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J. LANG

1,793,624

TUBE EXPANDER

Filed June 20, 1928

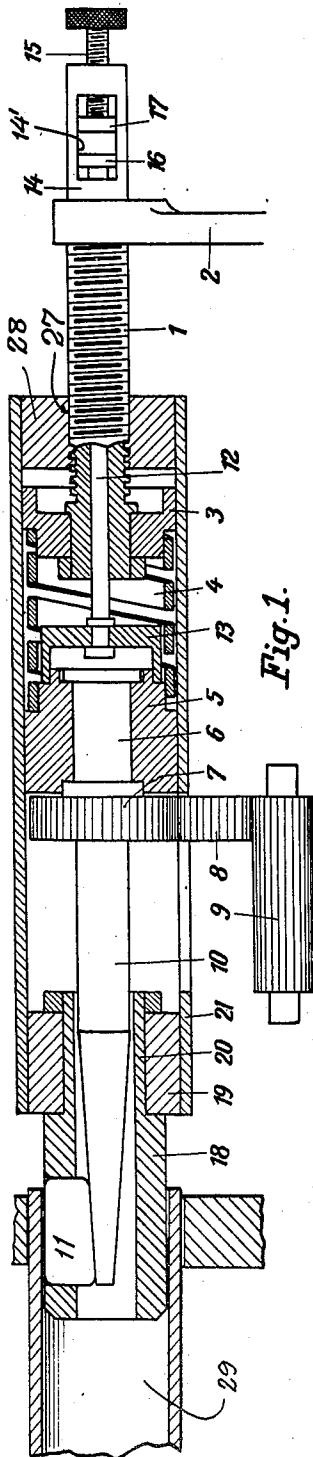


Fig. 1.

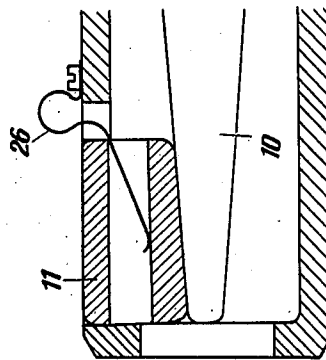


Fig. 6.

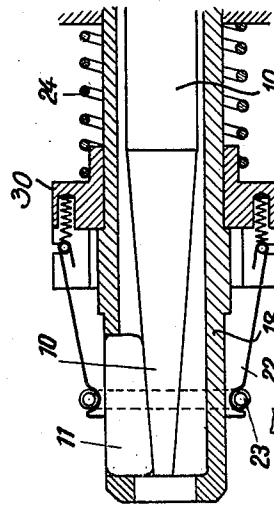


Fig. 2.

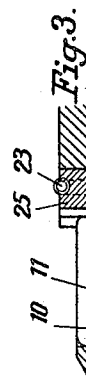


Fig. 3.

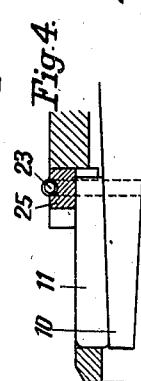


Fig. 4.

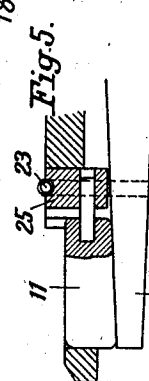


Fig. 5.

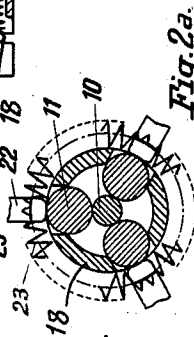


Fig. 2a.

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TUBE EXPANDER

Application filed June 20, 1928, Serial No. 286,934, and in Germany July 16, 1925.

My invention relates to a device for fastening tubes in boiler walls, flanges, plates, &c. by expansion.

In tube expanders as hitherto known and used spindles are sometimes employed composed of several sections which are rigidly connected with each other. This arrangement results in the disadvantage that the tool is fed into the tube with too great a speed and the expansion is apt to be insufficient.

In the tool according to my invention the feeding and expanding mechanisms are separate contrivances, so that the motions in axial and radial directions take place independently of each other. The connection between axial feeding and radial forcing members is by a compression spring which transmits the pressure exerted by the screw into the expansion rolls. While for generating the expanding pressure a few slow turns of the screw will do, the expanding arbor may be revolved at a relatively high speed tightening the tube in its seat without unduly straining the wall surrounding the tube. The invention will be better understood from the following description taken in conjunction with the accompanying drawing, in which

Fig. 1 is a sectional view of the device according to my invention,

Fig. 2 is a longitudinal section of the part containing the roller arrangement,

Fig. 2a is a cross-section thereof, and

Figs. 3, 4, 5, and 6 are partial sections through the roller cages, representing various modifications of the invention.

Referring now to the drawing 1 is the screw for the axial feed of the tool actuated by crank 2 and bearing against the thrust sleeve 3 which rests against the coil spring 4. The screw 1 engages a screw-threaded opening 27 in the member 28 which is securely fixed in one end of the housing 21. The pressure of the spring 4 is transmitted to the sleeve 5 in which the arbor 6 with the gear 7 secured firmly to it rotates freely. Gear 7 is driven through a pair of gears 8 and 9. Upon axial travel of the arbor 10 and the gear 7, the gear 8 is so arranged as also to partake of such travel. The gear 9 is such a length that the

gear 8 remains in engagement with gear 9 throughout said axial travel. The pressure of the screw is thus indirectly through the medium of the spring 4 transmitted to the expansion arbor 10 and hence distributed among the rolls 11. As soon as the rolls come to bear against the inside of the tube 29 to be expanded, the axial travel of parts 5, 6, 7, 8 and 10 is inhibited, while the parts 1, 2, 3 continue their travel in the direction of the axis according to the amount of spring compression, so that the pressure exerted against the work is relative to the adjustment of the screw 1. This rolling pressure which may be kept constant by adjusting the screw 1, is used for securing the tube to its seat. After finishing the work of expanding the tube the pressure on the rolls is released by turning back the crank handle 2, while parts 6, 7, 8, 9 and 10 retain their direction of rotation. Thus the motor driving the contrivance need not be stopped or reversed for starting the next tube.

The pressure aforesaid results, as in a spring weighing scale, from the compression of a spring. The relation of compression exerted to the amount of pressure is fixed by testing the spring previous to its insertion. If for example the test has shown that it takes a load of 500 kgs. for 5 mm. compression, 6 mm. for 600 kgs., 7 mm. for 700 kgs., and so on, these figures will constitute the working pressure. For applying a predetermined amount of pressure with such calibrated springs a novel device for measuring is used, which is also shown in Fig. 1 and is described as follows:

The screw 1 has a cavity to receive the measuring pin 12 connected with the shell 13, which again is rigidly attached to the sleeve 5. Screw 15 is used for adjusting the travel of the spring for the expanding pressure desired. Collars 16 and 17 are attached respectively to the members 12 and 15 and are received in an opening 14' in the end portion 14 of the screw member 1. Since collar 16 is attached directly to the sleeve 13, upon displacement of sleeve 13 relative to sleeve 3 the collar 16 will be displaced relative to the member 1 within the portion

14. Since the relative displacement between sleeves 13 and 3 is exactly the compression of spring 4 this displacement is a measure of the force exerted on and by spring 4.

5 Therefore the relative displacement of collar 16 with respect to member 1 is also a measure of the compression of spring 4. This displacement can easily be observed through the opening 14' in the end 14 of member 1.

10 During the work of expanding the collars 16 and 17 touch each other. When the collars 16 and 17 touch, the operator thereby knows that the maximum desired pressure on the rolls 11 has been reached. If the

15 initial distance of these parts 16 and 17, as mentioned previously amounts to 5, 6 or 7 mm. and the parts 16 and 17 abut, an expanding pressure of say 500, 600 or 700 kgs. results. The pressure on the expansion rolls may in this way be regulated to suit the work.

20 Collars 16 and 17 may be combined with an electric contact actuating an optical signal or a bell or other device for indicating that the pressure desired has been attained or is falling off.

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Another improvement is found in the rotary arrangement of the roller cage 18 within the bushing 19. The bearing 20 may be made as a separate part to which the roller cage 18 may be attached. By this arrangement the housing 21 may remain at a standstill while the roller cage 18 revolves at the ratio of speed given by the relation of the diameter of the expanding arbor and the box of the tube 29 and resulting in the roller cage 18 making fewer revolutions than expanding arbor 10.

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As a rule the upper edges of the slots in which the expanding rollers 11 are seated, are peened so that they will close in upon the rollers and prevent them from dropping out. The range of expansion is thereby diminished, and another disadvantage resulting is, that the projecting edges are apt to interfere with the rollers, acting as brakes, further it is necessary to force the rollers towards the center by hand when inserting the roller cage into the tube. This manipulation frequently leads to injury of the operator's hands and besides the rollers must be inserted into the slot from the inside of the cage in a rather awkward manner. All these drawbacks are obviated by my said invention which provides slots or notches of uniform width in which the rollers may be inserted from the outside and are automatically forced inward against the expanding arbor so that they are always in the position for starting the work and their radial travel is not stopped by the roller cage.

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Figures 2, 2a, 3, 4, 5 and 6 show several ways of achieving this end. Figs. 2 and 2a show the usual arrangement of the expanding rollers 11 on which spring holders 22 are seated and held in position by a coil spring

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23 so as to force the rollers 11 against the expanding arbor 10. The opposite ends of the spring holders 22 are carried by a collar 30 acted upon by a spring 24. When the roller cage 18 is inserted in the tube the holders 22 are forced backwards releasing the rollers 11 and putting spring 24 under tension. As soon as the roller cage 18 is withdrawn from the tube, spring 24 will automatically push the holders 22 back upon their expanding rolls 11 which will thereby be kept in contact with arbor 10.

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In the design shown by Fig. 3 the rollers are provided with integral studs, in Fig. 4 the taper is extended, in Fig. 5 a stud is inserted. All these extensions have their bearing in loose guide pieces 25, the lower faces of which rest upon the expanding arbor 10 and are clamped by the spring 23.

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In the arrangement shown in Fig. 6 the expanding rolls 11 are provided with a cavity into which a spring 26 projects so that it will force the expanding rollers against the arbor 10 independent of their radial position.

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In the arrangement shown in Figs. 3, 4 and 5 a holddown spring similar to spring 26 of Fig. 6 may likewise be employed. These springs would analogously be arranged to bear against the guide pieces 25 instead of against roller 11 as shown in Fig. 6.

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All the drawings show merely examples of my invention which implies the possibility of other forms of application, for instance the employment of ball or roller bearings for reducing the friction of the various mechanisms.

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

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1. In a tube expander, a rotatable expanding arbor, means for rotating said arbor, independent means for axially advancing said arbor, and elastic means transmitting the advancing force intermediate said arbor and said advancing means.

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2. In a tube expander, a conical arbor, means for rotating said arbor, conical expanding rollers associated with said arbor, independent means for advancing said arbor, and resilient force transmitting means intermediate said arbor and said advancing means.

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3. In a tube expander, a housing, a conical arbor, means for mounting said arbor so as to be rotatably and axially movable upon said housing, means for rotating said arbor, independent means for advancing said arbor with respect to said housing, and resilient force transmitting means intermediate said arbor and said advancing means.

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4. In a tube expander, a housing, a conical arbor rotatably and axially movable in said housing, a cage rotatably mounted on said housing, rollers radially and rotatably mov-

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able by said arbor in said cage, means mounted in said housing for advancing said arbor, independent means for rotating said arbor, and resilient force transmitting means intermediate said arbor and said advancing means.

5. In a tube expander, a housing, a conical arbor rotatably and axially movable in said housing, a cage rotatably mounted on said housing, rollers radially and rotatably movable by said arbor in said cage, means mounted in said housing for advancing said arbor, means for rotating said arbor, resilient force transmitting means intermediate said arbor and said advancing means, and means for measuring the compression of said resilient means.

6. In a tube expander, a housing, a conical arbor rotatably and axially movable in said housing, a cage rotatably mounted on said housing, rollers radially and rotatably movable by said arbor in said cage, means mounted in said housing for advancing said arbor, means for rotating said arbor, resilient force transmitting means intermediate said arbor and said advancing means, and means for measuring the distance between said arbor and said advancing means.

7. In a tube expander, a housing, a conical arbor rotatably and axially movable in said housing, a cage rotatably mounted on said housing, rollers radially and rotatably movable by said arbor in said cage, means mounted in said housing for advancing said arbor, means for rotating said arbor, resilient force transmitting means intermediate said arbor and said advancing means, and means for measuring the force transmitted by said resilient means.

8. In a tube expander, a housing, a conical arbor rotatably and axially movable in said housing, a cage rotatably mounted on said housing, rollers radially and rotatably movable by said arbor in said cage, means mounted in said housing for advancing said arbor, means for rotating said arbor, resilient force transmitting means intermediate said arbor and said advancing means, and means for limiting said force to a definite value.

9. In a tube expander, a housing, a conical arbor rotatably and axially movable in said housing, a cage rotatably mounted on said housing, rollers radially and rotatably movable by said arbor in said cage, means mounted in said housing for advancing said arbor, means for rotating said arbor, resilient force transmitting means intermediate said arbor and said advancing means, and means for limiting said force to a positively adjustable value.

10. In a tube expander, a housing, a conical arbor rotatably and axially movable in said housing, a cage rotatably mounted on said housing, rollers radially and rotatably movable by said arbor in said cage, means

mounted in said housing for advancing said arbor, means for rotating said arbor, resilient force transmitting means intermediate said arbor and said advancing means, and means limiting the distance between said arbor and said advancing means to limit said force to a positively adjustable value.

11. In a tube expander, a housing, a conical arbor rotatably and axially movable in said housing, a cage rotatably mounted on said housing, rollers radially and rotatably movable by said arbor in said cage, a screw mounted upon said housing for advancing said arbor and having a central bore, a rod coaxial with and rotatably connected to said arbor and extending through said bore, means for rotating said arbor, resilient force transmitting means intermediate said arbor and said screw, and means indicating the relative positions of said rod and said screw.

12. In a tube expander, a housing, a conical arbor rotatably and axially movable in said housing, a cage rotatably mounted on said housing, rollers radially and rotatably movable by said arbor in said cage, a screw mounted upon said housing for advancing said arbor and having a central bore, a rod coaxial with and rotatably connected to said arbor and extending through said bore, means for rotating said arbor, resilient force transmitting means intermediate said arbor and said screw, and adjustable means upon said screw for limiting the movement of said rod relative to said screw to definitely limit said force.

13. In a tube expander, a housing, a conical arbor rotatably and axially movable in said housing, a cage rotatably mounted on said housing, rollers radially and rotatably movable by said arbor in said cage, means mounted in said housing for advancing said arbor, means for rotating said arbor, resilient force transmitting means intermediate said arbor and said advancing means, a sleeve slidably mounted on said cage, resilient means between said sleeve and said housing, and means mounted on said sleeve for keeping said rollers in contact with said arbor.

14. In a tube expander, a housing, a conical arbor rotatably and axially movable in said housing, a cage rotatably mounted on said housing, rollers radially and rotatably movable by said arbor in said cage, means mounted on said housing for advancing said arbor, means for rotating said arbor, resilient force transmitting means intermediate said arbor and said advancing means, a sleeve slidably mounted on said cage, resilient arms on said sleeve extending in axial direction over said rollers, an annular spring pressing said arms toward said rollers, and resilient means between said sleeve and said housing tending to keep said arms in contact with said rollers.

15. In a tube expander, a housing, a conical arbor rotatably and axially movable in said housing, a cage rotatably mounted on said housing, rollers radially and rotatably movable by said arbor in said cage, means
5 mounted in said housing for advancing said arbor, means for rotating said arbor, resilient force transmitting means intermediate said arbor and said advancing means, and
10 means comprising an annular spring for keeping said rollers in contact with said arbor, said means being axially movable upon said cage.

In testimony whereof I affix my signature.

JOSEF LANG.

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