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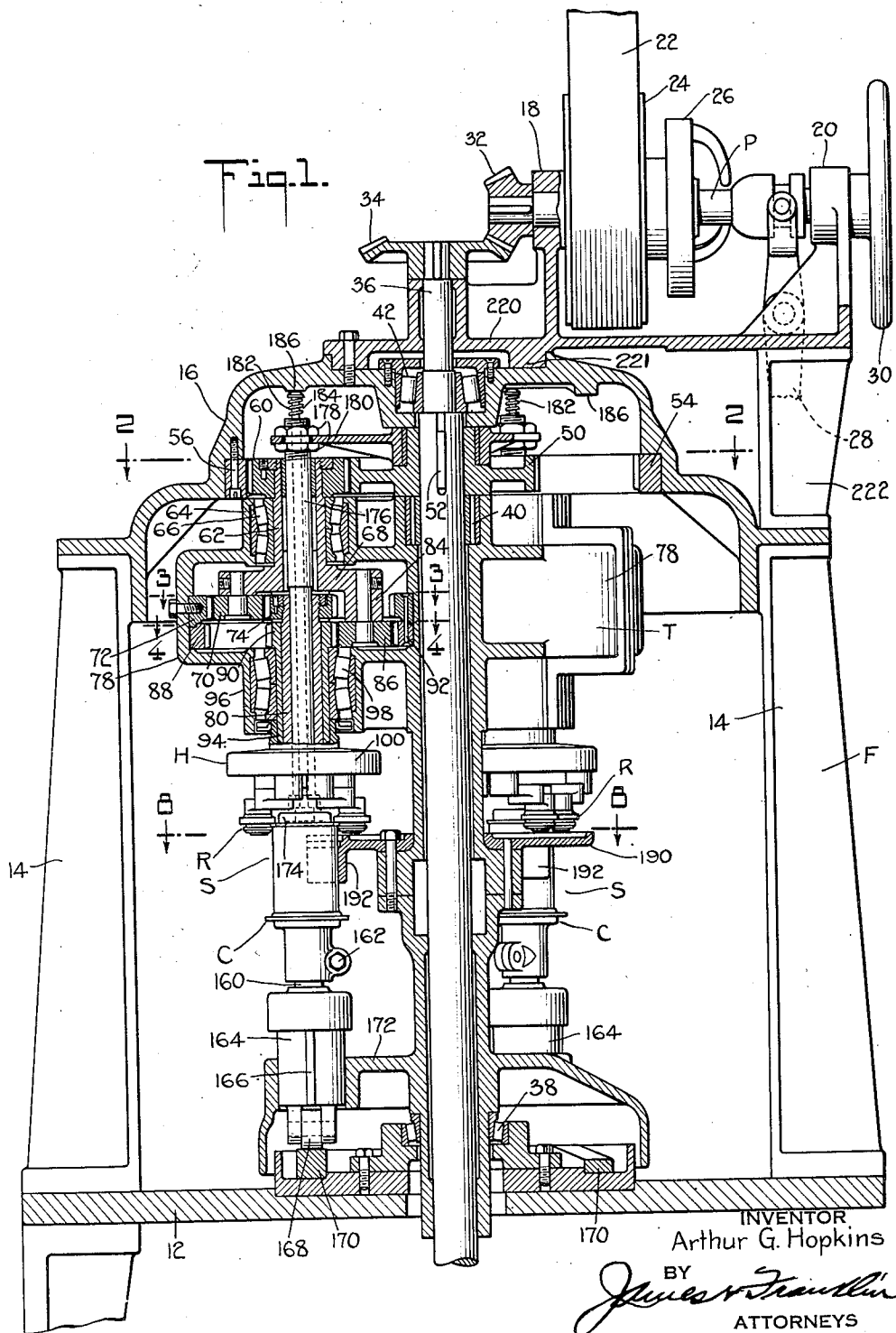
A. G. HOPKINS

1,989,518

SEAMING MACHINE

Filed July 25, 1933

4 Sheets-Sheet 1



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Fig. 2.

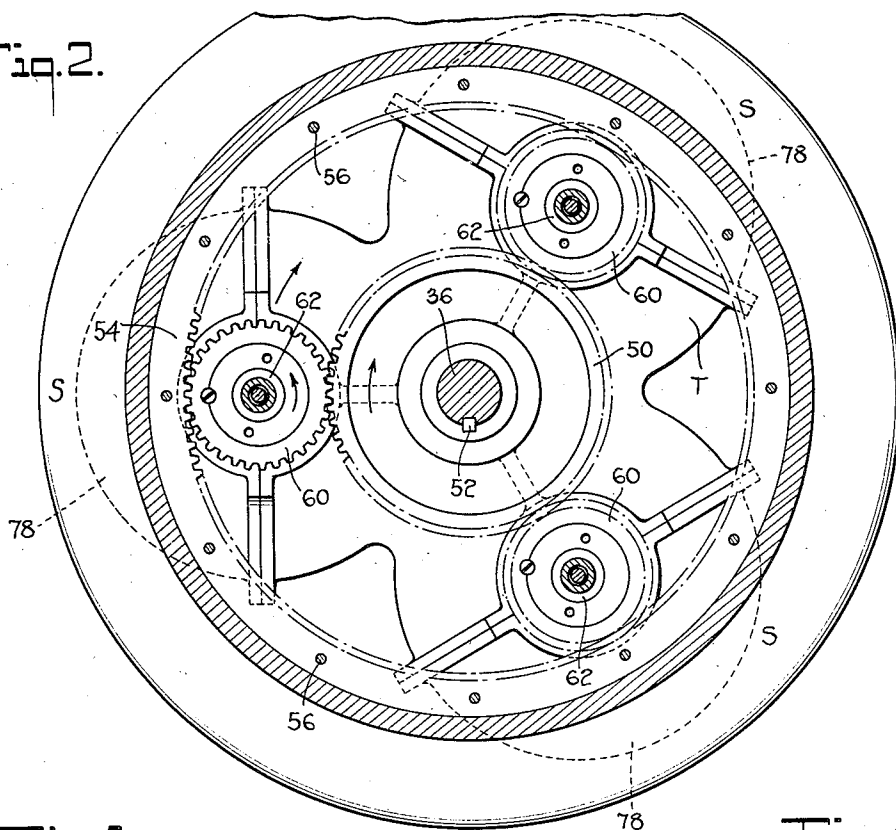


Fig. 3.

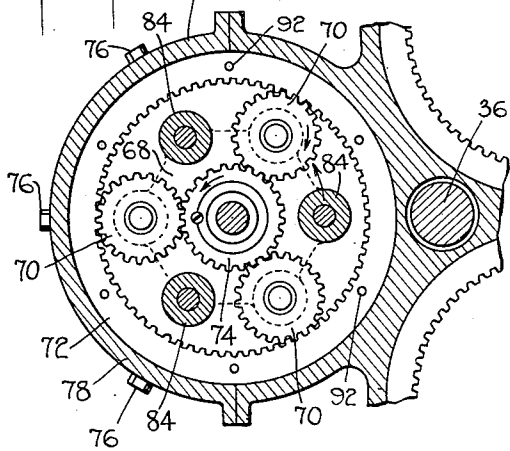
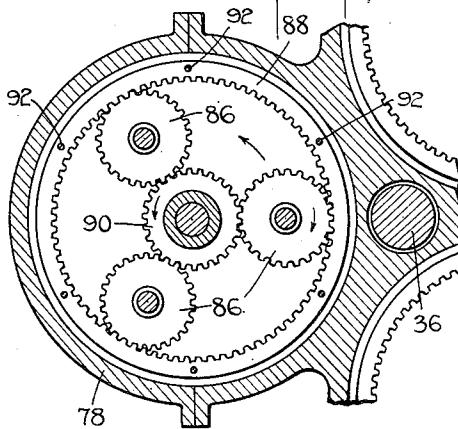


Fig. 4.



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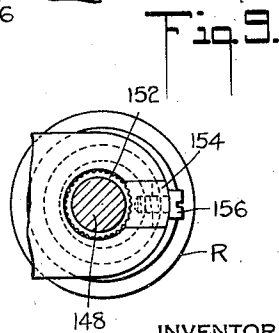
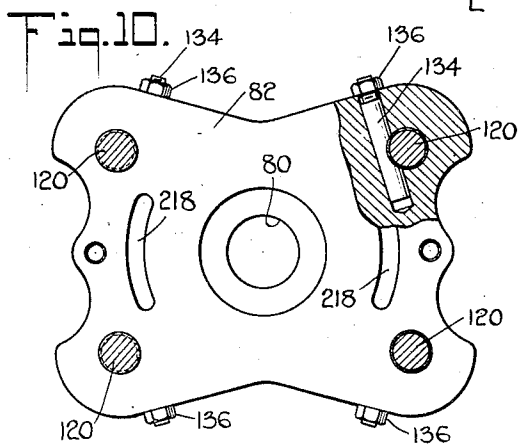
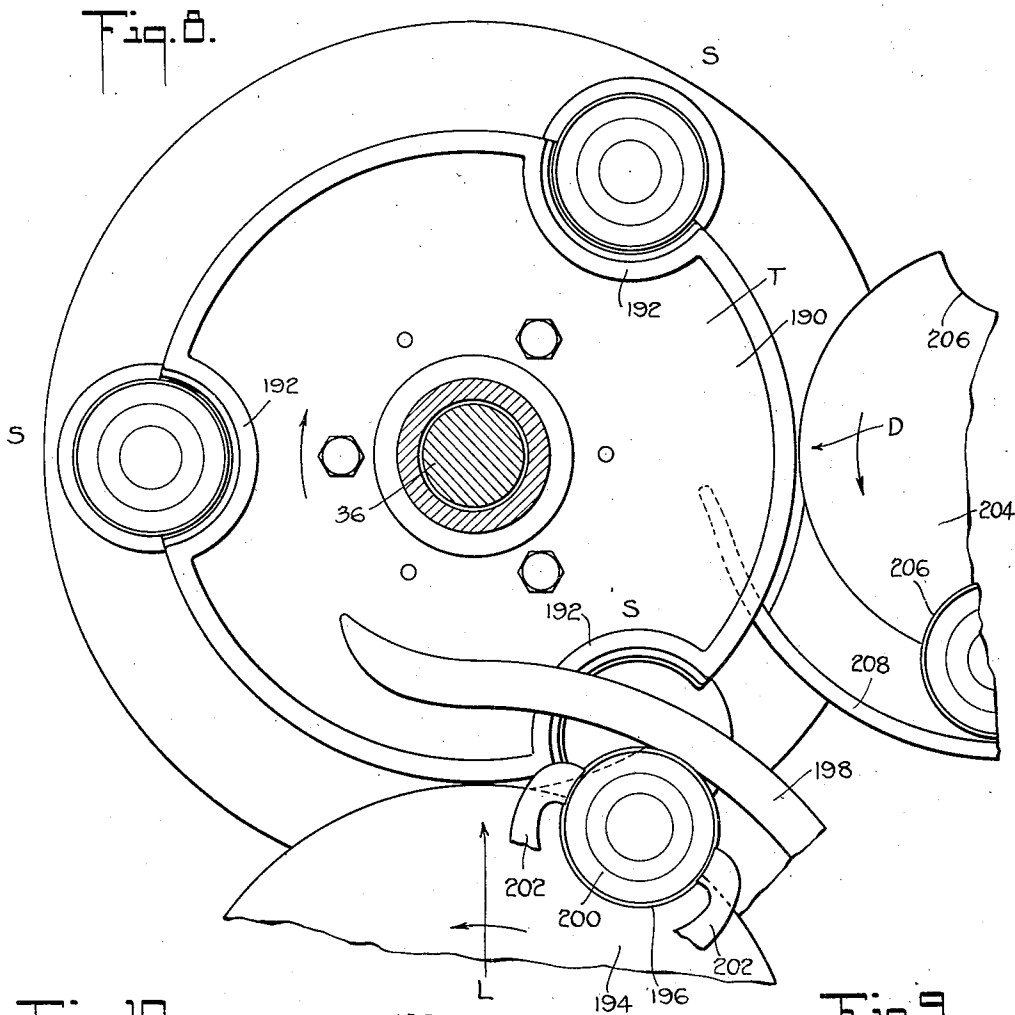
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SEAMING MACHINE

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4 Sheets-Sheet 4



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1,989,518

SEAMING MACHINE

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Application July 25, 1933, Serial No. 682,069

32 Claims. (Cl. 113—24)

This invention relates to seaming machines for metal cans, and more particularly to a high-speed can seaming machine of the turret type.

The object of the present invention is to generally improve seaming machines for closing and seaming metal cans and the like. More particular objects reside in the provision of an improved can seaming machine of the turret type which will be compact yet sturdy, all of the gears being relatively large and having ample tooth surface despite the compactness of the machine as a whole; which will be simple, having accessible parts, bearings of ample size, and utilizing nothing but spur gearing substantially throughout its mechanism, in contrast with the much more expensive helical, worm or bevel gearing frequently employed; which will operate at high speeds not only by reason of the multiplex or turret construction, but in actual rotative speed, this being made possible by perfect inherent balance of the rotating parts; and which will be adapted for efficient lubrication, most of the higher speed gearing being fully enclosed.

To the accomplishment of the foregoing and such other objects as will hereinafter appear, my invention consists in the seaming machine elements and their relation one to another, as hereinafter are more particularly described in the specification and sought to be defined in the claims. The specification is accompanied by drawings in which:

Fig. 1 is a section taken in elevation through a preferred form of machine embodying features of my invention;

Fig. 2 is a section taken in plan on the line 2—2 in Fig. 1, and shows the main planetary gear system;

Fig. 3 is a horizontal section taken in the plane of the line 3—3 in Fig. 1;

Fig. 4 is a horizontal section taken in the plane of the line 4—4 in Fig. 1;

Fig. 5 is an inverted plan view of the seaming head;

Fig. 6 is a vertical section through the seaming head, taken in the plane of the line 6—6 in Fig. 5;

Fig. 7 is a section in elevation through one of the seaming roller arms, it being taken in the plane of the line 7—7 in Fig. 5;

Fig. 8 is a horizontal section taken in the plane of the line 8—8 in Fig. 1 and showing portions of the feed and delivery mechanisms;

Fig. 9 is a detail taken in section in the plane of the line 9—9 in Fig. 7; and

Fig. 10 is a partially sectioned inverted plan view of the seaming roller plate.

Referring to the drawings, the seaming machine comprises a stationary frame F carrying a rotatable turret T provided with a plurality of can seaming stations S, each of said stations including an elevatable can table C and a seaming head H provided with seaming rollers R. The cans are supplied to the rotating turret T at a feed or loading station L (Fig. 8) and are delivered from the turret after the can top has been seamed to the can body at a delivery station D. Between the loading and delivery stations the can is held against rotation in the conventional manner while the seaming rollers rotate rapidly about the can, the first and second-operation seaming rollers being successively brought into engagement with the can and removed therefrom while the seaming head rotates relatively rapidly over the can. The entire machine is preferably driven from a single drive or propelling shaft P (Fig. 1).

It thus becomes necessary to appropriately interconnect the parts of the machine so that rotation of driving shaft P will cause rotation of the turret, rotation of the seaming head, and movement of the seaming rollers. In accordance with the present invention the various objects heretofore set forth are fulfilled by the use of planetary or epicyclic gear system throughout the machine, although it will be understood that the invention may be partially practiced by the use of some only of the planetary gear systems. More specifically, I employ a main epicyclic or planetary gear system lying approximately in the plane of the line 2—2 of Fig. 1 and best shown in Fig. 2, for rotating the turret and for providing a source of power at each of the seaming stations for driving its seaming head, and auxiliary planetary gear systems lying approximately in the planes of the line 3—3 or 4—4 of Fig. 1 and best shown in Figs. 3 and 4 of the drawings, for rotating the seaming rollers and for controlling the movement thereof toward and from the can. The present invention further comprehends a simplified seaming head providing pairs of diametrically opposed first and second-operation seaming rollers and controlling the movement of all of said rollers by a single relatively simple cam, this simplified seaming head being clearly shown in Figs. 5, 6 and 7 of the drawings.

Considering the apparatus in greater detail, the frame F includes a base the top plate of which is shown at 12 and on which there are rigidly mounted pedestals or standards 14 which may, if desired, be interconnected to form a continuous housing extending around the machine

but clearing the loading and delivery stations, and on top of which there is mounted a head 16. Head 16 is provided with bearings 18 and 20 carrying the preferably horizontal drive or propelling shaft P. The latter is externally driven through appropriate means, such as the belt 22 running on pulley 24 and forming the driving portion of a clutch 26 which may be engaged by manipulation of lever 28, thereby rotating the drive shaft. An appropriate hand wheel 30 may be provided on the drive shaft, permitting manual movement of the machine when adjusting or working on the same.

The inner end of drive shaft P carries a bevel pinion 32 meshing with a bevel gear 34 mounted at the upper extremity of a vertical drive shaft 36 which extends downwardly through the center of turret T but which is rotatable independently of the turret.

The turret T is rotatable about the axis of vertical shaft 36 and is borne partially independently of and partially on the said shaft 36. Specifically, the turret is carried at its lower end by a taper bearing 38 which takes the weight or downward thrust of the turret as well as any side thrust. The upper end of the turret is provided with a roller bearing 40 surrounding shaft 36, and the latter is in turn supported in head 16 of frame F by an appropriate taper bearing 42.

The turret is rotated by a system of epicyclic or planetary gearing best shown in Figs. 1 and 2 of the drawings. This system includes a sun gear 50 keyed at 52 to the vertical shaft 36, a fixed internally toothed ring gear 54 secured by appropriate bolts 56 to the head 16 of the machine frame, and a plurality of planet gears 60 rotatably mounted on turret T. It will be evident that upon rotation of vertical shaft 36, the resulting rotation of sun gear 50 will cause the planet gears 60 to rotate on their axes and to revolve about shaft 36. The latter revolution of the planet gears about the sun gear is taken advantage of to rotate the turret, while the rotation of each of the planet gears may be employed as a source of power to drive the seaming head at each station. For this reason I prefer to provide as many planet gears, in this case three, as there are seaming stations, and to locate each planet gear at its corresponding seaming station.

The rotation of the planet gear may be stepped up and applied to its seaming head in any desired manner, but I prefer to accomplish the sought-for result by the further use of epicyclic or planetary gear systems, as will next be described. Referring to Fig. 1, the planet gear 60 is secured to a sleeve or hollow shaft 62 borne in a bearing housing 64 on turret T by taper bearings 66 and rigidly secured to or, more preferably formed integrally with a train arm plate 68 carrying one or more planet gears 70 meshing with an internally toothed fixed ring gear 72 and a rotatable sun gear 74. The relation of planet gears 70, fixed gear 72, and sun gear 74, as well as the manner in which fixed gear 72 is locked in turret T by bolts 76, will be evident from an inspection of Fig. 3. It will also be noted, particularly by reference to Figs. 1, 2, 3, and 4 that the turret T at this point has a clover leaf formation, providing three separate and fully enclosed housings 78 for the planetary gear system now being described.

Reverting to Fig. 1 and referring at the same time to Fig. 6, the sun gear 74 is secured to the

upper end of a sleeve or hollow shaft 80 which extends downwardly to the seaming head H and which rigidly carries, as by being formed integrally therewith, a seaming roller plate 82 which in turn carries the seaming rollers R. On reflection, it will be evident that during the rotation of the turret the concomitant rotation of the planet gear 60 of the main epicyclic system causes rotation of the train arm plate 68 and revolves the planet gears 70. These, being in mesh with fixed gear 72, are caused to rotate and in turn produce a relatively rapid or stepped-up rotation of sun gear 74, which in turn rotates the seaming roller plate 82 and thus causes the seaming rollers R to run rapidly around the can being seamed.

In order to move the seaming rollers R toward and from the can, the seaming head is provided with a cam which, for simplicity, is rotated with the seaming rollers but at a slightly different speed in order to produce slow relative rotation of the seaming rollers and the cam, which relative rotation is advantageously employed to obtain the desired camming action. For this purpose I find it particularly convenient to employ still another planetary gear system quite similar to that last described but differing slightly therefrom in gear ratio. Referring to Figs. 1, 4 and 6, the train arm plate 68 is provided with three bosses 84 conveniently located between planet gears 70, as is best shown in Fig. 3, and each carrying a planet gear 86. The planet gears 86 mesh with a fixed internally toothed ring gear 88 and a rotatable sun gear 90. Ring gear 88 is secured to the turret compartment 78, as by being riveted by rivets 92 to ring gear 72. Sun gear 90 is secured to or, more preferably, formed integrally with a sleeve or hollow shaft 94 which extends downwardly from the sun gear to the seaming head. The sleeve 94 is carried in a depending bearing housing 96 carrying taper bearings 98. It will be evident that the planet gears 70 and 86 of both epicyclic systems will be simultaneously revolved and that they will both produce a stepped-up rotation of sun gears 74 and 90, but, as has already been mentioned, the gear ratios are made slightly different to produce a slight or slow relative rotation of the depending sleeves 80 and 94, which is then employed in the seaming head H, as will next be described.

Seaming head H is best described with reference to Figs. 5 through 10, referring to which, the head comprises not only the seaming roller plate 82 carrying the seaming rollers R as already mentioned, but also a cam 100 which moves the seaming rollers toward or from the can being seamed. In the present case there are four seaming rollers 102, 104, 106, and 108, of which two preferably diametrically opposed rollers, in this case the rollers 104 and 108, are first-operation seaming rollers, while the other two preferably diametrically opposed rollers, in this case rollers 102 and 106, are second-operation seaming rollers. The seaming rollers are all carried on seaming roller arms 112, 114, 116, and 118 which are pivotally secured to seaming roller plate 82 by bearing pins 120. The seaming roller arms carry at their opposite ends appropriate cam followers 122, 124, 126, and 128 which ride in a single continuous cam groove 130 cut in the lower face of cam 100. The cam groove or channel 130 is preferably made of constant width, thereby providing positive movement of the seaming rollers in both directions. When the cam groove is of small radius the seaming rollers are moved outwardly or away from the can, whereas when the cam

groove is of large radius the seaming rollers are moved inwardly or into engagement with the can. It will be evident from an inspection of Fig. 5 of the drawings that the first and second-operation 5 seaming rollers are moved successively into and out of engagement with the can; that both first-operation rollers are moved inwardly and outwardly simultaneously; that both second-operation rollers are moved inwardly and outwardly simultaneously; that at one period all of the rollers are moved outwardly, thus permitting the introduction of a new can to be seamed or the removal of an already seamed can; and that the entire seaming operation takes place in the course of 10 about a half revolution of the cam relative to the seaming roller plate. Accordingly, with this particular construction of seaming head, the difference in gear ratio of the two planetary systems in turret compartment 78 should preferably produce a half rotation of the cam relative to the seaming roller plate during the seaming operation.

Considering some of the details of the seaming head, it will be observed from inspection of Fig. 7 that the seaming roller arm 112 is preferably 25 mounted on bearing pin 120 through intermediate ball bearings 132, and that the pin 120, which is preferably screwed into bearing plate 82, may be locked by a lock bolt 134.

This construction is best shown in Fig. 10, in 30 which it will be noted that pin 120 may be jammed against rotation by lock bolt 134 upon tightening of the nut 136. Reverting to Fig. 7, it will be noted that cam follower 122 is carried on ball bearings 138 held by a bearing pin 140 threaded into lever 112 and there locked by set screw 142.

The seaming roller R is adjustable by eccentric mechanism best shown in Figs. 7 and 9. The seaming roller is rotatable on a bearing bolt 144 having eccentrically related portions 146 and 148. 40 The portion 146 carries the seaming roller, preferably through intermediate ball bearings not shown in the drawings, while the portion 148 is received in a mating hole in the seaming roller arm. It will be evident that because of the eccentric relation of the portions 146 and 148 of the bearing bolt, rotation of the bolt causes a slight movement of the seaming roller relative to the seaming roller arm and thus permits adjustment 45 of the seaming roller pressure. The bearing bolt may be locked not only by tightening the nut 150 but more positively by the cooperation of serrations or teeth 152 formed at the upper end of the portion 148 of the bolt against which a clamping piece 154 having mating serrations or teeth may 50 be forced by a lock screw 156.

The remainder of the machine may, if desired, be relatively conventional, but, for the sake of completeness, the preferred construction here employed will be described. Reverting to Fig. 1, the 60 can is carried on a can table C the elevation of which may be adjusted to accommodate different heights of can by moving the same relative to stud 160, the adjustment being locked by a clamp bolt 162. Stud 160 is carried by vertically reciprocable cylinder 164 preferably locked against rotation by a key 166 and carrying at its lower end a cam follower 168 which rolls on a circular cam track or ring 170 fixedly mounted on the base of the machine. The cylinder 164 is carried in an 70 outwardly flaring base portion 172 of turret T. It will thus be evident that the can tables C are carried around with the turret and are elevated to clamp the can or lowered to release the can at appropriately timed intervals determined by the rise and fall of cam track or ring 170. 75

As will be understood by those skilled in the art, the can with its superposed cover are moved upwardly by the can table against a mating chuck 174 which is located at the seaming head but which does not rotate therewith, it instead re- 5 maining stationary with the can and in fact having the can cover compressed tightly against its periphery during the seaming operation. The chuck 174 is mounted at the lower end of a tubular member 176 which passes axially through the 10 gear mechanism of the seaming station, and the upper end of which is threaded and anchored by nuts 178 on one arm of a spider plate 180 which in turn is freely rotatable about the hub of the main sun gear 50. The spider plate 180 rotates with 15 and in effect forms a part of the turret T, although it is not rigidly secured thereto, and it forms a means, through adjustment of nuts 178, of determining the elevation of chuck 176 and of supporting the chuck in position. 20

To insure freeing of the seamed can from the chuck at the end of the seaming operation, the machine is preferably provided with a knockout bar the upper end of which is clearly shown at 182 and which passes downwardly through the tubular member 176 to the chuck 174. The knock- 25 out rod is normally held in elevated position by a spring 184. The head of the knockout rod acts as a cam follower riding in contact with a top cam track or ring 186 secured to the interior of head 16 of the machine. It will be evident that at an appropriate point the cam track 186 may be depressed, thereby forcing the knockout rod downwardly and causing the bottom end thereof to strike the top of the seamed can and to forcibly 35 separate it from the chuck.

The turret T is provided at an intermediate point with a tray-like guard member 190 provided at each of the seaming stations with a pocket 192 for receiving and helping to support 40 the can body. The tray 190 as well as the pockets 192 are further shown in Fig. 8, and, referring to that figure, portions of the loading mechanism L and delivery mechanism D are also shown. These will not be described in detail for they are more fully disclosed in my copending divisional application Serial No. 682,070 filed concurrently herewith. However, it may be briefly stated that a feed turret 194 is employed, preferably equal in diameter and rotative speed to the seaming machine turret T and provided with an equal number of can pockets 196. The pockets 192 and 196 move in synchronism and provide a transfer of the can body from turret 194 to turret T in a smooth manner permitting high-speed operation. 55 The feed mechanism may further include a guide bar 198 which is effective until the can is clamped in the seaming machine turret by elevation of the can table. In accordance with an important feature of the invention described in my aforesaid copending application, the can cover 200 is applied to the can before the can is delivered to seaming machine turret T, and for this purpose the can cover or top is independently held by fingers 202 forming a part of the feed turret 194 and holding the can top securely on the can body. 65

The cans are taken from the seaming machine turret T by a delivery turret 204 provided with appropriate can pockets 206 and cooperating with a suitable guide rail 208. The feed and delivery turrets 194 and 204 may be driven through appropriate gearing from the vertical drive shaft 36, and it is for this reason that the lower end of the 75

shaft is extended downwardly in the manner shown in Fig. 1.

While the can feed mechanism may be and preferably is provided with appropriate mechanism for insuring that each can is provided with a cover and that no cover is provided unless there is a can to be topped, I prefer to add to the present machine additional safety stops best shown in Figs. 5 and 6 of the drawings. Referring to these figures, the seaming roller plate 82 carries a pair of depending stop members 210 each having a stop flange 212 appropriately dimensioned and positioned to engage the top of a can even should the can reach the machine without a cover and then be elevated by the can table. This prevents the chuck from even slightly entering the can and thus becoming soiled by the can contents. The safety stops 210 are secured to plate 82 by bolts 214 and are additionally held in position by tongues 216 which enter mating recesses 218 in the seaming roller plate 82, the said recesses 218 being best shown in Fig. 10 of the drawings.

One of the features of the present invention resides in the convenience with which the drive, as through the belt 22, may be accommodated to differences in the preferred mounting of the machine. Thus, reverting to Fig. 1 it will be noted that the head 16 of the frame F carries a top casting 220 by which the horizontal drive shaft P is supported. This top casting is received on the head by a circular flange 221 concentric with the vertical shaft 36 so that the top casting 220 may be rotated on the head. If desired, an additional support 222 may be provided, and in such case the support 222 is, of course, moved with the top casting and in effect forms a part thereof. It will thus be seen that the direction of the drive shaft P may be altered as desired relative to the frame F, which is convenient, for the position of the frame F is frequently determined by necessary or preferred location of the loading and delivery stations.

In a particular case the gear ratios of the several epicyclic systems were so selected that several revolutions of the vertical drive shaft 36 produced a single revolution of the turret, which in turn was accompanied by a larger number, say, sixteen revolutions of the seaming rollers. The difference in gear ratio between the planetary systems for the seaming roller head and the cam was so selected as to produce sixteen and one-half revolutions of the cam during sixteen revolutions of the seaming rollers, or one-half revolution of one relative to the other, during one revolution of the turret.

This half revolution need not be and preferably is not fully employed for active operation of the seaming rollers. It will be evident that a portion only of the full revolution of the turret is available for the seaming operation, first, because of the necessary spacing between the loading station L and the delivery station D (see Fig. 8), and secondly, because of a necessary period after loading to permit the can table to rise and clamp the can in position, and a period before delivery to permit lowering of the can table and actuation of the knockout rod to free the can from the chuck. The small radius portions of the cam extend peripherally for a greater distance than the large radius portions of the cam, thereby providing a substantial dwell period in which all of the seaming rollers are moved outwardly and are free of the can.

Of course, ample time for operation of the seaming rollers is available for the reason that

the first-operation rollers need not be moved fully away from the can before the second-operation rollers begin to move inwardly. The roller or cam movement may be divided into three portions, an approach, a seaming portion, and a departure. It is obvious that only the actual seaming portions of the first and second-operation rollers need be displaced from one another, for the second-operation roller may approach during the seaming portion of the first-operation roller, and may seam during the departure of the first-operation roller.

It is believed that the mode of constructing and using, as well as the many advantages of my improved seaming machine, will be apparent from the foregoing detailed description thereof. The machine is compact, sturdy, and simple. Except for one pair of bevel gears the gearing throughout is simple spur gearing which is the cheapest to manufacture and the strongest in use. While the machine is compact, ample room is provided for gears of generous tooth area and large bearings which, for the most part, are taper, roller, or ball bearings. The machine is particularly adapted for high-speed operation because the planetary gear arrangement here employed inherently provides a perfect balance of all rotating parts about their axes of rotation. The planetary gear arrangement further balances the gear thrusts and eliminates wear and vibration. The high-speed parts of the gearing are fully enclosed and may be run in a bath of oil carried, for example, in the compartments 78 of the turret. The usual functions and necessary adjustments for the various parts of the machine are all provided for in an effective and accessible manner. The seaming head is itself extremely simple, sturdy, and fool-proof in operation.

It will be apparent that while I have shown and described my invention in preferred form, many changes and modifications may be made in the structure disclosed without departing from the spirit of the invention, defined in the following claims.

I claim:

1. A seaming machine comprising a stationary frame, a rotatable turret, seaming mechanism, carried by the turret, and a planetary gear system including a sun gear, a ring gear, and a planet gear meshing with said sun gear and ring gear and rotatably mounted on said turret, and means operatively connecting the planet gear with the seaming mechanism.

2. A seaming machine comprising a stationary frame, a rotatable turret, seaming mechanism, carried by the turret, and a planetary gear system including an externally driven sun gear, a ring gear fixed on said frame, and a planet gear meshing with said sun gear and fixed gear and rotatably mounted on said turret, and means operatively connecting the planet gear with the seaming mechanism, whereby revolution of the planet gear about the sun gear causes rotation of the turret, and rotation of the planet gear drives the seaming mechanism.

3. A seaming machine comprising a stationary frame, a rotatable turret, a plurality of seaming stations, carried by the turret and a planetary gear system including an externally driven sun gear rotatable concentrically with the turret, a ring gear fixed on said frame, and a plurality of planet gears meshing with said sun gear and fixed gear and rotatably mounted on said turret at each of the seaming stations, seaming mechanism at each of the stations, and means operatively con-

necting the planet gear at each station with the seaming mechanism of that station, whereby revolution of the planet gears about the sun gear causes rotation of the turret, and rotation of each planet gear drives its connected seaming mechanism.

4. A seaming station comprising means to support a can, a rotatable seaming head including a seaming roller support with seaming rollers and means for moving said seaming rollers toward and from the can, means driving said seaming roller support including a planetary gear system having a fixed ring gear, a rotatable and revoluble planet gear, and a rotatable sun gear connected to the seaming roller support, and externally driven means for revolving the planet gear about the axis of the sun gear.

5. A seaming station comprising means to support a can to be seamed, a rotatable seaming head including a rotatable seaming roller support carrying seaming rollers, and a rotatable cam for moving said seaming rollers toward and from the can, means for driving said seaming head including two planetary gear systems having ring gears, planet gears, and sun gears, a driven gear of one of said systems being connected to the seaming roller support, and a driven gear of the other of said systems being connected to the cam, and a single means for simultaneously rotating the driving gears of both gear systems, the gear ratios of the two systems being slightly different in order to provide a slow relative rotation of the seaming roller plate and cam concomitant with rapid rotation of the seaming head.

6. A seaming station comprising means to support a can to be seamed, a rotatable seaming head including a rotatable seaming roller plate carrying seaming rollers, and a rotatable cam for moving said seaming rollers toward and from the can, means for driving said seaming head including two planetary gear systems each having fixed ring gears, rotatable revoluble planet gears and rotatable sun gears, the sun gear of one of said systems being connected to the seaming roller plate, and the sun gear of the other of said systems being connected to the cam, and externally driven means for simultaneously revolving the planet gears of both gear systems, the gear ratios of the two systems being slightly different in order to provide a slow relative rotation of the seaming roller plate and cam concomitant with rapid rotation of the seaming head.

7. A seaming station comprising means to support a can to be seamed, a seaming head including a rotatable seaming roller plate carrying four oscillatable seaming roller arms, alternate arms having first-operation seaming rollers and the intermediate arms having second-operation seaming rollers, a rotatable cam having a single cam groove receiving cam followers mounted on all four seaming roller arms, the cam groove being symmetrical and so designed as to move the first and second-operation seaming rollers successively into and out of engagement with the can in the course of a part revolution of the seaming roller plate relative to the cam, and driving means to rotate the seaming roller plate and the cam at different relatively high speeds differing only sufficiently to provide the desired part relative rotation in the course of a seaming operation.

8. A seaming station comprising means to support a can, a seaming head including a rotatable seaming roller plate carrying a plurality of movable seaming roller supports, some supports hav-

ing first-operation seaming rollers and other supports having second-operation seaming rollers, a rotatable cam having a single cam groove receiving cam followers mounted on the seaming rollers supports, and means for driving said seaming head including two planetary gear systems each having ring gears, planet gears, and sun gears, a driven gear of one of said systems being connected to the seaming roller plate, and a driven gear of the other of said systems being connected to the cam, and a single means for simultaneously rotating the driving gears of both gear systems, the gear ratios of the two systems being slightly different in order to provide slow relative rotation of the seaming roller plate and cam.

9. A seaming station comprising means to support a can, a seaming head including a rotatable seaming roller plate carrying oscillatable seaming roller arms, some arms having first-operation seaming rollers and other arms having second-operation seaming rollers, a rotatable cam having a single cam groove receiving cam followers mounted on the seaming roller arms, the cam groove being so designed as to move the first and second-operation seaming rollers successively into and out of engagement with the can, and means for driving said seaming head including two planetary gear systems each having fixed ring gears, rotatable planet gears and rotatable sun gears, the sun gear of one of said systems being connected to the seaming roller plate, the sun gear of the other of said systems being connected to the cam, and externally driven means for simultaneously rotating the planet gears of both gear systems, the gear ratios of the two systems being slightly different in order to provide slow relative rotation of the seaming roller plate and cam.

10. A seaming station comprising means to support a can to be seamed, a seaming head including a rotatable seaming roller plate carrying four oscillatable seaming roller arms, two diametrically opposed arms having first-operation seaming rollers, and the intermediate two diametrically opposed arms having second-operation seaming rollers, a rotatable face cam having a single cam groove receiving cam followers mounted on all four seaming roller arms, the cam groove being symmetrical and so designed as to move the first and second-operation seaming rollers successively into and out of engagement with the can in the course of a part revolution of the seaming roller plate relative to the cam, and means for driving said seaming head including two planetary gear systems each having fixed ring gears, rotatable planet gears and rotatable sun gears, the sun gear of one of said systems being connected to the seaming roller plate, and the sun gear of the other of said systems being connected to the cam, and externally driven means for simultaneously rotating the planet gears of both gear systems, the gear ratios of the two systems being slightly different in order to provide the desired part relative rotation of the seaming roller plate and cam in the course of the seaming operation.

11. A seaming machine comprising a stationary frame, a rotatable turret carrying a seaming station, and a main planetary gear system including a sun gear, a ring gear, a planet gear meshing with said sun gear and ring gear and rotatable on said turret, the seaming station including means to support a can to be seamed, a rotatable seaming head having a rotatable seaming

- roller support carrying seaming rollers and means for moving said seaming rollers toward and from the can, means for driving said seaming roller support including a planetary gear system having a fixed ring gear, a rotatable planet gear, and a rotatable sun gear, the sun gear being connected to the seaming roller support, and means operatively connecting the planet gear to the planet gear of the main planetary gear system.
12. A seaming machine comprising a stationary frame, a rotatable turret carrying a seaming station, and a main planetary gear system including an externally driven sun gear, a ring gear fixed on said frame, a planet gear meshing with said sun gear and fixed gear and rotatable on said turret, said seaming station including means to support a can, a rotatable seaming head having a rotatable seaming roller support carrying seaming rollers and a rotatable cam for moving said seaming rollers toward and from the can, and means for driving said seaming head including two planetary gear systems having ring gears, planet gears, and sun gears, a driven gear of one of said systems being connected to the seaming roller support, a driven gear of the other of said systems being connected to the cam, and means operatively connecting the driving gears of both of said systems to the planet gear of the main planetary gear system.
13. A seaming machine comprising a stationary frame, a rotatable turret carrying a plurality of seaming stations, a main planetary gear system including an externally driven sun gear rotatable concentrically with the turret, a ring gear fixed on said frame, a plurality of planet gears meshing with said sun gear and fixed gear and rotatable on said turret at each of the seaming stations, each seaming station including means to support a can, a rotatable seaming head having a rotatable seaming roller plate carrying seaming rollers and a rotatable cam for moving said seaming rollers toward and from the can, and means for driving said seaming head including two planetary gear systems each having fixed ring gears, rotatable planet gears and rotatable sun gears, the sun gear of one of said systems being connected to the seaming roller plate, the sun gear of the other of said systems being connected to the cam, and means operatively connecting the planet gears of both of said systems to a planet gear of the main planetary gear system.
14. A seaming machine comprising a stationary frame, a rotatable turret carrying a seaming station, and a main planetary gear system including a sun gear, a ring gear, and a planet gear meshing with said sun gear and ring gear and rotatable on said turret, said seaming station having a seaming head including a rotatable seaming roller plate carrying first and second-operation seaming rollers, a rotatable cam having a single cam groove receiving cam followers for the seaming rollers, means for driving said seaming head including planetary gear systems of slightly different gear ratio connected on one side to the seaming roller plate and to the cam, and both of said systems being connected on the other side to the planet gear of the main planetary gear system.
15. A seaming machine comprising a stationary frame, a rotatable turret carrying a plurality of seaming stations, and a main planetary gear system including an externally driven sun gear, a ring gear fixed on said frame, a plurality of planet gears meshing with said sun gear and fixed gear and rotatable on said turret at each of the seaming stations, each can seaming station having a seaming head including a rotatable seaming roller plate carrying four oscillatable seaming roller arms, alternate arms having first-operation seaming rollers, and the intermediate arms having second-operation seaming rollers, a rotatable cam having a single cam groove receiving cam followers mounted on all four seaming roller arms, the cam groove being so designed as to move the first and second-operation seaming rollers successively into and out of engagement with the can in the course of a part revolution of the seaming roller plate relative to the cam, means for driving said seaming head including two planetary gear systems each having fixed ring gears, rotatable planet gears and rotatable sun gears, the sun gear of one of said systems being connected to the seaming roller plate, and the sun gear of the other of said systems being connected to the cam, and means operatively connecting the planet gears of both of said systems to a planet gear of the main planetary gear system, the gear ratios of the said two systems being slightly different in order to provide the desired part relative revolution of the seaming roller plate and cam during the seaming operation.
16. A seaming machine comprising a stationary frame, a rotatable turret carrying a plurality of seaming stations, and a main planetary gear system including an externally driven sun gear rotatable concentrically with the turret, a ring gear fixed on said frame, a plurality of planet gears meshing with said sun gear and fixed gear and rotatable on said turret at each of the seaming stations, each can seaming station having a seaming head including a rotatable seaming roller plate carrying four oscillatable seaming roller arms, alternate arms having first-operation seaming rollers, and the intermediate arms having second-operation seaming rollers, a rotatable cam having a single cam groove receiving cam followers mounted on all four seaming roller arms, the cam groove being so designed as to move the first and second-operation seaming rollers successively into and out of engagement with the can in the course of a part revolution of the seaming roller plate relative to the cam, means for driving said seaming head including two planetary gear systems each having fixed ring gears, rotatable planet gears and rotatable sun gears, the sun gear of one of said systems being connected to the seaming roller plate, and the sun gear of the other of said systems being connected to the cam, and means operatively connecting the planet gears of both of said systems to a planet gear of the main planetary gear system, the gear ratios of the said two systems being slightly different in order to provide the desired part relative revolution of the seaming roller plate and cam during the seaming operation.
17. A seaming machine comprising a stationary frame, a turret rotatably mounted therein and carrying seaming mechanism, a vertical drive shaft concentric with said turret, and planetary gear mechanism interconnecting the shaft and turret for rotating the turret.
18. A seaming machine comprising a stationary frame having a top casting, a rotatable turret carrying a plurality of seaming stations, a planetary gear system including a sun gear mounted on a vertical shaft and rotatable concentrically with the turret, a ring gear fixed on the frame, and a plurality of planet gears meshing with said sun gear and fixed gear and rotatably mounted on said turret at each of the seaming stations, seaming mechanism at each of the stations, and means operatively connecting the planet gear of each station with the seaming mechanism of that station, a driving shaft mounted on the aforesaid top casting and geared to the vertical sun gear shaft, said top casting being rotatably adjustable on the frame about the axis of the turret, whereby the driving shaft may be directed as desired relative to the frame without affecting the gear system.

19. A seaming head comprising a seaming roller plate, seaming rollers mounted thereon, mechanism for moving said seaming rollers into and out of engagement with a can, a chuck, and stop means mounted on said seaming roller plate to limit the permissible upward movement of a can into the seaming head regardless of whether or not the can is provided with a cover.

20. A seaming station comprising means to support a can to be seamed, a seaming head including a rotatable seaming roller plate carrying movable seaming roller supports, some supports having first-operation seaming rollers and other supports having second-operation seaming rollers, a rotatable face cam having a single cam groove receiving cam followers mounted on the seaming roller supports, driving means to rotate the seaming roller plate and the cam at slightly different speeds, a chuck, and stop means mounted on the seaming roller plate to limit the permissible upward movement of a can on the support regardless of whether or not the can is provided with a cover.

21. A seaming machine comprising a stationary frame, a rotatable turret, seaming mechanism carried by the turret, a planetary gear system interconnecting the frame and the turret and operative for rotating the turret, and mechanism carried by the turret and interconnecting the said planetary gear system with the seaming mechanism for operating the seaming mechanism.

22. A seaming machine comprising a stationary frame, a rotatable turret, a main drive shaft, seaming mechanism carried by the turret, a planetary gear system interconnecting the frame, the turret and said main drive shaft and operative upon rotation of said shaft for rotating the turret, and mechanism carried by the turret and interconnecting the said planetary gear system with said seaming mechanism for operating the seaming mechanism.

23. A seaming machine, comprising a stationary frame, a rotatable turret, seaming mechanism carried by the turret, a main planetary gear system interconnecting the frame and the turret and operative for rotating the turret, and a planetary gear system carried by the turret and interconnecting the main planetary gear system with the seaming mechanism for operating the seaming mechanism.

24. A seaming machine comprising a stationary frame, a rotatable turret, a main drive shaft, seaming mechanism carried by the turret, a main planetary gear system interconnecting the frame, the turret and said main drive shaft and operative upon rotation of said shaft for rotating the turret, and a secondary planetary gear system carried by the turret and interconnecting the main planetary gear system with said seaming mechanism for operating the seaming mechanism.

25. A seaming machine comprising a stationary frame, a rotatable turret, a main drive shaft, seaming mechanism carried by the turret, a speed reduction planetary gear system interconnecting the frame, the turret and said main drive shaft and operative upon rotation of said shaft for rotating the turret, and a speed increasing planetary gear system carried by the turret and interconnecting the mentioned planetary gear system with said seaming mechanism for operating the seaming mechanism.

26. In a seaming machine a rotatable turret, a rotatable seaming head carried by the turret,

mechanism for rotating the turret, and a planetary gear system carried by the turret and including a sun gear, a planet gear and a ring gear, the planet gear being connected to said mechanism and the sun gear being connected to said seaming head.

27. In a seaming machine a rotatable turret, a rotatable seaming head including a revoluble roller and a revoluble actuating cam carried by the turret, mechanism for rotating the turret, and a planetary gear system carried by the turret and interconnecting said mechanism with said seaming head for independently rotating the roller and cam of the seaming head by the operation of said mechanism.

28. In a seaming machine a rotatable turret, a rotatable seaming head including a revoluble roller and a revoluble actuating cam carried by the turret, mechanism for rotating the turret, and a planetary gear system carried by the turret and interconnecting said mechanism with said seaming head for differentially revolving the roller and actuating cam of said seaming head by the operation of said mechanism.

29. In a seaming machine a rotatable turret, a rotatable seaming head including a revoluble roller and a revoluble actuating cam carried by the turret, mechanism for rotating the turret, and a planetary gear system carried by the turret and including pairs of sun gears, planet gears and ring gears, the pair of planet gears being connected to said mechanism and the two sun gears being connected respectively to said revoluble roller and to said revoluble actuating cam.

30. In a seaming machine, a rotatable seaming head including a revoluble seaming roller and a revoluble actuating cam, a drive mechanism, and a planetary gear system interconnecting said mechanism with said seaming head for differentially revolving the roller and the actuating cam of said seaming head.

31. In a seaming machine, a rotatable seaming head including a revoluble seaming roller and a revoluble actuating cam, a drive mechanism, and a planetary gear system interconnecting said mechanism with said seaming head for differentially revolving the roller and the actuating cam of said seaming head, said planetary gear system comprising pairs of sun gears, planet gears and ring gears, the planet gears being connected to said mechanism and the sun gears to said roller and actuating cam.

32. A seaming station comprising means to support a can to be seamed, a seaming head including a rotatable seaming roller plate having four seaming roller supports movably mounted thereon, alternate supports having first-operation seaming rollers, and the intermediate supports having second-operation seaming rollers, a rotatable cam having a single cam groove receiving cam followers mounted on all four seaming roller supports, the cam followers being so related to the cam groove and said cam groove being symmetrical and so designed as to move the first and second-operation seaming rollers successively into and out of engagement with the can in the course of a part revolution of the seaming roller plate relative to the cam, and driving means to rotate the seaming roller plate and the cam at different relatively high speeds differing only sufficiently to provide the desired part relative rotation in the course of a seaming operation.

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