United States Patent

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[54] **CROSS ROLL ADJUSTING AND LOCKING MEANS**
2 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **72/99,** 287/14, 74/89.15
[51] **Int. Cl.** **B21b 19/02,** B21d 3/04
[50] **Field of Search** 72/99, 162, 101, 102, 109, 111, 235; 74/89.15; 287/14

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ABSTRACT: Cross roll carrier frames are rotatably supported in the roll frame housing. A pair of spaced manually operated screws engage each frame on either side of the centerline of the frame with one screw adjusting the frame in one direction and the other screw locking the frame in its adjusted position. The operation of the screws is reversed for adjustment in the other direction.

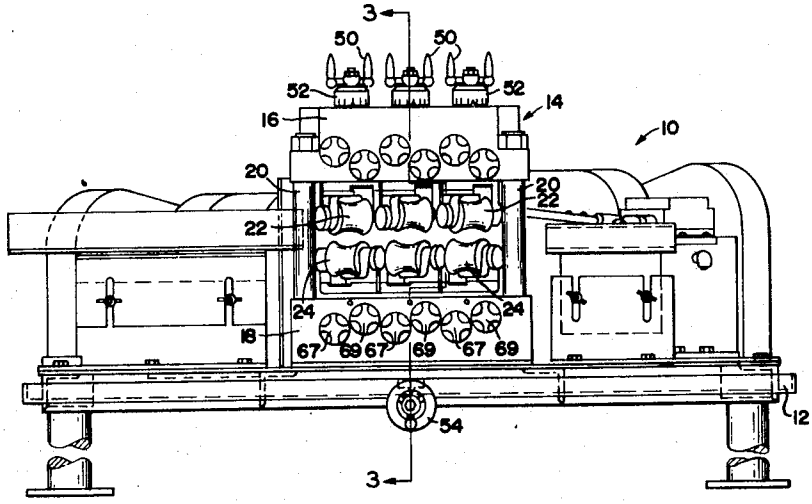

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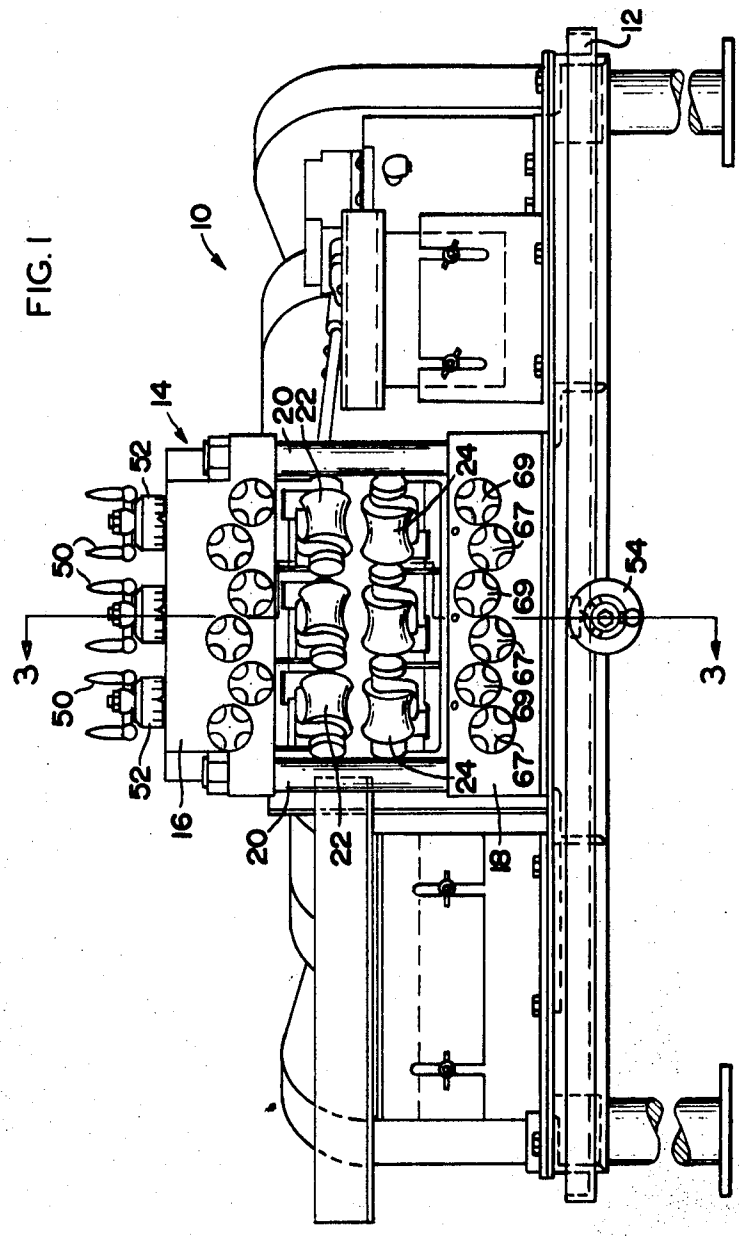
FIG. 1



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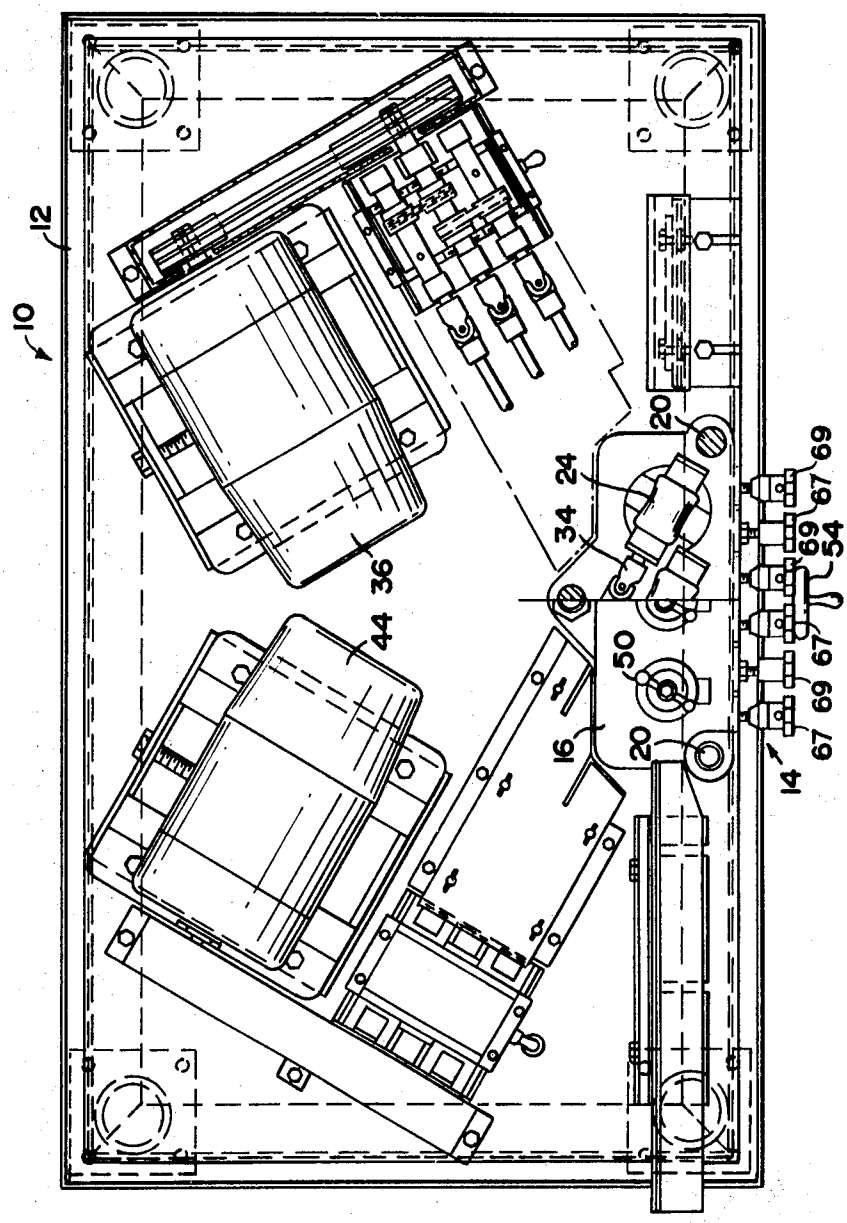

FIG. 2

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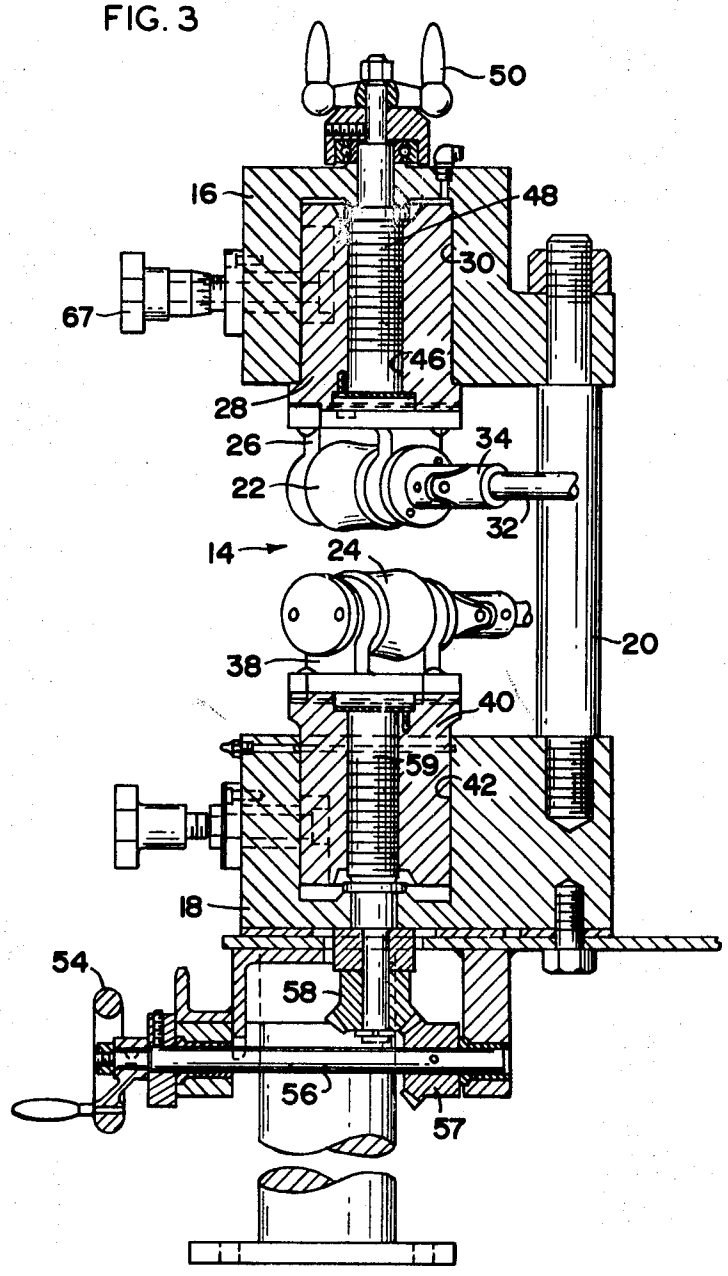
FIG. 3



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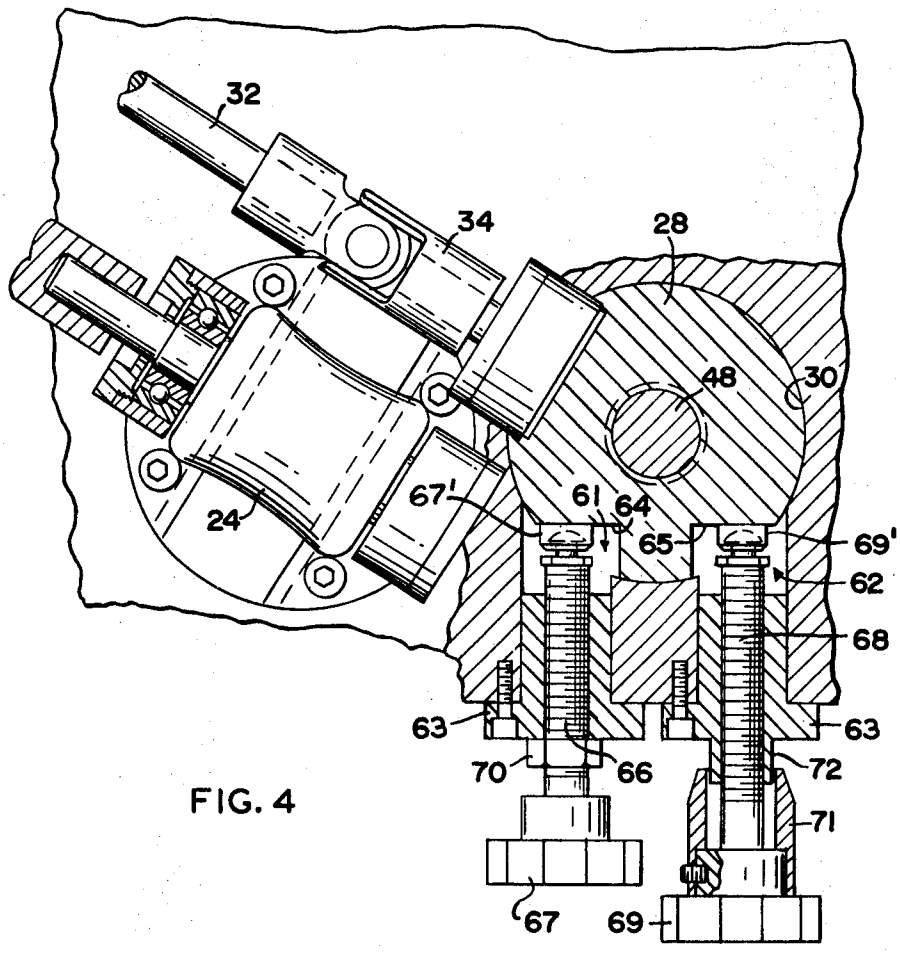

FIG. 4

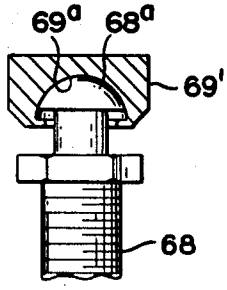

FIG. 5

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CROSS ROLL ADJUSTING AND LOCKING MEANS

This invention relates to cross roll machines and, more particularly, to an improved angular adjusting and locking means for the cross rolls in a cross roll straightener.

Cross roll machines typically are employed for straightening, polishing or derodding round bars or tubes. In general, cross roll machines comprise cooperative pairs of angularly disposed rolls with each roll being rotatably supported in a roll carrier frame. The roll carrier frames are normally adapted for angular adjustment and at least some of the frames may be vertically adjustable to vary the distance between the rolls thereby to accommodate stock of various dimensions. The vertical and angular adjustment of the roll-carrying frames is necessary not only to accommodate tubes and bars of varied dimensions but also to achieve the optimum amount of cross roll contact on the periphery of the workpiece for good straightening, polishing or derodding without spiral marking of the workpiece.

There have been several mechanisms developed by the prior art for effecting the angular adjustment of the roll carrier frame. One such approach is to employ a radially extending eccentric pin which is secured to the rotatable roll carrier frame, with the eccentricity of the pin causing angular adjustment of the frame when the pin is rotated.

A second approach employed by the prior art has been the use of a hand wheel-operated threaded screw which traverses a nut that is connected to the carrier frame and causes the frame to be displaced angularly.

A third prior art approach employs a cam follower in the form of a bell crank with one end of the bell crank disposed in a slot in the carrier frame and the other end of the bell crank cooperating with a screw-adjusted yoke to cause angular displacement of the frame.

The fourth approach employed by the prior art is related to the first described approach and involves a wrench operated eccentric pin which slidably and rotatably engages the carrier frame with the eccentricity of the pin causing the frame to be rotated.

All of these known mechanisms for angularly adjusting the cross rolls of a cross roll machine suffer from similar shortcomings. Each is basically inaccurate in application making it difficult to obtain the precise angular adjustment desired. The inaccuracy of each device is compounded by the increasing loss of accuracy which occurs as wear is sustained by the component parts of the apparatus. Moreover, each described prior art device requires some separate additional means for maintaining the desired angle of the cross rolls when the cross rolls are being adjusted vertically. In addition, it is also necessary to provide a separate means for locking the cross rolls in their angularly adjusted position after the adjustment has been completed.

It is a primary object of this invention to provide a cross roll adjusting mechanism which overcomes each of the above-described shortcomings of the prior art.

More specifically, it is the object of this invention to provide cross roll adjustment and final locking of the cross rolls in the desired angular position without the necessity for employing separate and additional means to perform each of these functions.

It is a further object of this invention to provide a cross roll adjusting device which is more precise and smoother operating than the prior art device.

Still another object of this invention is to provide an angular adjusting mechanism for cross rolls which is of simple construction and which can be readily understood and easily applied by the machine operator.

A further object of this invention is to provide a cross roll adjusting mechanism in which the rolls are locked in their final position by the same means as that which is used to achieve the angular adjustment of the rolls, thereby reducing set up time for the machine.

It is still a further object of this invention to provide an angular adjusting mechanism for cross rolls which permits the vertical adjustment of the cross rolls without resetting of the angular adjustment.

Still a further object of this invention is the provision of an angular adjusting mechanism for the cross rolls of a cross roll machine in which readily reproduced angular settings can be obtained.

More specifically, this invention contemplates cross roll carrier frames having cylindrical portions which are rotatably supported in cylindrical bores in the roll frame housing. The cylindrical frame and consequently the cross roll mounted thereon is rotated angularly within the desired angular limits by means of two adjusting screws which engage spaced planar surfaces on the cylindrical portion of the frame. One of the adjusting screws is mounted on one side of the center line of the rotatable carrier frame while the other screw is mounted on the other side of the center line. By longitudinally advancing one of the screws, the cylindrical frame is caused to rotate in one direction while advancing the other of the screws will cause the roll frame to rotate in the opposite direction. Thus, for rotation in any given direction, one screw functions as a pusher screw while the other screw opposes rotation of the frame and acts as a locking screw to maintain the angular adjustment of the cylindrical frame. One of the adjusting screws employs a vernier indicating means so that precise adjustment of the angular position of the rolls may be achieved.

Other objects and features of the invention will become more apparent upon a complete reading of the following description which, together with the attached drawings, describes but one preferred embodiment of the invention.

Referring now to the drawings wherein like reference numerals indicate like parts in the various views:

FIG. 1 is a front elevational view of a cross roll machine incorporating the principles of this invention;

FIG. 2 is a top plan view of the machine of FIG. 1;

FIG. 3 is a sectional view along line 3-3 of FIG. 1;

FIG. 4 is a fragmentary plan view illustrating the relationship between the cross roll frame and the adjusting screws.

Referring now to the drawings, and in particular FIG. 1, there is illustrated a cross roll machine, indicated generally by the reference numeral 10, which incorporates the principles of this invention. This cross roll machine comprises a base 12 on which there is supported the cross roll mechanism, much of which is conventional and forms no portion of this invention so will not be described in detail herein. Supported on the base 12 is a cross roll unit indicated generally by the reference numeral 14. This cross roll unit includes an upper housing 16 and a lower housing 18 with the upper housing being spaced from the lower housing by support columns 20. A plurality of upper cross rolls 22 and a lower cross rolls 24 are supported in the housing in a manner which will be described in more detail hereinafter. The pairs of upper and lower cross rolls cooperate to define a cross roll pass as is well understood in the art.

Referring now to FIG. 3, there is illustrated a sectional view through a pair of the cross rolls and illustrates the manner in which each of the upper and lower cross rolls 22, 24 is supported in their respective housings. The upper cross roll 22 is rotatably supported in roll neck bearings 26 which depend from the lower end of a cylindrical roll frame 28. The roll frame is received in a cylindrical bore 30 in the upper housing 16. A drive shaft 32 and universal joint 34 connect the upper roll 22 with a source of power such as an electric motor 36. Similar drive means would be provided for each of the other rolls 22, each of which would also be supported in the manner illustrated in FIG. 3.

The bottom roll 24 illustrated in FIG. 3 is also supported on roll neck bearings 38 carried by the upper end of a cylindrical roll frame 40. The roll frame 40 is supported in a cylindrical bore 42 formed in the lower roll housing 18. A drive shaft and universal joint connects the roll 24 to a second electric motor 44. Each of the other lower rolls 24 would be mounted and driven in a similar manner.

To provide for vertical adjustment of the upper rolls **22**, each roll frame **28** includes a bore **46** into which there is threaded a shaft **48**. The shaft **48** includes a hand wheel **50** secured to the upper end thereof. It will be appreciated that as the hand wheel **50** is rotated, the shaft **48** will also rotate causing the roll frame **28** to move vertically within the bore **30** thereby raising or lowering the upper roll **22**. Appropriate indicia means **52** may be associated with each of the hand wheels **50** thereby to provide an accurate means for controlling the adjusted position of the upper rolls.

A similar arrangement is provided for the middle lower roll **24**. This arrangement is illustrated in FIG. 3 wherein a hand wheel **54** mounted on the base **12** drives a shaft **56** which in turn drives a pair of gears **57**, **58** to rotate a thread shaft **59** carried in the roll frame **40**. This broad arrangement of an adjustable middle cross roll with vertically fixed end rolls is conventional in the art and is not intended to form any part of the invention.

As pointed out above, it is desirable that each of the cross rolls be angularly adjustable. This is accomplished in the present invention in a manner which is best illustrated in FIG. 4. Although only one roll frame-adjusting mechanism is illustrated in that Figure, it is to be understood that a similar arrangement is employed for each of the individual cross rolls.

As shown in FIG. 4, the roll frame **28** includes a pair of recesses **61**, **62** formed in the periphery of the frame. As viewed in FIG. 4, recess **61** is offset to the left of the centerline or axis of rotation of frame **28** while recess **62** being offset to the right of the axis of rotation. Both recesses are identical in configuration, with recess **61** including a planar or flat abutment surface **64** and recess **62** having a flat abutment surface **65**. The two surfaces **64**, **65** are coplanar with the plane of these surfaces being parallel to the centerline of frame **28**.

A pair of adjusting screws or threaded shafts **66**, **68** is threaded into replaceable bushings **63** secured in the housing **16**, with the one adjusting screw **66** being aligned with the recess **61** while the other screw **68** is aligned with the recess **62**. A knob or handle **67** is associated with the adjusting screw **66** and a corresponding knob or handle **69** is connected to the adjusting screw **68**. The two adjusting screws **66**, **68** are offset from the longitudinal centerline of the roll frame **28** with the adjusting screw **66** being positioned on one side of the centerline and the adjusting screw **68** spaced an equal distance on the opposite of the centerline. The inner end of each screw **66**, **68** is hemispherical in configuration and cooperates with a shoe **67'**, **69'** carried on the outer end thereof to form a swivel connection for a purpose hereinafter described.

A locknut **70** is threaded over the one adjusting screw **66** while the other adjusting screw carries a collar **71**. The collar **71** has appropriate indicia inscribed thereon and is telescopically received over a collar **72** formed on one of the bushings **67**. Indicia are also inscribed on the collar **72** with the two collars cooperating to function as a vernier micrometer arrangement.

The described adjusting mechanism operates in the following manner. Depending on the angular orientation desired for the cross rolls, one or the other of the adjusting screws **66**, **68** will be threaded to be longitudinally advanced inwardly while the other will be threaded to be withdrawn outwardly. Assuming, for purposes of illustration, that the cross roll is to be rotated in a counterclockwise direction as viewed in FIG. 4, the adjusting screw **66** will be rotated to be withdrawn from engagement to surface **64**. The other adjusting screw **68** will be rotated to advance inwardly with the shoe **69'** cooperating with surface **65** to rotate the frame **28** within the bore **30** in a counterclockwise direction. The amount of rotation imparted to the roll frame **28** may be measured by the vernier scale associated with the adjusting screw **68**. It will be appreciated that as the screw **68** is advanced inwardly, a corresponding withdrawal of the screw **66** must be effected. When the desired angular position of the cross roll has been obtained, the adjusting screw **66** is advanced until its associated shoe **67'** is in firm engagement with the surface **64**. Thereafter, the locknut **70** may be threaded down, thereby locking the screw **66** in position. In this condition, the roll frame **28** is restrained from angular movement in either direction by the cooperation of the two adjusting screws with the surfaces **64**, **65** and the roll frame **28**.

If angular rotation of the roll frame in the opposite direction is desired, it will be appreciated that the adjusting screw **66** will act as a pusher screw to rotate the roll frame in that direction, while the adjusting screw **68** will be withdrawn to permit the angular rotation. Thus, depending on the direction of rotation, one of the two screws acts as a pusher screw while the other of the two screws acts as a lock screw.

The swivel connection between the shoes **67'**, **69'** and the screws **66**, **68** permit the angular rotation of the roll frame while retaining firm engagement between the shoes and the surfaces **64**, **65**. In addition, the elongated configuration of the recesses **61**, **62** permits vertical adjustment of each of the cross rolls while retaining their angular adjustment. In this manner, the angular position of the rolls may be set and the machine may be adjusted to accommodate various diameters of stock without altering the angular settings.

The swivel connection between the shoes and screws may be of varying constructions. One specific construction is illustrated in FIG. 5 and comprises an enlarged head **68*a*** of a convex configuration cooperating with a concave surface **69*a*** in the shoe **69''**. A suitable retaining ring may be employed to retain the shoe assembled to the screw while permitting the desired swiveling action.

It will be appreciated that each of the advantages and objects set forth above have been accomplished by the described invention. Thus, the invention provides a means for achieving a minutely precise angular adjustment of each of the individual cross rolls. Moreover, the mechanism incorporates means for positively locking each cross roll in its adjusting position while at the same time permitting vertical adjustment of the cross rolls. The adjusting mechanism is simple in operation and may easily be employed by the machine operator. The vernier depth indicator readout markings associated with the adjusting screw provides a means whereby the final angular positions of the cross rolls can be recorded for satisfactory roll setting on specific tube sizes and types. Thereafter, the same roll settings can be quickly and precisely duplicated for similar tubes, thus reducing setup time and eliminating scrap losses.

Modifications and alterations in the described invention will suggest themselves to those having ordinary skill in the art and it is intended that such modifications and alterations are to be included within the scope of the invention as defined by the appended claims.

I claim:

1. In a cross roll machine having a roll frame housing, a roll frame rotatably supported in said housing, and a cross roll supported on said roll frame, the improvement comprising:

cross roll adjusting means carried by said housing,

said cross roll adjusting means comprising first and second longitudinally extending screw means threaded into said housing,

one of said screw means being located on one side of the axis of rotation of said frame and the other of said screw means being located on the other side of said axis of rotation of said frame,

a first abutment surface on said roll frame adapted to be engaged by said first screw means,

a second abutment surface on said roll frame adopted to be engaged by said second screw means,

manually operable handle means associated with each of said screw means whereby said screw means may be rotated to advance said screw means into and out of the engagement with surfaces on said roll frame,

indicia means associated with at least one of said screw means, and

vertical adjusting means on said housing for adjusting said roll frame along its axis of rotation.

2. The improvement of claim 1 wherein said cross roll machine includes a plurality of pairs of upper and lower cross rolls with each pair of upper and lower cross rolls defining a roll path, and

cross roll-adjusting means operatively associated with each of said cross rolls.