July 5, 1938. D. A. JOHNSTON 2,122,615

ALIGNING DEVICE FOR COLD ROLL FORMING MACHINES AND THE LIKE

Filed Feb. 23, 1937 5 Sheets-Sheet 1

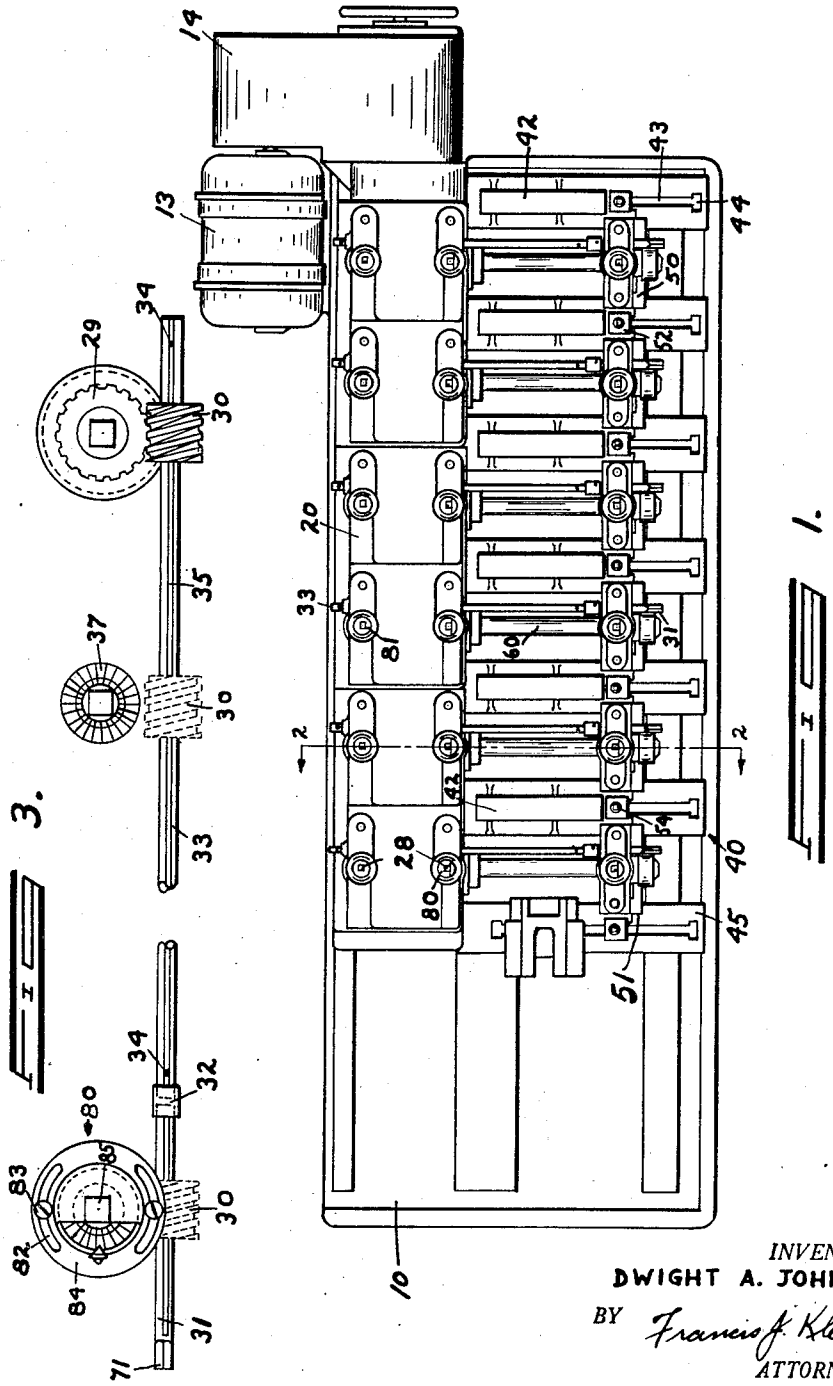



FIG. 1.

FIG. 3.

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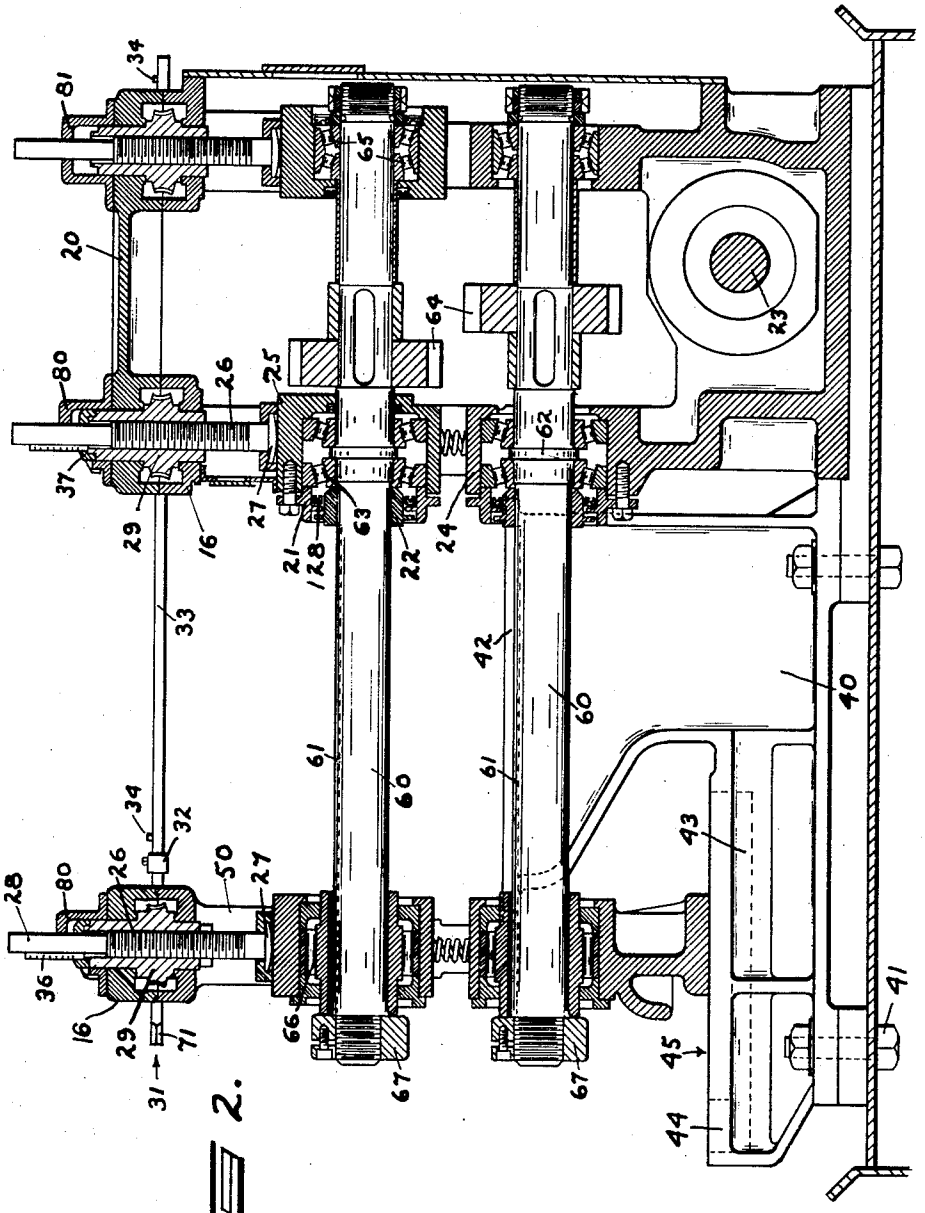



FIG. 2.

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Fig. 5.

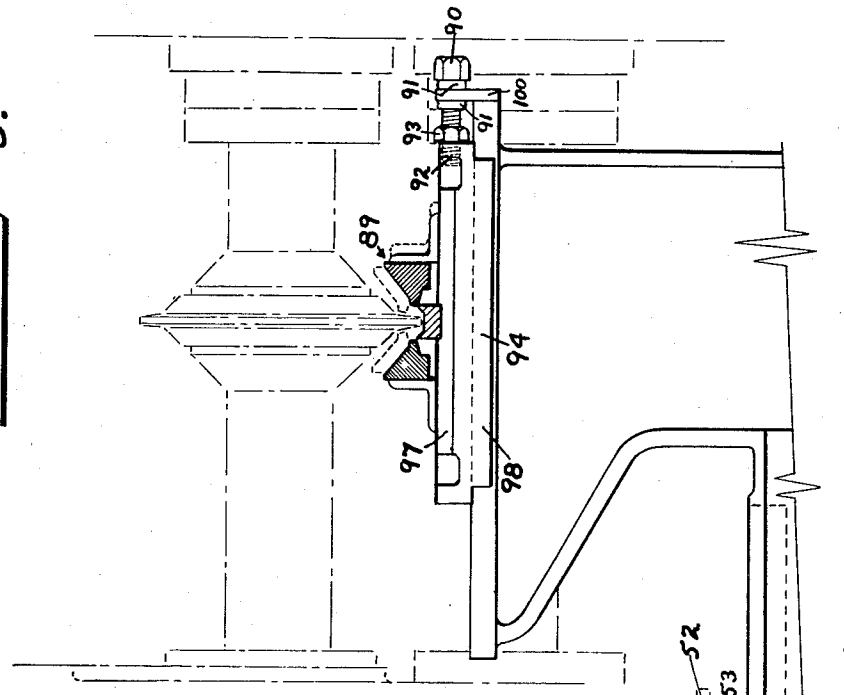
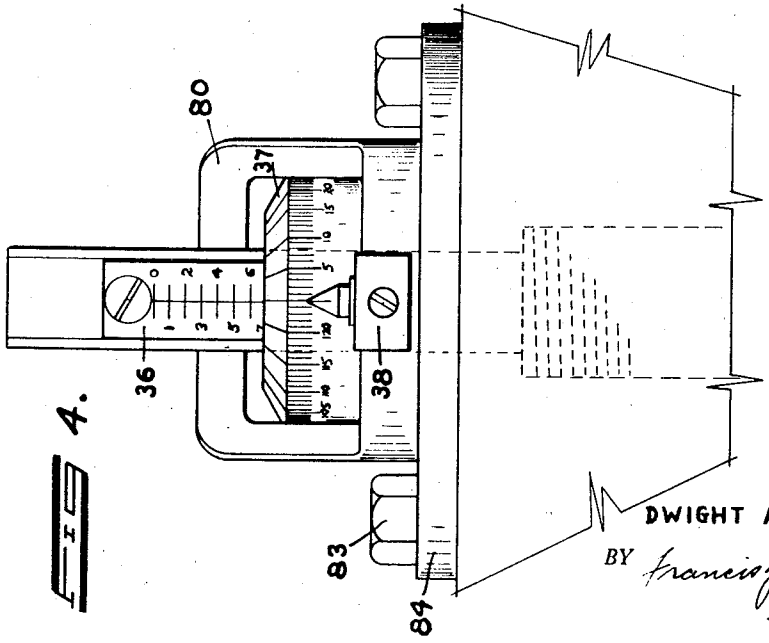



Fig. 4.




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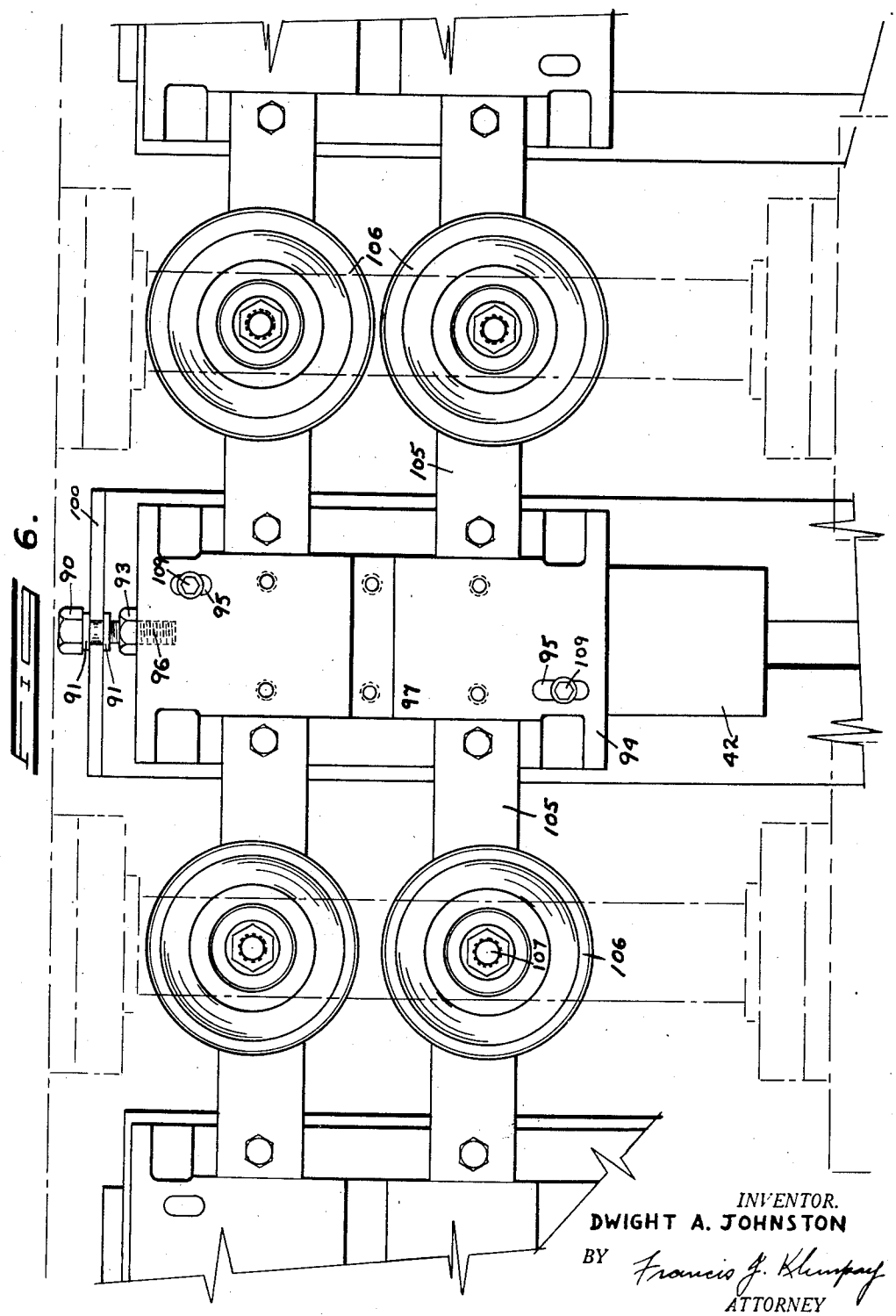



FIG. 6.

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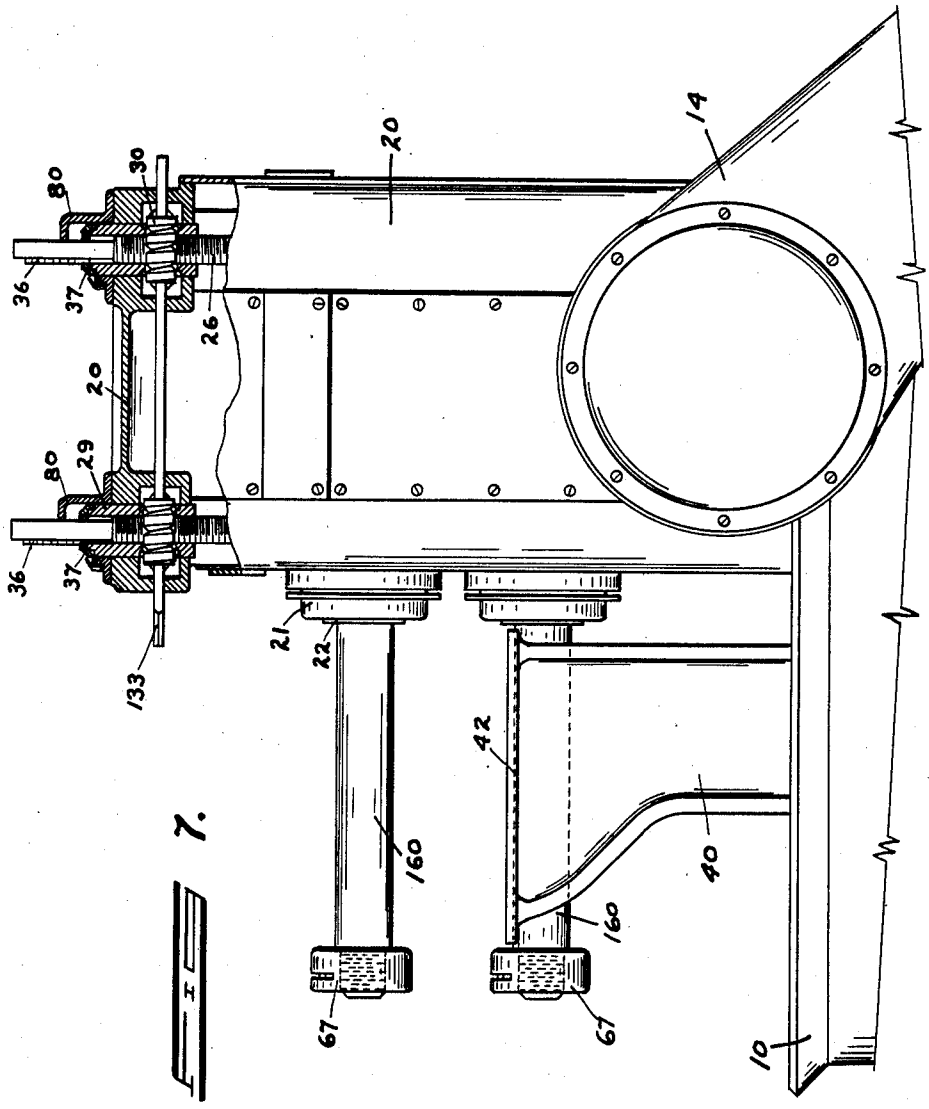



FIG. 7.

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Patented July 5, 1938

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# UNITED STATES PATENT OFFICE

2,122,615

## ALIGNING DEVICE FOR COLD ROLL FORMING MACHINES AND THE LIKE

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Application February 23, 1937, Serial No. 127,113

7 Claims. (Cl. 153—54)

This invention relates to aligning devices for cold roll forming machines and the like and more particularly to extremely accurate method and means for aligning and recording or preserving the alignment of certain essential parts of machines utilizing forming or straightening rolls and necessary ancillary equipment such as guides and guide rolls. While I have shown my invention as applied to a cold roll forming machine it should be understood that it is equally applicable to other machines such as straightening machines, for example. The invention is particularly useful in connection with machines comprising a series of stands of forming or working rolls in which the proper longitudinal alignment of the various forming, working and guiding surfaces constituting the passes of the machine or mill is of paramount importance. For illustration purposes I have selected a cold roll forming machine as being most representative.

Machines of the character referred to employ a large number of interchangeable rolls and guides to form the passes through the machine for the making or processing of a wide variety of sections. In modern practice of fabrication or production the forming machine is being used more and more for the making of light structural shapes, moldings and the like. In this process a flat strip of metal is subjected to a series of forming or bending operations, progressive in nature and extent and extreme accuracy must be employed in the alignment of the various forming surfaces, whether moving or fixed, if a satisfactory product is to be had. Provisions must be made for minute adjustments to compensate for variations in the thickness of the stock and for wear of the machine elements particularly the working rolls and guide devices.

Each separate product made on the forming machine usually requires an entirely different set of forming rolls and guides and while the interchanging of the elements presents no serious difficulty their proper adjustment and alignment is a time consuming and tedious task due to the peculiarities of the different sets of elements and the different processes. In the normal operation of the machines recurrent uses are made of the same set of elements for making the same sections and in order that the time consumed in the initial setting up of a particular assembly may not be required in subsequent assemblying it is desirable to provide some means whereby a record may be taken of the settings of the adjustable elements of the machine. These records may be preserved and used at a later date to facilitate the setting up of the machine for the purpose of making the same product from identical stock.

In machines of this kind the lower roll carrying shafts are usually fixed in relation to each other and to the guide supporting surfaces of the machine. The upper roll carrying shafts are so mounted that they may be vertically adjusted to vary the intervals between them and the lower shafts. In normal operations it is highly desirable to maintain parallelism between the upper and lower shafts and for this purpose I provide a common shaft for rotating the worms coupled with the worm wheels of vertically fixed rotatable members, the rotation of which raise or lower the supports for the bearings of the upper shaft. In certain situations it may be necessary or highly desirable to separately adjust the individual bearing supports and for this purpose I provide a novel means which not only varies the position of the individual bearing support without movement of the above mentioned common shaft but which also gives an accurate indication of the extent of movement of the individual bearing support and thus a measure of the cant of the upper roll shaft. Rotation of the common shaft raises or lowers the upper roll shaft but does not alter the cant thereof. This feature is advantageous in set ups requiring the upper shafts to be canted for satisfactory operation of the machine and in which frequent adjustments in vertical intervals must be made to compensate for variations in the thickness of the stock used.

Another object of my invention is to provide a novel aligning collar and novel construction for the machine generally whereby the collars may be easily removed from the machine for the grinding and surfacing of the faces thereof thus avoiding laborious hand grinding of aligning devices on the assembled machine.

A further object of the invention is to provide a novel guide carrying member in which the member with its attached guide members may be removed as a unit from the machine and which includes lockable means for cooperating with certain fixed elements of the machine to alter the setting of the guides in relation to the roll passes of the assembly.

A still further object of the invention is to provide a novel arrangement whereby the common shaft referred to above which spans both the housings of the stands may be easily moved to a receded position to facilitate the changing of the rolls and guides.

These and other objects and advantages of the invention will become apparent from a consid-

eration of the drawings and the following detailed description.

In the drawings:

Figure 1 is a plan view of a cold roll forming machine constructed in accordance with my invention;

Figure 2 is an enlarged sectional view taken along the line 2—2 of Figure 1;

Figure 3 is a fragmentary view of the operating means for vertically adjusting the upper roll shaft, together with the indicating device;

Figure 4 is an enlarged elevation of the device for indicating the vertical position of the roll shaft bearing with micrometer accuracy;

Figure 5 is an elevation of the guide supporting means, showing a forming roll in phantom;

Figure 6 is an enlarged plan view of the guide carrying member, with guides removed, and showing the use of these members for supporting idling forming or guiding rolls mounted on vertical axes; and

Figure 7 is an end elevation, partly in section, of a modified forming machine embodying my invention.

Referring more particularly to Figures 1 and 2 of the drawings the forming machine consists generally of a plurality of stands of driven roll carrying shafts 60 and a plurality of interposed guide and outboard housing supports 40. Roll shafts 60 are rotatably supported at one end in the double housings 20 and at their other end in the outboard housings 50. The double housings 20 and the supports 40 are mounted on and rigidly secured to a cabinet type base 10 of any suitable construction. Roll shafts 60 are driven by gears 64, keyed thereto, from the shaft 23, which extends throughout the length of the assembled double housings 20, through suitable transmission gearing (not shown). The shaft 23 is driven by motor 13 through a suitable transmission and clutch assembly within housing 14.

Lower roll shafts 60 are non-adjustably mounted in the lower portions of the windows of the housing. An integral aligning collar 62 cooperating with the pair of tapered roller bearings 63 is provided to prevent axial movement of the shaft. A retaining collar 21 is bolted onto the bearing housing 24 to secure the bearings 63 in their proper positions. Retaining collar 21 is provided with an integral inwardly extending flange for a purpose to be later described. The rear end of the shafts 60 are rotatably supported in the bearings 65 housed within windows in the rear wall of the double housings 20. It is therefore apparent that the roll shafts will be entirely supported by the double housings when the outboard housings 50 are removed from the machine for the changing of rolls and appurtenances.

The outboard housings 50 are adjustably mounted on the supports 40 with their lower portions spanning the interval between adjacent suports 40. Flanges 51 extend from the lower portions of the housings 50 and are adapted to overlie portions of the lower table surface 45 of the supports 40. A T-shaped slot 43 with an enlarged portion 44 is provided in the table 45 to receive the headed end of a T-headed bolt 53, the enlarged portion providing space for the insertion of the headed end. The threaded end of the bolt is adapted to pass up through an aperture in the clamping plate 52 the side edges of which overlie the ends of the flanges 51. A nut 54 threaded onto the shank of the T-headed bolt 53 securely clamps the plate 52 in position. The above described arrangement of the slots and clamping means enables the positions of the outboard housings 50 to be varied so as to vary the unsupported span of the roll carrying shafts. Also the outboard housings may be readily removed from the machine for the changing of the rolls.

Upper roll shafts 60 are identical with the lower shafts and are similarly mounted except that the housings for the supporting bearings therefor are mounted for vertical sliding movement in the windows of the housings 20 and 50 so that the vertical interval between the shafts may be varied and in order that the upper shafts may be canted in relation to the lower shafts if desired. The upper bearing housings are so mounted in the windows of the housings 20 and 50 that they may cant slightly in relation to the latter housings to allow for the canting of the upper shafts.

The upper ends of the outboard housings 50 and the upper ends of the two walls of the double housings 20 are each provided with an enlarged housing 16 for the reception and rotatable support of the worm wheels 29 which are provided with elongated hub portions having threaded bores therethrough. Screwthreadedly engaged within the bores are the vertically extending adjusting screws 26 having squared upper ends 28 and integral caps 27 at their lower ends, the caps 27 being received in annular recesses of the roll shaft bearing housings so that axial movement of the adjusting screws will result in corresponding vertical movement of the bearing housings. Each of the housings 16 are provided with means to rotatably support a worm 30 in operable relation to the worm wheels referred to. As indicated in Figures 1 and 3 the three worms of each stand are axially aligned so that all of them may be driven from a common adjusting shaft. The adjusting shaft consists of a short shaft 31, carried by the outboard housings 50, coupled at 32 with a longer shaft passing through the upper end of the double housings 20. A hand wheel, crank or other suitable tool engages the end of the shaft 31 at 71 to rotate the same and it is obvious that rotation of the same results in uniform vertical movement of the three adjusting screws 26 and the three bearing housings of the stand.

The shafts 31 and 33 are provided with keyways 35 to engage keys (not shown) carried by the worms 30 to transmit rotation to the worms. The shaft 33 is provided with a continuous keyway in order that the shaft may be moved axially and to a position beyond the working area of the rolls and roll shafts when the coupling 32 is unfastened. This feature is particularly advantageous when the outboard housings 50 are removed and the rolls and guides are being changed. The ends of the shaft 33 are provided with stop pins 34 to prevent the complete removal of the shaft.

To provide means to readily adjust the individual roll shaft bearing supports or housings without altering the adjustment of other bearing supports or housings and to give an accurate indication of the direction and extent of such individual adjustment I have devised the novel arrangement now to be described. As shown more particularly in Figure 2, the squared upper ends 28 of the adjusting screws 26 extend a considerable distance above the top surfaces of the housings 20 and 50. The elongated hubs of the worm wheels 29 also extend above these surfaces but

short of the end of the adjusting screw. A bell shaped adjustment cover 80 having a cut away portion (shown more clearly in Figures 3 and 4) is adapted to fit down over the end of the worm wheel hub and the adjusting screw on each of the assemblies adjacent the working portions of the roll shafts. The upper wall of the cover 80 is provided with a square opening to receive the squared end of the adjusting screw and an integral radially extending flange 84 is provided on the lower end thereof to engage the top surface of the housings 20 and 50. Flange 84 is provided with a pair of arcuately shaped slots 82 through which the shanks of the securing cap screws 83 may pass. The cap screws 83 are adapted to engage tapped holes in the housings 20 and 50 to securely clamp the cover 80 in selected position. It is obvious that rotation of the cover 80 results in rotation of the adjusting screw 26 and axial movement of the latter irrespective of the non-rotation of the worm wheel 29.

Housed within the cover 80 and carried by and securely fastened to the hub of the worm wheel 29 is the micrometer dial 37 which cooperates with the scale 36 on the end of the adjusting screw and the pointer 37 on the cover 80 to give an indication, with micromatic accuracy, of the position of the bearing support and of the direction and extent of adjustment regardless of whether the adjustment was made by rotating shaft 31 or by rotating cover 80.

By way of example I have illustrated the micrometer dial as being divided into 125 graduations. Each one of the graduations represents one-thousandths of an inch of vertical displacement of the bearing support since the pitch of the threads on the adjusting screw 26 is taken as eight threads per inch.

In the use of the machine readings of the indicators will be recorded and preserved after the machine is set up and is functioning properly in the production of a particular product. These readings are utilized at any later time when the machine is being set up again with the same set of rolls and guides for the production of the same product. It should be noted that even after an individual adjustment has been made by the rotation of cover 80, the three bearings of the shaft may be moved up and down in unison by rotation of shaft 31 coupled to shaft 33, preserving at all times the cant given by the individual adjustment. If desired, the upper end of the adjusting screw and the end 71 of the shaft 31 may have the same size and shape so that a common tool may be used to operate both the screw and the shaft.

For the purpose of removing the outboard housings 50, the clamping collars 67 on the outboard end of the roll shafts 60 are removed allowing the bearings to slide over the ends of the roll shafts. The keyways 62 of the shafts 60 extend to the end of the shafts to enable the ready removal of the forming rolls from the shafts. This construction also permits the ready removal of the aligning collars 22 which are provided with an axially extended portion to engage the inner races of the outer tapered bearings 63. The aligning collars 22 are provided with radially extending flanges to fit within the bearing retaining collars 21 and to overlie the inwardly extending flanges of the collars 21 to aid in sealing the bearing chamber. An oil retaining ring 128 is housed within the bearing retaining collar 21 adjacent the flange thereof.

The aligning collars 22 are adapted to be removed over the free ends of the roll shafts 60 when the housings 50 and rolls are removed. Since the outer faces of these collars form the guide for the alignment in horizontal planes of the working elements on the shafts it is very important that they be accurately ground and themselves accurately aligned. Heretofore the practice has been to grind by hand similar guide surfaces after the machine was assembled. With my construction I am enabled to readily remove these elements after determining the extent of grinding required and do this work by machine thus avoiding time consuming and expensive manual labor.

Figure 7 illustrates a modified form of machine in which the outboard housing 50 of the machine first described is dispensed with. The roll carrying shafts 160 are supported entirely within the double housings in the same manner as are the right ends of the roll shafts 60 of Figures 1 and 2. The forming rolls and appropriate spacing collars are carried by the free ends of the shafts 160 between the aligning collars 22 and the clamping collars 67. When housing 20 is used in a machine employing an outboard housing, as illustrated in Figure 2, the outer screw need not be provided with the micrometer dial 37 and scale 36 since the position of the outer bearing 65 does not determine the interval or cant of the rolls. For this reason a closed adjusting cover 81 is provided for the outer screw. When however the housing 20 forms the entire support for the roll shafts, a micrometer dial 37 and scale 36 together with the windowed adjusting cover 80 is provided for the outer screw so that indications may be given and minute adjustments made of the interval and angularity of the rolls. A shaft 133 keyed to both worms 30 move the screws 26 and consequently the shaft bearings up and down in unison. The guide supporting means described below are equally applicable to the machine of Figure 7.

Figures 5 and 6 show the guide carrying members 94 in position on the flat top surfaces 42 of the supports 40 and illustrate representative uses of these members. The arrangements and shapes of the various guides and forming rolls form no part of this invention and therefore no attempt has been made to show a complete guide unit or roll pass section. Figure 5 illustrates a guide assembly indicated generally at 89 supported on the guide carrying member 94 and Figure 6 shows the manner of utilizing the members 94 to support the idling vertically mounted rolls 106. These rolls are mounted on vertical shafts 107 carried by the straps 105 whose ends are bolted in the recessed edges 97 of the members 94.

Members 94 are each provided with depending flanges 98 adapted to tightly fit over the machined side edge of the top 42 of support 40. They are thus slidably mounted for adjustment along the longitudinal axis of the top. An adjusting screw 90 provided with spaced shoulders 91 engaging the front and rear surfaces of a slotted member 100 fixed to the support 40 is screw threaded into the tapped hole in member 94. Shoulders 91 prevent axial movement of the adjusting screw and therefore rotation thereof will result in sliding movement of the carrier member 94 along the surface 42. A lock nut 93 locks the screw 90 in selected position. Slots 95 in member 94 allow movement of member 94 even with the hold down screws 109 in position. When the adjustment is completed screws 109 are tightened down.

As stated above the making of different prod-

ucts usually requires the use of an entirely different set of rolls and guides for each product. The guide members assembled on each of the carriers 94 may be removed from the machine as a unit simply by removing the screws 109. The slot 101 enables the locked screw 90 to be removed along with the assembly without tampering with the adjustment thereof. Now when the machine is again set up to make the same product the assembled guide units may be bodily placed on the machine and the precise adjustment previously made will be automatically effected by locating the annular recess between the shoulders 91 of screw 90 in the slot 101 of member 100. Thus definite economies due to a reduction in the change-over time required are effected.

Having thus described my invention what I claim is novel and desire to secure to Letters Patent is:

1. Apparatus for varying and indicating the interval and angularity between two normally parallel roll carrying shafts comprising individual means spaced axially along said shafts to rotatably support said shafts, means to move the supporting means of one of said shafts comprising a screw threaded into a rotatable member held against axial movement, a micrometer dial secured to said member and rotatable therewith, a scale on a portion of said screw cooperating with said dial to indicate with minute accuracy the position of the adjacent roll supporting means, means to normally hold said screw against rotation but releasable to allow said screw to be rotated, and a pointer on said last mentioned means cooperating with said dial to indicate the extent of rotation of said screw and thus the extent of movement of the said adjacent roll supporting means caused by rotation of said screw.

2. Apparatus for varying and indicating the position of a member comprising a screw axially fixed but rotatable in relation to said member, said screw being threaded into a rotatable member held against axial movement, means to normally hold said screw against rotation, means to rotate said rotatable member, a micrometer dial secured to said rotatable member and rotatable therewith, a scale on said screw cooperating with said dial to indicate with minute accuracy the position of said first mentioned member, said holding means being releasable to allow said screw to be rotated, and an indicator rotatable with said screw cooperating with said dial to indicate the extent of rotation of said screw.

3. Apparatus for varying and indicating the interval and angularity between a movable and a fixed element of a machine comprising means spaced along said movable element to support the same, a screw axially fixed in relation to each of said supporting means, each of said screws being provided with means to prevent their rotation and being threaded in a rotatable member held against axial movement, a micrometer dial carried by and rotatable with each of said rotatable members, a scale carried by each of said screws cooperating with the dials to indicate with minute accuracy the position of the adjacent supporting means.

4. A housing for the reception and support of a bearing for a roll shaft comprising an upper chamber, a worm wheel in said upper chamber, said worm wheel being provided with an elongated hub portion extending up through an aperture in the upper wall of said chamber, said worm wheel being provided with a threaded bore to screw-threadedly receive a screw, the upper portion of said screw being squared and extending above the upper end of said hub portion, a micrometer dial secured to the upper end of the hub portion and rotatable with said worm wheel, a cover for said dial provided with a square aperture to receive the squared upper end of said screw, a radially extending flange on said cover adapted to engage the upper surface of the upper wall of said chamber, an arcuate slot in said flange, a clamping cap screw extending through said slot and screw threaded into a tapped hole in said upper wall, a scale on the squared portion of said screw cooperating with said dial to indicate with precise accuracy the relative vertical position of said first mentioned screw, said cover being cut away to expose a portion of said dial and said scale, and an indicator on said cover cooperating with said dial to indicate the extent of rotational movement of said cover.

5. In combination, a housing, a pair of spaced axially aligned bearings supported on said housing, a shaft having one end rotatably supported in said bearings, a spaced second housing having a bearing therein for the rotatable support of the other end of said shaft, a screw for each of said bearings to alter the vertical position of said bearings, a worm wheel and worm for each of said screws, rotation of said worm wheels resulting in axial movement of said screws, said worms being axially aligned and being provided with a keyed bore to receive a shaft having a longitudinally extending keyway therein, a shaft extending through said second housing and the bore of one of said worms, a second shaft extending through the worms of the first housing, a coupling connecting said shafts together, the second mentioned shaft being provided with a continuous keyway whereby the second mentioned shaft may be shifted to a position beyond the space between the two housings.

6. Apparatus for varying and indicating the interval and angularity between two normally parallel roll carrying shafts comprising a plurality of means spaced axially along one of said shafts to rotatably support the same, means to adjust one of the aforesaid supporting means comprising a member axially fixed in relation to said last mentioned means and screw-threaded into a second member axially fixed in relation to the other of said shafts, a scale having a medial line fixed on one of said members the other of said members being rotatable, a micrometer dial secured to and rotatable with the said other of said members in operative relation with said scale and medial line to indicate with minute accuracy the position of the adjacent roll shaft supporting means.

7. Apparatus for varying and indicating the interval and angularity between a movable and a fixed element of a machine comprising means at each end of said movable element to support the same, a screw-threaded member axially fixed but rotatable in relation to each of said supporting means, each of said screw-threaded members engaging a second screw threaded member axially fixed in relation to the fixed element of the machine, a scale having an axial line secured to one of said members, and a micrometer dial carried by the other of said members for cooperation with said scale and line to indicate with minute accuracy the position of the adjacent end of said movable element.

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