April 28, 1931. E. H. SEELERT 1,802,929

HEAT EXCHANGE CORE ASSEMBLING MACHINE

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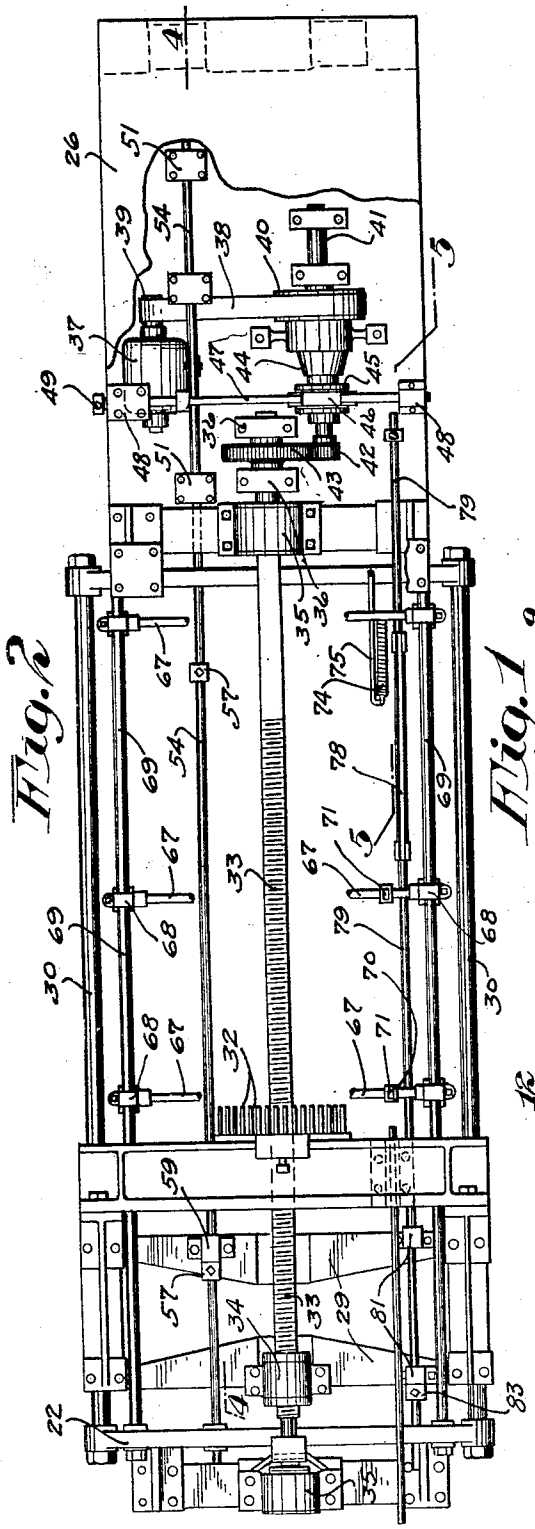


Fig. 2

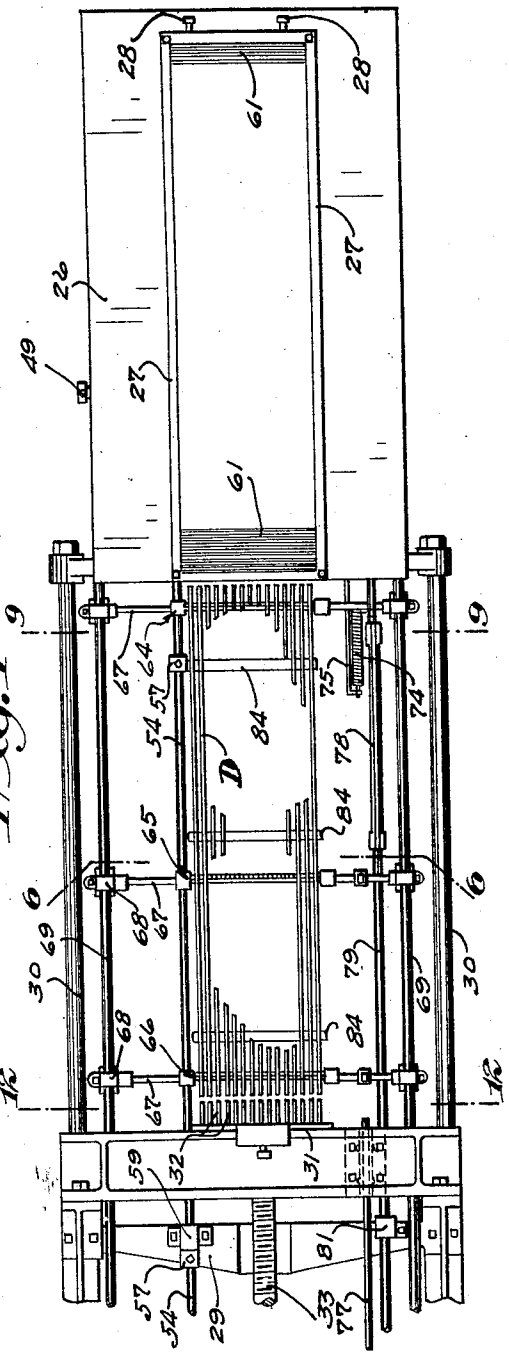


Fig. 1

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HEAT EXCHANGE CORE ASSEMBLING MACHINE

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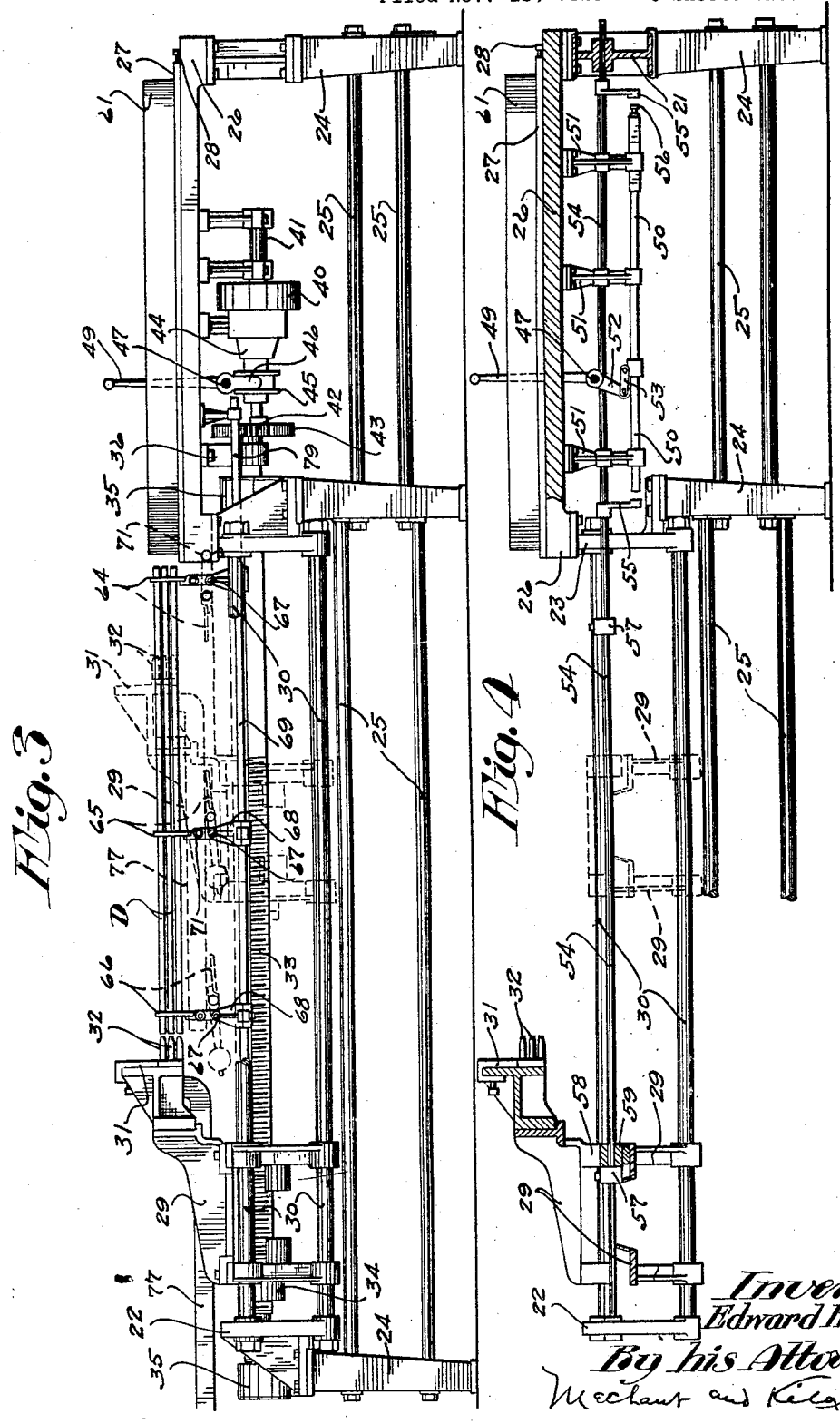


Fig. 3

Fig. 4

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HEAT EXCHANGE CORE ASSEMBLING MACHINE

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Fig. 5

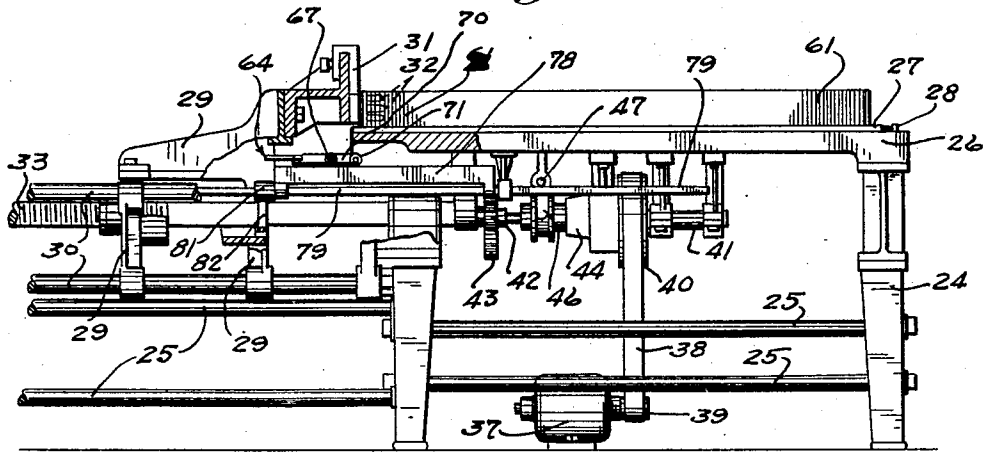
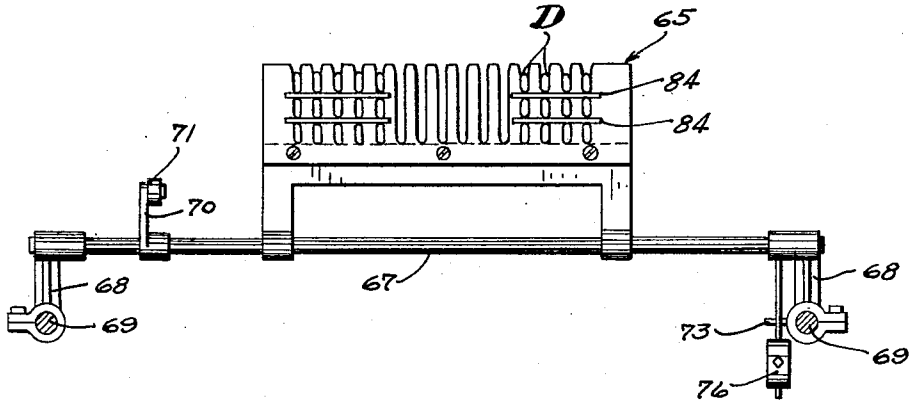



Fig. 6




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April 28, 1931. E. H. SEELERT 1,802,929

HEAT EXCHANGE CORE ASSEMBLING MACHINE

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Fig. 7

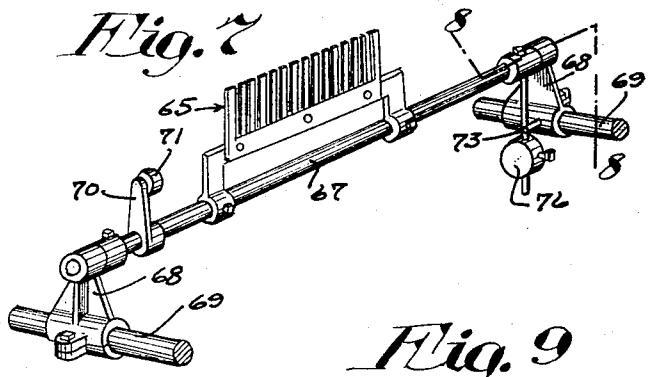



Fig. 8

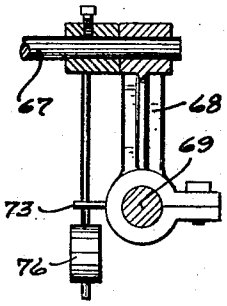



Fig. 9

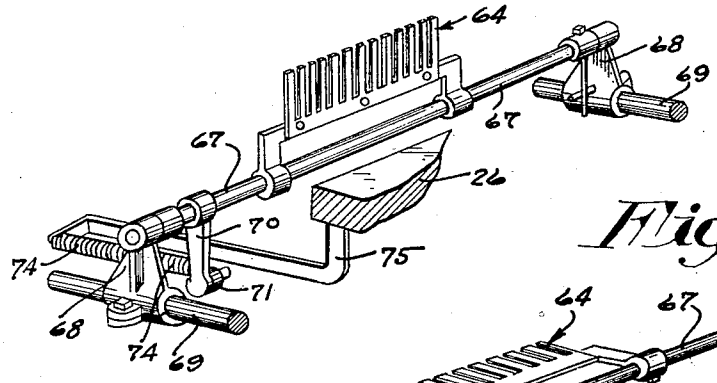



Fig. 10

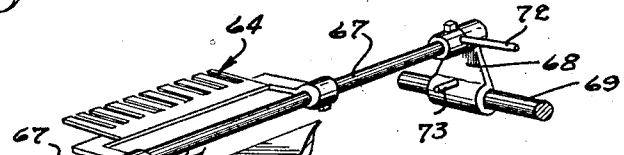



Fig. 11

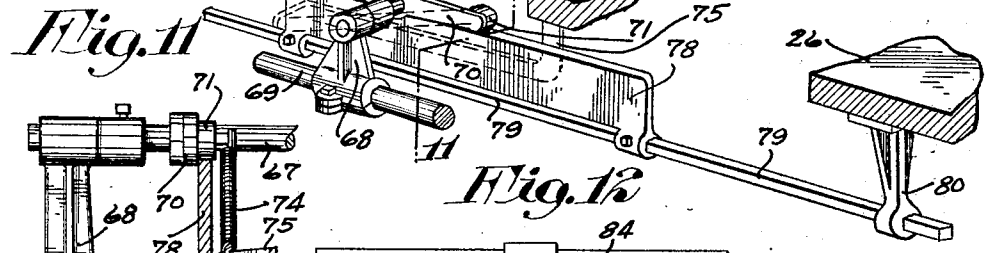
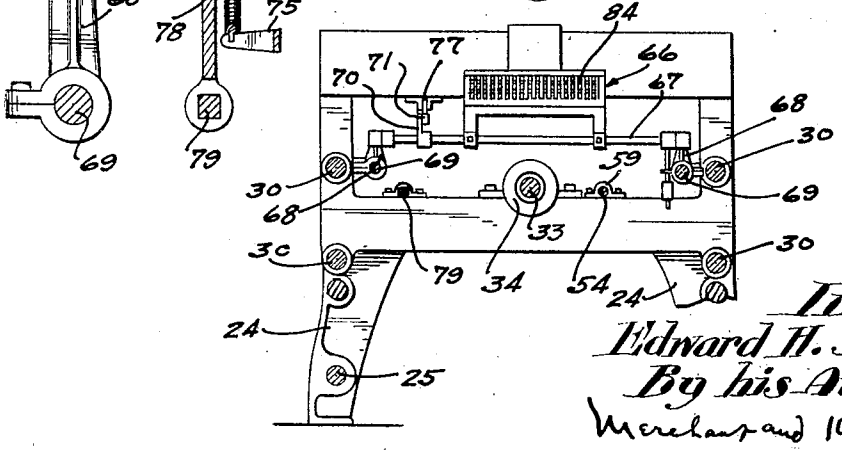



Fig. 12




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April 28, 1931. E. H. SEELERT 1,802,929

HEAT EXCHANGE CORE ASSEMBLING MACHINE

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Fig. 14

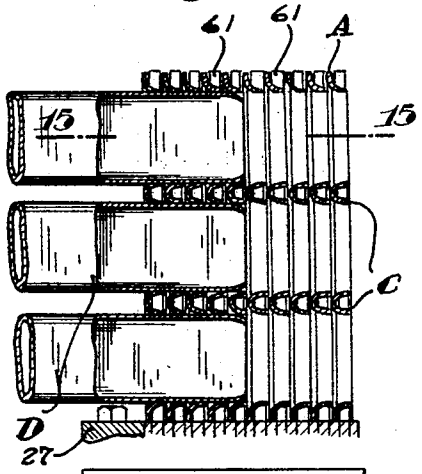



Fig. 13

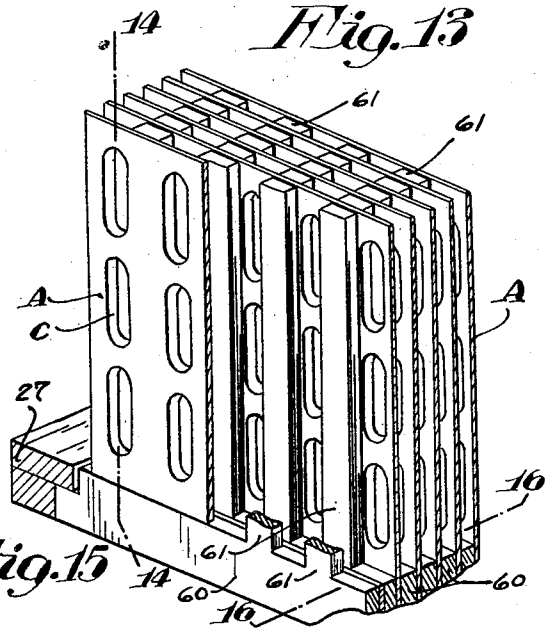



Fig. 15

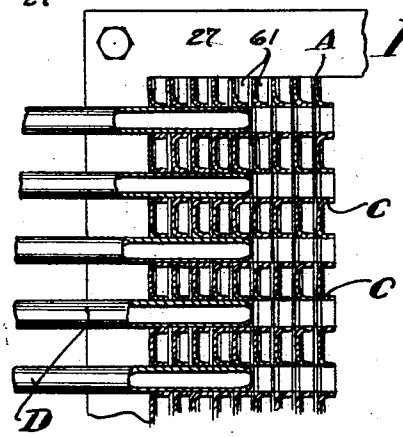



Fig. 16

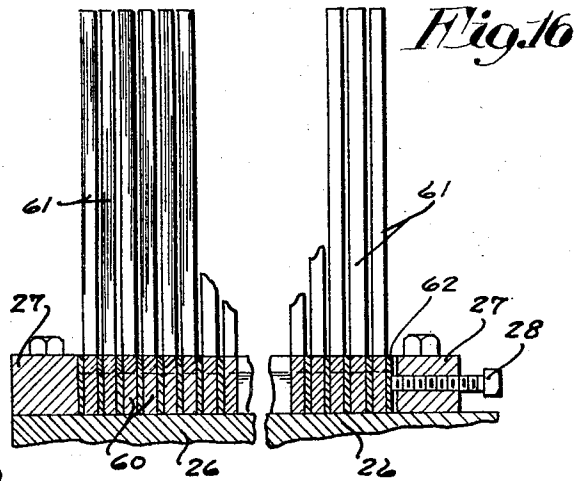
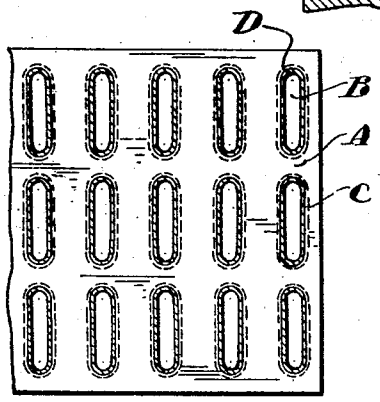



Fig. 12




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April 28, 1931. E. H. SEELERT 1,802,929

HEAT EXCHANGE CORE ASSEMBLING MACHINE

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Fig. 19

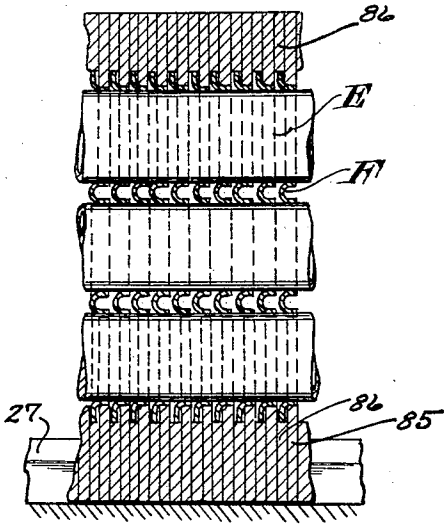



Fig. 18

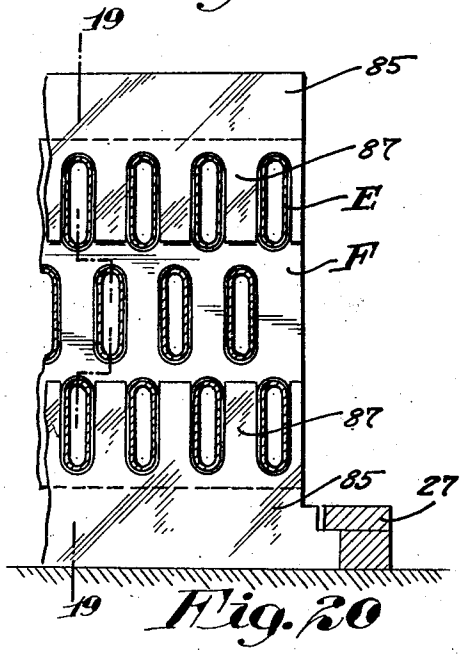
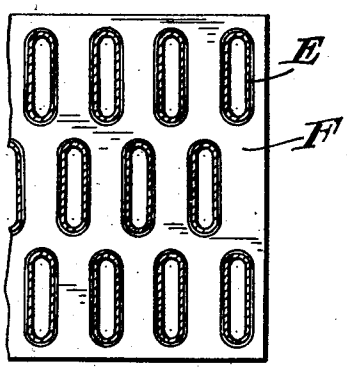



Fig. 20




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Patented Apr. 28, 1931

1,802,929

# UNITED STATES PATENT OFFICE

EDWARD H. SEELERT, OF MINNEAPOLIS, MINNESOTA, ASSIGNOR TO McQUAY RADIATOR CORPORATION, OF MINNEAPOLIS, MINNESOTA, A CORPORATION OF DELAWARE

## HEAT-EXCHANGE CORE-ASSEMBLING MACHINE

Application filed November 18, 1929. Serial No. 407,907.

My present invention has for its object the provision of a simple and highly efficient machine for assembling tubes and fins to form the core of a heat exchange unit and, generally stated, the invention consists of the novel devices and combinations of devices hereinafter described and defined in the claims.

The improved machine involves novel and efficient means for holding a sufficient number of fins for one or more units with their tube passageways aligned, for supporting tubes at different longitudinally spaced points in alignment with said passageways, for holding the rear ends of the tubes and centering the same in respect to the fin passageways, for feeding tubes endwise through the passageways in the fins to assemble said fins and tubes, and for causing the several tube-supporting means to progressively and successively release the tubes as they are fed through the fins and in advance of the tube-feeding means.

In the accompanying drawings, which illustrate the invention, like characters indicate like parts throughout the several views.

Referring to the drawings:

Fig. 1 is a plan view of the core assembling machine with some parts broken away;

Fig. 2 is a view corresponding to Fig. 1 with the exception that certain parts have been removed and additional parts illustrated;

Fig. 3 is a left-hand elevation of the machine with some parts shown in different positions by means of broken lines;

Fig. 4 is a view partly in elevation and partly in longitudinal section taken on the line 4—4 of Fig. 2, some parts being broken away and other parts being shown in different positions by means of broken lines;

Fig. 5 is a fragmentary view partly in left-hand elevation and partly in longitudinal vertical section taken on the line 5—5 of Fig. 2;

Fig. 6 is a detail view with some parts sectioned on the line 6—6 of Fig. 1, on an enlarged scale;

Fig. 7 is a perspective view of the parts shown in Fig. 6, with the exception that the tubes and spacing bars are removed;

Fig. 8 is a detail view principally in section taken on the line 8—8 of Fig. 7;

Fig. 9 is a perspective detail view with some parts sectioned on the line 9—9 of Fig. 1, on an enlarged scale;

Fig. 10 is a view corresponding to Fig. 9 with the exception that the tube holder and aligner have been moved into an inoperative position;

Fig. 11 is a fragmentary detail view with some parts sectioned on the line 11—11 of Fig. 10, on an enlarged scale;

Fig. 12 is a view in transverse vertical section taken on the line 12—12 of Fig. 1;

Fig. 13 is a fragmentary perspective view showing one form of fin holder and aligner and fins assembled therein;

Fig. 14 is a fragmentary detail view with some parts sectioned on the line 14—14 of Fig. 13 and further showing tubes fed partway in certain of the fins;

Fig. 15 is a view partly in plan and partly in horizontal section taken on the line 15—15 of Fig. 14;

Fig. 16 is a fragmentary detail view with some parts sectioned on the line 16—16 of Fig. 13;

Fig. 17 is a fragmentary view of the core which has vertically aligned tubes and which tubes are shown in section;

Fig. 18 is an elevation showing a fin holder and aligner for assembling a core in which the tubes are staggered;

Fig. 19 is a view principally in section taken on the irregular line 19—19 of Fig. 18; and

Fig. 20 is a fragmentary view of the core having the staggered tubes and which tubes are shown in section.

The frame of the core assembling machine comprises front, rear and intermediate cross-tie members 21, 22 and 23, respectively, each of which is supported on and rigidly secured to a pair of legs 24, and upper and lower longitudinal tie rods 25 which rigidly connect the legs 24 on each side of the machine. Mounted on the front and intermediate members 21 and 23 is a horizontal flat

bed 26 on the upper face of which is a fixed rectangular frame 27 detachably secured by screws to said bed and having in its front end member a pair of long clamping screws 28 which project into said frame to impinge against a fin holder and aligner, as will hereinafter appear.

A reciprocating cross-head 29 is mounted on ways in the form of upper and lower pairs of longitudinally extended guide rods 30 the ends of which are anchored in the cross-tie members 22 and 23 and support said cross-head for straight line sliding movement longitudinally of the machine in the plane of the bed 26. Detachably but rigidly secured to the front of the cross-head 29 is a follower 31 having a flat tube-engaging face that is perpendicular to the bed 26 and square with the frame 27. This follower 31 bears against the front vertical face of the cross-head 29, is hooked over the upper edge thereof, and rigidly but detachably secured thereto by a set-screw.

Rigidly secured to the flat face of the follower 31 is a plurality of parallel mandrels 32 which project horizontally toward the bed 26 in vertically and horizontally spaced rows with intervening spaces. These mandrels 32 are provided for supporting the rear ends of tubes and centering the same in respect to tube passageways in fins with which said tubes are to be assembled to form a core. Said mandrels 32 have the same cross-section as the tubes and their outer ends are tapered to cause said mandrels to readily enter the rear ends of the tubes and their movement onto the mandrels 32 is limited by the engagement of their rear ends with the follower 31 and the flat face thereof planes said ends so that the tubes are evenly assembled in the core.

The cross-head 29 is reciprocated by a long feed screw 33 which has threaded engagement with a cooperating nut block 34 rigidly secured to the cross-head 29. This feed screw 33 is journaled in front and rear bearings 35 on the cross-tie members 22 and 23 and in a pair of depending bearings 36 on the bed 26 forward of the front bearing 35.

The following connections are provided for turning the feed screw 33 from an electric motor 37 on a bed fixed to the floor under the machine, to wit: A belt 38, which runs over a small pulley 39 on the shaft of said motor and a large pulley 40 loosely journaled on a horizontal countershaft 41 that extends transversely of the machine and journaled in bearings on the under side of the bed 26, and a spur pinion 42 on said shaft which meshes with a spur gear 43 on the feed screw 33 between the two bearings 36.

A reversible clutch, indicated as an entirety by the numeral 44, is provided for connecting the loose pulley 40 to the countershaft 41. This clutch 44 is mounted on the countershaft 41 and its case is held suspended from the bed 26. Said clutch 44 is of the type commonly used in connection with motor boats and is movable from neutral position to a position to rotate the countershaft 41 either to the left or the right. As the clutch 44 is of well-known construction, it is not thought necessary to more fully describe the same, except to state that when said clutch is released it will automatically return to neutral position. Operating connections for the clutch 44 include a shipper collar 45 on the countershaft 41 and a cooperating shipper fork 46 carried by a transverse rock shaft 47 journaled in bearings 48 on the bed 26. On one end of the rock shaft 47 is a hand lever 49 by which the clutch 44 may be manually operated.

In the preferred arrangement of the clutch 44 it is manually set by the hand lever 49 to rotate the feed screw 33 either to the left or the right and is automatically released to stop the rotation of said feed screw by the action of the cross-head 29 during either the forward or reverse movement thereof. The automatic connections for releasing the clutch includes a longitudinally extended trip rod 50 mounted for endwise sliding movement in front, rear and intermediate depending bearings 51 on the under side of the bed 26. This trip rod 50, at its front end portion, and its front bearing 51 is square in cross section to hold said rod from turning about its longitudinal axis. The rock shaft 47 is operated from the trip rod 50 by a crank arm 52 on said rod and a link 53 connecting said crank arm and trip rod.

Reciprocatory movement is imparted to the trip rod 50 under the action of the cross-head 29 by a long push rod 54. This push rod extends parallel to the trip rod 50 and its end portions are mounted in bearings in the cross-tie members 21 and 22 and its intermediate portion is mounted in the bearings 51. Said push rod 54, at its front end portion, and its bearing in the cross-tie member 21 is square in cross section to hold said rod from turning about its longitudinal axis. Secured to the push rod 54 are depending front and rear arms 55 arranged to alternately engage the ends of the trip rod 50 which extends therebetween with freedom for a limited endwise movement in respect thereto. The operative length of the trip rod 50 may be varied, at will, by adjusting a screw 56 having threaded engagement with the front end of said rod and with which screw the front arm 55 directly engages.

Adjustably mounted on the push rod 54 are front and rear collars 57 held in place

by set-screws. Formed with the cross-head 29 is a depending fixed arm 58 having a shipper collar 59 through which the push rod 54, between the collars 57, loosely extends. At substantially the limit of the forward movement of the cross-head 29 its shipper collar 59 engages the front collar 57 and thereby imparts an endwise movement to the push rod 54 which carries the rear arm 55 into contact with the rear end of the trip rod 50, moves the same forward and thereby actuates the rock shaft 47 to release the set clutch 44 by means of the shipper fork 46 and stop further rotation of the feed screw 33. Substantially at the limit of the return movement of the cross-head 29 its shipper collar 59 engages the rear collar 57 and thereby imparts an endwise movement to the push rod 54 which carries its front arm 55 into contact with the screw 56 and thereby imparts an endwise movement to the trip rod 50, moves the same forward and actuates the rock shaft 47 to release the clutch by means of the shipper fork 46 and stop further rotation of the feed screw 33.

A fin holder and aligner is provided for holding and aligning a plurality of fins A to be assembled in a heat exchange unit and wherein the tube passageways B in said fins are vertically and longitudinally aligned. These fins A are formed from thin sheets of copper or other suitable material and provided with laterally projecting sleeve-like flanges C which surround the passageways B, contact with adjacent fins of the unit and hold said fins laterally spaced predetermined distances apart. This fin holder and aligner is, as shown, a laminated structure comprising flat base bars 60, set vertically edgewise transversely of the machine and provided with upstanding edgewise spaced flat bars 61, and intervening flat spacers 62 of substantially the same size as said bars. These base bars 60 and spacers 62 rest on the flat bed 26, extend transversely thereof and their end portions have rabbeted interlocking engagement with the frame 27 to hold the fin holder and aligner on the bed 26 with freedom for movement longitudinally thereof. The screws 28 hold the base bars 60 and spacers 62 clamped together and against the front member of the frame 27.

In mounting the fin holder and aligner on the bed 26, the same is placed thereon and the frame 27 placed thereover and bolted to said bed. The lateral spacing of the bars 61 is such that the fins may be freely inserted therebetween from the tops thereof and supported on the spacers 62 with freedom for slight lateral movements to permit the flanges C to contact with adjacent fins to laterally space the same. The edgewise spacing of the bars 61 is such as to receive the flanges C in the intervening spaces therebetween and in contact with the adjacent fins. After the fins A are assembled in the holder and spacer they are firmly pressed downward onto the spacers 62 which horizontally planes the same and vertically aligns the horizontal rows of passageways B and the insertion of the flanges C between the bars 61 horizontally aligns the vertical rows of passageways B.

In assembling the fins A in the holder and aligner, it will be noted that their flanges C project toward the front end of the machine or, in other words, away from the cross-head 29. With the fins A thus held assembled, their passageways B are aligned both horizontally and vertically with the mandrels 32.

Cooperating with the fin holder and aligner is a tube holder and aligner for holding a plurality of flat tubes D, formed from thin copper or other suitable material, to be assembled with the fins A by inserting said fins endwise through the passageways B and complete the heat exchange core. These tubes D are held between the bed 26 and follower 31 in longitudinal alignment with the mandrels 32 and passageways B. These tubes D, previous to the mounting thereof in the machine, are cut to the proper length and one end thereof is upset, as shown in Figs. 14 and 15 by my "Heat exchange tube upsetting machine" filed November 18, 1929, under Serial Number 407,908. This tube holder and aligner comprises individual front, intermediate and rear comb-like racks 64, 65 and 66, respectively, which normally extend upright transversely of the machine with the intervening spaces between their teeth in the same vertical planes with the vertical rows of mandrels 32 and passageways B in the fins A. These racks 64, 65 and 66 hold the tubes D in vertically spaced rows with freedom for endwise feeding movement to the fin holder and aligner. It is important to note that the rack 64 is positioned close to the frame 27 and supports the tubes D during substantially their full length of travel as they are assembled in the core.

The racks 64, 65 and 66 are independently movable and rigidly secured to rock-shafts 67 journaled in bearings 68 on a pair of longitudinal rods 69 anchored at their ends in the rear cross-tie member 22 and intermediate cross-tie member 23. Applied to each rock-shaft 67 for operating the same is a crank arm 70 having on its outer end a roller-equipped stud 71. The crank arm 70, on the front rock-shaft 67, normally projects downward, and the crank arms 70 on the rear and intermediate rock-shafts 67, normally project upward.

Radial stems 72, on the rock-shafts 67, normally engage stop pins 73 on certain of the bearings 68 and hold the racks 64, 65 and 66 from turning except in one direction.

The front pin 73 prevents the front rack 64 from turning except toward the rear of the machine or, in other words, toward the cross-head 29 during its forward movement, and the intermediate and rear pins 73 hold the rear and intermediate racks 64 from turning except toward the front of the machine or, in other words, in the direction of the forward travel of said cross-head. The bearings 68 are adjustably secured to the rods 69 whereby, the racks 64, 65 and 66 may be set different distances apart for holding tubes of different lengths.

A coiled spring 74, anchored to a bracket 75 on the intermediate cross-tie member 23 and attached to the roller-equipped stud 71 of the front rack 64, yieldingly and normally holds said rack upright with its rod 22 against the respective stop pins 73, see Fig. 9. The intermediate rack 65 and rear rack 66 are yieldingly and normally held in upright positions with their rods 72 against the respective stop pins 73 by counterweights 76 on said rods, see Fig. 7.

To progressively and successively turn the racks 67, 66 and 65 out of engagement with the tubes D and into inoperative positions below the same and thus hold said rack in advance of the forward movement of the cross-head 29 and permit the same to pass thereover as the tubes D are fed into the passageways B and to progressively and successively release said racks during the retracting movement of said cross-head and permit the weights 76 to return the same to operative positions, there is provided a reciprocating cam bar 77 for operating the rear rack 66 and intermediate rack 65 and a reciprocating cam blade 78 for operating the front rack 64. The cam bar 77 is operated by the cross-head 29 to which it is rigidly secured and arranged to engage the roller-equipped studs 71 on the crank arms 70 of the rear and intermediate racks 66 and 65, respectively, and lift the same to swing said racks forwardly and downwardly. The length of this cam bar 77 is such as to remain in engagement with the roller-equipped studs 71 of the rear rack 66 and intermediate rack 67 during the full forward travel of the cross-head 29 and thereby hold said racks inoperative.

The cam blade 78 is carried by a longitudinally extended shaft 79 mounted in bearing brackets 80 on the rear cross-tie member 22 and intermediate cross-tie member 23 for endwise reciprocatory movement imparted thereto by the cross-head 29. This shaft 79 and the seats therefor in the bearing brackets 80 are square in cross section to hold said shaft from turning about its longitudinal axis with the cam blade 78 in an upright position, see Fig. 10. During the forward movement of the cam blade 78 imparted thereto from the cross-head 29, it engages the roller-equipped stud 71 of the front rack 64, swings said rack rearwardly and downwardly against the tension of its spring 74, out of engagement with the tubes D and below the same, and holds said rack inoperative until the cross-head 29 has made its initial return movement.

The shaft 79 is intermittently reciprocated by a shipper collar 81 integrally formed with a fixed arm 82 on the cross-head 29 and through which said shaft extends for endwise sliding movement. During the forward movement of the cross-head 29, its shipper collar 81 engages the rear end of the cam blade 78 and moves said blade into an inoperative position. When the cross-head 29 is making its return movement, its shipper collar 81 engages a fixed collar 83 on the shaft 79 and moves said shaft rearward and hence the cam blade 78 from under the roller-equipped stud 71 of the rack 64 and permits said rack to be returned to an operative position under the action of the spring 74.

The tubes D are placed in the racks 64, 65 and 66 with transverse divider bars 84 therebetween to support said tubes in horizontally spaced rows, as shown in Fig. 6. These divider bars 84 are of the proper thickness to hold the tubes D vertically aligned with the passageways C and mandrels 32. During the feeding of the tubes D as they are assembled with the fins A the divider bars 84 are removed from between the tubes D in advance of the movement of the racks 66, 65 and 64 into inoperative positions.

Referring now to the adjustment of the machine to assemble a core in which tubes E are assembled in staggered arrangement in fins F of a heat exchange unit it will be necessary to substitute a follower having staggered mandrels, not shown, for the follower 31 and it will also be necessary to substitute a fin holder and aligner, as shown in Figs. 18 to 20, inclusive, for the holder and aligner 60, 61 and 62. This latter type of holder and aligner, as shown, comprises flat plates 85, set vertically edgewise transversely of the machine, and intervening top and bottom spacers 86, and which plates 85 have upright bars 87 with intervening spaces. Said fin holder and aligner is made in upper and lower sections, the latter of which rests on the bed 26 and has rabbeted interlocking engagement with the frame 27, and the former of which loosely rests on the upper edges of the fins F and is supported thereby. In assembling the fins F in this holder and aligner, they are mounted between the bars 87 of the lower section and supported on the lower spacers 86 which hold said fins with their passageways vertically aligned with their flanges extending

between said bars to horizontally align said passageways.

The upper section of the fin holder and aligner is placed over the fins F with its spacers 86 resting on the upper edges thereof and with the upper edge portions of said fins loosely extending between the upper sections of the bars 87, with the flanges of said fins extending between the bars 87 to hold the fins horizontally aligned, and with said flanges contacting with adjacent fins to hold said fins laterally spaced.

*Operation*

It may be assumed that the clutch 44 is in neutral position and the cross-head 29 in its rearmost position, as indicated in Figs. 3 and 4. The required number of fins are manually placed in the fin holder and aligner, and the required number of tubes are likewise placed in the tube holder and aligner with their upset ends turned toward said fins, as previously described. As the fins and tubes are thus held in the machine, the hand lever 49 is operated to set the clutch 44 and complete the operating connections to impart forward movement to the cross-head 29. During this initial movement of the cross-head 29, the mandrels 32 engage the rear ends of said tubes and slide said tubes forward in the tube holder and aligner and directs their upset ends into the tube passageways in the first fin which supports the front ends of the fins and centers the same in respect to said passageways.

The frictional contact between the tubes and fins retards the movement of said tubes into the fins sufficiently to cause the mandrels 32 to enter the rear ends of the tubes until stopped by their engagement with the follower 31 and support the tubes at their rear ends. This engagement between the rear ends of the tubes and follower 31 transversely planes the tubes so that they will be evenly assembled in the fins.

As previously stated, the entrance of the upset ends of the tubes in the first fin centers the respective ends of the tubes in respect to the tube passageways in the fins, and the entrance of the tapered ends of the mandrels 32 in the rear ends of the tubes centers the respective ends of said tubes in respect to the tube passageways in the fins so that they are longitudinally aligned with said passageways. This longitudinal alignment of the tubes with the tube passageways in the fin causes said tubes to enter the fins without undue friction and without bending or distorting the same. In addition to the supporting of the tubes at their ends, they are intermediately held at three longitudinally spaced points by the racks of the tube holder and aligner to prevent lateral movement thereof under the action of the follower 31 as the same is feeding said tubes endwise through the fins.

During the advance movement of the follower 31, the cam bar 77 on the cross-head 29 is first brought into engagement with the roller-equipped stud 71 on the rear rack 66 and swings said rack forwardly and downwardly into an inoperative position, as shown in Fig. 3, to release the tubes and move out of the way of said cross-head. Said cam bar 77 next engages the roller-equipped stud 71 on the intermediate rack 65 and swings the same forwardly and downwardly to release the tubes and move out of the way of said follower. These racks are thus held in inoperative positions by the cam bar 77 during the complete movement of the cross-head to assemble the fins and tubes. Further advance movement of the cross-head 29 will carry its shipper collar 59 into contact with the cam blade 78 and thereby move the same into engagement with the roller-equipped stud 71 on the front rack 64 and swing the same rearwardly and downwardly to release the tubes and permit the follower 31 to move close to the fins.

It will thus be seen that the tubes are held by the tube holder and aligner throughout substantially their entire feeding movement into the fins. The rack 64, by its close association with the fin holder and aligner, holds the tubes until the follower 31 has reached substantially the limit of its forward travel.

At the completion of the assembly of the tubes and fins, the shipper collar 59 engages the front collar 57 and thereby actuates the clutch mechanism which moves the clutch to neutral position and stops the forward movement of the cross-head 29. To return the cross-head 29 to its rearmost position, the hand lever 49 is manually operated to set the clutch to impart reverse movement to said cross-head and at substantially the limit of such movement the shipper collar 59 engages the rear collar 57 and thereby actuates the clutch mechanism which moves the clutch to neutral position and stops the rearward or return movement of the cross-head 29. The hand lever 49 permits the operator to stop the cross-head 29 at any time during its forward or reverse movements. After the head exchange unit has been assembled, the same is lifted from the fin holder and aligner.

What I claim is:

1. A machine of the class described, comprising a fin holder and aligner, a tube holder and aligner, and a feed device for assembling tubes and fins in said holders and aligners, said tube holder and aligner being arranged to release the tubes during the assembly of the tubes and fins.

2. A machine of the class described comprising a fin holder and aligner, a tube

holder and aligner, and a feed device for assembling tubes and fins in said holders and aligners, said tube holder and aligner being operable to progressively release the tubes during the assembly of the tubes and fins.

3. A machine of the class described comprising a fin holder and aligner, a tube holder and aligner comprising a plurality of independently movable members arranged to hold tubes at a plurality of longitudinally spaced points, a feed device for assembling tubes and fins in said holders and aligners, and means for progressively and successively operating the members of the tube holder and aligner to release the tubes during the assembly of the tubes and fins.

4. A machine of the class described comprising a fin holder and aligner, a tube holder and aligner, a follower, and means for operating the follower to feed tubes from the tube holder and aligner through fins in the fin holder and aligner, said follower having means for supporting the rear ends of the tubes, said tube holder and aligner being operable to release the tubes in advance of the follower.

5. A machine of the class described comprising a fin holder and aligner, a tube holder and aligner comprising a plurality of independently movable members arranged to hold tubes at a plurality of longitudinally spaced points, a follower, means for operating the follower to feed tubes from the tube holder and aligner through fins in the fin holder and aligner, said follower having means for supporting the rear ends of the tubes, and means for progressively and successively operating the members of the tube holder and aligner to release the tubes in advance of the follower.

6. A machine of the class described comprising a fin holder and aligner, a tube holder and aligner, a follower, means for operating the follower to feed tubes from the tube holder and aligner through fins in the fin holder and aligner, said follower having mandrels for supporting and centering the rear ends of the tubes, and means for moving the tube holder and aligner into an inoperative position to release the tubes in advance of the follower and for releasing the inoperative tube holder and aligner during the return of the follower.

7. A machine of the class described, comprising a fin holder and aligner, a tube holder and aligner comprising a plurality of independently movable members arranged to hold tubes therein at a plurality of longitudinally spaced points, a follower, means for operating the follower to feed tubes from the tube holder and aligner through fins in the fin holder and aligner, said follower having mandrels for supporting the rear ends of the tubes, and means for progressively and successively causing the members of the tube holder and aligner to release the tubes in advance of the follower and for progressively and successively releasing said members during the return movement of the follower.

8. A machine of the class described comprising a fin holder and aligner, a tube holder and aligner comprising front and rear independently movable members, a follower, means for operating the follower to feed tubes from the tube holders and aligners through fins in the fin holder and aligner, said follower having means for supporting the rear ends of the tubes, and additional means for moving the rear member of the tube holder and aligner in the direction of the forward travel of the follower to release the tubes and for moving the front member of the tube holder and aligner in a reverse direction from said forward travel to release the tubes and for releasing the members of the tube holder and aligner during the return movement of the follower.

9. A machine of the class described, comprising a fin holder and aligner, a tube holder and aligner, a cross-head, means for reciprocating the cross-head, and a follower detachably secured to the cross-head and having mandrels for supporting the rear ends of tubes in the tube holder and aligner, said tube holder and aligner being operable to release the tubes in advance of said follower.

10. A machine of the class described comprising a fin holder and aligner, a tube holder and aligner, a cross-head having a follower for feeding tubes from the tube holder and aligner through fins in the fin holder and aligner, operating connections for reciprocating the cross-head including a clutch under strain to move into neutral position, and clutch-actuating mechanism for releasing the clutch to permit the same to move into neutral position at the completion of the forward and reverse movements of the cross-head.

11. A machine of the class described comprising a fin holder and aligner, a tube holder and aligner, a cross-head having a follower to feed tubes from tube holder and aligner through fins in the fin holder and aligner, operating connections for reciprocating the cross-head including a clutch under strain to move into neutral position, manually controlled means for moving the clutch from neutral position to a position to impart either forward or reverse movements to the cross-head, and clutch-actuating mechanism controlled by the cross-head for releasing the clutch to permit the same to move into neutral position at the completion of the forward and reverse movements of the cross-head.

12. A machine of the class described comprising a fin holder and aligner, a tube holder and aligner, a follower, and means for operating the follower to feed tubes from the fin holder and aligner through fins in the fin holder and aligner, said follower having mandrels arranged to enter the rear ends of the tubes during the initial forward movement of the follower and support the tubes, said fin holder and aligner being arranged to release the tubes during the assembly of the tubes and fins.

13. A machine of the class described comprising a fin holder and aligner, a tube holder and aligner, a follower, and means for operating the follower to feed tubes from the tube holder and aligner through the fins in the fin holder and aligner, said follower having mandrels for supporting the rear ends of the tubes, said tube holder and aligner being arranged to hold tubes therein vertically and horizontally aligned with tube passageways in the fins and with the mandrels, said mandrels being arranged to engage the rear ends of the tubes, move the same endwise in the tube holder and aligner to cause the mandrels to enter the tube passageways in the fins, frictional contact btween the tubes and fins being such as to cause the mandrels to enter the tubes until stopped by the engagement of the follower therewith.

14. A machine of the class described comprising a fin holder and aligner, a tube holder and aligner comprising an upstanding comb-like rack, a follower, means for operating the follower to feed tubes from the tube holder and aligner through fins in the fin holder and aligner, means for operating said rack to release the tubes in advance of the follower, said tube holder and aligner being arranged to hold tubes therein horizontally aligned with the tube passageways in the fins, and spacers for holding said tubes vertically spaced with said passageways.

15. A machine of the class described comprising a fin holder and aligner, a tube holder and aligner comprising a plurality of independent comb-like racks normally and yieldingly held in upright positions, a follower, means for operating the follower to feed tubes from the tube holder and aligner through fins in the fin holder and aligner, means for operating said rack to release the tubes in advance of the follower, said rack being arranged to hold tubes therein horizontally aligned with tube passageways in the fins, and front and rear spacers for holding said tubes vertically aligned with said passageways.

16. A machine of the class described comprising a fin holder and aligner, a tube holder and aligner comprising front and rear comb-like racks normally and yieldingly held in upright positions, said racks being arranged to hold tubes therein horizontally aligned with tube passageways in fins in the fin holder and aligner, spacers for holding said tubes vertically spaced and aligned with said passageways, said racks being mounted for downward swinging movement longitudinally of the tubes to release said tubes therefrom, and means movable with the follower for progressively and successively moving said racks into inoperative positions in advance of the follower and for progressively and successively releasing said racks during the return movement of the follower.

17. The structure defined in claim 16 in which the front follower is closely positioned to the fin holder and aligner and in which the means movable with the follower is arranged to move said front rack toward the follower during its forward movement.

18. In a machine of the class described, a fin holder and aligner for fins having tube passageways and laterally projecting flanges at the sides of said passageways, said fin holder and aligner having transverse rows of laterally spaced upright bars with intervening spaces between the bars in each row and adapted to support fins between the several rows of bars with their tube passageways vertically aligned and with their flanges in said intervening spaces and contacting with adjacent fins and held by said bars to position said fins with their tube passageways horizontally aligned.

In testimony whereof I affix my signature.

EDWARD H. SEELERT.