March 11, 1969 R. E. CARLSON 3,431,620

APPARATUS FOR ASSEMBLY OF TUBE AND CENTER RADIATOR CORES

Filed July 19, 1966 Sheet 1 of 4

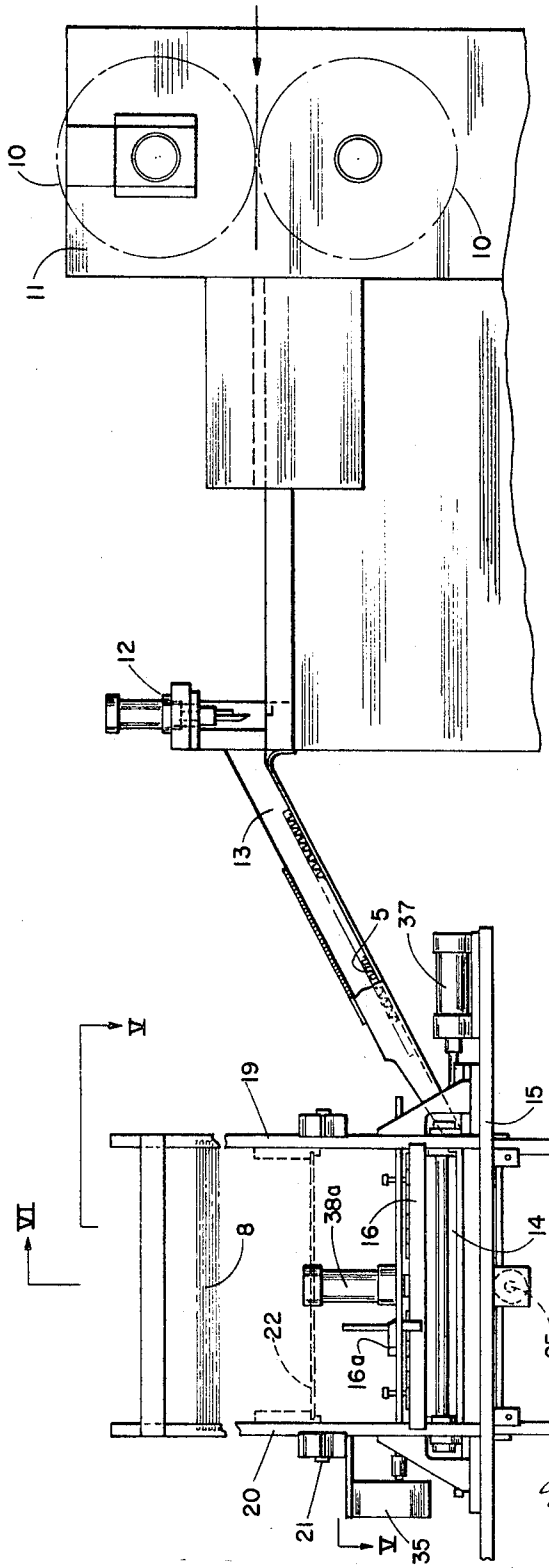


Fig 1

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APPARATUS FOR ASSEMBLY OF TUBE AND CENTER RADIATOR CORES

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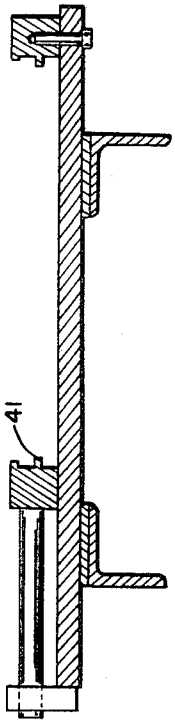


Fig 7

Fig 2

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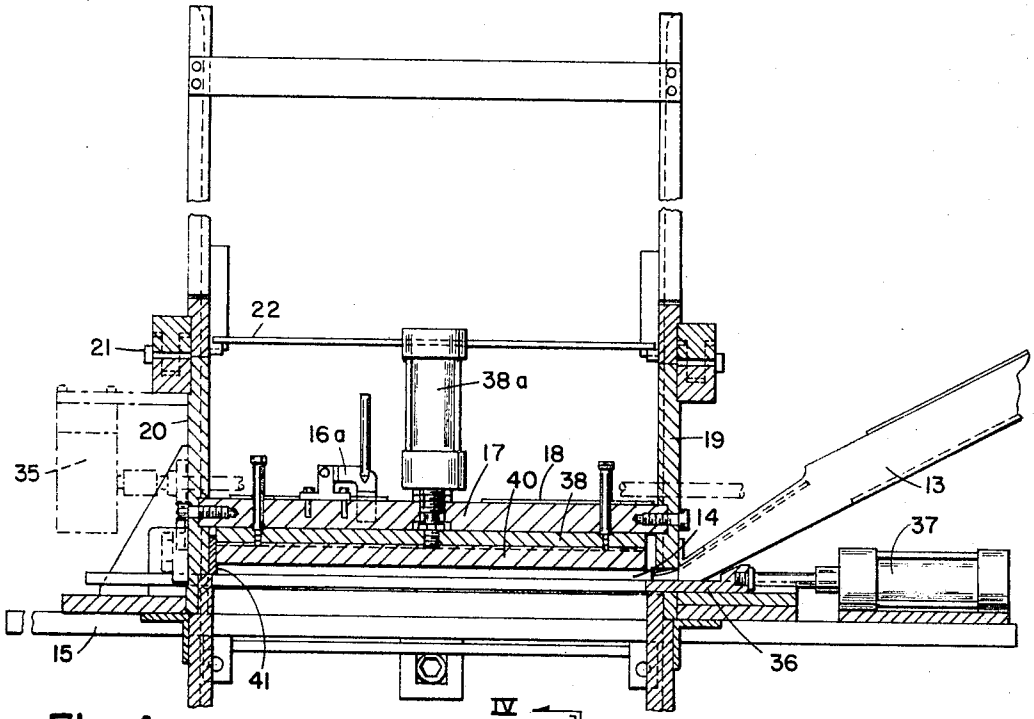


Fig 4

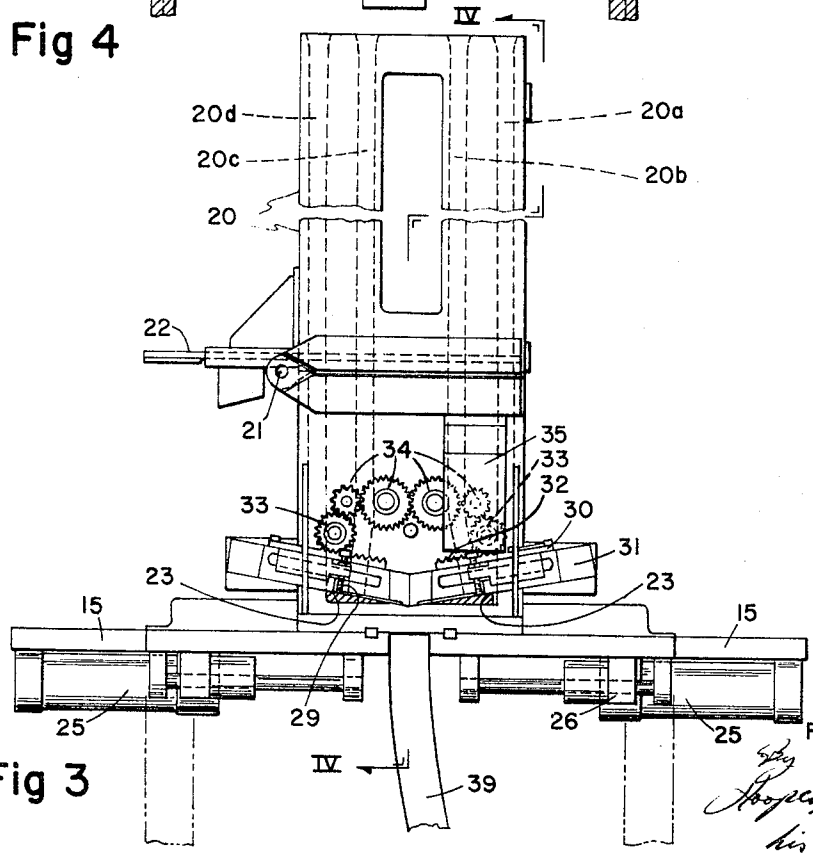


Fig 3

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APPARATUS FOR ASSEMBLY OF TUBE AND CENTER RADIATOR CORES

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Fig 5

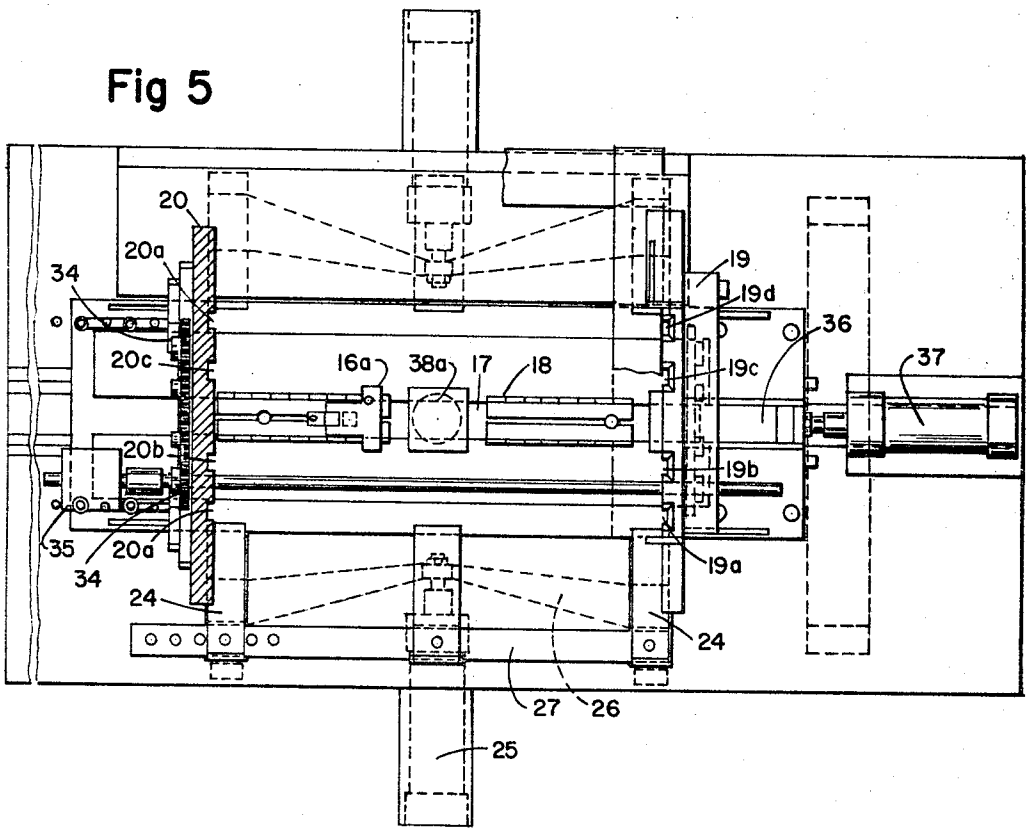
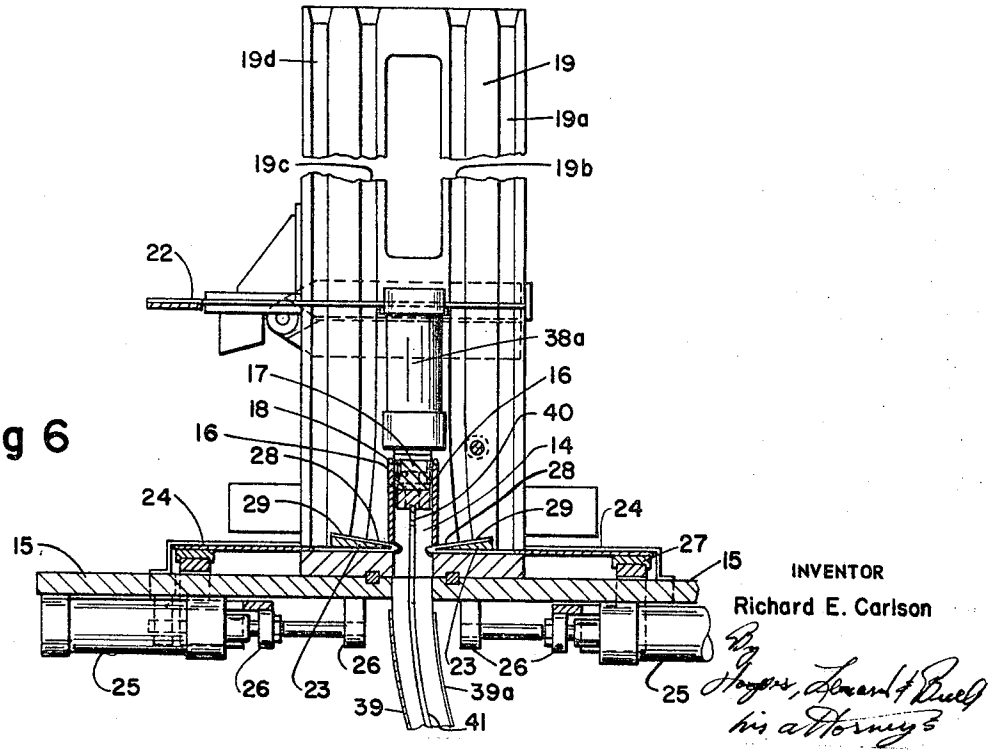


Fig 6



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Patented Mar. 11, 1969

3,431,620

APPARATUS FOR ASSEMBLY OF TUBE AND CENTER RADIATOR CORES

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U.S. Cl. 29—202 8 Claims
Int. Cl. B23p *19/04*

ABSTRACT OF THE DISCLOSURE

An apparatus is provided for automatically assembling tube and center radiator cores comprising a means for successively delivering a formed length of separator, guide means receiving the separator and resiliently holding the same, a pusher means advancing each separator into the guide means, a magazine means delivering at least two side-by-side tubes onto each length of separator and means in the guide means maintaining said tubes spaced from each other on the separator.

This invention relates to methods and apparatus for the assembly of tube and center radiator cores. Radiator cores for automotive vehicles of the tube and center type are made up of alternate rows of hollow brass tubes and copper separators. The hollow tubes carry water between the top and bottom tanks of the completed radiator. The separators act as heat exchanger surfaces between the tubes and air which is drawn through the core. Prior to the present invention tubes and separators were assembled by hand. This was a slow, tedious method of assembling cores and resulted in increased costs to the consumer by reason of the high labor costs.

The present invention makes it possible to receive the copper separators directly from the separator rolling machine and pile them alternately with the tubes, automatically and without the need for handling the separators by hand. By my invention it is also possible to mix separators and tubes of several thicknesses. In short it is possible to alternate a given number of light tubes with a given number of separators and then automatically to change and alternate a different number of heavy tubes with a different number of separators. All this is accomplished automatically without manual assistance.

Preferably, I provide an apparatus for automatic assembly of tube and center radiator cores comprising means for successively delivering a formed length of separator, guide means receiving said separator and resiliently holding the same, pusher means advancing each said separator into the guide means, magazine means delivering at least two side-by-side tubes onto each length of separator, and means on the guide means maintaining said tubes spaced from each other on the separator. Preferably, the magazine means is provided with side-by-side frames carrying stacked tubes and feeder means delivering simultaneously a tube from each frame onto the last separator delivered to the guide means. Table means are provided receiving the stacked separators and tubes, said table means having rib means maintaining said tubes in uniform spaced relationship with one another and the separators.

In the foregoing general description of my invention I have set out certain objects, purposes and advantages. Other objects, purposes and advantages of the invention will be apparent from a consideration of the following description and the accompanying drawings in which:

FIGURE 1 is a side elevation of an apparatus according to my invention;

FIGURE 2 is an end elevation of the apparatus of FIGURE 1 viewed from the left;

FIGURE 3 is an enlarged fragmentary side elevational view of the stacker frame as viewed from the left of FIGURE 1;

FIGURE 4 is a section on the line IV—IV of FIGURE 3;

FIGURE 5 is a partial section on the line V—V of FIGURE 1;

FIGURE 6 is a partial section on the line VI—VI of FIGURE 1; and

FIGURE 7 is a section on the line VII—VII of FIGURE 2.

Referring to the drawings, I have illustrated strip forming wheels **10** carried in a frame **11** by which a strip of copper is folded to form an undulant folded separator strip of usual form. Guillotine cutter means **12** is carried on the frame **11** to cut the formed separator into uniform lengths **5**. The guillotine cutter **12** may be actuated by rotation of the forming wheels or any other well known means to cut lengths with uniform numbers of folds. The cut length of separator **5** leaving the guillotine cutter **12** enters delivery chute **13** where it is delivered lengthwise into trough **14** on frame **15**. Trough **14** is defined by side panels **16** hinged to stacker frame member **17** by hinges **18**. The side panels are held in closed position by a bifurcated lock member **16***a* hinged to the top of frame member **17**. The stacker frame member **17** is mounted on stacker end members **19** and **20** fixed to frame **15**. The stacker end members **19** and **20** as illustrated provide for four stacks of water tubes **8** and to this end are provided with guide slots **19***a*, **19***b*, **19***c*, **19***d* and **20***a*, **20***b*, **20***c* and **20***d*, respectively, into which preformed water tubes are placed one on top of another. The end members **19** and **20** may be formed in two pieces, hinged together by hinge **21** and the top portion provided with a slide stop **22** so that the top portion can be closed by stop **22** and tilted for ease of loading. At the bottom of slots **19***a* and **19***d* and **20***a* and **20***d* are generally horizontal delivery slots **23**, one on each side of trough **14**, which receive the water tubes one at a time from the slots for delivery to trough **14**. Shuttle bars **24** are provided in each of slots **23** and are operated by cylinders **25** acting on cross heads **26** which are connected at their ends to the shuttle bars **24** through shuttle head **27**. At the bottom of slots **19***b* and **19***c* and **20***b* and **20***c* are sloped delivery slots **28**, one on each side of trough **14** which receive the water tubes one at a time from the slots for delivery to trough **14**. Shuttle bars **29** are provided in each of slots **28**. Each of shuttle bars **29** is connected to a drive member **30** carried in guides **31**. Each drive member **30** is provided with a rack **32** engaged by pinions **33** driven through gears **34** by a motor **35**.

A compressor bar **36** is provided at the feed end of trough **14**. The compressor bar **36** is operated by cylinder **37** and engages the end of the separator in trough **14** to compress it to uniform length in the trough. A feed bar **38** moves vertically in trough **14** by means of cylinder **38***a* to force the separator into the delivery guide frame **39** beneath resilient members **39***a* which hold the separator against sliding in the frame. The feed bar **38** is provided with a depending spacer **40** which spaces the water tubes apart on delivery. The guide frame **39** is provided with spacer ribs **41** on each side to maintain the spacing between the water tubes.

The apparatus of my invention operates as follows. A cut length of separator delivered by chute **13** enters trough **14** where one end butts against spacer rib **41** on the side opposite chute **13**. The other end of the separator is immediately engaged by compressor bar **36** which moves to the left viewing FIGURE 4 to the position shown in FIGURE 4. The feed bar **38** is forced downwardly by cylinder **38***a* into guide frame **39**. Immediately following

this, a pair of water tubes is delivered from delivery slots **23** or **28** depending upon whether cylinders **25** or motor **35** is actuated. The tubes so delivered are pushed into contact with spacer **40**. The compressor bar **38** is then raised and the cycle repeated with alternator spacers and paired tubes until sufficient members have been assembled and pushed onto the horizontal table to form a radiator core. The assembled separators and tubes are removed by a clamping gauge which selects the correct number of separators and tubes for one radiator. This group is then taken to the usual equipment for attaching the top and bottom tanks and completing the radiator assembly.

The use of four slots **19***a*, **19***b*, **19***c* and **19***d* and **20***a*, **20***b*, **20***c* and **20***d* makes it possible to feed two different weights of tube into the assembly, for example, one might feed 6 heavy tubes, 30 light tubes and 6 heavy tubes for each core thus providing added strength at the sides of the radiator. It is obvious that any two pairs of slots **19***a* and **19***d*, **20***a* and **20***d* or **19***b* and **19***c*, **20***b* and **20***c* might be eliminated if it was desired to feed only one weight of tubes or alternatively additional paired slots might be added to increase the versatility of the device.

The several actuating cylinders and hydraulic motor are interconnected by any conventional timing circuitry so that the apparatus is automatic in its operation. To this end, the operating cylinder **12** on the guillotine cutter is operated to raise the guillotine, a time delay is introduced to allow the separator to travel the length of chute **13** into trough **14** and then cylinder **37** is actuated to compress the separator. The operating cylinder **38***a* is actuated as soon as cylinder **37** completes its stroke. Cylinder **37** retracts and cylinders **25** or motor **35** are actuated to feed tubes as soon as cylinder **38***a* completes its stroke. And cylinder **38***a* and cylinders **25** are retracted as soon as cylinders **25** complete their stroke. All this can be accomplished by conventional valves and timing devices connected in well-known manner. It is accordingly not deemed necessary to show the valving and timing beyond the foregoing description of operation.

While I have illustrated and described a presently preferred embodiment of my invention, it will be understood that this invention may be otherwise embodied within the scope of the following claims.

I claim:

1. An apparatus for automatically assemblying tube and center radiator cores comprising means for successively delivering a formed length of separator, guide means receiving said separator and resiliently holding the same, pusher means advancing each said separator into the guide means, magazine means delivering at least two side-by-side tubes onto each length of separator, and means on the guide means maintaining said tubes spaced from each other on the separator.

2. An apparatus as claimed in claim **1** wherein the magazine means includes a pair of spaced vertical slots on opposite sides of said guide means, said slots engaging the ends of tubes to be delivered and transverse shuttle bars simultaneously pushing a tube from the bottom of each set of slots onto each separator in the guide means.

3. Apparatus as claimed in claim **1** wherein the pusher means is provided with a center depending spacer bar acting to space the tubes apart on the separator.

4. Apparatus as claimed in claim **1** wherein compressor means is provided at the entrance to the guide means compressing the length of separator to a standard length fitting into the guide means.

5. Apparatus as claimed in claim **1** wherein the magazine means includes two pairs of spaced vertical slots on each of the opposite longitudinal sides of said guide means, said slots engaging the ends of four spaced side-by-side stacks of tubes, two on each side of said guide means, a pair of vertically spaced transverse slots on each side of said guide means each slot communicating between a pair of vertical slots and the top of the guide means, shuttle bars movable in said transverse slots and means acting on the shuttle bars to simultaneously push a tube from one pair of vertical slots on each side of the guide means into the top of a separator in said guide means.

6. An apparatus as claimed in claim **5** wherein compressor means is provided at the entrance to the guide means compressing said separator lengthwise to a standard length fitting into the guide means.,

7. Apparatus as claimed in claim **6** wherein the pusher means is provided with a centrally depending spacer bar bearing on the separator prior to movement of the shuttle bars and acting to space the tubes apart on the separator.

8. An apparatus as claimed in claim **7** wherein the guide means is curved to connect to a horizontal run-out table, said run-out table having tube spacer means holding the tubes in spaced position between the separators.

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U.S. Cl. X.R.

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