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APPARATUS FOR RADIALLY CONTRACTING AND ELONGATING METAL CYLINDERS

Filed July 21, 1930

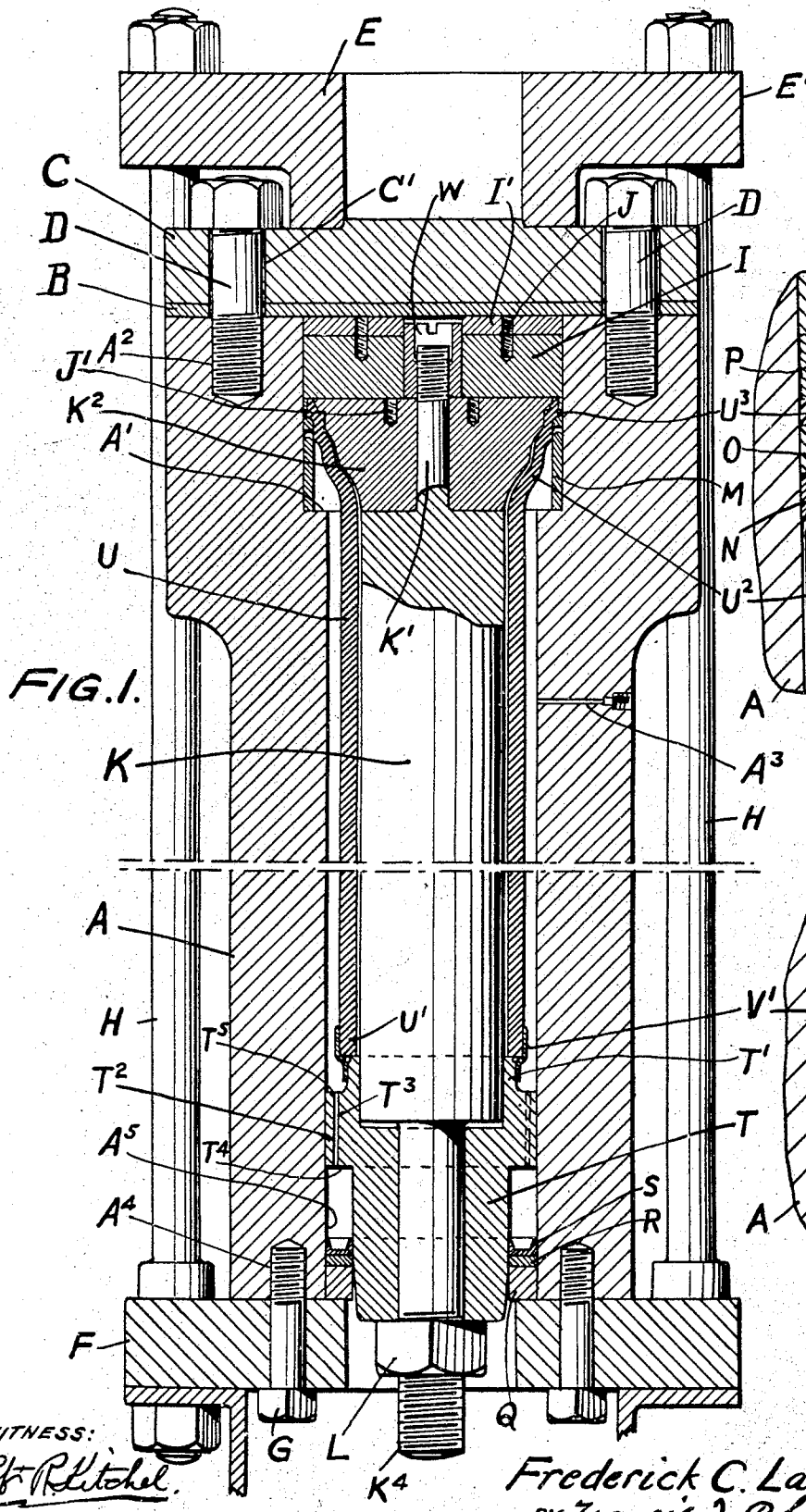


FIG. 1.

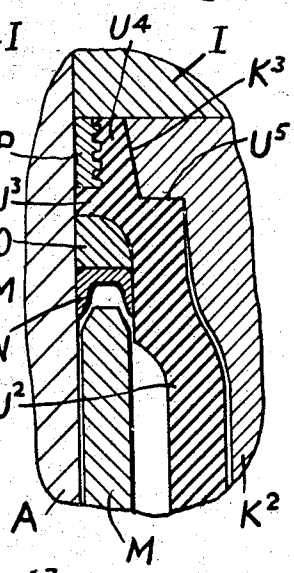


FIG. 2.

FIG. 3.

WITNESS:

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UNITED STATES PATENT OFFICE

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APPARATUS FOR RADIALLY CONTRACTING AND ELONGATING METAL CYLINDERS

Application filed July 21, 1930. Serial No. 469,539.

In my pending application, filed December 29, 1928, Serial Number 329,208, I have described and illustrated a method for radially contracting and simultaneously elongating metal cylinders and apparatus adapted for practicing the method and in my Patent No. 1,753,747, dated April 8, 1930, I specifically describe and claim the application of my method to the manufacture of metal molds adapted for the centrifugal casting of pipe. In my said former application and patent I have illustrated a construction in which a packing is inserted between the cylinder under treatment and the wall of the container, as a result of which construction the hydraulic pressure applied to effect the radial contraction of the cylinder under treatment is not applied to the portion of the cylinder lying outside of the packing and the object of my present invention is to provide an improved construction whereby the hydraulic pressure can be applied to the end or ends of the cylinder under treatment so that said end or ends can be readily contracted as well as the intermediate portions of the cylinder; essentially my invention consists in providing a sleeve or follower fitting over the mandrel on which the cylinder is to be compressed and abutting against the end of the cylinder which is free to expand longitudinally under treatment, said sleeve or follower being provided with a slightly enlarged head and fitting in a packing formed between its body portion and the walls of the container. A suitable packing is also required and provided at the contact line between the end of the follower and the end of the cylinder so as to exclude the pressure fluid from passing through the joint to the inside of the cylinder under treatment. Other features of my improved construction will be best understood as described in connection with the drawings, which illustrate apparatus especially adapted for radially contracting and longitudinally elongating steel molds adapted for the centrifugal manufacture of pipes, said apparatus embodying my present improvements.

The drawing shows, in Fig. 1, a vertical sectional elevation through the apparatus taken through the center line thereof with a steel mold blank in the position to be operated upon and in Figs. 2 and 3 a detailed construction of parts of the apparatus.

A indicates the container, which is best located in a vertical position. The container is internally of cylindrical form with an enlargement at the head forming a shoulder, indicated at A^1. A^2 A^2 indicate bolt holes formed in the top of the container. A^3 indicates the port through which water or other fluid under heavy pressure is introduced into the container. A^4 indicates bolt holes located in the lower end of the container. A^5 indicates a portion of the cylindrical wall of the container against which the packing at the lower end of the container rests. B indicates a plate of hard steel covering the top of the container and covered in turn by the heavy head C, which is made sufficiently massive and strong to resist the pressure when the pressure fluid is introduced into the container. This plate is formed with bolt holes as indicated at C^1 which register with the threaded bolt holes A^2 in the head of the container. D, D indicate the bolts which secure the head to the container. E is a heavy annulus resting on the head C and formed with flanges indicated at E^1 through which pass heavy tie rods H, secured at their lower ends to a bottom plate F, which is also secured to the bottom of the container by bolts indicated at G. This plate extends slightly inside of the cylindrical bore of the container. I indicates an annular spacing piece which when the apparatus is assembled rests through an intervening spacing piece I^1 against the plate B. These spacing pieces are provided as shown with threaded perforations J for the insertion of eyebolts used in handling the parts. K is the mandrel upon which the cylinder under treatment is contracted and which gives final form to the inside of the contracted cylinder; in the case illustrated this mandrel is formed with a threaded extension K^1 at its top and with a bottom extension of smaller diameter indicated at K^4, the lower end of which is threaded. In the case illustrated the upper end of the mandrel upon which the bell portion of the mold is

contracted is formed as a separate piece, indicated at K^2, and is secured to the upper end of the mandrel by the sleeve nut W screwing down on the threaded end extension K^1. The upper end of this portion, indicated at K^3, is, as shown, formed to make a neat fit with the portion of the mold blank which in the finished mold forms a seat for the core used in casting bell ended pipes. The portion K^2 is shown as provided with threaded perforations indicated at J^1 for the reception of eyebolts used in handling this part of the apparatus. I indicates a nut screwing on the threaded end of the bottom extension of the mandrel. M indicates a cylindrical support resting at bottom on the ledge A^1 of the container and supporting at its top packing indicated at N, upon the top of which rests a ring O, which fits against the outer flange of the mold blank and upon which the mold blank is supported. F indicates a metallic ring screwing on the threaded end of the mold blank and fitting against the flange of the blank and against the annular spacing piece I. Q is an annular ring the lower end of which rests upon the projecting edge of the plate F and the upper edge of which supports a packing made up as shown of a fibre annulus R and a leather packing S, resting on the fibre. T indicates a differential sleeve or follower, the lower portion of which fits over the extension K^4 of the mandrel and which should have only sufficient clearance to enable it to be contracted upon the mandrel without exceeding the elastic limit of the material of which it is composed. The outer portion of this portion of the sleeve fits against the packing indicated at R, S. The upper portion of the differential sleeve is enlarged as indicated at T^1 to fit over the lower end of the mandrel proper and again should have only such clearance as would enable it to be contracted on the mandrel without exceeding the elastic limit of its material. As the drawing shows, the differential sleeve is provided with an extension T^2 forming a fairly close fit with the inside of the container, through which are formed channels indicated at T^3. The lower face of the extension indicated at T^4 is as shown of greater diameter and area than the upper face T^5 so that when pressure is admitted to the container it will exert an upward force on the differential sleeve. U indicates the mold blank as it is located in the apparatus prior to the admission of pressure fluid to the container to radially contract it. U^1 indicates the lower end of the mold, which should be finished off with a smooth surface perpendicular to the axial line of the mandrel. U^2 indicates the bell portion of the mold, formed with an outwardly extending flange U^3 and an upwardly extending externally threaded extension U^4; U^5 indicates the core seat. V is a soft metal ring located at the contact edge of the differential sleeve and the lower end of the mold blank and overlaid by a layer of rubber or the like V^1 which extends over the lower end of the mold and the upper end of the differential follower, as shown.

Preparatory to operation the mold is assembled in the apparatus as shown in the drawings and pressure fluid is admitted to the container through the port A^3. When the pressure has reached about a thousand pounds to the square inch the nut L which has been screwed up on the threaded extension of the mandrel so as to hold the differential sleeve tight against the end of the blank is removed and the pressure thereafter raised to a sufficient amount to effect the radial contraction and simultaneous elongation of the blank, which elongation of course in such an assembly as that described results in a downward projection of the lower end of the blank carrying with it the differential follower which is held against the end of the blank with a pressure determined by the effective increase of the diameter of the head of the follower over its lower portion. This upward thrust of the follower involves the use of greater pressure in the container to effect the contraction of the blank than would be necessary if no such upward thrust was exerted against the blank but this is compensated for by the fact that the construction indicated permits the entire lower end of the blank to be contracted on the mandrel.

It is very important that the upper head of the differential sleeve against which the end of the blank rests should never be exposed to direct pressure from the liquid in the container to such an extent as would shift the differential pressure and result in the pressure operating to thrust the differential follower downward instead of upward against the end of the blank. It is therefore advisable, as shown, that the contacting end of the follower should be less in diameter than the diameter of the blank against which it rests and so proportioned that even when contracted the end of the blank will not extend within the periphery of the head of the follower.

It is advisable that a lubricant such as white lead should be used to coat the mandrel so as to dimnish as much as possible the friction due to the downward extension of the blank after it is contracted on the mandrel and the friction due to the contraction of the differential follower upon the mandrel and its extension. I have already pointed out that the clearance between the differential follower and the portions of the mandrel which it overlies should not exceed the amount to which the sleeve can be contracted on the mandrel without exceeding the elastic limit of the material of which it is constructed. In this way the differential sleeve after the withdrawal of pressure resumes its original form,

permitting its ready withdrawal and its reuse on other blanks.

The composite packing used to close the joint between the head of the differential follower and the blank and made up as described of a soft metal ring overlaid by a rubber-like cover has been found very effective to prevent the entrance of pressure to the inside of the blank under treatment.

While I have illustrated the apparatus as constructed for the treatment of blanks used in the formation of pipe molds, my invention is obviously applicable to the similar treatment of all substantially cylindrical bodies which it is desired to similarly contract and elongate and of course in the treatment of purely cylindrical bodies such as pipes the differential sleeve construction described can be used at both ends of the container, though equally of course it is obvious that all that is necessary is that one end of such a pipe should be in contact with the differential sleeve and the other firmly held in or on the head of the container.

Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. Apparatus for radially contracting and simultaneously elongating hollow metal bodies of a substantially cylindrical shape, comprising a container for fluid under pressure having a port for the introduction of high pressure fluid thereto, a mandrel for limiting the radial contraction of the hollow cylindrical body, a hollow cylindrical follower adapted to give passage to the mandrel and having an enlarged head adapted to abut against the end of the cylindrical body under treatment, packing located between the follower and the container and packing adapted to close the joint between the follower head and the end of the cylindrical body.

2. Apparatus as called for in claim 1 provided with means for temporarily clamping the follower against the end of the cylinder under treatment.

3. Apparatus as called for in claim 1 in which the internal diameter of the follower is only so much greater than that of the mandrel as will permit the follower to be radially contracted upon the mandrel without exceeding the elastic limit of its component material and imparting a permanent contraction to the follower.

4. Apparatus as called for in claim 1 in which the packing at the joint formed between the head of the follower and the end of the cylinder under treatment comprises a ring of plastic metal.

5. Apparatus as called for in claim 1 in which the packing at the joint formed between the head of the follower and the end of the cylinder under treatment comprises a ring of plastic metal and a layer of rubber-like material overlapping the metal ring.

6. Apparatus as called for in claim 1 in which the mandrel is provided with an extension of smaller diameter and the follower is shaped to form a loose fit with the extension and with the end portion of the mandrel proper.

7. Apparatus as called for in claim 1 in which the follower is provided with centering means operative to maintain it approximately centered in the container without interfering with its longitudinal motion therein.

8. Apparatus as called for in claim 1 in which the container is secured in vertical position, the mandrel located in the container is formed with an extension at its lower end of less diameter than its body portion and the follower is located at the lower end of the container and formed to form a loose fit with the mandrel extension and the end portion of the body of the mandrel.

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