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J. PRIMROSE

METHOD AND APPARATUS FOR EXPANDING TUBES

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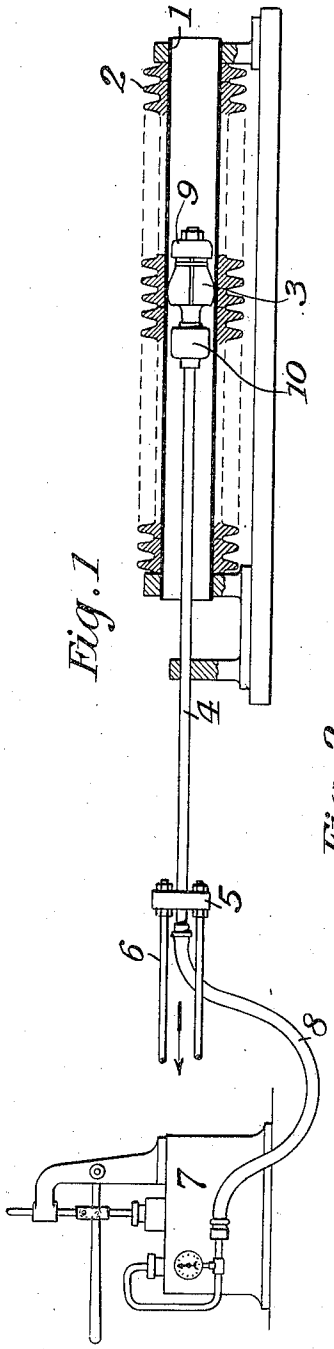

Fig. 1

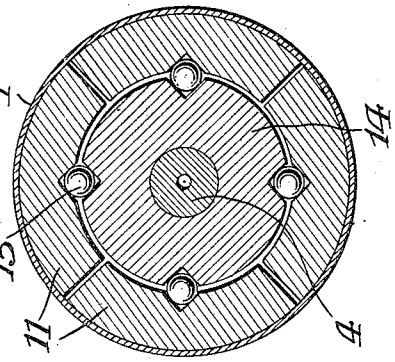

Fig. 3

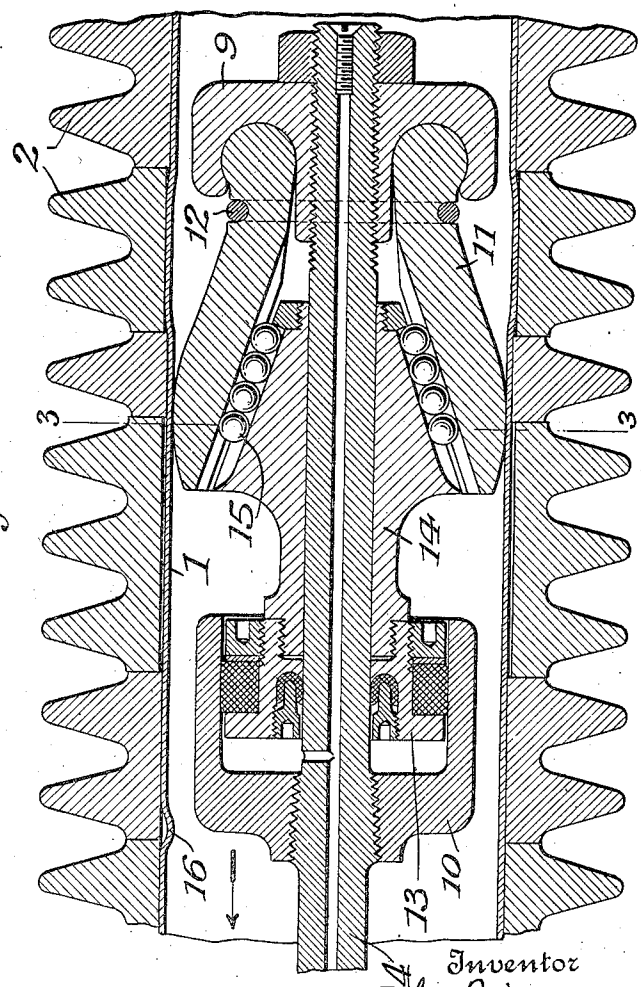

Fig. 2

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UNITED STATES PATENT OFFICE.

JOHN PRIMROSE, OF NEW YORK, N. Y., ASSIGNOR TO POWER SPECIALTY COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

METHOD AND APPARATUS FOR EXPANDING TUBES.

Application filed June 11, 1921. Serial No. 476,761.

To all whom it may concern:

Be it known that I, JOHN PRIMROSE, a citizen of the United States of America, residing at New York, in the county and State of New York, have invented certain new and useful Improvements in Methods and Apparatus for Expanding Tubes, of which the following is a full, clear, and exact description.

The subject of this application for Letters Patent is an improvement in tube expanders. The invention is applicable generally for the purpose of expanding or enlarging the internal diameter of metal tubes, but it has and is primarily designed to have a special function in expanding boiler, superheater or other tubes into close contact with the surrounding cast iron rings which are now so largely used to form a casing around such tubes. I shall describe the improvement as adapted and applied to this special purpose.

In all cases where wrought steel tubes are enclosed in a corrugated casing of cast iron rings or sections, it is of the first importance to secure and to maintain between the base tube and each of the surrounding rings a perfectly tight fit or union in order to facilitate the proper transfer of heat. This fit is not easy to secure. A slight difference in the internal diameter of the rings, equally slight variations in the thickness of the walls of the tubes or any inequalities in the surfaces of either leave spaces which very seriously impair the proper heat transfer. Various devices have been constructed and used to correct this objection, but none has met all requirements, so far as I am aware, because of the variable pressure between the expanding surfaces and the inner surface of the tube which inevitably results from the conditions of structure and function of the means which have heretofore been used for this purpose.

To overcome these and other objections I have devised a new method and means for expanding the tubes which, broadly stated, involves the application of a constant pressure between the expanding surfaces and the tubes. This I secure by hydraulic pressure, but the use or application of such pressure for the purpose involves a somewhat difficult problem, which, however, I have solved by the use of a rigid support for the expander which carries movable expanding jaws or surfaces which are forced outwardly by hydraulic pressure and which are designed and adapted to yield, when necessary, against such pressure while always exerting the same or substantially the same expansive force against the tube.

The means which I propose for carrying out this invention are illustrated in the accompanying drawings:

Fig. 1 is a general illustration of the complete apparatus, a tube section which is supposed to be undergoing expansion, being shown in section.

Fig. 2 is a central longitudinal section on an enlarged scale of the expander, and

Fig. 3 is a cross section of the same on the line 3—3 of Fig. 2.

For a general understanding of the invention, reference may be had to Fig. 1. In this figure, a section 1 of tube to be expanded has rings or corrugated sections of cast iron 2 strung over it, which, due to the improvements hereinafter described need not be machined. This tube is then properly supported and the expander 3 drawn through it by means of a hollow rod 4, connected to a cross-head 5, connected by rods 6 to any suitable source of power.

A pneumatic pump or pressure apparatus 7 is connected by a flexible tube 8 to the hollow rod 4, and the fluid under regulated pressure from the pump is carried to means in or on the expander for forcing outwardly the jaws which move over the internal surface of the tube 1.

The expander comprises a head or ring 9 screwed or otherwise securely fastened to the end of the rod 4, and a hydraulic chamber 10 fixed a proper distance back from the head of the rod. Within the head are a plurality, preferably four, of jaws 11, with suitably rounded ends that fit in sockets in the said head, and are held in place by a slightly elastic band, such as a split steel ring 12, in said head.

A piston 13 is fitted in the chamber 10 and is properly packed in any manner so as to be perfectly fluid tight. Attached to this piston in any proper manner, preferably by screwing into it is a sleeve 14, which slides over the rod 4. The end of this sleeve is conical and provided with raceways for balls 15 which run therein between the sleeve and corresponding ways in the conical inner surfaces of the jaws 11.

In the use of this apparatus the fluid pressure in the chamber 10 is raised to the point desired or which may be found necessary for good results. This forces the sleeve 14 in between the jaws 11, and forces these latter outwardly and against the inner surface of the tube 1 with the proper and predetermined pressure. When the expander as a whole is thus adjusted and drawn through the tube in the direction indicated by the arrows, this pressure forces out the walls of the tube into close union with the inner walls of the rings 2.

I have shown these rings as of different lengths and of varying internal diameters, but this has no effect upon the degree of expansion. When the jaws pass a ring of enlarged diameter, the pressure, remaining constant, forces the tube outwardly a sufficient amount to make a close fit. Should the ring be of normal or reduced diameter the amount of expansion is correspondingly decreased, and, the jaws, still under the same pressure, yield to accommodate such reduced diameter. Should a dent or irregularity occure at any point in the tube, as shown, for example, at 16, it will be smoothed out by the expander.

One of the chief merits of this device resides in the fact that the tube is neither cut nor injured, whatever the conditions may be. In other words, with the means heretofore employed, great care had to be exercised when irregularities in the rings or tube made necessary more than the least amount of expansion to prevent cutting or injuring the tube, but with this device this danger is entirely eliminated.

While the drawing, for purposes of illustration, shows abnormal irregularities in the rings, it shows how by the means herein described even such irregularities may be fully compensated for and overcome.

The specific construction of the means for carrying out this invention may be greatly varied, and I do not regard them as of the essence of the invention.

What I claim is:

1. The method herein described of expanding metal tubes which consists in drawing through the same an expander having movable parts, and maintaining the movable expanding surfaces of the same against the inner surface of the tube by uniform hydraulic pressure said pressure being maintained uniform during any movement of the movable parts of the expander.

2. A tube expander having movable expanding surfaces, in combination with means for forcing them into contact with the inner surface of the tube, and means for maintaining said contact under a uniform predetermined hydraulic pressure while the tube is being expanded.

3. A tube expander comprising an element for drawing an expander through a tube, an expander carried thereby and having movable expanding surfaces, a hydraulic pressure device carried by said element, a piston in said device, and means connected to said piston for forcing said expanding surfaces against the tube to be expanded and maintaining the same constantly against the inner wall of the tube substantially as described.

4. A tube expander having movable expanding surfaces, in combination with a hydraulic pressure device carried by said expander, a piston in said device, a mechanical device connected with the piston thereof and engaging the expanding surfaces and adapted to force the same into contact with the inner surface of the tube and maintain such contact with a constant pressure predetermined by the pressure in the hydraulic pressure device.

In testimony whereof I hereto affix my signature.

JOHN PRIMROSE.