

Dec. 8, 1959

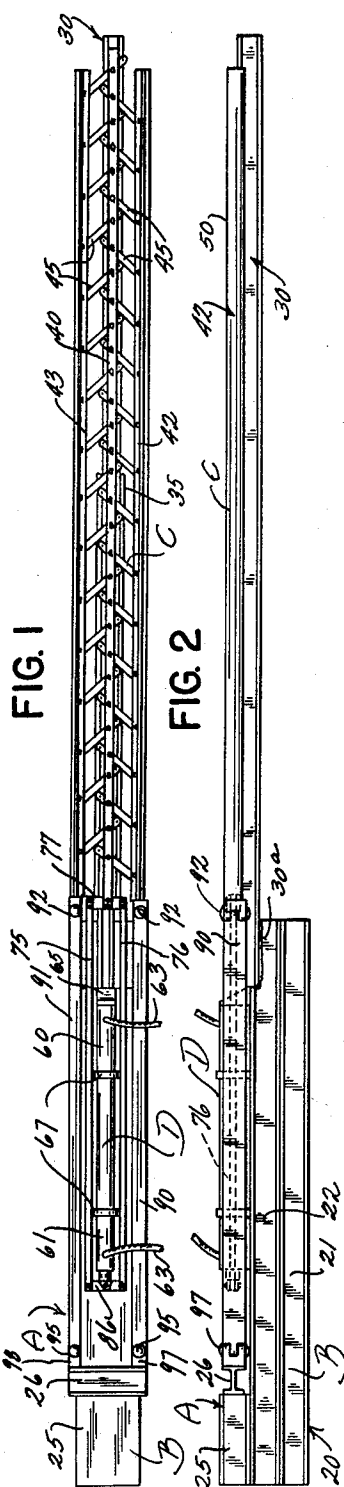
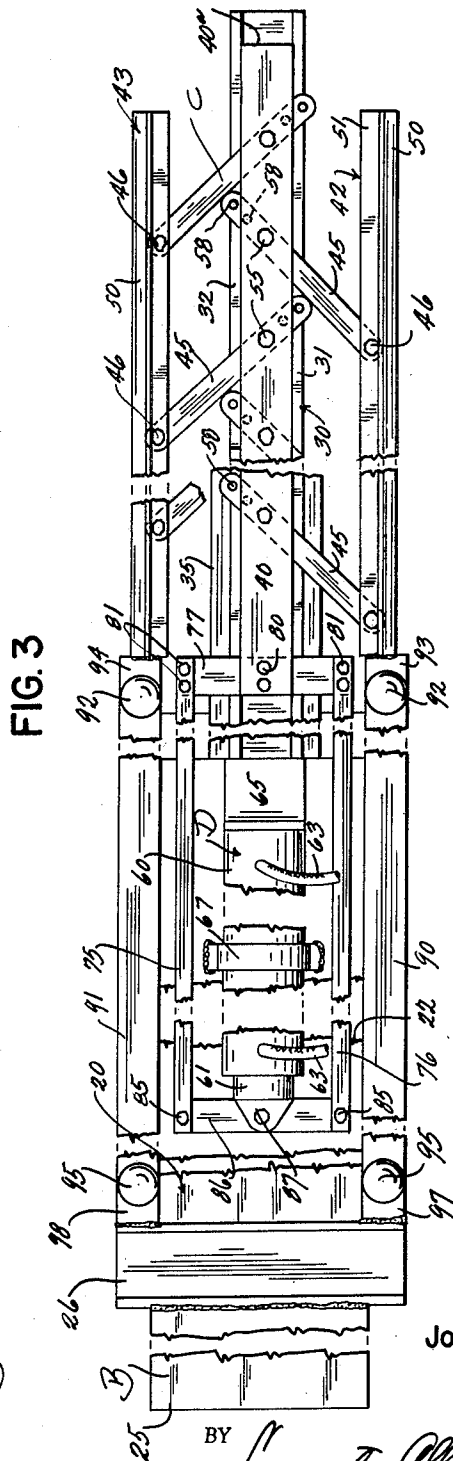
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2,916,076

APPARATUS FOR FABRICATING ARCH-TYPE CULVERTS

Filed Dec. 21, 1956

4 Sheets-Sheet 1



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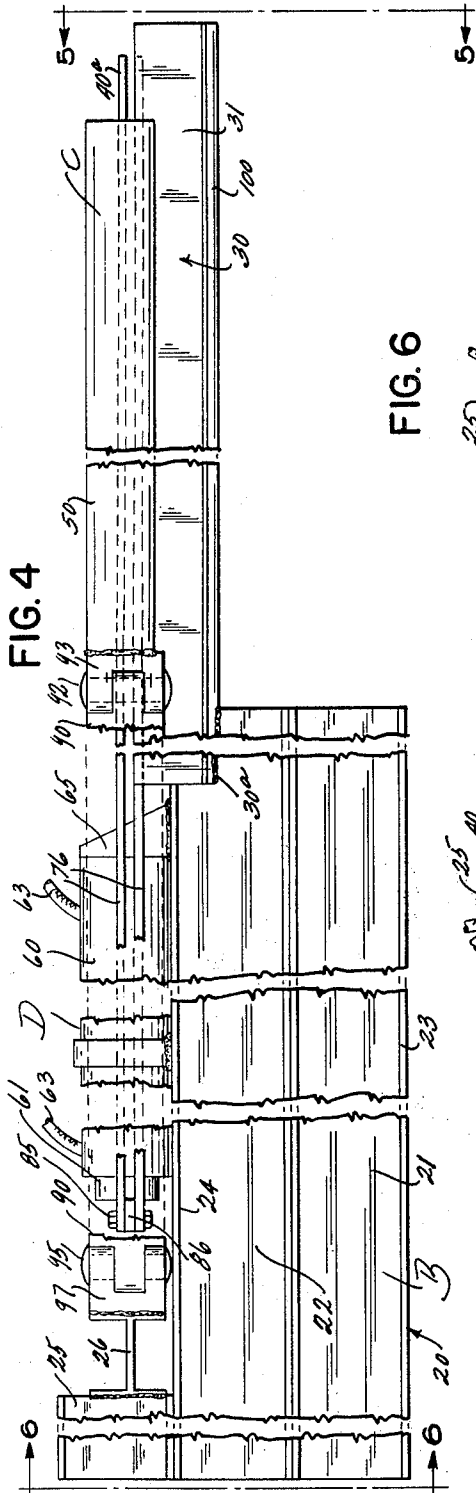
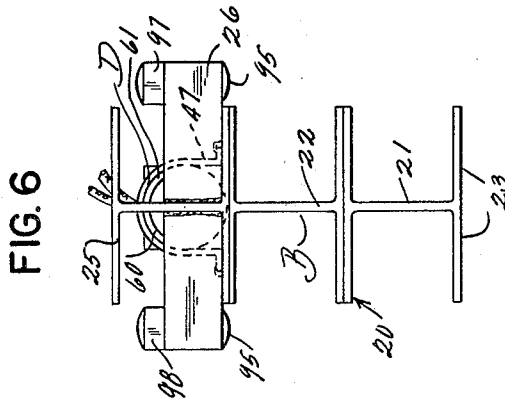
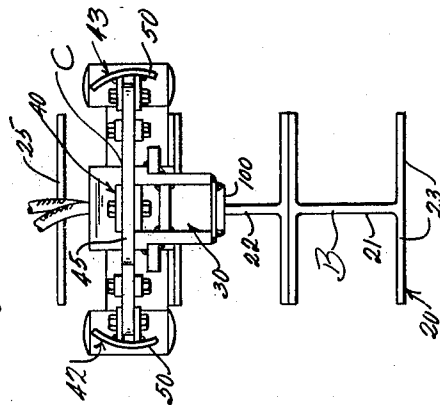
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2,916,076

APPARATUS FOR FABRICATING ARCH-TYPE CULVERTS

Filed Dec. 21, 1956

4 Sheets-Sheet 2



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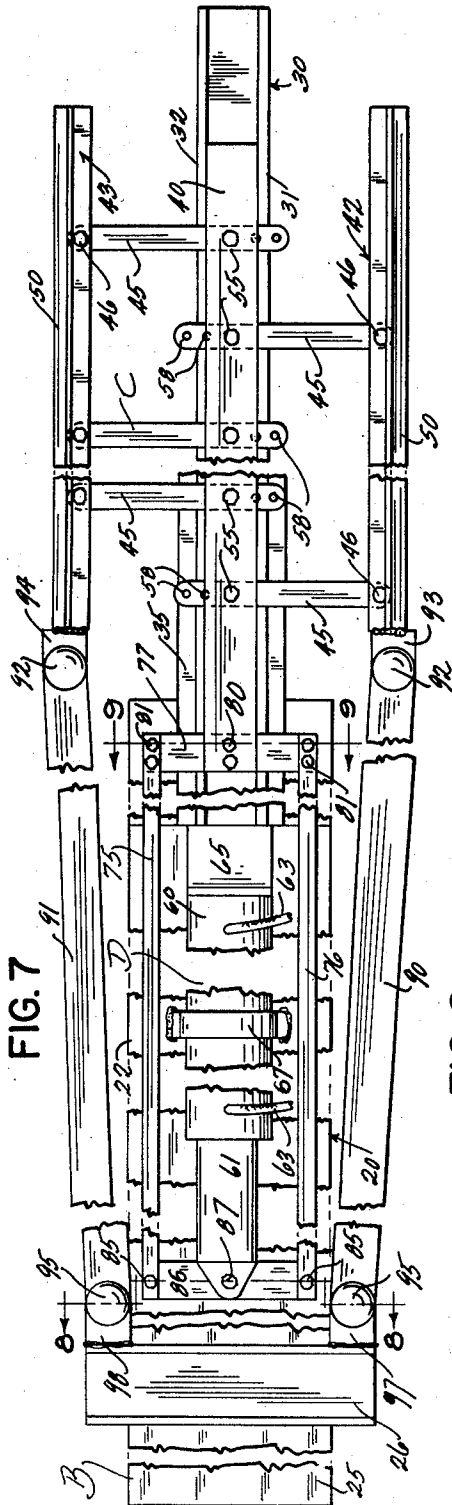
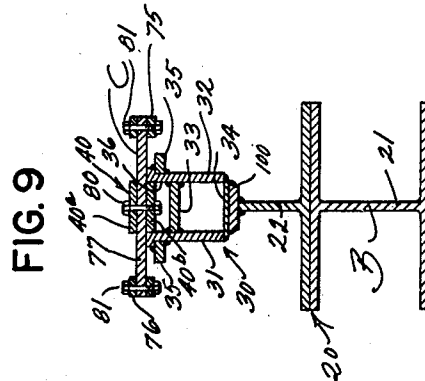
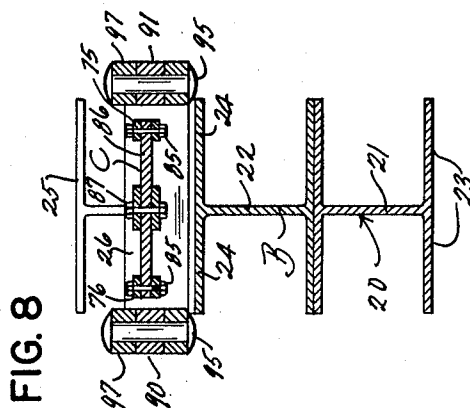
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APPARATUS FOR FABRICATING ARCH-TYPE CULVERTS

Filed Dec. 21, 1956

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FIG. 10

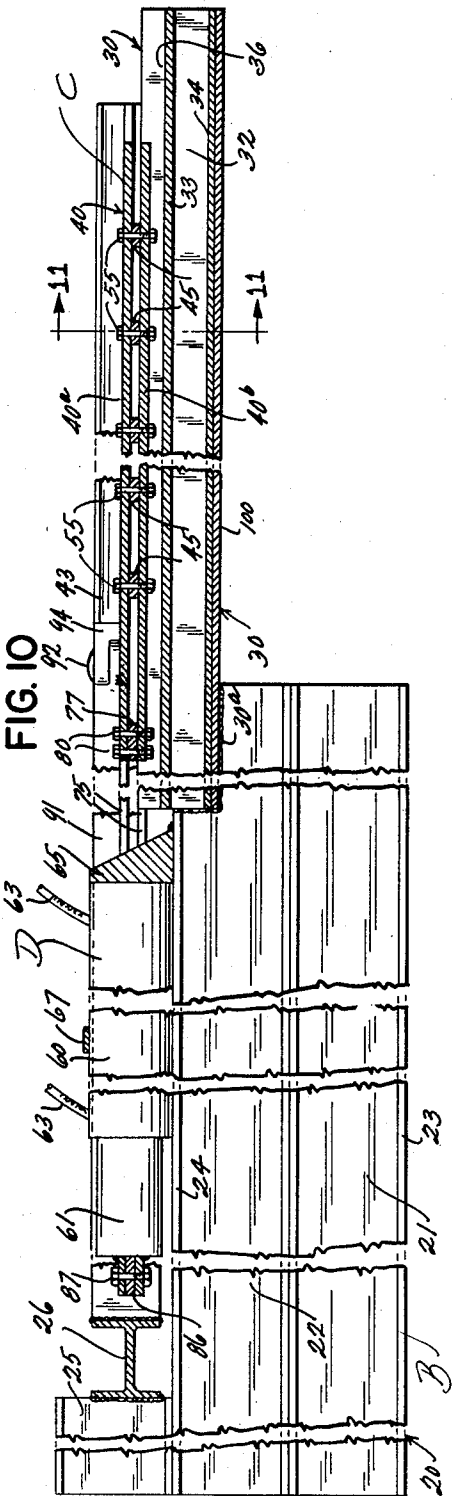


FIG. 12

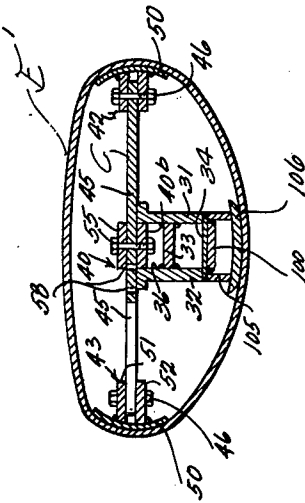
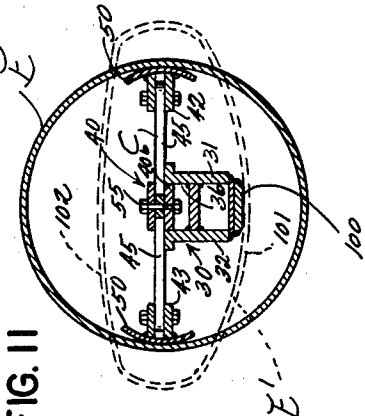


FIG. 11



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APPARATUS FOR FABRICATING ARCH-TYPE CULVERTS

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Application December 21, 1956, Serial No. 629,986

3 Claims. (Cl. 153—35)

This invention relates to improvements in means and a method for forming arch-type culverts.

The primary object of this invention is the provision of a relatively simple and sturdy machine for the expeditious and accurate fabrication of arch-type culverts through reshaping of cylindrical tubing by means of an internal expansion step, which will laterally increase the dimension of the pipe and correspondingly reduce its vertical depth. Such arch-type culverts are used under varied circumstances, one of which is there is a need for a large flow capacity culvert in locations where the ground depth is less than the diameter of conventional cylindrical pipe having the same capacity.

It is known to fabricate arch-type culverts out of conventional cylindrical shaped galvanized corrugated metal pipe, by means of internal expansion. In such instances the power means is located within the culvert. There are some drawbacks to this such as space, power operating factors and lack of expeditious and economical fabrication. It is an object of my invention to provide a machine having a relatively simple but sturdy frame with expanding means thereon actuated in a novel relationship by power means which is located externally of the pipe to be expanded whereby unskilled labor can quickly and accurately deform the pipe into the necessary shape.

A further object of this invention is the provision of an improved pipe forming machine capable of laterally deforming elongated cylindrical pipe lengths into arch-type culvert cross section, having regard for the necessary compression and tension factors incidental to accurate deformation of the pipe.

A further object of this invention is the provision of an improved method for the formation of arch-type culverts out of elongated normally cylindrical shaped sheet metal pipe in which an expanding force is applied to the cylindrical pipe in a plane intersecting the axis of the cylindrical pipe, with a controlling means associated therewith whereby the depth of the ultimately shaped pipe will be less than the width thereof, with one segment of the arch-type culvert in a direction transverse to the expansion plane having greater depth than its complementary segment.

Other objects and advantages of this invention will be apparent during the course of the following detailed description.

In the accompanying drawings, forming a part of this specification, and wherein similar reference characters designate corresponding parts throughout the several views,

Fig. 1 is a plan view of the improved machine used for fabricating arch-type culverts, showing the collapsed position of the expanding means.

Fig. 2 is a side elevation of the machine shown in Fig. 1.

Fig. 3 is a fragmentary enlarged plan view of the essential details of the machine shown in Fig. 1 with the expanding means collapsed.

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Fig. 4 is a fragmentary side elevation of the details shown in Fig. 3, approximately to the same scale.

Figs. 5 and 6 are respectively front and rear end views of the machine of Fig. 4, the views being taken substantially from the positions shown by the lines 5—5 and 6—6, as shown in Fig. 4.

Fig. 7 is a fragmentary plan view of the details shown in Fig. 3, but showing the expanding means in pipe expanding relation.

Figs. 8 and 9 are transverse cross sectional views taken through the machine, substantially on the respective lines 8—8 and 9—9 shown in Fig. 7.

Fig. 10 is a fragmentary longitudinal cross sectional view taken through certain of the details of the machine, more particularly illustrating the parts of the machine.

Fig. 11 is a transverse cross sectional view of the machine, taken on the line 11—11 of Fig. 10, but showing additionally a cylindrical pipe thereon prior to its deformation through expansion.

Fig. 12 is a transverse cross sectional view of the machine shown in Fig. 11, after the cylindrical pipe has been expanded into arch-type culvert formation; this view additionally showing a seat filler piece which may be used for formation of the larger sizes (diameter) of pipe.

In the drawings, wherein for the purpose of illustration is shown only a preferred embodiment of the improved machine, the letter A may designate the improved machines for distorting cylindrical expandable sheet metal tubes into arch-type culverts. It includes a frame B having expanding means C mounted thereon. The latter is actuated by power means D also mounted upon the frame B for the laterally distortion of normal cylindrical pipe E into arch-type culvert shapes E'.

Referring to the frame structure B, the same includes a base 20 which must be very heavy inasmuch as it supports a cantilever beam 30, as a part thereof, upon which the expanding mechanism and also the weight of the cylinder to be deformed must be supported. To that end, I preferably provide a pair of heavy wide flanged I-beam sections 21 and 22 sufficiently long and heavy to support the cantilever arrangement above described. The bottom flanges 23 are adapted to rest upon any suitable foundation (not shown). They may be bolted or otherwise secured to the foundation as desired. The upper beam flanges 24 are adapted to support the details of the power means D to be subsequently described. Any other sort of base arrangement 20 may be provided, and it is even possible to provide a single wide flanged I-beam instead of the two shown. Beams 21 and 22 are welded together. At its rear, frame 20 has a top I-beam 25 and a cross beam 26 secured to beam 25 as by welding. Beam 25 takes end thrust incidental to the expanding operation, as will be hereinafter more specifically described. The frame 20 includes as a part thereof, a cantilever beam structure 30 of box-type cross section, welded at 30^a to beam 22 for a portion of its length and preferably socketed in beam 22. The beam structure 30 must be sufficiently strong to support the weight of the pipe to be formed, without bending or flexing, and it must furnish a precise guide for longitudinal movement of certain details of the expanding means C to be subsequently described. The cantilever beam 30 preferably comprises a pair of side plates 31 and 32 which are welded together in spaced parallelism by an intermediate web or plate 33 and a bottom web or plate 34, as shown in Fig. 9 of the drawings. Plates 31 and 32 and the location of the web 33 are such as to provide a channel or a way 36 extending longitudinally of the frame structure for receiving rectilinearly slidable details of the expanding means C to be subsequently described. The plates 31 and 32 are reinforced by welding straps 35 secured to the plates 31 and 32 at the base connected end of the beam 30.

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Referring to the expanding means C by which the cylindrical shaped corrugated metal pipe is laterally deformed to provide an arch-type culvert, the same comprises an elongated assembly 40 preferably including superposed bars 40^a and 40^b, the latter of which slidably fits snugly in the guide way 36 of the cantilever 30, preferably with its side edges in contact with the inner-side surfaces of the plates 31 and 32, as is shown in Figs. 7 and 9. The power means D to be subsequently described moves this assembly 40 lengthwise along the longitudinal axis of the machine A in order to accomplish the pipe expanding and deforming operation.

Further details of the expanding construction C includes the provision of side rails, wings or members 42 and 43 which are connected to the rectilinearly slidable beam or assembly 40 by links or rods 45. The latter are pivoted at 46 at their outermost ends to the rails 42 and 43, by bolts, rivets or in any approved means found desirable. The shape of the rails 42 and 43 is not so important, but I preferably constructed the same of segmental or die portions 50, the convex sides of which face outwardly. On the concave sides thereof they have welded thereto relatively spaced bar portions 51 and 52, between which the pivot ends of the arms or links 45 are connected by the pivot bolts 46, as is shown in Figs. 10, 11 and 12 of the drawings.

Under controlled actuation of the expanding mechanism C, by the power means D, the rails 42 and 43 move inwardly and outwardly in parallelism. They are held against endwise movement by means to be subsequently described.

The connecting links or members 45 at their inner ends are pivotally connected by bolts or other means 55 between the bars 40^a and 40^b. The inner ends of the links 45 are provided with series of openings 58 for detachably receiving the pivot bolts 55 in order to adjust the lengths of the said links or arms 45 to suit different sizes of pipe to be deformed into arch-type culverts. In a machine which I have built three of such openings 58 are provided in each link 45 and it is thus possible to form arch-type culverts out of standardized fifteen-inch; eighteen-inch and twenty-one-inch riveted galvanized corrugated metal pipe.

Before completing the description of how the power means D is connected to the beam 40 and rails 42 and 43, it will be necessary to describe the power means D. It consists of a durable hydraulic cylinder 60 having a piston 61 operating therein in a conventional manner. Hose 63 feeds the operating fluid to the cylinder and piston. The fore end of the cylinder 60 is welded to a heavy heel 65 for the purpose of absorbing pressure thrusts. In the type of power means I have built it will take a pressure of five thousand pounds per square inch; the piston being five inches in diameter. The cylinder 60 is held onto the top flanges or walls of the frame by means of straps 67 which may be welded at their ends to the frame. These straps 67 are rigidly secured, as by welding to the cylinders. Thus, I will not have to provide a front heel for cylinder 60; such strap connections being sufficient to absorb forces incidental to collapsing of the expanding means after the pipe has been expanded to arch shape.

Referring again to connection of the expanding means with the power means D, I provide a pair of rods or links 75 and 76 connected at their front ends to the outer ends of a cross piece 77 which is attached to the fore end of rectilinearly movable beam 40. As is shown in Fig. 1 and in the cross sectional view, Fig. 9, the cross piece 77 is bolted at 80 to the rear ends of the sections 40^a and 40^b of the slidable beam 40. The front ends of the pull rods 75 and 76 are bolted at 81 to the ends of the cross piece 77. The rear ends of the pull rods 75 and 76 are bolted at 85 to the ends of a cross piece 86. The latter is pivoted at 87 to a bifurcated rear end of the piston 61, as more particularly shown in Figs. 7 and 8 of the drawings.

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For the purpose of holding the expanding rails 42 and 43 against any except very limited endwise movement, as the beam structure 40 moves longitudinally incidental to expanding or contracting operations, I provide compression rods or members 90 and 91, the front ends of which are pivoted at 92 upon extensions 93 and 94. The latter may be welded at the front ends of the rails 42 and 43 respectively. The rear ends of the compression rods or members 90 and 91 are pivoted at 95 to extensions 97 and 98 which are welded or otherwise rigidly secured in forwardly extending relation upon the ends of the cross piece 26 which may be considered a part of the base structure.

It will be noted that very long sections of pipe may be placed upon the cantilever beam structure of the frame because of the heavy frame base which supports the same.

The pipe to be expanded may be seamless or the conventional riveted type corrugated cylindrical formed galvanized metal pipe.

The expanding means C is collapsed in the relation of parts shown in Figs. 1 and 3 of the drawings, for starting an operation. The cylindrical shaped pipe is moved rearwardly from the front over the cantilever beam structure to its desired extent. In this position of parts the pipe E to be expanded will rest substantially as shown in Fig. 11.

After the pipe has been placed upon the machine, the operator, through the power means D, causes the piston 61 to move rearwardly from the cylinder 60. This places the connecting links 75 and 76 under tension and pulls the movable beam or member structure 40 rearwardly. The rails 42 and 43 are restrained from forward movement due to their attachment with the compression links or rods 90 and 91. Thus, the rails 42 and 43 are moved laterally into engagement with inner walls (at diametrically opposed zones) of the pipe E. As the expansion movement is continued the pipe E will be distorted into an arch-type culvert E', as shown in Fig. 12 of the drawings.

During the expanding action the connecting links 45 move from their diagonal positions into more right angled relation with respect to the longitudinal axis of the machine. This moves the rails 42 and 43 in parallelism laterally away from each other. The relation of parts is maintained because of the pivoted connections 92 and 95 of the compression rod structures upon the rails 42 and 43 and upon the frame of the machine at the locations 97 and 98.

After the expanding operation has been completed the hydraulic mechanism is reversed for retraction of the piston 61. This will cause the rods 75 and 76 to be placed under compression and will move the beam structure 40 forwardly. Due to the connections 90 and 91 with the rear ends of the rails 42 and 43 the latter will be prevented from endwise movement and this will cause the connecting links 45 to move from their expanded position into collapsed positions. During the latter operation the normal compression rods 90 and 91 are under tension, but the force is slight. The arch-type culvert E' may then be removed from the front end of the machine.

I have indicated that the connecting links 45 are provided with various openings to enable their link adjustment whereby to accommodate formation of arch-type culverts from cylindrical pipe sections of fifteen-inch, eighteen-inch, and twenty-one-inch diameters. During the deforming of the pipe (for smaller diametered pipe) a seat 100 is used. It may be welded or otherwise fixedly located upon the bottom of the beam structure 30. The beam 30 protrudes to a considerable extent downwardly from the plane in which the expansion takes place, at right angles thereto. No such protruding structure is provided above the plane of action of the expanding means. Thereby, at a location 90° from the zones of engagement of the expanding rails 42 and 43 with the

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pipe E the seat 100 will engage the inner wall of the pipe E to limit its distortion in the direction of expansion plane. Thus, the lower sector of the arch-type conduit (designated at 101 by the dotted lines in Fig. 11) has a greater depth than the upper sector (designated at 102 in Fig. 11). In use the arch-type segment E' as thus formed, will be inverted, since then the sector 102 is normally lowermost and the sector 101 uppermost.

The segments 50 engage the inner walls of the pipe E at exactly diametrically opposed zones. The linkage 45 lies in a plane which precisely intersects the longitudinal axis of the pipe E at the time the expansion action takes place.

Inasmuch as the machine is adaptable for forming arch-type culverts of various sizes from various diametered seamless cylindrical pipe, in addition to providing a series of openings 58 on the inner ends of each of the link arms 45, I also provide seat filler pieces 105, one of which is shown in Fig. 12. It straddles seat 100 and may be connected to it or the beam 30 in any approved manner. The seat filler piece 105 includes an arch piece 106 adapted to engage the inner wall of the pipe at a zone 90° from the side expansion rail connections of the expanding means within the pipe, with the result that the arch-type culvert will have the same shape characteristics above described.

It is within contemplation of this invention that the power mechanism, instead of being reversed to collapse the expansion wings or rails 42 and 43, may continue its rear movement. This will likewise result in collapsing the expansion assembly.

Various changes in the shape, size and arrangement of parts of the improved machine and in and to the steps of forming the cylindrical pipe into arch-type culvert formation may be made to the invention herein described without departing from the spirit of the same or the scope of the claims.

I claim:

1. In a machine for causing lateral expansion and reshaping of conduits from a circular shape to an arch-type cross sectional shape, the combination of a stationary supporting frame including an elongated beam adapted to movably receive thereon a conduit to be reshaped, expansion means mounted upon said beam having side wing portions adapted to engage the conduit internally for causing lateral reshaping thereof, the expansion means including an elongated member mounted on the frame which is movable along the line of the conduit, power means mounted upon the frame connected to said member and having a power action along the line of the movement of said elongated member, and means connecting the frame with the wings to limit their lengthwise movement as said elongated member is longitudinally moved, said last mentioned means having relatively spaced pivotal connections with said base and said wings to permit the wings to laterally move toward and away from each other in parallelism with respect to each other.

2. A machine for laterally reshaping long lengths of sheet metal pipe and the like, comprising a base having a pipe supporting frame connected therewith over which

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a section of pipe is adapted to be positioned, a lengthwise movable elongated rail mounted upon said frame for supported sliding action therealong, expansion wings, links pivotally connecting said expansion wings at opposite sides of said rail, said links being pivotally connected to said rail whereby the wings may be moved in parallelism towards and away from said frame and rail, hydraulic mechanism including a cylinder and a piston mounted upon said base, the piston having a movement in line with the action of said rail, tension means connecting the piston to said rail for movement of the wings into pipe expanding position as the piston is moved in its cylinder, and compression members connecting the wings with said base to limit endwise movement of the wings as they are moved toward and away from each other incident to longitudinal movement of the rail, said compression members having relatively spaced pivoted connections with said wings and said base.

3. In a machine for forming arch-type culverts from circular seamless sheet metal pipes, the combination of a heavy supporting base structure, an elongated supporting beam fixed to and connected with said base and extending endwise from the base for an appreciable distance for the support of lengths of sheet metal pipes, an elongated bar assembly slidably guided upon said elongated beam for lengthwise movement therealong, a series of links pivotally connected at their inner ends to the bar assemblage at each side of the bar assemblage and extending laterally at each side of the bar assemblage, parallel rails pivotally connected at the outer ends of each set of links with a rail positioned at each side of said beam, a cylinder fixedly mounted upon said base at an end of said beam, a piston assembly slidably mounted in said cylinder for movement on an axis in the line of movement of the bar assembly upon said beam, said piston assembly being mounted in the cylinder for movement in extended relation from the cylinder at a position directly opposite the location of said beam, tension members connecting said piston assemblage at the outer end of the piston assemblage to said bar assemblage for moving the bar assemblage longitudinally upon said beam, and means connecting the base with said rails to limit the endwise movement of said rails comprising elongated members pivotally connected to both the rails and base whereby as the piston moves the bar assemblage longitudinally of the beam the links will be angled to relatively move the rails laterally.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 2,916,076

December 8, 1959

John L. Young

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the grant, lines 2 and 12, and in the heading to the printed specification, lines 4 and 5, name of assignee, for "Young & Greenwalt Co." read -- Young & Greenawalt Co. --; in the printed specification, column 3, line 66, for "Fig. 1" read -- Fig. 7 --.

Signed and sealed this 17th day of May 1960.

(SEAL)

Attest:

KARL H. AXLINE

Attesting Officer

ROBERT C. WATSON
Commissioner of Patents