July 4, 1944. C. M. YODER 2,352,675

MECHANISM FOR SHAPING SHEET METAL

Filed April 21, 1941 3 Sheets-Sheet 1

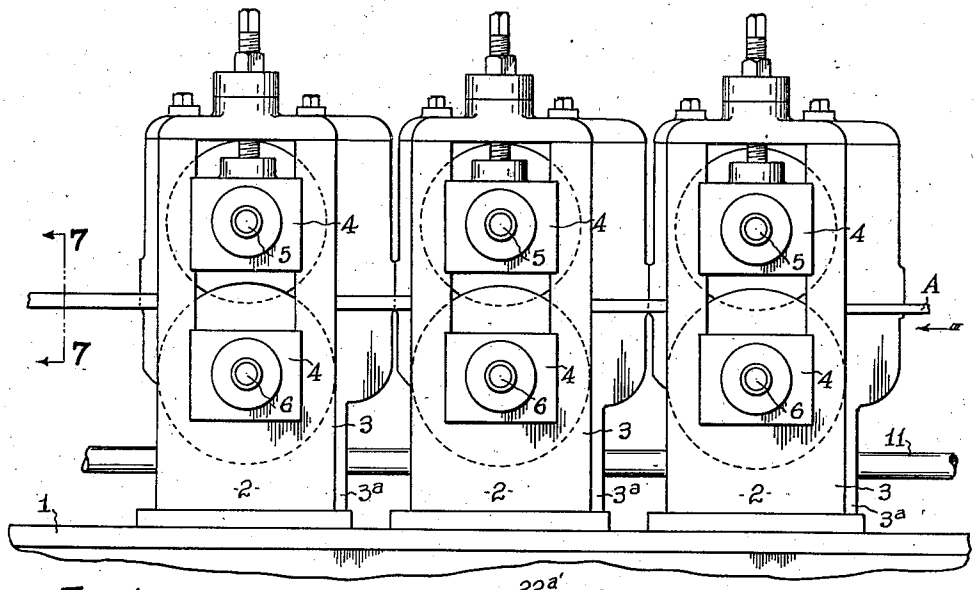


FIG. 1

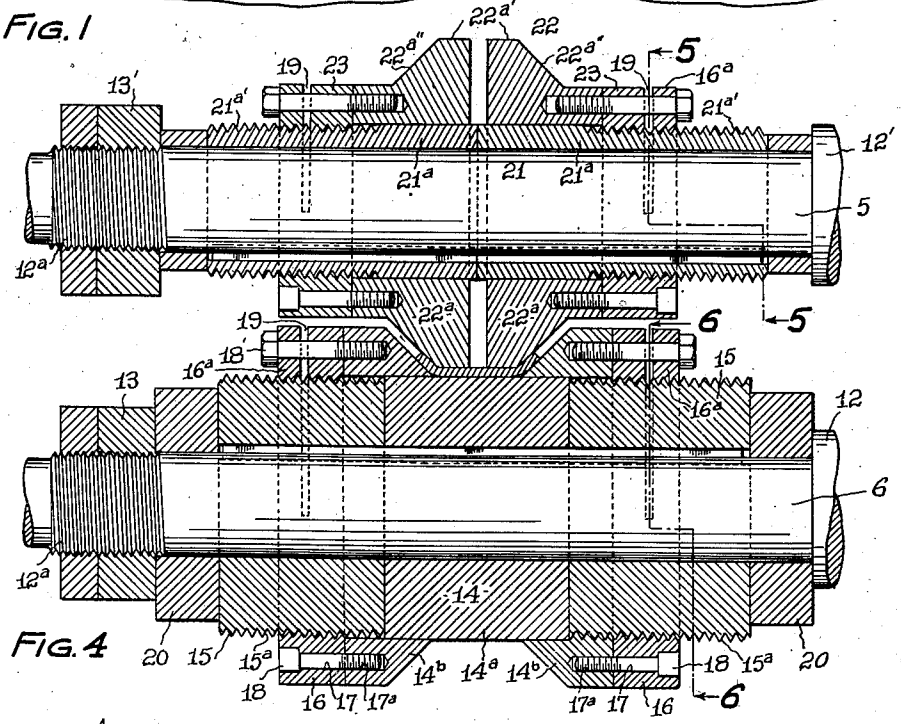


FIG. 4

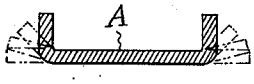


FIG. 7



FIG. 8

INVENTOR
CARL M. YODER
BY Geo. A. Pitts
ATTORNEY

July 4, 1944. C. M. YODER 2,352,675

MECHANISM FOR SHAPING SHEET METAL

Filed April 21, 1941 3 Sheets-Sheet 2

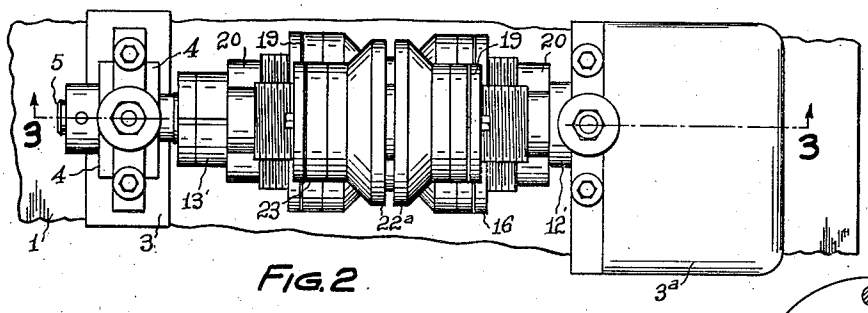


FIG. 2

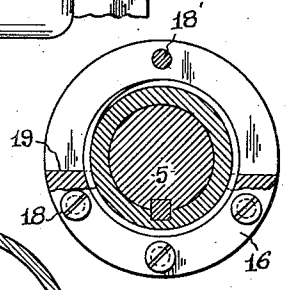


FIG. 5

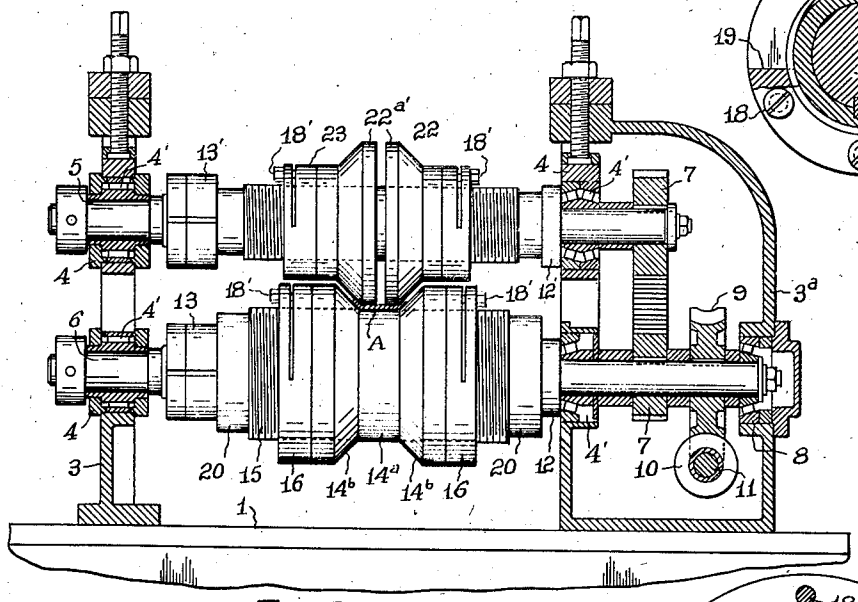


FIG. 3

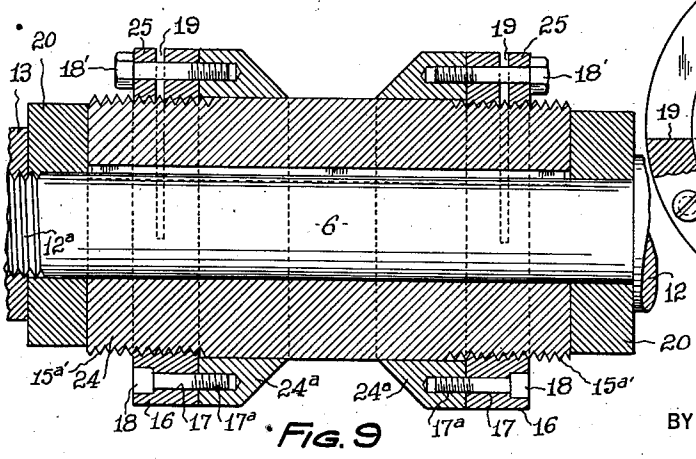


FIG. 9

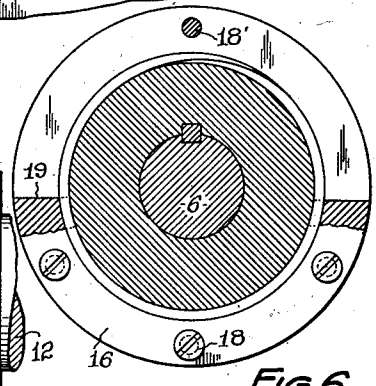


FIG. 6

INVENTOR
CARL M. YODER
BY Geo. B. Fitch
ATTORNEY

July 4, 1944. C. M. YODER 2,352,675

MECHANISM FOR SHAPING SHEET METAL

Filed April 21, 1941 3 Sheets-Sheet 3

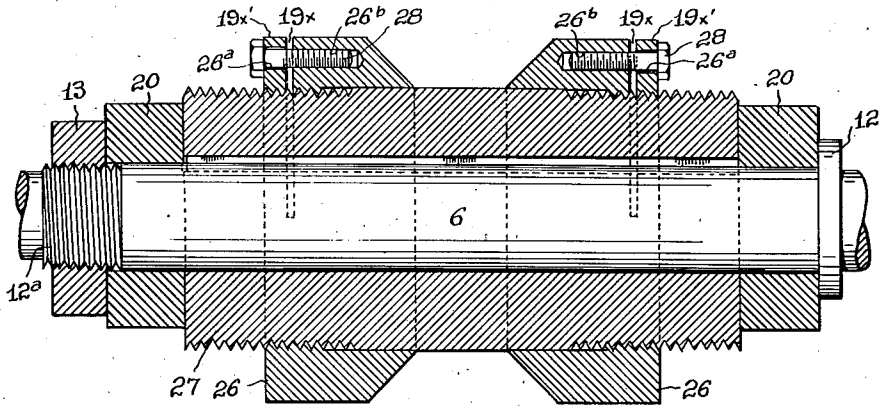


FIG. 10

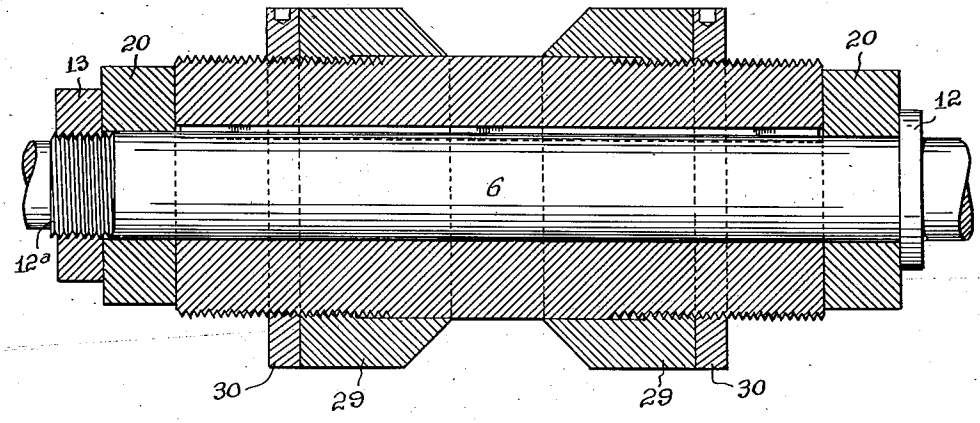


FIG. 11

INVENTOR
CARL M. YODER
BY Geo. A. Gitt
ATTORNEY

Patented July 4, 1944

2,352,675

UNITED STATES PATENT OFFICE

2,352,675

MECHANISM FOR SHAPING SHEET METAL

Carl M. Yoder, Lakewood, Ohio

Application April 21, 1941, Serial No. 389,502

14 Claims. (Cl. 153—28)

This invention relates to mechanism for shaping sheet metal, more particularly to a mechanism having a plurality of roll passes which progressively shape the metal into final form for assembly in fabricated structures. The invention is particularly adapted for shaping sheet metal for use in light building construction and the fabrication of aeroplanes for commercial and military uses. The sheet metal may be continuously delivered to the shaping mechanism and the shaped portion severed into predetermined lengths or members; or as shown in my Letters Patent No. 2,234,999, dated March 18, 1941, the sheet metal may be partly severed in advance of the shaping thereof, and following the shaping of the metal, it may be completely severed into lengths. In the fields of industry referred to, all cross sectional portions of each shaped member must meet predetermined micrometer dimensions as to spacing, width, length and curvature and the surfaces thereof must be free from scratches, imperfections and marks caused by the shaping rolls. To manufacture or shape sheet metal sections for these particular applications, it has been the practice according to my knowledge, to provide sectional rolls and effect adjustment of the roll sections relative to each other by means of shims to set them in accurate relation dependent upon the thickness of and desired cross sectional shape to be imparted to metal.

In many instances a very large number of shims have been required. To secure an exact setting of the roll sections it has been necessary to insert between them and remove many shims of different thicknesses to ascertain and finally attain the correct setting of the roll sections for each roll. Obviously, this cut-and-try method is not only tedious but time consuming, and the shims cause objectable markings on the surfaces of the shaped member.

One object of the invention is to provide an improved roll pass construction having sectional rolls, the respective sections of which may be readily set and related to bend or shape sheet metal along predetermined lines, whereby each cross sctional portion or portions will be accurately shaped as to spacing, width, length and/or curvature.

Another object of the invention is to provide an improved sectional shaping roll, the sections of which may be adjusted to meet micrometer dimensions, whereby the material may be bent into a predetermined, final shape ready for fabrication.

Another object of the invention is to provide an improved sectional shaping roll and combined means for accurately adjusting and locking the roll sections in a predetermined adjusted relation.

A further object of the invention is to provide an improved roll assembly removably and adjustably mounted on a shaft and having a sectional shaping roll and means for adjusting and setting in adjusted position one or more sections of the roll.

A further object of the invention is to provide an improved roll assembly mounted on a shaft and having a sectional roll comprising an inner member keyed to the shaft and one or more sections each adjustable on said inner member axially of said shaft and provided with means for securing the section or sections to said inner member.

Other objects of the invention will be apparent to those skilled in the art to which my invention relates from the following description taken in connection with the accompanying drawings, wherein

Fig. 1 is a side elevation of a portion of a mechanism having roll passes, one or more of which embody my invention.

Fig. 2 is a fragmentary plan view of parts shown in Fig. 1.

Fig. 3 is a section on the line 3—3 of Fig. 2; the rolls and shafts therefor being in elevation and showing in section the metal between the rolls.

Fig. 4 is a fragmentary section, also on the line 3—3 of Fig. 2, but enlarged; the rolls and adjacent parts being shown in section.

Figs. 5 and 6 are sections on the line 5—5 and 6—6, respectively, of Fig. 4.

Fig. 7 is a cross sectional view of the shaped member.

Fig. 8 is a cross sectional view of a differently shaped member.

Figs. 9, 10 and 11 are fragmentary sections showing modified forms of construction.

In the drawings, 1 indicates as an entirety the top portion of a suitable support on which a plurality of roll passes 2 are mounted in any well known manner. I have illustrated three passes (each indicated as an entirety at 2) through which the sheet metal A is fed, but it will be understood that the number of passes will depend on the size and thickness of the metal and also the predetermined cross sectional shape to be imparted to the metal.

While I prefer to construct each pass accord-

ing to the disclosure herein, the invention is not to be limited to mechanism where all of the roll passes are of this construction, since the invention in its broader phase resides in the roll assembly and its mounting on one shaft, although it is advantageous that both rolls of a pass embody the novel features constituting my invention, for which reason only one pass and the parts thereof are illustrated and described in detail, as shown in Figs. 2 to 6, inclusive. In these views 3, 3a, indicate spaced standards supporting boxes 4, 4, having suitable anti-friction bearings 4', 4', for upper and lower shafts 5, 6; the boxes 4 for the bearings 4' for the upper shaft 5 being adjustable vertically in a well known manner. The standard 3a is shaped to form a housing into which the adjacent ends of the shafts 5, 6, extend. Those portions of the shafts 5, 6, within the standard 3a are provided with gears 7, in mesh with each other. The lower shaft 6 is extended beyond the upper shaft 5 and has bearing at 8 in the outer side wall of the standard 3a. Between the bearing 8 and adjacent gear 7, the shaft 6 is provided with a worm gear 9 in mesh with a worm 10 which is fixed to a shaft 11, the latter being driven in any desired manner. The roll carrying shafts for each of the roll passes are preferably connected to and driven by the shaft 11 in the manner above described.

Each shaft 5, 6, is provided on one end portion inwardly of the adjacent standard with a collar 12 (preferably formed integrally with the shaft) and on its opposite end portion with screw threads 12a to take clamping nuts 13, between which (that is, the collar 12 and nuts 13) is positioned a roll assembly, later referred to. The mechanism herein shown for illustrative purposes is adapted to form sheet metal into U-shape, as shown in Fig. 7, the preliminary bending steps being shown in dotted lines; whereas Fig. 8 shows in cross section a shaped member, of modified form, which, by means of rolls of the proper shape, may be formed by the mechanism herein disclosed.

The rolls of the roll assemblies shown in Figs. 2, 3 and 4 are shaped to effect the first preliminary bending step shown in dotted lines in Fig. 7 and include male and female sectional rolls, the latter being mounted on the lower shaft 6. The roll assembly mounted on the shaft 6 consists of a sectional roll 14, collars 15 at opposite sides of the roll and adjustable and locking means between each collar 15 and the adjacent section of the roll. The roll 14 consists of a center section 14a keyed to the shaft 6 and side sections 14b, 14b, slidably and rotatably fitting the center section 14a and independently adjustable thereon and forming therewith material engaging faces to co-act with the roll on the shaft 5, these sections being formed of suitable material and hardened in a well known manner. The collars 15 are keyed to the shaft 6 and provided on their outer surfaces with screw threads 15a with which engage the adjusting and locking means. Each adjusting and locking means comprise a ring nut 16 detachably secured to the outer side of the adjacent roll side section 14b and engaging the threads 15a on the adjacent collar. The outside diameter of the collars 15 is slightly less than that of the center roll section 14a to permit the side sections to freely slide and rotate on the collar when assembled in position or adjustment is being made. The ring nut 16 is formed with a plurality of spaced through openings 17, in registry with screw threaded openings 17a formed in the adjacent roll side section 14b, to receive suitable cap screws 18, 18', which secure the ring nut and roll side section rigidly together. As shown, each ring nut 16 is formed with a slot 19, preferably extending through the side wall thereof throughout one-half of its circumference, and arranged nearer the outer face of the nut than its inner face, to form a section 16a which may be deflected inwardly toward and relative to the main section of the nut upon tightening of the adjacent screw 18', the effect of which is to clamp the threads on the section 16a to the threads on the adjacent collar, or in abnormal relation thereto as compared to the relation of the threads on the main portion of the nut to the threads on the collar, whereby the nut is locked to the latter against rotation.

From the foregoing description, it will be seen that upon loosening the screws 18' and turning each nut 16 in either direction on the adjacent collar 15 the roll side sections 14b may be adjusted any desired degree relative to the center section 14a inwardly or outwardly any desired distance, dependent upon the angular or rotative movement of the nut.

Accordingly, micrometer adjustments of the roll side sections, in either direction may be readily effected. By increasing the number of multiple threads per inch, the adjustments for each turn or partial turn of the nuts may be reduced to relatively fine dimensions. It will be noted that the roll side sections 14b are independently adjusted to insure accurate relationship to the adjacent active face of the roll on the shaft 5.

Suitable spacers 20 are provided between the fixed collar 12 and adjacent collar 15 and between the clamping nuts 13 and the adjacent collar 15, the latter nuts when tightened serving to secure the spacers, collars 15, and roll section 14a rigidly together between them and the fixed collar 12. By using spacers 20 of desirable lengths, axially of the shaft 6, the roll assembly may be positioned on the shaft 6 mid-way of the standards 3, 3a, or to one side of the mid-position. As the collars 15 are keyed to the shaft 6, rotative movement thereof relative to the roll section 14a is eliminated during operation of the roll or adjustment of its side sections.

The roll assembly on the shaft 5 consists of a member 21 preferably formed in sections 21a keyed to the shaft 5 and disposed in endwise relation end to end and clamped between the fixed collar 12' and clamping nuts 13' and a sectional roll 22. The roll 22 consists of side members 22a each having active faces 22a', 22a'', arranged to co-act with the roll sections 14a, 14b, respectively. As shown, the sections 21a comprise elongated collars and are provided with screw threads 21a' with which engage ring nuts 23. Each ring nut 23 is constructed and connected to the adjacent roll section 22a similar to the nut 16 and its connection with the adjacent roll section 14b, and accordingly each roll section 22a may be adjusted axially of the shaft 5 any desired distance in either direction and then locked against movement. As shown in Figs. 5 and 6, I provide three screws 18 between the unslotted portion of each ring nut 16 or 23 and the adjacent roll section and one screw 18' between its slotted portion and the adjacent roll section, the screw 18' being disposed mid-way the ends of the slot 19, so that operation of one screw only is required to lock or unlock the ring nut relative to the adjacent collar.

Fig. 9 illustrates a modified form of construc-

tion wherein the roll assembly consists of a sleeve **24**, side sections **24***a* slidable and rotatable thereon and adjusting and locking means for the sections **24***a*. The sleeve **24** is suitably keyed to the adjacent shaft and formed of suitable material and hardened to serve as the center roll section for the roll. In this form of construction the opposite end portions of the sleeve are provided with screw threads **15***a'* with which engage the adjusting and locking ring nuts **25**. The ring nuts **25** are constructed and connected to the roll side sections **24***a* similarly to the ring nuts **16** to effect the adjustment and locking of the latter sections. The sleeve **24** is clamped between the fixed collar **12** and clamping nuts **13** in the manner already set forth. spacers **20** being interposed between the assembly and the fixed collar and clamping nuts to secure the assembly in any desired position endwise of the shaft.

Fig. 10 illustrates a modification wherein each of the side sections **26** of the roll is extended axially so that a portion of its inner wall inwardly of its outer side may be provided with screws to engage the screw threads on the inner member **27** and its remaining portion slidably and rotatably fits the member **27**. By extending each section **26** axially sufficient metal is provided to permit the formation therein of a slot **19***x* extending substantially one-half the circumference of the member, whereby there results an integrally connected section **19***x'* capable of being deflected laterally. In this arrangement, the section **19***x'* is formed with an opening **26***a* in registry with a screw threaded recess **26***b* formed in the adjacent portion of the roll section, so that by means of a cap screw **28** screwed into the recess **26***b* the section **19***x'* is deflected laterally, the effect of which is to bind or lock its threads to the threads on the member **27**. Fig. 11 illustrates another modification wherein each of the side sections **29** of the roll is similar in construction to the side sections **26** shown in Fig. 10, but instead of providing thereon an integrally connected section capable of being deflected for locking the section to the inner member **27**, the side sections are adjustably held against outward movement by nuts **30**. I provide a jam nut **30** which is tightened against the roll section to lock it against movement.

From the foregoing description it will be noted that the sections of the male and female rolls may readily be adjusted within small dimensional limits in a ready manner and locked against movement and that by reason of such adjustments the rolls may be set to operate on sheet metal of different thicknesses, so that separate sets of rolls for varying thicknesses of metal are not required. Also, that the sections are independently adjustable and shims or spacers are entirely eliminated, so that not only may the adjustments be readily made, but danger of objectionable marks on the surfaces of the shaped members totally avoided. It will be further noted that the means for locking the roll sections in adjusted position are of a character which do not mutilate the screw threads of either of the threaded parts, so that ready adjustment of the roll sections relatively short angular distances is not impaired.

It will be understood that where the roll section **14***a* and collars **15** or the sections **21***a* in Figs. 2, 3, and 4, the sleeve **24** in Fig. 9 or the inner members in Figs. 10 and 11 occupy the space between the fixed collar and clamping nuts, the spacers may be omitted.

To those skilled in the art to which my invention relates, many changes in construction and widely differing embodiments and applications of the invention will be apparent without departing from the spirit and scope thereof. My disclosures and the illustration herein are purely illustrative and are not intended to be in any sense limiting.

What I claim is:

1. In a sheet metal shaping machine, the combination with a support, of a shaft mounted thereon, a roll assembly comprising a member surrounding and keyed to said shaft and spaced annular members arranged to cooperate with a portion of said member to form a shaping roll, one of said annular members slidably and rotatably fitting said first mentioned member, a device secured to the outer side of said slidable and rotatable annular member and having screw threaded engagement with said first mentioned member, whereby rotation of said device adjusts the adjacent annular member axially of the adjacent shaft, said device being slotted throughout a portion thereof circumferentially to form a section capable of being deflected laterally, and means for flexing the said section laterally to effect a locking relation between its threads and the threads on said first mentioned member.

2. In a sheet metal shaping machine, the combination with a support, of a shaft mounted thereon, a roll assembly comprising a member surrounding and keyed to said shaft and spaced annular members arranged to cooperate with a portion of said member to form a shaping roll, one of said annular members slidably and rotatably fitting said first mentioned member, a device having screw threaded engagement with said first mentioned member and a plurality of screws for securing said device to the outer side of said slidable and rotatable annular member, whereby rotation of said device adjusts the adjacent annular member axially of the adjacent shaft, said device being slotted throughout a portion thereof circumferentially to form a section capable of being deflected laterally, one of said screws extending through said section and arranged when tightened to flex the said section laterally to effect a locking relation between its threads and the threads on said first mentioned member.

3. In a sheet metal shaping machine, the combination with a support and a pair of shafts mounted thereon, of a shaping roll assembly mounted on each of said shafts, each assembly comprising annular members fixedly related to the adjacent shaft and sections slidable axially and rotatable relative to said members, certain of said members being provided with externally screw threaded walls, a device secured to the outer side of each slidable and rotatable section and internally threaded to provide screw threaded engagement with the adjacent threaded walls, whereby rotation of said device adjusts the adjacent section axially of the adjacent shaft, said device being slotted throughout a portion thereof circumferentially to form a section capable of being deflected laterally, and means for flexing the said section laterally to effect a locking relation between its threads and the threads on said first mentioned member, the slidable and rotatable sections of one roll assembly being disposed in spaced relation and the slidable and rotatable sections of the other roll assembly being disposed between said spaced sections.

4. In a sheet metal shaping machine, the combination with a support, of a shaft thereon, a

sectional shaping roll on said shaft and comprising a center section keyed to said shaft and spaced annular sections slidably and rotatably fitting said center section, collars keyed to said shaft at opposite sides of said center roll section and provided on their outer surfaces with screw threads, an annular device secured to the outer side of each of said annular roll sections and internally screw threaded to provide screw threaded engagement with the adjacent collar, whereby rotation of said device adjusts the adjacent annular section axially of the adjacent shaft, each of said devices being slotted throughout a portion thereof circumferentially to form a section capable of being deflected laterally, means for flexing each said section laterally to effect a locking relation between its threads and the threads on the adjacent collar, and means for securing said center roll section and collars together in end-to-end relation.

5. In a machine of the class described, the combination with a support and a shaft thereon, of a sleeve keyed to said shaft and provided on its opposite end portions with screw threads, annular members slidably and rotatably fitting said sleeve and cooperating with the central portion thereof to form a shaping roll, ring nuts engaging the threaded portions of said sleeve and each secured to the adjacent annular member, whereby rotative movement of said nuts adjusts the adjacent annular member axially of said sleeve, each said nut being slotted throughout a portion of its circumference to form a section capable of being deflected laterally, and means for deflecting said section to effect a locking relation between its threads and the adjacent threads on said sleeve.

6. In a machine of the class described, the combination with a support and a shaft thereon, of a sectional roll comprising a center section keyed to said shaft and side sections slidably and rotatably fitting said center section, collars at opposite sides of said center section keyed to said shaft and provided externally with screw threads, ring nuts each having threaded engagement with one of said collars and secured to the adjacent roll side section, whereby rotation of the nut adjusts said side section axially of said center section, each said nut being formed with a slot extending throughout a portion of its circumference to provide a section integrally connected to the remaining portion of the nut but capable of being deflected laterally, and a device for deflecting said section laterally to effect a locking relation between its screw threads and the threads on the adjacent collar.

7. In a machine of the class described, the combination with a support and a shaft thereon, of a roll assembly including spaced roll sections slidable on and rotatable about said shaft and collars or sleeve sections keyed to said shaft and provided externally with screw threaded portions, ring nuts having engagement with said threaded portions, each said nut being formed with a slot extending throughout a portion thereof circumferentially, to provide a section capable of being deflected laterally, means for securing the unslotted portion of each ring to the adjacent roll section, and a screw extending through said section of each nut and threaded into the adjacent roll section and arranged when tightened to flex said section laterally to effect a lock between its screw threads and the threads on the adjacent collar.

8. In a sheet metal shaping machine, the combination with a support, of a shaft thereon, a roll assembly comprising a member surrounding and keyed to said shaft and spaced annular members arranged to cooperate with a portion of said member to form a shaping roll, one of said annular members slidably and rotatably fitting said first mentioned member, and means independent of said shaft for locking said slidable and rotatable member to said first mentioned member.

9. In a sheet metal shaping machine, the combination with a support, of a shaft thereon, a roll assembly comprising a member surrounding and keyed to said shaft and spaced annular members arranged to cooperate with a portion of said member to form a shaping roll, one of said annular members slidably and rotatably fitting said first mentioned member, a portion of said first mentioned member being provided externally with screw threads, a nut engaging said screw threads for locking said slidable and rotatable member to said first mentioned member, and means for securing said nut to said slidable and rotatable member.

10. In a sheet metal shaping machine, the combination with a support, of a shaft thereon, a roll assembly comprising a member surrounding and keyed to said shaft and spaced annular members arranged to cooperate with an intermediate portion of said member to form a shaping roll, one of said annular members rotatably fitting said first mentioned member, said first mentioned member outwardly of said intermediate portion being provided externally with screw threads and a portion of said rotatable member being provided internally with screw threads arranged to engage the screw threads on said first mentioned member, and means for locking said slidable and rotatable member to said first mentioned member.

11. In a sheet metal shaping machine, the combination with a support, of a shaft thereon, a roll assembly comprising a member surrounding and keyed to said shaft and spaced annular members arranged to cooperate with a portion of said member to form a shaping roll, one of said annular members rotatably fitting said first mentioned member, a portion of said first mentioned member being provided externally with screw threads and a portion of said rotatable member being provided internally with screw threads arranged to engage the threaded portion of said first mentioned member, the threaded portion of said slidable member being formed with a slot extending circumferentially thereof to form a section capable of being deflected laterally, and means for deflecting said section laterally for locking the threads on said section to the threads on said first mentioned member.

12. In a sheet metal shaping machine, the combination with a support and a shaft mounted on said support, of a roll assembly on said shaft and comprising a member surrounding and keyed thereto and annular members arranged to rotate on said first mentioned member, co-acting elements between said first mentioned member and each of said annular members for moving the latter axially when said annular member is rotated, and means carried by each said annular member for effecting a locking relation between said co-acting elements to secure said annular member to said first mentioned member.

13. A machine as claimed in claim 10 wherein the locking means consists of a nut threaded on said first mentioned member.

14. In a sheet metal shaping machine, the com-

bination with a support, of a shaft mounted thereon, a pair of sleeves keyed to said shaft in end-to-end relation, the opposite outer portions of said sleeves being provided externally with screw threads, a sectional shaping roll, each section of which is rotatably and slidably mounted on one of said sleeves, a device carried on the outer end of each roll section and provided internally with screw threads engaging the screw threads on the adjacent sleeve, and means for effecting a locked relation between the screw threads on each device and the adjacent sleeve.

CARL M. YODER.