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ARRANGEMENT FOR SHAPING OF PROFILED CURVED WORKPIECES FROM BLANKS

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Fig. 1

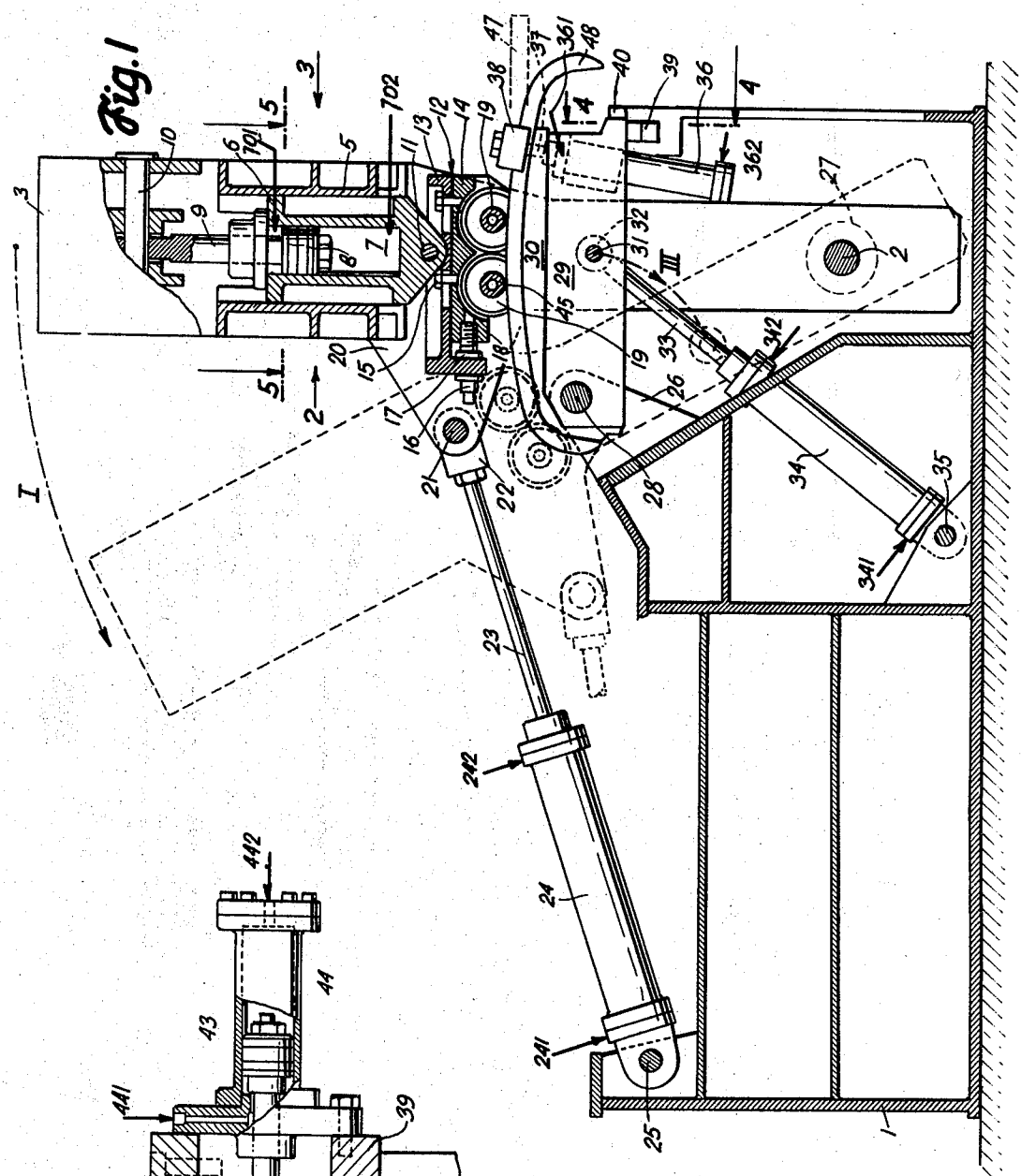

Fig. 4

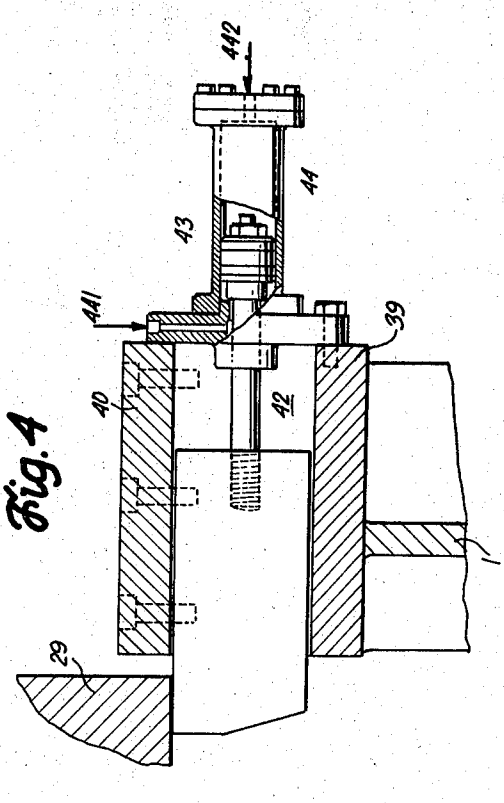

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Fig. 3

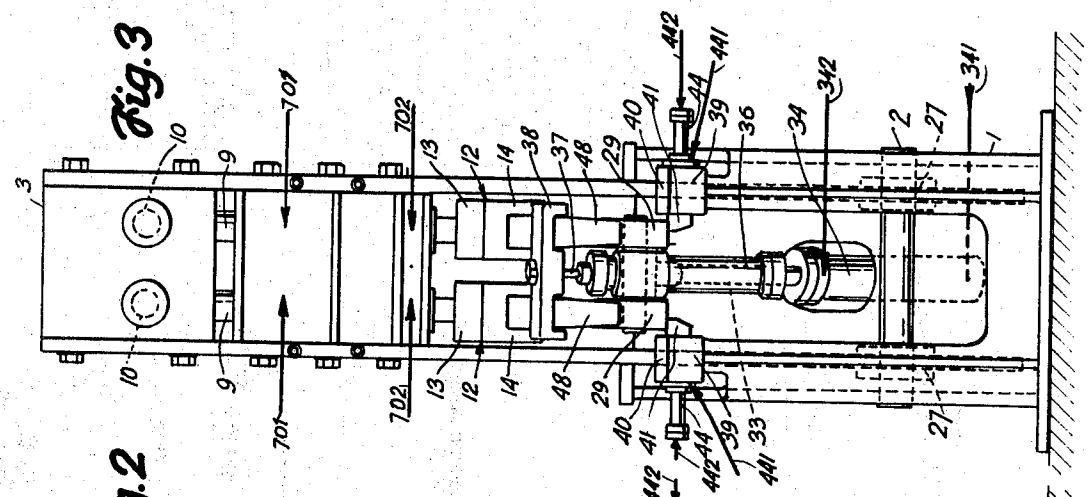


Fig. 2

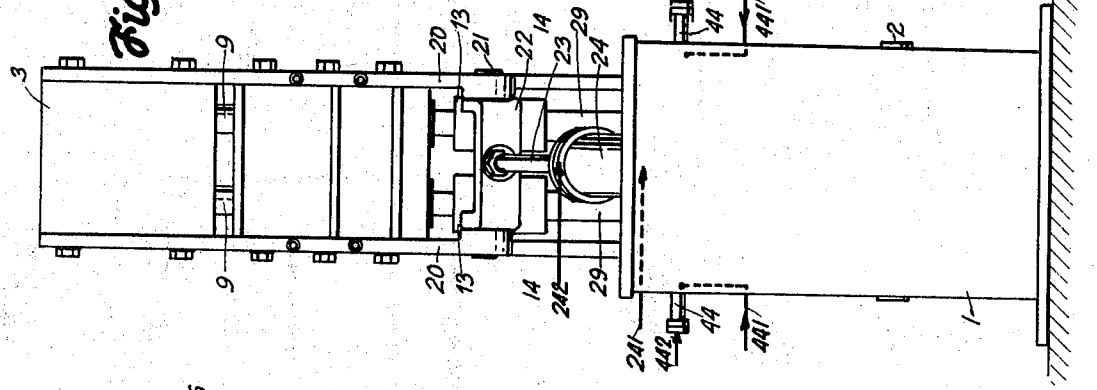


Fig. 7

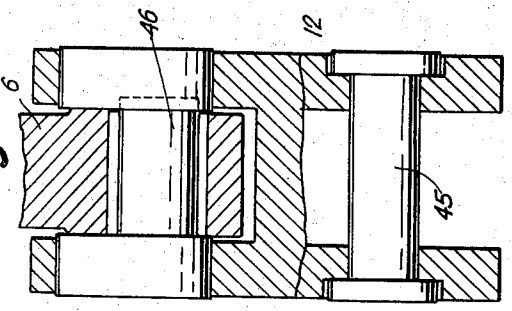


Fig. 6

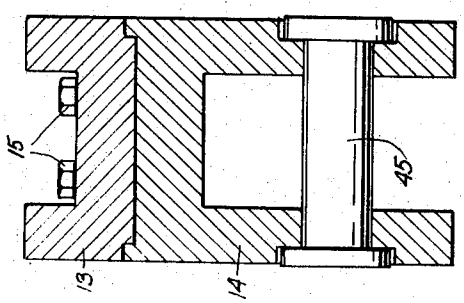
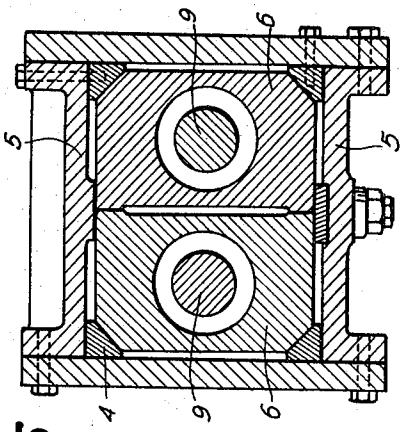


Fig. 5



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ARRANGEMENT FOR SHAPING OF PROFILED CURVED WORKPIECES FROM BLANKS

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Int. Cl. B21d 7/02
U.S. Cl. 72—219 7 Claims

ABSTRACT OF THE DISCLOSURE

An arrangement for shaping of profiled curved workpieces from blanks to a configuration with adjacent sections with different radii of curvature by pressure rollers acting on said blanks supported by a die. The pressure rollers are arranged on a thrust head supported by an auxiliary frame, arranged pivotally with respect to the main frame of the machine so as to shape in the course of its angular movement parts of the workpiece having larger radii of curvature, while the dies are maintained in a stable position. Parts of the workpiece having smaller radii of curvature are shaped by imparting to the support of said die a rotating movement around an axis substantially coincident with the centres of curvature of said part while the housing of pressure rollers acting on said part remains substantially stable.

Object of the present invention is an arrangement for shaping profiled curved blanks by wrapping them progressively by means of profiled rollers onto a shaped die and its aim is to realize a configuration, which comprises successive curves of various radii of curvature or of various combinations of successive straight sections and curves.

In the present state of art profiled blanks are bent on special forming machines of which several types are known. The common feature of these machines is that the worktable on which is clamped a die of oval, rectangular or irregular form with rounded edges, is rotatable around an axis, which is situated between the profile to be bent and its center of curvature. Moreover this axis is situated in the plane of symmetry of this curvature at a distance, which is less than half the length of the finished part. The profile rollers or a profile bar are, during forming, pressed onto the surface of the die on which is clamped the initial profile blank. The profile rollers are pressed mechanically, pneumatically or hydraulically. Also, bending machines are known having a rotary table in which is built another sliding table with a die mounted on it.

The inconvenience of these known machines for bending profiled blanks consists in that the die rotates during forming around only one axis so that the section with a large radius of curvature is bent on a relatively small radius of rotation while the section having a small radius of curvature is bent on a large radius of rotation determined by the overall length of the workpiece. This fact causes an unfavourable distribution of the forces of the thrust mechanism on the various rollers which affects the quality of bending of the profile blank. The magnitude of the forces acting on the various profile rollers varies during the forming operation and their ratio in the position at the die end is reverse to that required for a perfect shaping of the workpiece end.

In order to eliminate this unfavourable distribution of the forces, the known machines of this type are provided by a device for positive pivoting of the profile roller holder. This arrangement however, has a drawback

in that the device has one more mechanism and besides this the profile rollers cause an acceleration of the motion of the rotary die. In order to eliminate the acceleration of the die rotation it is necessary to provide in hydraulically driven machines a relatively complex control means in the pressure fluid distribution system.

A further drawback of known machines consists in that the considerable difference between the radius of rotation at the start of bending and at the end of bending requires a long stroke of the thrust mechanism. Therefore when using a hydraulic system for forcing the rollers against the workpiece a large amount of pressure fluid must be expelled from the pressure cylinder and the stroke of both piston and crosshead pin is excessive, which affects adversely the size of the pumps, lengths of guidings of the crosshead, the cooling system and thus also the overall dimensions of the machine.

With most of the known machines for bending of profiled blanks the forming die rotates in a horizontal plane, thus making the clamping of blanks and removal of the finished workpiece difficult. This circumstance affects very adversely the capacity of the bending machines.

It is an object of this invention to provide an arrangement for shaping of profiled curved workpieces with adjacent sections of different radii from blanks where in the course of bending of parts of smaller radii no strokes of the thrust heads of excessive magnitude would be required resulting thus in considerable savings of pressure fluid.

It is another object of this invention to provide the most favourable distribution of forces acting on the blank in the course of the operation.

It is still another object of this invention to enable an easy clamping of blanks and an easy removal of finished workpieces in order to increase the capacity of the machine.

It is finally an object of this invention to provide a machine with reduced overall dimensions resulting in saving of costs and floor space.

Having these and other objects in mind the arrangement for shaping of workpieces from blanks according to this invention operates in that the initial blank is clamped to a die and by means of profiled rollers arranged on a thrust head supported by an auxiliary frame, arranged pivotably with respect to the main frame of the machine, parts of the workpiece having larger radii of curvature are shaped in the course of an angular movement of said auxiliary frame, while the die remains stable. Parts of the workpiece with small radii of curvature are subsequently shaped by imparting to the support of the die an angular movement around an axis, substantially coincident with the centres of curvature of said part of the workpiece, while the housing of pressure rollers remains substantially stable. The auxiliary frame is for this purpose arranged with respect to the main frame pivotally around an axis, spaced from the pressure rollers in operating position by at least one half of the length of the finished workpiece.

The accompanying drawings show an exemplary embodiment of the invention.

FIG. 1 is an elevation of a shaping machine in a partly sectional view,

FIG. 2 is a side view in direction 2 as indicated in FIG. 1,

FIG. 3 is a side view in direction 3 as indicated in FIG. 1,

FIG. 4 is a section along a plane indicated in FIG. 1 by 4 showing supporting blocks of the bolster and die,

FIG. 5 is a section through bearing and guiding parts of the thrust head along lines 5 indicated in FIG. 1,

FIG. 6 is a section through the roller housing,

FIG. 7 is another example of mounting roller housings to the thrust head.

In the forward portion of the main frame **1** is mounted rotatably on a horizontal cylindrical main pin **2** a pivotable auxiliary frame **3**. In the upper portion of this pivotable auxiliary frame **3** are guided, by means of adjustable guide gibs **4** (see FIG. 5) and inserted braces **5**, two sliding blocks **6** forming hydraulic cylinders **7** with pipe lines **701** and **702** for the supply and release of pressure fluid. The pistons **8** with the respective sealing packings are fastened on piston rods **9** which are fixed to the pivotable auxiliary frame **3** by suspension pins **10**. In the bottom portion of the sliding blocks **6** are mounted pivotably on pins **11** two-piece housings **12** of profile rollers **19** comprising a top portion **13** and a bottom portion **14** assembled by bolts **15**. Through not illustrated lateral openings in the top portion **13** of the housings **12** pass adjustment spindles **16** with collars **17**, the spindles engaging by a thread into the lateral walls **18** of the bottom portion **14** of the housings **12**. The adjusting spindles **16** adjust a suitable distribution of forces of the hydraulic cylinders **7** onto the various profile rollers **19** which are mounted rotatably on axles **45** (see FIG. 6) in a recess in the bottom portion **14** of the housing **12**. In the FIG. 6 is shown a section through the housing **12** in a plane going through a not illustrated axis of the axle **45**.

The pivotable auxiliary frame **3** is provided on one side with brackets **20** for a link pin **21** receiving an eye **22** of a piston rod **23** of the hydraulic cylinder **24** mounted pivotably on a second link pin **25** fixed in the main frame **1** of the device. Pipe lines **241** and **242** supply and release pressure fluid from said cylinder **24**.

In the opposite portion of the frame **1** are arranged brackets **26** and **27** in which are bored holes for receiving the die pin **28**. On this pin are arranged pivotably bolsters **29** as one-arm levers on which are fixed the profile bending dies **30** proper. It is advantageous to mount at least two parallel bolsters **29** on said pin **28** in order to shape simultaneously at least two workpieces. The form of the brackets **26**, **27** of the bolsters **29** and the position of through holes on these elements are such that the die pin **28** is positioned near the center of the small radii of curvature of the round end of the profiled bending die **30**. The greatest length of the bolsters **29** and of the profile bending dies **30** must not exceed a definite limit which depends on the distance of main pin **2** of the pivotable arm **3** from the center of the active surface of the profile bending die **30**. This distance must exceed the half length of the finished workpiece. The bolsters **29** are connected to each other by a bolt **31** on which is slit also the eye **32** of the piston rod **33** actuated by a pivotable hydraulic cylinder **34** mounted on a stationary bolt **35**. Pipe lines **341** and **342** supply and release pressure fluid from said cylinder **34**. Between the two bolsters **29** is pivotably mounted on pins **48** the hydraulic clamping cylinder **36** with the piston rod **37**, at the end of which is arranged a double clamping jaw **38** which has at its lower face two recesses of a shape corresponding to the profiles being formed. Pressure fluid is supplied to and released from this cylinder **36** by way of pipe lines **361** and **362**.

In the forward section of the frame **1** of the device in a recess **39** covered in FIG. 1 by the top guide gib **40**, are slidably mounted blocks **41** which are connected by piston rods **42** to the piston **43** of the auxiliary hydraulic cylinders **44**. Details of these blocks **41** are shown in FIG. 4. These blocks **41** secure the bolsters **29** with the bending dies **30** in the horizontal position in the course of shaping parts of the blanks **47** having larger radii of curvature.

A further example of realization of the housings **12** of profile rollers **19** is illustrated in FIG. 7. The housing body is solid and in its bottom portion are inserted pins **45** supporting loosely rotatable profile rollers **19**. The relative radial spacing of the profile rollers **19** is thus

invariable also in this embodiment. The housings **12** are attached to the front part of the sliding blocks **6** by an eccentric pin **46**, the central portion of which, having a much smaller diameter, is eccentric relative to its end portions. This arrangement permits first a pivotable movement of the housings **12** and by rotation of the crank pin **46** the distribution of thrust forces onto the various profile rollers **19** is altered.

The described device functions as follows:

The operator places the blanks **47**, previously profiled, on the profile bending dies **30**. The double clamping jaw **38**, actuated by the hydraulic clamping cylinder **36** firmly clamps two such blanks **47** to the bending dies **30**. Now the pivotable arm **3** is set into motion in direction of the arrow I by action of the hydraulic cylinder **24** and piston rod **23**. During this movement the housings **12** with profile rollers **19** swing moderately on pins **11** following the shape of the bending die **30**. Because the center of curvature of the contour of the part **48** being formed is not positioned within the axis of rotation of the pivotable auxiliary frame **3** the profile rollers **19** recede together with the sliding blocks **6** movable in guide gibs **4**. After attaining the position marked by dotted lines the auxiliary hydraulic cylinders **44** arranged in the top portion of the frame **1**, rear of the opening **39**, are set into operation. These cylinders **44** move away the blocks **41**, on which rest in the first phase of operation the bolsters **29**. The blocks **41** retract into recesses **39**. Their movement is denoted by the arrow II in FIG. 4. This releases the bolsters **29** which then by action of the swingable hydraulic cylinders **34** rotate on the die pin **28** toward the baseplate of the frame **1** as shown in FIG. 1 by an arrow III. The duration of overlap of the operating movements of the pivotable auxiliary frame **3** and bolsters **29** may be preset by a programme control system.

In the way described is formed on the bending dies **30** half the length of the profile blanks **47**. After releasing the double clamping jaws **38** the operator may remove the blanks in a suitable adjustable position of the bolsters **29** or directly in the initial position when the blocks **41** are inserted below the bolsters **29**.

The whole cycle of the device is controlled for instance according a programme. The operator loads and clamps the blanks, releases and unloads them after forming and by means of push-buttons puts the machine into operation.

What is claimed is:

1. An arrangement for shaping of profiled curved workpieces from blanks to a configuration with adjacent sections with different radii of curvature comprising:

a main frame,

an auxiliary frame,

a bolster with a bending die,

a thrust head supported slidingly by said auxiliary frame,

a housing with pressure rollers joined to said thrust head,

said bolster being pivotably supported on said main frame about an axis substantially at the centers of curvature of the small radii of the shaped blank,

said auxiliary frame being pivotably supported on said main frame about an axis spaced from the pressure rollers in operating position by at least one half of the length of the finished workpiece,

means for actuating said auxiliary frame with respect to said main frame,

means for locking said bolster in an operating position in the course of bending parts of the blank with large radii in a position between said thrust head and the pivoting axis of said auxiliary frame,

means for actuating said bolster with respect to said main frame,

means for generating pressure on said thrust head substantially in the direction of the pivoting axis of said auxiliary frame,

and means for clamping the treated blank to said bending die and bolster.

2. An arrangement as set forth in claim 1, said thrust head comprising a hydraulic sliding cylinder, cooperating with a stable piston fixed on said auxiliary frame.

3. An arrangement as set forth in claim 1 comprising bolsters adapted for supporting a plurality of parallel bending dies.

4. An arrangement as set forth in claim 3, comprising clamping means for simultaneous clamping of a plurality of treated blanks with said bending dies.

5. An arrangement as set forth in claim 1 comprising means for adjusting the position of the pressure rollers to respect to said thrust head.

6. An arrangement as set forth in claim 5, said pressure rollers comprising a housing composed of two parts, with means for adjustment of their relative position.

7. An arrangement as set forth in claim 5, said pressure rollers provided with a housing supported by said thrust head by means of an eccentric pin.

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MILTON S. MEHR, Primary Examiner

U.S. Cl. X.R.

72—153, 216, 406