

H. S. HUMPHREY.
COIL WINDING MACHINE.
APPLICATION FILED MAY 31, 1913.

1,165,779.

Patented Dec. 28, 1915.

3 SHEETS—SHEET 1.

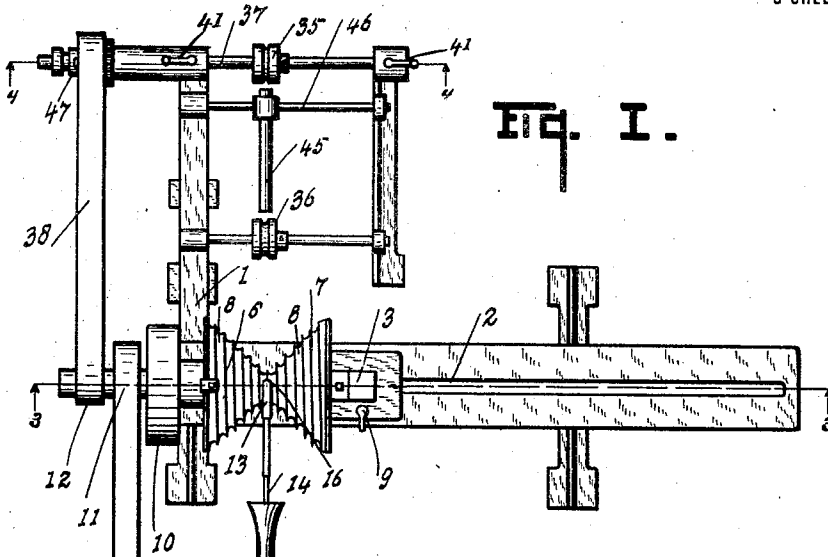


Fig. I.

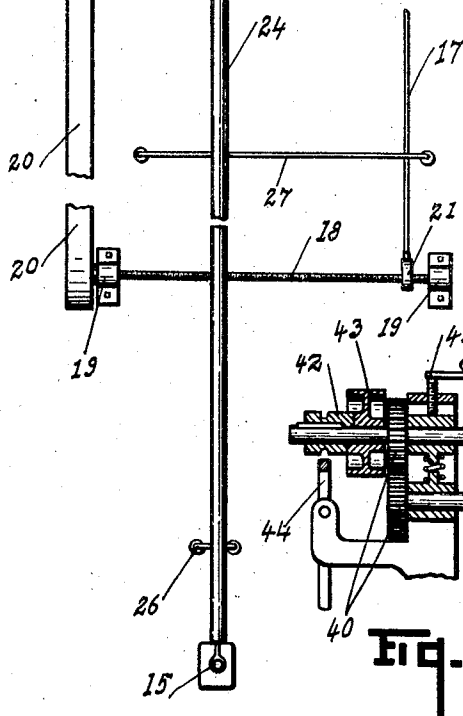


Fig. IV.

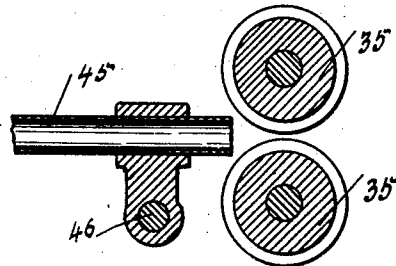


Fig. V.

Witnesses
M. J. Woodruff
M. L. Glasgow

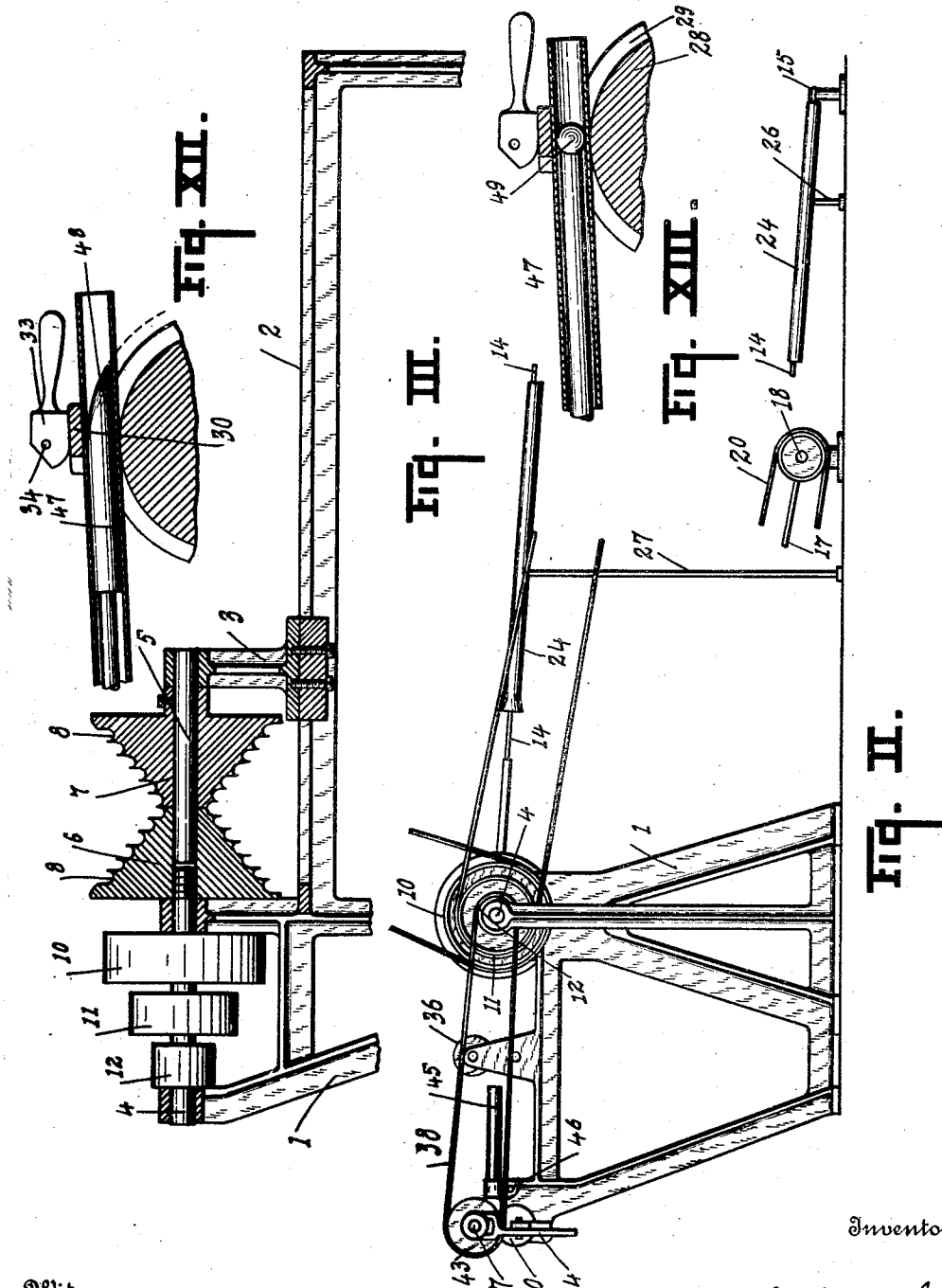
Inventor
Herbert S. Humphrey
By Chappell & Earl
Attorneys

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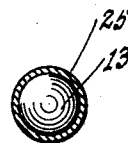
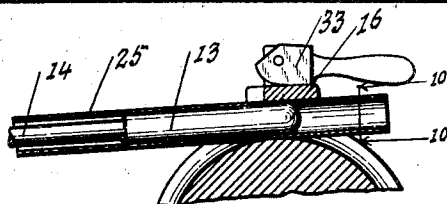
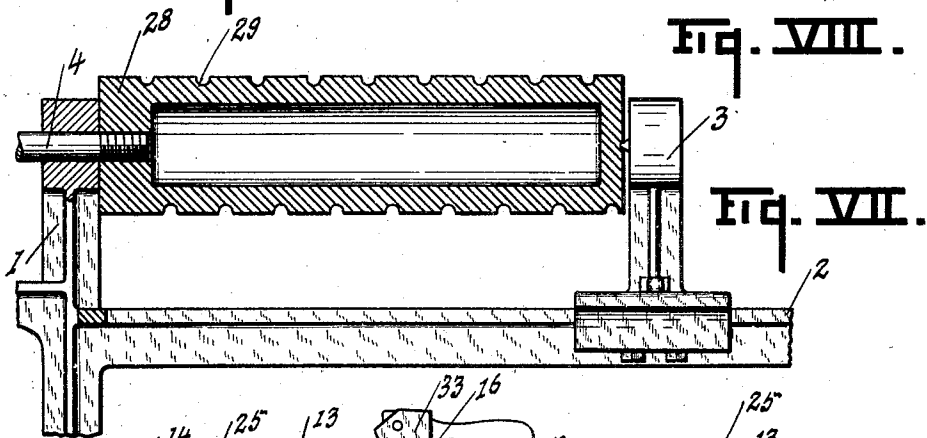
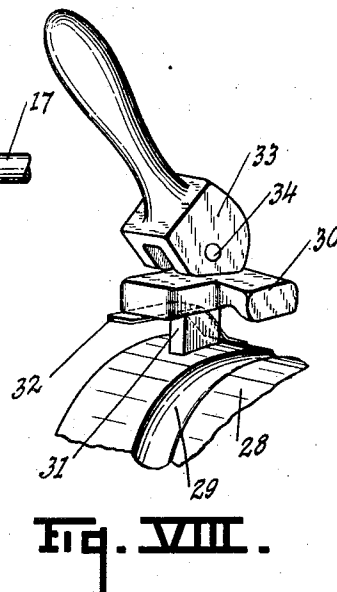
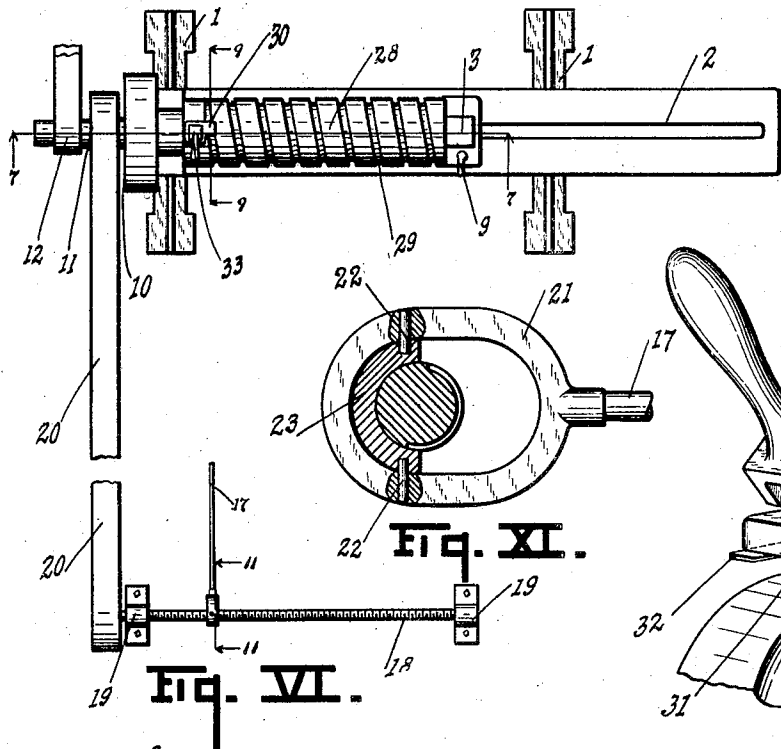
Inventor
Herbert S. Humphrey
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3 SHEETS—SHEET 3.



Inventor

Fig. X.

Fig. IX.

Witnesses
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M. L. Glasgow.

Herbert S. Humphrey
Chappell & Earl
Attorneys

UNITED STATES PATENT OFFICE.

HERBERT S. HUMPHREY, OF KALAMAZOO, MICHIGAN.

COIL-WINDING MACHINE.

Specification of Letters Patent.

Patented Dec. 28, 1915.

1,165 779.

Application filed May 31, 1913. Serial No. 771,057.

To all whom it may concern:

Be it known that I, HERBERT S. HUMPHREY, a citizen of the United States, residing at Kalamazoo, Michigan, have invented certain new and useful Improvements in Coil-Winding Machines, of which the following is a specification.

This invention relates to improvements in coil winding machines.

My improvements are especially designed by me for use in the manufacture of coils for water heaters, and I have shown my improvements embodied in a machine for that purpose. My improvements may, however, be readily adapted or embodied in a machine for forming tubular coils for various purposes.

The main objects of this invention are: First, to provide an improved coil winding machine by means of which tubular coils may be rapidly and accurately produced. Second, to provide an improved coil winding machine by means of which double helically coiled tubular coils may be effectively produced. Third, to provide an improved coil winding machine which is of large capacity and may be successfully operated by an unskilled workman. Fourth, to provide an improved coil winding machine which is simple in structure and at the same time very durable.

Further objects, and objects relating to structural details, will definitely appear from the detailed description to follow.

I accomplish the objects of my invention by the devices and means described in the following specification.

The invention is clearly defined and pointed out in the claims.

A structure which is a preferred embodiment of my invention is clearly illustrated in the accompanying drawing forming a part of this specification, in which:

Figure I is a detail plan view of a structure embodying the features of my invention, the frame and driving connections being shown mainly in conventional form. Fig. II is a detail side elevation looking from the left of Fig. I. Fig. III is a detail vertical section taken on a line corresponding to line 3—3 of Fig. I. Fig. IV is a detail vertical section taken on a line corresponding to line 4—4 of Fig. I, showing details of the pipe straightening feed rollers. Fig. V is an enlarged detail vertical section on a line corre-

sponding to line 5—5 of Fig. IV. Fig. VI is a detail plan view showing a form for producing cylindrical coils as distinguished from helical coils. Fig. VII is a detail vertical section on a line corresponding to line 60 7—7 of Fig. VI. Fig. VIII is an enlarged detail perspective of the pipe clamp. Fig. IX is a detail vertical section on a line corresponding to line 9—9 of Fig. VI, showing a pipe or tube secured by the clamp and also 65 showing the operative relation of the mandrel and form. Fig. X is an end view of the pipe or tube with the mandrel therein. Fig. XI is an enlarged detail section through the feed screw, on a line corresponding to 70 line 11—11 of Fig. VI. Fig. XII is a vertical section corresponding to that of Fig. IX, showing a modified form of mandrel, the modification being in the shape of the end 75 of the mandrel. Fig. XIII is a similar vertical section showing a further modification of the mandrel.

In the drawing similar reference characters refer to similar parts throughout the several views, and the sectional views are 80 taken looking in the direction of the little arrows at the ends of the section lines.

Referring to the drawing, the frame 1 is provided with a way 2 for the carriage 3. The driving shaft 4 is supported in suitable 85 bearings on the frame, while the carriage 3 is provided with a shaft or spindle 5 in axial alinement with the shaft 4.

The form shown in Fig. I is especially designed for use in the manufacture of double 90 helically coiled coils. The form comprises a pair of opposed conical sections 6 and 7 having spiral grooves 8 therein. The section 6 is secured to the shaft 4, while the section 7 is mounted on the shaft or spindle 5. 95 The shaft 5, when the sections are brought end to end, as shown, is adapted to extend into the section 6, thus assisting in supporting and alining the sections. The carriage 3 is adjustably secured on its way by means of 100 the clamp 9. The carriage and ways are shown in conventional form only as their details form no part of this invention. The shaft 4 is provided with pulleys 10, 11 and 12, all fixed to rotate therewith. The man- 105 drel 13 is supported by the rod 14 which is pivoted at 15 at the rear of the form. This rod is disposed so that the end of the mandrel is supported at the point where the pipe bends as it is wrapped around the form. The 110

mandrel is provided with a spherical end 16 in the preferred construction, and this is found to effectively support the walls of the tube so that they do not collapse as the tube or pipe is wrapped about the form.

In the embodiment shown in Fig. I the rod 14 is of such length that the position of the mandrel relative to the form is not varied in an objectionable degree. Where a shorter rod 17 is used as in the embodiment shown in Fig. VI, a feed screw 18 is provided. This feed screw is supported in suitable bearings 19 and is connected by the belt 20 to the pulley 11 on the shaft 4.

The rod 17 is provided with a yoke 21 which is connected by means of the pivots 22 to the half-nut 23, the nut being adapted to coact with the rear side of the screw so that when the rod is drawn forward the nut engages and when the rod is pushed back the nut is disengaged. The yoke is of advantage for two purposes: First, it permits the ready disengaging of the nut from the screw, and, further, it permits the mandrel being withdrawn from the end of the tube forming the coil, so that coils may be formed with straight ends.

Where the long rod 14 is used, it is of advantage to provide the same with a supporting tube 24 into which the pipe telescopes. This effectively prevents bending or flexing of the mandrel rod and the pipe 25. Rests 26 and 27 are also provided to assist in supporting the rod. It will be observed, that, in the structure illustrated, the rod is supported substantially tangentially to the form.

The form 28, shown in Figs. VI and VIII, is cylindrical, and provided with a spiral groove 29, and is used when it is desired to form cylindrical coils as distinguished from helical coils. The pipe 25 to be coiled, is secured to the form by means of the clamp shown in detail in Fig. VIII, consisting of the clamp member 30 mounted on the stud 31, and held yieldingly upward by means of the spring 32. The eccentric 33 is pivoted at 34 on the stud so that by swinging the eccentric the clamp is forced down upon the pipe as shown in Fig. IX.

In setting the machine, the clamp is engaged on the pipe, directly over the end of the mandrel. Suitable means for stopping and starting the form shaft are provided.

The pipe is straightened and fed from the mandrel onto the supporting rod 14 by a straightening device consisting of sets of grooved rollers 35 and 36, the rollers 35 being the driven or feed rollers, the shaft 37 being connected by the belt 38 to the pulley 12 on the shaft 4.

The roller shaft 39 is connected by the gears 40 to the shaft 37. The shaft 37 is adjusted by means of the screws 41. The clutch 42 is provided for the pulley 43 for the belt 38, the clutch being actuated by means of the

lever 44. Between the sets of grooved rollers 35 and 36 is a straightening tube 45 which is supported by a rod 46 at its front end. The tube or pipe to be straightened is introduced between the rollers 35 and is fed thereby through the tube 45 and the rollers 36, and if desired, onto the mandrel supporting rod 14. The end of the tube is then secured to the form by means of the clamp described and the form rotated, which winds the pipe about the form, the grooves serving to guide and position the coils, the operator assisting in guiding the mandrel. Where a comparatively long rod is used, the screw 18 is not necessary to satisfactory operation. It is, however, very desirable where the short mandrel supporting rod is used.

In the modification shown in Fig. XII, the mandrel 47 is provided with a curved end 48, the curvature being such that it forms the arc of a circle concentric with the curve of the form. The mandrel having the spherical end is, however, preferred, as it is more easily produced and may be used on a form of any diameter. The mandrel has a sliding fit within the tube or pipe and in practice soap or other material may be used if desired to make it slip freely within the tube.

In the modification shown in Fig. XIII, a spherical mandrel 49 is shown.

By means of my improved machine, I am able to produce coils very rapidly and the machine may be operated by unskilled workmen. It has been quite common practice to fill the pipe with sand in order to support the walls, as it is wound upon the forms. This entails a great deal of labor and necessitates the rattling of the sand from the coils and cleaning the coils with considerable care, as, if any sand is left within the coil used for a water heater, it forms the nucleus for a deposit of lime and sediment and is highly objectionable. By means of my improvements, I am able to produce very uniform coils and also very rapidly and economically.

I have illustrated various parts largely in conventional form as such parts are not important to an understanding of my invention and may be designed as conditions or taste may dictate. I have illustrated and described my improvements in a form in which I have embodied them in practice.

While various modifications other than those I have illustrated and described are possible, I do not undertake to describe such various modifications or changes, as I believe the disclosure made is sufficient for a clear understanding of my invention. I desire, however, to be understood as claiming my improvements specifically in the form illustrated as well as broadly within the scope of the appended claims.

Having thus described my invention, what

I claim as new and desire to secure by Letters Patent is:

1. In a coil forming machine, the combination of a form comprising opposed conical sections having spiral grooves therein, a driving shaft on which one of the said sections is mounted, a carriage provided with a shaft for the other section whereby the sections may be separated or brought end to end into coöperating relation, the shaft on said carriage extending into the form section on the driving shaft when the sections are brought together; a mandrel having a curved end, said mandrel having a sliding fit within the pipe to be coiled, a mandrel supporting rod adapted to receive the pipe, supported at its rear end so that the end of the mandrel is supported in substantially the vertical plane of the form axis, and a clamp on the form section on the driving shaft for securing the end of the pipe thereto.
2. In a coil forming machine, the combination of a form comprising opposed conical sections having spiral grooves therein, a driving shaft on which one of the said sections is mounted, a carriage provided with a shaft for the other section whereby the sections may be separated or brought end to end into coöperating relation, a mandrel having a curved end, said mandrel having a sliding fit within the pipe to be coiled, a mandrel supporting rod adapted to receive the pipe, supported at its rear end so that the end of the mandrel is supported in substantially the vertical plane of the form axis, and a clamp on the form section on the driving shaft for securing the end of the pipe thereto.
3. In a coil forming machine, the combination of a form comprising opposed conical sections having spiral grooves therein, a driving shaft on which one of the said sections is mounted, a carriage provided with a shaft for the other section whereby the sections may be separated or brought end to end into coöperating relation, the shaft on said carriage extending into the form section on the driving shaft when the sections are brought together, a mandrel, and a mandrel supporting rod adapted to receive the pipe.
4. In a coil forming machine, the combination of a form comprising opposed conical sections having spiral grooves therein, a driving shaft on which one of the said sections is mounted, a carriage provided with a shaft for the other section whereby the sections may be separated or brought end to end into coöperating relation, a mandrel, and a mandrel supporting rod adapted to receive the pipe.
5. In a coil forming machine, the combination of a spirally-grooved rotatable form, a mandrel having a spherically curved end, said mandrel having a sliding fit within the pipe to be coiled, a mandrel supporting rod adapted to receive the pipe, disposed tangentially of the form and pivotally supported at its rear end so that the end of the mandrel is supported to be moved substantially in an axial plane of the form, and a clamp on the form for securing the end of the pipe thereto.
6. In a coil forming machine, the combination of a rotatable form, a rigid mandrel, a mandrel supporting rod adapted to receive the pipe disposed tangentially of the form and pivotally supported at its rear end so that the end of the mandrel is supported to be moved substantially in an axial plane of the form, and a clamp on the form for securing the end of the pipe thereto.
7. In a coil forming machine, the combination of a rotatable form member, a rigid mandrel having a spherically curved end, said mandrel having a sliding fit within the pipe to be coiled, means for supporting said mandrel so that it may be moved above the form longitudinally thereof with its end substantially in the vertical plane of the axis of the form, and means for securing the end of the pipe to the form member.
8. In a coil forming machine, the combination of a rotatable form member, a rigid mandrel having a curved end, means for supporting said mandrel so that it may be moved longitudinally of the form with its end substantially at the point the pipe is curved as it is wrapped upon the form, and means for securing the end of the pipe to the form member.
9. In a coil forming machine, the combination of a rotatable form member, and a rigid mandrel having a curved end, said mandrel having a sliding fit within the pipe to be coiled and being supported to support the walls of the pipe as the same is drawn from the mandrel and coiled about the form by the rotation of the form.
10. In a coil forming machine, the combination of a rotatable form member, and a rigid mandrel having a curved end, said mandrel having a sliding fit within the pipe to be coiled and being supported to support the walls of the pipe as the same is drawn from the mandrel and coiled about the form.
11. In a coil forming machine, the combination of a rotatable form member, a rigid mandrel, and a mandrel supporting rod adapted to receive the pipe, said rod being supported for longitudinal movement to permit the withdrawal of the mandrel from the end of the pipe thereby permitting the forming of a coil with a straight end.
12. In a coil forming machine, the combination of a rotatable form member, a rigid mandrel, and a mandrel supporting rod adapted to receive the pipe, said mandrel being supported by said rod so that its end

is substantially at the point the pipe is curved as it is wrapped about said form.

13. In a structure of the class described, the combination with a rotatable form member, a mandrel, a supporting rod for said mandrel, said rod being pivotally mounted at its rear end, a tube on said rod adapted to receive the pipe, the mandrel and front end of the rod projecting from said tube, and rests for said supporting rod and tube.
14. In a structure of the class described, the combination with a rotatable form member, a mandrel, a supporting rod for said mandrel, and a tube on said rod adapted to receive the pipe, the mandrel and front end of the rod projecting from said tube.
15. In a structure of the class described, the combination of a mandrel, a supporting rod for said mandrel, a tube on said rod, the mandrel and front end of the rod projecting from said tube, means for straightening a pipe and delivering it onto said rod over said mandrel comprising pairs of spaced grooved feed rollers, a straightening tube arranged between the pairs of feed rollers so that the pipe is delivered therethrough by the feed

rollers and onto the mandrel supporting rod, and rests for said supporting rod and tube.

16. In a structure of the class described, the combination of a mandrel, a supporting rod for said mandrel, means for straightening a pipe and delivering it onto said rod over said mandrel comprising pairs of spaced grooved feed rollers, and a straightening tube arranged between the pairs of feed rollers so that the pipe is delivered therethrough by the feed rollers and onto the mandrel supporting rod.

17. In a coil forming machine, the combination of a mandrel and a pipe straightening device comprising feed rollers and a tube through which the pipe is delivered by said feed rollers, the straightening device being adapted to deliver the pipe onto the mandrel.

In witness whereof, I have hereunto set my hand and seal in the presence of two witnesses.

HERBERT S. HUMPHREY. [L. S.]

Witnesses:

M. PHINA WOODRUFF,
ANNIE PARRY.