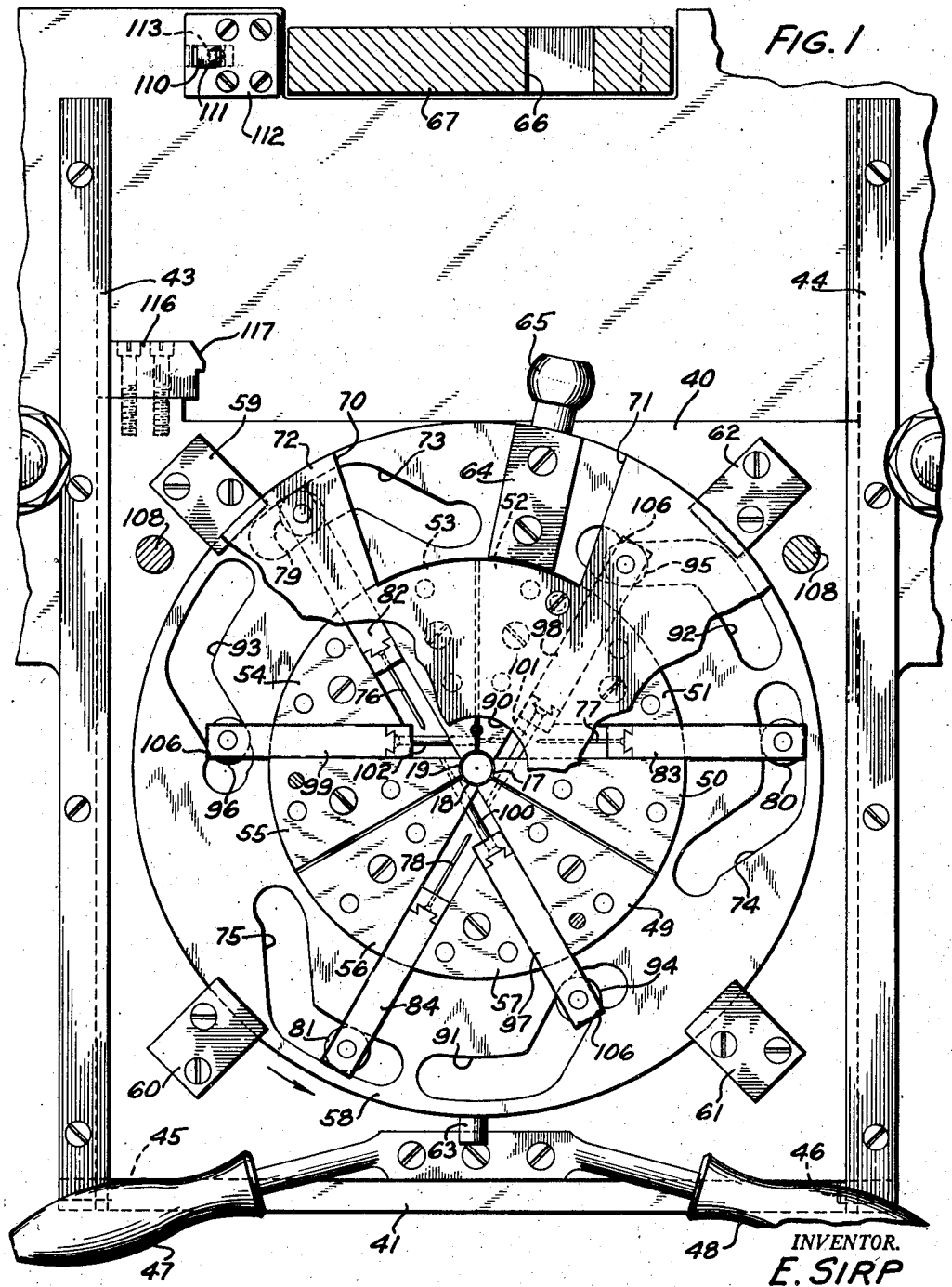
July 16, 1946. E. SIRP 2,404,197

ARTICLE ASSEMBLING APPARATUS

Filed June 17, 1943 5 Sheets-Sheet 1

FIG. 1



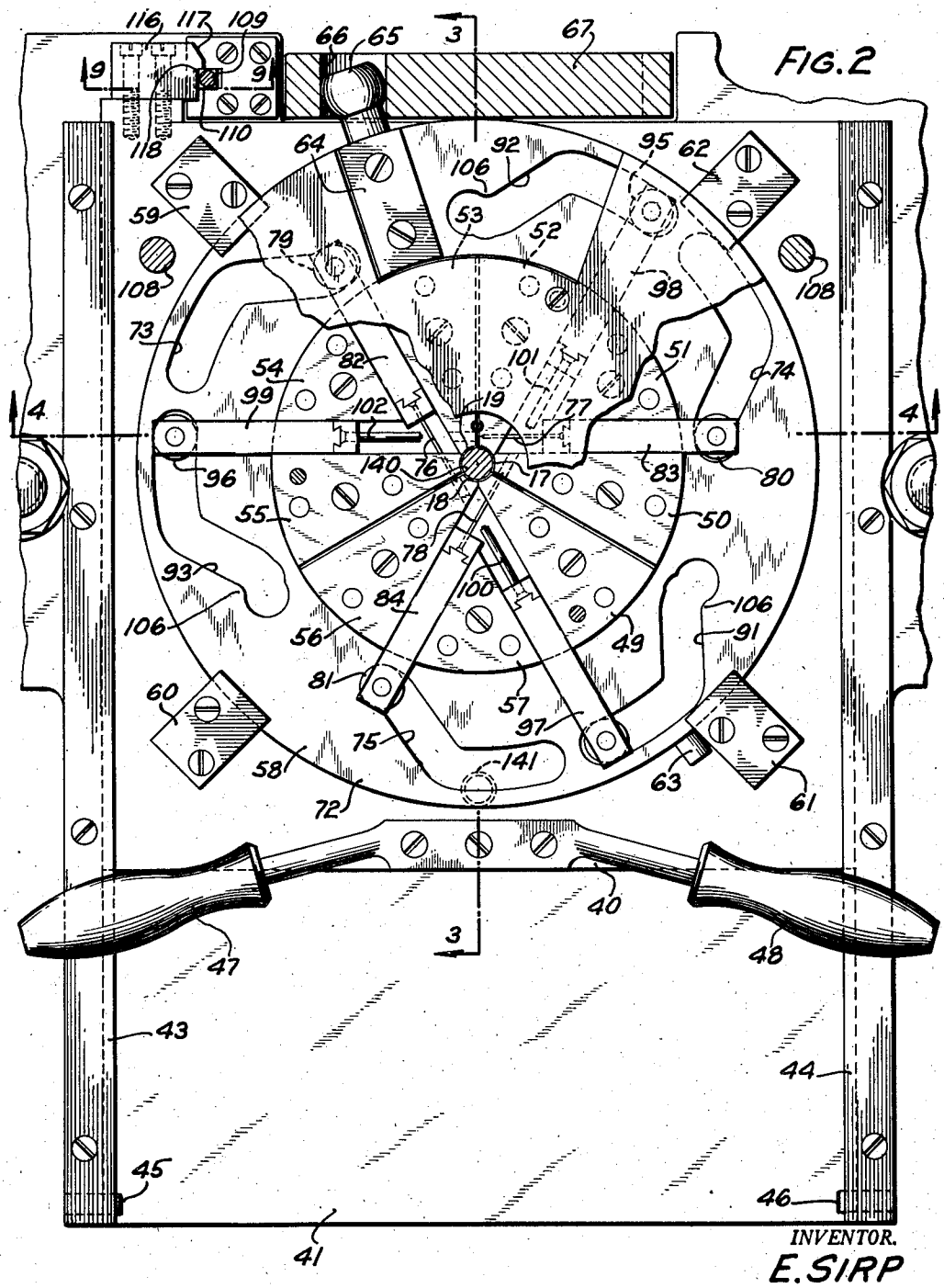
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ARTICLE ASSEMBLING APPARATUS

Filed June 17, 1943 5 Sheets-Sheet 2

FIG. 2



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ARTICLE ASSEMBLING APPARATUS

Filed June 17, 1943 5 Sheets-Sheet 3

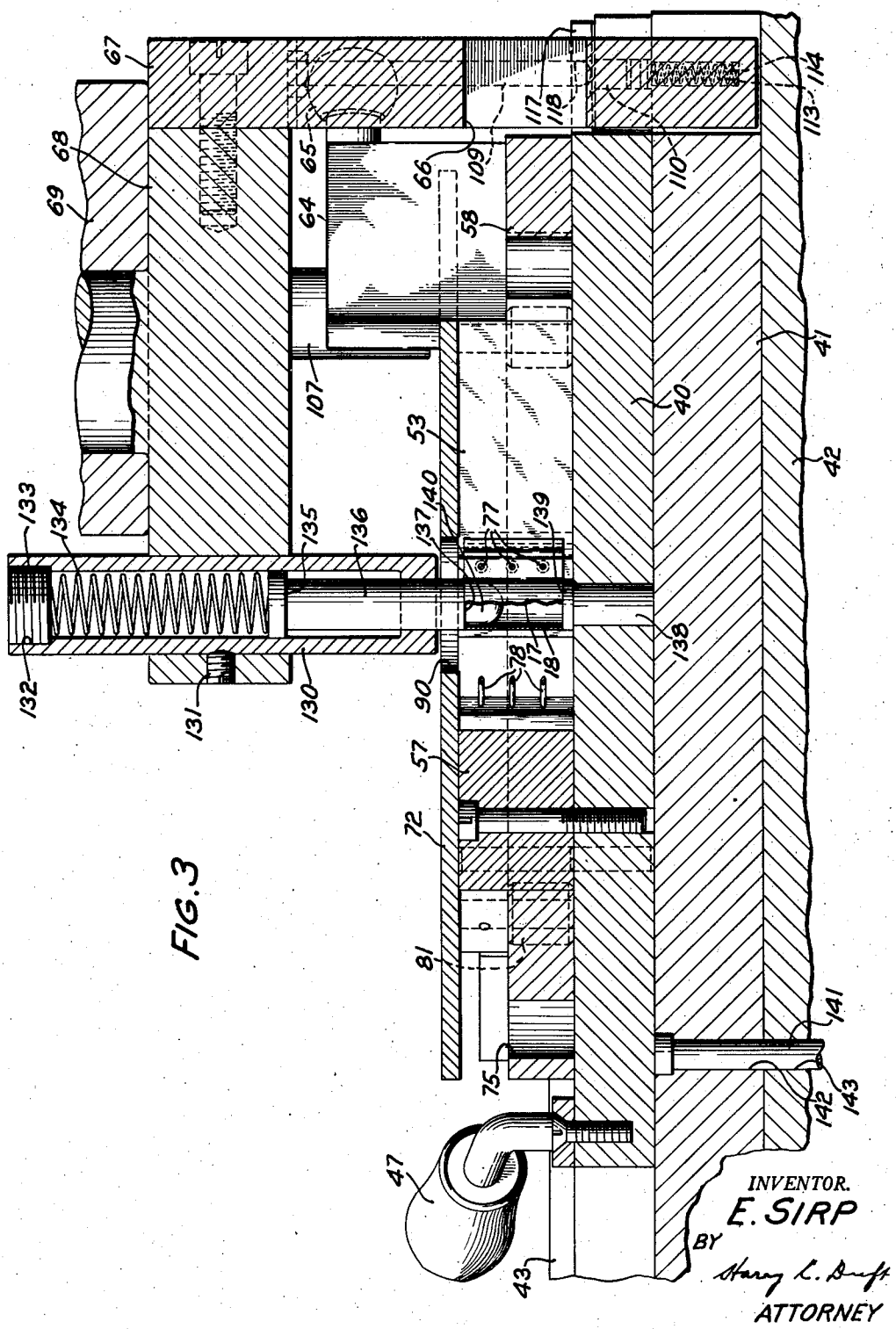


FIG. 3

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ARTICLE ASSEMBLING APPARATUS

Filed June 17, 1943 5 Sheets-Sheet 4

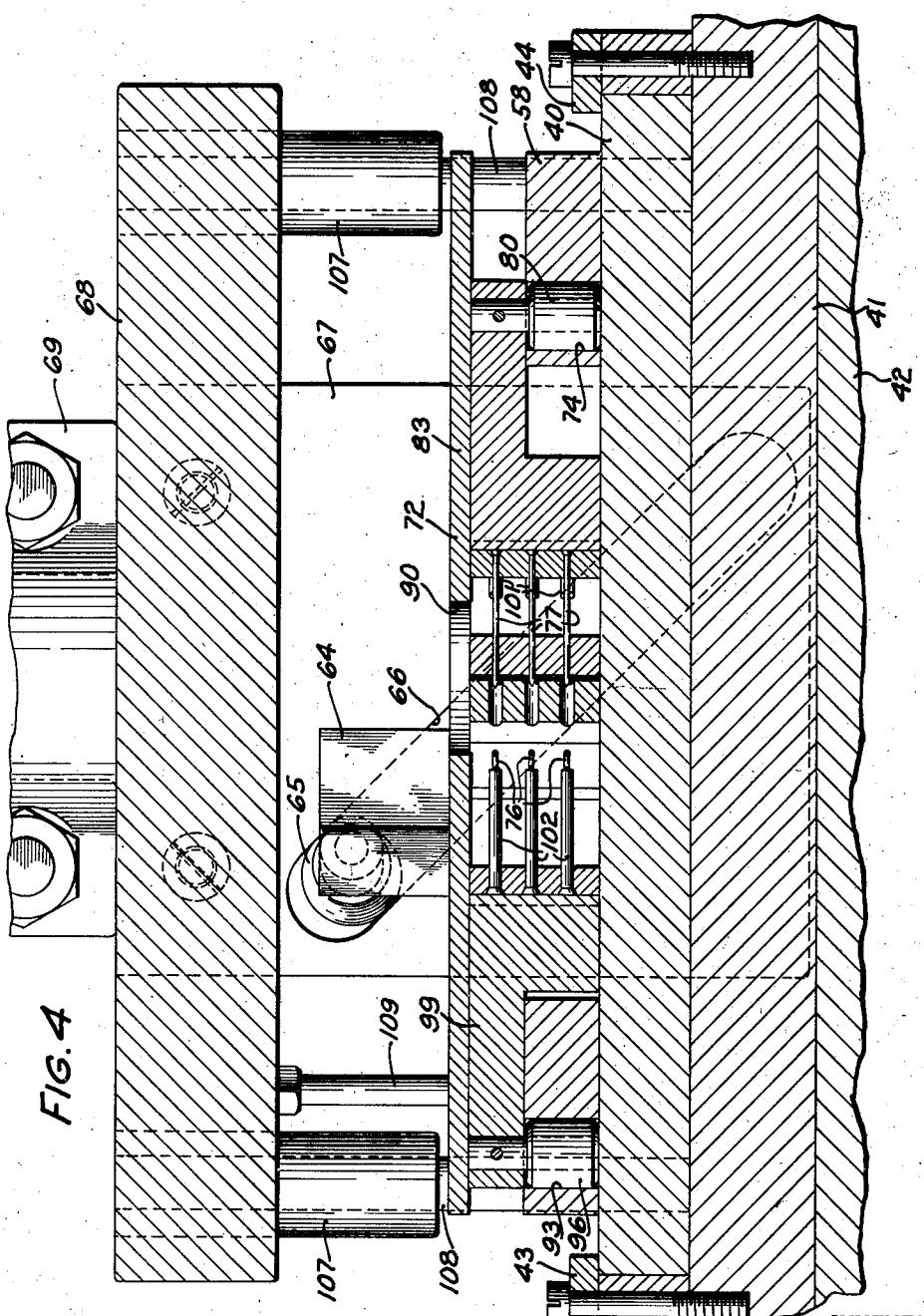


FIG. 4

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July 16, 1946. E. SIRP 2,404,197

ARTICLE ASSEMBLING APPARATUS

Filed June 17, 1943 5 Sheets-Sheet 5

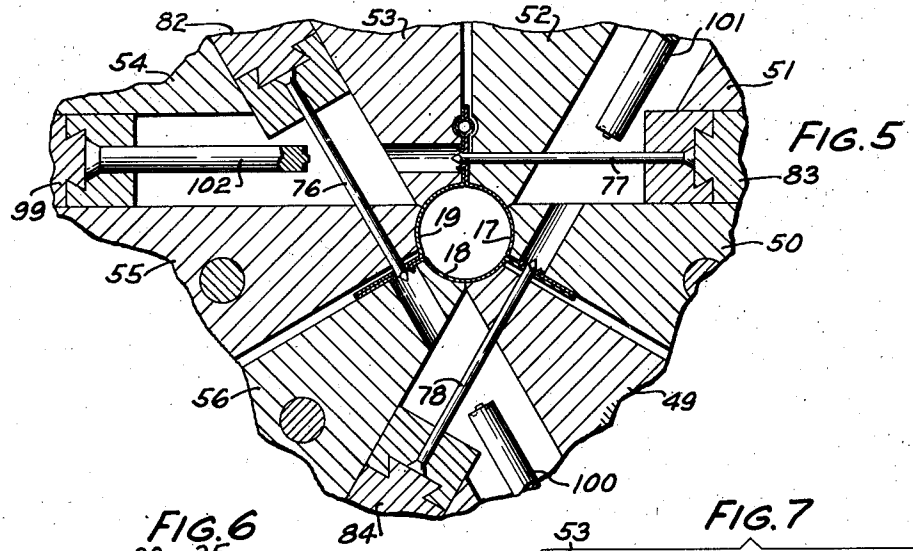


FIG. 5

FIG. 6

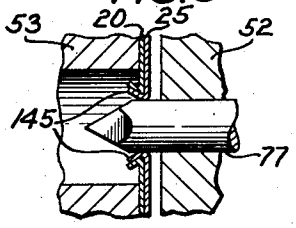


FIG. 8



FIG. 7

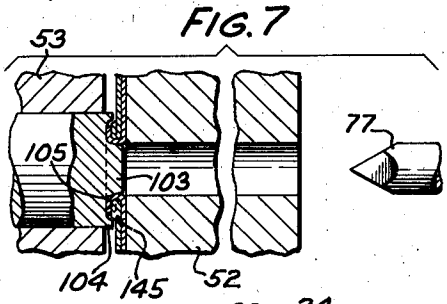


FIG. 9

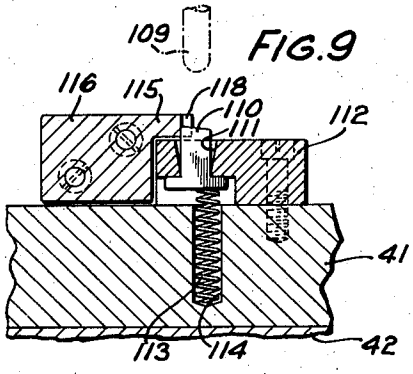


FIG. 10

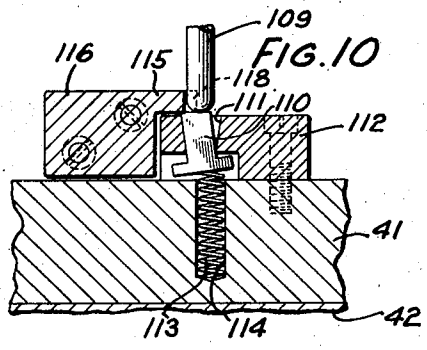


FIG. 11

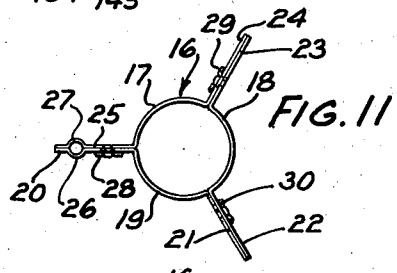
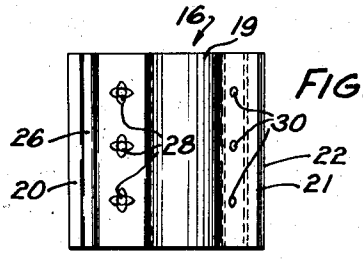


FIG. 12



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Patented July 16, 1946 2,404,197

UNITED STATES PATENT OFFICE

2,404,197

ARTICLE ASSEMBLING APPARATUS

Emil Sirp, Downers Grove, Ill., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York

Application June 17, 1943, Serial No. 491,129

7 Claims. (Cl. 113—1)

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This invention relates to article assembling apparatus and more particularly to apparatus for assembling the plate elements of vacuum tubes.

In some vacuum tubes, a tubular plate element having three equally spaced webs is formed from molybdenum. It has proven desirable to form these plate elements in three parts, each of the parts including an arcuate portion of the wall of the tubular plate element and two flanges extending outwardly radially at the end of the arc portion whereby the complete element may be assembled by attaching the flanges or webs together, preferably by staking the flanges.

It is an object of the present invention to provide a simple apparatus for expeditiously assembling the parts of a vacuum tube plate.

In accordance with one embodiment of the invention, a slidable fixture is provided, which is adapted to be slid across the bed of a punch press into position under the ram of the press. The fixture has mounted on it an annular oscillatable cam plate, carrying a cam roller for actuation by the punch press and having grooves therein for simultaneously driving three sets of staking tools and three sets of crimping tools which are slidable to work upon the extending webs or flanges of a three-part plate assembly whereby all of the staking operations are performed on the downstroke of the punch press and all of the crimping operations are performed on the upstroke of the ram of the press.

A better understanding of the invention may be had by reference to the following detailed description when considered in conjunction with the accompanying drawings, wherein

Fig. 1 is a plan view of the bed of a punch press with a portion of the cam roller actuating member mounted on the ram shown in section and with the slidable plate shown in its inoperative position prior to being slid under the ram of the press;

Fig. 2 is a view similar to Fig. 1 except that it shows the slidable plate in position under the ram of the press and shows the oscillatable cam plate carried by the slidable plate in its operated position;

Fig. 3 is a vertical sectional view taken substantially along the line 3—3 of Fig. 2 in the direction of the arrows;

Fig. 4 is a vertical sectional view taken substantially along the line 4—4 of Fig. 2 in the direction of the arrows;

Fig. 5 is a fragmentary plan sectional view on an enlarged scale taken through the center of the apparatus, as shown in plan in Fig. 2, showing the staking tools in their operative position;

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Fig. 6 is a still further enlarged view of a fragment of the mechanism shown in Fig. 5 and showing the contour of the staking tool in detail;

Fig. 7 is a fragmentary detailed view showing the crimping tool in its operative position and a portion of the staking tool in its retracted inoperative position;

Fig. 8 is an end view of the point of the staking tool;

Figs. 9 and 10 are fragmentary sectional views taken substantially along the line 9—9 of Fig. 2 in the direction of the arrows, showing a trip lock for the slidable plate in its operative and inoperative positions, respectively;

Fig. 11 is a plan view of the vacuum tube plate assembly which is formed in the apparatus; and

Fig. 12 is a side elevational view of the structure shown in plan in Fig. 11.

Referring to the drawings wherein like reference characters designate the same parts throughout the several views, particular reference being first had to Figs. 11 and 12, wherein the article assembled in the apparatus is shown in detail, it will be seen that the vacuum tube plate assembly 16 is comprised of three parts 17, 18 and 19. The parts each include a segment of a tube and outwardly extending ribs or flanges, the part 19 having flanges 20 and 21, the part 18 having flanges 22 and 23 and the part 17 having flanges 24 and 25. The flanges 21, 22, 23 and 24 all comprise flat extensions formed integrally with the parts 17, 18 and 19, whereas the flanges 20 and 25 have ridges 26 and 27, respectively, formed therein. When the plate assembly is staked together, as shown at 28, 29 and 30, the ridges 26 and 27 cooperate to form a passage in which a mounting post may be suitably secured.

The plate assembly 16 may be assembled and the various parts thereof attached together by staking them in the apparatus shown in plan view in Fig. 1, wherein a slidable plate 40 is shown mounted on a bed plate 41 suitably mounted on the upper surface of a bed 42 of a punch press. The slidable plate 40 extends under guide rails 43 and 44 suitably attached to the bed plate 41 and provided with stops 45 and 46 for limiting the movement of the slidable plate 40 toward the front of the machine. The slidable plate 40 is provided with a pair of handles 47 and 48 whereby the plate may be manipulated to move it from the position shown in Fig. 1 to the position shown in Fig. 2 and vice versa.

Suitably attached to the upper surface of the slidable plate 40 are a series of segmental plates

49, 50, 51, 52, 53, 54, 55, 56 and 57, around which there extends an annular oscillatable cam plate 58. The cam plate 58 is held down around the segmental plates 49 and 57 by a series of retainer blocks 59, 60, 61 and 62, one of which, that is, retainer block 61, also serves as a stop against which an abutment member 63 will strike to limit the oscillatory movement of the plate 58 in a counter-clockwise direction. Fixed to the oscillatable cam plate 58 is a cam roller supporting block 64, which carries freely rotatable at the end of it a cam roller 65 for engagement with a cam slot 66, which is, in turn, formed in a cam plate 67, attached to a head plate 68. The head plate 68 is, in turn, suitably mounted on a ram 69 constituting a part of the punch press mechanism which may be of any suitable construction. The block 64 oscillates between the edges 70 and 71 of a cut-out formed in a cover plate 72, which is attached to the upper surface of the segmental plates 49 to 57, and is notched to receive the retainer blocks 59, 60, 61 and 62.

When the block 64 is oscillated due to the engagement of the cam roller 65 with the cam slot 66, three cam slots 73, 74 and 75 formed in the cam plate 58 will serve to actuate three sets of staking pins designated as 76, 77 and 78, respectively. The cam slots 73, 74 and 75 have cam rollers 79, 80 and 81 extending into them for actuating cam slides 82, 83 and 84, respectively, on which the staking pins 76, 77 and 78, respectively, are fixed. The cam slides 82, 83, and 84 ride in the passageways formed by the segmental plates 53 and 54, 50 and 51, and 56 and 57, respectively, to engage the series of staking pins 76, 77 and 78, with the flanges 21 and 22, 20 and 25 and 23 and 24, respectively, which are held in position between the segmental plates 55 and 56, 53 and 52, and 49 and 50. It should be noted that the inner ends of the segmental plates 49 and 50, 52 and 53 and 55 and 56 are rounded slightly to receive the parts of the vacuum tube plate assembly and that these segmental plates are spaced apart slightly to permit the parts of the vacuum tube plate assembly to be inserted between them when the slidable plate 40 is in the position shown in Fig. 1, a central aperture 90 being provided for this purpose in the cover plate 72.

In addition to the cam slots 73, 74 and 75, the cam plate 58 has three cam slots 91, 92 and 93 formed in it in which ride cam rollers 94, 95 and 96, respectively. The cam rollers 94, 95 and 96 are mounted adjacent the end of cam slides 97, 98 and 99, all of the same construction, and carrying crimping tools 100, 101 and 102. The crimping tools are all of the same construction and have a guide projection 103 surrounded by an annular shoulder 104, which cooperate to define the operating face 105 of the tools. It should be noted at this time that the annular oscillatory cam plate 58 normally rests in the position shown in Fig. 1. In other words, the timing of the punch press is so arranged that the press will stop with the ram 69 slightly above its lowermost position. This mode of operation is provided since each of the cam slots 91, 92 and 93 is provided with a bumping projection 106 which engages the rollers 94, 95 and 96 to drive the crimping tools 100, 101 and 102 against the article being assembled twice, that is, once at the very end of the cycle of the press and once just before the end of the cycle of the press. In this manner, the parts of the tube element inserted in the apparatus when the slidable plate 40 is in the position shown in Fig. 1 will not be contacted by the crimping tools until they

have been staked by the staking tools. The method of staking and the crimping tools per se are described in detatil and claimed in the co-pending application of E. Sirp, Serial No. 491,128, filed June 17, 1943.

In addition to carrying the cam plate 67, the head plate 68 of the punch press carries a pair of guide sleeves 107—107, which cooperate with guide pins 108—108 extending upwardly from the slidable plate 40, thus to insure the proper alignment of the ram of the punch press and the mechanisms mounted on the slidable plate 40. Fixed to the underside of the head plate 68 is a release pin 109, which, as seen most clearly in Figs. 2, 9 and 10, is adapted to engage a latch member 110 at the bottom of the stroke of the punch press. The latch member 110 is seated in a tapered aperture 111 formed in a bracket 112 and is normally urged upwardly by a compression spring 113 to the position shown in Fig. 9. The compression spring 113 is seated in a pocket 114 and engages the latch member 110 eccentrically so that when the release pin 109 pushes the latch member 110 downwardly against the action of the spring 113, the latch member 110 will tilt and will catch under the shoulder 115 of a bracket 116 mounted on the rear end of the slidable plate 40. The bracket 116, as seen most clearly in Fig. 2, has a cam surface 117 formed on it, which, when the plate 40 is slid to the position shown in Fig. 2, will engage the latch member 110 and cam it aside to permit it to engage a surface 118 of the shoulder 115, thus to locate the slidable plate 40 in its rearmost position until the release pin 109 engages the latch member 110 and trips the latch member 110 to the position shown in Fig. 10. The features of this trip lock mechanism are described and claimed in the co-pending application of F. W. Vorreyer, Serial No. 491,127, filed June 17, 1943.

A tubular sleeve 130 is fixed in the head plate 68 by means of a set screw 131. The upper end of the tubular sleeve 130 is threaded, as shown at 132, to receive a plug 133, which serves to compress a spring 134 against a head 135 formed on a locating pin 136. The locating pin 136 has an annular shoulder 137 formed on it adjacent its lower end for engaging the upper surface of the parts 17, 18 and 19 of the vacuum tube plate assembly 16 to clamp them against a knockout pin 138, which extends through the slidable plate 40 and has a head 139 which rests on the upper surface of the slidable plate 40 to serve as a base on which the parts 17, 18 and 19 will rest when they are placed in position to be worked upon. Extending downwardly from the main body of the locating pin 136 is a rounded projection 140, which will be pushed into the center of the assembled parts 17, 18 and 19 to properly set them against the ends of the segmental plates 49, 50, 52 and 53, 55 and 56 when the ram of the press is moved downwardly. After a staking and crimping operation has been completed by the apparatus and the slidable plate 40 has been slid back to the position shown in Fig. 1, the knockout pin 138 will be directly above an actuator rod 141, which is freely slidable in aligned apertures 142 and 143 in the bed plate 41 and bed of the press 42. The actuator rod 141 may be manually operated to drive the knockout pin 138 upwardly to strip a vacuum tube plate assembly 16 from the apparatus after the parts thereof have been staked together.

A more complete understanding of the apparatus may be had by reference to the following

brief description of the mode of operation thereof. The three parts 17, 18 and 19 of the vacuum tube plate assembly may be placed in the position shown in Fig. 1, where the slidable plate 40 is in its position at the front of the bed plate 41. After the parts 17, 18 and 19 have been placed in position between the segmental plates 49, 50, 52, 53, 55 and 56, the operator may grasp the handles 47 and 48 and push the slidable plate 40 and all of the parts carried thereby back to the position shown in Fig. 2. As the slidable plate 40 approaches the end of its travel toward the rear of the machine, the cam surface 117 will strike the latch member 110 and will rock it slightly in a clockwise direction, compressing the spring 114 slightly. As the slidable plate 40 reaches the end of its movement toward the rear of the machine, the latch member 110 will snap back to the position shown in Figs. 2 and 9, thus to lock the slidable plate against movement toward the front of the apparatus until after the ram of the press drives the release pin 109 against the latch member 110 to shift it to the position shown in Fig. 10. With the slidable plate 40 locked in the position shown in Fig. 2, the guide pins 108 will be in direct vertical alignment with the guide sleeves 107 and the cycle of the punch press may be started. It should be noted at this time that the timing of the punch press is so arranged that its cycle stops with the ram of the press moved down slightly from its uppermost position. In other words, the cycle of the press stops with the cam roller 65 in the position shown in Fig. 1 and with the cam plate 67 in the position shown in Fig. 1.

After the plate 40 has thus been positioned beneath the ram of the punch press, the press may be operated to go through its complete cycle. When the plate 40 reached its rearmost position, the cam roller 65 was nested in the cam slot 66. Thereafter, as soon as the cycle of the punch press is started, the oscillatable cam plate 58 will move in a counter-clockwise direction from the position shown in Fig. 1 to the position shown in Fig. 2. In moving from the position shown in Fig. 1 to the position shown in Fig. 2, the cam plate 58 will, due to the interaction of the cam slots 73, 74 and 75 and their associated cam rollers 79, 80 and 81, drive the cam slides 82, 83 and 84 to the position shown in Fig. 2. In moving to the position shown in Fig. 2, the cam slides 82, 83 and 84 will drive the staking tools 76, 77 and 78 through the abutting flanges formed on the parts 17, 18 and 19. The effect of this action is illustrated in Fig. 6, where the staking tool 77 is in its farthermost operative position and wherein it has pierced the plates 25 and 20 and partially formed clinching webs, as shown at 145. As the punch press continues its cycle of operation, the cam plate 67 will move upwardly to shift the cam plate 58 in a clockwise direction until the cam slots 91, 92 and 93 cause the cam slides 97, 98 and 99, respectively, to move inward and clinch or crimp the webs 145, as shown in Fig. 7, the operating face 105 of the crimping tools 100, 101 and 102 serving to perform this function. The cycle of the punch press will, however, continue until the cam plate 58 rocks back to the position shown in Fig. 1 and, accordingly, the crimping tools 100, 101 and 102 will be pushed against the webs 145 a second time by the bumping projection 106 provided near the end of the cam slots 91, 92 and 93. As soon as the punch press completes its cycle of operation, the latch member 110 having been tripped by the releasing pin 109 at the bottom of the stroke of the punch press ram, the slidable plate may be slid to the front of the press by means of handles 47 and 48 and the actuator pin 143 may be operated manually to drive the knockout pin 138 upwardly. In moving downwardly, the punch press ram carried the locating pin 136 with it and the shoulder 137 on the locating pin serves to properly seat the parts 17, 18 and 19 on the head 139 of the knockout pin 138.

What is claimed is:

1. In an article assembling apparatus, means for supporting a plurality of article parts in position to be assembled, a cam plate encircling said supporting means and having a plurality of camming surfaces formed in it, a plurality of sets of opposed, coaxially reciprocatable assembling tools slidable in said supporting means and operable upon opposite sides of abutting article parts in said supporting means, cam means slidable in said supporting means and engaging said camming surfaces for actuation thereby, and means for oscillating said cam plate in opposite directions to separately actuate opposed tools, one tool of each set being operable on the parts in each direction of oscillation of the cam plate.

2. An article assembling apparatus comprising a support for parts of an article, a piercing tool mounted for reciprocation in said support and operable to pierce two abutting parts held in said support for displacing the material of said parts, a clinching tool in alignment with said piercing tool and mounted for reciprocation in said support to clinch the material of the abutting parts displaced by the piercing tool, an annular cam plate surrounding said support and oscillatable for alternately actuating the piercing and clinching tools, said cam plate in one direction of oscillation being operable to actuate the piercing tool and in the other direction being operable to actuate the clinching tool, and means to oscillate the cam plate.

3. An article assembling apparatus comprising a support for parts of an article, piercing and clinching tools mounted for reciprocation in said support, an annular cam plate surrounding said support and oscillatable for actuating the tools, and means to oscillate the cam plate, said cam plate having cams formed therein for actuating the piercing tools when the plate oscillates in one direction and other cams for actuating the clinching tools when the plate oscillates in both directions.

4. The combination of a punch press having a reciprocatory ram and a bed with an assembling means to be operated by the press comprising a support for parts of an article, piercing and clinching tools mounted for reciprocation in said support, an annular cam plate surrounding said support and oscillatable for actuating the tools, means connecting the cam plate and press ram to transmit motion from the ram to oscillate the cam plate, said cam plate having cams formed therein for actuating the piercing tools when the plate oscillates in one direction and other cams for actuating the clinching tools when the plate oscillates in both directions, and means on said ram for positioning parts to be operated on by said tools.

5. In an article assembling apparatus, a reciprocatory ram, a plate positionable beneath said ram, means for guiding the plate to position beneath the ram, means for positioning blanks to be assembled on said plate, cooperating tools reciprocably mounted in said positioning means,

an annular tool actuating cam surrounding said positioning means and operable to successively actuate said tools, and means on the ram for actuating said tool actuating cam, said tools being arranged in pairs to successively operate on the same area of the blank.

6. In an article assembling apparatus, a reciprocatory ram, a plate positionable beneath said ram, means for guiding the plate to position beneath the ram, means for positioning blanks to be assembled on said plate, tools reciprocably mounted in said positioning means, an annular tool actuating cam surrounding said positioning means, means on the ram for actuating said tool actuating cam, and a cam roller mounted on said tool actuating cam and engageable with the

means on the ram when the plate is positioned beneath the ram.

7. In an article assembling apparatus, a reciprocatory ram, a plate positionable beneath said ram, means for guiding the plate to position beneath the ram, means for positioning blanks to be assembled on said plate, tools reciprocably mounted in said positioning means, an annular tool actuating cam surrounding said positioning means and formed to actuate the tools in succession, and means on the ram for actuating said tool actuating cam, said tools being operable in automatic succession by the cam in response to the means on the ram travelling in both directions of its reciprocation by the ram.

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