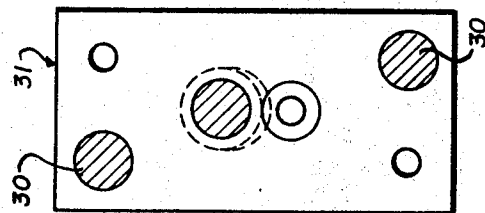
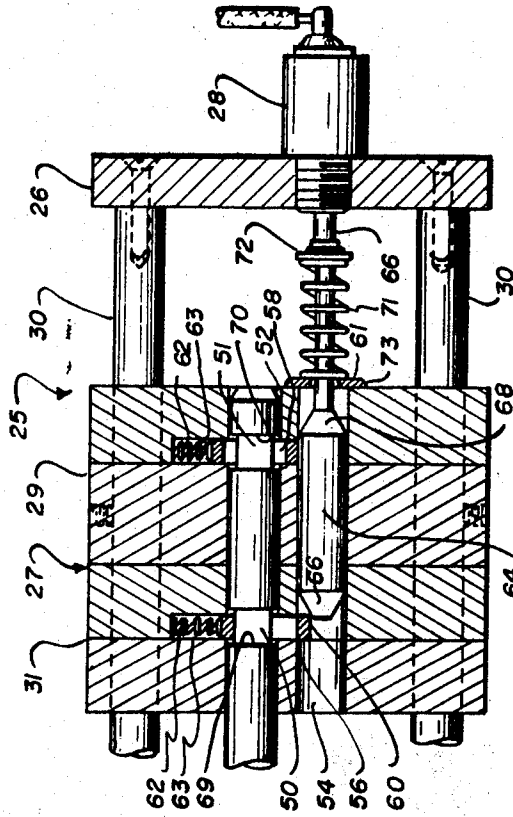
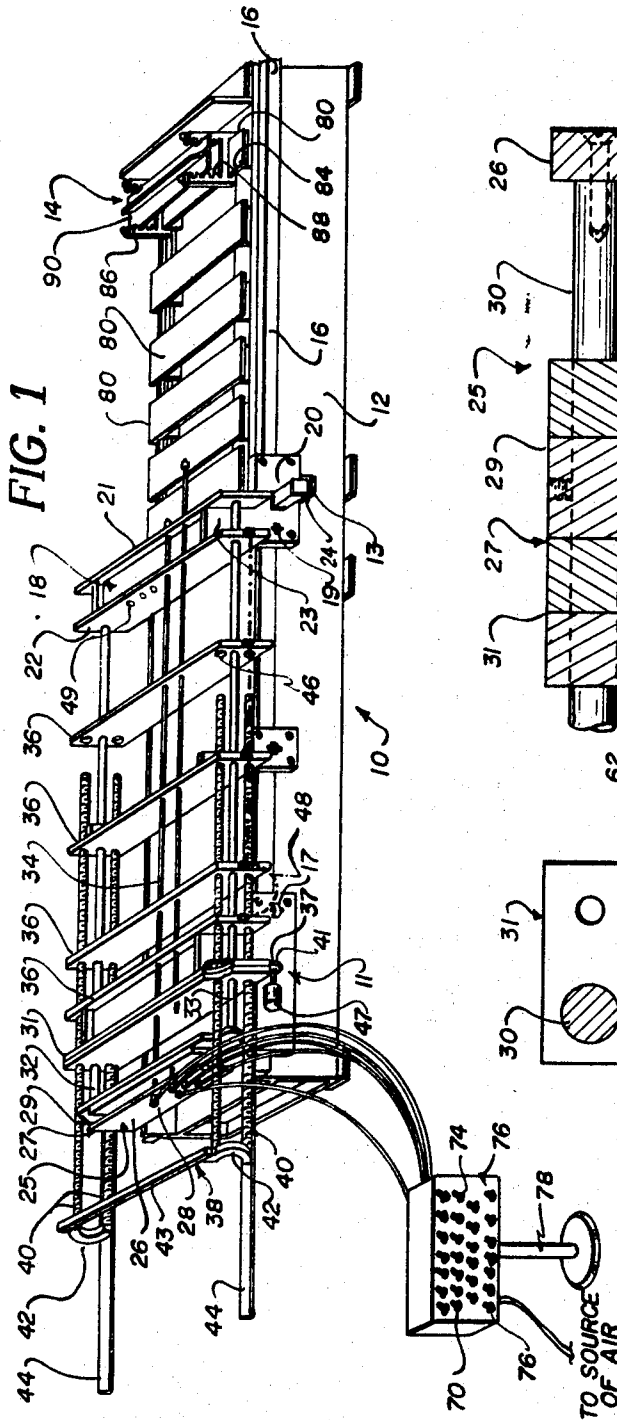


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 APPARATUS FOR SELECTIVELY ENGAGING ANY ONE OR MORE
 OF A PLURALITY OF RODS FOR OPERATION
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APPARATUS FOR SELECTIVELY ENGAGING ANY ONE OR MORE OF A PLURALITY OF RODS FOR OPERATION

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16 Claims

ABSTRACT OF THE DISCLOSURE

Tube expansion apparatus having a number of expander rods horizontally disposed therein, in a rectangular array. One end of each of the expander rods has a pair of spaced-apart annular grooves formed therein, and this end of the expander rods is slidably retained with a rod tooling plate assembly of the tube expander apparatus. The rod tooling plate assembly includes a fixed and a movable rod plate, each of which has ring locks therein associated with each of the rods which are operable to selectively "lock" within respective ones of the annular grooves to lock the expander rod to the fixed or to the movable rod plate. The expander rods locked to the movable rod plate are operative to expand the tubular rods of the heat exchanger coils and the like, while those locked to the fixed rod plate are caused to "idle" during the operation of the tube expansion apparatus.

This invention relates, in general, to mechanical expansion apparatus for radially expanding a portion of a tubular member for the purpose of uniting it with a structural part having a preformed aperture for receiving the tube. More particularly, this invention relates to apparatus for releasably securing the expander rods in expansion apparatus of the above-type, whereby any one or more of the expander rods therein can be easily and quickly operatively engaged for operation, automatically and on a selective basis.

Tube expansion apparatus of the type in which this invention finds unique application are employed for the purpose of expanding tubular members, to form cooling coils and the like for "custom-built" air conditioners or other heat exchange equipment. By "custom-built" air conditioners or other heat exchange equipment, it is meant to imply those which are built to customer specification, for a particular application such as, for example, for installation in a factory, store or other large structure. These units generally are relatively massive in comparison to the ordinary "home" unit, and each of them is usually different from the other. At least, any production run is exceedingly small in comparison to the production runs on home units and others which are "mass-produced" on an assembly line basis. A production run on custom-built units generally is from 1 to 6 units.

In view of the relatively massive size of the custom-built units, they are generally fabricated on "flat-bed" tube expansion apparatus, as opposed to "vertically-disposed" apparatus on which the home units and the like generally are fabricated. The flat-bed apparatus are of a large size so that most any type of custom-built unit can be fabricated on it and, furthermore, they are designed to easily handle the custom-built units.

In view of the fact that the production runs on the custom-built units are small, and the units fabricated during each production run are different from the other, the expander rods in the flat-bed apparatus must be frequently changed and replaced to correspond to the design of the various units. In the past, numerous methods have been used to removably affix the expander rods in the apparatus so that the expander rods can be easily re-

moved or repositioned, however, regardless of the method used, it is found that the time and labor required is disproportionate to the overall time and labor required to fabricate the entire unit. The down-time of the apparatus and the labor cost for making the necessary changes in placement of the expander rods, therefore, is excessive, and substantially increases the cost of the finished units.

It is an object of the present invention to provide improved tube expansion apparatus, particularly of the so-called flat-bed type, used for fabricating custom-built air conditioning units or other heat exchange equipment.

Another object is to provide an improved rod tooling plate assembly for use with tube expansion apparatus of the above-described type, whereby any one or more of the expander rods therein can be easily and quickly operatively engaged for operation, automatically and on a selective basis.

Another object is to provide an improved rod tooling plate assembly for use with tube expansion apparatus, whereby any one or more of the expander rods of the apparatus can be easily and quickly selectively engaged for operation.

Still another object is to provide a rod tooling plate assembly for use with tube expansion apparatus which is simple in construction, relatively inexpensive, and virtually maintenance-free.

A still further object is to provide tube expansion apparatus including a rod tooling plate assembly which permits the expander rods to be easily and quickly adapted to the design of a unit to be fabricated.

A still further object is to provide tube expansion apparatus of the above-type, wherein the expander rods need not be removed to adapt the apparatus to fabricate a unit, or units, of different designs.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The above objectives are accomplished with a flat-bed tube expansion apparatus having a number of expander rods horizontally disposed therein, in a rectangular array. One end of each of the expander rods has a pair of spaced-apart annular grooves formed therein, and this end of the expander rods is slidably retained with a rod tooling plate assembly of the tube expander apparatus. The rod tooling plate assembly includes a fixed and a movable rod plate, each of which has ring locks therein associated with each of the rods which are operable to selectively "lock" within respective ones of the annular grooves to lock the expander rod to the fixed or to the movable rod plate. The expander rods locked to the movable rod plate are operative to expand the tubular rods of the heat exchanger coils and the like, while those locked to the fixed rod plate are caused to "idle" during the operation of the tube expansion apparatus.

The invention accordingly comprises the features of construction, combination of elements, and arrangement of parts which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawing in which:

FIG. 1 is a perspective view of a flat-bed tube expansion apparatus exemplary of the invention;

FIG. 2 is a side plan view of a portion of the rod tooling plate assembly, illustrating the ring locks thereof and the manner in which the expander rods are selectively engaged for operation; and

FIG. 3 is an end plan view of the portion of the rod tooling plate assembly illustrated in FIG. 2.

Similar reference characters refer to similar parts throughout the several views of the drawing.

Referring now to the drawing, in FIG. 1 there is shown tube expansion apparatus 10 of the flat-bed type, having a main frame 12 which is adapted to support the apparatus 10 and to form an enclosure within which hydraulic means such as one or a pair of hydraulic cylinders for operating the apparatus 10 is contained. A nest tooling structure 14 for supporting a number of nests (not shown) of the well-known type is affixed to one end of the frame 12, transversely across its width. A guide track 16 is affixed to the frame 12, longitudinally along its length, on each of its opposite sides (only one guide track 16 is visible). A pair of generally L-shaped guides 20 (only one of which is shown) are movably affixed to and supported by respective ones of the guide tracks 16 by means of camrod bearings 19. These guides 20 are an integral part of a final plate assembly 18 which further includes a work head or final plate 21 and a rod support plate 22. These plates 21 and 22 are affixed to legs 23 of the guides 20, in vertically disposed, parallel, spaced relation and are movable with the guides 20. The guides 20 each also have an air cylinder brake 24 and a hydraulic cylinder lock 13 affixed to them, for reasons set forth more fully below.

A rod tooling plate assembly 25 (a portion of which is shown in FIGS. 2 and 3) is disposed transversely across the frame 12, at the end opposite the nest plate assembly 14, and comprises a support plate 26 and a rod tooling plate 27 including a fixed rod plate 29 and a movable rod plate 31. The support plate 26 supports a number of air cylinders 28, described more fully below, and is fixedly secured to the fixed rod plate 29, preferably in spaced relation thereto, by means of spacers 30. The movable rod plate 31 is fixedly secured to and supported by a main ram assembly 11 which is guided on the guide rails 16, with camrod bearings 17 and which is movably operated by the hydraulic means of the apparatus. The expander rods 34 are affixed within the apparatus 10 by means of the rod tooling plate assembly 25, in a manner described more fully below.

A pair of guide rods 32 and 33 are fixedly secured at one end thereof to the fixed rod plate 29 and are slidably extended through and supported within apertures (not shown) in a number of movable alignment plates 36 and the rod support plate 22. The opposite ends thereof are affixed to the final plate 21. The rod plate 29 and the final plate assembly 18 therefore are affixed together and moved as an integral unit.

In the illustrated embodiment, four movable alignment plates 36 are illustrated, however, a greater or lesser number may be used, depending upon the length of the apparatus 10.

The apparatus 10 also has a length adjustment assembly 38 including four rotatable screws 40 affixed to it, for final sizing of the heat exchanger fins to a coil, in a manner described below. One end of each of the screws 40 is rotatably affixed to one of a pair of generally arcuate-shaped members 42. The members 42, in turn, are affixed together in spaced relation by a spacer bar 43 and are adapted to slidably seat in respective ones of a pair of guide tracks 44 affixed to the rod plate 31 and disposed longitudinally along each of the opposite sides of the frame 12 of the apparatus 10. The movable rod plate 31 has four nuts (not shown) included in it which are threaded to receive respective ones of the screws 40 and which have sprockets 41 drivably affixed to them. The sprockets 41 are coupled to one another and to motor means 47 by means of a chain 37. The screws 40 are threaded through the nuts in the rod plate 31, and slidably extend through apertures 46 in the alignment plates 36. A pair of flexible cables 48 are affixed respectively to each of the opposite sides of the alignment plates 36 for slidably moving and positioning the alignment plates in spaced relation along the length of the apparatus 10, as the final plate assembly 18 or the alignment plate 36 affixed to the movable rod plate 31 is moved. The rod plates 29 and 31 of the rod tooling plate 27, the alignment

plates 36, and the support plate 22 and the final expander plate 21 of the final plate assembly 18 all have apertures 49 corresponding in number to the number of expander rods 34 used in the apparatus 10, formed therein a rectangular array, through which the expander rods slidably extend.

The apparatus 10 also has a number (six, as illustrated) of coil base plates 80 trolleyed and guided on guide rails 82 affixed to the frame 12, by means of camrod bearings. The coil base plates 80 each has a number of spaced indexing apertures 84, for locating and locking a pair of side reinforcing plates 86 to them. The side reinforcing plates 86 each has a number of spaced indexing slots 88 formed in them, for receiving top reinforcing plates 90. Only a single set of side reinforcing plates 86 and a top reinforcing plate 90 is illustrated affixed to one of the coil base plates 80 for simplicity; it is understood that each of the coil base plates requires a similar set of them. These side and top reinforcing plates 86 and 90 function to support the heat exchanger fins during the forming operation, to prevent them from being distorted. Also, the coil base plates 80 move easily with the heat exchanger fins during the forming operation so that damage to the fins is prevented. All or part of the coil base plates 80 can be used during a forming operation, and the unused ones are adapted to be shunted aside under the work head or final plate assembly 18.

Referring now to FIGS. 2 and 3, it can be seen that the end of each of the expander rods 34 has an outwardly tapered chamfer 52 formed on it, and has a pair of annular grooves 50 and 51 formed therein, in predetermined spaced relation, along the length thereof from the chamfered end 52. The rod tooling plate 27 has a number of plunger receiving apertures 54 extending through it which are in parallel, spaced relation to respective ones of the expander rod receiving apertures 49. A pair of ring receiving cavities 56 and 58 which are in communication with and which extend perpendicular from the plunger receiving apertures 54 are formed in the fixed rod plate 29 and the movable rod plate 31, respectively. A pair of rings 60 and 61 are disposed in respective ones of the ring receiving cavities 56 and 58, and normally are biased toward the plunger receiving aperture 54, by biasing means such as the springs 62 retained within a pair of spring receiving cavities 63 in communication with the ring receiving cavities 56 and 58, respectively. The ring receiving cavities 56 and 58 are positioned so as to align with the annular grooves 50 and 51, respectively, when the end of the expander rod 34 is inserted within the rod tooling plate 27, as illustrated in FIG. 2. The fixed rod plate 29 can be formed of two halves 29a and 29b, and the ring receiving cavity 58 and the spring receiving cavity 63 can be advantageously formed in one of the two halves 29a or 29b so that the rod plate 29 can be easily formed. The movable rod plate 31 can be formed in a like manner.

A plunger 64 is slidably retained within each of the plunger receiving apertures 54, and is affixed to a piston 66 of one of the air cylinders 28 affixed to and supported by the support plate 26. The plungers 64 are cylindrical-shaped and have diameters substantially corresponding to the diameters of the plunger receiving apertures 54. They also have chamfered end surfaces 66 and 68 on each of their opposite ends, and have an overall length corresponding to the distance between the edges 69 and 70 of the annular grooves 50 and 51.

A spring 71 is affixed to the pistons 66 of the air cylinders 28 and are engaged with a spring stop 72 affixed to the piston 66 and a stop plate 73 affixed to the fixed rod plate 29 so as to normally bias the plungers toward (to the right, as illustrated) the air cylinders 28. The air cylinders 28 are operative to move the plungers 64 (to the left, as illustrated) against the biasing force of the springs 71, when operated.

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The air cylinders 28 can be of any type operable in the manner described below. In a particular application, Bimba air cylinders manufactured by the Bimba Manufacturing Company in Monee, Ill., were used and found to be entirely satisfactory. The air cylinders 28 each are coupled to a source of air (not shown) by air lines 75 and through air switches 74 mounted in a control panel 76. The air switches 74 can be miniature control valves of the type manufactured by the Clippard Instrument Laboratory Inc., Cincinnati, Ohio. The air switches 74 preferably and advantageously are mounted in a rectangular array corresponding to the rectangular array of the expander rods with which they are associated. The control panel 76 also can be mounted on a pedestal stand 78 so that it can be moved to a convenient location with respect to the apparatus 10.

The operation of the apparatus 10 and particularly the rod tooling plate assembly 25 thereof is as follows. Normally, the plungers 64 are in the plunger receiving apertures 54, in the position illustrated in FIG. 2. It can be seen that the rings 61 are riding on the peripheral surface of the plungers 64, free of the annular grooves 51 in the expander rods 34, so that the expander rods can freely pass through the rings 61 when the expander rods are moved longitudinally. The rings 60, on the other hand, are biased downwardly by the springs 62 so that a part of the rings 60 are seated within the annular grooves 50 in the expander rods 34. With the rings 60 in this position, the expander rods 34 are locked to and moved along with the movable rod plate 31, when the latter is moved, since the rings 60 engage the edges of the annular grooves 50 so as to prevent the expander rods 34 from passing through them. Accordingly, it can be seen that with the plungers 64 in the illustrated position, all of the expander rods 34 are moved along with the movable rod plate 31.

The expander rods 34 are disengaged from the movable rod plate 31 and locked to the fixed rod plate 29 in an "idling" position, as follows. The air switches 74 are operated to, in turn, operate the air cylinders 28 coupled to them. When the air cylinders 28 are operated, the plungers 64 are moved (to the left, as illustrated) against the biasing action of the springs 71. As the plungers 64 move, the chamfered ends 66 thereon engage and forcibly urge the rings 60 upwardly (as illustrated) against the biasing force of the springs 62, free from the annular grooves 50 in the expander rods 34. The expander rods 34 now can slidably pass through the rings 60 so that they are disengaged from the movable rod plate 31.

When the plungers 64 are fully moved to the left (as illustrated), the rings 61 are forcibly urged downwardly by the springs 62, to lockingly engage a part of them within the annular grooves 51 in the expander rods 34. The expander rods 34 are now locked to the fixed rod plate 29, and held in an "idling" position. The depth of the annular grooves 50 and 51 in the expander rods 34 preferably substantially correspond to the thickness of the walls of the rings 60 and 61 so that a substantial portion of the rings seat within the grooves and provide a secure lock between the expander rods and the respective rod plates 29 and 31.

With this arrangement, it is easily seen how the apparatus 10 is easily and quickly initially set up, or changed, to fabricate a heat exchanger coil. The operator merely observes the design of the heat exchanger coil and the expander rods 34 required to form it, and then operates the appropriate ones of the air switches 74 to disengage the expander rods 34 which are not required.

Next, the motor means 47 is operated to rotate the sprockets 41 and hence the nuts affixed to them and to the rod plate 31. Since the rod plate 31 is held in a fixed position, the screws 40 are caused to thread through the rod plate 31, to engage the ends thereof against the rod support plate 22. The final plate assembly 18 is advanced by the screws 40 as the latter are continued to be driven

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by the motor means 47, to a point where the correct coil length will be obtained, as indicated by a calibrated scale on the frame 12, for final coil sizing. The final sizing of the coils usually is determined and controlled by the operator, however, the apparatus 10 can be adapted to automatically accomplish final sizing. This can be done, for example, by affixing and operating a microswitch with the final plate assembly 18 when the latter is properly positioned, which microswitch, in turn, controls the operation of the motor means 47.

The assembly of heat exchanger fins and tubular rods used to form the heat exchanger coil then is loaded onto the bed of the apparatus 10, in any suitable fashion. The hydraulic means of the apparatus 10 is then operated to move the main ram assembly 11, and hence the movable rod plate 31 affixed to it. The friction between the expander rods 34 affixed to and moved by the rod plate 31 and the rod support plate 22 and the final plate 21 of the final plate assembly 18 causes the final plate assembly to move with the rod plate 31. The rod plate 29 being affixed to the final plate assembly by means of the guide rods 33 also is caused to move. When the final plate 21 engages the stack of heat exchanger fins, the air cylinder brakes 24 are operated and hold the final plate assembly 18 sufficiently to overcome the frictional engagement of the expander rods. The advancement of the rod plate 31 and hence the expander rods 34 is continued to extend the expander rods into the tubular rods of the heat exchanger coil. The tubular rods are thereby expanded to lock the stack of heat exchanger fins together to form the coil, in the well-known fashion. The final plate assembly creeps forward as the expander rods are extended into the tubular rods and compresses the stack of heat exchanger fins to size the coil.

The hydraulic cylinder locks 13 are automatically operated at the time that the coils are sized, to lock the final plate assembly 18 against movement so that the expander rods 34 can be withdrawn without damage to the coil. The operation of hydraulic means of the apparatus 10 simultaneously is reversed to move the main ram assembly 11 (to the left, as illustrated) and hence the rod plate 31 and the expander rods 34 affixed to it, to withdraw the latter from the coil. The rod plate 31 abuts the rod plate 29 at the time the expander rods are free of the coil, and at this time the hydraulic brakes 24 and the hydraulic cylinder lock 13 are released so that the rod tooling plate 27 and the final plate assembly 18 can be restored to its initial starting position, to ready the apparatus 10 for the next operation.

While not illustrated, the side and top reinforcing plates 86 and 90 can be adapted to be automatically properly indexed or positioned using air cylinders and a control plate, in much the same fashion as the expander rods 34. When adapted in this fashion, the apparatus 10 is substantially completely automatic in operation.

Also, while not illustrated, the piston, or pistons, of the hydraulic cylinder forming the ram for the apparatus 10 is initially extended, and is retracted into the cylinder during the forming operation. Accordingly, the operation is the reverse of that generally used. By operating the same in the described fashion, however, the overall length of the apparatus 10 is substantially reduced.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above construction without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention, which, as a matter of language, might be said to fall therebetween.

Now that the invention has been described, what is claimed as new and desired to be secured by Letters Patent is:

1. Tube expansion apparatus comprising, in combination: a frame; a rod tooling plate assembly including a first and a second rod plate movably supported by said frame; a final plate assembly movably supported by said frame; said first and second rod plates and said final plate assembly each having a plurality of apertures therein for slidably receiving expander rods; a plurality of expander rods slidably extended through said apertures in said final plate assembly an having one end thereof slidably received within said first and second rod plates; said first and second rod plates each including a plurality of lock means, each of said locking means being associated with one of said expander rods and being operable to lockingly engage said expander rod to selectively lock said expander rod to one of said rod plates; means for selectively operating said lock means; said first rod plate being fixedly secured in spaced relation to said final plate assembly; brake means affixed to said final plate assembly and operable to brake said final plate assembly to permit said expander rods to be slidably extended through said final plate assembly; means on said frame for supporting a plurality of heat exchanger fins; hydraulic means disposed within said frame and coupled to said second rod plate, said hydraulic means upon being operated moving said second rod plate to slidably extend said expander rods locked to it through said final plate assembly when said brake means are operated to engage said heat exchanger fins to form them into a coil; and lock means affixed to said final plate assembly and operable to lock said final plate assembly against movement thereof to permit said expander rods to be withdrawn from said formed coil without damaging it.

2. Tube expansion apparatus, as claimed in claim 1, wherein said final plate assembly is slidably movably supported by said frame and is advanced and retracted by the friction engagement of said expander rods within the apertures therein to compress said heat exchanger fins; said brake means being operable to brake said final plate assembly sufficiently to overcome said frictional engagement to permit said expander rods to be slidably extended through said final plate assembly; said apparatus further including length adjustment means for forcibly urging the advancement of said final plate assembly against the braking action of said brake means to final size said heat exchanger fins to form said coil.

3. Tube expansion apparatus, as claimed in claim 2, wherein said length adjustment means comprises threaded nuts rotatably retained within said second rod plate; a threaded screw associated with and rotated by each of said nuts to extend them through said second rod plate to forcibly engage the ends of said screws with said final plate assembly to advance the latter to final size said heat exchanger fins to form said coil; and means for rotating said threaded nuts.

4. Tube expansion apparatus, as claimed in claim 1, wherein each of said expander rods has a pair of annular grooves formed in its peripheral side wall on the end thereof slidably received within said first and second rod plate; and wherein said lock means each includes a ring member which is laterally movably disposed within a ring receiving cavity formed in said first and second rod plates and in a fashion such that said grooved end of an expander rod is slidably extendable through said ring member and biasing means engaged with and normally biasing said ring member to lockingly engage a portion thereof within said one annular groove; said means for selectively operating each of said lock means is operable to selectively laterally displace said ring members to disengage said ring members from said annular grooves to unlock said expander rods from said first and second rod plates.

5. Tube expansion apparatus, as claimed in claim 4, wherein said means for selectively operating each of said

lock means comprises a plurality of plunger receiving cavities in said rod tooling plate assembly, each of which is in communication with said ring receiving cavities in said first and second rod plates associated with respective ones of said expander rods, a plunger slidably disposed within each of said plunger receiving cavities normally engaged with one of said ring members in said ring receiving cavities so as to laterally displace said ring member to disengage it from its associated one of said pair of annular grooves in an expander rod and slidably movable therein so as to engage the other one of said ring members in said ring receiving cavities to laterally displace said ring member to disengage it from its associated one of said pair of annular grooves in said expander rod, whereby said expander rod is locked to one or the other of said first and second rod plates.

6. Tube expansion apparatus including a rod tooling plate assembly, a plurality of expander rods each of which has a pair of annular grooves formed in its peripheral side wall at its one end, said grooved end of each of said expander rods being slidably received within said rod tooling plate assembly, said rod tooling plate assembly including a first and a second rod plate, one of which is movable with respect to the other, said rod plates each including a lock means associated with each of the respective ones of said expander rods which is operable to lockingly engage within one of said annular grooves in said expander rods to lock said expander rod to said first and second rod plates, and means for selectively operating each of said lock means associated with an expander rod to lock said expander rod to a selected one of said first and second rod plates, whereby said expander rod is selectively movable with said movable rod plate or is held fixed with said other rod plate.

7. The tube expansion apparatus of claim 6 wherein said lock means each includes a ring member which is laterally movably disposed within a ring receiving cavity formed in said first and second rod plates and in a fashion such that said grooved end of an expander rod is slidably extendable through said ring member and biasing means engaged with and normally biasing said ring member to lockingly engage a portion thereof within said one annular groove; and wherein said means for selectively operating each of said lock means is operable to selectively laterally displace said ring members to disengage said ring members from said annular grooves to unlock said expander rods from said first and second rod plates.

8. The tube expansion apparatus of claim 7, wherein said means for selectively operating each of said lock means normally laterally displaces one of said ring members to disengage said ring member from said annular groove and when operated laterally displaces the other one of said ring members to disengage said ring member from said annular groove, whereby said expander rods are locked to one or the other of said first and second rod plates.

9. The tube expansion apparatus of claim 7, wherein said means for selectively operating each of said lock means comprises a plurality of plunger receiving cavities in said rod tooling plate assembly, each of which is in communication with said ring receiving cavities in said first and second rod plates associated with respective ones of said expander rods, a plunger slidably disposed within each of said plunger receiving cavities normally engaged with one of said ring members in said ring receiving cavities so as to laterally displace said ring member to disengage it from its associated one of said pair of annular grooves in an expander rod and slidably movable therein so as to engage the other one of said ring members in said ring receiving cavities to laterally displace said ring member to disengage it from its associated one of said pair of annular grooves in said expander rod, whereby said expander rod is locked to one or the other of said first and second rod plates.

10. The tube expansion apparatus of claim 9, further including a support plate affixed to said first rod plate, a plurality of plunger operating means affixed to said support plate and affixed respectively to different ones of said plungers for slidably moving said plungers to engage and laterally displace said ring members, and a switch means coupled to each of the respective ones of said plunger operating means for selectively operating said plunger operating means.

11. The tube expansion apparatus of claim 10, wherein said expansion rods are arranged in said rod tooling plate assembly in a rectangular array, and wherein said switch means are arranged and affixed to a control panel in a correspondingly arranged array.

12. The tube expansion apparatus of claim 9, further including a support plate affixed to said first rod plate, a plurality of air cylinders affixed to said support plate, each of said air cylinders having a piston which is affixed to respective ones of said plungers and which is operated by said air cylinder to slidably move said plunger to engage and laterally displace said ring members, and a switch means coupled to each of the respective ones of said air cylinders for selectively operating said air cylinders.

13. The tube expansion apparatus of claim 12, wherein said expansion rods are arranged in said rod tooling plate assembly in a rectangular array, and wherein said switch means are arranged and affixed to a control panel in a correspondingly arranged array.

14. A rod tooling plate assembly for selectively operatively engaging any one or more of a plurality of rods including a rod receiving aperture for each of said plurality of rods and a plunger receiving aperture associated with each of said rod receiving apertures, said rod tooling plate assembly including a first and a second rod plate, one of which is movable with respect to the other, a ring lock in both said first and second rod plates associated with each of said rod receiving apertures and in communication with said plunger receiving apertures, said ring locks each including a ring receiving cavity having a ring member laterally movably disposed therein and biasing means engaged with and normally biasing said ring

member to overlies a portion of the associated one of said rod receiving apertures; said rods each having a pair of annular ring grooves in its peripheral side wall, said rods being extendable through said rod receiving apertures and through said ring members in said ring receiving cavities, said ring members being forcibly urged laterally by said rods to permit said rods to pass through said ring members and being biased to lockingly engage within said ring grooves to lock said rods within said first rod plate and said second rod plate, and a plunger slidably and movably disposed within each of said plunger receiving apertures, said plungers being of a length to cammingly engage one of said ring members to center said ring member with respect to said rod receiving aperture to disengage said ring member from said ring groove and to thereby unlock said rod from said rod plate in which said displaced ring member is disposed, and means for slidably moving said plungers within said plunger receiving apertures to selectively laterally displacing respective ones of said ring members to lock said rods to said first rod plate and to said second rod plate.

15. The rod tooling plate assembly of claim 14, wherein said means for slidably moving plungers comprises an air cylinder having a piston which is affixed to said plunger and which is operated by said air cylinder to slidably move said plunger to engage and laterally displace said ring members.

16. The rod tooling plate assembly of claim 15, further including a plurality of switch means each of which is coupled to and adapted to selectively operate said air cylinders.

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