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MACHINE FOR MAKING ARCH-TYPE CULVERTS BY
MEANS OF INTERNALLY POSITIONED FORMS
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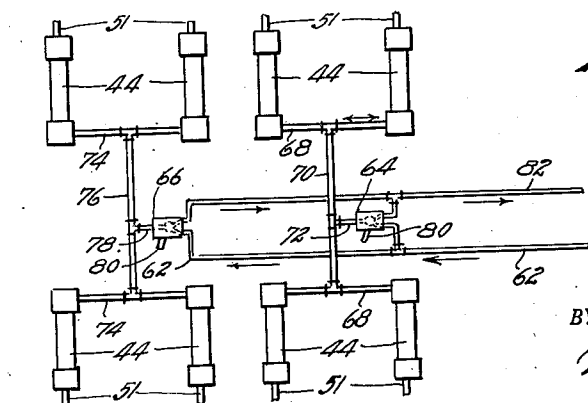


Fig. 6

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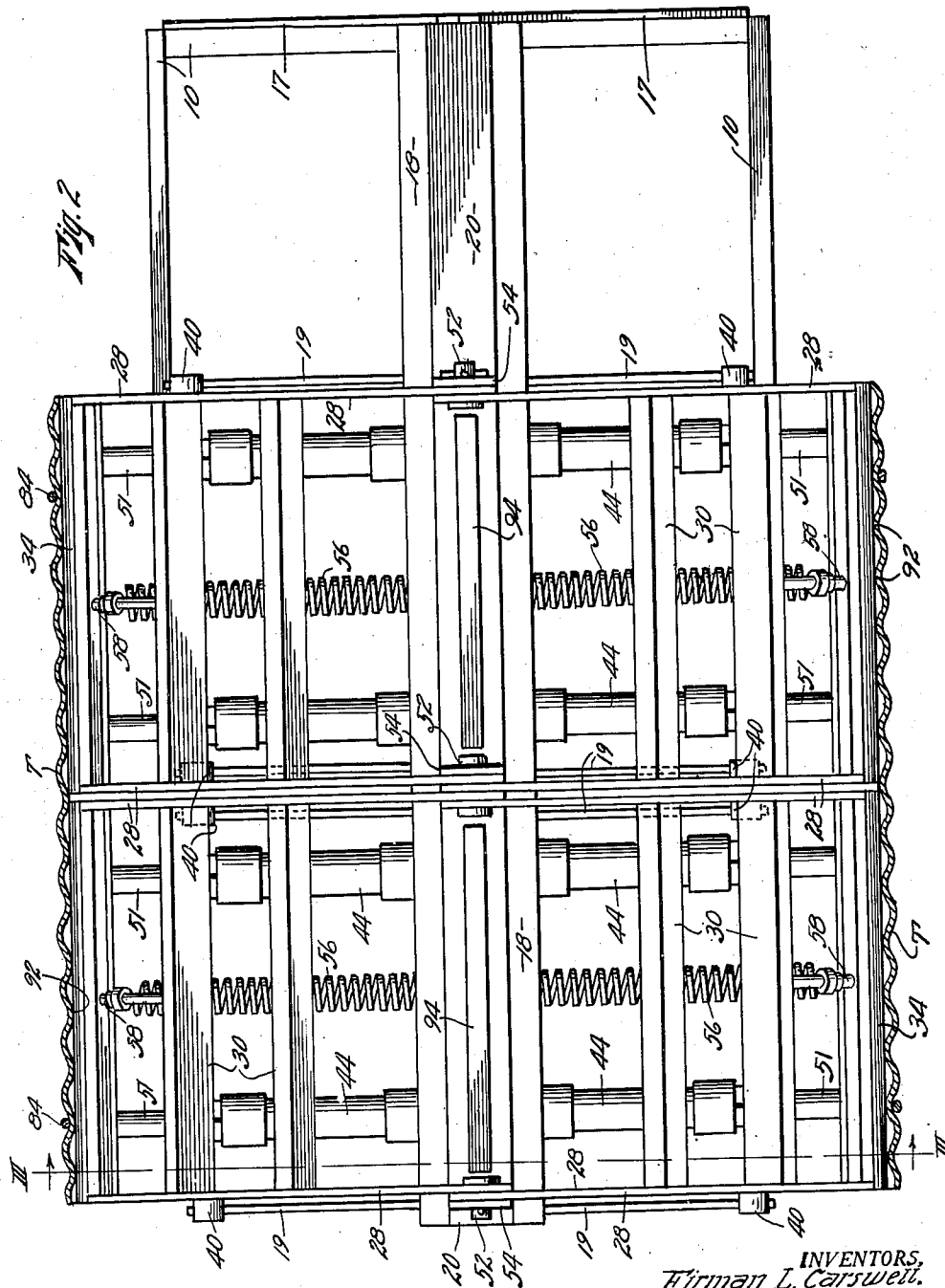
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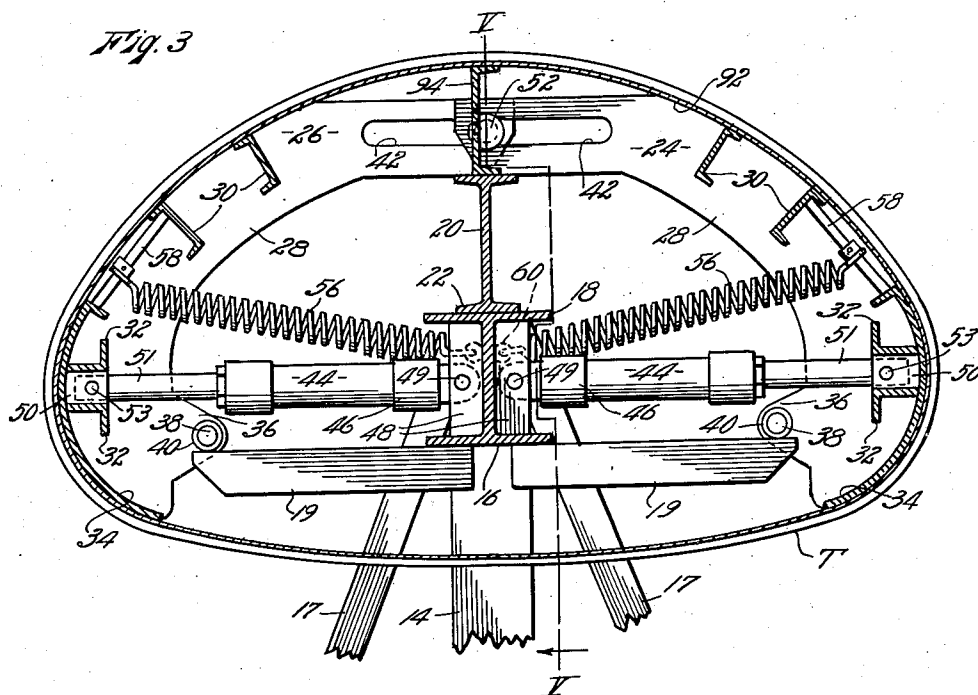
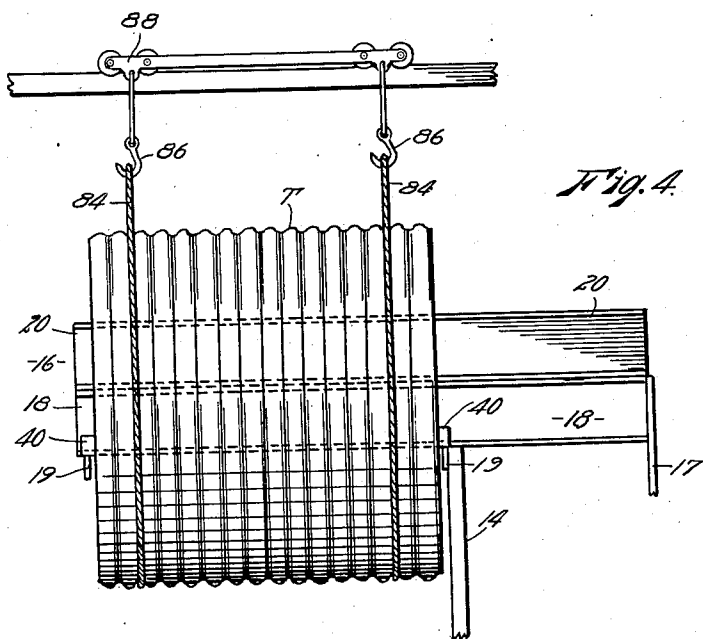


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4 Sheets-Sheet 3



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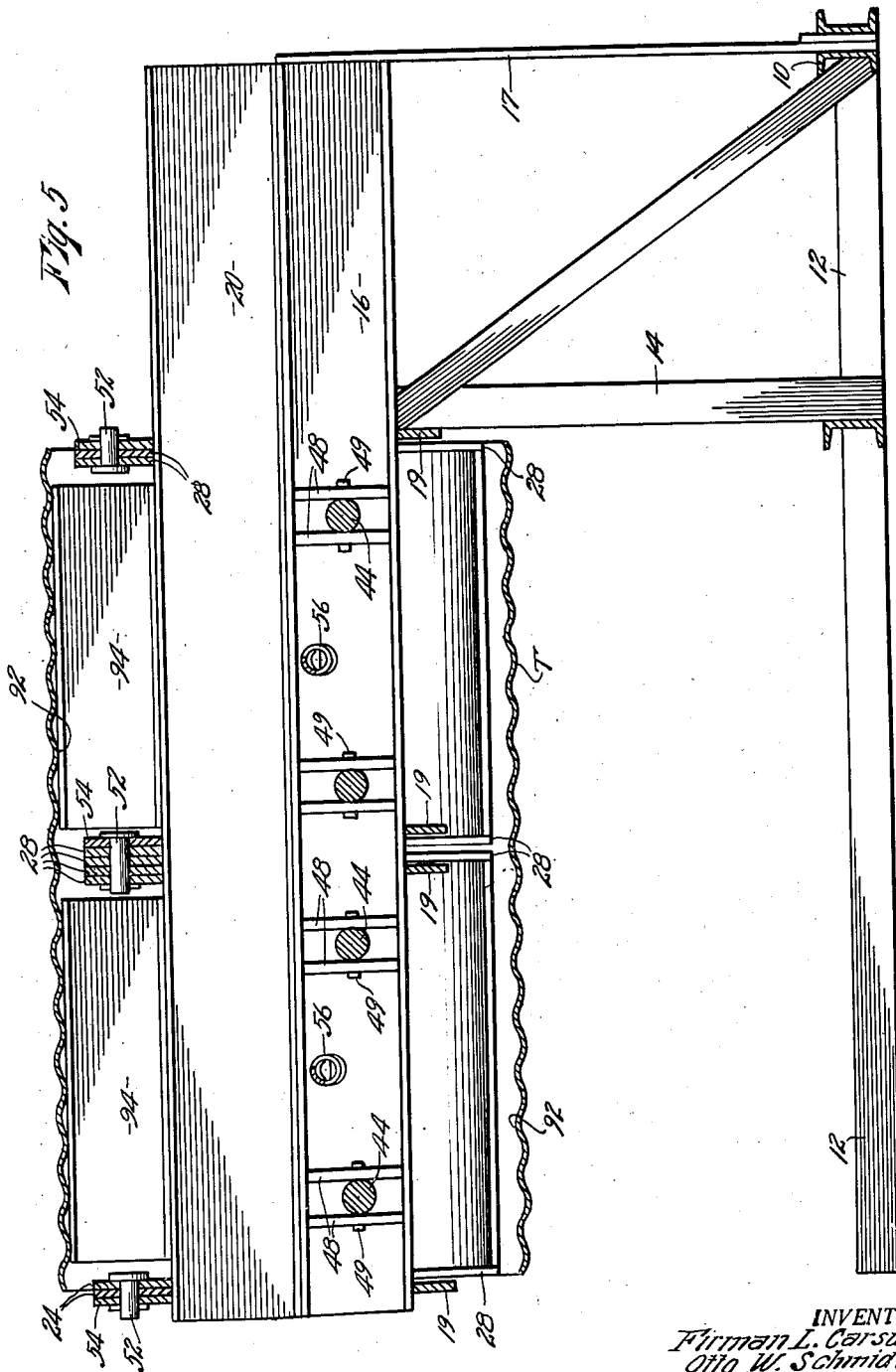
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UNITED STATES PATENT OFFICE

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MACHINE FOR MAKING ARCH-TYPE CULVERTS BY MEANS OF INTERNALLY POSITIONED FORMS

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Application July 29, 1946, Serial No. 686,912

10 Claims. (Cl. 153—2)

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This invention relates to improvements in machines for making arch-type culverts, and refers more specifically to machines for making circumferentially corrugated, arch-type conduits using the method claimed in our copending application, Serial Number 651,805, filed March 4, 1946.

The principal object of the present invention is the provision of a machine operable to apply pressure to the inside wall of a preformed tubing whereby it is distorted to present an arch-type conduit.

Another object of this invention is the provision of a machine having horizontally disposed, symmetrical forms adapted to engage the opposite inner walls of a cylindrical tube and operable whereby the tube is transversely elongated on its horizontal axial plane and shortened on its vertical dimension to form an arch-type conduit.

A further object of the invention is the provision of a machine having a plurality of power driven forms, simultaneously operable to engage the inside wall of a tubular member whereby it is distorted to form a tube of substantially elliptical cross section.

Other objects are simplicity and economy of construction, ease and efficiency of operation and adaptability for receiving a length of tube over a plurality of power driving forms for deforming said tube.

With these objects in view, as well as other objects which will appear during the course of the specification, reference will be had to the drawings wherein:

Figure 1 is an end elevation of the apparatus with the forms retracted to receive a substantially circular tube thereabout as shown.

Fig. 2 is a plan view of the apparatus with the forms extended and the corrugated tube shown in section.

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

Fig. 4 is a reduced side elevational view of the apparatus with a tube shown in the suspended position ready for forming.

Fig. 5 is a sectional view of the apparatus taken on irregular line V—V of Figure 3.

Fig. 6 is a diagrammatic view showing the feed and exhaust pipes to and from the hydraulic rams.

Throughout the several views like reference characters refer to similar parts and the numeral 10 designates a frame having a base 12 on which is mounted a standard 14 adjacent its one end. A horizontally disposed composite beam 16 is

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supported on top of said standard to extend the full length of the base and is secured at its end adjacent said standard by means of downwardly diverging bars 17 which respectively engage the outer extremities of the base. The main body of the beam 16 extends above base 12, is substantially parallel therewith, and is adapted to receive a tubular member thereabout for forming.

Beam 16 is preferably made up of a heavy I-beam 18 provided with a lighter I-beam 20 which has its lower flange 22 securely attached to the upper flange of I-beam 18. Securely welded to the lower flange of beam 18 is a series of transverse bars 19 which serve as tracks and extend at right angles to the beam. Similar series are positioned on opposite sides of the beam and are adapted to receive rollers for support-moving forms by means of which the cylindrical tube is deformed.

Series of forms 24 and 26 (see Fig. 3) are disposed on opposite sides respectively of said beam 18 and each form comprises a pair of transversely disposed parallel members 28 joined together by channel irons 30, angle irons 32 and arcuate plates 34. The outer edge of each of the members 28 is shaped to conform to the inner contour of the conduit when it is fully extended by the power applied to the forms. It will be noted that the channel irons 30, angle irons 32 and arcuate plates 34 joining these parallel members 28 together are disposed in parallel relation to the I-beam 18 and have their outer faces flush with the outer edges of the parallel members 28, thus serving to contact the inner surfaces of the circumferentially corrugated tube during the forming operation.

Instead of using spaced apart connecting members, continuous plates might be used to bear against the inner wall of the corrugated tube. The lower portion of members 28 each have an ear 36 carrying stud 38 on which is mounted a roller 40 which rests on one of the tracks 19. The upper free ends of members 28 have slots 42 which are disposed in parallel relation with the track bars 19 so that the form is adapted to move at substantially right angles to the beam and in a horizontal plane.

The length of the forms 24 and 26 may vary, and the number of forms at each side of the beam may be such as to make it possible to simultaneously form a conduit of any desired length. In the drawings we have shown two forms on each side, each form is powered by two hydraulic

jacks 44 which are respectively positioned ad-

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jacent opposite ends of the form with their cylinder portions 46 pivoted at 49 to transverse ribs 48 positioned between the upper and lower flanges of I-beam 18 and with its piston rod 51 pivoted at 53 to a pair of plates 50 secured to spaced apart angle irons 32 and arcuate plate 34. These jacks are so mounted that they are substantially parallel with the tracks 19 and are pivoted at their opposite ends to permit slight up and down movement of the form relative to the frame during the forming operation. Thus the forms are permitted a limited pivotal movement about pins 52 as an axis, during their rectilinear outward movement.

Referring to Figure 2, it will be noted that the members 28 of forms 24 and 26 overlap and are slidably secured together by pins 52 passing through slots 42 and which are anchored to ears 54 formed integral with beam 20. For rigidly supporting the upper portion of the forms, the members 28 are adapted to rest upon the upper flange of beam 20 as shown.

The forms 24 and 26 are each provided with a tension spring 56 attached at 58 to the outer portion of the form and at 60 to the beam 18, and are so tensioned that when the pressure is released in the jacks they will function to exhaust the jack cylinders and move the forms back to the normal position, shown in Figure 1, for receiving a tube for forming.

Referring to Figure 1 it will be noted that a channel member 94 is positioned on top of the beam 20 and cooperates with the forms 24 and 26 to maintain the upper portions of the conduit in an arched form. The lower portions of the form are spaced apart a relatively great distance whereby that portion of the tube being formed is tensioned and pulled to a relatively flat form to form the bottom of the conduit.

The jacks are operated by fluid pressure as shown in Figure 6. A pressure feed pipe 62 leads from any suitable fluid pressure means and is controlled by three-way valves 64 and 66 which regulate the flow of the fluid pressure to and from the jack cylinders 44. Pipes 68, 70 and 72 connect feed pipe 62 with the four jacks which operate the first pair of forms 24 and 26, and pipes 74, 76 and 78 connect the feed pipe to the four jacks which operate the second set of forms 24 and 26. Valves 64 and 66 are independently operable so that two or all the forms may be simultaneously operated. As indicated, the valves are set to feed pressure fluid to the jack cylinders. By throwing the valve levers 80 the feed pipe will be closed to the cylinders and the exhaust pipe 82 will be connected with all the cylinders so that the springs 56 will be permitted to contract to force the fluid from the cylinders and retract the forms 24 and 26. It is quite apparent that any desired number of sets of forms might be operated in this manner to form conduits of desired lengths.

Referring to Figure 4 it will be noted that the corrugated tube T is suspended by two slings 84 which engage hooks 86 suspended from a wheeled carriage 88 longitudinally adjustable on track 90. This carriage support permits the easy movement of the tube to the proper position over the forms. These slings may be left in position during the forming operation and after the forms are retracted the conduit will take a form due to the release of the form pressure so that it can be supported by said slings and removed from the apparatus while suspended on the track.

During the conduit forming operation it will

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be observed that inner corrugations 92 rest against the forms to insure the proper arching of the tube, also the channel irons 94 secured on the top flange of beam 20 on the vertical, central line of the tube is of a proper predetermined height to limit the downward movement of the arch during the forming operation. To strengthen the conduit, the sharp curves at the opposite sides of the conduit are provided. These sharp curves also make it possible to provide a wide base for the conduit to carry a large volume of water adjacent the bottom of the conduit.

The forms 24 and 26 are so constructed that they function to contact and curve the major portion of the pipe, and are spaced apart at their lower portions a relatively great distance so that that portion of the tube therebetween is put under tension and pulled to a relatively flat form to produce a substantially flat bottom for the conduit.

Referring to Figs. 1 and 3 it will be noted that arcuate formed plates 34 are positioned to engage the corrugated tube T at its opposite sides in a horizontal plane spaced below the major horizontal axial plane of the tube, thus eliminating to a large degree any slippage between the tube and plates 34 due to the fact that the portion of the tube above the forms 34 is greater than the relatively flat bottom portion.

The degree of arching the tube may be easily controlled by the shape, size and length of stroke of the forms.

This machine for applying internal pressure to a tubular member to distort it and form an arch-type culvert gives a much more uniform form than can be obtained by applying external pressure to the tube as is the usual practice.

It is apparent that many minor changes might be made in the construction of this machine without departing from the spirit of the invention, and it is desired to be limited only by the scope of the claims.

What we claim as new and desire to protect by Letters Patent is:

1. A machine of the class described comprising a fixed frame, a pair of rectilinearly movable forms carried by said frame, means operable to cause outward movement of said forms, whereby a cylindrical tube fitted thereover is outwardly distorted, and means for positioning said tube with its axis at one side of the plane of the force exerted by said forms.

2. A machine of the class described comprising a frame, a pair of forms adjustably carried by said frame, fluid pressure operable means to simultaneously force said forms outwardly from each other, resilient means whereby said forms are retracted, and means for positioning a cylindrical tube about said forms with the axis thereof disposed in spaced relation from the plane of the forces exerted by said forms.

3. A machine of the character described comprising a frame having an outwardly projecting beam adapted to receive a tube thereabout, a pair of forms adjustably carried by said beam, resilient means to normally urge said forms toward each other, separate power means operable by fluid pressure to force each of said forms outwardly, whereby the tube mounted on said beam is outwardly deformed said pressure operable means being interconnected to equalize the outward pressure of said forms, and means for positioning said tube with the axis thereof parallel to but spaced apart from the plane of the lines of application of the forces exerted by said forms,

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4. A machine of the character described comprising a frame having an outwardly projecting beam adapted to receive a tube thereabout, a pair of forms carried for rectilinear outward movement by said beam and having limited axial pivotal movement relative to said beam on an axis parallel to said beam, and power means operable to force said forms apart whereby the tube mounted on said beam is engaged thereby and outwardly distorted.

5. A machine of the character described comprising a frame having an outwardly projecting horizontal beam provided with transversely disposed tracks and adapted to receive a tube thereabout, a pair of substantially like forms adjustably carried by said beam, each form having an arched upper arm positioned to overlap the corresponding arm of the other form, and each having a short lower arm provided with a roller to operatively engage the adjacent transverse track and power means operable to force said forms outwardly to engage the opposite inner walls of the tube positioned about said beam, whereby said tube is formed into an arch-type culvert.

6. A machine of the character described comprising a frame provided with an outwardly projecting beam having rigidly attached transversely disposed tracks, and adapted to receive a tubular member thereabout, a pair of substantially like forms carried by said frame for movement along said tracks, said forms having overlapping, arched upper sections, and spaced apart lower sections, and power means operable to force said forms outwardly to engage the opposite inner walls of a tube positioned about said beam, whereby said tube is distorted to substantially conform to the shape of said forms.

7. A machine of the character described comprising a frame provided with an outwardly projecting beam having rigidly attached transversely disposed tracks, and adapted to receive a tubular member thereabout, a pair of substantially like forms carried by said frame for movement along said tracks, said forms having overlapping, arched upper sections, and spaced apart lower sections, power means operable to force said forms outwardly to engage the opposite inner walls of a tube positioned about said beam, whereby said tube is distorted to substantially conform to the shape of said forms, and resilient means energized by the outward movement of said forms, whereby the forms are returned to their normally retracted position.

8. A machine of the character described comprising a frame provided with an outwardly projecting beam having rigidly attached transversely disposed tracks, and adapted to receive a tubular member thereabout, a pair of substantially like forms carried by said frame for movement along said tracks, said forms having overlapping, arched

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upper sections, and spaced apart lower sections, power means operable to force said forms outwardly to engage the opposite inner walls of a tube positioned about said beam, whereby said tube is distorted to substantially conform to the shape of said forms, and a fixed stop carried by said beam to limit the downward movement of the top wall of said tube during the forming operation.

9. A machine of the character described comprising a frame having an outwardly projecting beam adapted to receive a tube thereabout, a pair of forms disposed within said tube, a longitudinally extensible member pivotally secured at one end to each of said forms and pivotally secured at its opposite end to said beam, each of said forms also being secured to said beam at a point spaced apart from the pivotal points of said extensible members for limited pivotal movement on an axis parallel to said beam, and power means for extending said extensible members to force said forms in substantially opposite directions whereby the tube disposed about said beam is engaged and outwardly distorted.

10. A machine of the class described comprising a frame, a pair of forms carried by said frame, means for positioning an expandable cylindrical tube about said forms, said forms being adapted to contact substantially opposite inner walls of said tube along lines parallel to the axis of said tube but lying in a common plane spaced apart from said axis, and means for moving said forms outwardly whereby said tube is distorted to present a cross-sectional form having a relatively sharply arched portion and a relatively flat portion extending between the ends of said arched portion.

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