

F. S. YOUTSEY, E. C. WALKER AND A. S. MOSES.

KEG MAKING MACHINE.

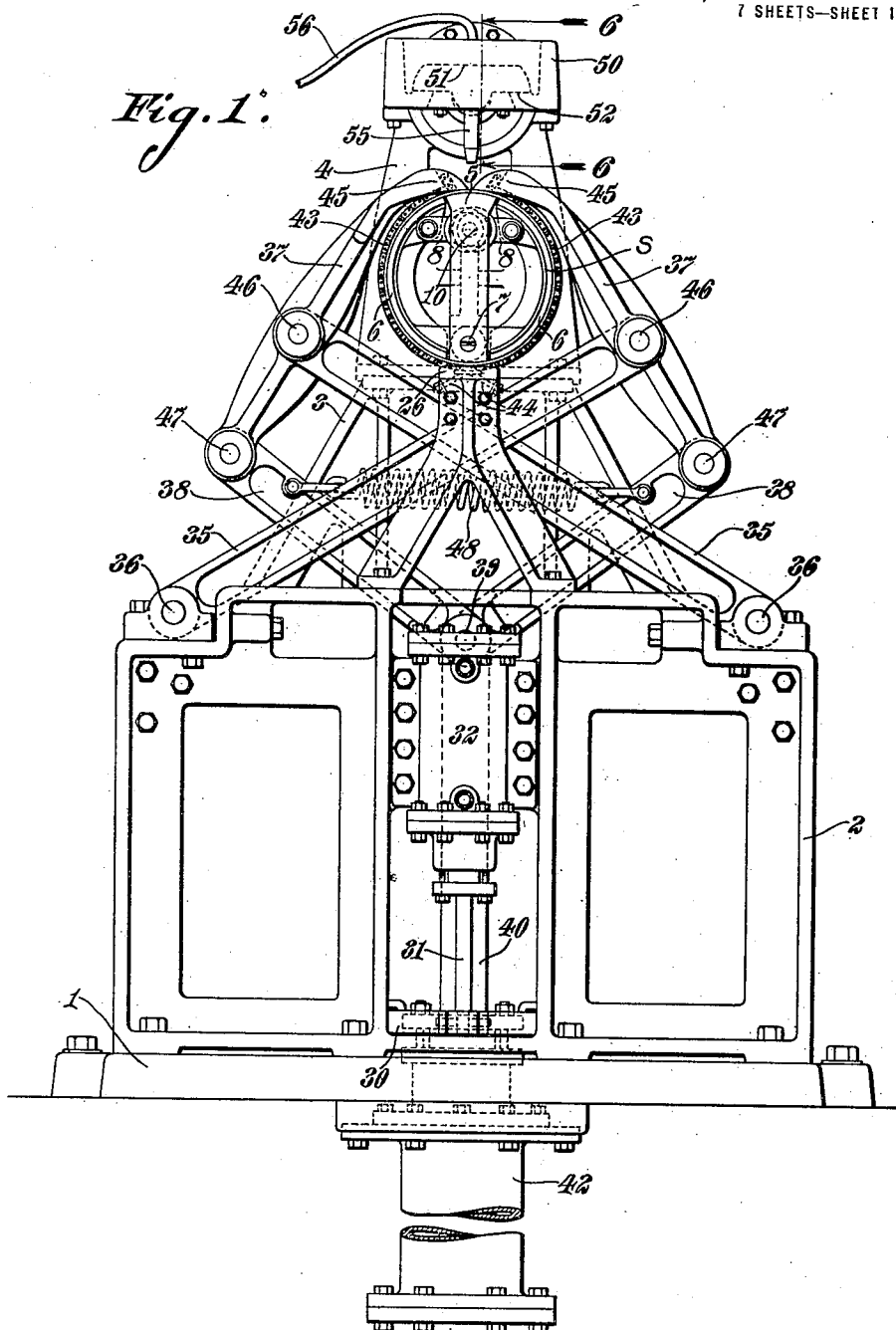
APPLICATION FILED MAR. 22, 1916.

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7 SHEETS—SHEET 1.

Fig. 1.



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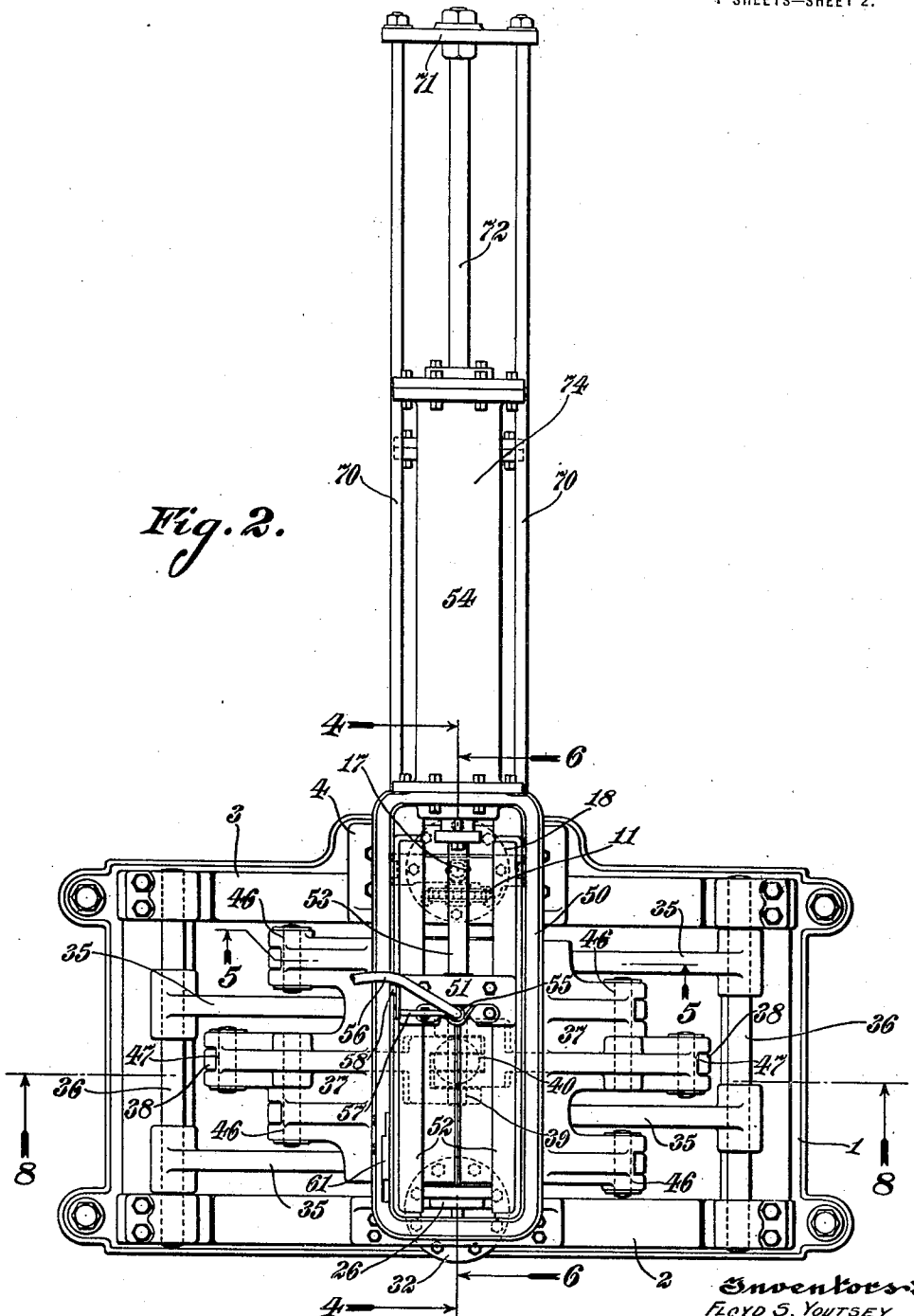


Fig. 2.

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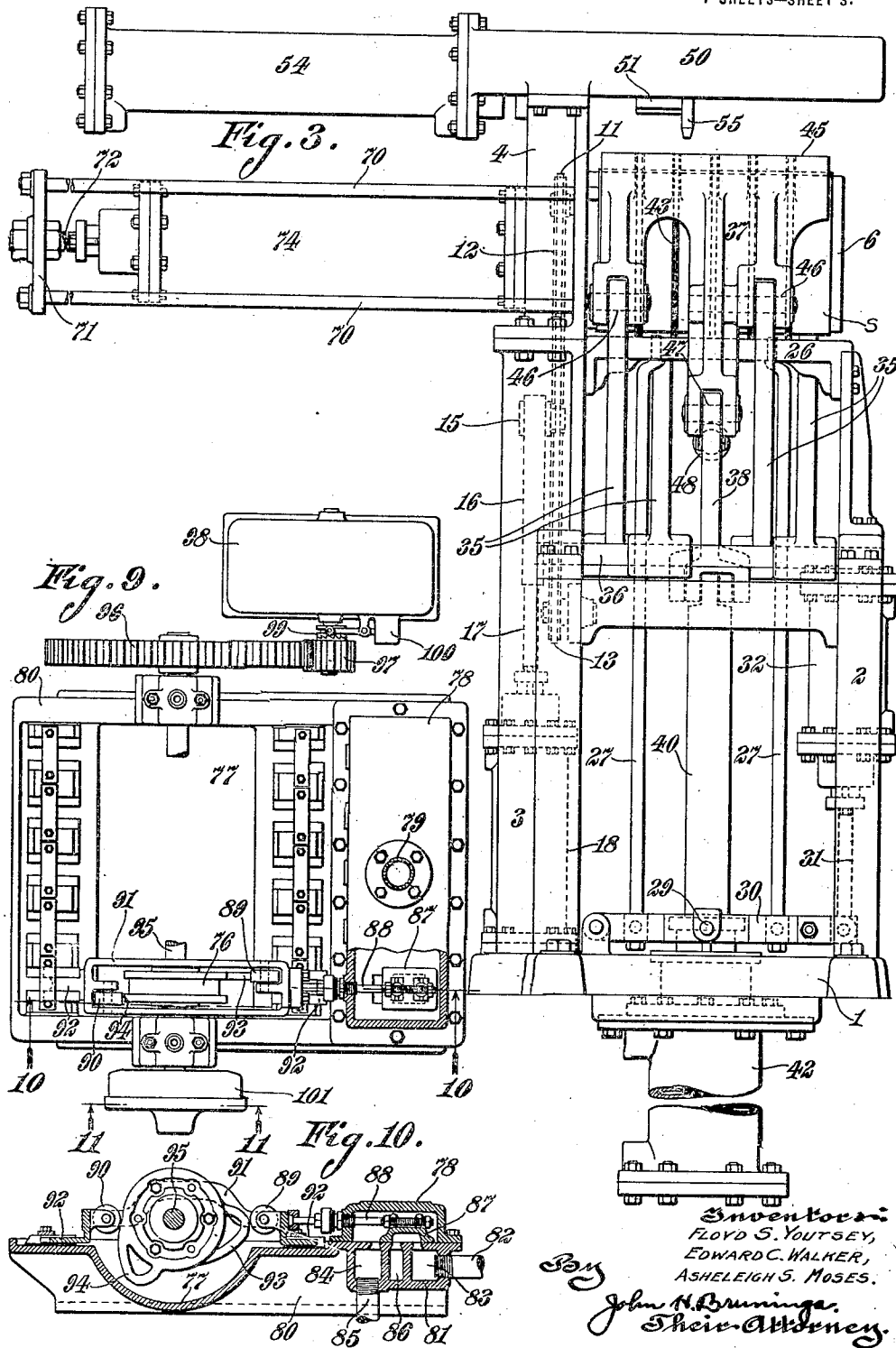
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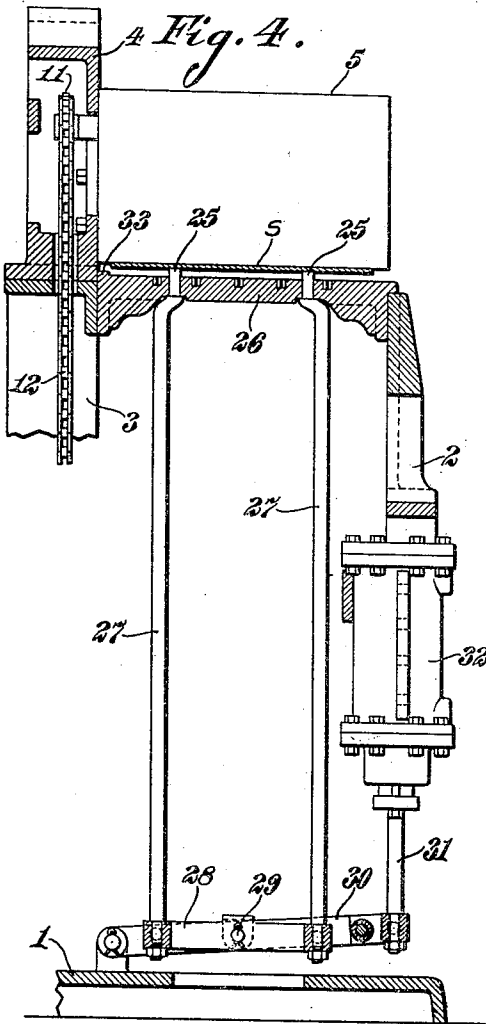
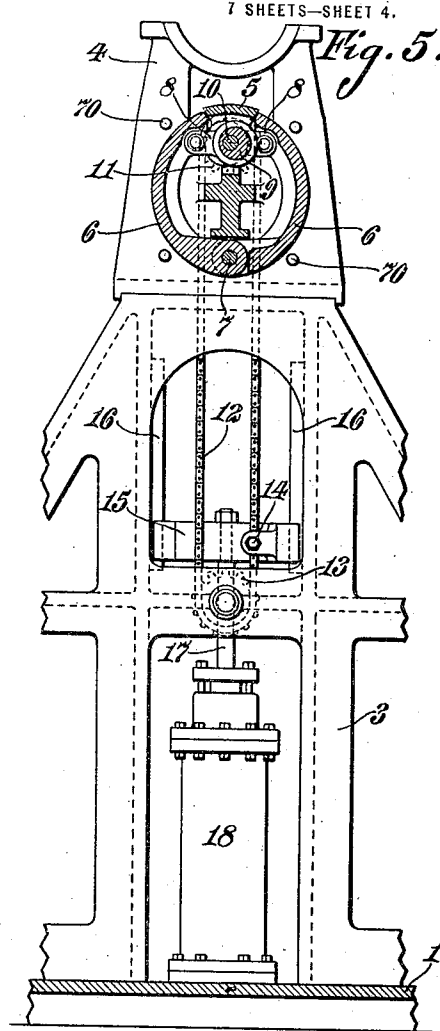
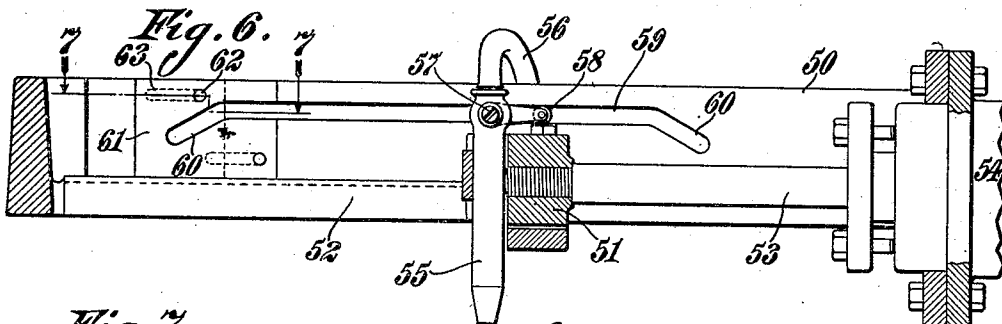
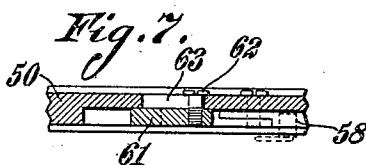
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Fig. 8.

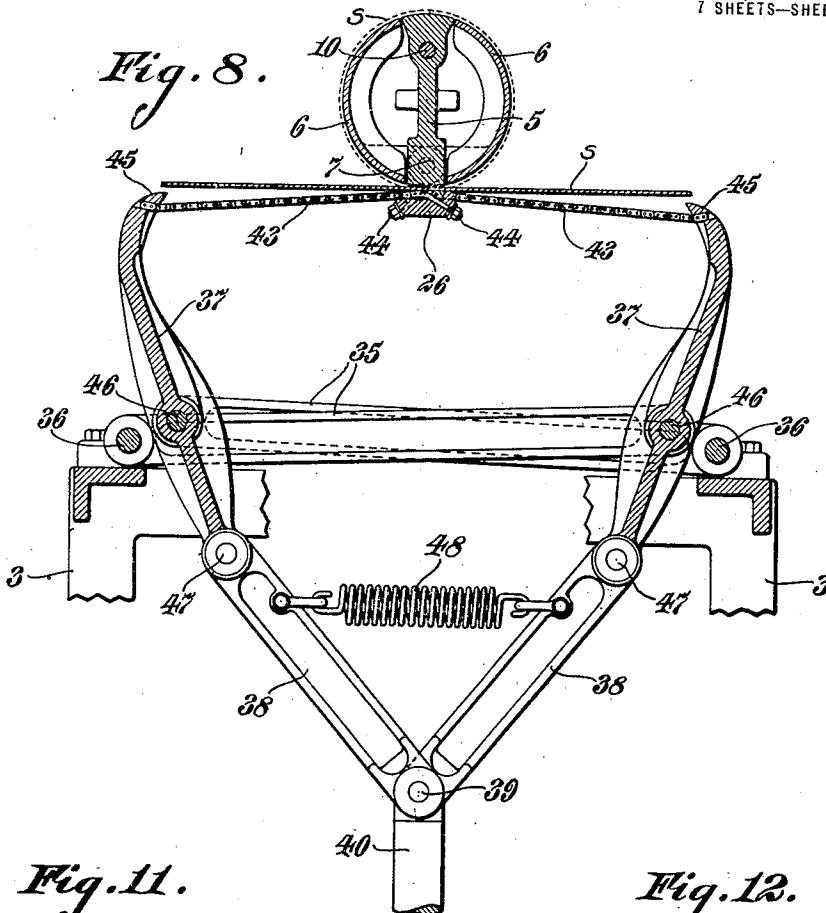


Fig. 11.

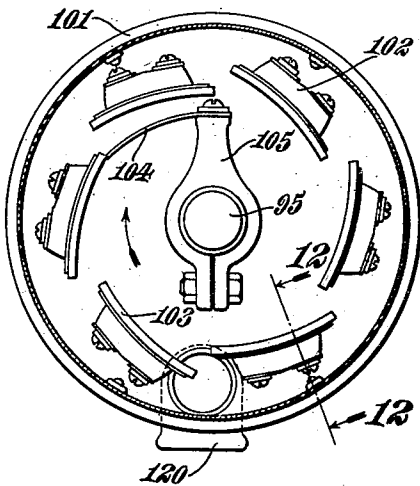
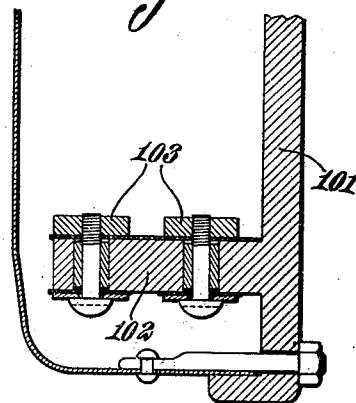


Fig. 12.



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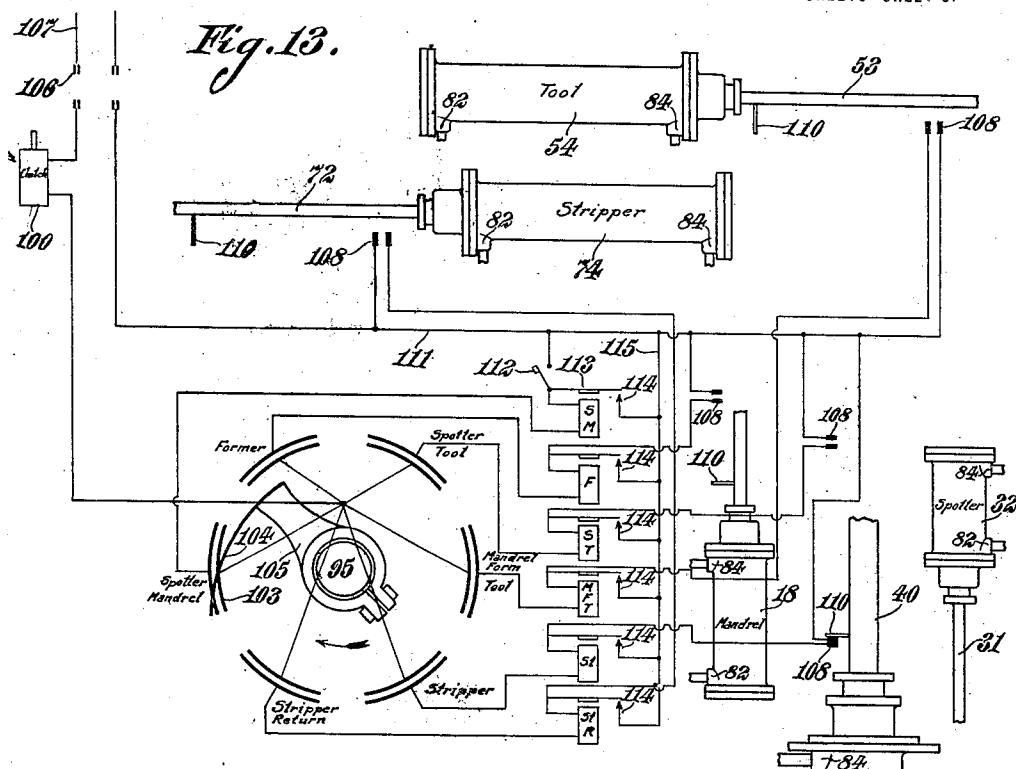
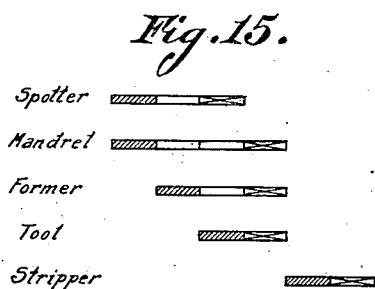
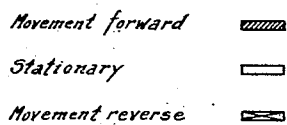
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KEY MAKING MACHINE.

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7 SHEETS—SHEET 7.

*Fig. 16.*

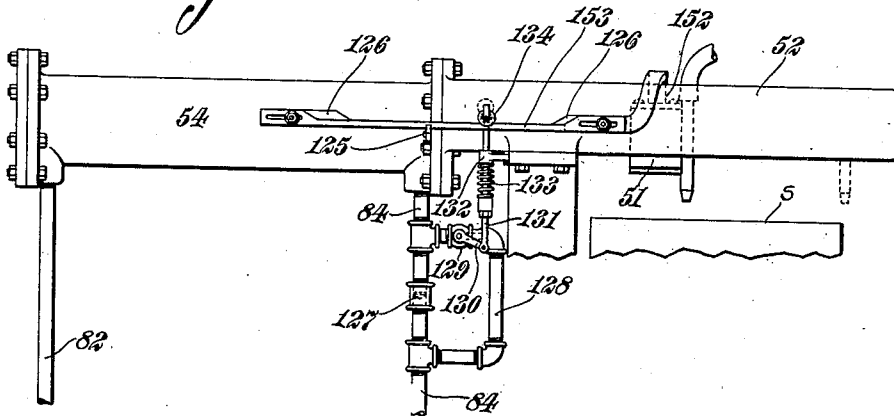
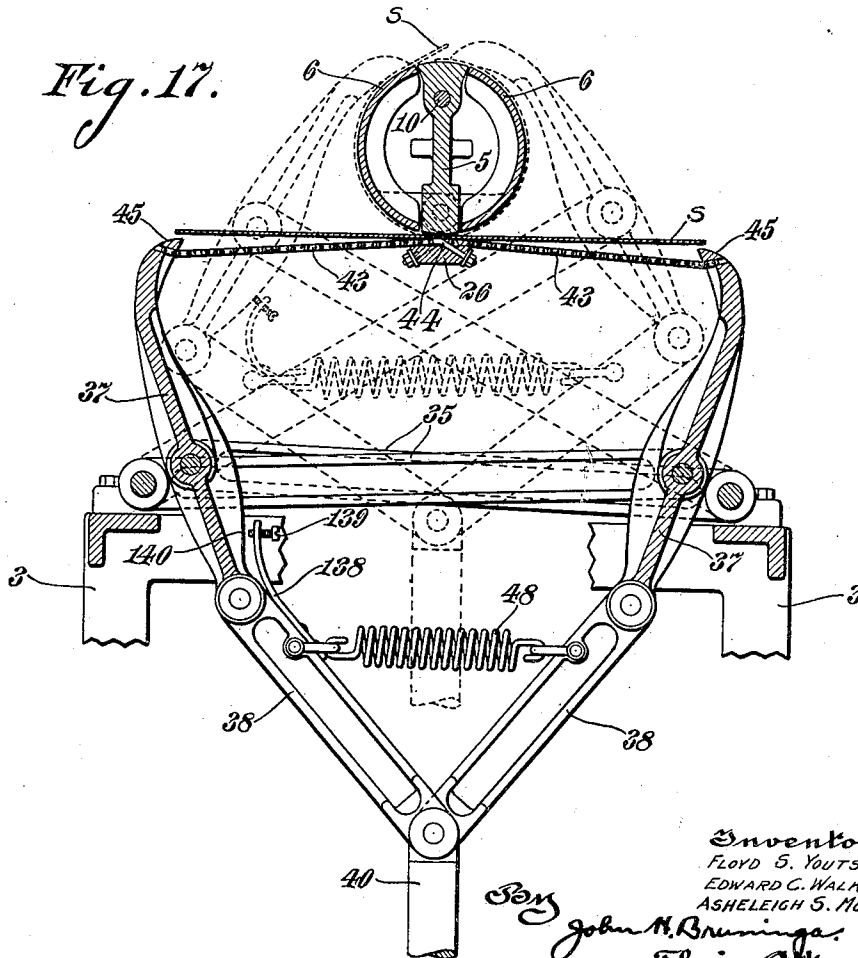


*Fig. 17.*



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# UNITED STATES PATENT OFFICE.

FLOYD S. YOUTSEY AND EDWARD C. WALKER, OF ST. LOUIS, MISSOURI, AND ASHELEIGH S. MOSES, OF NEW YORK, N. Y., ASSIGNORS TO NATIONAL LEAD COMPANY, OF ST. LOUIS, MISSOURI, A CORPORATION OF NEW JERSEY.

## KEG-MAKING MACHINE.

1,371,833.

Specification of Letters Patent. Patented Mar. 15, 1921.

Application filed March 22, 1916. Serial No. 85,795.

*To all whom it may concern:*

Be it known that we, FLOYD S. YOUTSEY, EDWARD C. WALKER, and ASHELEIGH S. MOSES, all citizens of the United States, and said FLOYD S. YOUTSEY and EDWARD C. WALKER residing at St. Louis, in the State of Missouri, and said ASHELEIGH S. MOSES residing at New York, State of New York, have invented a certain new and useful Improvement in Keg-Making Machines, of which the following is a specification.

This invention relates to machines for forming sheets into tubular structures, such as kegs, and more particularly, to means and methods of welding.

One of the objects of this invention is to provide a machine which will form a sheet so as to cause its ends to abut and then weld the abutting ends to form a butt weld.

Another object is to provide a machine of this type which will not only form and secure the ends of a sheet, but also strip or eject the formed sheet from the machine.

Another object is to provide a machine of this type which is automatic in its action, and certain and reliable, so as to insure such proper sequence of operation of the different mechanisms as to prevent interference.

Another object is to provide a novel welding means and method, whereby the welded seam will be uniform and damage is prevented.

Further objects will appear from the detail description taken in connection with the accompanying drawings, in which:

Figure 1 is a front elevation of a machine embodying this invention;

Fig. 2 is a plan;

Fig. 3 is a side elevation;

Fig. 4 is a section on the line 4—4, Fig. 2, the mandrel being shown in elevation and the welding torch and bracket being omitted;

Fig. 5 is a section on the line 5—5, Fig. 2;

Fig. 6 is an enlarged section of the welding torch and its standard, taken on the line 4—4, Fig. 2;

Fig. 7 is a section on the line 7—7, Fig. 6;

Fig. 8 is a section on the line 8—8, Fig. 2; but showing the formers down;

Fig. 9 is a plan of the controller, part of the casing of which is cut away to show a controlling valve and cam;

Fig. 10 is a section on the line 10—10, Fig. 9;

Fig. 11 is an enlarged section on the line 11—11, Fig. 9;

Fig. 12 is an enlarged section on the line 12—12, Fig. 11;

Fig. 13 is a diagram showing the electrical connections between the controller and the machine;

Fig. 14 is an enlarged detail of a part of the controlling mechanism;

Fig. 15 is a diagram showing the sequence of operation of the different elements of the machine;

Fig. 16 is a view similar to Fig. 6, but showing another embodiment of this invention; and,

Fig. 17 is a view similar to Fig. 8, but showing another embodiment of this invention.

Referring to the accompanying drawings, 1 designates a base having mounted thereon standards 2 and 3. The standard 3 has mounted thereon a bracket 4 carrying the mandrel. This mandrel comprises a central part or base 5, fixed to the bracket, and wings 6 pivoted, at their lower ends, at 7, to the base. The upper ends of the wings have connected thereto eccentric straps 9 engaging oppositely arranged eccentrics 9 fixed to a shaft 10 having a bearing in the base 5, and provided with a sprocket 11 positioned in the bracket 4. A chain 12 engages the sprocket 11 and passes over a sprocket 13 mounted on a stub shaft in the standard 3. The chain 12 is connected by a bolt 14 with a cross head 15 working in guides 16 on the standard 3, and connected with the piston rod 17 of a piston working in the cylinder 18 mounted on the base 1. With this construction, reciprocation of the piston will cause an outward and inward movement of the wings 6 to expand and contract the mandrel, as shown in Figs. 5 and 8 respectively.

Spotters 25 move vertically in a bridge or support 26 connecting the standards 2 and 3, and these spotters are formed on links 27 fixed, at their lower ends, in a cross head 28 pivoted at 29 on a lever or frame 30, which in turn is pivoted to the piston rod 31 of a piston working in a cylinder 32 mounted in a standard 2. Movement of the piston in the cylinder will move the spotters

25 toward and from the mandrel, so as to clamp the sheet S against the mandrel.

Arms or carriers 35 are pivoted at 36 between the standards 2 and 3, and these arms  
5 carry former jaws 37 pivoted at 46 to the arms 35, and at 47 to and flexibly supported by links 38 in turn pivoted at 39 to the piston rod 40 of a piston working in a cylinder 42 mounted on the base 1. Chains 43 are  
10 connected, at their inner ends, with the bridge 26 by means of eye bolts 44, and are connected, at their outer ends, to the ends 45 of the jaws 37, which ends are curved and beveled, so as to conform to the mandrel. The links 38 are connected by a  
15 strong spring 48, which tends to move the lower ends of the jaws 37 toward each other, so as to separate these jaws at their upper ends. Reciprocation of the piston will cause  
20 the jaws to move up and down and toward and from each other, as shown in Figs. 1 and 8, so as to wrap the sheet S around the mandrel.

A skeleton bracket 50 is mounted on the  
25 bracket 4, and this bracket has mounted therein a cross head 51 working in guides 52 in the bracket 50. The cross head 51 is fixed to the end of a piston rod 53 having a connected piston working in a cylinder  
30 54 mounted on the bracket 50. The cross head 51 has mounted thereon a welding tool 55 of any suitable construction, this welding tool being preferably of the oxy-acetylene type, and mixture being conducted thereto  
35 by means of a tubing 56. This tool is simply illustrated in a general way, and no attempt has been made to show it in detail, since it may be of any well known type. The tube is provided with a suitable regulating valve 57, which may regulate the  
40 mixture, or, concurrently, the flow of the oxygen and acetylene, and this valve is provided with an arm carrying a cam roll 58 working in a cam groove 59, 60, in one of  
45 the side members of the bracket 50. The cam groove has a straight portion 59 which operates to open the valve its maximum amount, and cam portions 60 which operate to set the valve to its minimum port opening. The left cam groove 60 is formed in  
50 a plate 61 slidable on the side member of the bracket, and arranged to be clamped in adjusted position by screws 62 working in grooves 63. Reciprocation of the piston will  
55 move the tool back and forth along the mandrel, and the cam groove 59, 60 will so adjust the flow of gases to the tip as to cause this flow, and, therefore, the flame, to be reduced at the ends of the stroke of the tool,  
60 which ends of the stroke correspond to the end of the sheet S. The purpose of this construction will be more fully hereinafter described.

Rods 70 project through and are guided  
65 by holes in the bracket 4, and are arranged

around the mandrel. These rods are connected with a cross head 71 mounted on a piston rod 72 of a piston working in a cylinder 74 mounted on the bracket 4. This forms a stripper device which operates to  
70 strip the formed keg or receptacle from the mandrel, this being accomplished by forward movement of the piston and the connected rods 70.

Referring now more particularly to Figs. 75 9 to 15 inclusive, 80 designates a base which has mounted thereon covers 77 and 78, the latter of which forms a valve casing into which any suitable motive fluid, such as water, oil, or compressed air, is led by a pipe  
80 79. The base 80 has also formed thereon a casing 81 sub-divided into a series of pockets or chambers 83 and 84, the sub-dividing partitions running crosswise of the casing, and there being in this case five separate  
85 pairs of inlet chambers 83 and 84. Each pair of chambers has a pair of pipes 82 and 85 leading to opposite ends of its corresponding cylinder. A common exhaust chamber 86 extends along the casing. Six  
90 separate valves 87 control the inlet and exhaust to the chambers 83 and 84, and each of these valves has a valve rod 88 provided with cam rolls 89 and 90 on a yoke 91, the end of this yoke being guided in ways 92  
95 on the base 80. The cam rolls 89 and 90 are engaged respectively by cams 93 and 94 mounted on a shaft 95. There are a pair of cams 93 and 94 for every valve, one cam engaging one cam roll, and the other the  
100 other cam roll, and these cams are adjustably connected with a disk 76 on the shaft 95, so that the cams of a set may be independently adjusted in any desired angular relation with respect to each other and with  
105 respect to the shaft. The shaft 95 has mounted thereon a gear 96, with which meshes a pinion 97 loosely mounted on the shaft of an electric motor 98. The pinion is clutched to and from the motor shaft  
110 by a clutch 99 controlled by an electromagnet 100. With this construction, rotation of the shaft 95 will operate the valves 87, and each valve will control its corresponding cylinder, so as to alternately admit and exhaust motive fluid to and from  
115 the opposite ends of the cylinder, which the actuated valve controls, it being understood that one cam 93 will control the admission of motive fluid to one end of the cylinder, and the exhaust from the other end of the cylinder, while the cam 94 will control the reverse operation. In this particular case, the valve 93 controls the forward stroke of the piston in the cylinder, while the valve  
120 94 controls the return stroke.

The shaft 95 extends into a casing 101 fixed to the base 1 and having mounted therein a series (in this case six) of lugs  
102, each lug carrying a pair of contacts  
130

103 insulated from the casing. A contact 104, of flexible material, is mounted on an arm 105 fixed to the shaft, and is arranged to close pairs of contacts during the rotation of this arm with the shaft. Suitable electrical conductors are connected with the contacts, and issue from the casing 101 through the outlet 120.

The electrical connections are shown in Fig. 13. As shown in this figure, one contact 103 of each set is connected to a common terminal, which is connected with one of the terminals of the electro-magnet 100, the other terminal of the electro-magnet being connected with a double pole switch 106 receiving current from any suitable source of supply 107. The other terminal of the double pole switch is connected by a series of connections with the other contacts of each set, and these connections will now be described in detail. It will be noted, first, that the contacts 103 are inclined inwardly in the direction of rotation of the arm 105, so that the contact 104 will be under tension, and, as it leaves, one pair of contacts will snap into engagement with the succeeding pair of contacts.

Referring to Figs. 13 and 14, one of each set of contacts 103 is connected in circuit with the relay, the series of relays corresponding to the contacts being indicated by SM, F, ST, MFT, St, StR. Connected in circuit with certain of these relays are sets of contacts 108, each set being yieldingly mounted on a block 109 and adapted to be closed by pins or projections 110 on certain of the piston rods, so that the piston rods will operate to close the contacts. Thus, the pair of contacts connected in circuit with the relay F are adapted to be closed by the mandrel piston rod upon its forward movement; the contacts connected in circuit with the relay ST are adapted to be closed upon the forward stroke of the former piston; the contacts connected in circuit with the relay MFT are adapted to be closed upon the forward stroke of the tool piston rod; the contacts connected in circuit with the relay St are adapted to be closed upon the return movement of the former piston rod; and the contacts connected in circuit with the relay StR are adapted to be closed upon forward movement of the stripper piston rod. The circuit through the electro-magnet 100, the contacts 103, the different relays, and the different contacts 108 are completed by a main 111 connected to the right terminal of the switch 106. A switch 112 is adapted to close the circuit through the first relay SM, so as to connect the same directly with the main 111, and this switch 112 may be spring actuated so as to be normally open. Each relay has an armature 113 electrically connected with the relay terminal and adapted, when attracted by the

relay, to engage a contact 114, a series of these contacts 114 being connected with a branch 115 connected to the main 111. The action is, therefore, such that, if the circuit through any of the relays is completed, then the movement of the relay armature will close a contact 113, 114, so as to connect this relay directly to the main 111, independent of the contact 108, or even the switch 112, and this contact will remain closed until the circuit is broken by the disengagement of the brush 104 with the contacts 103.

Starting now with the parts as shown in Fig. 13, and referring, also, to the sequence diagram, Fig. 15, the parts will be in the positions shown in the drawings, that is, with the mandrel contracted, the spotter, former, stripper and the tool retracted, and with the brush 104 bridging the contacts 103. If the switch 112 is now closed, the circuit will be completed through the clutch electro-magnet, the contacts 103, the brush 104, the relay SM, and the main 111. This connection will preliminarily be through the switch 112; but, immediately thereafter, through the contacts 113, 114, and this circuit will remain closed until the brush 104 leaves the spotter and mandrel contacts 103, at which time, also, the contacts 113, 114 of the relay SM are separated. The operator can, therefore, after closing the switch 112, again release or even open the same. During the movement of the brush 104 and the shaft 95, the valves 87 will be operated to admit motive fluid to the mandrel and spotter cylinders, so as to cause the mandrel to expand and the spotter to clamp the sheet against the under face of the mandrel. Rotation of the shaft 95 will continue until the brush 104 leaves the spotter and mandrel contacts 103, at which time the circuit will be broken and the shaft 95 will stop, unless the contacts 108 in circuit with the former relay F have been closed by the mandrel piston, in which latter case the circuit is completed through the contacts 108 with the main 111, as brush 104 has, by this time, snapped into engagement with and closed the former contacts 103. The shaft 95 will now be rotated to admit motive fluid to the former cylinder so as to cause the formers to wrap the sheet around the mandrel. It will, therefore, be seen that it is insured that the former will not be started until the mandrel has been fully expanded. After the contacts 108 have once been closed, the circuit is completed directly through the armature of the relay F to the corresponding contact 114, so that the circuit will remain closed until the brush 104 leaves the former contacts and snaps into engagement with the succeeding pair of contacts 103. When the brush 104 connects the succeeding pair of contacts 103, the circuit will be open un-

less the former has closed the contacts 108 in circuit with the relay ST, in which latter case the circuit is completed and the shaft 95 is rotated to admit motive fluid to the spotter and tool cylinders to cause the spotter to return and the tool to move forward. Upon the succeeding movement of the relay MFT is connected in circuit, provided the contacts 108 have been closed by the tool piston rod upon its forward movement, and during the movement of the shaft 95, the mandrel is contracted, the former withdrawn, and the tool also retracted. The circuit is now closed through the stripper contacts 103 and the relay St, provided the contacts 108 in that circuit have been closed by the return of the former. During the succeeding movement of the shaft 95, motive fluid is admitted to the stripper cylinder to move the stripper forward to eject the keg body from the mandrel. Upon the completion of the forward movement of the stripper, the contacts 108 are closed to close the circuit of the relay StR, whereupon the shaft 95 will continue in its movement to cause the return of the stripper. As the brush 104 now leaves the stripper return contacts 103, and if the switch 112 is, at this time, open, the circuit will be broken and the shaft 95 will stop, causing the entire machine to come to rest at the completion of the cycle of operations. If the switch 112 is now again closed, the machine will perform another cycle of operations.

It will, therefore, be seen that, in accordance with this invention, it is insured that each operation will be completed before the succeeding operation will start. This insures the performance of the separate functions of the mechanism in accordance with a predetermined cycle of operations. With this controlling mechanism it is possible to use a separate motor for each mechanism, and, therefore, permit the use of fluid pressure operated means for operating the separate elements of the complete mechanism.

In accordance with this invention, the sheet is first pressed positively against the bottom of the mandrel by the spotters, and the formers then operate to fold the sheet around the mandrel. The provision of the chains 43, which form a flexible backing for the sheet and which are movable with the sheet around the mandrel, together with the movement of the jaws on account of their peculiar mounting, causes the sheet to be tightly wrapped around the mandrel from its center toward its ends, so as to cause the sheet to firmly engage the mandrel surface at all points. The keg can, therefore, be made to conform closely to the mandrel, and to a given size. With this construction it is possible to form a butt weld, since the ends of the sheet will move toward each other until their ends engage, and then the linkage

connections, together with the slight play in the joints, will cause the jaws to automatically adapt themselves so that the ends of the sheets will abut and not overlap. In this way the formation of a butt joint is insured, and this butt welded joint will form a practically continuous surface, which is desirable in kegs or containers which are to be provided with closures.

It is sometimes desirable to form a lap weld instead of a butt weld. The mechanism may be readily converted for that purpose. Referring to Fig. 17, the link 38 is shown as provided with a leaf spring 138 anchored at its end on said link, and provided, at its free end with an adjustable screw 139, adapted to engage a face 140 on the arm 37. By a proper adjustment of the screw 138, this screw is made to engage the face 140 during the latter part of the movement of the arm 37, so as to retard the mechanism on that side during the latter part of its movement. This will cause the retarded jaw 45 to lag behind the unretarded jaw, so that the right edge of the sheet S, Fig. 17, will be placed on the mandrel before the left edge of the sheet comes down on the mandrel, thereby causing the left edge to lap over the right edge and form a lap joint. The machine can, therefore, be readily converted into one which forms a lap joint.

In the welding of a seam, the conduction of the heat to the sheet is necessarily greater when midway of the sheet, or away from its ends, than at the ends of the sheet. This is because, in the former case, the conduction is in all directions, while, in the latter, it is through only 180°. If, therefore, the relation of the flame with respect to the seam is constant, the sheet, while at a proper heat at its center, on account of the more rapid loss by radiation, is liable to burn at the ends of the seam on account of the smaller amount of radiation. In accordance with this invention, therefore, the relation of the flame with respect to the seam is controlled by the nature of the seam material adjacent the point impinged by the flame. This can be accomplished in a number of ways, one of which, as shown in Fig. 6, is by the throttling of the gas to reduce the flame as the welding tool approaches the ends of the sheet. In accordance with another method, the duration of the flame contact is controlled and reduced as the flame approaches the ends of the sheet. The first method is shown in Figs. 6 and 7, and has been briefly referred to. In accordance with this construction, by a proper construction of the cam groove 60, the welding temperature of the sheet can be maintained constant. By adjustment of the slide 61, the machine can be adapted to different length kegs. This adjustment need, however, be only at

one end, since the sheet can always be placed on the mandrel so that the other end abuts against a gage 33 on the beam 26. The cam groove 60 can be so formed that the gas is  
 5 entirely shut off when the tool reaches its retracted position, a pilot flame being utilized to light the gas automatically.

Fig. 16 shows another embodiment of this invention. In accordance with this construction, the cross head 51 has mounted thereon a bracket 152 which has an arm 153  
 10 extending along the tool guide and the cylinder, and which may be supported by a bracket guide 125 on the flange of the cylinder 54. The arm 153 has mounted  
 15 thereon a pair of cams 126, which are adapted to be adjustably clamped thereon by having a slotted connection therewith. The pipe 84 is provided with a check valve which  
 20 opens inwardly, but closes outwardly. Shunting the check valve is a pipe circuit 128 having a valve 129, the arm 130 of which is connected with a link 131 guided in a bracket 132 moved downwardly by a spring  
 25 133 and having a cam roll 134 engaging the arm 153. With this construction, therefore, the inlet of the motive fluid to the right end of the cylinder 54 is unimpeded, being directly through the pipe 84 past the check  
 30 valve 127, while the exhaust of the motive fluid from that end of the cylinder must be through the branch 128, as the check valve closes the passage directly through the pipe 84. When the valve 129 is fully open, as  
 35 shown in dotted position, Fig. 16, the flow of motive fluid through the branch 128 is unimpeded, and the tool will, at that time, move at its maximum rate: when, however, the valve 129 is partially closed, as shown in  
 40 full lines, then the passage through the branch 128 is throttled and the tool will, at that time, move at its minimum rate.

As the tool reciprocates back and forth, the cam roll 134 is moved from full line position to dotted position to open and partially close the valve 129. As the tool proceeds on its initial forward movement, with  
 45 the cam roll 134 engaging the right cam 126, the movement of the tool will be at a maximum rate; as soon, however, as the cam roll 134 leaves the cam 126, the movement of the tool will be at a minimum rate. The  
 50 cams 126 are so placed as to result in a movement of the tool at the maximum rate as the tool starts and leaves the ends of the sheet, but to result in the movement of the tool being a minimum after it is once fully  
 55 on the sheet. The tool will, therefore, move rapidly on and rapidly off of the sheet, but when fully on the sheet, will move at a uniform slow rate. By the proper proportion of the cams 126 the heating effect on the  
 60 seam can be made absolutely uniform. As there is no throttling of pipe 82, and, therefore, no back pressure to the return move-

ment of the tool, the return movement will be rapid, which is necessary, as the seam is welded upon the forward movement.

It is obvious that various changes may be made in the details of construction without  
 70 departing from the spirit of this invention, and it is, therefore, to be understood that this invention is not to be limited to the specific construction shown and described.

Having thus described the invention, what  
 75 is claimed is:

1. In a machine of the class described, the combination with a mandrel, of formers co-operating therewith, and means for actuating said formers, adapted to permit said  
 80 formers to adjust themselves to said mandrel and the sheet to be formed, said formers operating to wrap a sheet around said mandrel to position the edges thereof in abutting relation and to hold the sheet edges so  
 85 positioned on the mandrel and press the same together to form a butt joint.

2. In a machine of the class described, the combination with a mandrel, of formers co-operating therewith, and means for actuating said formers, adapted to wrap a sheet  
 90 around said mandrel and position the edges thereof in abutting relation, and means for supporting said formers to permit the same to adjust themselves to the wrapped sheet, adapted to cause said formers to hold the  
 95 sheet edges so positioned on the mandrel and press the same together to form a butt joint.

3. In a machine of the class described, the combination with a mandrel, of formers co-operating therewith, and means for actuating said formers, adapted to wrap a sheet  
 100 around said mandrel and position the edges thereof in abutting relation, and flexible means for supporting said formers, adapted to cause said formers to engage the sheet edges so positioned to form a butt joint.

4. In a machine of the class described, the combination with a mandrel, of formers co-operating therewith, flexible means connecting said formers adapted to form a support  
 110 for a sheet, and means for actuating said formers, adapted to wrap the sheet around said mandrel and position the edges thereof in abutting relation, said formers operating  
 115 to engage the sheet edges so positioned to form a butt joint.

5. In a machine of the class described, the combination with a mandrel, of formers co-operating therewith, flexible means connecting said formers adapted to form a support  
 120 for a sheet, and means for actuating said formers, adapted to wrap the sheet around said mandrel and position the edges thereof in abutting relation, and flexible means for  
 125 supporting said formers, adapted to cause said formers to engage the sheet edges so positioned to form a butt joint.

6. In a machine of the class described, the combination with a mandrel, of formers co-  
 130

operating therewith to wrap a sheet around said mandrel, and a flexible backing connected with said formers, and adapted to move with the sheet around said mandrel.

5 7. In a machine of the class described, the combination with a mandrel, of formers co-operating therewith to wrap a sheet around said mandrel, a support adjacent said mandrel, and flexible backings connecting said  
10 formers with said support, and adapted to move with the sheet around said mandrel.

8. In a machine of the class described, the combination with a mandrel, of formers co-operating therewith to wrap a sheet around  
15 said mandrel, and a flexible backing supported in the middle and connected at its ends to said formers, adapted to move with the sheet around said mandrel.

9. In a machine of the class described, the combination with a mandrel, of means for clamping a sheet intermediate its ends  
20 against said mandrel, formers adapted to wrap the clamped sheet around said mandrel, and a flexible backing connected with said formers, adapted to move with the sheet  
25 around said mandrel.

10. In a machine of the class described, the combination with a mandrel, of means for clamping a sheet intermediate its ends  
30 against said mandrel, formers adapted to wrap the clamped sheet around said mandrel, and a flexible backing supported intermediate its ends and connected at its ends with said formers, adapted to move with the  
35 sheet around said mandrel.

11. In a machine of the class described, the combination with a mandrel, of formers co-operating therewith to wrap a sheet  
40 around said mandrel, adapted to position the edges thereof in abutting relation, and a flexible backing connected with said formers and adapted to move with the sheet around said mandrel, said formers operating  
45 to engage the sheet edges so positioned to form a butt joint.

12. In a machine of the class described, the combination with a mandrel, of means for clamping a sheet intermediate its ends  
50 against said mandrel, formers adapted to wrap the clamped sheet around said mandrel, adapted to position the edges thereof in abutting relation, and a flexible backing connected with said formers, adapted to  
55 move with the sheet around said mandrel and engage the sheet edges to form a butt joint.

13. In a machine of the class described, the combination with a mandrel, of formers co-operating therewith, carriers for movably  
60 supporting said formers, means connecting the free mandrel-engaging ends of said formers, and means for actuating said formers.

14. In a machine of the class described,  
65 the combination with a mandrel, of formers

co-operating therewith, carriers for movably supporting said formers, flexible means for connecting the mandrel-engaging ends of said formers, and means for actuating said  
70 formers.

15. In a machine of the class described, the combination with a mandrel, of formers co-operating therewith, carriers for movably supporting said formers intermediate  
75 their ends, means connecting the mandrel-engaging ends of said formers, and actuating means connected to the other ends of said formers.

16. In a machine of the class described, the combination with a mandrel, of formers co-operating therewith, carriers for movably  
80 supporting said formers intermediate their ends, means for flexibly connecting the mandrel-engaging ends of said formers, and actuating means connected to the other ends  
85 of said formers.

17. In a machine of the class described, the combination with a mandrel, of formers co-operating therewith, pivotally mounted intersecting arms adapted to pivotally support  
90 said formers intermediate their ends, means connecting the mandrel-engaging ends of said formers, and actuating means connected to the other ends of said formers.

18. In a machine of the class described,  
95 the combination with a mandrel, of formers co-operating therewith, carriers for movably supporting said formers, a flexible backing connecting the mandrel-engaging ends of said formers, and means for actuating said  
100 formers.

19. In a machine of the class described, the combination with a mandrel, of formers co-operating therewith, pivotally mounted intersecting arms adapted to pivotally support  
105 said formers intermediate their ends, a flexible backing connecting the mandrel-engaging ends of said formers, and actuating means connected to the other ends of said formers.  
110

20. In a machine of the class described, the combination with a mandrel, of means for forming a sheet around said mandrel adapted to join the edges of said sheet, a  
115 welding tool, and means for moving said tool back and forth along the joined edges, adapted to weld the same together.

21. In a machine of the class described, the combination with a mandrel, of means for forming a sheet around said mandrel  
120 adapted to join the edges of said sheet, a welding tool, and means for moving said tool along said mandrel and the joined edges of the sheet thereon, adapted to weld the joint.  
125

22. In a machine of the class described, the combination with a frame and a mandrel thereon, of formers adapted to wrap a sheet  
130 around said mandrel and join the edges thereof, a welding tool mounted for move-

ment on said frame, and means for moving said tool along said mandrel and the joined edges of the sheet thereon, adapted to weld the joint.

- 5 23. In a machine of the class described, the combination with a frame and a mandrel thereon, of formers adapted to wrap a sheet around said mandrel, a welding tool mounted for movement on said frame, and means for  
10 actuating said formers and said tool in co-operative relation, adapted to join the edges of the sheet and then move said tool along the joined edges while the sheet is held by said forming means.
- 15 24. In a machine of the class described, the combination with a frame and a mandrel thereon, of formers adapted to wrap a sheet around said mandrel, a welding tool mounted for movement on said frame, and  
20 means for actuating said formers and said

tool in coöperative relation, adapted to engage the edges of the sheet to form a butt joint and then move said tool along the joint while the sheet is held by said forming means.

- 25 25. In a machine of the class described, the combination with a mandrel, of formers coöperating therewith, means for actuating said formers, adapted to wrap a sheet around said mandrel, and position the edges thereof  
30 in abutting relation, said formers operating to engage the sheet edges so positioned to form a butt joint, a welding tool, and means for moving said tool along the joint while the sheet is held by said forming means.

35 In testimony whereof we have hereunto affixed our signatures.

FLOYD S. YOUTSEY.  
EDWARD C. WALKER.  
ASHELEIGH S. MOSES.