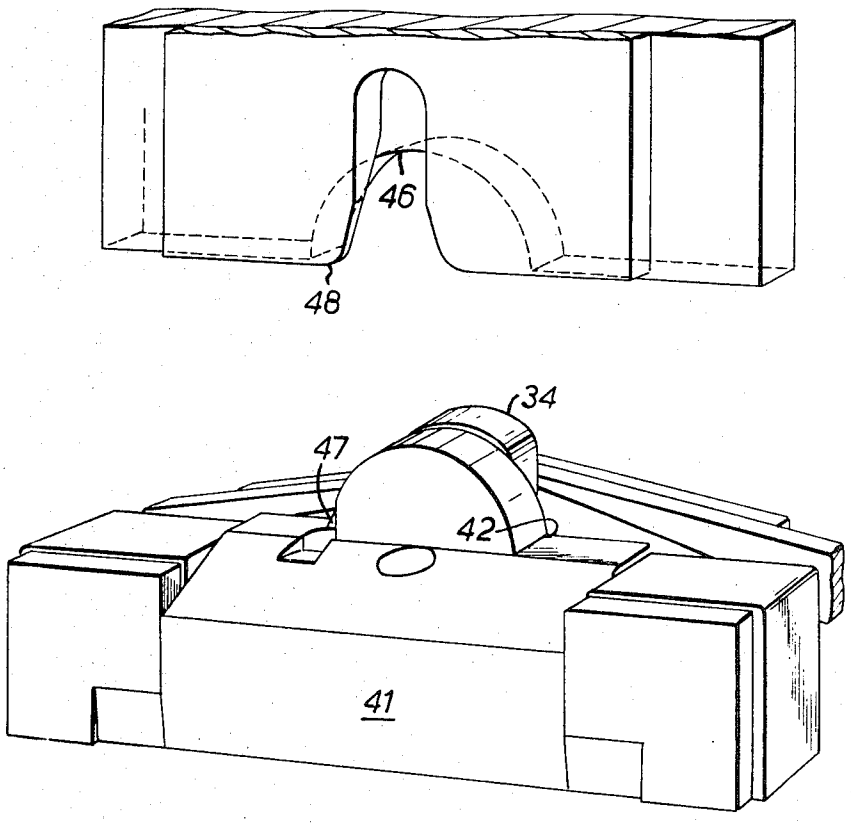


FIG. 5.

METHOD AND APPARATUS FOR MAKING BEARINGS

A prior proposal in Vandervell's British Pat. No. 1180742 is a somewhat similar method of forming a bearing shell, but the shell is coined or formed by a die before it is severed from the rest of the length of the strip as can be seen best in FIG. 2 and this has been found to prevent accurate shaping of the shell because of stresses transmitted through the neck holding it to the rest of the strip and stresses which act to distort the formed shell during subsequent severing. In the present invention the blank is partly formed and then severed from the strip immediately before being coined and this can in fact give a very accurately shaped bearing shell by use of a relatively cheap standard pressing machine.

This invention relates to a method and apparatus for making bearings in which a strip of material is fed lengthwise into a press step by step and the press is operated after each step to perform an operation on each of a number of different blanks constituting successive transverse lengths of the strip.

One object of the present invention is to enable bearings to be made of very precise shape without requiring a very complicated and expensive press.

According to one aspect of the invention in such a method one operation of the press constitutes a movement of a die to sever a part-formed bearing from the rest of the strip and then to form the severed blank into part-cylindrical shape.

Advantageously the operation constitutes movement of the die perpendicular to the direction of stepping movement and then the severing may be effected by an edge of the die and after severing a surface of the die is used to define the shape of a surface of the formed bearing.

The fact that the blank is severed at a late stage in its formation but immediately before forming by the die, means that the forming will be unrestrained by stresses in any neck connecting the blank to be formed with the rest of the strip and that there will be a minimum of subsequent operations which may deform the bearing after formation.

According to another aspect of the invention a press for forming bearings from strip material includes a number of pairs of forming tools situated side by side, one of the pairs comprising a die and a block and being arranged for relative movement in one stroke of the press, first to sever a partly formed blank from the strip material and then to form the severed blank into part-cylindrical shape.

The invention may be carried into practice in various ways and one embodiment will be described by way of example with reference to the accompanying drawings, of which:

FIG. 1 is a perspective view with parts cut away of a press for making half bearings continuously from elongated strip lined bearing material;

FIG. 2 is a diagram showing the form the leading end of the strip takes during its passage through the press;

FIG. 3 is a diagram showing the part-shearing and complete shearing actions by which a blank is sheared from the end of the strip;

FIG. 4 is a view looking axially towards the incoming strip showing two progressive steps in the formation of a bearing and in particular the action of coining; and

FIG. 5 is a diagram of the punching stage.

The elongated strip **11** of bearing material consisting of a backing lined with an appropriate bearing lining is fed lengthwise step by step into horizontal guides **12** in the press. In each of a number of repeated cycles of the press a top bolster **13** is lowered and rises again and the strip is stepped forward by one step between successive movements of the bolster. The leading end of the strip passes in turn into four different horizontal positions in each of which it is operated on by different tools in the press for progressively forming it into a finished half bearing so that in fact it takes four cycles of the press to form the leading end of a strip into a finished half bearing.

FIG. **2** shows the form of the leading end after each press cycle. Thus the first pressing step chamfers both upper and lower faces of the strip at **14** with 'V' chamfers forming the trailing edge of the leading blank so defined and the leading edge of the succeeding blank to be formed. Also at this stage the back of the bearing is embossed with an identifying mark indicated generally at **15**.

In the second stage the blank is partly severed from the rest of the strip by shearing inwardly from both edges at **16** leaving only a central connecting neck **17** connecting the partly severed blank with the rest of the strip. At the same time the blank is partly bent or kinked out of the flat.

In the third stage the blank is severed from the rest of the strip at **18** and is coined into a shape of a semi-cylindrical shell **19** by coining dies.

In the last stage the coined blank is provided with an oil aperture **21** and a locating tag **22** between co-operating press tools. The next step forward of the strip **11** pushes the finished half bearing **23** out of the press for collection.

At this stage it may be remarked that if the bearing is to have a cylindrical groove this can be formed at an appropriate position in the strip before it enters the press as indicated generally at **10**.

The operations in the four different stages are performed by co-operating tools carried respectively in the top bolster **13**, and (with one exception) in an intermediate bolster **24** which is normally held up by heavy compression springs **25** from a bottom bolster or base plate **26** but does in fact bottom on the bottom bolster **26** at the bottom point of each compression cycle.

CHAMFERING AND EMBOSSING STAGE

Chamfering and embossing are performed by opposed upper and lower chamfering tools **27** and **28** carried respectively in the top and floating bolsters and an embossing tool (not shown) and an anvil **29** carried respectively in the top bolster and the floating bolster. The floating bolster carries a pair of stops to prevent the upper tools from damaging the lower tools if the press is operated in the absence of the strip.

PART-SHEARING STAGE

In this stage the cuts **16** are made by an angled shear block **31** in the top bolster and an angled shear plate **32** carried on the floating bolster.

FIG. **3** shows the shape of these tools and it will be seen that the angled edges at the inlet end of the shear block **31** co-operate with the top edge of the adjacent end of the anvil to effect this shearing action throughout the width of the strip at the chamfers except for the

small neck **17** at the centre of the width. The block **31** is cut away at **30** where the neck will be.

SHEARING STAGE

In the third stage a coining die **33** is lowered on to the partly bent and severed blank which is pushed into the semi-cylindrical interior of the coining die by a bend punch **34** which is bolted to the angled shear plate and as the edge of the coining die **33** continues to move downwards past the adjacent edge of the angled shear plate **32** the neck **17** is severed so that the blank is now ready for coining and has been severed from the rest of the strip at the last possible moment before coining.

COINING STAGE

Further downward movement of the top bolster with the coining die **33** causes the edges **36** (parallel with the bearing axis) of the curved blank to sit on shoulders **37** one at the top of each of a pair of coining blocks **38.** It will be seen that between the bend punch **34** and the coining blocks **38** is a light compression spring **39** for pushing the coining blocks downwards. In fact the contour of the top curved section of the bend punch is not cylindrical so that it only makes light contact in two places with the internal surface of the bearing lining and does not lead to deformation or destruction of this lining (FIGS. **6D** and **6E**). The coining blocks are the one exception mentioned above to the lower tools in that they are the only lower tools that are not supported by the floating bolster **24.** As the top bolster **13** continues with its downward movement the coining blocks bottom on the bottom bolster **26.** During the last part of the stroke of the top bolster the blank is coined while the bottom bolster **26** provides the restraint to enable coining of the blank to be effected.

The downward movement of the floating bolster also effects a horizontal movement towards the main body of the strip **11** of an end-face-restraint block **41** through cams (not shown). This block **41** has an end face **42** which moves against the leading semi-circular end of the blank while the trailing semi-circular end is forced against the leading face of the angled shear plate **32.** Thus during coining all the surfaces of the blank are under pressure except the internal curved surface of the lining. If the curved surface is acted on by the coining die, the edges **36** sit on the shoulders on the coining blocks and the ends are pressed between the faces of the end face restraint block **41** and the angled shear plate **32.** In this way a precisely shaped blank is produced.

As the top bolstr **13** rises again, although the cams do not still provide the large force necessary for coining, a light spring **40** against the block **41** enables the blank to be held between the face of the block **41** and the plate **32** which act to separate it from the interior of the coining die **33.** After the coining die has cleared the top of the coined blank, a lost-motion coupling between shoulders **43** on the coining die and shoulders **44** on legs **45** carrying the coining blocks **38** ensures that during the further movement of the top bolster **13** to its uppermost position, the coining blocks are lifted to lift the coined blank sufficiently for it to be pushed forward to the fourth stage by the following part of the strip as it is next stepped forward.

PUNCHING AND TAGGING STAGE

In this stage the coined blank has a locating tag and an oil aperture punched in it through co-operating upper and lower tools **46** and **47** carried respectively on the top bolster and the floating bolster and during this operation the coined blank is located against a locating block **48** at the front of the top tools. A spring ejector **52** ejects the punched blank from the top tool.

The next forward step of the strip **11** causing the just coined blank to push the tagged and punched finished half bearing on to a guide **49** as indicated at **51.**

The stepping of the strip is by a mechanical drive against a stop constituted by the rear face of the angled shear block **31.** The widths of the tools in the successive stages are slightly greater for the later stages to allow for spread of the material during forming and to eliminate any slivers of waste material, but in order to prevent the rising coining die **33** from fouling and damaging the leading end of the partly sheared blank about to the stepped forward for coining, a slight counter feed is introduced by a spring (not shown) just before the coining die rises. The spring acts to tilt the lower chamfering tool **28** rearwardly, and this is of course engaged with the under side of the blank which has just been chamfered.

What we claim as our invention and desire to secure by Letters Patent is:

1. A method of making bearings in which a strip of material is fed lengthwise into a press step by step, and the press is operated after each step to perform an operation on each of a number of different blanks constituting successive transverse lengths of said strip, one operation of the press constituting a movement of a first die to partially sever a bearing blank and partially deform said blank from the rest of the strip while leaving the partially severed and deformed blank attached to the rest of the strip by a local neck, and a succeeding operation constituting a single movement of a second die perpendicular to the general surface of the strip first to sever the neck to release the blank completely from the rest of the strip and second, in a later part of the movement of the die to form the completely-severed blank into part-cylindrical shape.

2. A method as claimed in claim **1** in which the severing of the neck is effected by an edge of the first die.

3. A method as claimed in claim **1** in which the successive operations on the strip are performed by side by side pairs of tools.

4. A method as claimed in claim **3** in which one tool of each pair of certain tools are mounted on a base and the others are mounted on a part which can move in relation to the base.

5. A method as claimed in claim **4** in which movement of the said part in relation to the base in the direction of pressing movement effects movement of components in the direction of stepping.

6. A method as claimed in claim **1** in which certain of the tools performing successive operations extend through different lengths in the direction of stepping of the strip.

7. A method as claimed in claim **1** in which the trailing edge of a severed blank is directly severed from the leading edge of a following blank so that no scrap slivers of strip material are formed.

8. A press for forming bearings from strip material including a number of pairs of forming tools situated side by side, one of the pairs comprising severing tools arranged for relative movement in one stroke of the press, arranged to partially sever and partially deform

a bearing blank from the rest of the strip while leaving the partly severed blank attached to the rest of the strip by a local neck, and a succeeding pair of forming tools comprising a die and a blank arranged for relative movement in one stroke of the press first to sever the neck to release the partially severed blank completely from the rest of the strip and second in a later part of the said one stroke to form the severed blank into part-cylindrical shape.

9. A press as claimed in claim **8** including pairs of tools for performing each of the operations of chamfering, embossing, part-severing and grooving positioned upstream of the said one of the pairs.

10. A press as claimed in claim **8** in which one of the tools of the said one of the pairs is mounted on a base and other tools one from each of the other pairs are mounted on a part which can move in relation to the base perpendicular to the length of the strip material.

11. A press as claimed in claim **10** including a connection for effecting movement of a part of the press in the direction of the length of the strip material in consequence of movement of the moving part in relation to the base.

12. A press as claimed in claim **8** in which the components for severing a partly formed blank from the rest of the strip material comprise respectively the die and the shearing edge of a component which is positioned immediately on the inlet side of the die.

13. A press as claimed in claim **12** in which the block, the die and a pair of bearing end engaging surfaces act during forming of the severed blank to confine all the faces of the blank except the internal part-cylindrical surface.

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