Jan. 27. 1925. 1,524,401

I. LUNDGAARD

METHOD OF AND MACHINE FOR MAKING HEAT EXCHANGERS

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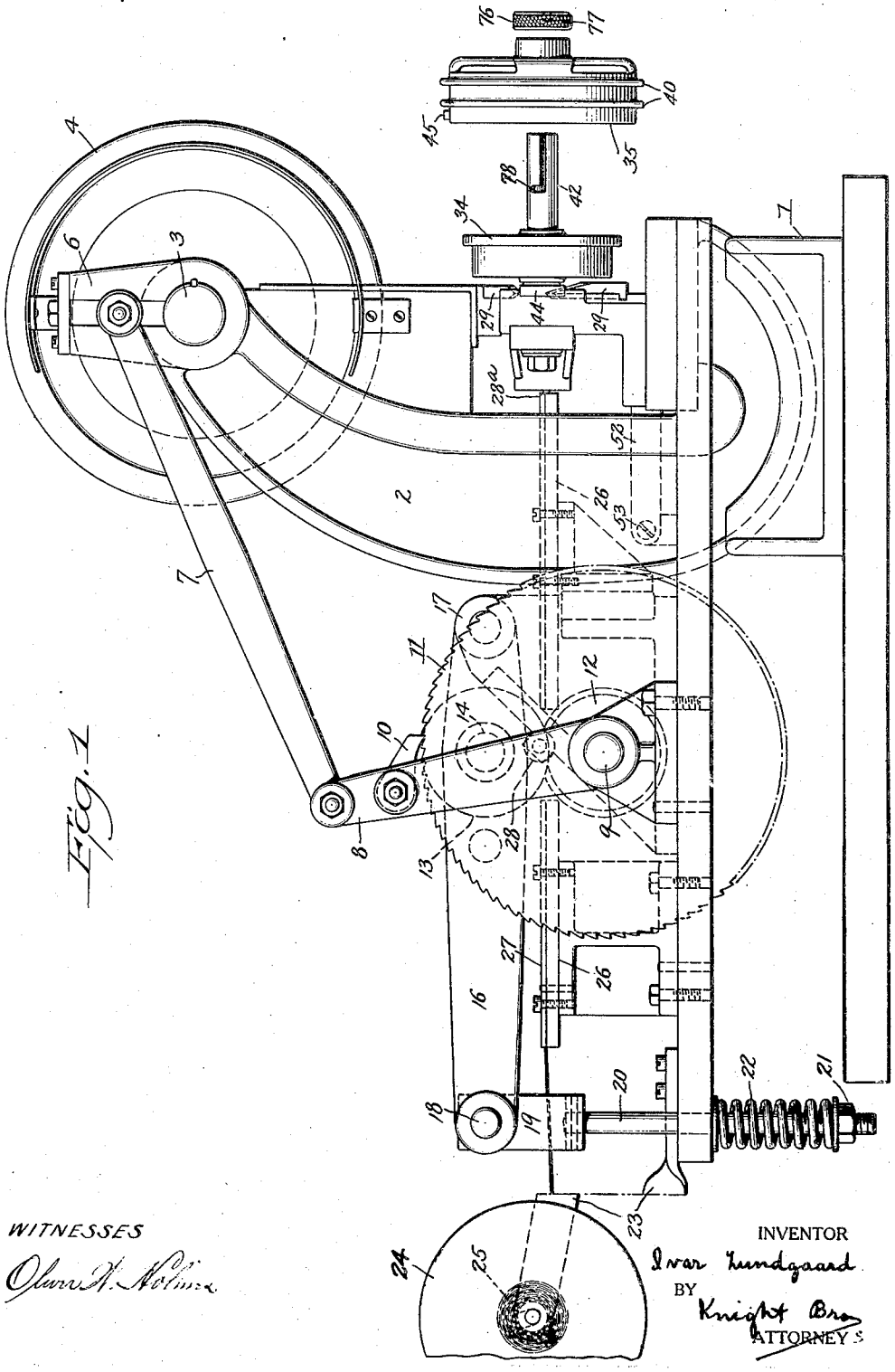


Fig. 1

WITNESSES

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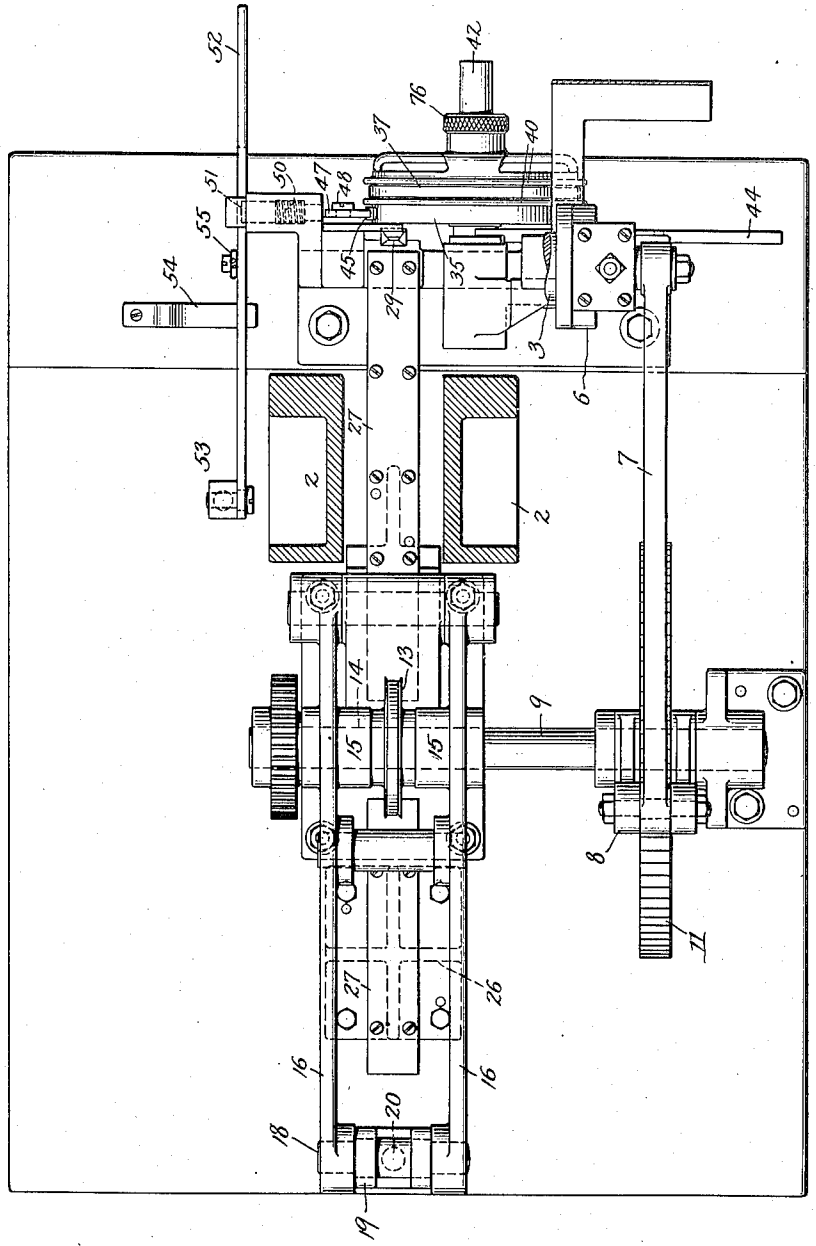


Fig. 2.

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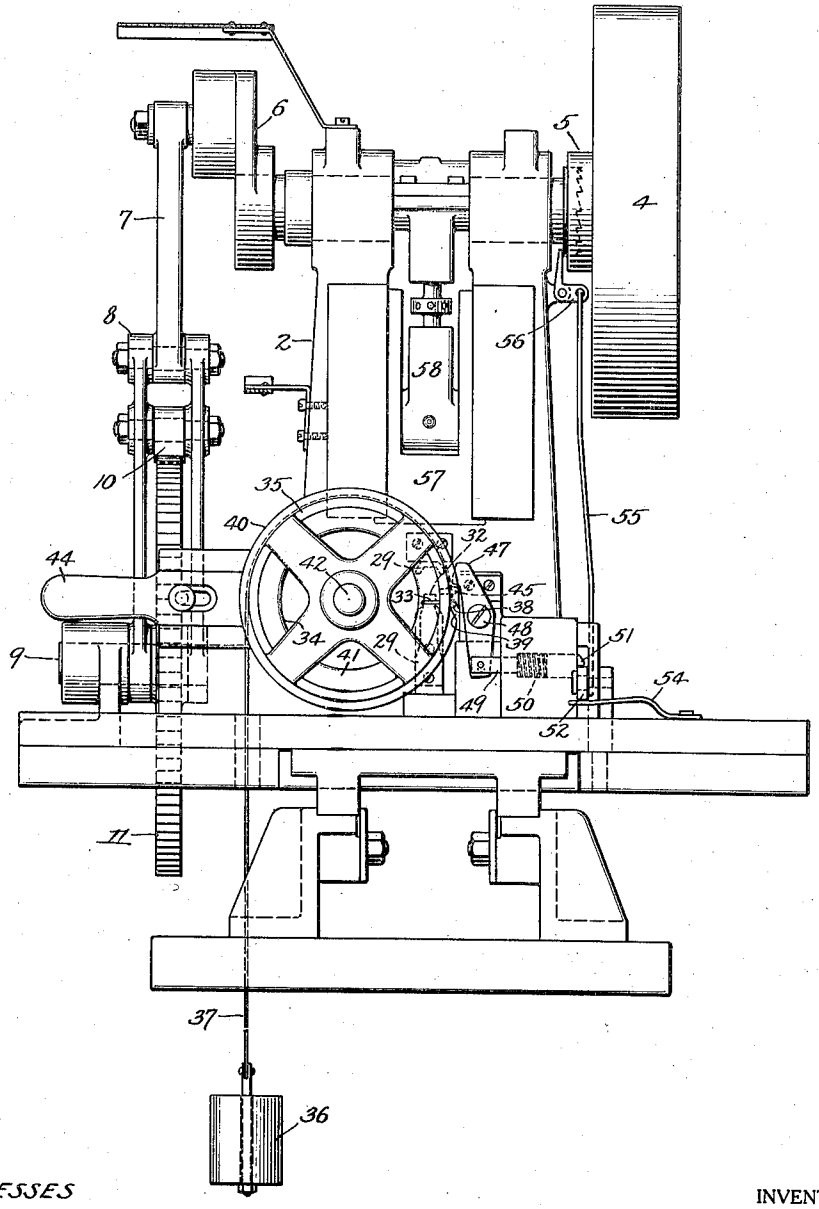
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Fig. 3.



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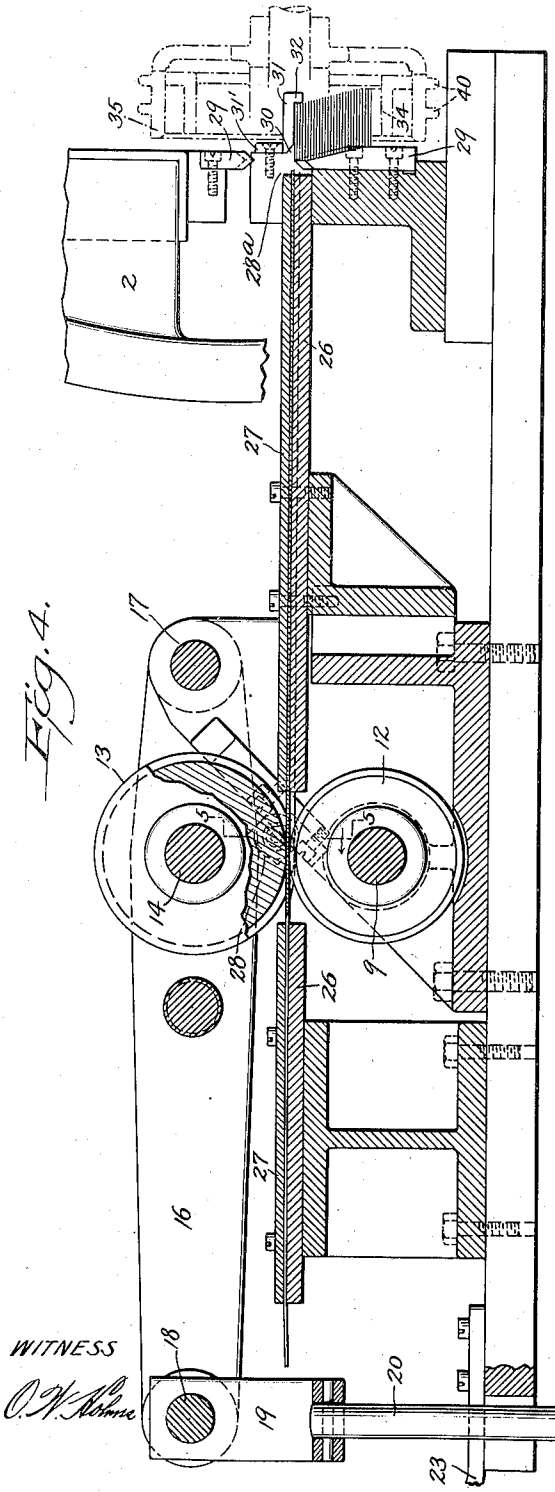


Fig. 4.

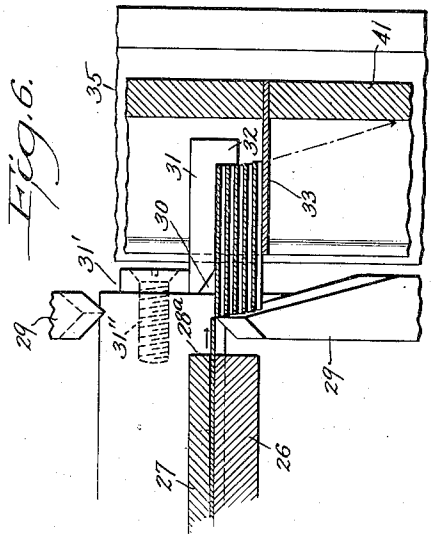


Fig. 6.

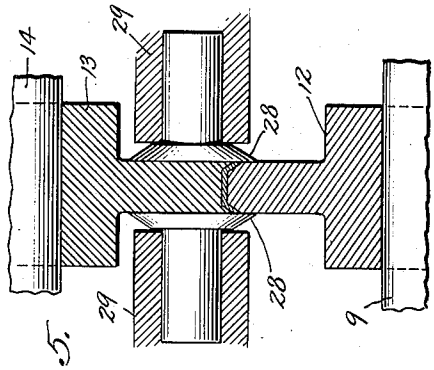


Fig. 5.

WITNESS

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Fig. 7.

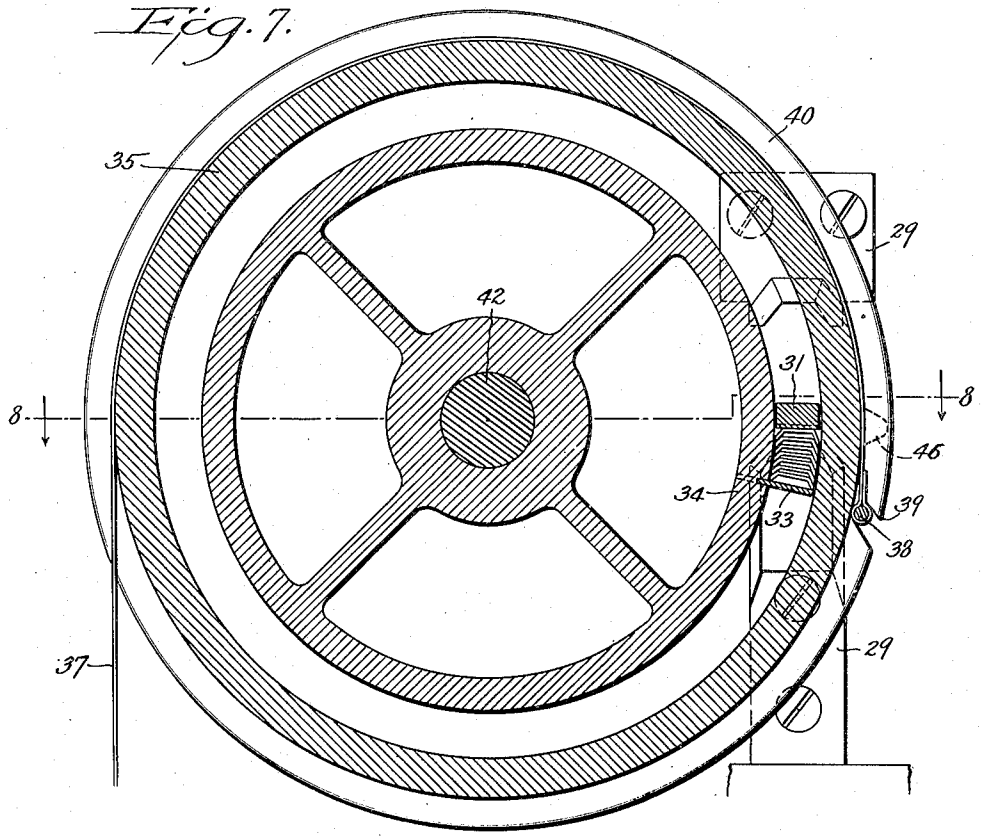
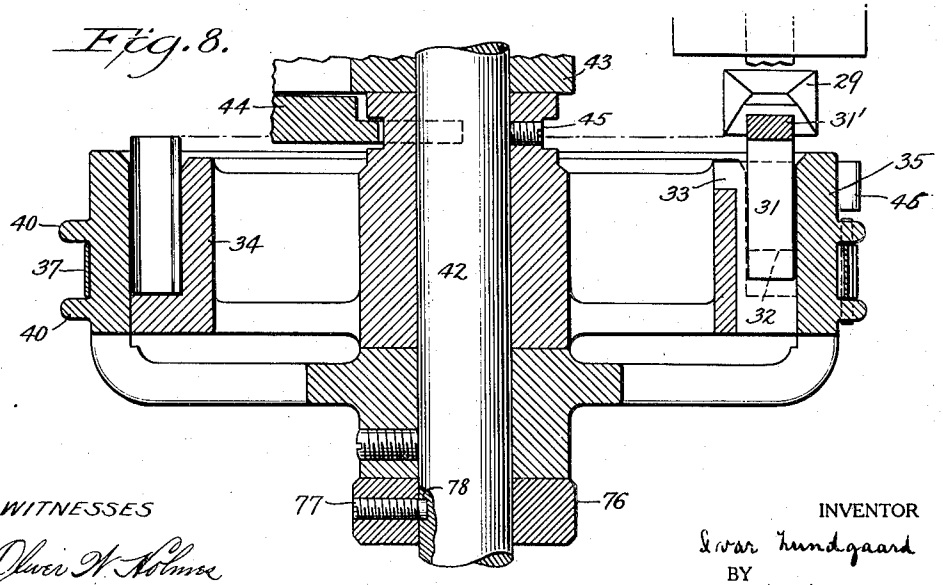


Fig. 8.



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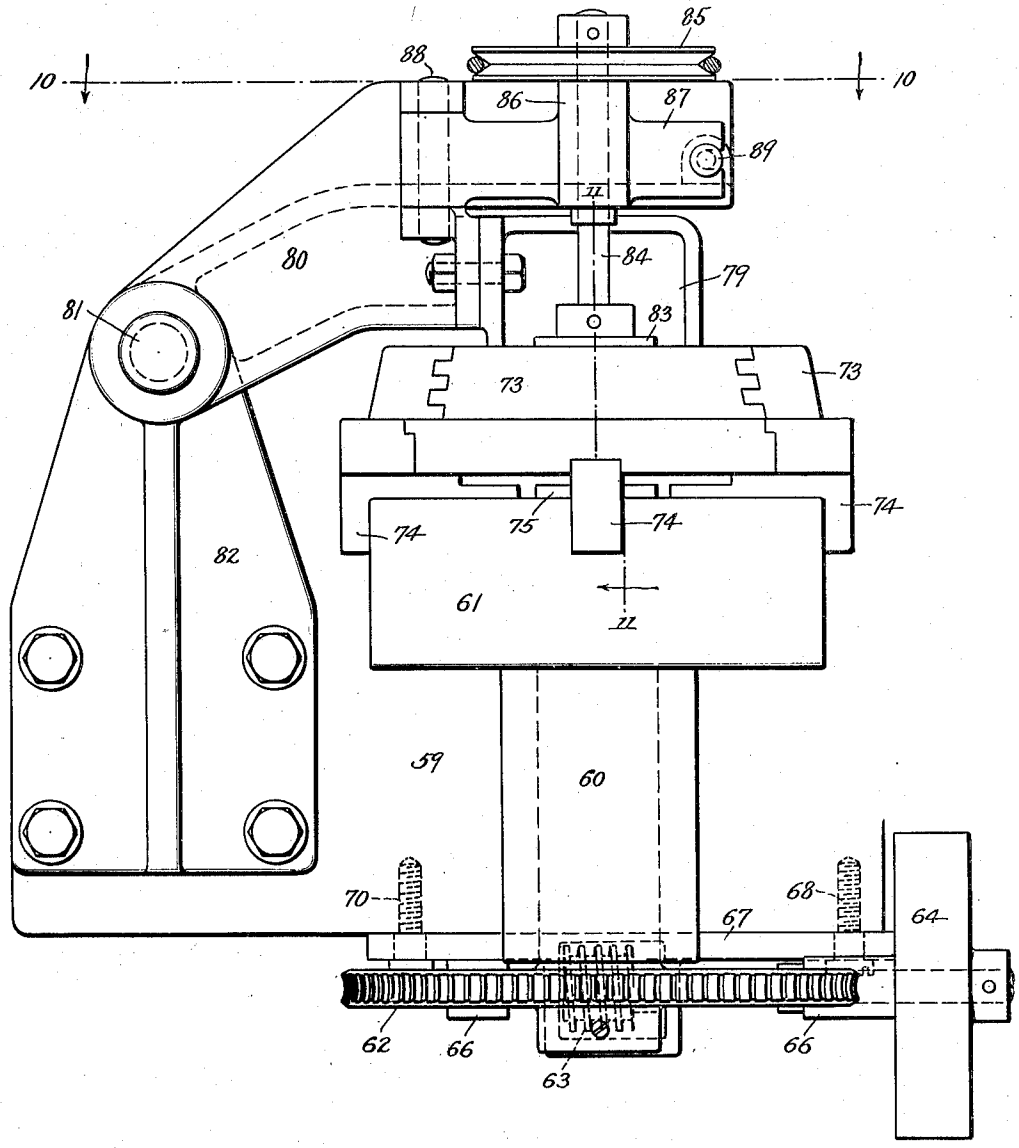
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Fig. 9.



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Fig. 10.

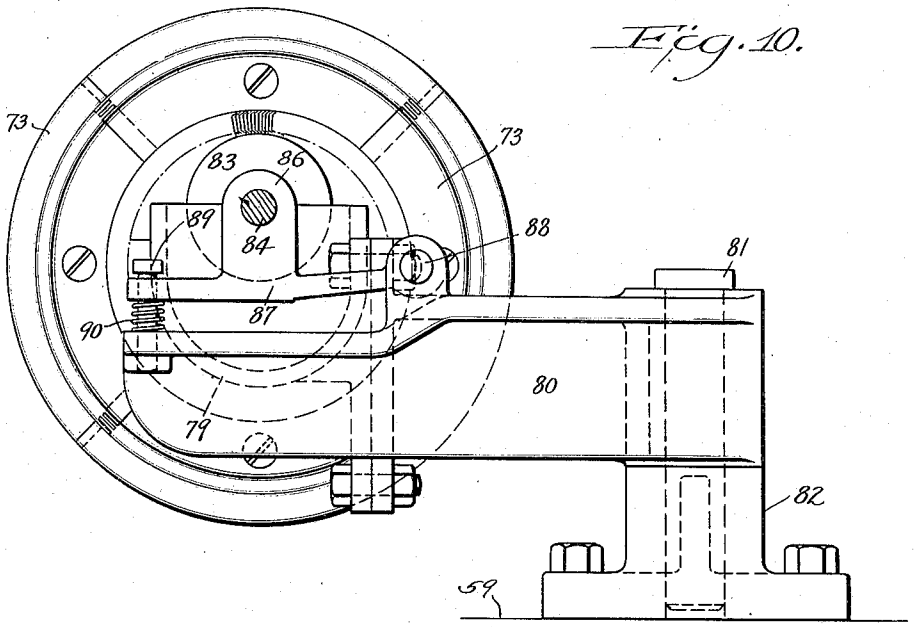


Fig. 11.

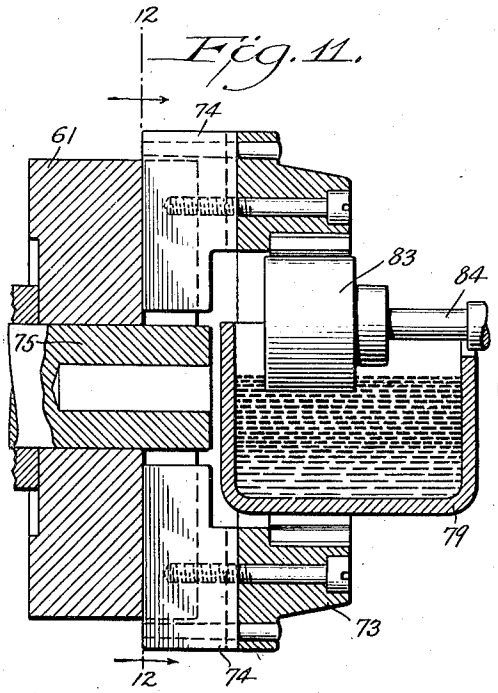
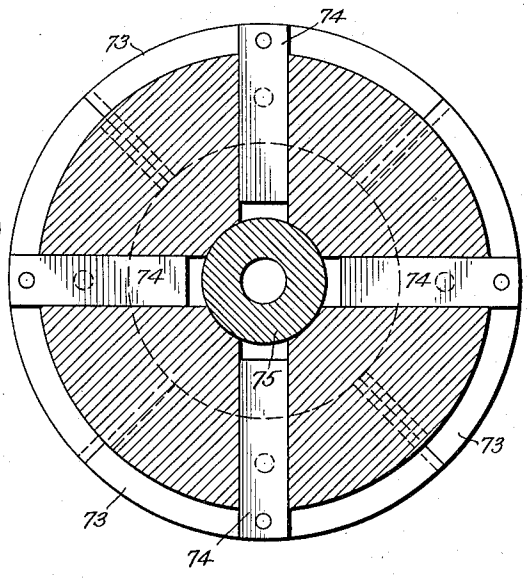


Fig. 12.



WITNESSES

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METHOD OF AND MACHINE FOR MAKING HEAT EXCHANGERS

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Fig. 13.

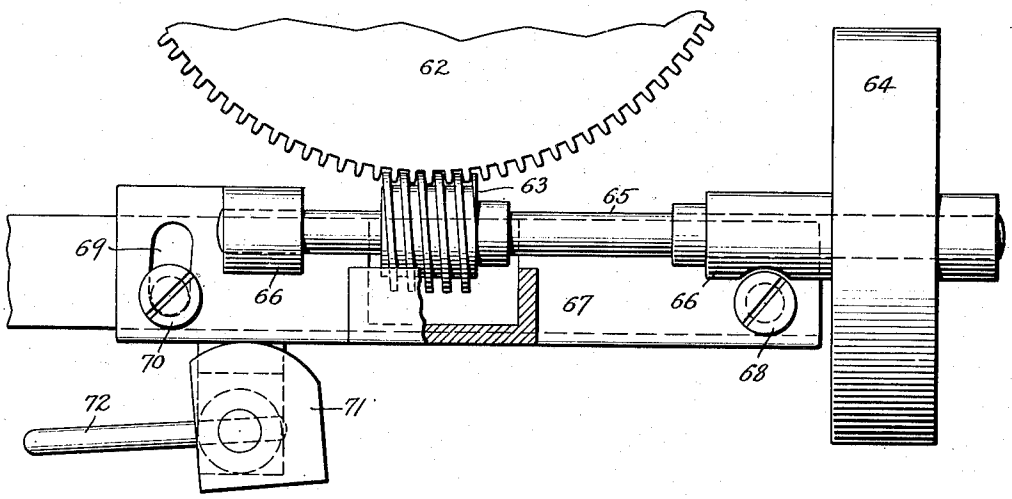
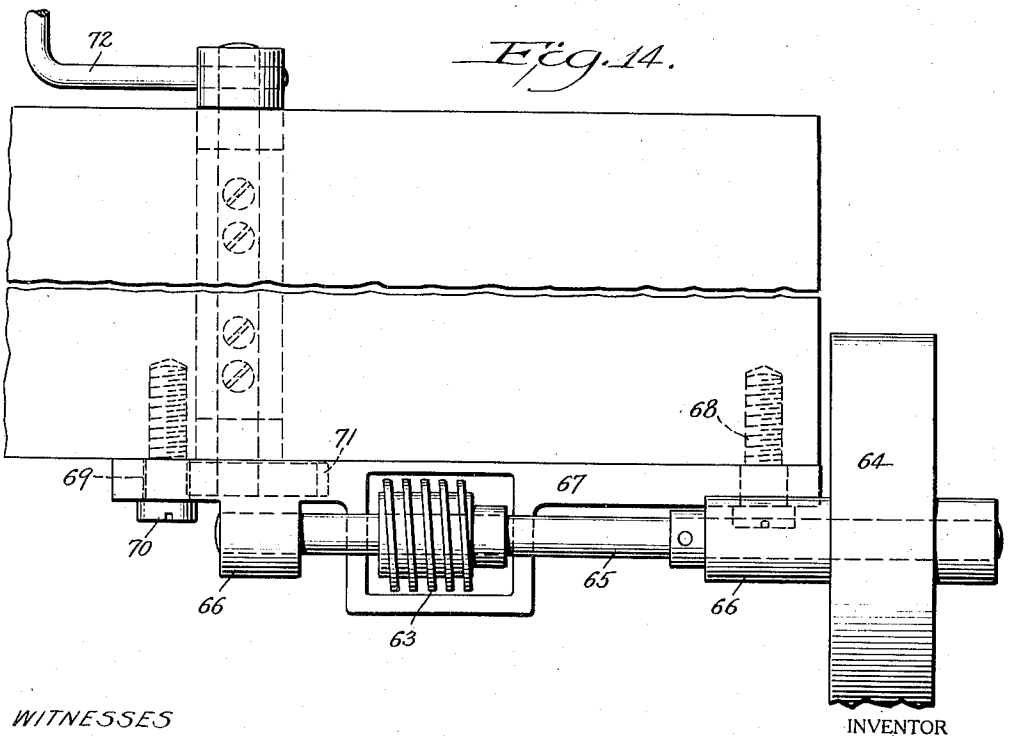


Fig. 14.



WITNESSES

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Patented Jan. 27, 1925. 1,524,401

UNITED STATES PATENT OFFICE.

IVAR LUNDGAARD, OF HARTFORD, CONNECTICUT, ASSIGNOR TO THE AUTOMATIC REFRIGERATING COMPANY, OF HARTFORD, CONNECTICUT, A CORPORATION OF NEW JERSEY.

METHOD OF AND MACHINE FOR MAKING HEAT EXCHANGERS.

Application filed November 22, 1923. Serial No. 676,366.

To all whom it may concern:

Be it known that I, IVAR LUNDGAARD, a citizen of the United States, and a resident of Hartford, county of Hartford, State of Connecticut, have invented certain new and useful Improvements in Methods of and Machines for Making Heat Exchangers, of which the following is a specification.

In the manufacture of heat exchangers for use in connection with refrigerating machines and the like, it is desired to have a large amount of surface exposed to mediating fluids and yet at the same time keep the apparatus within dimensions as small as possible.

My present invention relates to a method and machine for making and assembling into an integral unit a great number of small heat exchanging vanes or channels. The invention can be best understood by reference to the accompanying drawings which represent an embodiment of apparatus for carry out my improvements.

In the drawings:

Figure 1 is a side elevation of my improved machine;

Figure 2 is a plan view in partial section;

Figure 3 is a front view in elevation;

Figure 4 is a longitudinal vertical section thru the middle of the machine;

Figure 5 is a transverse section on the line 5—5, Figure 4;

Figure 6 is an enlarged view at the delivery end of the machine;

Figure 7 is a transverse section of the gill holder;

Figure 8 is an axially horizontal section of the same on the line 8—8, Figure 7;

Figure 9 is a plan view of the gill holding apparatus;

Figure 10 is an end view in partial section on the line 10—10, Figure 9;

Figure 11 is a vertical axial view on the line 11—11, Figure 9;

Figure 12 is a section on line 12—12, Figure 11;

Figure 13 is a partial rear view of the soldering machine showing the driving mechanism; and

Figure 14 is a plan view of the same.

Upon a frame 1 having two vertical standards 2, is mounted a driving shaft 3, adapted to be driven by pulley 4 thru clutch 5 similar to an ordinary stamping press. An adjustable crank arm 6 mounted on this shaft drives a connecting rod 7 which gives a rocking motion to rocking arm 8 which is pivoted loosely on the shaft 9, journalled in the frame of the machine. A pawl 10 pivoted on the rocking arm engages a ratchet wheel 11 which is keyed to the shaft 9. There is also keyed to the shaft 9 a disk wheel 12 (see Figs. 4 and 5) and mounted immediately above the disk 12 is another disk 13. Disk 12 has its edges chamfered or bevelled and the disk 13 has bevelled flanges corresponding to the bevels on the disk 12. The disk 13 is mounted on a shaft 14 journalled at 15 in two lever arms 16 which in turn are fulcrumed at 17 and have their outer ends articulated at 18 in a clevis 19 from which depends a rod 20. A nut 21 on the rod 20 brings tension to bear upon a spring 22, the function of which is to hold down the arm 16 with a resilient pressure. Mounted on brackets 23 at the rear of the machine is a spool 24 carrying a ribbon of copper 25. The ribbon of copper is drawn over supports 26 on the frame being guided by guides 27 thereof. The ribbon is made to pass between the disks 12 and 13 whereby its edges are folded downward to give it a channel shape. While passing between the disks 12 and 13 the edges of the ribbon are sheared by rotary shearing rollers 28 journalled in the frame at 29. The edges of the channel are thus trimmed off and the channel is left with two parallel end surfaces the purpose of which will appear later. Upon emerging from the folding disk and cutting shears the ribbon passes thru further guides 26, 27 and emerges therefrom at 28ª. Here it passes between cutting-off blades 29 and impinging against the bevelled end 30 of abutment 31 it is pushed under said abutment until it reaches a back stop 32 thereof. This abutment is secured to the frame by an L-extension 31′ and a screw 31″. The feeding of the ribbon is accomplished by the disk 12 being propelled step by step by the ratchet 10 from the crank arm 6. Upon reaching stop 32, the ribbon is severed by blades 29 (see Figure 6). As the end of the ribbon is pushed under the abutment 31, particularly as it impinges against the bevelled edge 30 it pushes down upon the pile of severed pieces of ribbon that

have previously been accumulated upon the removable shelf 33 (see Figures 6 and 7) which is inserted in a slot made for the purpose in a cylindrical hub portion 34 of an annular holder, the outer part of which is formed by a cylindrical casing 35 (see Figures 7 and 8). This annular holder thus forms a receptacle into which the pieces of ribbon are pushed one by one in a superposed relation until by their accumulation in the annular holder they force the shelf 33 thru nearly a complete circle until it comes against abutment 31 (see Figure 7). The pile of channels thus being formed are held in snug relation to each other and between the parts 31 and 33 by the pressure of a weight 36 (see Figure 3) pulling on a band 37 which reaches around the outer periphery of the outer member 35 of the annular holder and has on its end a pin 38 that locks in slots 39 in flanges 40 formed on the outer periphery of the holder. As the channels increase in number the annular holder rotates and winds up the band 37 of the periphery of the holder. Referring to Figure 6, it will be seen that the lower plate 29 has a bevelled outer face. As the channels accumulate, they are pushed endwise by the said bevelled face on the plate 9 until they are forced against the back 41 of the holder (see Figures 4 and 6). The annular holder is mounted on a shaft 42 which turns freely in a bearing 43 in the frame (see Figure 8) and the holder together with its shaft may be removed from the machine by retracting bolt 44 (see Figures 3 and 8). The inner end of the bolt engages in a slot 45 in the hub of the holder to hold it in axial position while it is being filled. When the hopper is filled with channels a boss 46 on the outside of the holder impinges against the upper end of a tripper 47 pivoted at 48 to the lower end of which is articulated a bolt 49 normally held by spring 50 so that its outer end 51 engages over and holds down a clutch lever 52. The clutch lever (see Figure 2) is pivoted at 53 and is under the influence of spring 54 which tends to push it upward. A connecting rod 55 connects the clutch lever to bell crank 56 so that when the clutch lever is released by the bolt 51 it will under the action of spring 54 allow the clutch 5 to be unclutched and the machine brought to a standstill. The upper blade 29 for severing the ribbon into segments is mounted in a reciprocating guide 57 driven by connecting rod 58 from a crank on a shaft 3 so that the blades operate to cut the ribbon into segments synchronously with the period of rest of the ribbon corresponding to the idle stroke of the pawl 10. When the holder is filled with segments, band 37 and weight 36 are removed, bolt 44 retracted and the holder with its shaft is removed from the machine. The stop 32 on abutment 31 will hold back one or two channels which may be afterwards replaced. The shelf 33 is then removed from the holder and the natural spring of the channels will bring the two ends of the column together to form a continuous line of closely associated ducts. It now becomes necessary to unite the ducts into one integral ring which is best accomplished by soldering their flanged edges together and for this purpose I provide additional apparatus illustrated in Figures 9 to 14. In this apparatus upon a suitable base 59 is mounted a shaft 60 carrying at one end a universal chuck 61 and at the other end a driving worm wheel 62. The worm wheel is propelled by the worm 63 from pulley 64. The shaft 65 carrying the worm 63 is mounted on bearing 66 by frame 67 pivoted at 68 and having a slot at 69 allowing a certain amount of play on the frame with respect to a bolt 70. A cam 71 having a handle 72 by impinging against the bottom of the frame 67 can be made to force the worm into engagement with the worm wheel or vice versa. The radial chuck arms 73 are mounted on the radial moving chuck jaws 74 of the universal chuck. The inner surface of the chuck jaws 73 are turned to a circle corresponding to the outer periphery of the assembled ring. In the center of the chuck is a shaft holder 75 and into this holder the shaft 42 carrying the annular holder is forced until the outer edges of the channels enter the jaws of the chuck. The inner part of the holder is then forced inward, accessibility to it for this purpose, being provided by the spoked arrangement of the outer member. When the ring of channels has been forced into the chuck as far as it will go, it will be held there by friction and the outer member of the holder may then be removed. The outer member of the holder is held on the holder shaft by means of a collar 76 having a pin 77 engaging in bayonet lock fashion in slot 78 (see Figure 1). The inner member of the annular holder may now also be removed from the assembled ring and the chuck jaws closed down until the diameter of the ring is made of the right dimensions.

The mechanism described above may be used for any diameter of assembled ring or for straight sections. For circular rings the chamfering of the flanges should be such that the inner flange should be just enough narrower than the outer flange to allow for the difference in diameter.

The ring is now ready to be soldered together and for this purpose I provide a swinging solder cup 79 mounted on swinging arm 80 pivoted at 81 on a bracket 82 mounted on the frame 59.

The solder cup is partially filled with molten solder heated by a gas jet immediately under it when in its outward position.

Dipping into the molten solder is a copper solder roll 83 carried by a shaft 84 which in turn is driven by a pulley 85 from an overhead shaft not shown. As shown in Figure 10 this shaft is carried in a bearing 86 on an arm 87 pivoted at 88 in the swinging arm 80 and guided at its outer end by a stud 89. A spring 90 between the outer end of the bearing arm 87 and the swinging arm 80 gives an upward resilient force to the soldering roll so that it is pressed against the inside periphery of the ring of segments as it rotates. By this means the solder is deposited in a uniform and smooth manner on the inner periphery of the ring. When the soldering is complete the soldering roller with its solder cup are swung out of the way by movement of the swinging arm 80. The chuck is released and the ring can be taken out. The outer periphery of the segmental ring can now be soldered by hand or the ring may be mounted on a mandrel and the outer periphery soldered by the solder roller 83. The operating being in every respect the same as that for soldering the interior surface.

It will be seen from the above description that I have provided apparatus for assembling a pile of sections cut off from a continuous band into a removable receptacle and that combined with the method of assembling I have shown additional steps whereby the assembled section formed into a continuous ring in the removable receptacle may be transferred to a soldering machine where the sections are all united into one integral exchanger and while I have shown a preferred example of suitable mechanism for carrying out my method of making exchangers, I do not wish to be strictly limited thereto as the steps of the method may be obviously performed by well known alternative means.

I claim:—

1. The method of making heat exchangers comprising, folding the edges of a metallic band into a channel formation passing the band intermittently between cutters and into a receptacle between a fixed abutment and a yielding pile of previously deposited sections and severing individual sections by the cutters in the periods of rest.

2. The method of making heat exchangers comprising, folding the edges of a metallic band into a channel formation passing the band intermittently between cutters and into a receptacle between a fixed abutment and a pile of previously deposited sections while applying compressive force to the pile and severing individual sections by the cutters in the periods of rest.

3. The method of making heat exchangers comprising, folding the edges of a metallic band into a channel formation passing the band intermittently between cutters and into a receptacle between a fixed abutment and previously deposited sections severing individual sections by the cutters in the periods of rest, removing the receptacle with its contained pile of sections, transferring the pile from the receptacle to a rotary chuck and soldering together the flanges of the sections while held in and rotated by the chuck.

4. In a machine for making heat exchangers, the combination of means for feeding a band of metal intermittently, means for forming flanges on the edges of the band, means for severing the band into sections, means for assembling the sections in pile formation and means for holding the sections of the pile in close contact while being assembled.

5. In a machine for making heat exchangers, the combination of opposed flange forming disks with bevelled edges, means for pressing the disks together, means for intermittently turning the disks so as to feed in a step by step manner a band of metal gripped between them, a reciprocating cutter connected to and coacting with the disk to cut off sections from the end of the band and a rotatable receptacle in which the sections are assembled in a superposed pile as they are cut off.

6. In a machine for making heat exchangers, the combination of means for feeding a band of metal intermittently, means for forming flanges on the edge of the band, means for severing the band into sections, a receptacle for assembling the sections in pile formation, a fixed abutment extending into the receptacle, an abutment in the receptacle between which abutments the sections are forced one by one and means tending to move the receptacle so as to hold the sections compressed between the two abutments.

7. In a machine for making heat exchangers, the combination of means for feeding a band of metal intermittently, means for forming flanges on the edge of the band, means for severing the band into sections, a receptacle for assembling the sections in pile formation, a fixed abutment extending into the receptacle, a removable abutment in the receptacle between which abutments the sections are forced one by one and means tending to move the receptacle so as to hold the sections compressed between the two abutments.

8. In a machine for making heat exchanges, the combination of means for feeding a band of metal intermittently, means for forming flanges on the edge of the band, means for severing the band into sections, a detachable receptacle for assembling the sections in pile formation, a fixed abutment extending into the receptacle, a removable abutment in the receptacle between which

abutments the sections are forced one by one and means tending to move the receptacle so as to hold the sections compressed between the two abutments.

9. In a machine for making heat exchangers, the combination of opposed flange forming disks with bevelled edges, means for pressing the disks together, means for intermittently turning the disks so as to feed in a step by step manner a band of metal gripped between them, a reciprocating cutter connected to and coacting with the disk to cut off sections from the end of the band, a rotatable receptacle in which the sections are assembled in a superposed pile as they are cut off and means for holding the receptacle from displacement axially while permitting its rotation.

10. In a machine for making heat exchangers, the combination of means for feeding a band of metal intermittently, means for forming flanges on the edges of the band, means for shearing the edges of the flanges, means for severing the band into sections, means for assembling the sections in pile formation and means for holding the sections of the pile in close contact while being assembled.

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