Nov. 9, 1943. J. GLANS 2,333,997

CATHODE FORMING MACHINE

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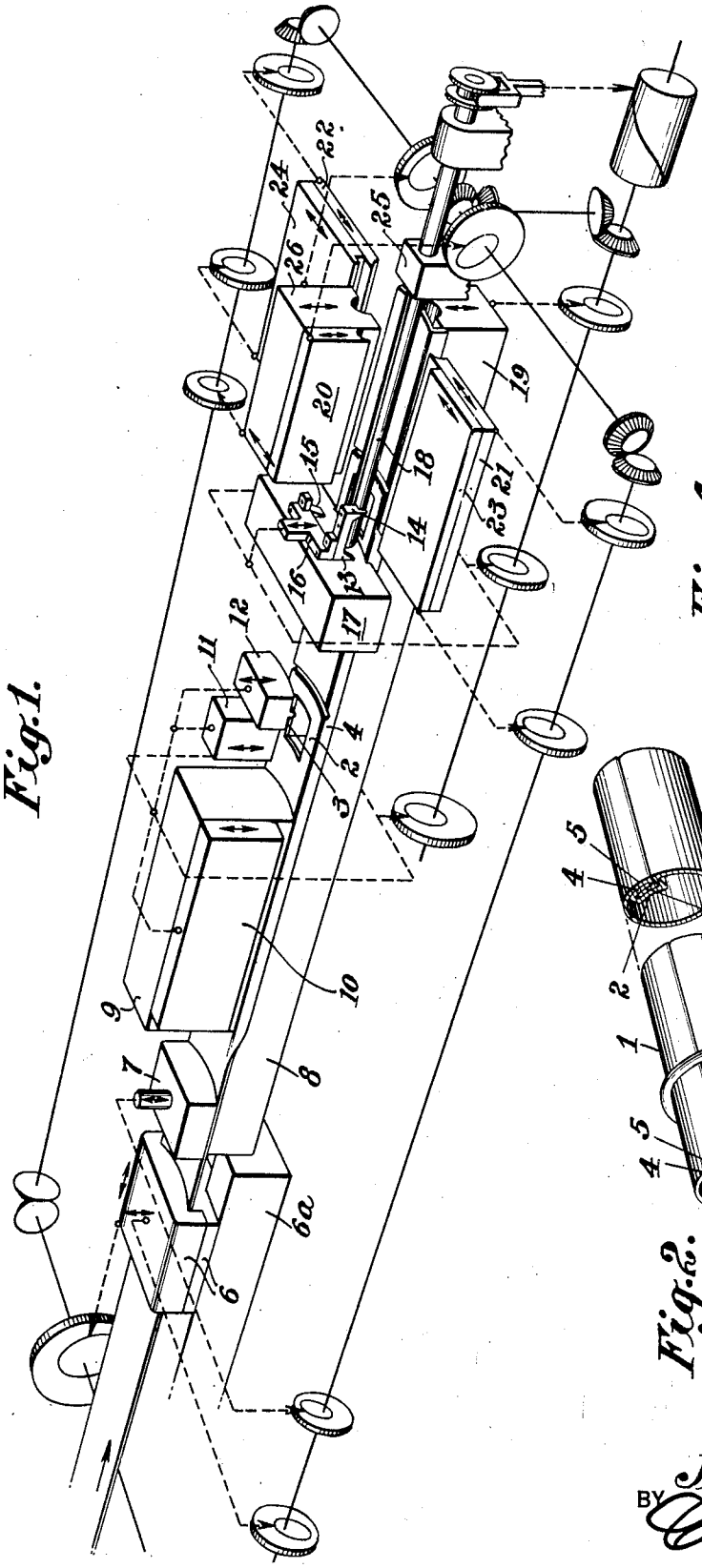


Fig. 1.

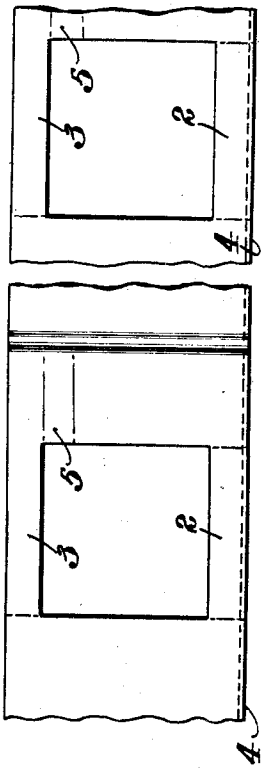


Fig. 4.

Fig. 2.

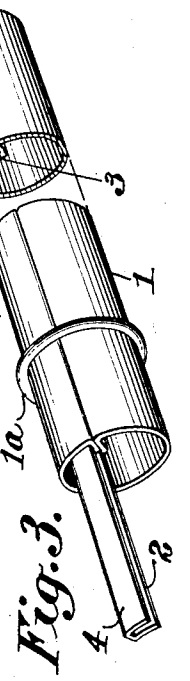


Fig. 3.

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Fig. 5.

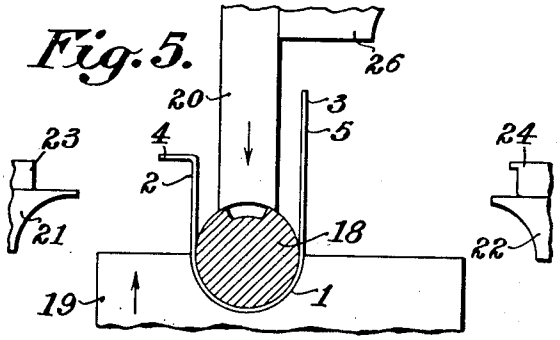


Fig. 6.

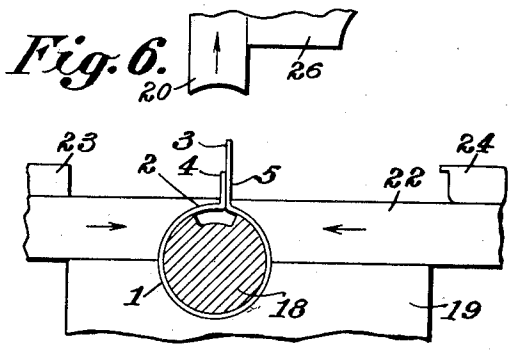


Fig. 7.

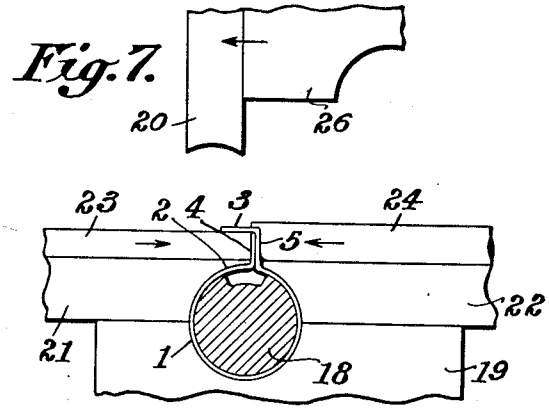


Fig. 8.

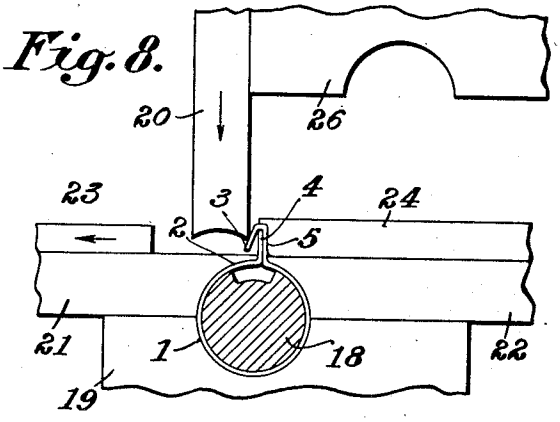


Fig. 9.

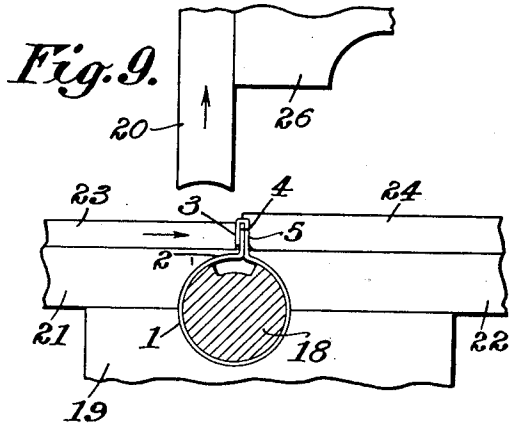
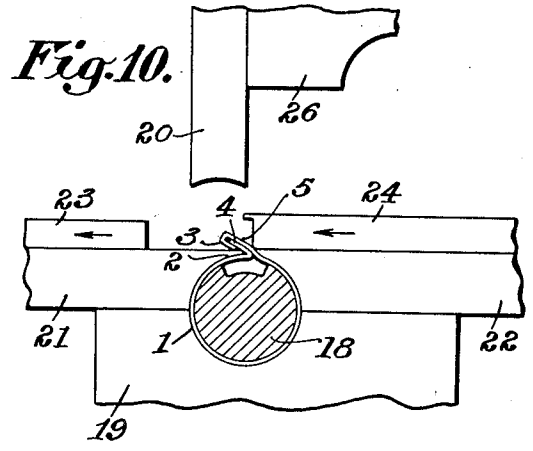


Fig. 10.



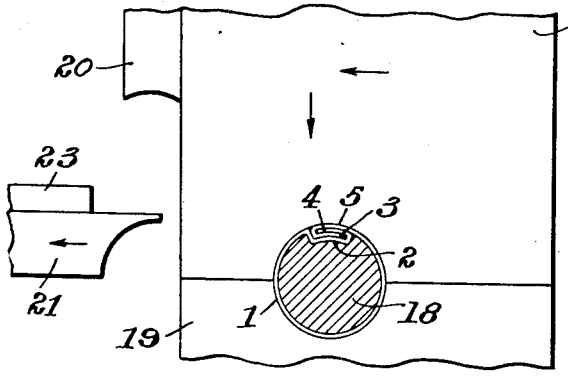
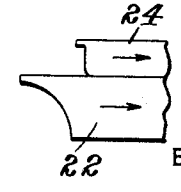


Fig. 11.



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Fig. 12.

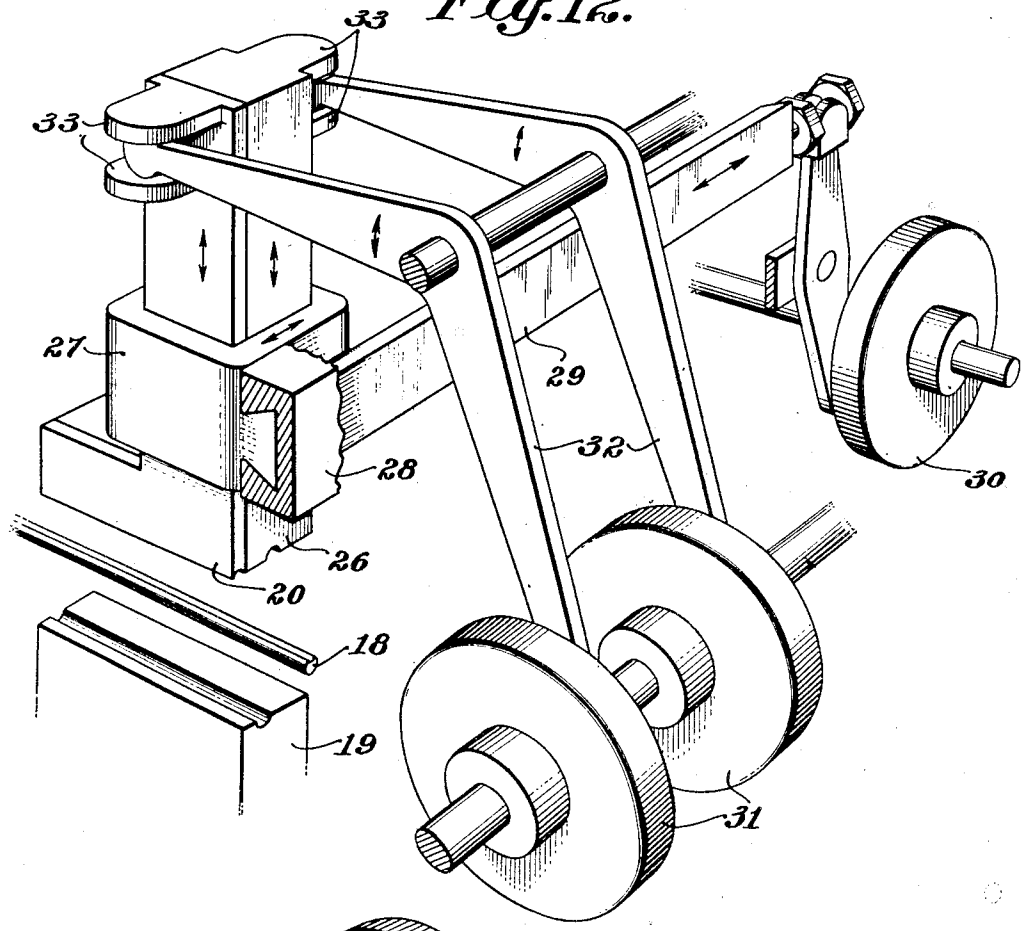
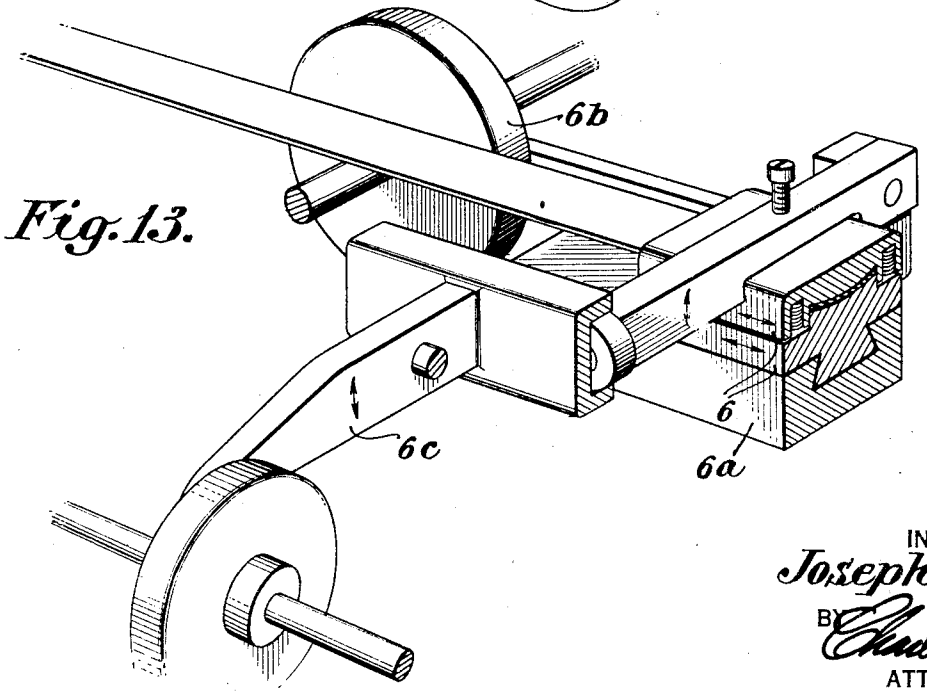


Fig. 13.



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UNITED STATES PATENT OFFICE

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CATHODE FORMING MACHINE

Joseph Glans, Bloomfield, N. J., assignor to Radio Corporation of America, a corporation of Delaware

Application December 14, 1940, Serial No. 370,157

7 Claims. (Cl. 113—1)

My invention relates to sleeve or tube manufacture, particularly to lock seamed cathode sleeves with integral tabs.

In making wrapped and seamed sleeves or tubes in very small sizes suitable for use as cathodes in radio tubes, the problem becomes difficult of making uniform and strong seams along the side of the sleeve. Often the blank, from which the sleeve is made, shifts slightly with respect to the mandrel around which the blank is wrapped, and flanges of the proper width cannot be creased along the blank edges for making the seam, and defective sleeves result. Where laminated tabs, integral with the end of the sleeve, are formed by extending the edged portions of the blank beyond the end of the blank, as suggested by Haslauer 2,029,482 of February 4, 1936, it is particularly important that the sheet metal be held from shifting during wrapping and seam forming operations. Further, tools and dies for wrapping the blank around the mandrel must prevent slack in the blank on the mandrel to insure uniform and accurate sizing of the finished sleeve.

An object of my invention is an improved machine for making wrapped or seamed sleeves or tubes with means for making strong and uniform sleeves that are accurately sized.

A further object of my invention is an improved machine for making lock seamed cathode sleeves with one of the longitudinal edge portions extended beyond the end of the sleeve to provide a rigid integral tab for the sleeve.

The characteristic features of my invention are defined in the appended claims and the preferred embodiment of the machine is described in the following specification and shown in the accompanying drawings in which:

Figure 1 is a schematic perspective view of my machine showing the positional relationship of the essential parts of the machine;

Figure 2 shows one completed sleeve with a one-layer integral tab made on my improved machine;

Figure 3 shows a second sleeve with a two-layer integral tab made on my machine;

Figure 4 shows a portion of ribbon metal stock from which the sleeve is made, with a rectangular hole stamped in the ribbon preparatory to severance of the blank from the ribbon for the wrapping and seaming operations;

Figures 5 to 11 show in end view the mandrel and dies during the wrapping and seam forming operations;

Figure 12 is an enlarged and detailed perspective view of mechanism for actuating in a horizontal and vertical direction two of the seam making dies; and

Figure 13 is an enlarged detailed perspective view of strip feeding mechanism for my novel machine.

One sleeve made with my improved machine, shown in Figure 2, comprises a thin walled cylinder 1 of any desired cross sectional shape closed by a conventional four-layer lock seam. The edge portions or flanges 2 and 4 along one side of the sheet metal blank from which the cylinder is made, interlock with flanges 3 and 5 along the other edge of the blank. One of the layers of the seam, 3 as shown in Figure 2, extends beyond the end of the seam and may be used as a support or electrical connector for the sleeve. Alternatively, a double thickness tab, as shown in Figure 3, may be conveniently made by extending flanges 2 and 4 beyond the end of the sleeve, the two laminations of the tab being integrally joined along their edges throughout their length. For convenience of description, the reference characters applied to the flanges in Figures 2 and 3 are applied throughout the other figures of the drawings, to the corresponding edge portions of the ribbon and blank from which the cylinder is made.

In Figure 1 the strip metal or ribbon from which the sleeves are made is fed from the left and is moved forward step-by-step by stepping jaws 6 which grip the strip and for each step advance the ribbon a distance equal to the combined length of the finished sleeve and its integral tab. The two jaws close upon the ribbon and move forward while the gripping block 7 is elevated. The jaws release their grip upon the ribbon and return as the gripping block holds the ribbon against the stationary anvil 8 to prevent backward movement of the ribbon. The ribbon passes under the guide block 9 with one edge extending beyond the aligned sides of the anvil and guide block, and between each feeding step this extended edge is folded down by the flanging plunger 10. The flange, designated by 4, thus formed along the edge of the ribbon stiffens the ribbon so that it may be pushed without buckling. The stepping jaws 6, more fully hereinafter described in connection with Figure 13, are curved to groove the ribbon and further stiffen the ribbon. This flange 4, further, may be held against the side of the anvil to guide and accurately center the strip over the anvil. The blanking die 11 reciprocates above a rectangular opening in the anvil and for each downward

movement of the blanking die cuts a rectangular window in the strip, leaving that portion of the ribbon ahead of the blanking die attached to the oncoming ribbon only by the edge portions 2 and 4 on one side and 3 on the other side of the ribbon. It has been found convenient to press a transverse groove in the strip with beading die 12, while the window is being cut, when a circumferentially embossed bead 1a, Figure 3, is desired around the tab end of the sleeve. The beading die may be placed where desired to form the bead at any point along the blank.

The next step forward of the ribbon carries the edge portions of the ribbon opposite the window beneath cut-off knives 13, 14 and 15. Two of the knives 13 and 14 may be mounted on a single block detachably secured to one end of the cross head 16 while the third knife 15 is detachably mounted on the other end of the cross head. The cross head and knives are guided along the side of the stationary anchor block 17 spaced above the anvil 8. The cutting edges of the knives reciprocate over the edge portions of the ribbon opposite the corners of the window, and by interchanging the knives, an integral tab may be left on either side of the blank. The double knife block is shown, in Figure 1, on the near end of the cross head and in position to cut the entire flanged edge of the ribbon opposite the window, while the third knife is in position to cut only the trailing end of the opposite strip edge. A blank thus cut will appear, when finished as a cylinder, with the single layer integral tab of Figure 2. If the block carrying knives 13 and 14 are interchanged with knife 15, the finished cylinder will have an integral two-layer tab as shown in Figure 3.

When moved into the tab cutting position, the blank is carried under the mandrel 18 about which the blank is wrapped and, according to one of the characteristic features of my invention, the blank is firmly pressed against the underside of the mandrel by the folding die 19 before the knives descend to sever the blank from the ribbon. At no time is the sheet metal blank left free to shift laterally under the mandrel. To prevent upward bending or deflection of the rather long thin mandrel by the folding die, the mandrel is supported from above by the backing die 20 which descends to the mandrel as the folding die moves up from beneath to press the blank against the mandrel. After the blank is severed from the ribbon, the folding die continues its upward movement to fold the blank around the mandrel and push the two sides of the blank into the upstanding parallel positions shown in Figure 5. Wrapping is completed and the lock seam is made with the stretching dies 21 and 22 and the flanging dies 23 and 24, as more fully hereinafter described and shown in Figures 5 to 11.

The mandrel 18, supported at opposite ends of the blank by anchor 17 and stripper block 25, is withdrawn from the finished sleeve as best shown in Figure 1 by longitudinal movement to the right through the stripping block. If the sleeve thus stripped from the mandrel does not fall free of the dies, it may be delivered to a suitable receptacle by a blast of air. Preferably the stripping block is positioned close to the end of the dies so that the two points of support for the mandrel may be no farther apart than the combined length of the sleeve and its tab.

Drive means for the various parts of my improved machine are interlinked with a common source of power so that each operation takes place at the proper time in the sleeve forming cycle. Since the various parts of my machine may be interlinked by shafts, gears, chains or other conventional power transmission means, the drive means forms no part of my invention, and to simplify the disclosure the linkage in Figure 1 has been shown diagrammatically with solid lines to represent shafts and dotted lines to indicate mechanical connection between each moving part and its cam. My machine may, because of the simplified movement of parts, be operated at a speed of over 100 complete sleeve making operations per minute. Sleeves of different lengths may be made by simply adjusting the length of travel of the stepping jaws and different diameters or cross sectional shapes of sleeves may be made by inserting the appropriate mandrel.

The positional relationship of the horizontally and vertically movable seam forming dies are shown in end views in Figures 5 to 11. The blank lying on the upper flat surface of the folding die 19 is firmly held against the underside of the mandrel as the cutting knives sever the tab sections from the ribbon, and after the backing die 20 moves down into contact with the upper side of the mandrel the folding die proceeds upward to fold the blank into the U-shape shown in Figure 5. Here the folding die remains throughout the remaining seam forming operations. Preferably the recess in the folding die in registry with the mandrel is fitted, or shaped to conform to the mandrel, and is of such a depth that the flat top surface or end of the folding die comes to rest opposite the center line of the mandrel. The backing die is then raised as the stretching dies 21 and 22 move in from either side. The forming surfaces of the stretching dies conform to the shape of the upper quarter sections of the mandrel and completely enclose the cylinder from the top of the folding die to the flanges 4 and 5 at the top of the cylinder. The stretching dies move in and firmly press the cylinder to the mandrel throughout its circumference. With the forming surfaces of the stretching dies entirely above the center of the mandrel the inward force of the stretching dies delivers to the upper half of the cylinder a stretching movement toward the flanges at the top. The stretching dies remain in the position shown in Figure 6 and hold the cylinder walls under tension while the flanges are folded and interlocked. Flanging dies 23 and 24 move in from either side of the upstanding flanges 3, 4 and 5 as shown in Figure 7 and fold flange 3 over the end of flange 4 and the left die is withdrawn as the backing die moves down to fold the flange 3 over the outer edge of flange 4, as shown in Figure 8. Thereupon the backing die is retracted and the left flanging die again moves in to complete the interlock between flanges 3, 4 and 5. The upstanding lock seam is now ready to be laid over and flattened against the wall of the cylinder. As shown in Figure 10, left hand flanging die moves back, right hand flanging die moves forward a short distance to lay over or incline the lock seam. Now both the stretching dies and flanging dies move back, forming die 26 moves to the left displacing the backing die 20, and then moves downward to press the seam into the longitudinal recess in the top of the mandrel.

It has been found expedient to mount the backing die 20 and the forming die 26 in side-by-side

vertical slidable engagement and to move these two dies transverse of the seam in operation. As best shown in Figure 12 the two dies are mounted side-by-side in a yoke **27** slidably carried in the V-way of a stationary block **28** and joined through the connecting rod **24** to cam **30**. The vertical reciprocatory movement of the backing and forming dies may conveniently be accomplished by cams **31** and cam levers **32** with rollers riding between laterally extending ears on the upper ends of the dies. The ears **33** are sufficiently long to permit the transverse movement of the dies from the position shown in Figure 5 to the position shown in Figure 11.

The stepping jaws **6** shown in greater detail in Figure 13 reciprocate lengthwise of the ribbon and are guided in the V-way of the stationary block **6a**, power for the reciprocatory movement of the blocks being supplied by cam **6b**. The two blocks are pressed together by the pivoted cam lever **6c** to positively grip the ribbon during the forward movement of the jaws and are moved apart to slightly relieve the pressure on the strip upon the return travel of the jaws. According to one feature of my invention the clamping surfaces of the jaws **6** are slightly curved so that the ribbon is grooved lengthwise by the jaws as the jaws slide to the left over the ribbon. That portion of the ribbon to the right of the jaws is strengthened by the concaved cross sectional configuration and can be pushed through the dies and guides of the machine without buckling or bowing. My improved ribbon feeding mechanism is positive in operation, accurately feeds the ribbon to the dies, and stiffens even the most foil-like strip material so that it can be easily handled in my sleeve making machine.

My improved lock seamed cathode making machine is simple in construction, easy to adjust and fast in operation. It accurately forms and sizes sleeves from thin metal stock.

I claim:

1. A machine for making lock seamed cathode sleeves comprising a metal strip feeding mechanism for feeding the strip lengthwise step-by-step, means for bending a right angle flange along the edge of the strip, a mandrel axially aligned with the strip, a folding die beneath said mandrel, said folding die comprising a block of metal flat on its upper side and having a longitudinal groove in registry with the mandrel, said groove being in depth equal to approximately one-half the vertical diameter of said mandrel, the mandrel and folding die being positioned at the end of said strip to receive one section at a time and to grip and fold each section in succession, cut-off knives for severing each section from the end of said ribbon, stretching dies reciprocable along said upper surface of the folding die to wrap said section around the mandrel, flanging dies reciprocable on said stretching dies, a backing die above said mandrel reciprocable in a direction normal to the direction of travel of the flanging dies, the movements of said flanging dies and said backing die being coordinated to interlock said flange and opposite edge portion of the section, and a forming die to press the interlocked edges against said mandrel.

2. A machine for making locked seam cathode sleeves comprising a rectilinear horizontal mandrel, a folding die reciprocably mounted beneath said mandrel and having in registry with the mandrel a shaping surface fitted to the lower half of said mandrel, a metal strip feeding mechanism for feeding a sheet metal strip lengthwise step by step to place the end portions of said strip between said mandrel and said folding die, cut-off knives for cutting off the portion of strip between said folding die and said mandrel, actuating means for moving said folding die upward to grip the end portion of said strip between said folding die and said mandrel, actuating said cut-off knives to sever the portion gripped by said folding die, and continuing the upward movement of said folding die to fold the severed portion of said strip around the mandrel, means for bringing together and joining the edge portions of the folded blank by an upstanding seam formed from said portions, a vertically reciprocable backing die above said mandrel to support said mandrel against the thrust of said folding die, a forming die reciprocably mounted above said mandrel side by side with said backing die to press the seam and the sleeve down against the mandrel, and means for transversely shifting said backing die and said forming die in succession into operative position above said mandrel.

3. A lock seamed cathode making machine comprising a mandrel, two spaced supports for said mandrel through which said mandrel may longitudinally reciprocate, a vertically reciprocable folding die beneath said mandrel between said supports shaped to conform to the lower half section of the mandrel, a horizontal reciprocable stretching die on each side of said mandrel with forming surfaces shaped to conform to the upper quarter sections of the mandrel, means to interlock opposite edge portions of a blank wrapped around said mandrel, and means to press said interlocked portions against said mandrel.

4. A machine for making lock seamed cathode sleeves comprising a mandrel, a vertically reciprocable folding die beneath said mandrel, means for feeding a sheet metal blank lengthwise between the mandrel and folding die, horizontally reciprocable stretching dies on either side of the mandrel for pressing said blank into snug engagement with the mandrel, horizontally reciprocable flanging dies on either side of the mandrel for holding upstanding longitudinal edge portions of said blank wrapped around said mandrel, a backing die, a forming die, said backing and forming dies being reciprocably mounted side-by-side above said mandrel, means for transversely shifting said backing and forming dies to operative positions above said mandrel, and drive means for successively moving the folding die, the stretching dies, the flanging dies and the backing die toward the mandrel to wrap and form a seam on the blank, and for moving the forming die to flatten the seam against the mandrel.

5. A machine for making seamed sleeves comprising a mandrel, a vertically reciprocable folding die for folding a sheet metal blank upward around the bottom of the mandrel, means for bringing together and joining the edge portions of the blank, a backing die vertically movable against the top side of the mandrel to support the mandrel, a forming die vertically movable against the top side of the mandrel for pressing the interlocked edge portions against the mandrel, said backing die and forming die mounted side by side above said mandrel, and means for shifting the two last mentioned dies laterally above the mandrel.

6. A machine for making seamed sleeves comprising a horizontal mandrel, a folding die reciprocably mounted below said mandrel to fold a sheet metal blank upward and around the bottom of the mandrel, a backing die reciprocably

mounted above the mandrel for supporting the mandrel against the thrust of said folding die, means for bringing together the edge portions of the folded blank and joining said edge portions by an upstanding seam formed from said edge portions, a forming die reciprocably mounted side by side with said backing die for pressing the seam and the sleeve down against the mandrel, and means for laterally shifting said backing and forming dies to bring said dies successively into operative position above said mandrel.

7. A machine for making seamed cathode sleeves comprising a mandrel having the cross sectional size and shape of the sleeve, a folding die vertically reciprocable to and from said mandrel, said die having a groove in registry with and formed to fit the lower portion of the mandrel and adapted to bend a sheet metal blank into a U-shape fold on the mandrel, means to push the two legs of the folded blank into snug contact with the upper portion of the mandrel, said means comprising two stretching dies horizontally reciprocable to and from opposite sides of the mandrel, the forming surfaces of the stretching dies being shaped to cover the portions of the mandrel not covered by the groove of said folding die, and means for joining the longitudinal edges of the legs of the folded blank by a seam formed from the blank while the blank is positively held on the mandrel by the folding and stretching dies and a forming die reciprocably mounted above said mandrel side by side with said folding die for pressing the seam against the mandrel, and means for transversely shifting said backing and forming dies to operative positions above said mandrel.

JOSEPH GLANS.