Aug. 11, 1931. A. C. WALWORTH 1,818,593

APPARATUS FOR ASSEMBLING RADIATOR ELEMENTS

Original Filed April 21, 1928 2 Sheets-Sheet 1

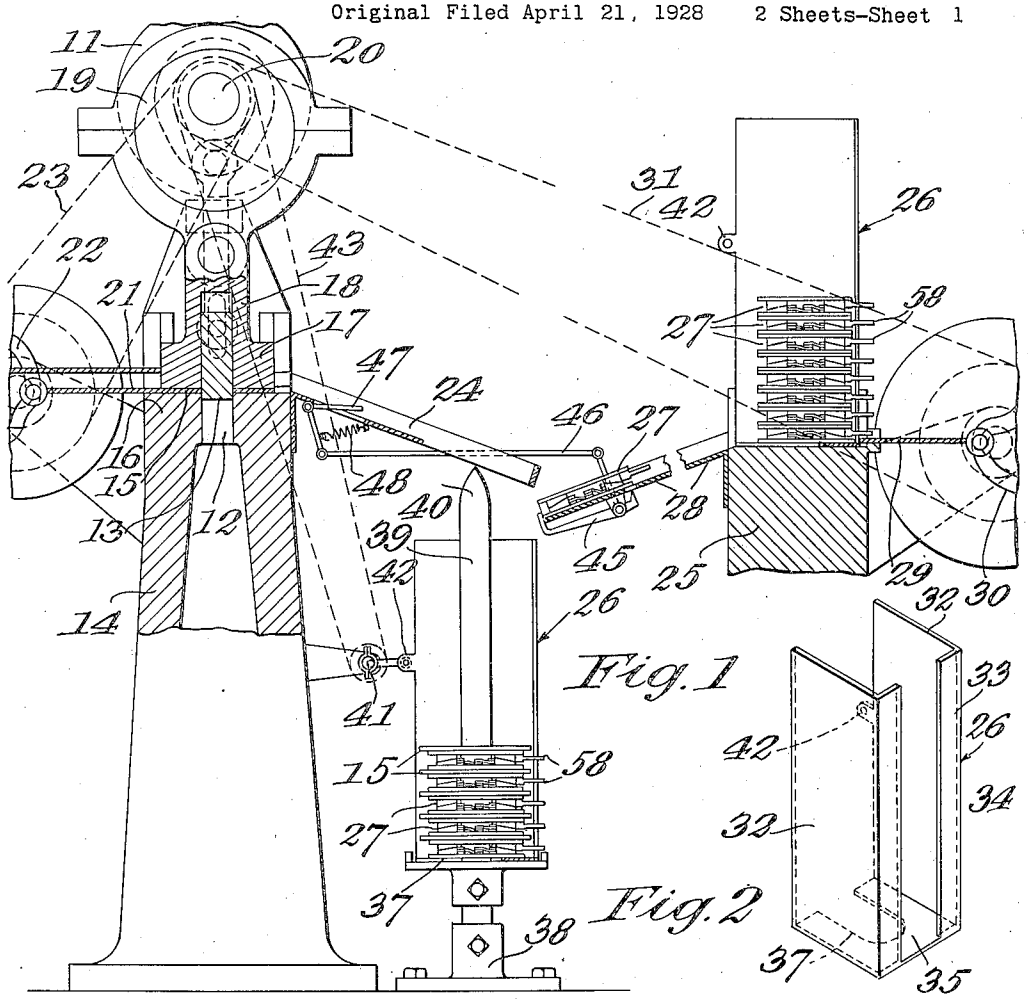


Fig. 1

Fig. 2

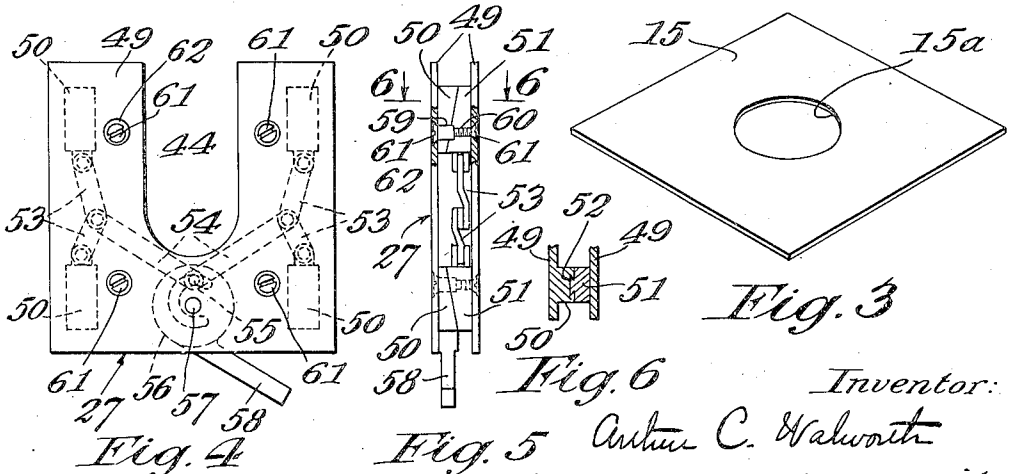


Fig. 4

Fig. 5

Fig. 6

Fig. 3

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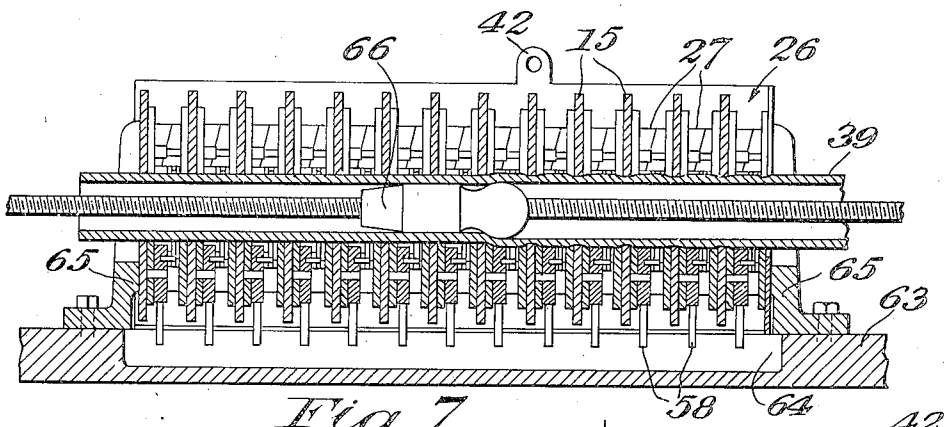


Fig. 7

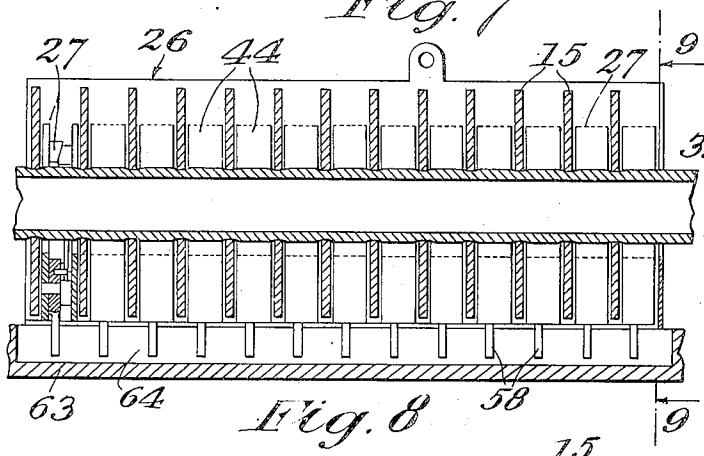


Fig. 8

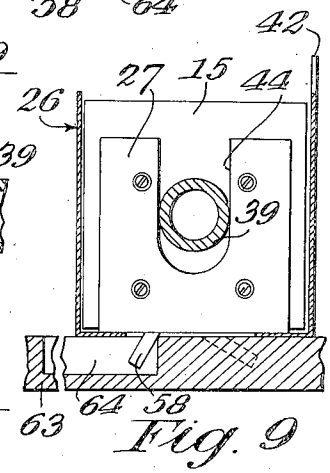


Fig. 9

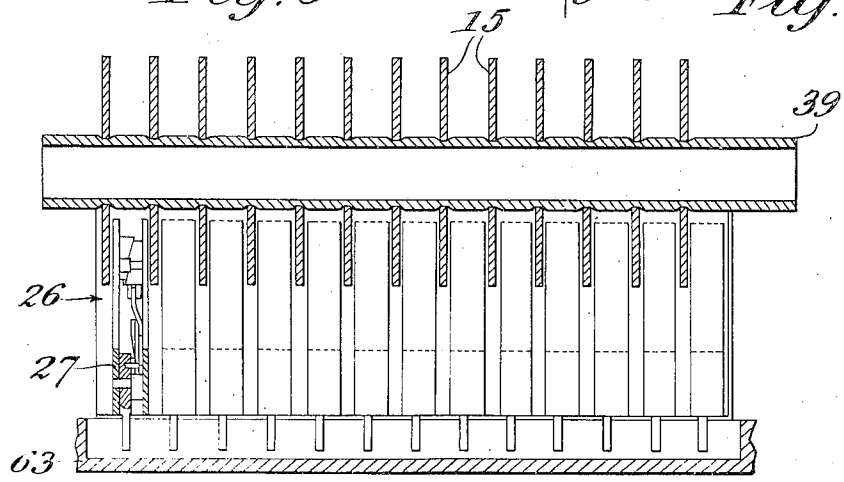


Fig. 10

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Patented Aug. 11, 1931

1,818,593

UNITED STATES PATENT OFFICE

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APPARATUS FOR ASSEMBLING RADIATOR ELEMENTS

Original application filed April 21, 1928, Serial No. 271,950. Divided and this application filed November 20, 1929. Serial No. 408,450.

This invention relates to the manufacture of radiator tubes or similar heat exchange elements of the type comprising a tube having fixed thereon in spaced parallel relation a series of perforated plates constituting heat radiating or absorbing fins or flanges. More particular the invention relates to the assembly of the fins or plates on the tube of such an element in proper spaced parallel position and their retention in such position until they are secured to the tube and is a division of my co-pending application, Serial No. 271,950, filed April 21, 1928. The invention has for its object to provide an apparatus whereby these operations may be conveniently, efficiently and economically performed in the commercial quantity production of elements of this character with a minimum amount of manual labor and skilled attention, and without the necessity of employing spacing projections on the plates or permanent spacing sleeves on the tubes, such as, in many instances, have heretofore been required.

The more particular objects of the invention, together with means whereby the latter may be carried into effect, will best be understood from the following description of a preferred embodiment thereof illustrated in the accompanying drawings. It will be understood however that the particular constructions and arrangements described and shown have been chosen for purposes of exemplification merely, and that the invention, as defined by the claims hereunto appended, may be otherwise embodied without departure from the spirit and scope thereof.

In said drawings:

Fig. 1 is a fragmentary and somewhat diagrammatic side elevation, partly in section, of an apparatus embodying the invention and operating in accordance therewith.

Fig. 2 is a detail perspective view of one of the interchangeable spacer containers.

Fig. 3 is an enlarged detail perspective view of one of the fins or plates.

Fig. 4 is a face view of one of the spacers.

Fig. 5 is an end view thereof partially broken away.

Fig. 6 is a detail section on line 6—6, Fig. 5.

Fig. 7 is a longitudinal sectional view of the tube with the fins and spacers thereon, illustrating the expansion of the tube.

Fig. 8 is a similar view of the fully expanded tube, showing the spacers collapsed.

Fig. 9 is a section on the line 9—9, Fig. 8.

Fig. 10 is a view similar to Figs. 7 and 8, illustrating the withdrawal of the attached fins and the collapsed spacers from one another.

As shown in Fig. 1, the apparatus includes a punch press for stamping out perforated fins or plates 15, which may be of the flat form shown in Fig. 3, without spacing projections or flanges but with a central perforation 15*a*. Said punch press may comprise a lower die 16 carried by a suitable support or pedestal 14 and a cooperating punch or upper die 17 carried by a ram 18 which is operated by an eccentric 19 carried by a driving shaft 20 to which power may be applied in any suitable manner. Within the punch 17 may be provided a second inner punch 13 cooperating with a die opening 12 in the pedestal 14 to form the openings 15*a*, said punch 13 being operated through suitable connections by a cam 11 on the shaft 20. The punch mechanism for forming or blanking out the plates or fins is not shown in detail as such mechanism is well known in the art, specifically forms no part of the present invention, and may be of any form and arrangement suitable for the purpose described.

The lower die 16 is slotted to receive a reciprocating feed slide or ejector 21 operated by a cam 22 which is driven through a belt or chain 23 from a suitable pulley or sprocket on the driving shaft 20, it being understood that the parts are so timed that when the ram 18 rises the slide 21 will be advanced to eject the formed plate 15 from the die 16. The plates so formed and ejected are fed by the slide 21 in succession into a chute 24.

Mounted on a suitable support 25 adjacent the pedestal 14 is a supply container 26 for a plurality of spacers 27 disposed in

superposed relation therein and adapted to be fed in succession therefrom into a chute 28 by a reciprocating feed slide 29 operated by a cam 30 which is driven by a belt or chain 31 from a second pulley or sprocket on the shaft 20. The operating connections, including the belts or chains 23 and 31 and the cams 22 and 30, are so arranged as to cause the plates 15 and spacers 27 to be fed into the chutes 24 and 28 respectively in alternation.

The plates and spacers thus alternately fed through the chutes 24 and 28 are received in superposed relation in a second or receiving container 26 substantially similar to and interchangeable with the supply container 26 above referred to. As shown most clearly in Fig. 2, each of said containers comprises side walls 32 closing two opposite sides of the container, a side wall 33 partly closing a third side but formed with a slot 34 and an end wall 35 partly closing one end of the container, the fourth side of said container and the opposite end being open, and the end wall 35 having a notch 37 extending inwardly from the edge of said wall adjacent said open side to approximately the center thereof.

The receiving container 26 is suitably supported, as upon a base 38, in a position to receive the plates and spacers from the chutes 24 and 28, it being understood that said container is supported with its open end uppermost. If desired, the base 38 may be arranged also to support a tube 39, said tube being disposed in upright position axially of the container 26, extending through the notch 37 in the bottom end 35 of the latter, and being provided with a detachable pointed guide tip 40 to facilitate the feeding of the perforated plates thereover. The spacers are formed with open notches 44 and are preferably fed laterally upon the tube so as to cause the notches to embrace the tube. In some instances, if preferred, the plates and spacers may be fed into the otherwise empty container, and the tube thereafter inserted through the notch 37 in the container and the perforations 15*a* and notches 44 of the alternating plates and spacers of the set or stack so assembled, instead of assembling said set or stack upon the tube.

As shown, suitable jarring mechanism 41 detachably connected with an ear 42 on the receiving container 26 and actuated by a belt 43 from a third pulley on the shaft 20 is provided to insure the settling of the separate plates and spacers into proper superposed relation in the container 26.

In order to insure the delivery of plates and spacers in alternation, and the consequent alternate arrangement of the plates and spacers in the resulting set or stack, the delivery of the spacers is preferably controlled by the delivery of the plates. As shown, the chute 28 is provided, adjacent its delivery end, with an oscillating escapement device 45 of any suitable or well known form adapted at each oscillation to release one spacer from said chute.

Said escapement device is connected by a link 46 with a pivoted feeler or trigger member 47 comprising a bell crank having one arm connected to the link 46 and the other arm normally held by a spring 48 in a slightly elevated position in the chute 24. When a plate 15 is ejected by the feed slide 21 into the chute 24, said plate, in passing over said last named arm of the feeler, depresses the latter and thereby actuates the escapement member 45 to release one spacer from the end of the chute 28. Should the delivery of the plates be in any manner interrupted, as by the failure to supply stock to the blanking-out mechanism, the escapement mechanism will not be operated, and no spacer will be delivered from the chute 28, the spacers fed from the supply container 26 by the feed slide 29 merely accumulating in said chute.

The spacers 27 are of expansible and collapsible form, preferably within variable limits, to vary their effective maximum and minimum thickness. As shown in Figs. 4 to 6, each spacer comprises a pair of parallel plates 49 connected by relatively movable wedge members 50 and 51, the wedge members 50 being rigidly secured to or formed integral with one of the plates, and the wedge members 51 having a dove-tailed connection 52 with the wedge members 50 and sliding on the latter and on the other plate.

As shown, four sets of cooperative wedge members 50 and 51 are employed, the movable wedge members 51 of each set being connected in pairs by toggle links 53, and each pair of toggle links being connected by links 54 with a pin 55 cooperating with a cam 56 pivoted at 57 to one of the plates and having an operating handle or member 58 projecting from between the plates, preferably at the side of the spacer opposite the notch 44.

The separation of the plates 49 is controlled by limiting devices connecting said plates, four of said devices being preferably employed, and each comprising two adjustably telescoping members 59 and 60 in threaded engagement with one another and having heads 61 received in countersunk recesses 62 in the outer faces of the plates. The separation of the plates, and consequently the effective maximum thickness of the spacer, is limited by the seating of the heads 61 in the bottoms of the recesses 62 and is determined by the length of the limiting devices. When the spacer is collapsed, the heads 61 move outwardly in the recesses 62

until their outer faces are flush with the outer faces of the plates 49, which determines the effective minimum thickness of the spacer since, while the plates may be free to approach one another further, the limiting devices would, in such case, project beyond the faces of the plates and themselves constitute spacing elements. It will therefore be seen that, by turning the members 60 in the members 59, the length of the limiting devices can be adjusted to vary the limits between which the spacer is expanded and collapsed. As shown, the heads 61 are slotted to receive a suitable tool whereby this adjustment can be conveniently effected.

The spacers 27 are received in each container 26 with their several operating members 58 in alinement and projecting through the slot 34 in the container, this relative arrangement being preserved in the transfer of the spacers from the supply container to the receiving containing, whereby all of said operating members may be actuated simultaneously, as hereinafter further explained, to expand or collapse all of the spacers in the container in unison. The spacers are held in the supply container in their expanded condition and are transferred therefrom into the receiving container in this condition, whereby the spacing of the plates or fins is determined by the adjusted effective maximum thickness of the spacers.

When a complete set or stack of alternate plates and spacers has been built up in the receiving container, as above described, said receiving container, with said plates or spacers therein, together with the tube 39 (which, as above explained, may have been placed initially in the container or may have been inserted after the formation of the set or stack of plates and spacers), is removed from the support 38 and placed, with its slotted side 33 downward and its open side upward, on a suitable table 63 (Fig. 7) having a groove or slot 64 to receive the alined operating members 58. The container may then be secured against longitudinal movement by means of clamps 65 secured to the table, and the tube 39 expanded to fix the fins or plates thereon in the spaced relation in which they are held by the spacers. This may conveniently be done by forcing an expander 66 through the tube, as more fully explained in the Bergstrom Patent No. 1,646,384, dated October 25, 1927, or otherwise as may be preferred.

After the fins or plates have been secured to the tube by whatsoever means may be employed for this purpose, the clamps 65 are released and the members 58 of the several spacers operated to collapse all of said spacers in unison. This, in the apparatus shown, may conveniently be done by a lateral movement of the container on the table 63, whereby engagement of said members with one wall of the slot 64 causes them to be moved from the position shown in dotted lines in Fig. 9 into the position shown in full lines therein.

As shown most clearly in Fig. 8, the collapse of the spacers releases them from the plates 15, so that said spacers and plates may be withdrawn from between one another by a relative lateral movement, as by lifting the tubes 39 with the plates fixed thereon from the container 26 through the open side of the latter, as shown in Fig. 10, the notch 37 in the container and the notches 44 in the spacers permitting this movement.

The spacers, which remain in the container after the tube with its attached plates has been lifted therefrom, are then expanded in unison, as by a lateral movement of the container on the table 63 from the position indicated in full lines in Fig. 9 to that indicated in dotted lines therein, and the container with the expanded spacers therein thereafter placed in position in the apparatus shown in Fig. 1 to serve as a supply container from which the spacers are fed in building up another set or stack of alternate spacers and plates, as already described. In this way each of the interchangeable containers is used alternately as a receiving container to receive spacers from a supply container and, after being filled with plates and spacers, and after the plates have been withdrawn, as a supply container to replace the former supply container when the latter has been emptied of spacers, said emptied container being then placed in position to serve as a receiving container.

Having thus described my invention, I claim:

1. An apparatus for assembling perforated fins or plates in spaced relation on a radiator tube or the like, said apparatus comprising, in combination, means for feeding a succession of plates, separate means for feeding a succession of separate spacers, means for receiving said plates and spacers in superposed relation, and positive operating connections for said several feeding means adapted to cause said plates and spacers to be fed in alternation.

2. An apparatus for assembling perforated fins or plates in spaced relation on a radiator tube or the like, said apparatus comprising, in combination, mechanism for stamping out said plates and feeding them in succession, separate means for feeding a succession of separate spacers, means for receiving said plates and spacers in superposed relation, and positive operating connections for said several feeding means adapted to cause said plates and spacers to be fed in alternation.

3. An apparatus for assembling perforated fins or plates in spaced relation on a radiator tube or the like, said apparatus com-

prising, in combination, means for feeding a succession of plates, separate means for feeding a succession of separate spacers, means for receiving said plates and spacers in superposed relation, means for jarring said receiving means, and positive operating connections for said several feeding means adapted to cause said plates and spacers to be fed in alternation.

4. An apparatus for assembling perforated fins or plates in spaced relation on a radiator tube or the like, said apparatus comprising, in combination, means for supporting a tube in upright position, means for feeding a succession of plates onto said tube, separate means for feeding a succession of spacers onto said tube, and positive operating connections for said several feeding means adapted to cause said plates and spacers to be fed in alternation.

5. In an apparatus of the character described, in combination, means for feeding a succession of plates, means controlled by the delivery of successive plates by said feeding means for delivering an equal number of spacers in alternation with said plates, and means for receiving said plates and spacers in superposed relation.

6. In an apparatus of the character described, in combination, means for feeding a succession of plates, means for feeding a succession of spacers, means for receiving said plates and spacers in superposed alternating relation, and means controlled by the delivery of plates by said plate feeding means for controlling the delivery of spacers by said spacer feeding means, whereby delivery of plates and spacers in alternation is insured.

7. In an apparatus of the character described, in combination, means for feeding a succession of plates, a chute through which said plates are delivered, a second chute for delivering spacers, an escapement mechanism for controlling the delivery of spacers singly from said second chute, a feeler in said first named chute actuated by the passage of a plate therethrough, and an operative connection between said escapement mechanism and said feeler for actuating the former by the latter.

8. An apparatus for assembling fins or plates in spaced relation on a radiator tube or the like, said apparatus comprising, in combination, means for feeding a succession of plates, a container for holding a supply of spacers in superposed relation, means for feeding said spacers from said container and delivering them singly in alternation with said plates, and a second container similar to and interchangeable with said first-named container for receiving said plates and spacers in superposed relation.

9. In an apparatus for assembling perforated fins or plates in spaced relation on a radiator tube or the like, the combination with mechanism for feeding a succession of plates and notched spacers in alternation, of a container arranged to receive said plates and spacers in superposed relation, said container having an open side through which said plates can be withdrawn laterally from between said spacers by a tube passing through the perforations therein and itself removable laterally from the notches in said spacers.

10. In an apparatus for assembling perforated fins or plates in spaced relation on a radiator tube or the like, the combination with mechanism for feeding a succession of plates and notched collapsible spacers in alternation, of a container arranged to receive said plates and spacers in superposed relation, said container having an open side through which said plates can be withdrawn laterally from between said spacers by a tube passing through the perforations therein and itself removable laterally from the notches in said spacers, said spacers having collapsing means accessible from the exterior of said container.

11. In an apparatus for assembling fins or plates in spaced relation on a radiator tube or the like, the combination with a plurality of expansible and collapsible spacers each having a projecting member operable to expand and collapse the same, of a container in which said spacers are received in superposed relation, said container having a slot through which the projecting members of the several spacers extend in alined relation and in which they are operable.

12. In an apparatus for assembling fins or plates in spaced relation on a radiator tube or the like, the combination with a plurality of expansible and collapsible spacers each having a projecting member operable to expand and collapse the same, of a container in which said spacers are received in superposed relation, said container having a slot through which the projecting members of the several spacers extend in alined relation and in which they are operable, and means engageable with said projecting members for expanding and collapsing all of said spacers in unison.

13. In an apparatus for assembling fins or plates in spaced relation on a radiator tube or the like, the combination with a plurality of expansible and collapsible spacers each having a projecting member operable to expand and collapse the same, of a container in which said spacers are received in superposed relation, said container having a slot through which the projecting members of the several spacers extend in alined relation and in which they are operable, and a table on which said container is movably supported, said table having a slot to

receive said projecting members, whereby movement of said container on said table operates all of said members to expand or collapse all of said spacers in unison.

14. A spacer for use in assembling fins or plates in spaced relation on a radiator tube or the like, said spacer comprising a pair of parallel plates, relatively movable wedge members interposed between said plates, means for limiting the separation of said plates, and means including a projecting operating member for relatively moving said wedge members to separate said plates or to permit them to approach each other.

15. A spacer for use in assembling fins or plates in spaced relation on a radiator tube or the like, said spacer comprising a pair of parallel plates, expanding means operable to separate said plates or to permit them to approach each other, and limiting devices connecting said plates for limiting the separation thereof, each of said devices comprising two adjustably telescoping threaded members having heads received in countersunk recesses in the outer faces of the respective plates.

In testimony whereof I affix my signature.

ARTHUR C. WALWORTH.