

[54] **APPARATUS FOR FORMING SPIRAL STEEL PIPE**

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[58] Field of Search..... 72/49, 50, 135, 448; 100/299, DIG. 18; 29/477.3

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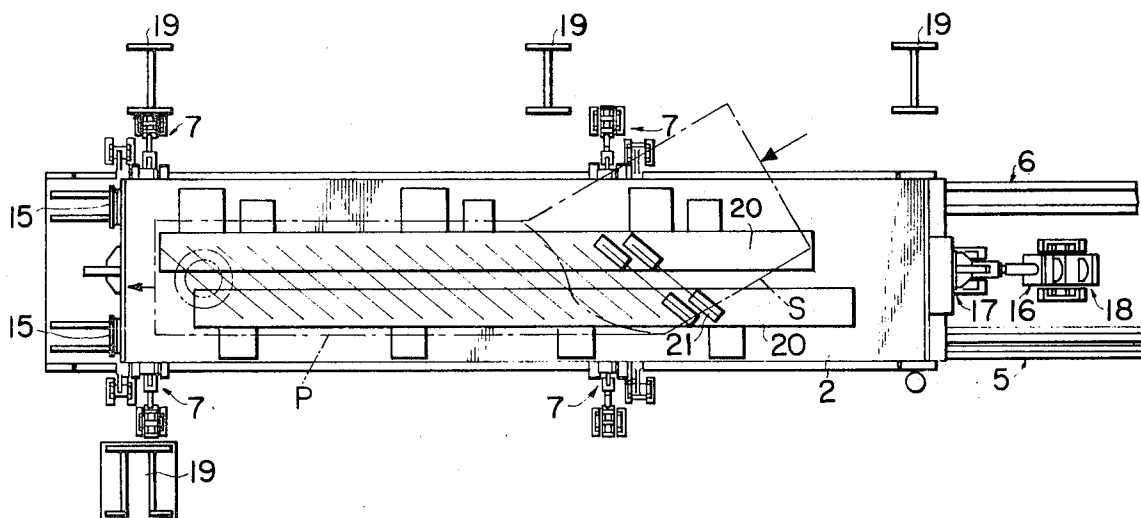
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[57] **ABSTRACT**

An improved apparatus for forming spiral steel pipe by pressing a steel strip against exterior forming rolls by mandrel rolls so as to bend the steel strip spirally. A freely movable truck has the exterior forming roll supporting stands fixedly mounted on the upper surface thereof, and is movably mounted on rails on the base of the apparatus. The rails having raisable and lowerable portions at the positions where the truck is supported thereon when the exterior forming rolls are at their operative positions on the apparatus. Clamps along the base are engageable with the truck for fixing the truck at a predetermined position on the base, and supporting frame means is provided adjacent the rails for removably supporting the mandrel roll supporting stand at its operative position above the exterior forming roll supporting stands. With the exterior forming roll supporting stand resting on the base, the rail portions can be raised and the mandrel roll supporting stand removed from the supporting frame means to rest on the exterior forming roll supporting stand, and the truck can be moved along the rails to remove both stands from the apparatus, and the stands can be replaced in the apparatus by a reverse sequence of operations.

5 Claims, 8 Drawing Figures



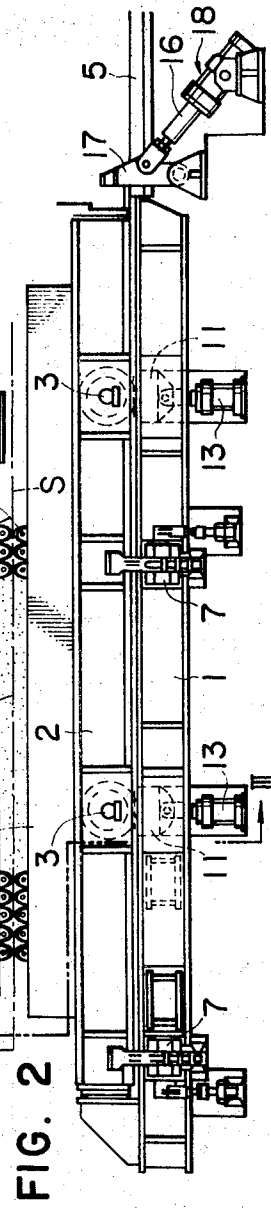
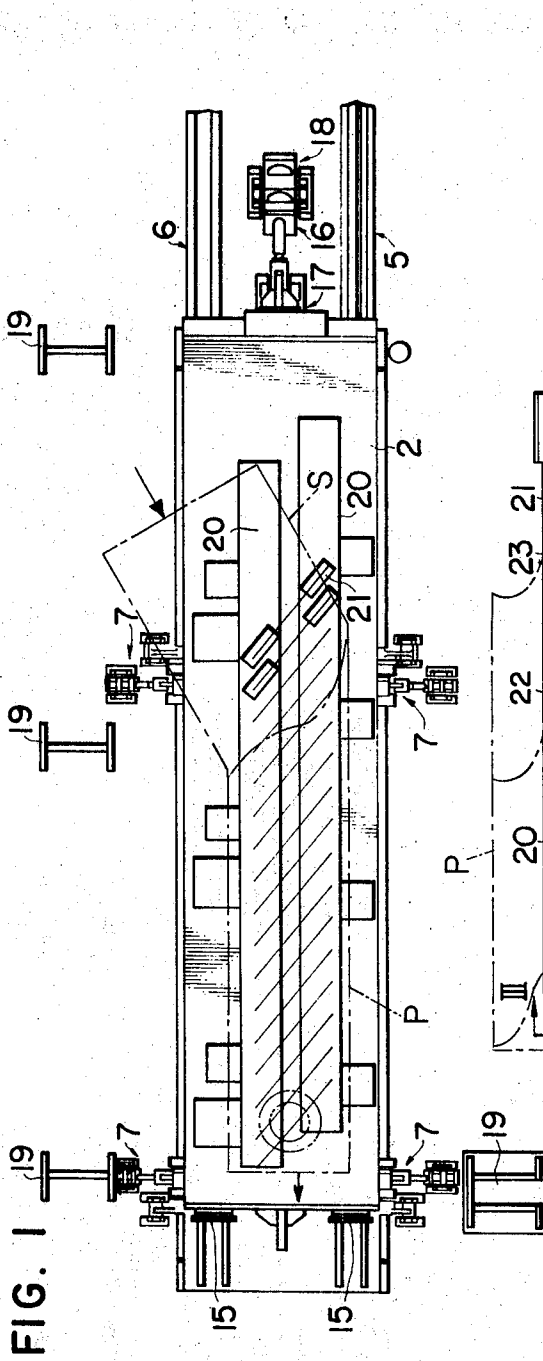


FIG. 1a

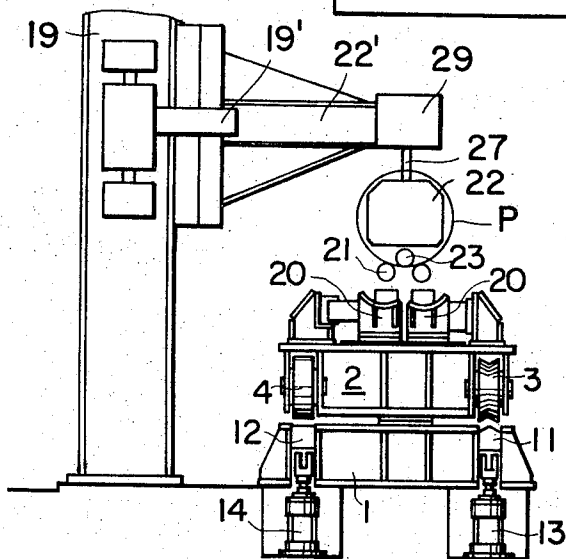
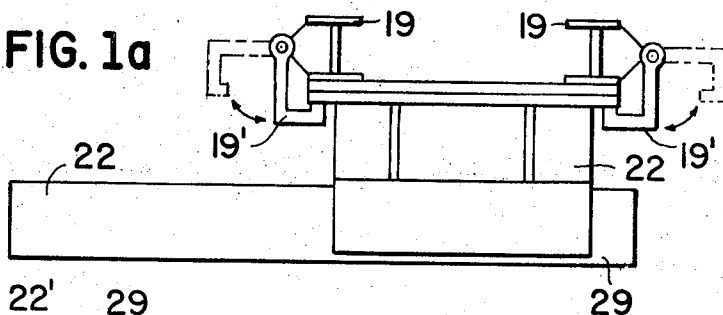


FIG. 3

FIG. 4

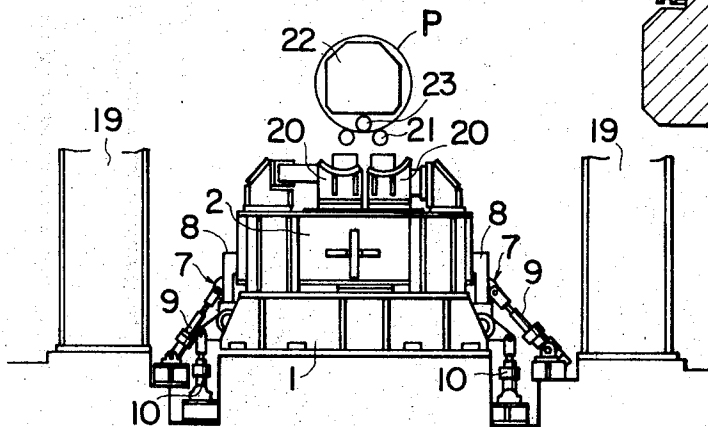


FIG. 7

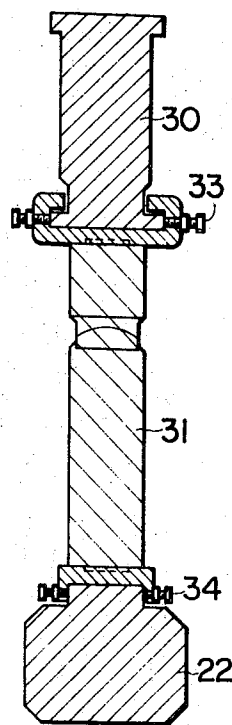


FIG. 5 PRIOR ART

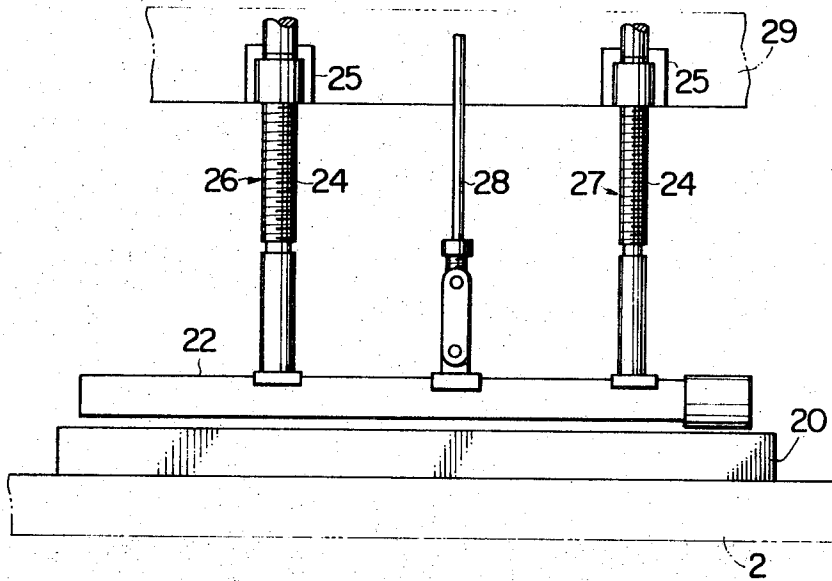
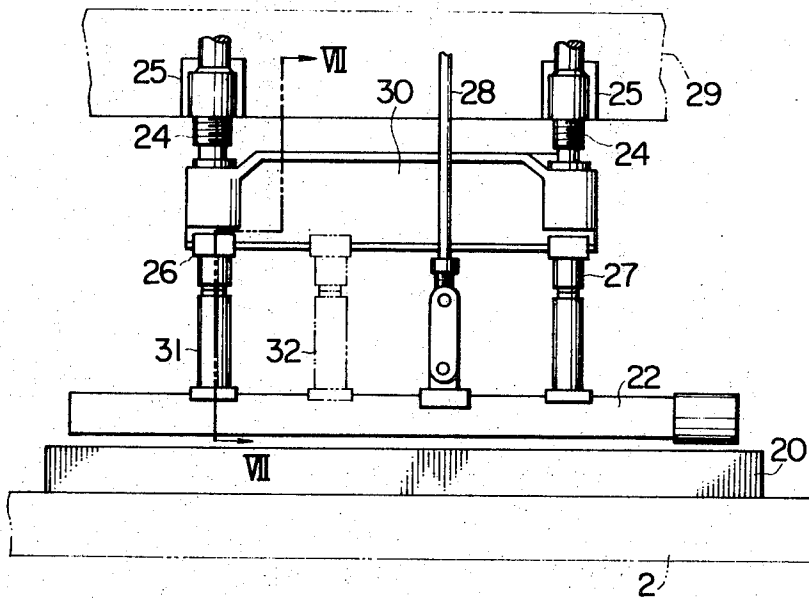


FIG. 6



APPARATUS FOR FORMING SPIRAL STEEL PIPE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an apparatus for forming spiral steel pipe, more particularly to such a device for replacing the forming roll supporting stands having the outer surface forming rolls and inner surface forming rolls thereon with accuracy in a desired position and in a short time, and also to a screw down device for the apparatus.

2. Description of the Prior Art

According to the conventional art prior to the present invention, the replacement of stands for forming spiral steel pipe is carried out by separately removing the inner surface forming roll support stand equipped with inner surface forming or mandrel rolls and the outer surface forming roll support stand equipped with outer surface forming rolls from the apparatus, adjusting them and again placing them back in the apparatus. The mounting of the thus adjusted stands in the limited space of the apparatus, as well as putting them back therein requires a long time and much labor. Besides, in the mounting of the stands, it is difficult to have them reinstalled with accuracy at the right positions, such difficulty affecting the size stabilization of the spiral steel pipe produced.

The screw down device for the conventional type of the apparatus for forming spiral steel pipe, which is driven through a screw 24 and a nut 25 as shown in FIG. 5, or by using a cotter or the like, is so constructed as to apply a forming force to the mandrel roll stand 22 through the two screw down rods 26 and 27, and have it balanced at the balancing point in the vicinity of its center by the balance rod 28 which is always exerting a pulling force by means of an oil pressure cylinder (not shown in the drawings) or a spring.

When spiral steel pipe is formed of steel sheets of various widths by using one and the same apparatus of a conventional type, no great dislocation takes place of the position of screw down device on the forming stand from the position of the forming stand so that the mandrel rolls on the stand can work on steel sheet, even though the screw down rods are fixed, as described above, since the forming point is near the center of the steel sheet.

However, the operation using such a forming point as described above, requires additional work for adjusting the pre-treatment devices for the steel sheet such as the side-trimmer to accommodate various widths thereof.

Therefore, the recent trend has been toward the use of a forming point "L," that is, the forming point has been located in an increasing number of cases at the left end of the material steel sheet in the direction of operation.

This method has an advantage that such pre-treatment devices for the steel sheet as side trimmer can remain fixed. However the operation of the device with the forming point "L" as shown in FIG. 5, tends to cause a great dislocation of the screw down position from the forming position, producing deformation due to the forming force on the mandrel roll forming stand.

SUMMARY OF THE INVENTION

For obviating the abovementioned difficulty inherent in the prior art, the present invention provides an apparatus for forming spiral steel pipe which has a mandrel

roll stand and the outer surface forming roll stand which are both adjustable and replaceable with great ease and in a very short time.

Another object of the present invention is to provide an apparatus for forming spiral steel pipe which is equipped with a mandrel roll stand and an outer surface forming roll stand both of which are adjustable and replaceable with high accuracy in set positions during reinstallation.

Another object of the present invention is to provide an apparatus for forming spiral steel pipe from a variety of steel sheets, with extremely little deformation of the so formed pipe caused by the forming force of the mandrel roll stand.

These objects and other objects of the present invention will become apparent from the following description of embodiments with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan of an apparatus for forming spiral steel pipe according to the present invention.

FIG. 1a is a partial plan view of a portion of the apparatus positioned above the apparatus as shown in FIG. 1.

FIG. 2 is a side view of the apparatus shown in FIG. 1.

FIG. 3 is a sectional view taken on line III — III of FIG. 2.

FIG. 4 is a front view of the apparatus shown in FIG. 1.

FIG. 5 is a side view of an apparatus according to the prior art for forming spiral steel pipe showing the screw down device for the inner surface forming roll stand.

FIG. 6 is a side view of the screw down device for the inner surface forming roll stand according to the present invention.

FIG. 7 is a sectional view of the screw down device shown in FIG. 6 along the line VII — VII.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The following is a detailed description of the preferred embodiment of the present invention with reference to drawings:

As shown in FIGS. 1 and 2, the exterior forming roll stands 20 have a great number of parallel exterior forming rolls 21 freely rotatably mounted on the upper surface of said stands 20, spaced along the long direction of said stands 20, with the axis of each of said rolls 20 being oblique to the long direction of said stands 20. On the lower surface of the interior forming roll, or mandrel roll, stand 22, there are a great number of mandrel rolls 23 mounted in the same manner as the exterior forming rolls 21 on the exterior forming stands 20. One series of mandrel rolls 23 is placed right over two series of exterior forming rolls 21 in a pyramid-like arrangement when viewed sectionally, as seen in FIGS. 3 and 4. Steel strip S is then fed between the two kinds of rolls, that is between the exterior forming rolls 21 and the mandrel rolls 23, obliquely to the long direction of both stands, that is, the exterior forming stand 20 and the interior forming stand 22, in a direction along these rolls 21 and 23. The steel strip S is then pressed against the exterior forming rolls on stands 20 by the mandrel rolls on stand 22 which is forced down by a screw down device (not illustrated), the strip thus

being bent so as to form pipe P, shown in phantom lines.

An outer surface forming roll supporting stand 20 having the outer surface forming rolls 21 thereon, is fixed, by means of bolts, wedge grips, etc., on the upper surface of a truck 2 for the transportation of the main part of the forming apparatus of the present invention (hereafter called the "truck"), said truck 2 being freely movable on rails 5 and 6, which are laid in the long direction of the base 1 of the forming apparatus. In this case, the base 1 of the apparatus is a stand for setting said truck 2 at the position right for the operation of the apparatus.

Said rails 5 and 6 for the movement of said truck 2 may be the normal type, so far as they are effective for the prevention of side-swinging and derailling. In this case, one of said rails 6 has a flat head, and the other has the head shaped like an inverted letter V. Clamps 7 are provided according to the requirement at appropriate positions on both sides of the base 1 for the fixation of said truck 2 to the base 1. They need not be a particular kind, but in this embodiment, each clamp consists of a cylinder 9 for setting into operation and releasing arms 8 holding the truck 2 and another cylinder 10 for moving the arms 8 up and down, so as to fix the truck 2 on the base 1, as shown in FIG. 4.

In FIG. 2 and FIG. 3, raisable and lowerable rail portions 11 and 12 make up parts of said rails 5 and 6 within the base 1, on which portions guiding wheels 3 and 4 on the truck 2 are positioned when the truck 2 stops against stops 15.

The raisable and lowerable rail portions 11 and 12 are moved up and down by means of fluid pressure cylinders 13 and 14, so that when they move, they can be brought level with said rails 5 and 6; therefore, their heads are respectively the same in shape as those of said rails 5 and 6. Stops 15 provided at one end of the base 1 position said truck 2 at the right position on the base 1. A truck pushing device is provided which consists of a pushing arm 17 with one end pivoted for free rotation on the stand and of a pushing cylinder 18 for pressing said pushing arm 17 in the vicinity of its center; said device 16 is provided at the end of the base 1 opposite to the position of the stops 15, for the adjustment of the location of said truck 2 in the long direction of the apparatus then the truck 2 is placed on the base 1. The truck pushing device 16 may function as a clamp, in addition to pushing of the truck 2.

An inner surface forming roll or mandrel roll, stand having inner surface forming rolls 23 mounted thereon, is held firmly by holding frames 19 on each side of the base 1.

The mandrel roll stand 22 is releasably supported on the holding frames 19 through housing 29 by a supporting frame 22', which in turn is releasably clamped to the upright holding frames 19 by pivotable clamp member 19' mounted on the holding frames 19.

In the apparatus of the present invention, the replacement of forming stands is so carried out that in the first place, the mandrel roll supporting stand 22 is released from the holding frames 19, and is placed on the outer surface forming roll supporting stand 20, and then all the clamps 7 are released and the rail portions 11 and 12 are moved up respectively by the cylinders 13 and 14 until they are level with said rails 5 and 6 for connection therewith. At the same time, said truck 2 moves up on its guiding wheels 3 and 4 to the level of

the rails 5 and 6. In other words, said truck 2 is so placed as to run on the rails 5 and 6.

Then, by using any appropriate type of trailer (not shown in the drawings), the truck 2 is rolled off the base 1. Then, the truck 2 may be replaced by another truck 2 already having an outer surface forming roll supporting stand 20 and a mandrel roll supporting stand 22, or it may have another outer surface forming roll supporting stand 20 and another mandrel roll supporting stand 22 mounted thereon and moved back onto the base 1 by the trailer (not shown in the drawings), whichever is convenient.

The replacing of the truck 2 with the new or substituted stands thereon, is complete when the truck stops against the stops 15. At that time, the portions 11 and 12 of the rails 5 and 6 respectively supporting the guiding wheels 3 and 4 of the truck 2 are moved down respectively by the cylinders 13 and 14 so as to lower the truck 2 onto the base 1. As there are concavities made in the bottom of the truck 2 they are engaged with convexities of the rails 5 and 6, setting the truck 2 firmly at the right position and preventing its side-dislocation during the forming of the spiral pipes.

Then, the position of the truck 2 in the long direction of the apparatus when the truck 2 is lowered onto the base 1, is adjusted by pushing the truck 2 against the stops 15 again and again by means of the truck pushing device 16. After that, the truck 2 is fixed on the base 1 with the clamps 7.

On the other hand, the mandrel roller supporting stand 22 is disconnected from the temporary connection with the outer surface forming roll supporting stand 20, and is fixed to the holding frames 19 at the proper position.

In reference to FIG. 6 one embodiment of the screw down device for the mandrel roller supporting stand according to the present invention is shown.

A balance rod 28 extends downwardly from above toward the vicinity of the central part of the stand 22, and the lower end is connected to said central part of the stand 22 and the top is connected with a liquid pressure cylinder or spring (not illustrated). The stand 22 receives upward force produced by said liquid pressure cylinder or spring and transmitted through said balance rod 28, so as to balance said stand 22 against a downward screw down force. Housing 29 is releasably mounted on said supporting frames 19 and on housing 29 are mounted said downward screw down force producing means and said liquid pressure cylinder or spring. Screw down rods 26 and 27 supply forming force to the stand 22, both of which are set by a screw 24, and are rotated by the driving force supplied from a power source (not shown) through nuts 25 attached to the housing 29, releasably mounted on supporting frames 19, generating the forming force. A screw down device using a cotter instead of a screw is also useful for this purpose. The abovementioned two screw down rods 26 and 27 are connected to each other by a screw down connection beam 30; and one of the rods 26 and 27 the screw down rod 26 placed in the vicinity of the end of the stand 22 has an end piece 31 freely movable along the screw down connection beam 30 toward the screw down rod 27, say, as far as the position 32 shown in the drawing.

The movable connection means between the end piece 31 of the screw down rod and the screw down connection beam 30 and between the end piece 31 of

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the screw down rod and the forming stand 22, are the form of dovetail grooves as shown in FIG. 7. But such means are not limited to this construction. Set screws 33 and 34 are provided for fixing the end piece 31 to the stand 22 at the right positions. The movement of the end piece 31 of the screw down rod 26 depending on the width of the steel sheets S may be made automatically or manually, whichever is convenient.

What is claimed is:

1. In an apparatus for forming spiral steel pipe by pressing a steel strip against exterior forming rolls by mandrel rolls so as to bend said steel strip spirally, the mandrel rolls being mounted on a mandrel roll supporting stand and the exterior forming rolls being mounted on exterior forming roll supporting stands, the mandrel roll supporting stand being above the exterior forming roll supporting stands, the improvement comprising a freely movable truck having said exterior forming roll supporting stands fixedly mounted on the upper surface thereof, rails on the base of the apparatus on which said truck is movably mounted, said rails having raisable and lowerable portions at the positions where said truck is supported thereon when said exterior forming rolls are at their operative positions on the apparatus, clamps along said base engageable with said truck for fixing said truck at a predetermined position on the base, and supporting frame means adjacent said rails for releasably supporting said mandrel roll supporting stand at its operative position above said exterior forming roll supporting stands, whereby with the exterior forming roll supporting stand resting on said truck, said rail portions can be raised and said mandrel roll supporting stand released from said supporting frame means to rest on said exterior forming roll supporting

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stand, and said truck can be moved along said rails to remove both stands from the apparatus, and the stands can be replaced in the apparatus by a reverse sequence of operations.

2. The improvement as claimed in claim 1 in which said rail portions comprise fluid pressure operated piston-cylinder means for raising and lowering the rail portions.

3. The improvement as claimed in claim 1 in which said clamps each comprise a clamp member mounted on said base for movement up and down relative to said truck, first fluid pressure piston-cylinder means coupled to said clamp member for moving said clamp up and down and a second fluid pressure piston-cylinder means coupled to said clamp for urging said clamp member toward said truck for tightly engaging said clamp member with said truck.

4. The improvement as claimed in claim 1 in which said base has a stop thereon against which said truck abuts when it is in the operative position, and a truck pushing means at the opposite end of the base from the stop for urging said truck into engagement with said stop.

5. The improvement as claimed in claim 1 in which a screw down connection is provided for mounting said mandrel roll supporting stand, said screw down connection comprising a pair of screw down rods spaced along the length of the mandrel roll supporting stand and a connecting beam extending between said screw down rods, one of said screw down rods having at least a portion thereof movably connected to said connecting beam for movement along said beam toward the other screw down rod.

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