Oct. 3, 1939. E. M. CARTWRIGHT 2,174,967

METHOD AND APPARATUS FOR SIZING TUBULAR TERMINALS

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Fig. 2.

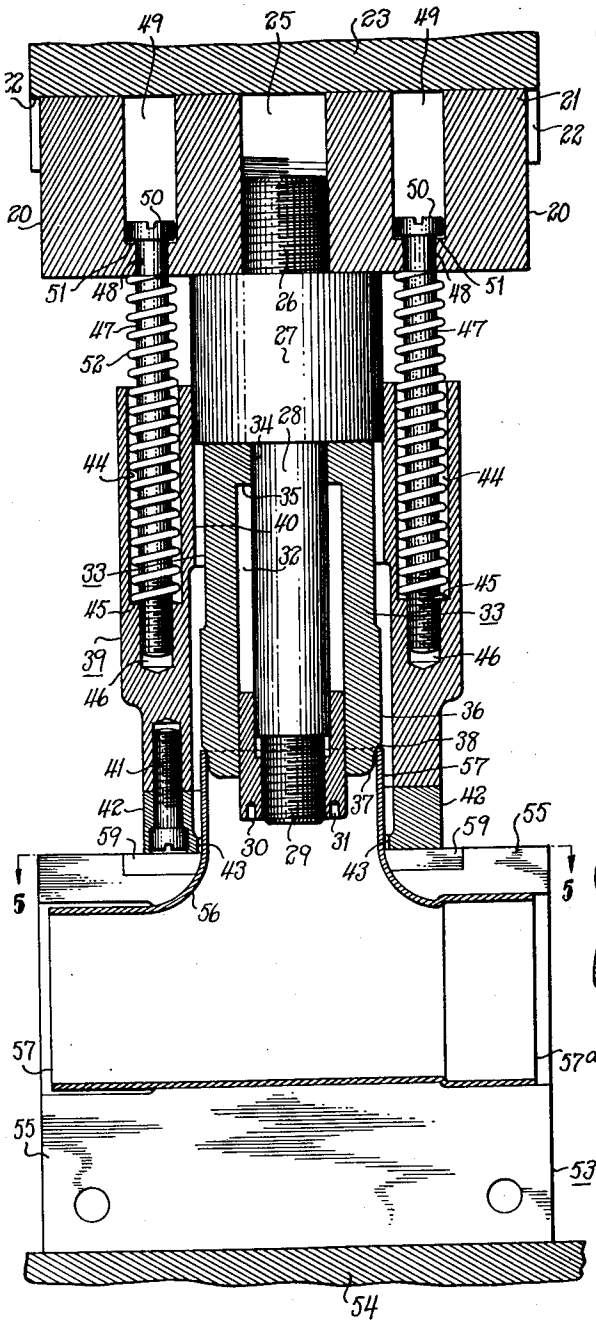
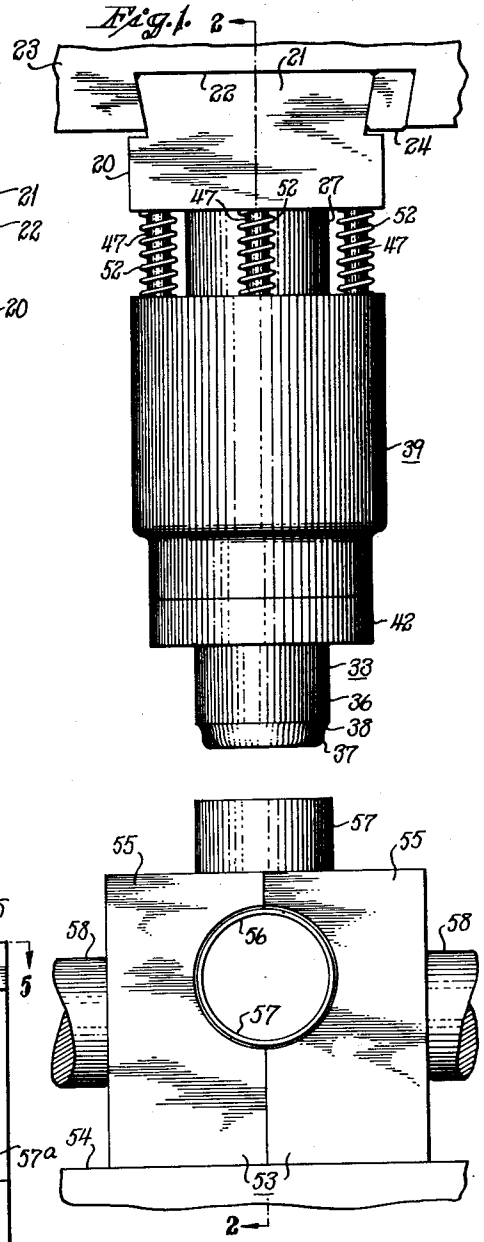


Fig. 1.



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Fig. 4.

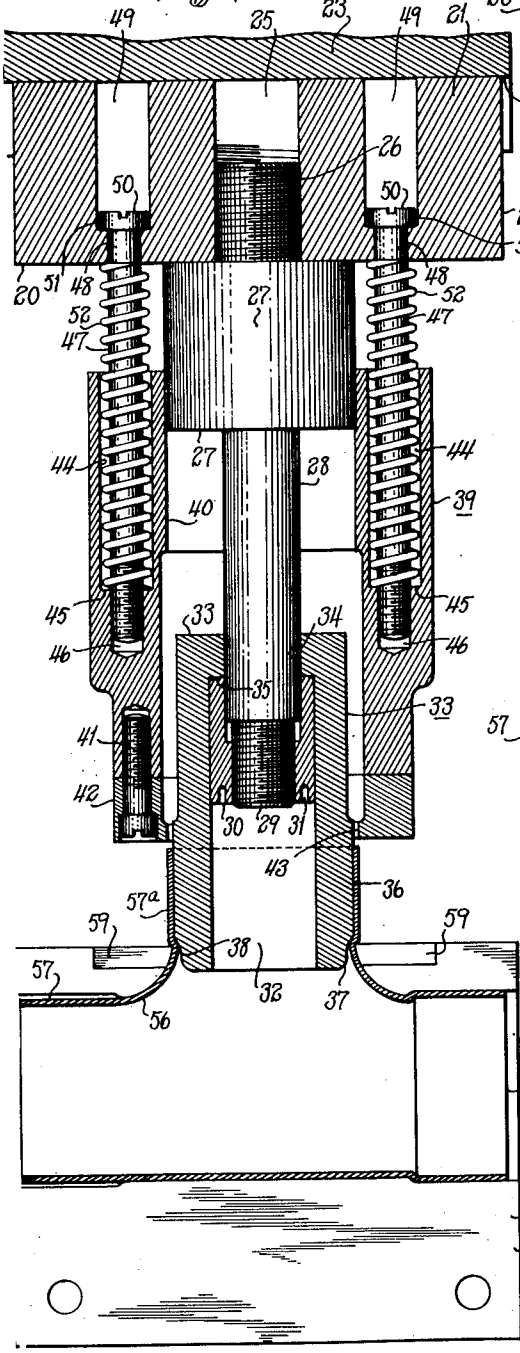
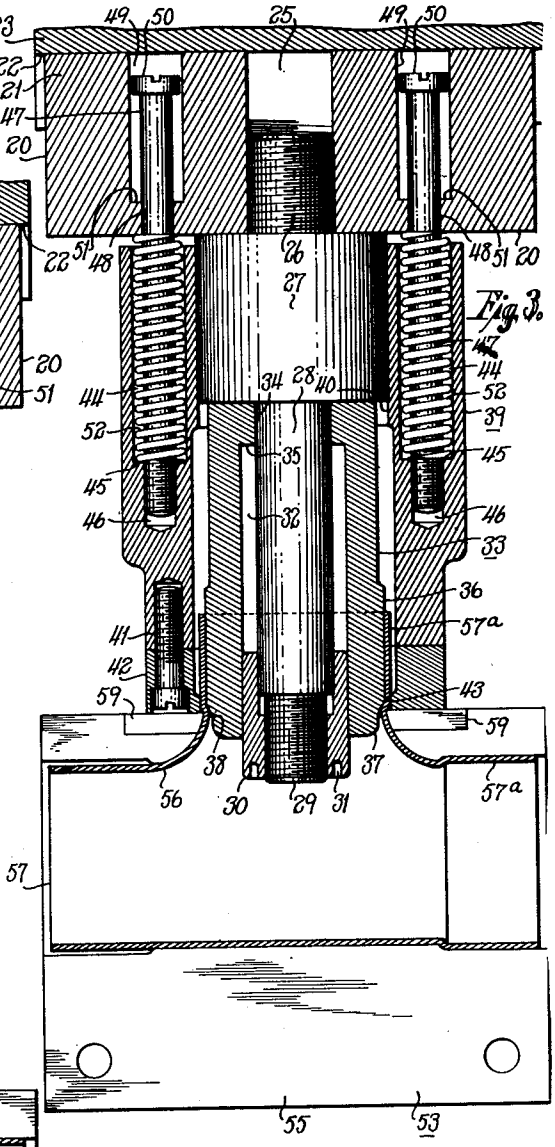


Fig. 3.



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METHOD AND APPARATUS FOR SIZING TUBULAR TERMINALS

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Fig. 5.

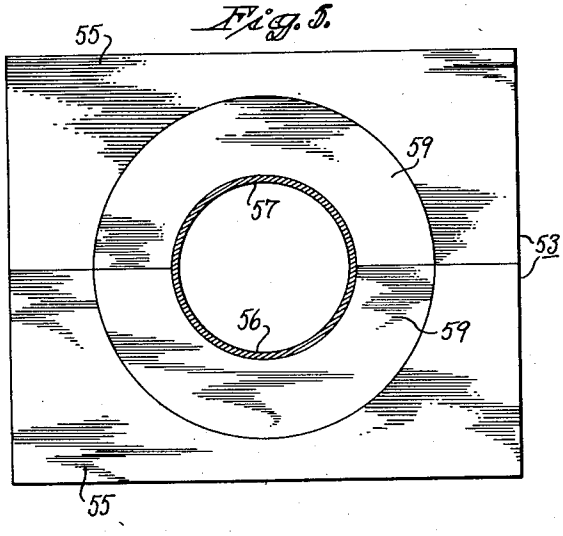


Fig. 6.

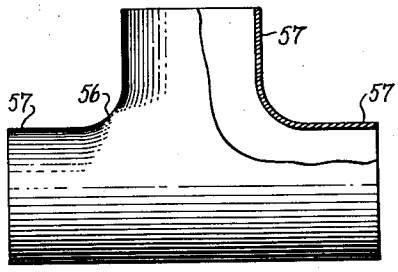


Fig. 7.

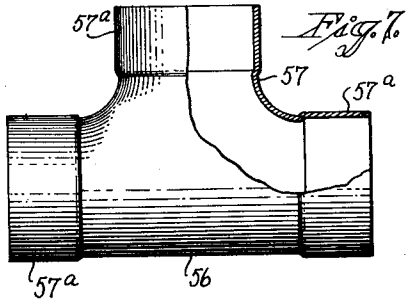


Fig. 10.

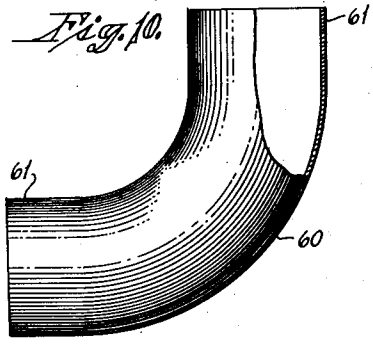


Fig. 9.

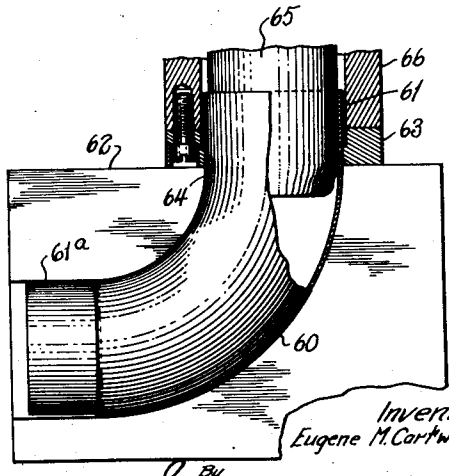
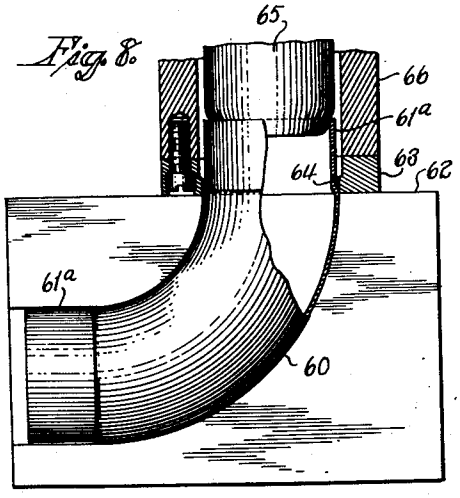


Fig. 8.



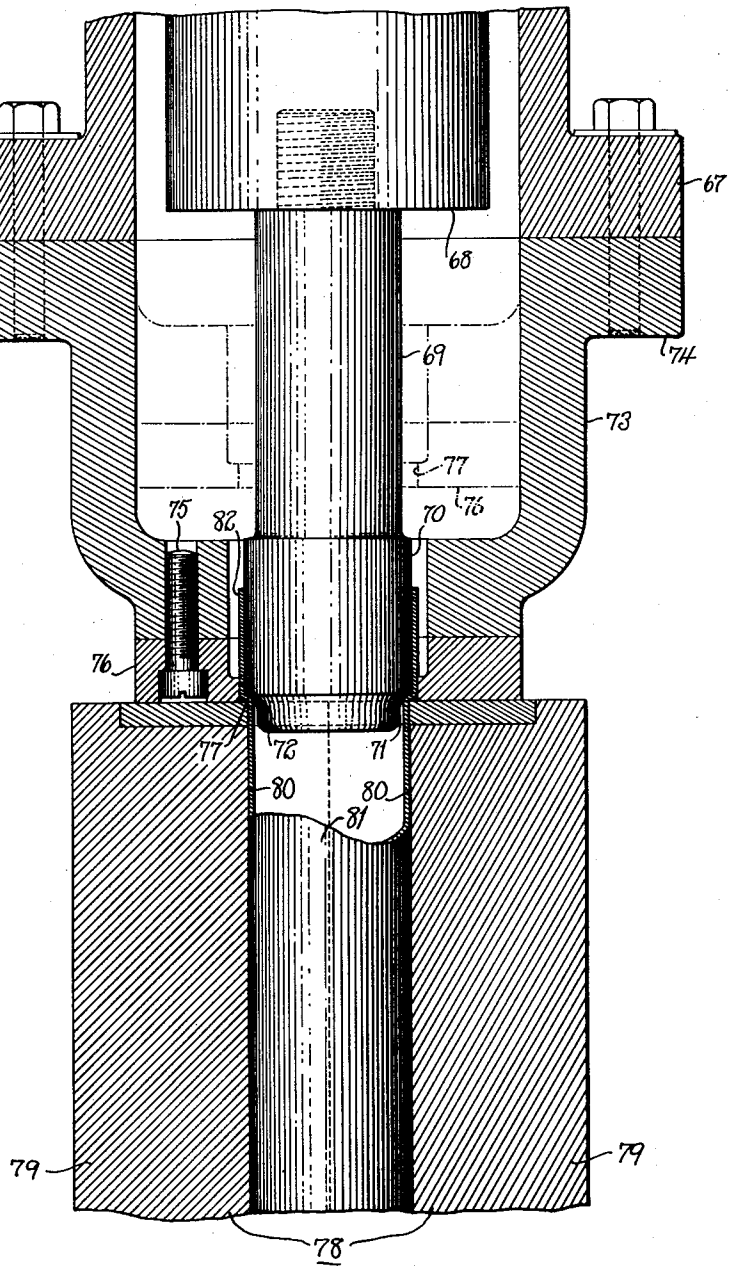
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METHOD AND APPARATUS FOR SIZING TUBULAR TERMINALS

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Fig. 11.



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UNITED STATES PATENT OFFICE

2,174,967

METHOD AND APPARATUS FOR SIZING TUBULAR TERMINALS

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Application June 4, 1937, Serial No. 146,449

11 Claims. (Cl. 153—80.5)

This invention relates to methods and apparatus by means of which the terminals of elbows, T's and other tubular articles may be sized.

One of the objects of the present invention is to provide a superior method and a superior apparatus whereby the terminals of tubular articles may be economically brought to desired size and shape.

A further object is to provide a superior method and apparatus whereby the terminals of tubular articles may be rendered substantially uniform in wall-thickness.

Another object of the present invention is to provide a superior method and apparatus by means of which there may be given to the cylindrical terminals of T's, elbows and other tubular articles, a sizing operation of such character as will insure the permanency of the form and dimensions thus imparted.

A still further object is to provide a superior method and a superior apparatus by means of which tubular terminals may not only be sized and shaped, but also hardened.

With the above and other objects in view, as will appear to those skilled in the art from the present disclosure, this invention includes all features in the said disclosure which are novel over the prior art.

In the accompanying drawings, in which certain modes of carrying out the present invention are shown for illustrative purposes:

Fig. 1 is a broken view in front elevation of an improved sizing apparatus embodying the present invention and shown in conjunction with portions of a power press and fitting-holder;

Fig. 2 is a vertical central sectional view taken on the line 2—2 of Fig. 1, but showing a draw-die member at the limit of its approach toward the fitting and showing the mandrel-member engaged with one of the terminals of a T but prior to its being forced thereinto;

Fig. 3 is a vertical central sectional view corresponding to Fig. 2, but showing the mandrel-member as having been forced the limit of its movement into the terminal of the T to expand or bellmouth the same;

Fig. 4 is a view corresponding to Figs. 2 and 3, but showing the draw-die moved outwardly to effect the ironing action, and the parts in position to start the withdrawal of the mandrel;

Fig. 5 is a horizontal sectional view taken on the line 5—5 of Fig. 2;

Fig. 6 is a view partly in elevation and partly in central section of a T prior to its being sized;

Fig. 7 is a similar view showing all three terminals of the T as having been sized by the apparatus and method of the present invention;

Fig. 8 is a schematic view of an apparatus for sizing previously-reduced male terminals of male fittings, the draw-die being shown in its lowermost position and the mandrel being shown at the start of its expanding stroke;

Fig. 9 is a view corresponding to Fig. 8, but showing the mandrel-member at the limit of its advance into the terminal to expand and size the same;

Fig. 10 is a view partly in side elevation and partly in central section of a double male elbow sized by the apparatus of Figs. 8 and 9; and

Fig. 11 is a schematic view in vertical central section, showing another form of sizing apparatus embodying the present invention.

The particular apparatus herein chosen for illustration in Figs. 1 to 5 inclusive is designed primarily for expanding the terminals of wrought copper or other suitable pipe-fittings into bellmouth form for the telescopic reception of pipe or tubing or of the terminals of other fittings. The apparatus referred to includes a carrier-block or -member 20 having a dovetail rib 21 upon its upper face for entry into a similarly-shaped groove 22 formed in the gate 23 of a power press having any suitable form and not requiring detailed description or illustration herein. The said carrier-block 20 advances and retires vertically with the gate 23 and is securely held in place therein by means of a wedge 24, as indicated in Fig. 1.

The carrier-block 20 is formed centrally with an internally-threaded vertical bore 25 receiving an externally-threaded stud 26 formed integral with and upstanding from a mandrel-operating plunger 27 which has its upper surface firmly seated against the under-surface of the said carrier-block 20. The mandrel-operating plunger 27, just referred to, is also formed with a depending cylindrical guide-stem 28 provided at its lower end with an externally-threaded portion 29 of slightly-reduced diameter and having threaded onto it an adjustable mandrel-retracting abutment 30. The said abutment 30 is of tubular form and is provided in its lower edge with a plurality of sockets 31 for the reception of a spanner wrench or other suitable tool.

The exterior of said mandrel-retracting abutment 30 is of cylindrical form and is adapted to slide within a cylindrical bore 32 formed in a tubular mandrel 33. The surface of the cylindrical bore 32 reciprocates upon the surface of the abutment 30 and is reduced at its upper end

to provide a bearing-portion 34 reciprocating upon the periphery of the guide-stem 28 of the mandrel-operating plunger 27. At the junction of the bearing-portion 34 with the upper end of the cylindrical bore 32 proper, the mandrel 33 is formed with a downwardly-facing mandrel-retracting shoulder 35 which is adapted to be engaged by the upper surface of the mandrel-retracting abutment 30, before referred to.

The mandrel 33 is preferably formed of suitably-hardened tooled steel and is provided on its outer periphery, adjacent its lower end, with a carefully-ground sizing-portion 36 having a diameter corresponding to the desired internal diameter of the pipe-fitting terminal. The extreme lower end of the mandrel 33 is reduced in diameter to provide an annular pilot-lip 37 resulting in the formation of a sloping holding-shoulder 38 at a point immediately below the lower terminal of the sizing-portion 36.

Arranged concentrically with respect to both the mandrel 33 and the mandrel-operating plunger 27 is a tubular die-holder 39 having a cylindrical bearing-surface 40 in its interior adapted to reciprocate vertically upon and be guided by the main portion of the mandrel-operating plunger 27. At its lower end the vertically-reciprocating die-holder 39 has secured to it, by a suitable number of screws such as 41, a ring-shaped draw-die 42 having at its lower end an inwardly-projecting annular draw-lip 43 which is adapted to engage with the outer surface of a pipe-fitting terminal, in a manner as will hereinafter appear.

The die-holder 39 is formed in its upper surface with a plurality of upwardly-opening spring-receiving pockets 44, each of which has an upwardly-facing annular spring-seat 45 forming its bottom-wall and out of which latter leads an internally-threaded socket 46. Passing through each of the pockets 44 and into threaded engagement with the threaded socket 46 at the bottom thereof is a draw-bolt 47.

Each of the draw-bolts 47, above referred to, is thus rigidly, though adjustably, carried by the die-holder 39, and extends upwardly through a vertical guide-passage 48 formed in the carrier-block 20 and leading out of the lower end of a cylindrical clearance-passage 49 formed in the said block 20 above each of the said guide-passages 48 therein. The clearance-passage 49 accommodates the head 50 of the aligned draw-bolt 47 and is provided with an upwardly-facing annular lifting-shoulder 51 adapted to engage with the under-face of the adjacent head 50.

Mounted upon each of the draw-bolts 47 is a helical compression-spring 52 which is seated at its upper end against the under-face of the carrier-block 20 and extends downwardly into the aligned one of the spring-receiving pockets 44 in the die-holder 39 and is seated at its lower end against the spring-seat 45 therein.

In connection with the sizing apparatus above described, a fitting-holder is employed, which is generally designated by the reference character 53, and which is adapted to rest upon the upper-surface of the bed 54 of the power press, of which latter the gate 23 forms a feature. The T-holder 53 is composed of two opposed separable holder-blocks 55—55 each of which is suitably recessed to accommodate a wrought metal T such as 56 (Figs. 1 to 7 inclusive), so that its branch-terminal 57 will project to the desired extent above the upper-surface of the holder 53. The complemental members 55—55 of the holder 53 may be firmly held together by any suitable means such, for instance, as plungers 58—58 (Fig. 1). Each of the said holder-blocks 55—55 has inset into its upper-surface a semicircular gauge-ring 59, each of which complements the gauge-ring in the other member 55 to completely encircle the branch-terminal 57 of the T 56. The said gauge-rings 59—59 are preferably formed of properly-hardened tool steel and may be readily replaced in the event of excessive wear or damage.

With the T 56 firmly clamped in the holder 53, so that its terminal 57 is axially aligned with the mandrel 33, as shown in Fig. 1, the gate 23 of the power press is caused to descend to similarly depress the carrier-block 20 and the parts carried thereby.

As the carrier-block 20 descends, the pilot-lip 37 of the mandrel 33 will enter the terminal 57 of the T 56 and the descent of the said mandrel will be momentarily checked by the engagement of its holding-shoulder 38 with the upper edge of the terminal 57. The continued downward movement of the carrier-block 20 will similarly move the die-holder 39 downwardly until the under-face of the draw-die 42 rests upon the upper-faces of the gauge-rings 59 of the fitting-holder 53. The parts will now have assumed the positions in which they are indicated in Fig. 2, in which figure it will be noted that the internal diameter of the draw-lip 43 of the draw-die 42 exceeds the external diameter of the terminal 57, so that the said draw-die may descend, as described, without being impeded by frictional engagement with the outer periphery of the said terminal 57. At about the time the draw-die 42 comes to rest upon the upper-surface of the fitting-holder 53, the under-face of the body-portion of the mandrel-operating plunger 27 will have engaged with the upper-surface of the mandrel 33.

After the parts have reached the positions in which they are indicated in Fig. 2, the continued downward movement of the carrier-block 20 will cause the compression of the compression-springs 52 and also force the mandrel 33 into the terminal 57 of the T 56, to thus expand the same into a bellmouth terminal 57a. The parts will now have assumed the positions in which they are indicated in Fig. 3, in which it will be noted that the holding-shoulder 38 of the mandrel 33 is in close proximity to the adjacent edges of the gauge-rings 59—59, and the outer periphery of the now-expanded terminal 57a has been brought into engagement with the draw-lip 43 of the draw-die 42.

When the parts have reached the positions in which they are shown in Fig. 3, the gate 23 of the power press will have reached the limit of its downward movement toward the fitting-holder 53. The carrier-block 20 will now be caused to rise, and when during this rise the lifting-shoulders 51 in the said carrier-block engage with the under-faces of the heads 50 of the cooperating draw-bolts 47, the die-holder 39, together with the draw-die 42, will also be caused to rise while the mandrel 33 remains in place in the terminal 57a. The rising of the draw-die 42 as described will cause an ironing or drawing action upon the portion of the terminal 57a confined between the same and the mandrel 33, to thus correct irregularities in the wall-thickness of the said terminal and so thoroughly cold work the same in conjunction with the previous action of the mandrel 33 as to insure that the said terminal will permanently retain both the size and shape imparted

to it. The parts will now have assumed the positions in which they are shown in Fig. 4, in which it will be noted that the draw-die 42 has cleared the upper end of the terminal 57ª and the upper-face of the mandrel-retracting abutment 30 has come into engagement with the retracting-shoulder 35 in the interior of the said mandrel, preparatory to causing the withdrawal of the latter from the terminal 57ª.

The further upward or retiring movement of the carrier-block 20 will now effect the withdrawal of the mandrel 33 from the now-expanded and sized terminal 57ª until the parts reassume the positions in which they are shown in Fig. 1, preparatory to another sizing operation upon the terminal of another T or upon another terminal of the T 56.

In the manner above described, the triple male T of Fig. 6 may be converted into the triple female T of Fig. 7.

In Fig. 10 is shown a double male elbow 60 of wrought copper or other suitable material having terminals 61 which have been previously sized by the method and apparatus of the present invention.

In the sizing of the terminals 61, the ends of the elbow 60 are preferably first operated upon by any suitable means well known in the art to produce reduced terminals 61ª. The elbow 60 is now mounted in a suitable holder represented at 62 in Figs. 8 and 9, so that one of its reduced terminals 61ª projects beyond the upper face of the said holder. A draw-die 63 is now positioned so that its draw-lip 64 surrounds the base of the terminal 61ª, and a mandrel 65 is brought into engagement with the outer edge of the said terminal, as indicated in Fig. 8. The mandrel 65 is now forced into the reduced terminal 61ª, as indicated in Fig. 9, to restore the diameter thereof to substantially its original size. The die-holder 66 is now raised while the mandrel 65 remains stationary in the position described, so that the draw-lip 64 of the said die-holder is caused to draw or iron, so to speak, the said terminal. The mandrel 65 is now withdrawn from the now-sized terminal 61ª and the operation thus completed.

Both the mandrel 65 and the die-holder 66, just above described, may be operated by mechanism of the same general character as that shown and described in connection with the mandrel 33 and the die-holder 39.

In Fig. 11 is schematically illustrated portions of a double-action power press, which power press may be any one of the large number available on the market and requires no detailed description herein other than to say that it includes a reciprocating outer plunger-head 67 within which is mounted a second or inner plunger-head 68 capable of independent vertical reciprocation with respect to the outer plunger-head 67, in the usual manner of double-action presses.

Threaded into or otherwise rigidly attached to the inner plunger-head 68 is a depending mandrel 69 formed of suitably-hardened tool steel and formed adjacent its lower end with a cylindrical sizing portion 70 having a diameter corresponding to the desired internal diameter of the tubular terminal to be sized. The extreme lower end of the mandrel 69 is reduced in diameter to provide an annular pilot-lip 71 resulting in the formation of a sloping holding-shoulder 72 at a point immediately below the lower edge of the sizing portion 70.

Arranged concentrically with respect to the mandrel 69 is a tubular die-holder 73 provided at its upper end with an outwardly-extending annular flange 74 which is bolted to the under-face of the outer plunger-head 67, before referred to. At its lower end, the vertically-reciprocating die-holder 73 has secured to it by a suitable number of screws such as 75, a ring-shaped draw-die 76 having at its lower end an inwardly-projecting annular draw-lip 77 which is adapted to engage with the outer surface of a tubular terminal, in a manner as will hereinafter appear.

Rigidly mounted in any suitable manner below the mandrel 69 and the die-holder 73 and their associated parts, is a two-part tube-holder, generally designated by the reference character 78, and including two complemental separable blocks 79—79, each of which latter is provided in its inner face with a vertical semicylindrical groove 80 which, together with the corresponding groove in the complemental block, forms a cylindrical holding-chamber for the reception of a tube 81.

The tube 81 is installed in the holder 78, so that a desired portion of its upper end projects beyond the upper surface of the holder. The double-action press of which the plunger-heads 67 and 68 form a part is timed so that the outer plunger-head 67 first descends into substantial engagement with the upper surface of the holder 78, after which the inner plunger-head 68 descends to force the mandrel 69 into the projecting upper portion of the tube 81 to expand or otherwise shape or size the same, all as shown in Fig. 11. The double-action press now acts to retire the outer plunger-head 67 so that the draw-lip 77 of the draw-die 76 is caused to draw or iron, so to speak, the terminal of the tube, while the mandrel 69 is firmly held in its lowermost position, to thus prevent the upward movement of the tube 81 during this operation. After the completion of the ironing action of the draw-die 76, the press is timed so that the inner plunger-head 68 will lift and thus withdraw the mandrel 69 from the now-completed bellmouth terminal 82 of the tube 81. Tubular terminals of various cross-sectional forms, such, for instance, as oval, hexagonal, etc., may be produced by employing draw-dies and mandrels of the desired cross-sectional form.

The invention may be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention, and the present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

I claim:

1. An apparatus for sizing tubular terminals, comprising: an axially-movable mandrel-member larger in external diameter than the internal diameter of the tubular terminal to be sized and constructed and arranged to be forced into the interior of the latter to expand the same; an axially-movable draw-die member having an internal diameter larger than the external diameter of the tubular terminal to be sized and constructed and arranged to surround the said terminal and the mandrel-member within the same; and actuating-means constructed and arranged to effect the forcible entry of the said mandrel-member into the tubular terminal, the axial shifting of the said draw-die member into a position to surround the said terminal and the man-

drel-member therein, and also effecting the axial movement of at least one of the said members relative to the tubular terminal to effect an ironing action on the portion of the said terminal confined between the two said members.

2. An apparatus for sizing tubular terminals, comprising: an axially-movable mandrel-member larger in external diameter than the internal diameter of the tubular terminal to be sized and constructed and arranged to be forced into the interior of the latter to expand the same; an axially-movable draw-die member having an internal diameter larger than the external diameter of the tubular terminal to be sized and constructed and arranged to surround the said terminal and the mandrel-member within the same; and actuating-means constructed and arranged to effect the forcible entry of the said mandrel-member into the tubular terminal, the axial shifting of the said draw-die member into a position to surround the said terminal and the mandrel-member therein, and also effecting the axial movement of one of the said members relative to the other and relative to the said terminal to effect an ironing action on the portion of the said terminal confined between the two said members.

3. An apparatus for sizing tubular terminals, comprising: an axially-movable mandrel-member larger in external diameter than the internal diameter of the tubular terminal to be sized and constructed and arranged to be forced into the interior of the latter to expand the same; an axially-movable draw-die member having an internal diameter larger than the external diameter of the tubular terminal to be sized and constructed and arranged to surround the said terminal and the mandrel-member within the same; and actuating-means constructed and arranged to effect the forcible entry of the said mandrel-member into the tubular terminal, the axial shifting of the said draw-die member into a position to surround the said terminal and the mandrel-member therein, and also effecting the axial movement of the said draw-die member relative to said mandrel and relative to the said terminal to effect an ironing action on the portion of the said terminal confined between the two said members.

4. An apparatus for sizing tubular terminals, comprising: an axially-movable mandrel-member larger in external diameter than the internal diameter of the tubular terminal to be sized and constructed and arranged to be forced into the interior of the latter to expand the same; an axially-movable draw-die member having an internal diameter larger than the tubular terminal to be sized and constructed and arranged to surround the said terminal and the mandrel-member within the same; and actuating-means constructed and arranged to effect the forcible entry of the said mandrel-member into the tubular terminal, the axial shifting of the said draw-die member into a position to surround the said terminal and the mandrel-member therein, and also moving the said draw-die member outwardly in a direction away from the said terminal while the said mandrel-member is substantially stationary in the terminal to effect an ironing action on the portion of the latter confined between the two said members.

5. An apparatus for sizing tubular terminals, comprising: an axially-movable mandrel-member larger in external diameter than the internal diameter of the tubular terminal to be sized, and having a holding-shoulder thereon; an axially-movable draw-die member having an internal diameter larger than the external diameter of the tubular terminal to be sized; and actuating-means constructed and arranged to effect the forcible entry of the said mandrel-member into the tubular terminal and also the axial movement of the said draw-die member relative to the said mandrel-member while the holding-shoulder of the latter remains substantially stationary within the terminal to effect an ironing action on the portion of the said terminal confined between the two said members.

6. An apparatus for sizing tubular terminals, comprising: an axially-movable mandrel-member larger in external diameter than the internal diameter of the tubular terminal to be sized and having a holding-shoulder thereon; an axially-movable draw-die member having an internal diameter larger than the external diameter of the tubular terminal to be sized; and actuating-means constructed and arranged to effect the forcible entry of the said mandrel-member into the tubular terminal and also the reverse outward movement of the said draw-die member in a direction away from the holding-shoulder on the said mandrel, to effect an ironing action on the portion of the said terminal confined between the two said members.

7. An apparatus for sizing tubular terminals, comprising: a carrier; a mandrel-member having a lost-motion connection with the said carrier, and constructed and arranged to be extended into and to operate on the interior of a tubular terminal; and an axially-movable draw-die member also having lost-motion connection with the said carrier, and constructed and arranged to operate on the exterior of the tubular terminal and to surround it and the mandrel-member within the same; and means to interengage between said carrier and said mandrel at the end of its lost motion in one direction, to effect a forcible entry of the mandrel into said pipe-fitting terminal.

8. An apparatus for sizing tubular terminals, comprising: a carrier; a mandrel-member having a lost-motion connection with the said carrier, and constructed and arranged to be extended into the interior of a tubular terminal; and an axially-movable draw-die member also having lost-motion connection with the said carrier, and constructed and arranged to surround the tubular terminal and the mandrel-member within the same; and means interengaging between said carrier and draw-die member at the end of its lost motion away from the pipe-fitting, to effect its forcible engagement with the exterior of said pipe-fitting terminal prior to the retraction of the mandrel therefrom.

9. A method of sizing tubular terminals, comprising: first reducing the diameter of the tubular terminal to a diameter materially less than the desired finished diameter; expanding the reduced tubular terminal between an axially-movable mandrel-member extending within the said terminal to substantially restore its diameter while confining a portion thereof and a draw-die member axially movable relative to the said mandrel-member and fitting over the exterior of the said terminal; and axially shifting at least one of the said members relative to the tubular terminal, to effect an ironing action on the portion of the said terminal confined between the two said members.

10. A method of sizing pipe-fitting terminals,

consisting in forcibly inserting into an unsized terminal of a pipe-fitting a mandrel of predetermined diameter larger than that of the interior surface of said terminal; and in ironing out the exterior surface of said terminal on said mandrel by a constricting draw-die of predetermined diameter less than that of the exterior surface of said terminal after it is expanded, the shape of the working surface of the draw-die being substantially similar to that of the mandrel, and the mandrel and draw-die being held in coaxial relationship during the ironing operation, so that the wall of said terminal is drawn to uniform thickness.

11. A method of sizing pipe-fitting terminals, consisting in forcibly inserting into an unsized terminal of a pipe-fitting a mandrel of predetermined diameter larger than that of the interior surface of said terminal, and in ironing out the exterior surface of said terminal on said mandrel by a constricting draw-die of predetermined diameter less than that of the exterior surface of said terminal after it is expanded.

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