July 22, 1941. C. J. KLEIN 2,250,025

COIL HANDLING APPARATUS

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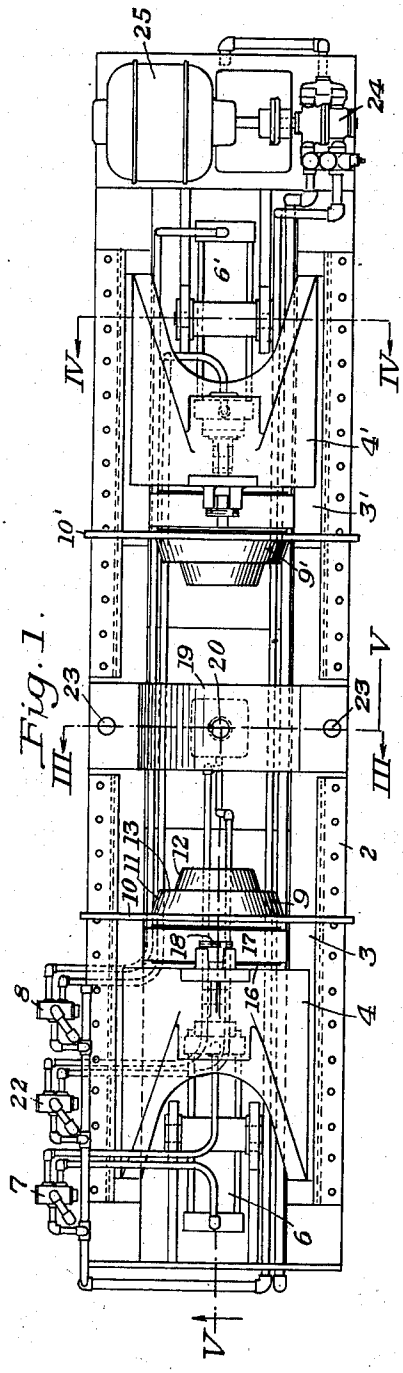


Fig. 1.

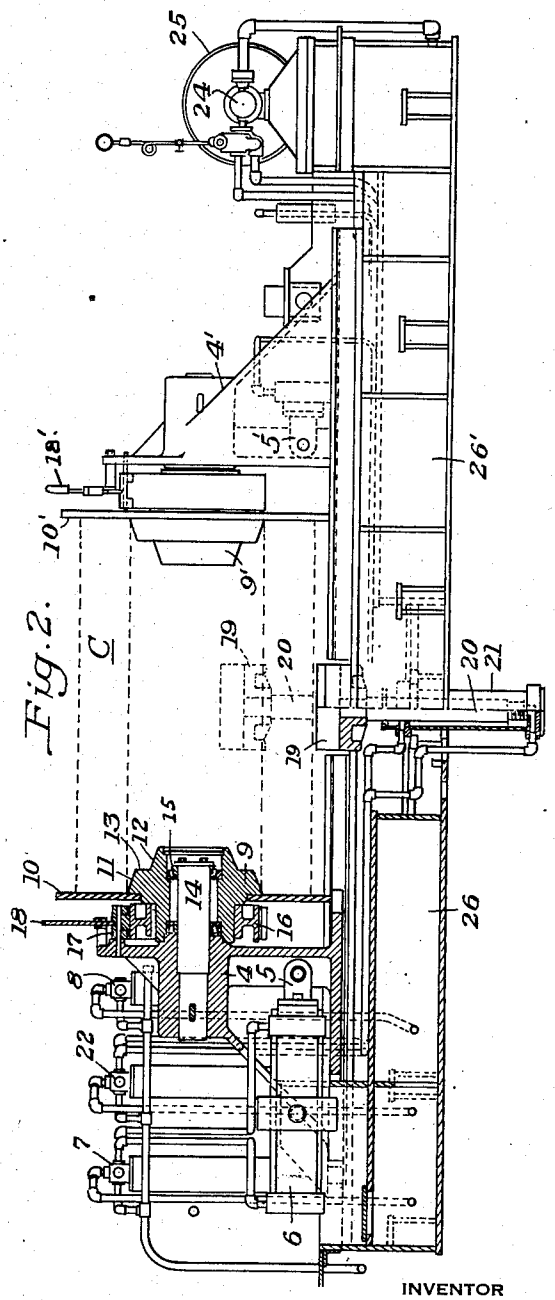


Fig. 2.

INVENTOR

Clarence J. Klein

BY Stebbins, Blenko & Parmelee

ATTORNEYS

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Fig. 3.

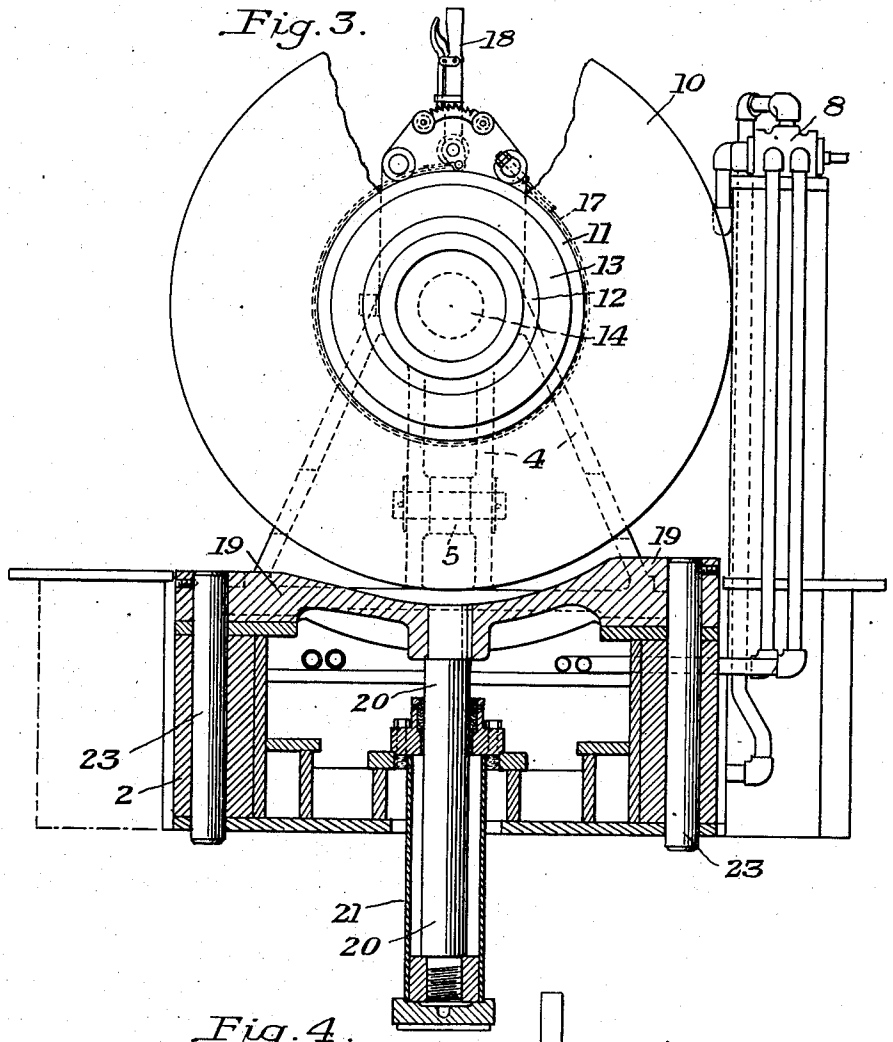
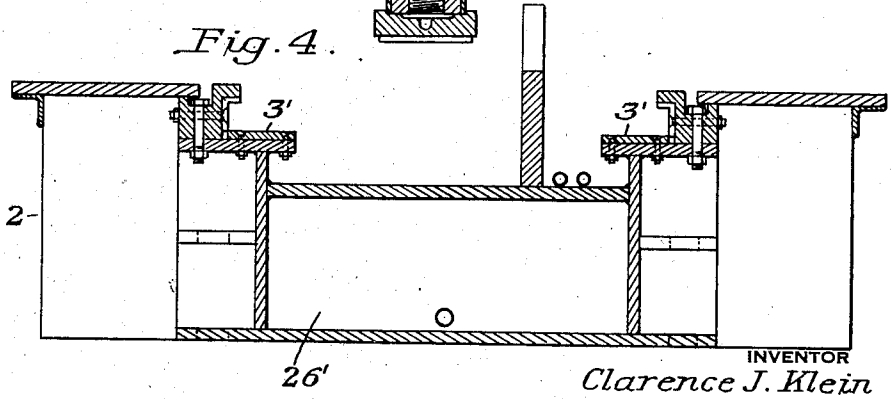


Fig. 4.



INVENTOR

Clarence J. Klein

By Stebbins, Blenko & Pannell

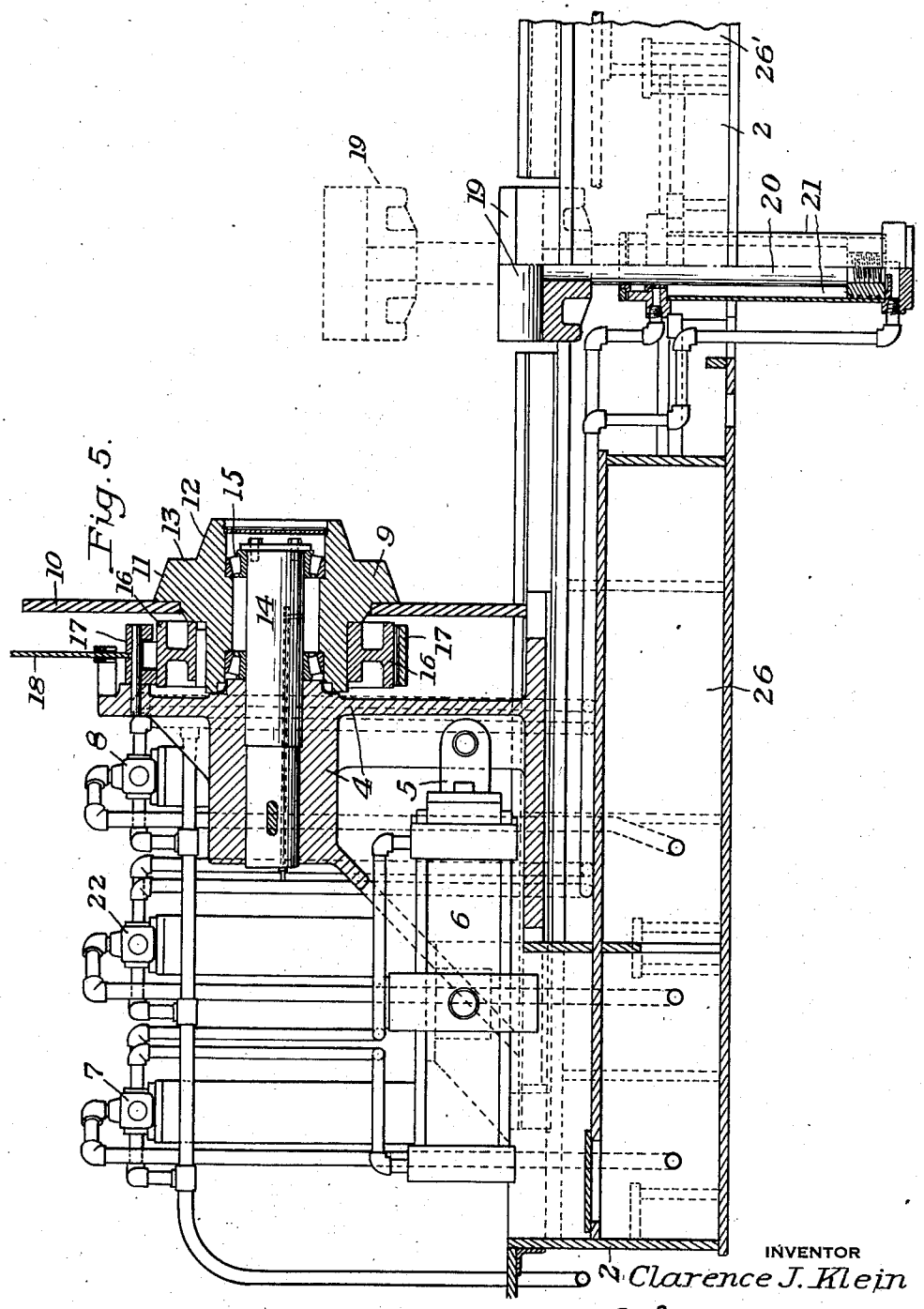
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Fig. 5.



INVENTOR
Clarence J. Klein
By Stebbins, Blenko & Parmelee
ATTORNEYS

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2,250,025

COIL HANDLING APPARATUS

Clarence J. Klein, Marland Heights, W. Va.

Application September 29, 1938, Serial No. 232,344

11 Claims. (Cl. 242—78)

This invention relates broadly to apparatus for handling material and more particularly to apparatus suitable in the rolling mill industry for handling and unwinding coils of strip sheet metal, of various widths.

At the present time it is the customary practice in the rolling mill art to coil, into a hollow roll, strip sheet metal after it is delivered by the last stand of rolls in order to facilitate handling of the material during further treatment thereof. This practice reduces the space required by the mill to a minimum and the metal so coiled is easy to handle. The metal must be smoothly unwound from the coil for subsequent operations thereon, for example, before it is passed through a cold mill or a cleaning and cutting line, and this necessitates that the apparatus function in such a manner that the coil will be kept in circular form and closely coiled. This requires that a retarding force be exerted by the apparatus on the coil; otherwise the coiled metal will tend to uncoil itself and kink. I provide an apparatus by means of which sufficient resistance to the turning of the coil may be exerted so that the metal of the coil is kept at the desired tension and properly coiled while it is being unwound.

The coils vary both in width and diameter and the open center of the coil varies in diameter. By means of the present invention I provide an improved coil apparatus adapted to center the coils regardless of their width and internal diameter and hold the coils in such a manner that the strip material may be uniformly drawn therefrom as required, for example, during a cold rolling operation. My apparatus also functions to automatically keep the contour of the coils truly circular and the center line of the coil in line with apparatus to which the strip is being fed and thus facilitate the proper unwinding of the material.

A further object of my invention is to provide an apparatus wherein the placing of a coil of sheet metal in operative position in the uncoiling apparatus is facilitated and wherein the sheet, after it is uncoiled, passes from the apparatus under a desired tension, the apparatus itself exerting a desired resistance to the free rotation of the coil.

In my apparatus I support the coil on opposed cones which engage the opening in the hollow coil and which turn with the coil. I provide means for exerting a force which retards the turning of the coil holders and this force can be adjusted within desired limits. I thus control the pull necessary to unwind the coil. Any suitable means may be employed for resisting the turning movement of the cones and of the coil and the resisting force may be used to generate electricity when the coil is being unwound, or a comparatively simple brake arrangement can be provided for the cones.

In the accompanying drawings, I have shown for purposes of illustration only certain features of the present invention, which features constitute certain preferred embodiments of my invention.

In the drawings:

Figure 1 is a top plan view of a coil handling apparatus constructed in accordance with the present invention.

Figure 2 is a view partly in side elevation and partly in vertical section of the structure illustrated in Figure 1;

Figure 3 is a vertical sectional view taken along the line III—III of Figure 1 but to an enlarged scale;

Figure 4 is a vertical sectional view of the base portion of the apparatus taken along the line IV—IV of Figure 1 to an enlarged scale; and

Figure 5 is a view in vertical section along the line V—V of Figure 1, but to an enlarged scale.

In the drawings there is illustrated a supporting frame 2 having therein guideways 3 in which the opposed coil supporting stands 4 and 4' are movable toward and away from each other. Since these coil supporting stands are alike, only one of them will be described and wherever a number is applied to one stand, the same number with a suffix prime (') affixed thereto will designate a similar part in the other coil supporting stand.

The coil supporting stand 4 is connected to a plunger 5, which plunger works in a hydraulic cylinder 6 secured to the frame 2. The plunger 5 may be extended or retracted at will and thus move the stand 4. When the plunger 5 is extended it will move the coil supporting stand 4 toward the center of the apparatus, that is, to the right as viewed in Figure 2. The movement of plunger 5 is controlled by means of a hydraulic valve 7. Similarly, the movement of plunger 5' can be controlled by valve 8. It is understood that in place of valves 7 and 8 one valve only need be employed, in which case the piping is arranged so that hydraulic pressure to the cylinders 6 and 6' is simultaneously controlled so that by manipulation of such a valve, the coil supporting stands will move toward or away from one another.

Each of the coil supporting stands 4 and 4' have journaled therein coil-cones or coil trunnions 9 and 9'. The coil trunnion 9 has a head 10 which, when certain size coils are being handled, will bear against the end thereof as shown in Figure 2, in which the coil C is represented by dotted lines. The coil trunnion 9 has tapered bearing portions or coil supports 11 and 12 projecting therefrom for engaging the openings in the hollow coil C. These tapered bearing portions 11 and 12 are arranged in steps. In the drawings two steps are illustrated, but it is apparent that any number of steps may be provided. This arrangement takes care of coils having inside openings of various diameters. The portions 11 and 12 are frusto-conical, the largest diameter of the outer step 12 being less than the smallest diameter of the inner step 11, thereby providing a flat bearing portion or head 13 between the steps. The frusto-conical bearing portions 11 and 12 are concentric with each other and with the coil trunnion 9, which is concentrically supported on a shaft 14 preferably by means of anti-friction bearings such as roller bearings 15. The shaft 14 is supported in and keyed to the coil supporting stands 4 and movable therewith.

Secured to the coil trunnion 9 and concentric therewith is a brake drum 16. Cooperating with the brake drum 16 is a brake 17 of the friction type adapted to be adjusted by a brake lever 18. In actual practice the brake is so adjusted that overrunning of the coil under the pull exerted when it is being unwound will not be permitted and it is preferably such as to exert an appreciable amount of tension on the strip material, thereby preventing kinking or bending thereof. If desired, the coil trunnion 9 may be directly geared to the slow speed shaft of a motor gear reducing unit which can be used as a drag and payoff unit. In some instances the connections and circuit of the electrical equipment can be such that power is generated by the retarding influence exerted on the material being unwound. The generator can be connected, for example, in a dynamic braking circuit.

By reason of the hydraulically operated separate plungers 5 and 5' and connected mechanism, the coil stands 4 may be maintained at a substantially uniform distance from opposite sides of a predetermined center line. This center line may correspond to the center line of the mill or apparatus in which the strip from the coil C is to be further processed. It is thus possible, by means of my coil handling apparatus, to always maintain the coil in proper relationship to the apparatus in which the strip material is to be further processed and to handle coils of various widths and having various coil openings.

Entry of the portions 11 and 12 into the coils is facilitated by reason of the tapered construction of the coil trunnion 9. Entry of the portion 11 or 12 into the coils having been accomplished by manipulation of the valves 7 and 8, the valves 7 and 8 are further manipulated to advance the stands 4 and 4' toward each other to an extent sufficient to firmly seat the coils on the frusto-conical surfaces 11 or 12 and against either the head 13 or the head 10. When this advancing movement has been completed, the coil is automatically centered with respect to the axis of rotation of the shaft 14. If the coil should happen to be of elliptical contour, which sometimes happens, the movement of the trunnions is also effective for rounding the coil in such a manner as to impart to it a substantially circular contour. Such a contour is necessary and highly desirable for proper unwinding of the material of the coil.

Midway between the coil trunnions 9 and 9', at the center line of the apparatus, there is provided means for lifting the coil to a position such that the coil trunnions 9 and 9' may engage the open ends of the coil. This means consists of a curved coil saddle 19 mounted on a plunger 20 which plunger works in a hydraulic cylinder 21 whereby it may be vertically raised at the will of the operator from a position below and clear of the tapered coil supports as shown in the full line position in Figure 2 to any desired position such as shown, for example, in dotted lines, and lowered as desired. The raising and lowering of the coil saddle 19 is controlled by means of the hydraulic valve 22, which is connected by appropriate piping to the cylinder 21 and is located adjacent the valves 7 and 8. The saddle 19 is so disposed that the coil is held with its longitudinal axis substantially parallel to the longitudinal axis extending through the coil trunnions 9 and 9'. After the coil has been placed on the saddle 19, fluid is admitted to the cylinder 21 by the operation of the valve 22 and the coil saddle is raised sufficiently to bring the opening in the center of the coil into alignment with the tapered coil supports 11 or 12. The coil stands are then moved by the operation of the valves 7 or 8 so that the appropriate tapered portion 11 or 12 enters and supports the coil. After the coil is seated on the appropriate tapered portion, the saddle 19 is lowered out of contact with the periphery of the coil, by the operation of the valve 22.

To insure vertical planar movement, and lateral support for the coil lifting means, there is provided at each side of the saddle 19, pins 23, which are slidably received in appropriate passages in the sides of the frame 2. The pins 23 and the piston 20 are parallel to each other and their axes lie in a common plane. The arrangement of the saddle and associated structures is such that a plane will pass substantially through the center line of each trunnion 9 and 9' and through the center line of the plunger 20. This insures that the center line of a coil raised to trunnion engagement position by the coil saddle 19 will be in line with the center line of the trunnions 9 and 9'.

Fluid pressure may be supplied to the coil supporting stands and to the cradle apparatus from any desired source. In the drawings I have shown a hydraulic pump 24 which is coupled to an electric motor 25. Operation of the motor 25 provides the hydraulic power necessary to operate the plungers 5, 5' and 20. Water, after passing through the various cylinders, is discharged through the valves 7, 8 and 22 and flows to the sumps 26 and 26' from whence it is recirculated by the pump 24. The control valves 7, 8 and 22 are grouped together in a suitably convenient position.

I have provided apparatus which is extremely economical to construct, is self-contained, is positive in operation and which can readily be operated so as to securely hold the coil in proper unwinding position and condition and to exert a braking action thereon, so as to impede free rotation of the coil to prevent the possibility of overrunning thereof when the strip is being unwound from the coil. The apparatus is of compact form, may be readily installed, is conveniently con-

trolled, requires comparatively small floor space, and can accommodate coils of various widths and having various sized coil openings.

While I have illustrated and described certain preferred embodiments of my invention, it will be understood that the invention is not limited thereto but may be otherwise embodied and practiced within the scope of the following claims.

I claim:

1. In apparatus for handling hollow coils, a supporting frame, a pair of coil supporting stands slidably mounted on the frame, fluid operated means for moving said stands toward and away from each other, said stands including tapered coil trunnions adapted to center a coil thereon by engagement with the inside wall of the coil, means carried by said trunnions to engage the ends of the coil after the tapered trunnions are moved to position within the coil, a vertically adjustable coil saddle adapted to support a coil and move it to a position to engage the coil supporting stands, fluid operated means for raising and lowering the saddle, a fluid reservoir in said frame and a single fluid pressure generating unit for supplying fluid under pressure to each of said fluid-operated means.

2. In apparatus for handling hollow coils, a supporting frame, a pair of coil supporting stands slidably mounted on the frame, fluid operated means for moving said stands toward and away from each other, a vertically adjustable coil saddle adapted to support a coil and move it to a position to engage the coil supporting stands, fluid operating means for raising and lowering the saddle, means to insure planar movement of the saddle, a fluid reservoir in said frame and a single fluid pressure generating unit for supplying fluid under pressure to each of said fluid-operated means.

3. In combination, a frame, a vertically movable coil positioning device, comprising a saddle connected to a plunger, the plunger being movably received in a cylinder connected to the frame, means to prevent rotation of the saddle, coil supporting stands comprising opposed frusto-conical supports disposed above the coil positioning device and adapted to support and receive a coil between them, a plunger connected to each stand, cylinders connected to the frame and in which each plunger is received, a pump for supplying fluid under pressure to the cylinders, means for controlling the supply of fluid under pressure to each of the cylinders and a sump in said frame for receiving the fluid after it has passed through the cylinders.

4. In apparatus for handling hollow coils, a supporting frame, a pair of coil-supporting stands slidably mounted on the frame, said stands having mounted thereon tapered coil trunnions adapted to center a coil thereon by engagement while the inside wall of the coil, a fluid-operated cooperating pistion and cylinder interposed between each of the stands and the frame and mounted below the trunnions for moving said stands toward and away from each other, means carried by said trunnions to engage the ends of the coil after the tapered trunnions are moved to position within the coil, means for supplying fluid under pressure mounted on said frame, and valves adjacent each other for controlling the supply of fluid under pressure to each of the cylinders.

5. In apparatus for handling hollow coils, a supporting frame, a pair of opposed coil-supporting stands mounted on the frame, each of said stands including an inwardly projecting frusto-conical support mounted thereon and rotatable about a common axis, a plunger and cooperating cylinder in which the plunger is received interposed between and connected to each of said stands and the frame and below the axis of rotation of said frusto-conical support, means for supplying fluid under pressure to the cylinders, means for controlling the supply of fluid under pressure to the cylinders, a sump in said frame for receiving the fluid flowing from the cylinders, and means for imposing a resistance to rotation of said frusto-conical support.

6. In combination, a frame, a vertically movable coil-positioning device on the frame comprising a saddle connected to a plunger, the plunger being movably received in a cylinder, means to prevent rotation of the saddle, coil-supporting stands including opposed frusto-conical supports disposed above the coil-positioning device and adapted to support and receive a coil between them, piston and cooperating cylinder fluid-operated means interposed between each of the stands and the frame for moving the stands relative to each other and to the frame, means whereby fluid pressure may be supplied for moving the plunger and the pistons, and a fluid-retaining space in the frame for receiving fluid discharged from said cylinders.

7. In apparatus for handling hollow coils, a supporting frame, a pair of oppositely disposed coil-supporting stands slidably mounted on the frame, each of said stands having mounted thereon inwardly projecting frusto-conical supports rotatable about a common axis, a fluid-operated motor having cooperating plunger and cylinder members connected between each stand and the frame and eccentric of the axis of rotation of the frusto-conical supports for moving the stands relative to the frame, one member of each motor being secured to the frame and the other member of each motor being connected with the stand which it operates, a vertically adjustable coil saddle adapted to support a coil and move it to a position to be engaged by the frusto-conical supports disposed between the stands, a fluid-operated motor having cooperating plunger and cylinder members interposed between the frame and the saddle, one member being connected with the frame and the other member with the saddle, a pump on the frame for supplying fluid under pressure to all the cylinders, valve means mounted on the frame for controlling the supply of fluid to each cylinder, and a sump in which the fluid discharged from the cylinders is received.

8. In apparatus for handling hollow coils, a supporting frame, a pair of oppositely disposed coil-supporting stands slidably mounted on the frame, each of said stands having mounted thereon inwardly projecting frusto-conical supports rotatable about a common axis, a fluid-operated motor having cooperating plunger and cylinder members connected between each stand and the frame and eccentric of the axis of rotation of the frusto-conical supports for moving the stands relative to the frame, one member of each motor being secured to the frame and the other member of each motor being connected with the stand with which it operates, a vertically adjustable coil saddle adapted to support a coil and move it to a position to be engaged by the frusto-conical supports disposed between the stands, a fluid-

operated motor having cooperating plunger and cylinder members interposed between the frame and the saddle, one member being connected with the frame and the other member with the saddle, means for preventing rotation of the saddle, a pump mounted on the frame for supplying fluid under pressure to all of the cylinders, and means for controlling the supply of fluid to the cylinders.

9. In apparatus for handling coreless metal coils, a supporting frame, a pair of coil-supporting stands slidably mounted on the frame, each of said stands including a coil support having inwardly projecting stepped frusto-conical surfaces of various sizes, said coil supports being concentrically arranged and rotatably supported on the stands, a fluid-operated motor having cooperating plunger and cylinder members connected between each stand and the frame for moving the stands relative to the frame, one member of each motor being secured to the frame and the other member of each motor being connected with the stand which it operates, a vertically movable coil-positioning device connected to the frame and comprising a saddle, a fluid-operated plunger and cooperating cylinder device interposed between the saddle and the frame for raising and lowering the saddle, means to prevent rotation of the saddle, a pump mounted on the frame for supplying fluid under pressure to each of the cylinders, and means for controlling the supply of fluid under pressure from the pump to the cylinder.

10. In apparatus for handling coreless metal coils, a supporting frame, a pair of coil-supporting stands slidably mounted on the frame, each of said stands including a coil support having inwardly projecting stepped frusto-conical surfaces of various sizes, said coil supports being concentrically arranged and rotatably supported on the stands, a fluid-operated motor having cooperating plunger and cylinder members connected between each stand and the frame for moving the stands relative to the frame, one member of each motor being secured to the frame and the other member of each motor being connected with the stand which it operates, a vertically movable coil-positioning device connected to the frame and comprising a saddle, a fluid-operated plunger and cooperating cylinder device interposed between the saddle and the frame for raising and lowering the saddle, means to prevent rotation of the saddle, a pump mounted on the frame for supplying fluid under pressure to each of the cylinders, means for controlling the supply of fluid under pressure from the pump to the cylinder, and a sump on said frame for receiving the fluid from the cylinders and from which fluid may be supplied to the pump.

11. In apparatus for handling hollow coils, a supporting frame, a pair of coil supporting stands slidably mounted on the frame, each of said stands including a coil support having inwardly projecting, stepped, frusto-conical surfaces of various sizes, said coil supports being concentrically and rotatably supported on the stands, a plunger connected to each of said stands below the axis of rotation of the said supports, a cylinder connected to the frame and in which each plunger is received, means for supplying fluid under pressure to the cylinders, means for controlling the supply of fluid under pressure and a sump in said frame for receiving the fluid flowing from the cylinders.

CLARENCE J. KLEIN.