Nov. 27, 1962 C. O. MERCHANT ET AL 3,065,530

MULTIPLE MOTION PROCESSING MACHINE

Filed July 16, 1959 5 Sheets-Sheet 1

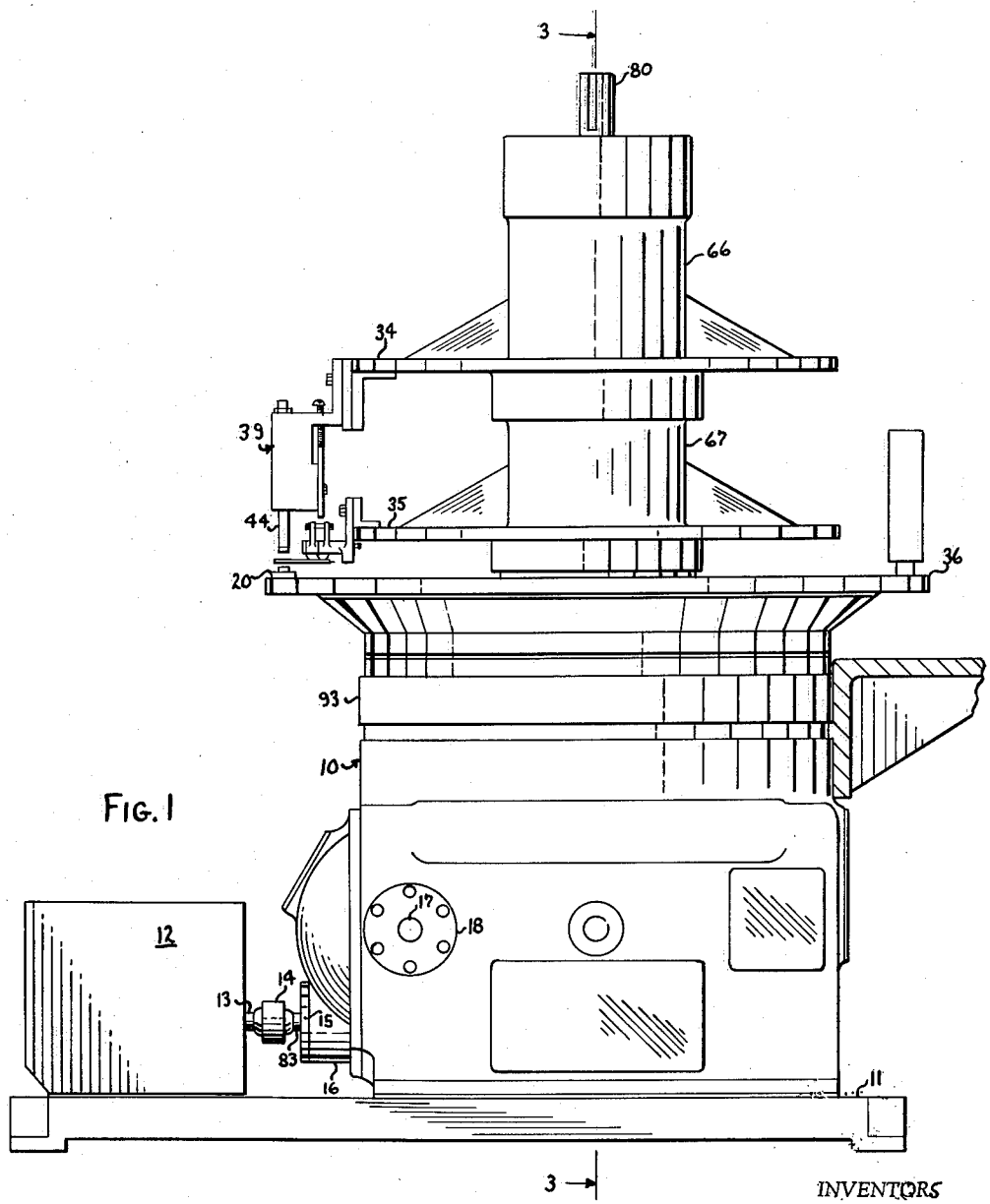


FIG. 1

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Filed July 16, 1959 5 Sheets-Sheet 2

FIG. 5

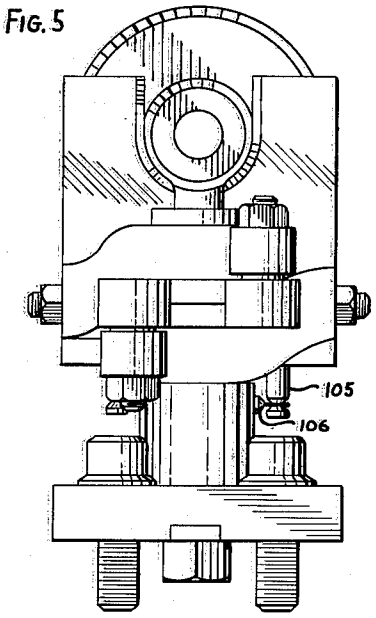
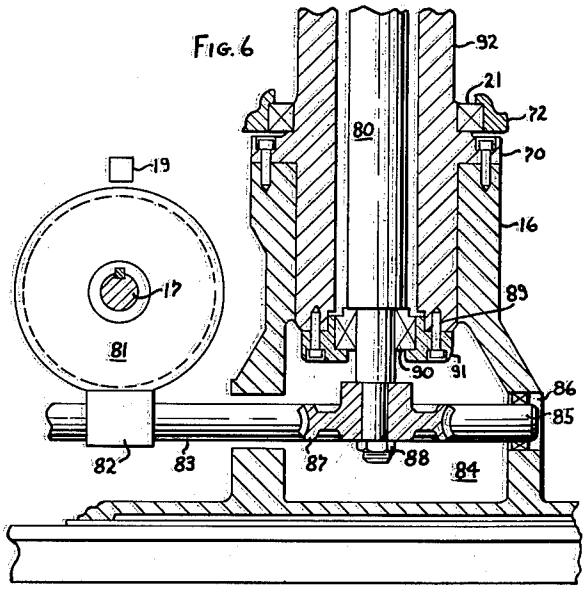


FIG. 6



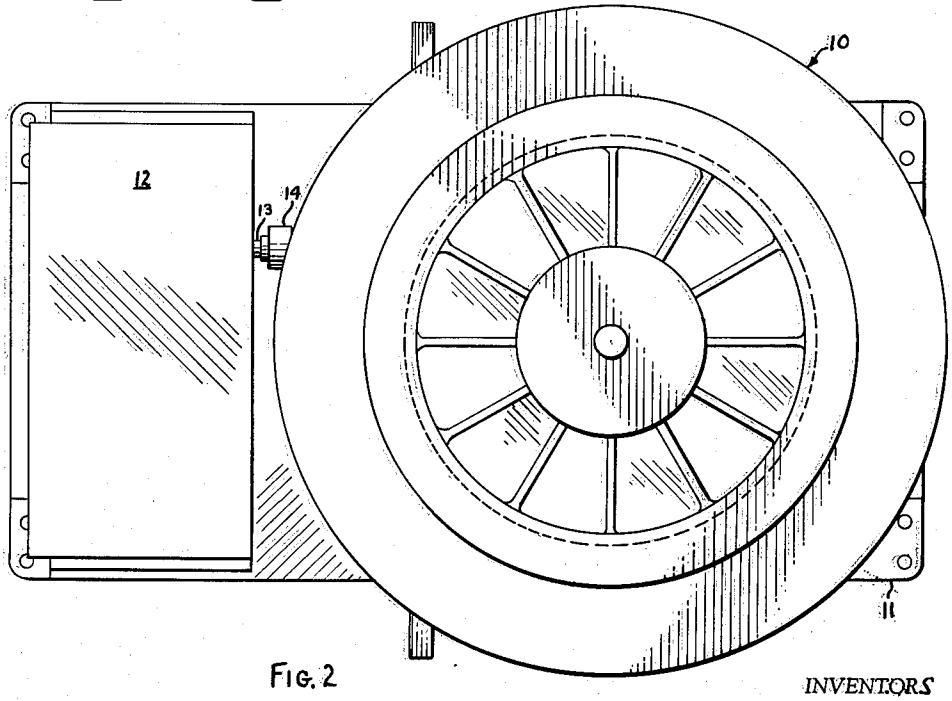


FIG. 2

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MULTIPLE MOTION PROCESSING MACHINE

Filed July 16, 1959 5 Sheets-Sheet 3

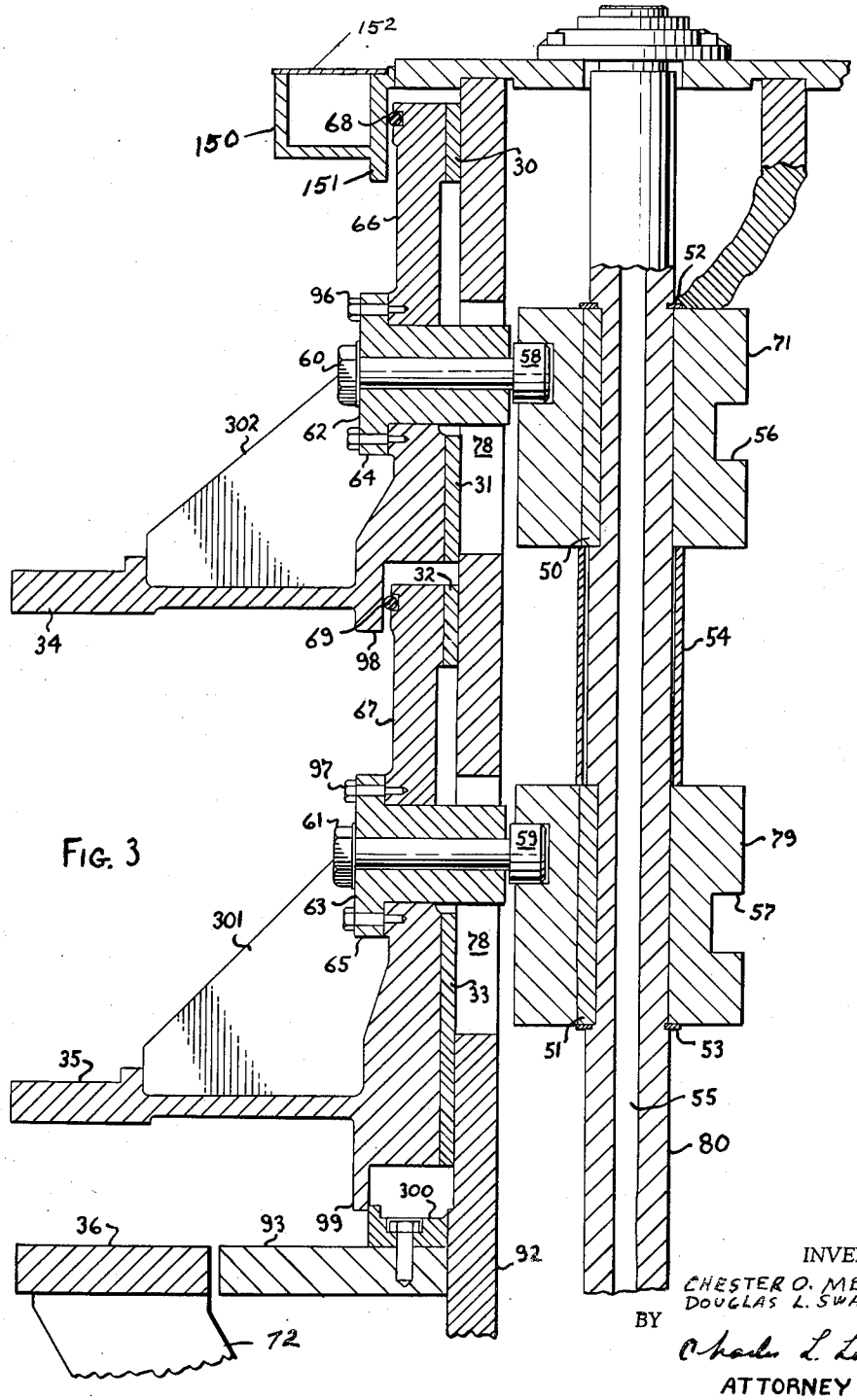


FIG. 3

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MULTIPLE MOTION PROCESSING MACHINE

Filed July 16, 1959 5 Sheets-Sheet 4

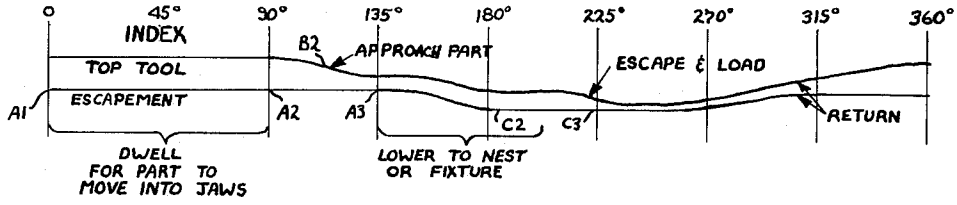


FIG. 9

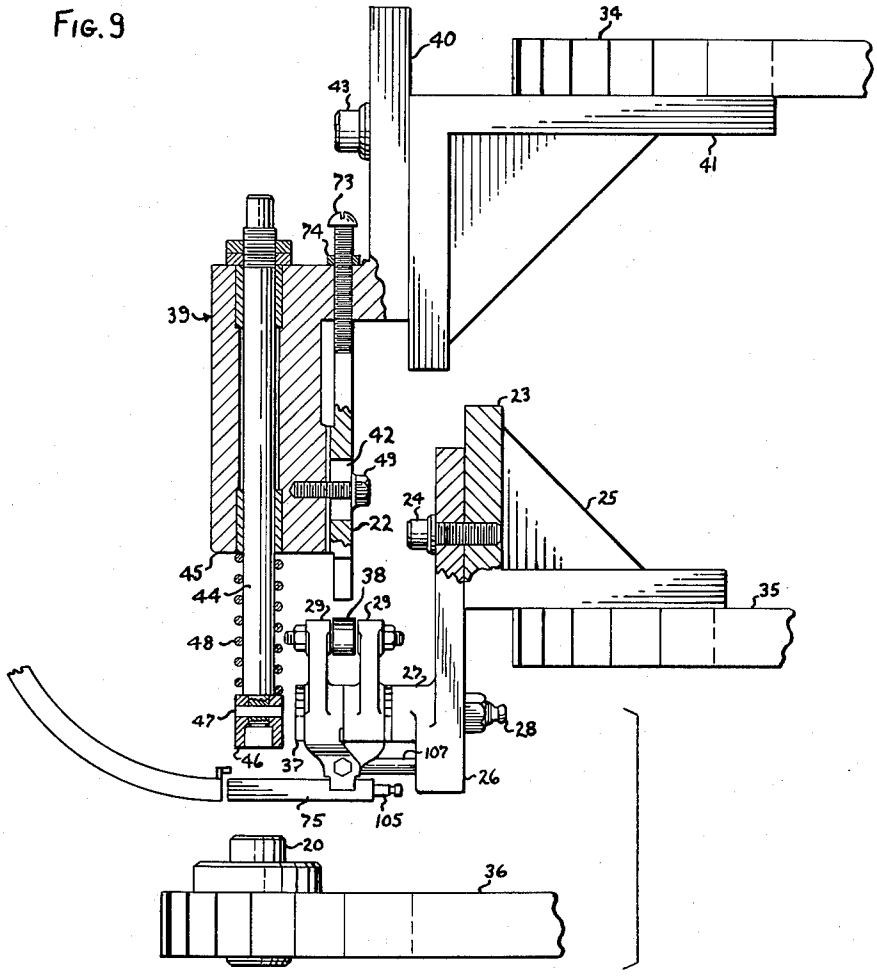


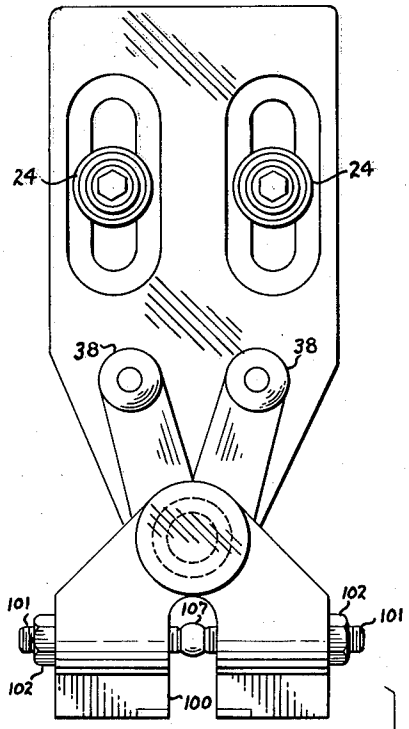
FIG. 4

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MULTIPLE MOTION PROCESSING MACHINE

Filed July 16, 1959 5 Sheets-Sheet 5



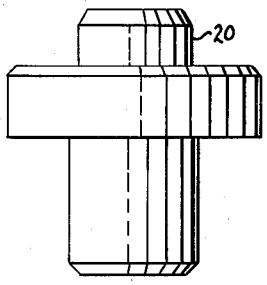
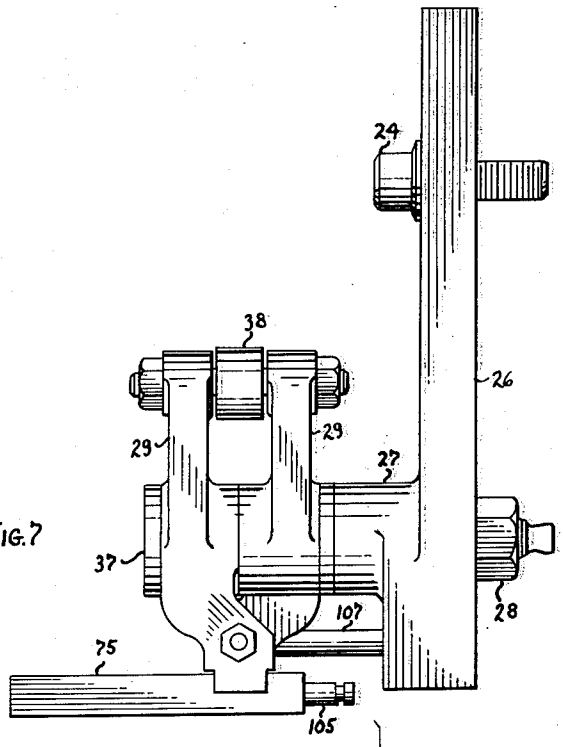


FIG. 7



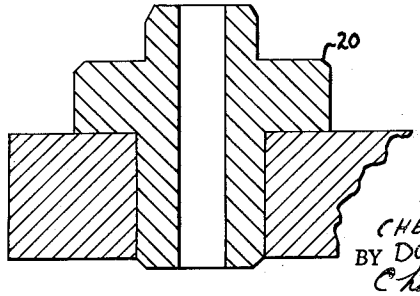


FIG. 8

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MULTIPLE MOTION PROCESSING MACHINE

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Filed July 16, 1959, Ser. No. 827,581
14 Claims. (Cl. 29—428)

This invention relates to assembly machines and, more particularly, to machines adapted to assemble articles of manufacture made up of several parts.

In assembling parts on automatic machines, it has been a practice to feed parts down an inclined chute or track to a point immediately above the fixture into which the part is to be loaded. A plunger is used to push the part downwardly while either swingable or retractable gates are withdrawn, permitting the part to escape and drop into position. This method has disadvantages in that:

(1) Oftentimes, the part has an excessive distance to move downwardly without guidance or control, thereby permitting mislocation of the part; and

(2) The closeness of the escapement to the fixture tends to block visual and physical access to the area so that the practical development as well as the use of the machine is handicapped.

With the application of two individual moving sections, it makes it possible to escape the part at a much lower level so that, often, there is no free fall but, rather, the part is guided at all times so it cannot get mislocated. Also, in the retracted position, there is sufficient clearance to inspect or even remove the part from the fixture if desired.

The moving plates also tend to reduce the complications of an automatic machine in that they may be used not only as a means of escaping parts but, also, to actuate probes to see that parts have been loaded into the fixture as required and, also, as a means, in reverse, of unloading parts assembled by the machine. The plates may also support rotating spindle members to drill, tap, drive screws, or radially orient parts to be fed into the fixture on the indexing table. Accomplishing all of these operations with only two cams is not normally possible using other types of machines.

The machine disclosed herein functions properly at all practical operating speeds with no danger of jamming and damaging the mechanisms. This is not the case when other means of actuation are applied. Other machines and methods require elaborate safeguards to provide "failsafe" operation.

During the assembly of articles of manufacture in machines in common use wherein it is necesary to place the article or a part thereof into a nest like support member or fixture on the machine or where parts nest in each other or to assemble one part of the article with another part of the article already loaded in the machine nest, it is sometimes difficult to move the articles properly into the nest one after the other without having some of the articles occasionally become jammed and, therefore, blocking the machine and interrupting the manufacturing operation. It has been discovered that it is possible to solve this problem by providing a machine having relatively movable parts moving in synchronism with each other such as disclosed herein. The parts of the machine must move in such a way that one said part will place the article into the nest and bottom it in the nest while another part of the machine resiliently engages the article and applies a biasing force thereon before the first part of the machine releases the article. This will prevent the machine from jamming and will insure that all of the articles will be loaded uniformly.

The machine may have a rotatable or otherwise movable table and the nests will be spaced around the outer portion of the upper side of the table. Various assembling and finishing operations may be performed upon articles of manufacture in the nests on the table. The articles can be loaded into the nests by means of the well known vibratory bowl feeders, manually or by other suitable means. Other well known methods of feeding, aligning, and loading can be used. Specific advantages of the machine disclosed herein are that ample clearance is provided for the nests and, therefore, complete accessibility, the articles being processed face outwardly, and all parts of the machine are in complete synchronism with the drive.

It is, accordingly, an object of the present invention to provide an improved assembly machine.

Another object of the invention is to provide an improved machine wherein one part of the machine will load articles in a nest and another part will hold the articles in place while the first part of the machine releases the articles.

Still another object of the invention is to provide an assembly machine having a support and article assembling and supporting parts moving relative to each other and to the support.

A further object of this invention is to provide an assembly machine which is simple in construction, economical to manufacture, and simple and efficient in operation.

With the above and other objects in view, the present invention consists of the combination and arrangement of parts hereinafter more fully described, illustrated in the accompanying drawings and more particularly pointed out in the appended claims, it being understood that changes may be made in the form, size, proportions, and minor details of construction without departing from the spirit or sacrificing any of the advantages of the invention.

In the drawings:

FIG. 1 is a side view of a machine according to the invention;

FIG. 2 is a top view of the machine shown in FIG. 1;

FIG. 3 is a cross sectional view of part of the machine taken on line 3—3 of FIG. 1;

FIG. 4 is a view partly in cross section of a part of the accessory equipment for use on the machine;

FIG. 5 is a top view of the accessory equipment shown in FIG. 4;

FIG. 6 is a vertical cross sectional view of the lower part of the apparatus shown in FIG. 3;

FIG. 7 is a side view of the accessory equipment shown in FIGS. 4 and 8;

FIG. 8 is an end view of the accessories shown in FIG. 7; and

FIG. 9 is a timing diagram of the machine.

Now with more specific reference to the drawings, a machine 10 is shown having a base 11 which constitutes the fixed frame of the machine 10. A motor and drive assembly 12 is supported on the base 11 at one side of the machine 10. The drive assembly 12 has a shaft 13 extending laterally therefrom which is connected by a coupling 14 to a shaft 83 of the machine 10. Suitable bearings on the base 11 support the shaft 83. These bearings are held in place by means of a removable bearing plate 15 which is attached to a side 16 of the machine housing.

A shaft 17 extends from the side of the machine 10 and is held in place by bearings which are supported by a plate 18. The shaft 17 has a worm gear 81 keyed thereto as shown. A vertical shaft 80 is supported at its lower end in a bearing 90 which is in turn supported on a core 92 by means of a plate 91. The plate 91 is

held in place by means of bolts 89. The core 92 has an outwardly extending integral flange 70 which rests on and is attached to the side or frame casting 16 by means of bolts as shown.

A bearing 21 is supported above the flange 70 and it supports an outwardly extending web member 72. The web 72 is fixed to and is a part of the structure of a rotating table 36. The rotating table 36 will have suitable indexing rollers 19 which engage a peripheral spiral groove in a cross over cam wheel which is supported on the shaft 17 concentric with the gear 81, more particularly shown in patent application Serial No. 812,032. The rotating table or work transfer means 36 is intermittently rotated around the shaft 80 and the core 92.

It will be seen, therefore, that when the shaft 83 is driven at a constant rate, the rotating table 36 will move intermittently. The shaft 80 will be rotated at a constant rate through a worm gear 87. Cams 71 and 79, being attached to the shaft 80, will also rotate at a constant rate. The cams 71 and 79 will carry followers 58 and 59 upwardly and downwardly in synchronism with each other, depending upon the contour of cam surfaces 56 and 57 and, therefore, tool plates or supports 34 and 35 will move up and down relative to each other and relative to the rotating table 36 in synchronism with the movement thereof.

A conduit channel 150 is integral with a cap plate 151 and extends around the top of the machine 10 to receive the wiring used for the electrical components thereof. The channel 150 may have a removable cover 152.

An exemplary attachment which could be utilized with the machine 10 to carry out a particular manufacturing process is shown supported on the machine 10 in FIG. 1 and in more detail in the other figures, including FIGS. 4, 5, 7, and 8. This attachment is made up of a mechanism for inserting parts into nests 20 which will be supported on top of the rotating table 36 in spaced relation thereon. The purpose of the attachment is to, for example, assemble one component part of an article within the other and to move the first component part of the article to bottom on the nest before the other part is pushed into the first component part. This mechanism will therefore prevent jams in handling the parts. The mechanism is a pincers like member made up of jaws 29 which grip the articles at their lower parts and upper ends. The jaws 29 are actuated by a cam 22 which spreads the jaws 29 to release the article. A spring loaded ram 44 engages the article as it is lowered.

The lower part of the fixture is attached to the lower tool plate or support 35 by means of a bracket 26 which is attached to an upwardly extending bracket 23 by means of studs 24. The bracket 23 has a reinforcing flange 25 which will be fixed to the tool plate 35. An axle 37 is fixed to a boss 27, in turn integral with the bracket 26. A grease fitting 28 provides lubrication for the jaw members 29 which are rotatably supported on the axle 37 as shown. The jaw members 29 have rollers 38 rotatably supported on the upper ends thereof which are engaged by the cam 22. The cam 22 has a V-shaped lower end and is supported on an upper fixture member 39. The upper fixture member 39 has a bracket 40 which is fixed to a bracket 41 in turn attached to the upper tool plate or support 34. The bracket 40 is attached to the bracket 41 by means of studs 43. The upper fixture member 39 has the cylindrical ram 44 slidably supported in bushings 45 and a head 46 is attached to the lower end of the ram 44 by means of a pin 47. The head 46 is especially constructed to engage a part of an article and for urging it down into the nest 20. The ram 44 is urged downwardly by means of a spring 48 which is disposed between the lower end of the fixture member 39 and the upper edge of the head 46. The nests 20 are moved progressively by the cross-over cam wheel to move up parts or sub-assemblies of articles from one fixture to another which may be supported on the plates 34 and 35 to progressively assemble the parts article as the nests are moved.

The cam 22 may be adjusted by sliding it relative to the fixture 39. This can be accomplished by loosening a stud 49 and a lock nut 74. The cam 22 is supported on the fixture 39 by means of the stud 49 which threadably engages a hole in the fixture 39 and extends through a slot 42 in the cam 22. Therefore, the cam 22 can slide upwardly and downwardly when the stud 49 is loosened.

A limit screw 73 is threadably supported in the fixture member 39 and may be locked in a fixed position by the lock nut 74 to limit the upward movement of the cam 22.

Jaws 75 are fixed to the lower ends of the jaws 29. The jaws 75 extend outwardly from the jaws 29 and have an article receiving portion 100 thereon. Threaded limit members 101 may be moved inwardly or outwardly and locked in spaced relation to each other by nuts 102 when the jaws 75 are closed. Each of the jaws 75 has a binding post 105 fixed thereto and the binding post 105 has a peripheral groove on the outer end thereof which receives the end of a helical spring 106. The spring 106 is a tension spring which urges the jaws 75 toward each other. A pin 107 is fixed to the bracket 26 and extends forwardly between the ends of the limit members or stop screws 101.

The jaws 75 are urged toward each other. When the table 36 moves downwardly, the V-shaped end of the cam 22 is forced downwardly between the rollers 38 and the jaws 75 are thereby moved away from each other to release the article.

During operation, the table 36 will be indexed by the cross over cam gear 81 to bring the nest 20 into position under the jaws 75. Then as the shaft 83 continues to rotate, the shaft 80 will rotate the cams 71 and 79 to bring the tool plate 34 down relative to the tool plate 35 and the part held between the jaws 75. The plate 35 will not move at this part of the cycle. This will bring the ram 44 into engagement with the article. The plates 34 and 35 will remain stationary and will not move as the shaft 80 continues to rotate. The plates 34 and 35 then will move down at the same rate, placing the article in the nest 20. The plate 34 will then descend further and the cam 22 will thus move relative to the plate 35 to cause the cam 22 to engage the rollers 38 and force the jaws 75 apart, releasing the part of the article. Then both of the tool plates 34 and 35 will be raised and the rotating table 36 will be indexed to another position where an additional operation can be performed on the article as the tool plates raise and lower, as pointed out in column 1, lines 34–44 hereof.

The foregoing specification sets forth the invention in its preferred practical forms but it is understood that the structure shown is capable of modification within a range of equivalents without departing from the invention which is to be understood is broadly novel as is commensurate with the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An assembly machine comprising a first support selectively movable to a plurality of positions, spaced nest members on said support for receiving articles of manufacture, said support having means thereon to move it through a plurality of positions adjacent an accessory member, said accessory member having a first tool support and a second tool support vertically spaced from each other and from said first support, and cam means rotated in synchronism with said moving means for said first support, said first tool support having jaw means thereon for supporting an article, said second tool support having a spring loaded member, said cam means moving said second tool support and said spring loaded member toward said first tool support whereby said article is brought into engagement with said nest members, said cam means being further movable into engagement with said jaw means to

release said article, said first and second tool supports being adapted to have additional accessory members thereon spaced from said accessory member for performing additional functions on said articles.

2. A method of assembling articles of manufacture comprising providing a table having nests rotatable in a circular path, providing a first tool plate and a second tool plate spaced vertically from each other and from said table, providing accessories on said tool plates having jaw members on one said tool plate and a spring loaded member on the other said tool plate, intermittently moving said table to cause each said nest to dwell intermittently below said jaw members, moving said jaw members with an article supported thereby into engagement with said nest, bringing said spring loaded member into engagement with said article supported by said jaw members, and then bringing a release member supported on said one tool plate into engagement with said jaw members to release said article.

3. An assembly machine comprising a base, a vertical shaft on said base, a table rotatable around said vertical shaft, a first and a second tool plate supported on said machine and movable generally parallel to said vertical shaft, cam means on said vertical shaft moving said tool plates relative to each other and relative to said table, said table having spaced article receiving nests thereon, index means operating in synchronism with said vertical shaft, said nests being moved intermittently into position below said tool plates, jaw means on one said tool plate for moving articles into said nests, resilient means, and release means on one said jaw means, said cam means moving said jaw means to lower said articles into said nests, said cam means engaging means on said resilient means to move said resilient means into engagement with said articles to resiliently hold them in said cam means and further moving said release means into engagement with said jaw means while said articles are engaged by said release means to release said jaw means from said articles, said tool plates being adapted to have additional means thereon spaced from said jaw means and actuated by the movement of said tool plates for performing other operations on the parts of said articles in said nests.

4. The machine recited in claim 3 wherein an outwardly extending cap plate is attached to the upper end of said vertical shaft and an outwardly directed channel is attached thereto for receiving wires for electrically wiring said machine.

5. The machine recited in claim 3 wherein said resilient means comprises a ram supported on said first tool plate and vertically slidable thereon, and means on said ram for engaging said articles supported by said jaw means, said resilient means urging said ram toward said articles.

6. The machine recited in claim 3 wherein said release means comprises a cam member on said first tool plate and follower means on said jaw means, said cam means engaging said follower means releasing said jaw means from said articles when said articles have been deposited in said nests.

7. The machine recited in claim 3 wherein said resilient means comprises a ram supported on said first tool plate and vertically slidable thereon, and means on said ram for engaging said articles supported by said jaw means, said resilient means urging said ram toward said articles, said release means comprises a cam member on said first tool plate and follower means on said jaw means, said cam means engaging said follower means releasing said jaw means from said articles when said articles have been deposited in said nests.

8. An assembly machine comprising a base, a vertically disposed shaft on said base, a table rotatable around said shaft in synchronism therewith, an upper tool support and a lower tool support each comprising tables disposed generally concentric to and around said shaft, means on said machine rotating said shaft, spaced article receiving means on said table, a cam means on said shaft, and follower means on said tool supports, said tool supports being moved up and down in synchronism with the rotation of said shaft, said tool supports being adapted to have means thereon for performing operations on parts of articles supported in said article receiving means.

9. An assembly machine for assembling articles of manufacture made up of a plurality of parts comprising a table having a surface disposed in a plane, means to move said table about an axis, two spaced supports on said machine, said spaced supports being movable relative to each other, each said support being disposed in a plane generally parallel to the plane of said table and having spaced means thereon to support component parts of said articles, and means to move said supports relative to said table in synchronism with the movement of said table to process said articles.

10. The assembly machine recited in claim 9 wherein means is provided to move said table about a common axis with the movement of said supports and in synchronism with the movement of said supports, said table having means thereon adapted to support parts of articles of manufacture.

11. The machine recited in claim 9 wherein a shaft is disposed on said common axis, cam means on said shaft, means to rotate said shaft, follower means on said supports engaging said cam means whereby said supports are moved relative to said table, and means to move said table in synchronism with the movement of said supports.

12. The machine recited in claim 11 wherein the movement of said table is an intermittent motion.

13. The machine recited in claim 12 wherein said supports are disposed on one side of said table and one said support is disposed between said table and the other said support.

14. A machine for processing articles comprising a first support, spaced article holder means on said support, means to move said first support to cause said article holder means to move in a path, a rigid support for tools spaced from said first support, said rigid support for tools having means thereon for supporting tools at spaced positions, means to move said rigid support relative to said first support in synchronism with the movement of said first support to actuate said tools whereby articles supported on said first support are successively processed, said first support spaced from said rigid support and generally coextensive therewith adapted to support tool means generally equidistant from said first support to cooperate with tools on said rigid support.

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