Sept. 7, 1965 S. H. CREED ETAL 3,204,386

CONTAINER PACK FORMING MACHINE

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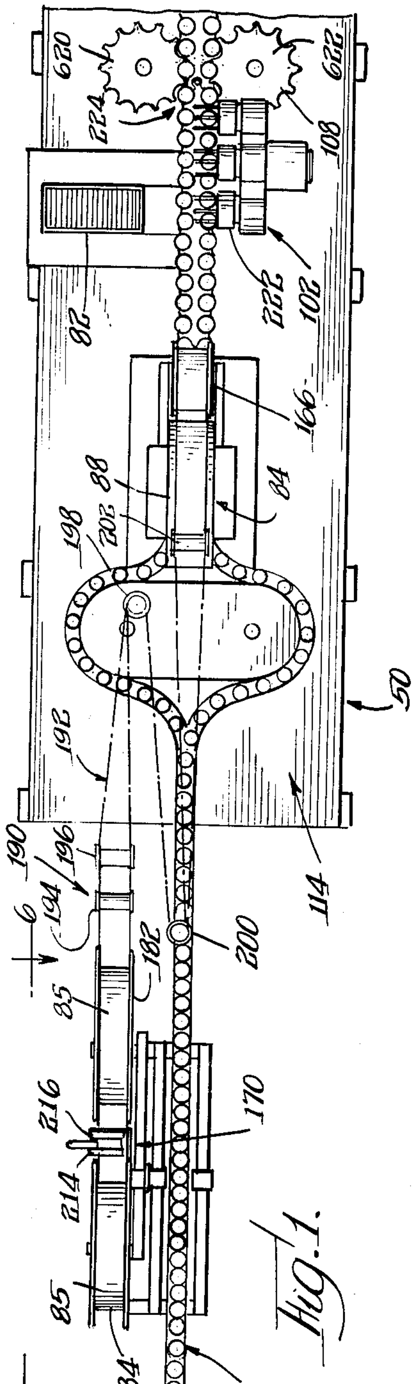

Fig. 1.

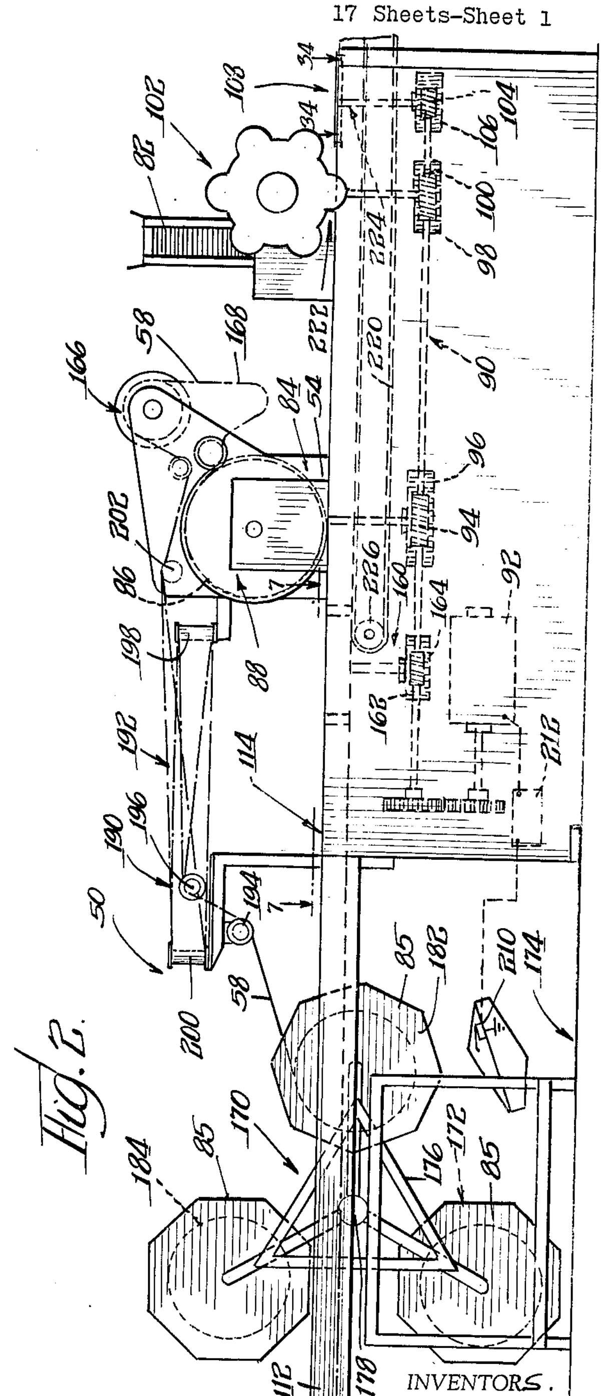

Fig. 2.

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CONTAINER PACK FORMING MACHINE

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Fig. 6.

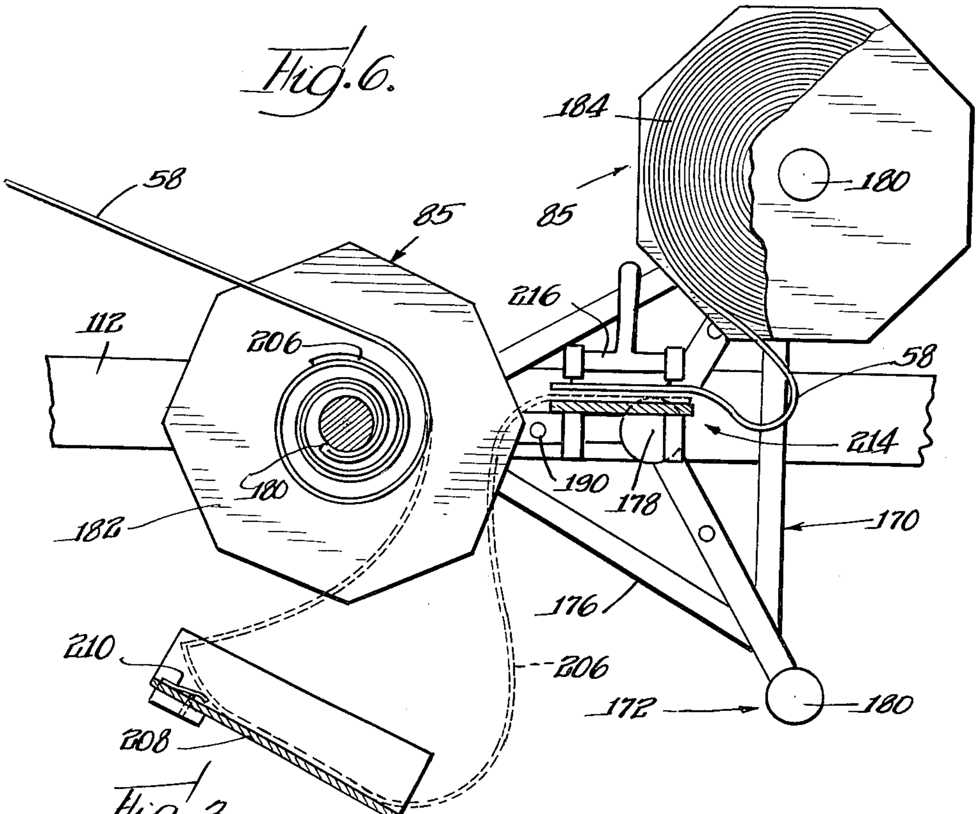


Fig. 3.

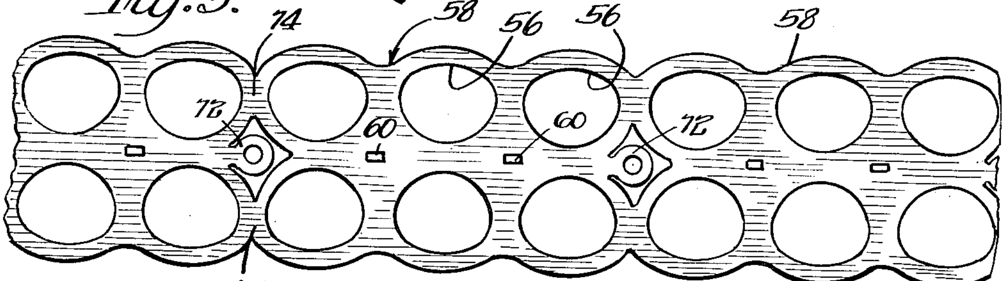
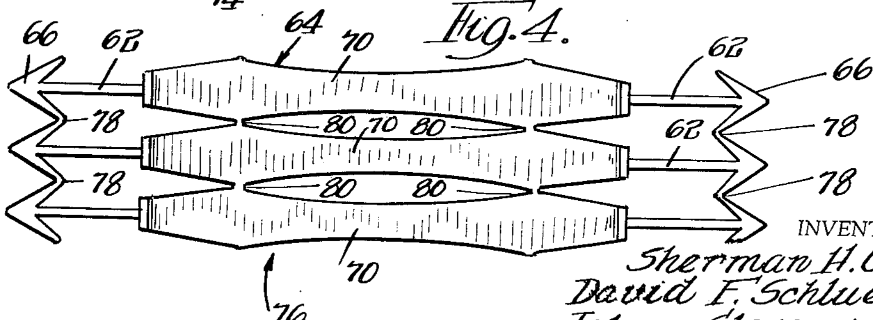


Fig. 4.



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CONTAINER PACK FORMING MACHINE

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Fig. 34.

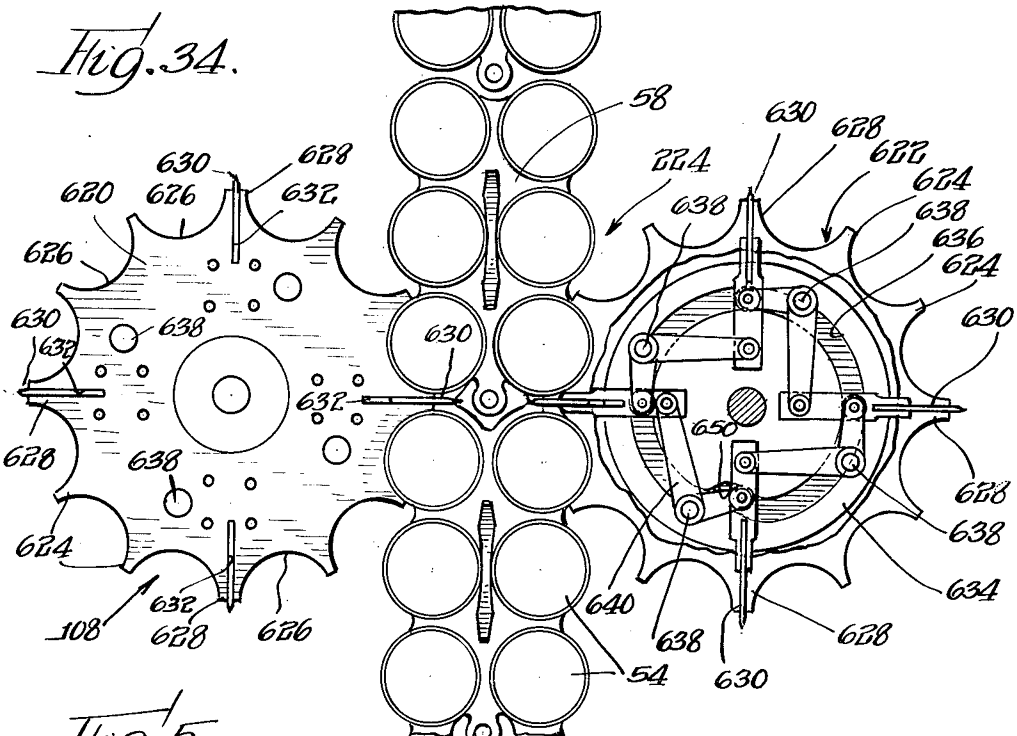


Fig. 5.

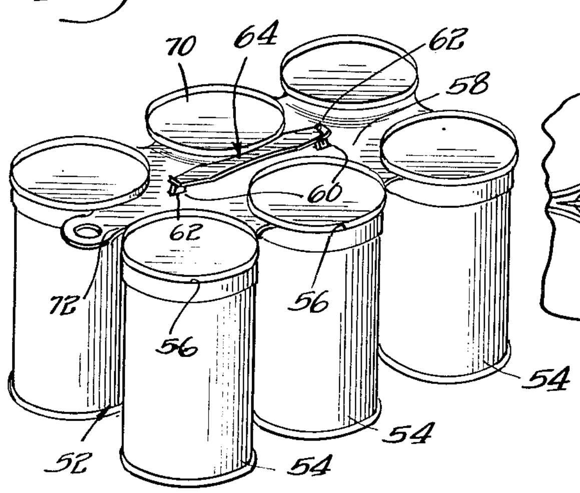
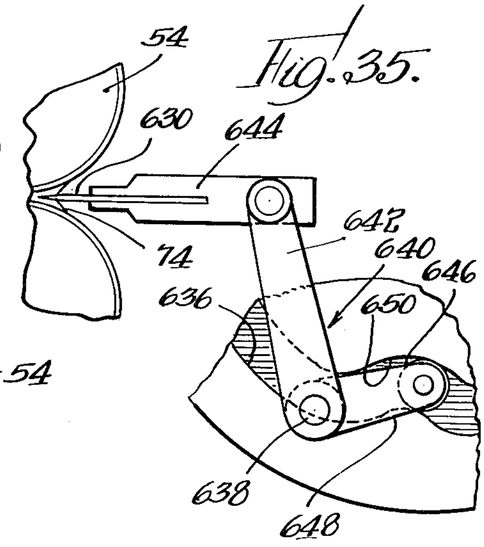


Fig. 35.



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CONTAINER PACK FORMING MACHINE

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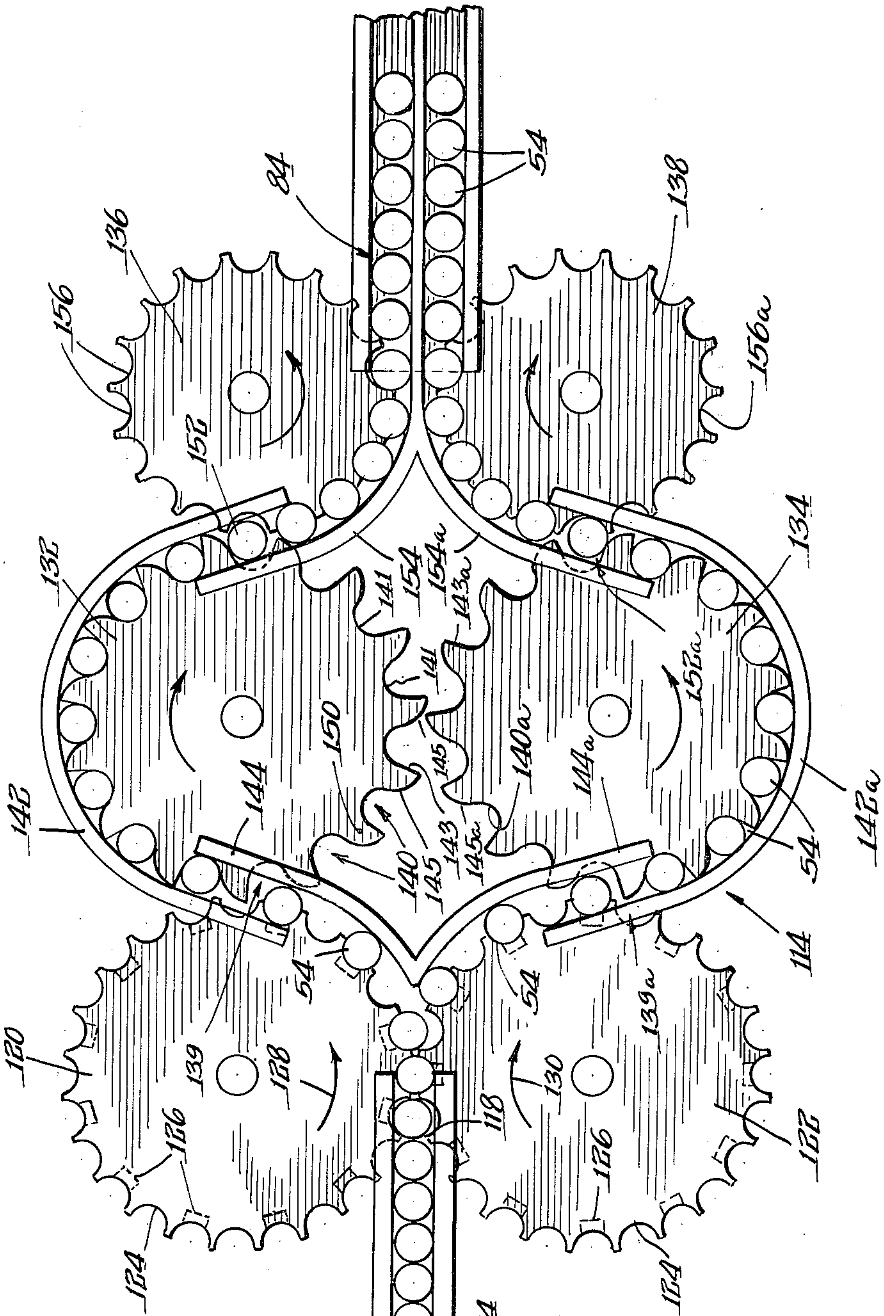

Fig. 7

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CONTAINER PACK FORMING MACHINE

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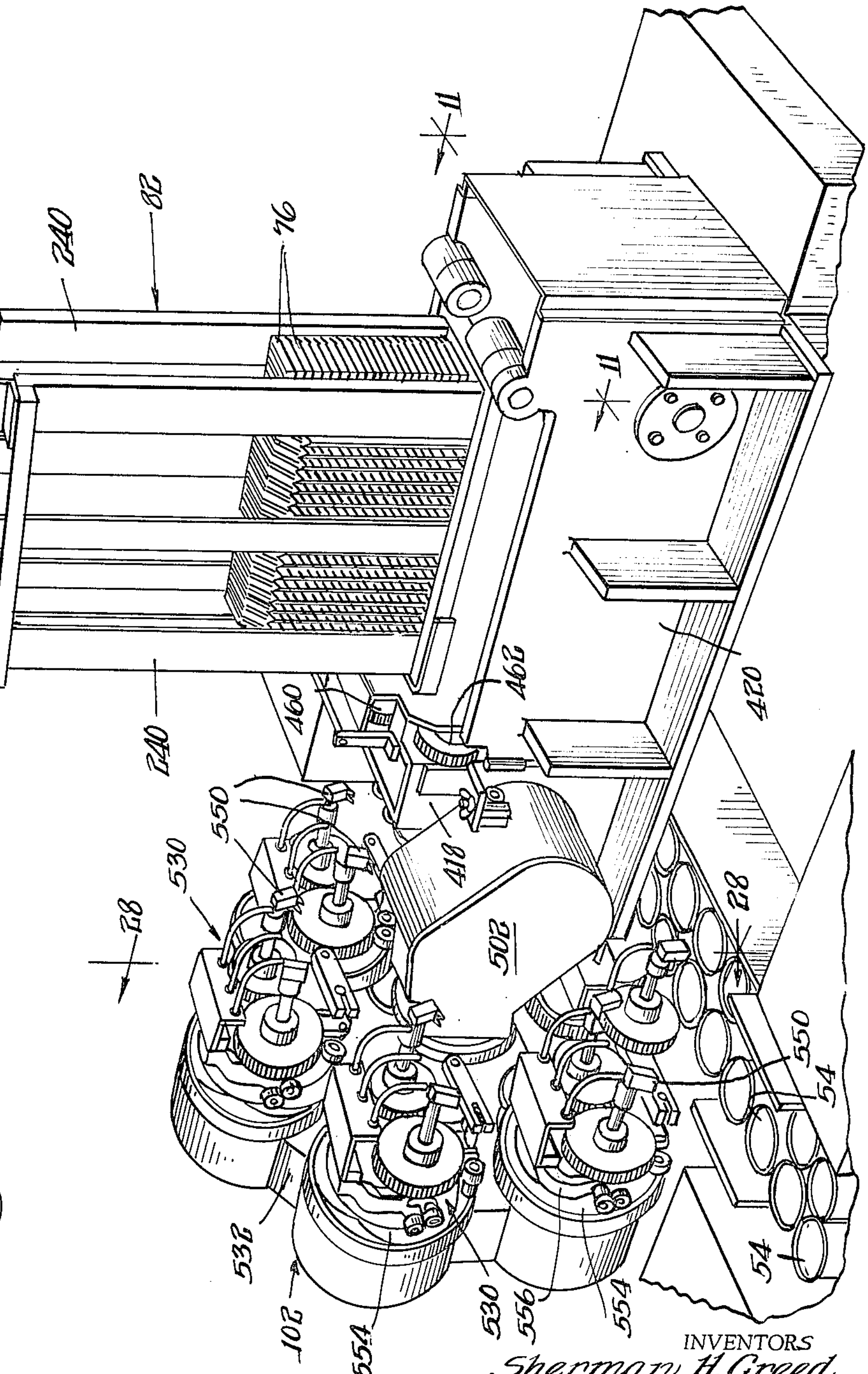

Fig. 8.

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CONTAINER PACK FORMING MACHINE

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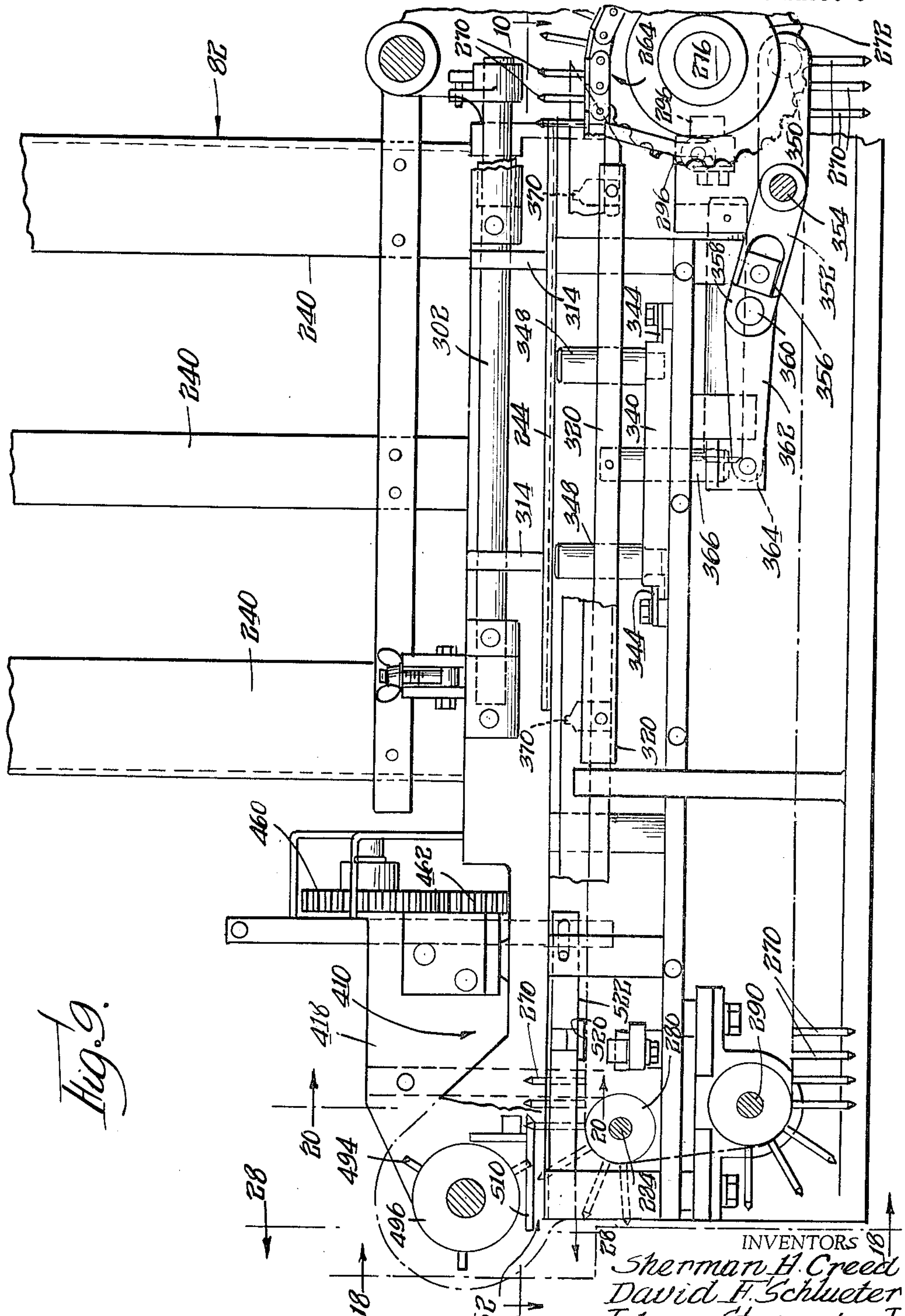

Fig. 9.

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CONTAINER PACK FORMING MACHINE

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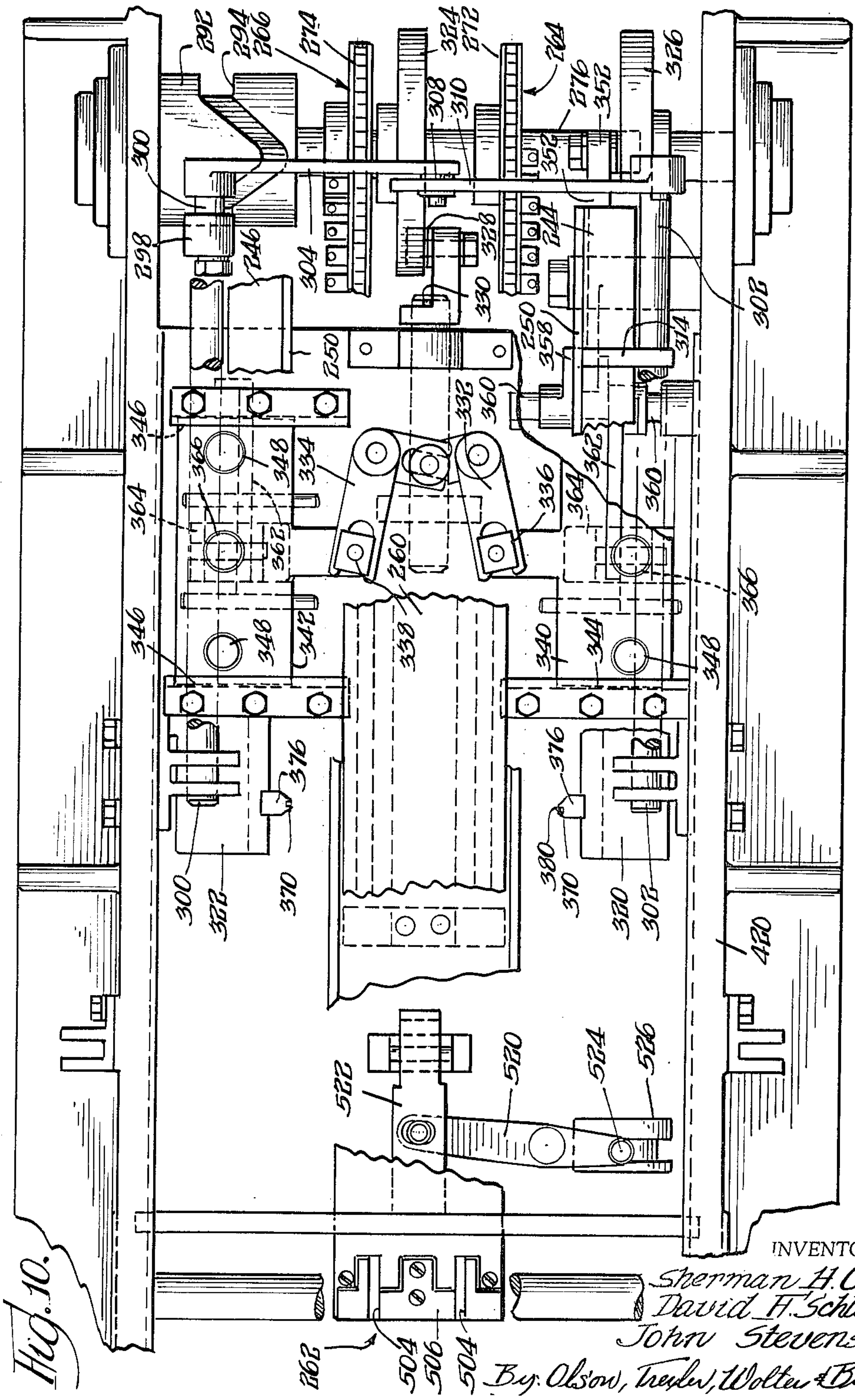

Fig. 10.

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CONTAINER PACK FORMING MACHINE

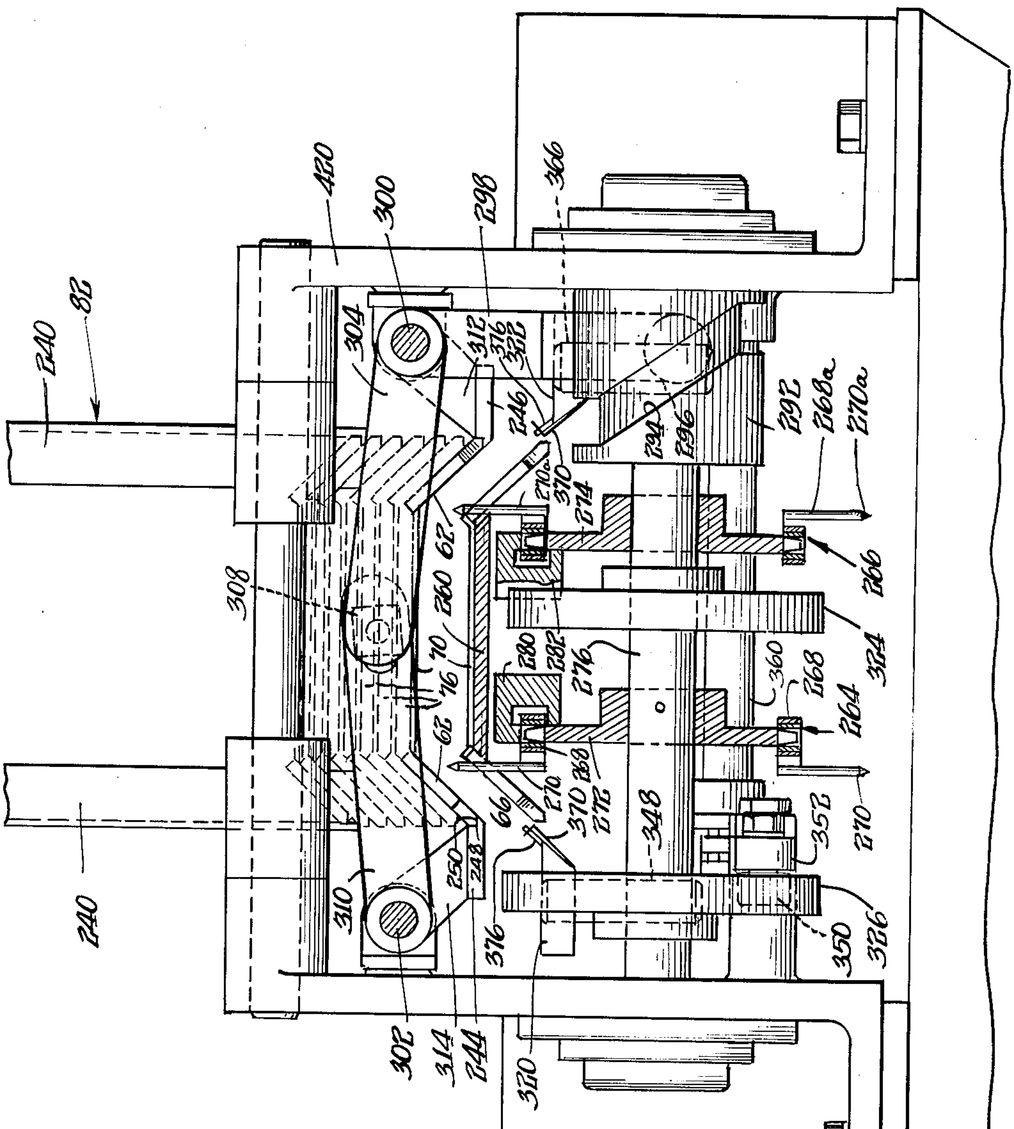

Fig. 11.

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CONTAINER PACK FORMING MACHINE

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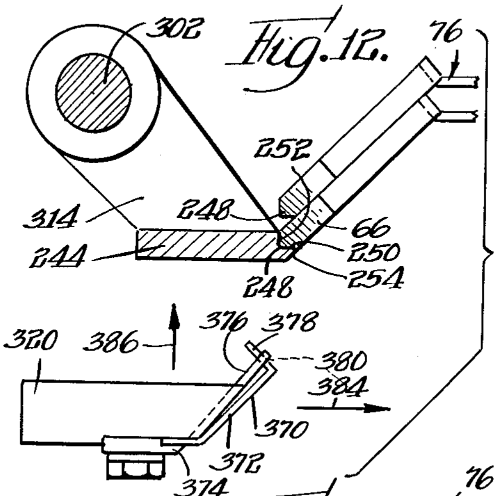

Fig. 12.

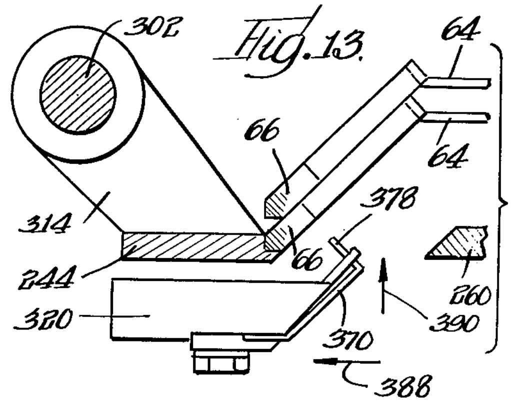

Fig. 13.

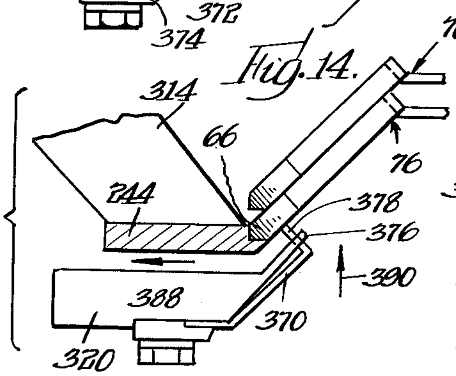

Fig. 14.

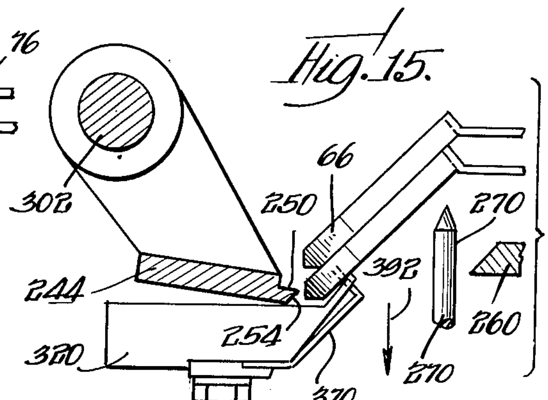

Fig. 15.

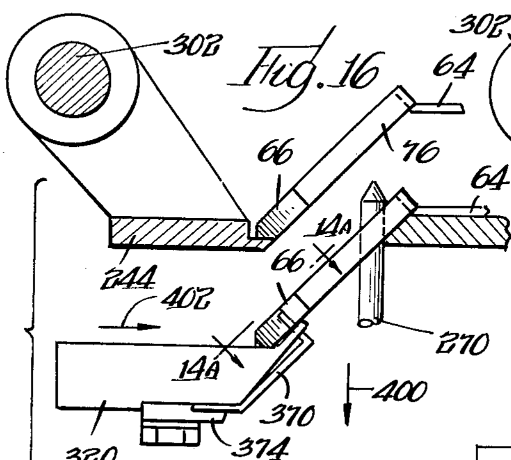

Fig. 16

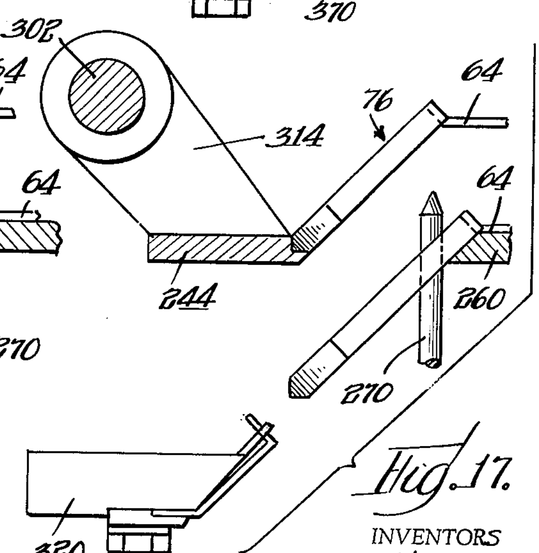

Fig. 17.

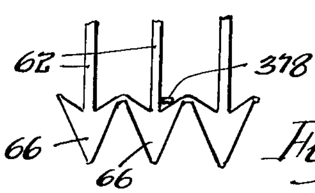

Fig. 14A.

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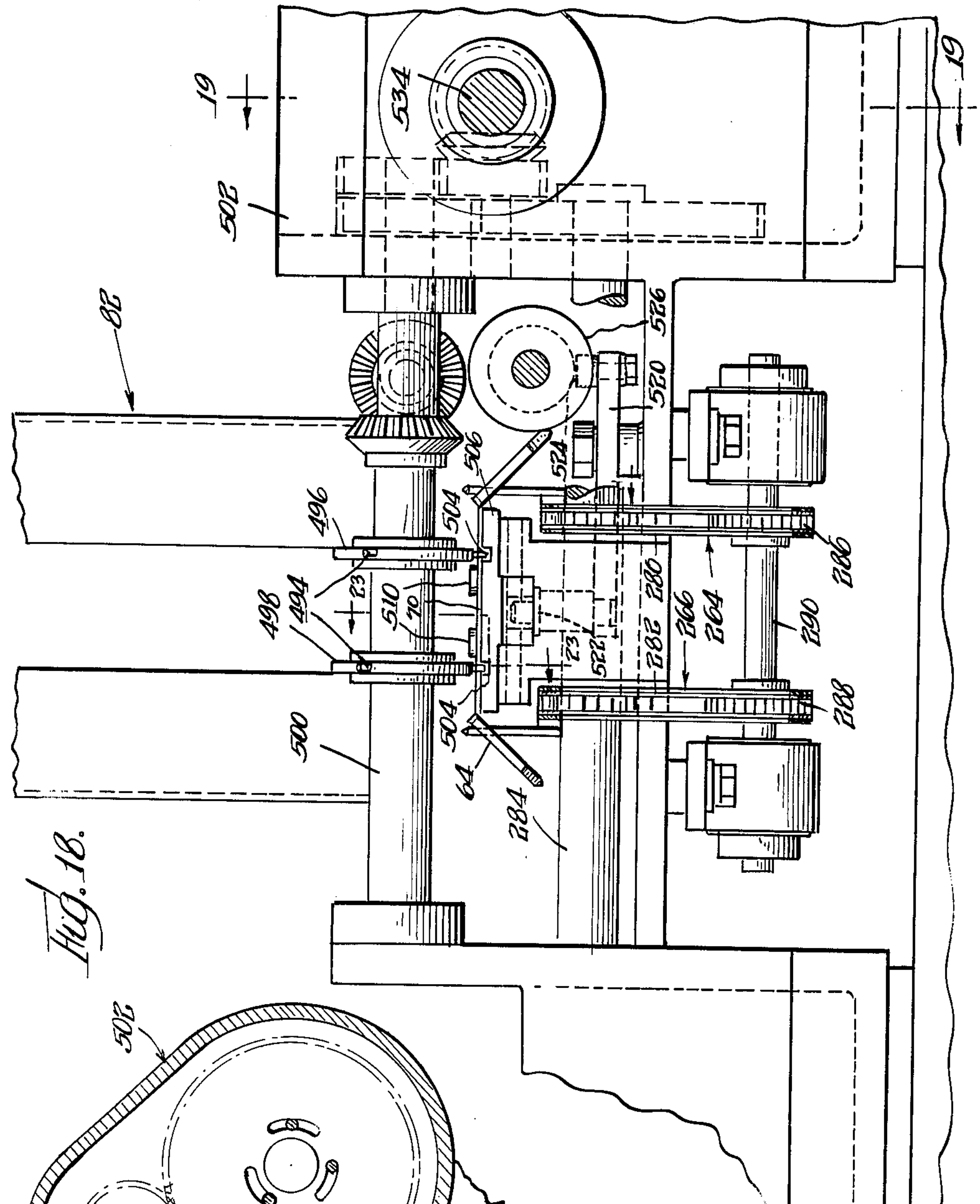

Fig. 18.

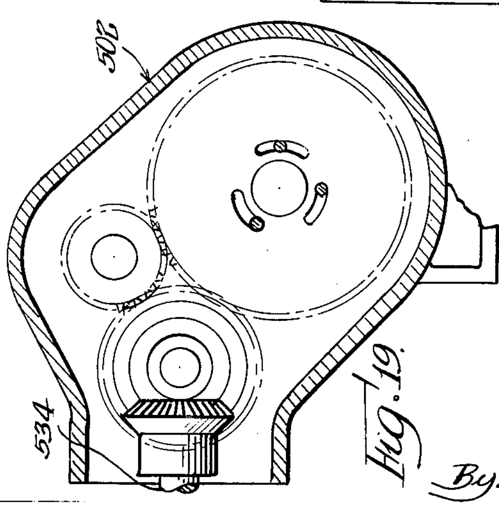

Fig. 19.

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CONTAINER PACK FORMING MACHINE

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Fig. 22.

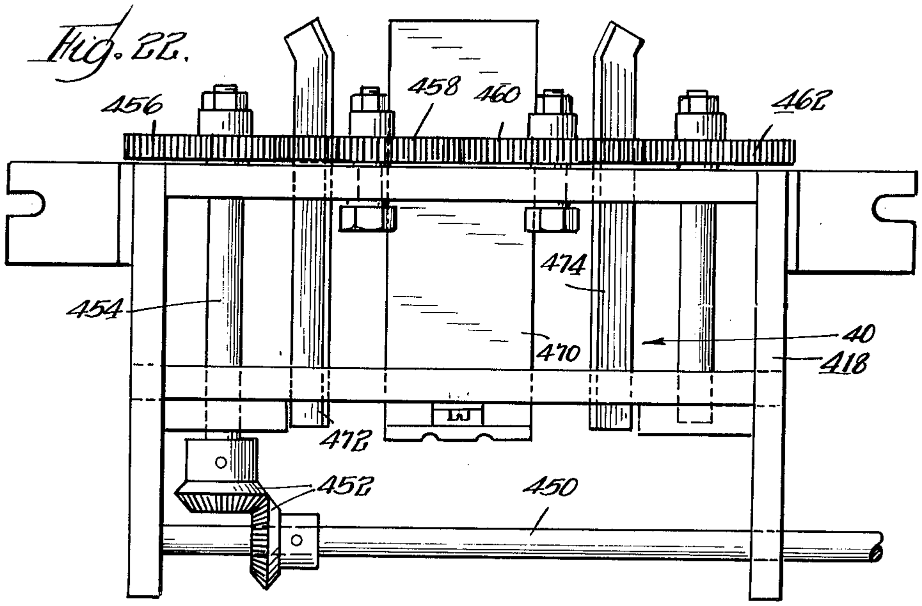
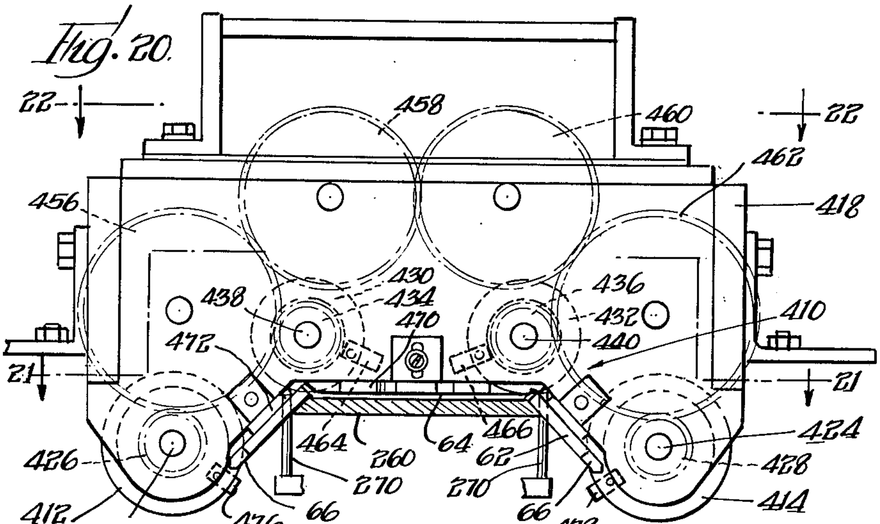


Fig. 20.



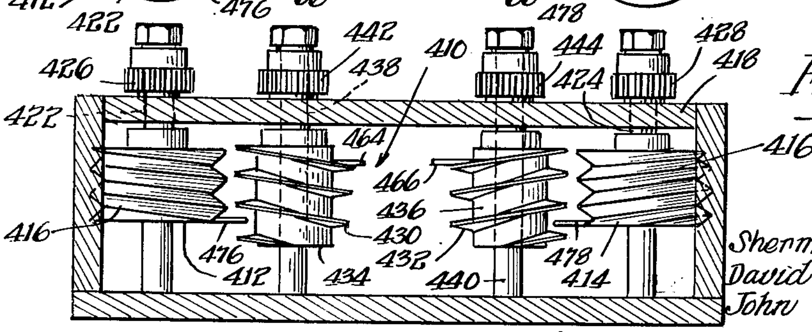


Fig. 21.

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CONTAINER PACK FORMING MACHINE

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Fig. 23.

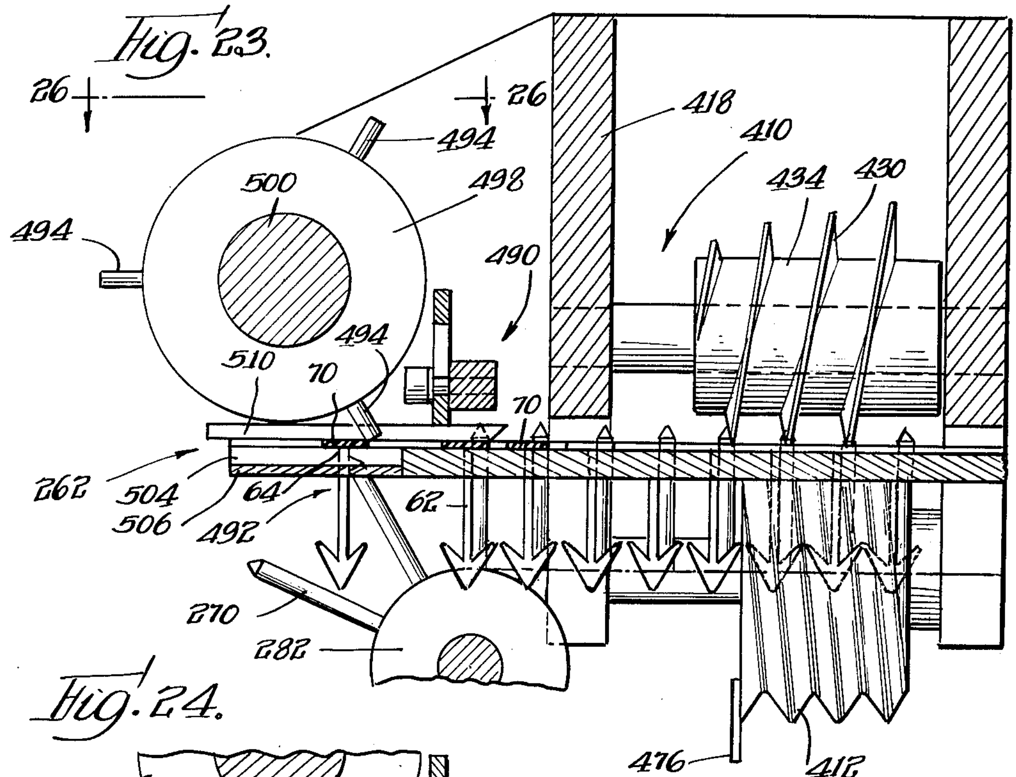


Fig. 24.

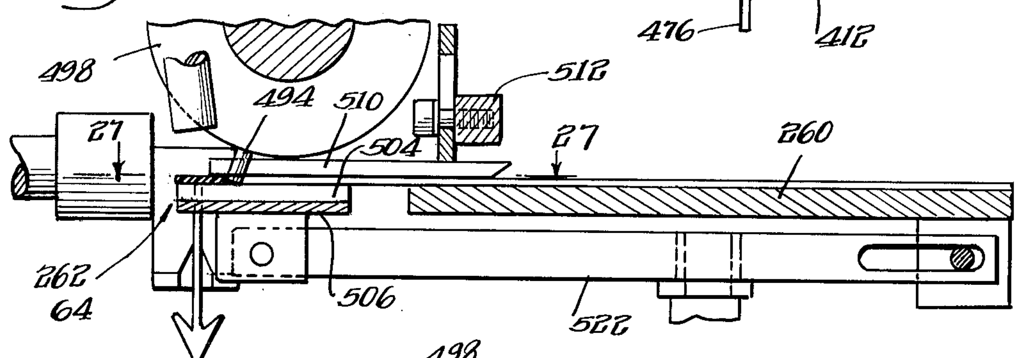
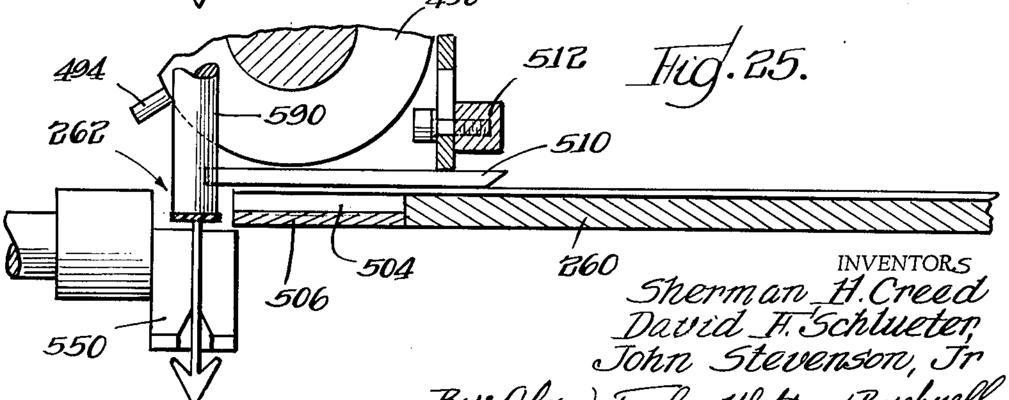


Fig. 25.



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CONTAINER PACK FORMING MACHINE

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Fig. 26.

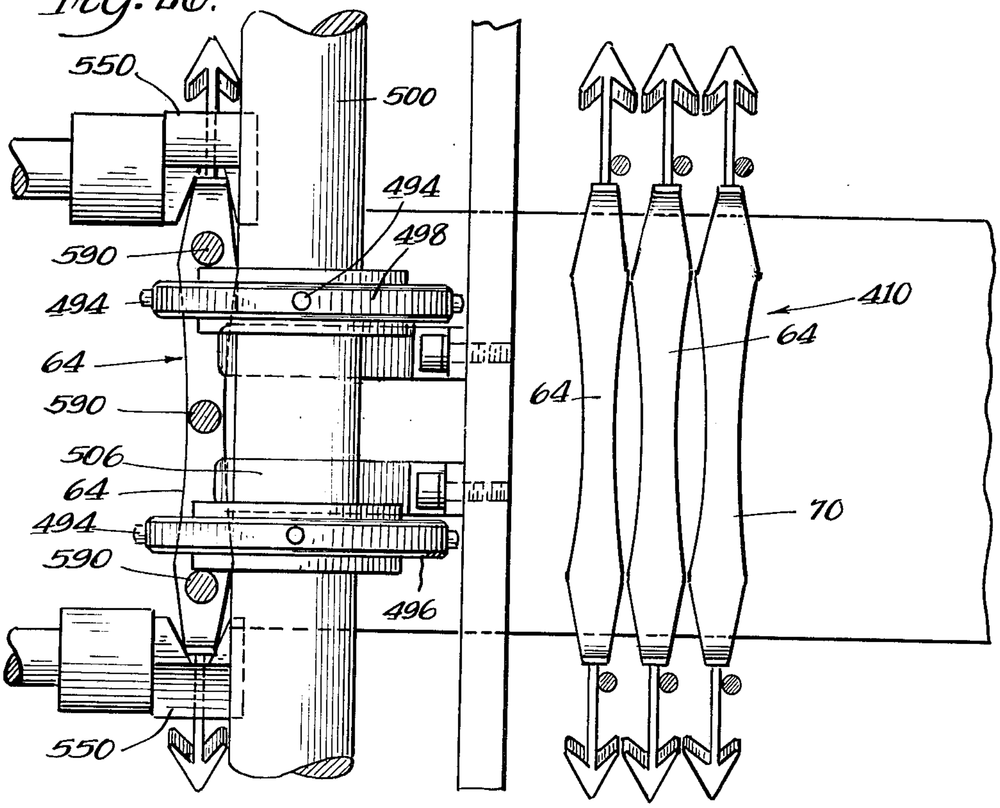
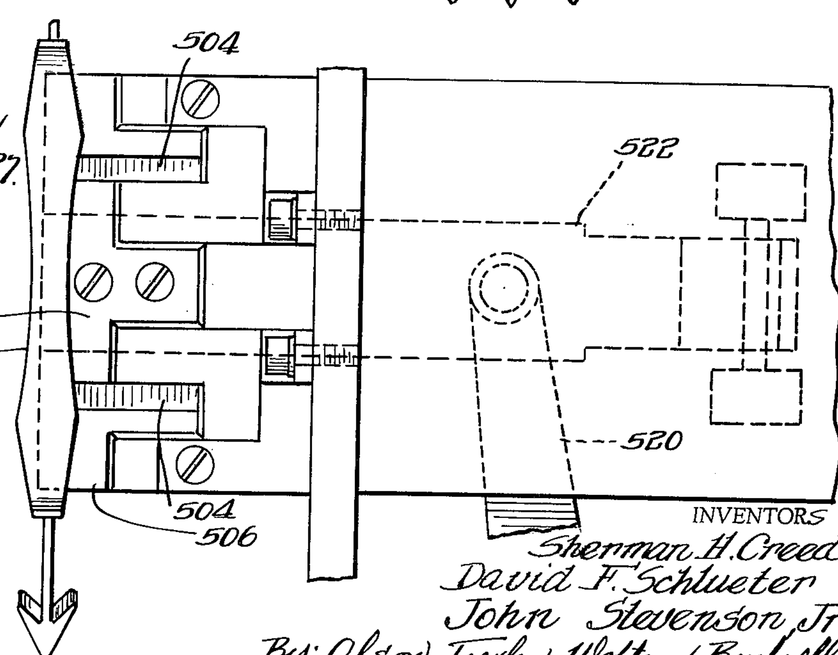


Fig. 27.



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CONTAINER PACK FORMING MACHINE

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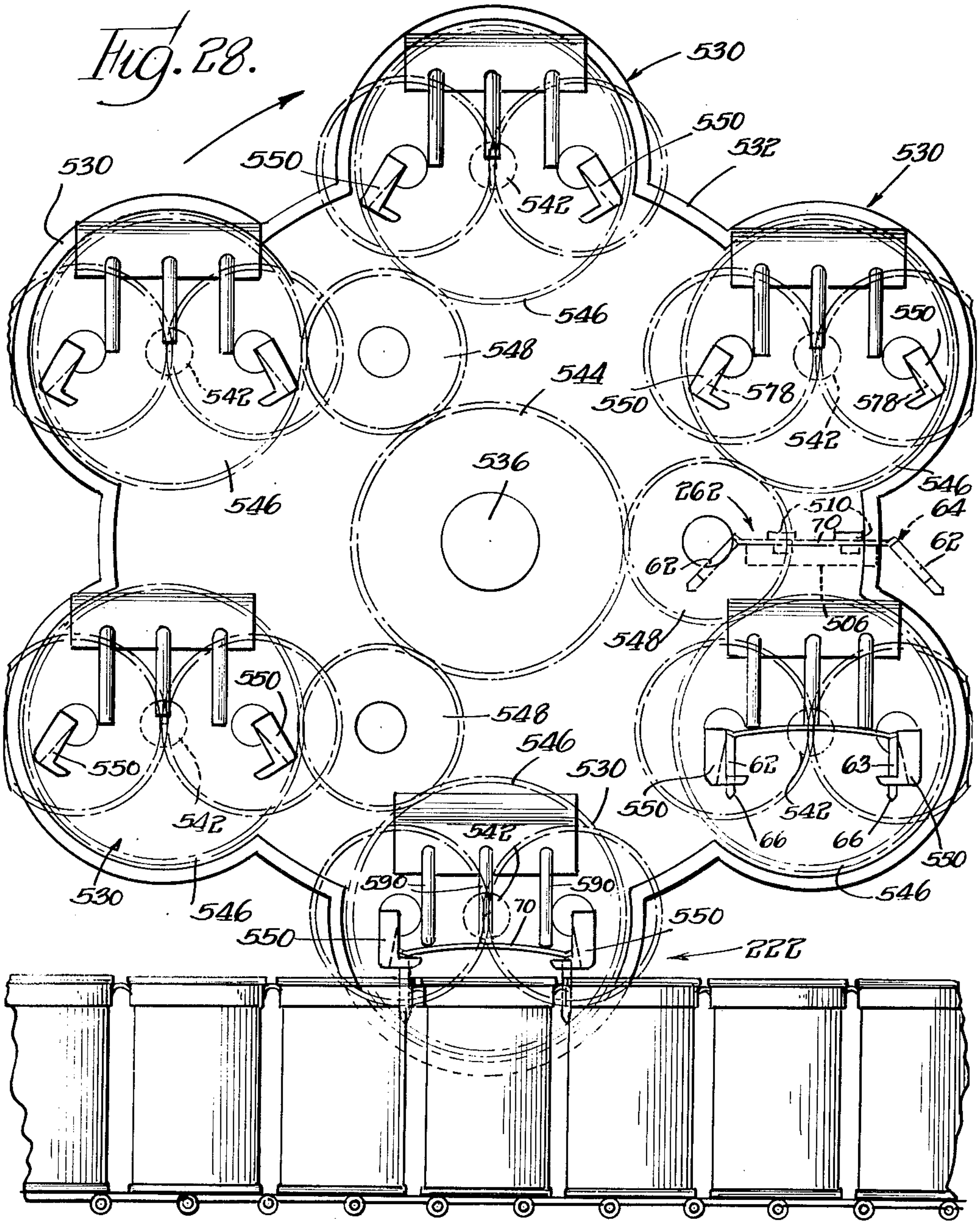
Fig. 28.



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CONTAINER PACK FORMING MACHINE

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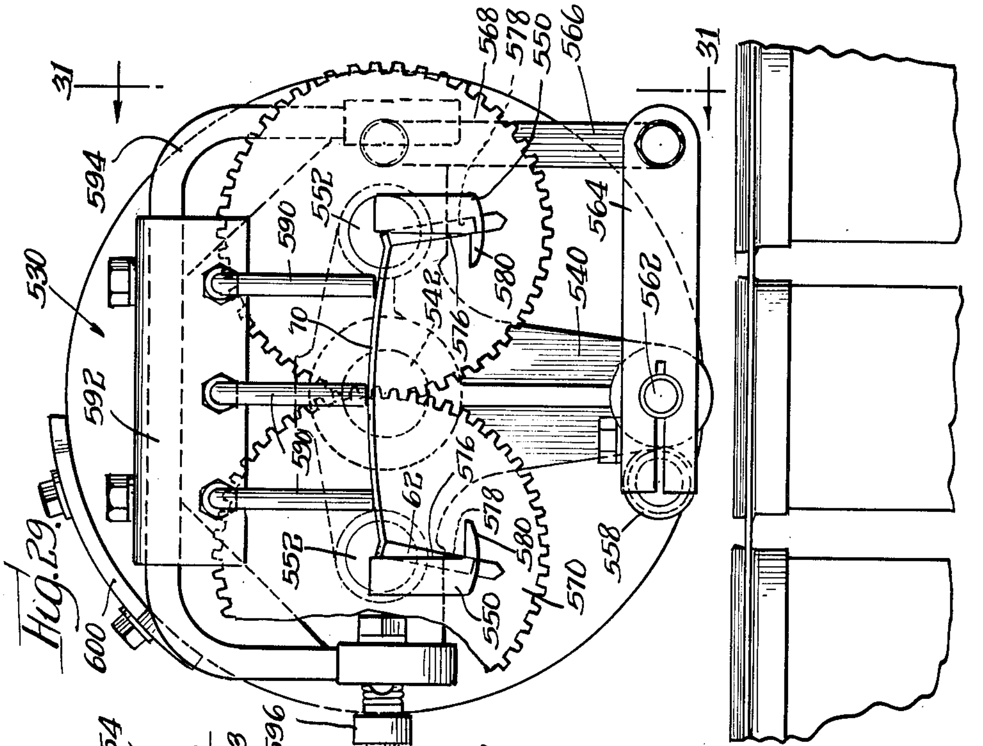

Fig. 29.

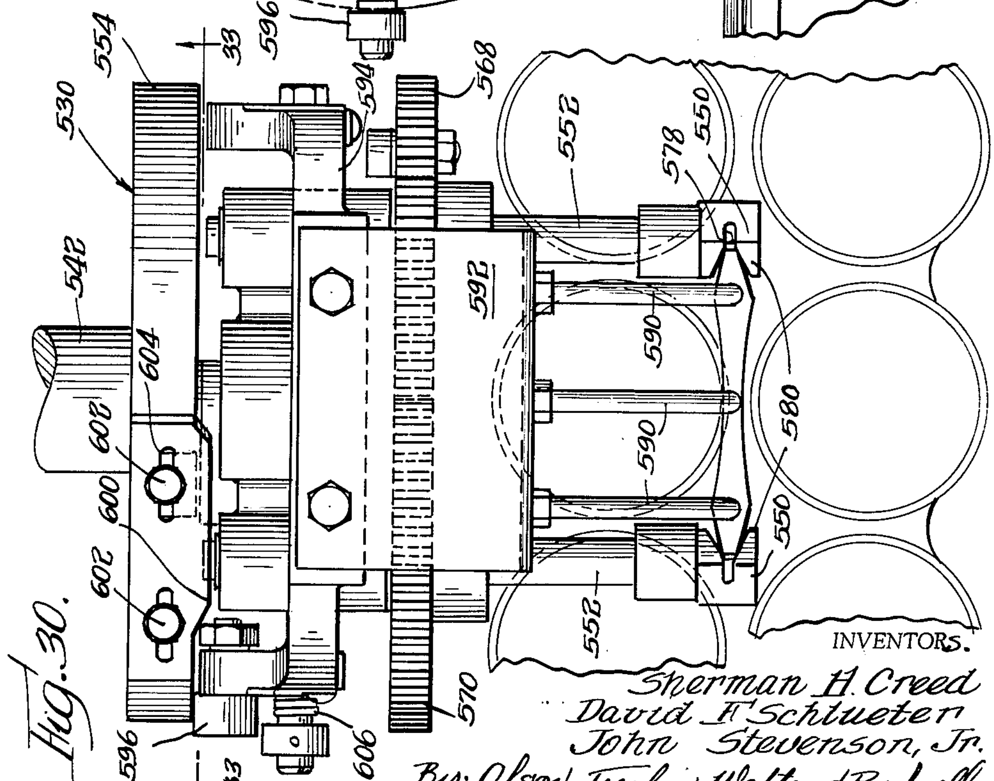

Fig. 30.

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CONTAINER PACK FORMING MACHINE

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Fig. 31.

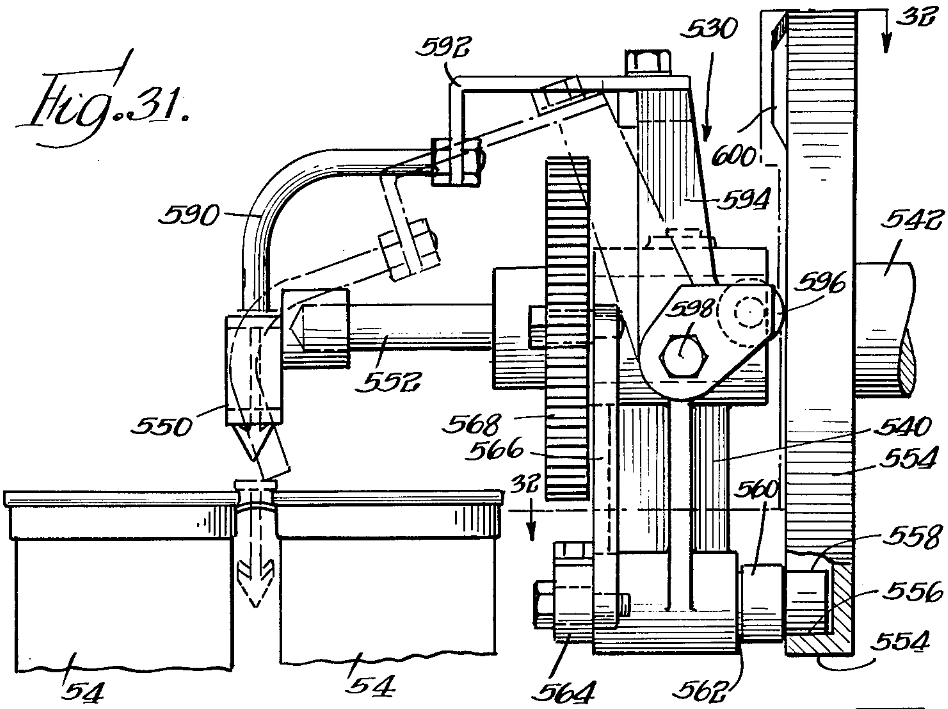


Fig. 33.

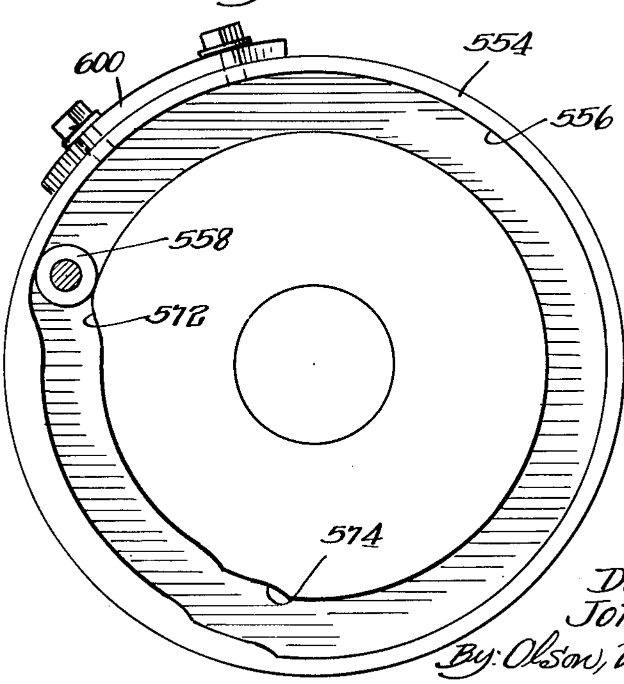
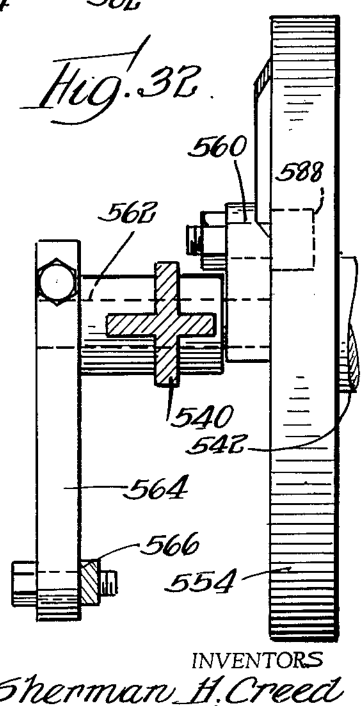


Fig. 32.



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CONTAINER PACK FORMING MACHINE

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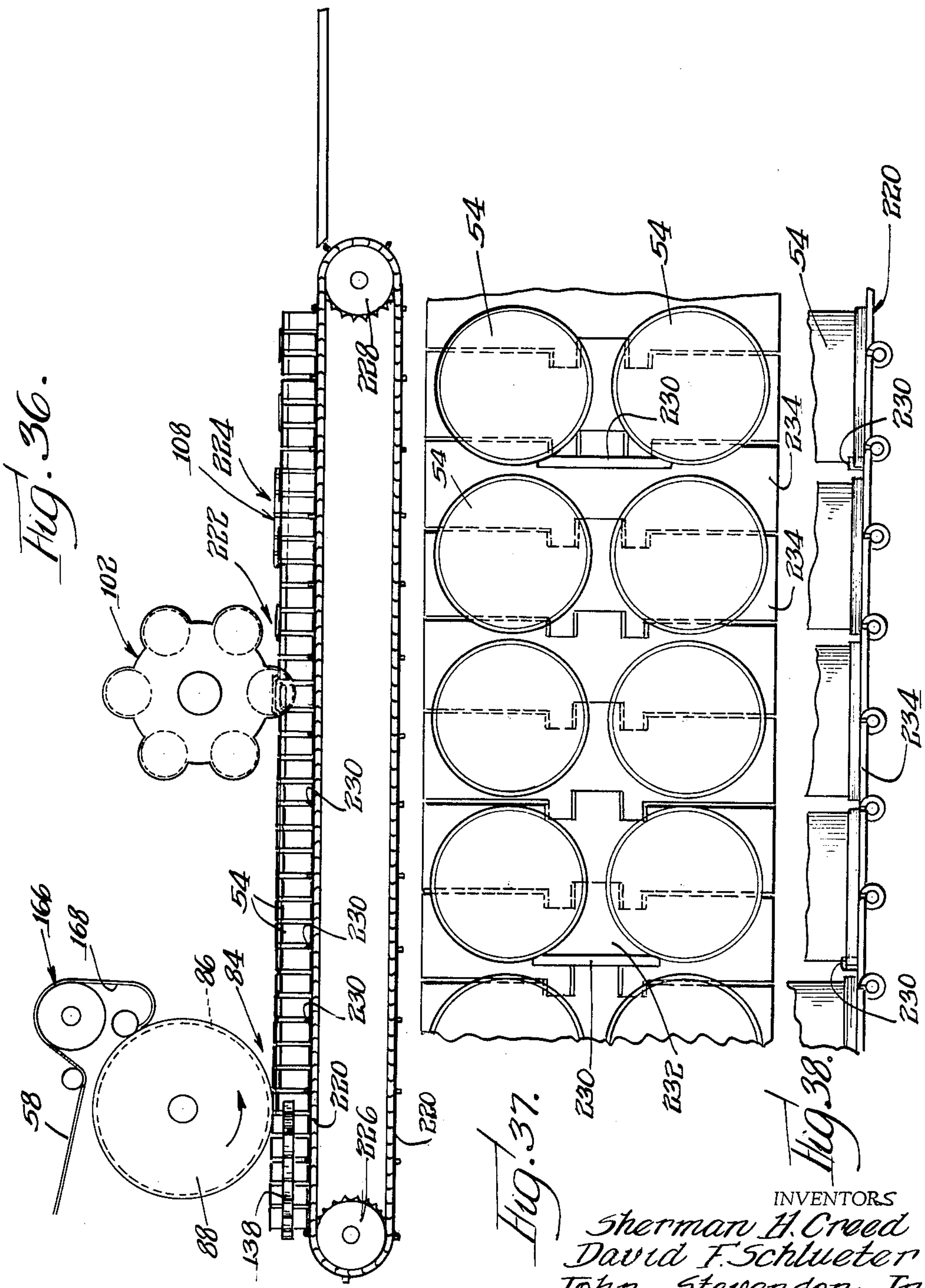

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United States Patent Office 3,204,386
Patented Sept. 7, 1965

3,204,386
CONTAINER PACK FORMING MACHINE

Sherman Howell Creed, San Jose, Calif., David Frederick Schlueter and John Stevenson, Jr., Hoopeston, Ill., assignors to Illinois Tool Works Inc., Chicago, Ill., a corporation of Delaware

Filed Feb. 19, 1962, Ser. No. 174,023
33 Claims. (Cl. 53—48)

The present invention relates to machines for assembling containers and carriers together to form individual packs of containers adapted to be carried. Machines of this character are disclosed in United States patent application Serial No. 861,811, filed December 24, 1959, and United States patent application Serial No. 49,259, filed August 12, 1960, both of which are assigned to the assignee of the present application.

One object of the invention is to provide a new and improved container pack forming machine of the above character.

Another object is to provide an improved container pack forming machine which is capable of operating with certainty and dependability at exceptionally high production speeds.

Another object is to provide a container pack forming machine as recited which is so constructed that the major components of the machine, which move, have a motion that is fundamentally rotary in character.

Another object is to provide a container pack forming machine of the character recited in which container feeding means having an inherently high capacity operates with efficiency and dependability to accept a procession of containers moving in a single file and feed the accepted containers to an assembly zone in the machine in a double file in which the containers move in successive ranks of two containers abreast.

Another object is to provide a container pack producing machine in which containers are supplied to a container and carrier assembly zone in a double file of successive rows of two containers abreast, by means of improved feeding means which accepts containers from an inlet for a single container and operates efficiently at a high production rate without overstressing or damaging the containers.

Another object is to provide a container pack producing machine which provides advantageously for supplying interconnected container carriers to carrier and container assembly means for an unlimited period of time.

Another object is to provide a container pack forming machine of the above character which facilitates loading of reels of connected carriers into the machine for application to containers.

Another object is to provide an improved machine, as recited, which is not subject to extended delays in production in the event of a temporary interruption in the normal supply of interconnected container carriers to the machine.

Another object is to provide a container pack forming machine, as recited, in which assembled containers and carriers are transferred between major operating stations within the machine rapidly and efficiently by structure which assures positive movement of the transferred containers in synchronism with the operating pace of the machine, while at the same time avoiding overstressing of the containers or subjection of the containers or the machine to jamming.

Another object is to provide a pack producing machine, as recited, in which interconnected carriers assembled on moving containers are severed, while moving, with precision and efficiency by means of structure having an inherently high production capability.

Another object is to provide, in a machine of the character recited, for high speed severance of successive carriers assembled on containers by means of severing structure which rotates with rotary container engaging structure which effects a precise positional relationship of the carrier severing means to the carriers to be severed.

Another object is to provide in a machine which assembles containers with interconnected carriers for severance of successive carriers on containers by means of carrier severing structure incorporated into star wheels which engage and pace the containers on which the carriers are assembled.

Another object is to provide in a machine which assembles containers into closely coupled carriers for severance of successive carriers between closely adjacent containers in a manner which through precise operation avoids weakening of the severed carriers.

Another object is to provide in a container pack forming machine for application of carrying handles at a very high production rate to carriers assembled onto moving containers.

Another object is to provide in a carrier pack assembly machine for application of carrying handles to carriers on containers at a very high production rate, while at the same time effectively minimizing the required operating speed of the structure used to apply the handles to the carriers.

Another object is to apply handles to container carriers in a machine of the above character by means of handle applying structure which is synchronized with carriers on moving containers and brought into operative handle applying relation to the carriers by structure having a movement which is fundamentally rotary in character.

Another object is to apply handles to container carriers, in a machine of the character recited, by means of handle applying structure which performs simultaneously a number of actions which are carried out successively in the application of a particular handle to a coacting carrier.

Another object is to provide, in a machine of the character recited, for application of handles to carriers at a high production rate by means of structure which effects and maintains a positive positional control over the handles from the time they are positively removed from a handle storage space in the machine until the handles are fully applied to the coacting carriers.

Another object is to provide a carrier pack forming machine, of the character recited, in which a procession of handles are fed to a handle pickup station by improved structure which is capable of operating at a very high production speed while at the same time assuring unfailing and accurate positioning of successive handles in the pickup station.

Another object is to provide, in a machine of the character recited, new and improved means for positively removing successive strips of handles from the bottom of a stack of handle strips and advancing each successive handle strip toward a handle feeding station by means which continuously maintains a positive control of the handles.

Another object is to provide, in a machine of the character recited, new and improved means for severing successive handles initially joined in a handle stripe, while at the same time maintaining full control of the handles and providing a very high production speed.

Another object is to provide, in a machine of the character recited, for the transference of a succession of handles from handle supply structure to handle applying structure at a high production speed, while at the same time continuously maintaining assured control of the individual handles so as to avoid jamming or fouling of the machinery.

Another object is to achieve reliable operation at a very high production speed, in a machine of the character recited, by means of machine structure which by virtue of its mode of operation and construction is inherently suited to run smoothly and efficiently without strain at high production speed.

Other objects and advantages will appear from the following description of the exemplary embodiment of the invention illustrated in the drawings, in which:

FIGURE 1 is a generally schematic plan view of the machine forming the illustrated embodiment of the invention;

FIG. 2 is a side view of the machine of FIG. 1;

FIG. 3 is a plan view showing a segment of typical interconnected container carriers which are assembled with containers in the machine;

FIG. 4 is a plan view of a number of adjoined carrier pack handles which are supplied to the machine for application to carriers on containers;

FIG. 5 is a perspective view of a typical container pack which is produced by the machine;

FIG. 6 is a fragmentary side view, taken with reference to the line **6—6** of FIG. 1, and illustrating carrier supply structure used in the machine;

FIG. 7 is a fragmentary plan view, taken with reference to the line **7—7** of FIG. 2, with certain parts removed to more clearly reveal major components of container feeding structure used in the machine.

FIG. 8 is a perspective view illustrating handle supply and handle applying assemblies incorporated into the machine;

FIG. 9 is a side view of handle supply structure illustrated in FIG. 8, certain parts being removed to more clearly reveal major internal components;

FIG. 10 is a sectional view, taken with reference to the line **10—10** of FIG. 9, certain parts being broken away and others removed for clearness in illustration;

FIG. 11 is a fragmentary sectional view, taken with reference to the line **11—11** of FIG. 8;

FIG. 12 is a detail view illustrating normal positions of an element which supports one side of a stack of handle strips in the handle magazine and structure used to positively remove the lowermost handle strip from the stack;

FIG. 13 is similar to FIG. 12, but illustrates the handle strip pulldown structure approaching the lowermost handle strip in an early phase of the operating cycle of the handle strip pulldown structure;

FIG. 14 is similar to FIG. 13, but shows the pulldown structure engaged with the lowermost handle strip;

FIG. 14A is a fragmentary sectional view taken along the line **14A—14A** of FIG. 16;

FIG. 15 is similar to FIG. 14, but illustrates the action of the parts as a handle strip is positively moved downwardly;

FIG. 16 is similar to FIG. 15, but illustrates a slightly later phase in the operating cycle in which there is a positive separation of overlying handle strips from the lowermost handle strip;

FIG. 17 is similar to FIG. 16, but illustrates the position of the parts upon completion of positive removal of the lowermost handle strip from the stack and the depositing of a removed strip on positive strip advancing structure;

FIG. 18 is a fragmentary sectional view of the handle feeding structure, taken with reference to the line **18—18** of FIG. 9;

FIG. 19 is a sectional view of transmission structure taken with reference to the line **19—19** of FIG. 18;

FIG. 20 is a fragmentary sectional view, taken with reference to the line **20—20** of FIG. 9, and illustrating structure used in severing handles as they are advanced along a handle feeding path;

FIG. 21 is a sectional view, taken along the line **21—21** of FIG. 20, and illustrating handle severing structure;

FIG. 22 is a fragmentary sectional view, taken along the line **22—22** of FIG. 20;

FIG. 23 is a fragmentary sectional view, taken with reference to the line **23—23** of FIG. 18, and illustrating structure used to feed individual handles to a handle pickup or supply station;

FIG. 24 is a fragmentary sectional view showing handle control elements of FIG. 23 advanced to locate a handle in the handle supply station;

FIG. 25 is similar to FIG. 24, but illustrates the positional relationship of the parts at a slightly later operational phase in which the handle is picked up by coacting handle applying structure;

FIG. 26 is a fragmentary plan view, taken generally with reference to the line **26—26** of FIG. 23, and illustrating the positional relationship of parts which supply handles to the supply station to parts of the handle applying structure which pick up individual handles at the handle supply station;

FIG. 27 is a fragmentary plan view, taken with reference to the line **27—27** of FIG. 24;

FIG. 28 is a simplified vertical sectional view, taken with reference to the line **28—28** of FIGS. 8 and 9, and illustrating an annular array of handle applying units which are orbited to apply handles to carriers assembled on the containers;

FIG. 29 is a front view of a typical handle applying unit of the assembly of units illustrated in FIG. 28;

FIG. 30 is a plan view of the typical handle applying unit illustrated in FIG. 29;

FIG. 31 is a side view of a typical handle applying unit, as viewed from the line **31—31** of FIG. 29;

FIG. 32 is a sectional view of a typical handle applying unit, taken along the irregular line **32—32** of FIG. 31;

FIG. 33 is a sectional view, taken with reference to the line **33—33** of FIG. 30;

FIG. 34 is a fragmentary plan view, taken with reference to the line **34—34** of FIG. 2, and illustrating carrier severing structure, certain parts being broken away to reveal underlying components;

FIG. 35 is an illustration of a typical cutter actuating linkage used in the carrier severing assembly of FIG. 34;

FIG. 36 is a simplified longitudinal side view of the machine illustrating the manner in which containers are supported on the endless conveyor for movement through successive working stations;

FIG. 37 is a fragmentary plan view of a segment of the endless conveyor illustrated in FIG. 36; and

FIG. 38 is a fragmentary edge view of the conveyor segment of FIG. 37.

The container pack forming machine **50**, FIGS. 1 and 2, forming the illustrated embodiment of the invention, operates automatically at a high production rate to produce individual carrying packs of containers, a typical one of which is illustrated in FIG. 5.

The typical carrying pack **52** of containers illustrated in FIG. 5 is a "six-pack" in which six containers **54** are disposed in two adjacent rows of three containers each. The individual containers are cylindrical in form and are commonly referred to as "tin cans," such as are used to contain foods, beverages, and other products.

The upper ends of the cans or containers **54** of the pack **52** are fitted into apertures **56** in a carrier **58** formed of a stretchable plastic material, such for example as polyethylene. A connected series of typical carriers **58** is illustrated in FIG. 3.

To form a pack, a typical carrier **58** is assembled onto the associated containers **54** so that the upper ends of the individual containers extend through the apertures **56** of the carrier and are tightly embraced by the carrier. The carrier itself is essentially flat in its construction before it is applied to the containers. However, upon assembly of a carrier with containers, portions of the carrier which define the apertures **56** may be tipped in relation to the central plane of the carrier. Such carriers and container packs formed with the carriers as such are not new with this invention.

Nevertheless, it should be noted, with reference to FIGS. 3 and 5, that each carrier 58 defines two longitudinally spaced medial apertures 60 adapted to receive the anchoring shanks or legs 62 of a U-shaped carrying handle 64. Typical handles 64 are illustrated in FIG. 4. As shown, the free end of each handle leg 62 is integrally joined to an anchoring barb 66 shaped somewhat in the form of an arrow tip. The individual handles 64, including the anchoring barbs 66 are integrally formed of a tough, flexible plastic material.

As will presently appear, after the plastic carriers 58 are assembled with coacting containers 54 in the machine 50, handles 64 are applied to the respective carriers by inserting the anchoring barbs 66 through the handle apertures 60 of each carrier and moving the coacting handle downwardly to a storage or collapsed position in relation to the carrier.

It may be noted, with reference to FIGS. 3 and 5, that each carrier 58 includes a sizable pull tab 72 projecting from one end of the central longitudinal portion of the carrier. This tab 72 is used to rip out the central longitudinal portion of the carrier to effect release of the containers when it is subsequently desired to disassemble the pack.

The supplies consumed by the machine 50 in assembling containers into packs consist essentially of interconnected plastic carriers 58, FIG. 3, and interconnected plastic handles 64, FIG. 4. It is particularly noteworthy that adjacent longitudinal ends of successive carriers 58 are integrally joined together, as shown in FIG. 3, by two integral junctures 74 between the trailing end of each carrier and the leading end of the succeeding carrier. More particularly, the connecting junctures 74 between adjacent carriers are between the plastic structure of the respective carriers encircling the apertures 56 in the adjacent longitudinal ends of the two carriers. In a sense, the junctures 74 between successive carriers may be regarded as connecting webs between the carriers. However, the successive carriers are so closely coupled that the junctures 74 are more accurately visualized as an integral merging of the adjacent structure on the respective carriers defining the adjacent apertures 56.

The significance of this will appear presently in the description of the machine 50. It is particularly noteworthy that the spacing of the apertures 56 in one end of a typical carrier 58 from the adjacent apertures 56 in the adjoining end of the next carrier 58 is substantially the same as the spacing between correspondingly adjacent apertures of the same carrier. As will be described, the interconnected carriers 58 are assembled with the cans or containers 54 before the carriers are severed in the machine 50. This makes the close coupling of successive carriers significant, in that it complicates the problem of effecting a high speed severance of the carriers after the containers are assembled with the carriers.

The integrally joined plastic carriers 58 are, after manufacture, wound on reels for storage and handling.

The plastic handles 64 are formed in strips in which adjacent handles are connected together by integral connecting webs at four points. A short segment of a handle strip 76 is illustrated in FIG. 4. The number of handles joined together in a strip 76 is determined by handling convenience. As shown, each anchoring barb 66 on each handle 64 is connected to the barb on each adjacent handle 64 of the strip by a connecting web 78. The grip portion 70 of each handle 64, which is generally straight, is connected to the grip portion of each adjacent handle by two connecting webs 80.

The four connecting webs 78, 80 between each handle 64 and each adjacent handle of a strip 76 makes the strip sufficiently stable for convenient handling, but requires that all of the connecting webs be severed, to separate the handles for application to the coacting carriers, as will appear.

The strips 76 of handles are stacked in a handle supply magazine 82 positioned on the machine 50, as shown in FIGS. 1, 2, 8 and 9. As will presently appear, the machine operates automatically to remove successive strips of handles from the bottom of the magazine 82 and to apply the handles to carriers.

Interconnected carriers 58 are supplied to carrier and container assembly means within the machine 50 from reels 85 by means which serves to advantage in maintaining an uninterrupted supply of carries to the carrier and container assembly structure, while at the same time easing the task of loading reels of carriers into the machine.

In the machine 50, containers 54 are assembled with carriers 58 in a container and carrier assembly station or zone 84, FIGS. 2 and 7. The containers are moved continuously through the assembly zone 84 two abreast in a double file or procession. A succession of interconnected carriers 58 is applied to the containers 54 moving through the station 84 by means of endless carrier applying means 86, FIG. 2, which is continuously circulated through a closed path free of abrupt changes in direction and extending through said carrier applying station.

Components of the machine 50 which effect the actual assembly of carriers and containers together in the assembly zone 84 are similar in construction to corresponding components of the carrier pack assembly machine disclosed in the previously mentioned patent application Serial No. 49,259. Since reference may be made to that application for a full description of the carrier applying means 86, and since no claim is being made in this application to the details of the carrier applying means 86, it is unnecessary here to specifically illustrate and describe this component of the machine 50 in the present application.

However, it should be noted specifically that the present machine 50 is a single channel machine in that it is designed to receive and apply carriers to only a single double file procession of containers. The high speed production capabilities achieved in the machine 50 afford sufficient container pack forming capacity in a single channel to accommodate the output of cans from canning machinery with which the machine 50 would ordinarily be used.

While reference may be made to the above mentioned application for details of the carrier applying means 86, it may be noted here that the endless carrier applying means 86, which serves to receive the connected carriers 58 and applies the carriers to the cans, is disposed in an annular array on the rotor or drum 88.

The rotor 88 is driven continuously from a common drive 90 for the whole machine 50.

As illustrated schematically in FIG. 2, a single electric motor 92 energizes the common drive or transmission 90 for the machine. Suitable gear trains are used to connect the drive 90 to each of the major components of the machine, so that all are caused to move in synchronism with each other. For the purpose of illustration, FIG. 2 illustrates the drive 90 being connected to the drum 88 by means of a worm 94 and gear 96. Similarly, a worm and gear 98, 100, connect the drive 90 to handle applying means 102 in the machine to effect application of handles in synchronized relation to the assembly of cans and carriers. A worm and gear 104, 106, connect the drive 90 to operate carrier severing means 108 in synchronism with the other components of the machine.

As previously intimated, the pack forming machine 50 is designed to accept the output of cans or containers from high speed canning machinery (not shown), such as may be used in a brewery, for example. Conventional canning machines, such as may be used to supply filled cans or containers to the machine 50, have very high output capacities, frequently running well in excess of one thousand cans per minute. Use of the pack forming machine **50** to accept and package the concurrent output of a modern canning machine of the output capacity just indicated places a great premium on operational dependability, since a stoppage of the machine **50** can seriously interfere with an over-all production line going beyond the machine **50**. Moreover, the achievement in the machine **50** of a production rate which is sufficient to accommodate the output of high speed canning machinery in a single channel of the machine **50** greatly simplifies the construction and cost of the machine **50**, thus making it unnecessary to duplicate parts to provide multiple pack forming channels, as might be required in machines having a lower capacity rate for a single pack forming channel.

The machine **50** is designed to receive containers **54** in a single file procession from canning machines, or the like. The single file input procession **112**, FIGS. 1 and 7, is transformed into a double file procession of containers two abreast by high speed container rearranging means **114**, FIGS. 1, 2 and 7, positioned on the machine **50** just ahead of the container-carrier assembly zone **84**.

The incoming single file procession **112** of containers is carried by a suitable infeed conveyor **116**, FIG. 7, into a container pickup space **118** between a pair of procession dividing star wheels **120**, **122**.

The periphery of each star wheel **120**, **122** defines a circumferential series of generally semi-cylindrical pockets **124**. A series of effectively powerful container attracting magnets **126** are mounted on each of the star wheels **120**, **122** at the base of alternate ones of the pockets **124**.

The wheels **120**, **122** are rotated in opposite directions in synchronism with each other, as indicated by the arrows **128**, **130**, so that the pockets **124** on the opposing wheels move through the container receiving space **118** in opposed synchronized relation to each other. The synchronization of the wheels **120**, **122** is such that the magnetized pockets on each wheel oppose an unmagnetized pocket on the other wheel in moving through container receiving space **118**.

The result is to divide the single procession of incoming containers, so that alternate ones of the containers are attracted into the magnetized pockets in each wheel **120**, **122**, as shown in FIG. 7. In this manner, successive containers in the infeed procession **112** are separated and moved in diverging relation to each other.

These containers are brought back together in a double file column in which containers move two abreast through the assembly zone or station **84**. It will be appreciated that the two containers which are presented abreast to the assembly zone **84** have a positional relationship in the infeed procession **112** such that one container is behind the other. Thus, two containers which travel one behind the other in the infeed procession **112** assume positions abreast of each other in the double file procession entering the station **84**. To achieve this change in relative positional relationship of the containers which are brought into an abreast relationship, it is necessary that the container which trails the other in the single file infeed procession be advanced in relation to the container which leads in the infeed procession. At the same time, it is necessary to reduce the speed of the containers so that the containers which travel two abreast through the assembly zone or station **84** have a linear speed that is approximately one-half the linear speed of the containers moving in the single file procession **112** toward the container pickup or dividing space **118**. This makes the rate at which the containers move through the assembly station **84** equal to the rate at which containers enter the space **188**.

These functions are achieved to advantage by means of two additional pairs of star wheels **132**, **134**, and **136**, **138** which operate in conjunction with the star wheels **120**, **122** to reduce the speed of the containers and to produce the desired repositioning of the containers at a high production speed without overstressing or damaging the containers. As will presently appear, the speed of the containers is reduced largely in two steps, one of which is effected in the transfer of containers from the wheels **120**, **122** to the star wheels **132**, **134** and the other of which is effected in the transfer of containers from the star wheels **132**, **134** to the star wheels **136**, **138**.

As illustrated in FIG. 7, the intermediate star wheels **132**, **134** are symmetrical in construction and turn in opposite directions. The reference numbers used to identify components of the star wheel **132** and coacting structure are also used, with the addition of the suffix "*a*," to identify similar structure associated with the wheel **134**.

The periphery of the star wheel **132** defines a circumferential series of pockets **140** intervening between protuberances **150** formed on the star wheel **132** and having a generally claw-like shape which affords running clearances between coacting parts while at the same time aiding in depositing containers in the pockets **140**.

The bottom **141** of each pocket **140** has a nearly semicircular shape. The edge **143** of each protuberance **150**, which extends outwardly from the bottom **141** of the adjacent pocket **140** and confronts an oncoming container **54** in the transition zone **139**, is substantially straight and extends outwardly in a generally radial direction to the extreme end of the protuberance. The edge **143** is the trailing edge of the protuberance with respect to the direction of the star wheel **132**. The opposite or leading edge **145** of each protuberance **50** is generally convex all the way from the adjacent pocket bottom **141** to the end of the protuberance where it meet the protuberance edge **143**.

The containers supported in the magnetized pockets of the wheel **120** are transferred to pockets **140** in the intermediate wheel **132** through the aid of a container stripper and retaining element **142**. The stripper and retainer element **142** extends into overlying relation to the periphery of the wheel **120** to have a generally tangential relationship to the path of the bottom of the magnetized pockets in the wheel **120**. This effects an engagement of the element **142** with the containers in the magnetized wheel pockets without excessive stressing or excessive jarring of the containers. Thus, the element **142** sweeps the containers out of the magnetized pockets by overcoming the attraction of the magnets **126** to allow the containers to move into the pockets **140** in the wheel **132** in the container transfer or transition zone **139** between the wheels **120** and **132**. An unfailing transition of the containers from the infeed procession to the wheel **132** is further assured by a container guard **144** extending from adjacent the dividing space **118** into spaced opposed relation to the generally straight end of the element **142** which sweeps containers from the wheel **120** into pockets of the wheel **132**.

The wheel **132** is rotated at a speed synchronized with the wheel **120**, so that the rate at which the pockets **140** are moved into opposing relation to the wheel **120** is one-half of that of the rate at which pockets in the wheel **120** move into opposing relation to the wheel **132**. This effects loading of containers into all of the pockets **140** moving into the container transfer zone between the wheels **120**, **132**.

As described, containers **54** are attracted into every second one of the pockets **124** in the wheel **120**. The chordal spacing between successive containers carried in pockets of the wheel **120** is somewhat in excess of twice the diameter of a single container. The pockets **124** travel at a constant speed and move containers into the transfer zone **139** at the same speed at which the containers move in single file into the pickup or dividing zone **118**.

In the transfer zone **139** the speed of the containers is reduced and the spacing between successive containers is reduced. For this purpose, the wheel **132** is constructed so that the chordal spacing between adjacent pockets **140** is considerably less than twice the diameter of an individual container. The rotary speed of the star wheel is such that the speed of the pockets **140** has a medial value between the container pocket speed of the star wheel **120** and the container pocket speed of the star wheel **136**. The container pocket speed of the star wheel **136** is approximately one-half that of the wheel **120** and is equal to the speed at which containers are moved through the assembly zone **84**.

The wheels **132**, **134** change the paths of the containers received by these wheels so that the containers which are moving away from each other upon engagement with the wheels **132**, **134** are directed toward each other to converge toward the double file procession desired.

Containers in the pockets of the wheel **132** are transferred to the wheel **136** in a transfer zone **152** by the aid of a stripper and guide element **154** which has a generally straight leading end positioned in generally tangential relation to the path of the bottom of the pockets **140**. The element **154** sweeps the containers from the pockets **140** of the wheel **132** into pockets **156** of the wheel **136**.

The chordal spacing of the pockets **156** in the wheel **136** exceeds the diameter of an individual container by only a small amount equal to the desired spacing between successive containers moving through the assembly zone **84**. Because of this and the reduced speed of the pockets **156**, the transfer of containers in the zone **152** is accompanied by a "second stage" slowing of the containers which complements the "first stage" slowing of the containers in the zone **139** to effect the necessary over-all reduction of the container speed.

In a similar manner, containers are transferred from the wheel **134** to the wheel **138**, component elements of the wheel **138** and coacting parts which are similar to those associated with the wheel **136** are identified with the same reference numbers with the addition of the suffix "*a*."

The two wheels **136**, **138** move the containers into the carrier and container assembly zone **84** positively in a double file procession in which containers appear two abreast, as desired.

Timing of the movement of the containers so as to bring the containers into the desired two abreast relationship in the assembly zone **84** is effected by lengthening the path of the containers which move around one of the intermediate star wheels **132**, **134** in relation to the path of the containers which move around the other of these star wheels. This is done in the present instance by positioning the star wheels **132**, **134** so that the axis of one of these wheels has a greater spacing than does the axis of the other star wheel from a center line extending between the space **118** where containers are picked up by the wheels **120**, **122** and the assembly zone **84** where the containers are discharged from the star wheels **136**, **138**. In a machine designed to handle containers of the size most commonly used to contain beverages, one of the star wheels **132**, **134** is located with its axis one and eleven-thirty seconds inches further from the above mentioned cented line than is the axis of the other star wheel. In the alternative, one of the wheels **132**, **134** can be made larger in diameter than the other wheel to produce container paths of different lengths around the respective wheels **132**, **134**.

The star wheels **120**, **122**, **132**, **134**, **136** and **138** are rotated in synchronized relation to the operating pace of the machine by positively synchronized drive means **160** of a suitable construction which includes, as illustrated diagrammatically in FIG. 2, a worm gear **162** meshing with a driving worm **164** in the power train **90**.

Interconnected carriers **58** are supplied to the carrier applying means **86** on the continuously rotating drum or rotor **88** by carrier feeding means **166**, FIGS. 1, 2 and 36 which produces slack in the interconnected carriers moving through a portion **168**, FIG. 2, of the path through which the carriers move in approaching the applying means **86**. For a detailed disclosure of the carrier feeding means **166**, reference may be made to the previously mentioned application Serial No. 49,259.

Interconnected carriers are supplied to said carrier feeding means **166** by carrier supply means which makes for easy loading of reels **85** of carriers to the machine, while at the same time affording an uninterrupted supply of interconnected carriers to the feeding means **166**, thereby effectively avoiding stoppages in the operation of the machine.

Individual reels **85** of carriers are loaded into the machine by placing the reels on movable carrier reel support structure **170**.

The reel support structure **170** is designed to support a plurality of carrier reels **85** at once, and provides for loading of the individual reels **85** onto the structure **170** at a loading station **172** located in a position alongside the path **112**, FIG. 1, of the incoming containers at a level adjacent the floor **174**, FIGS. 2 and 6, which minimizes the necessity for lifting each reel being loaded, and in general makes loading of individual reels most convenient for the operator.

As shown, the movable reel support structure **170** comprises a triangular web **176** of metal parts journaled for rotary indexing movement about a horizontal axis **178**, FIGS. 2 and 6, centrally located with respect to the web **176**. The web **176** has the over-all form of an equilateral triangle, and supports at its three apices or corners three equally spaced reel support axles **180**, FIG. 6. When one of the axles **180** is located in the reel loading station **172**, the other two axles **180** are located in carrier supplying stations **182**, **194** which are positioned above the loading station **172**, as illustrated in FIG. 2 and 6.

The supply station **182** more nearly adjacent the rotor **88** is located near the level of the path **112** of the incoming containers **54**, and the other supply station **184** for a reel is located above the level of the container path, as illustrated.

The reel support **170** is rotatably indexed to move each reel axle **180** into the loading station **172** and into the supplying stations **184**, **182** in succession. Suitable means, such for example as a locking pin **190**, FIG. 6, is provided for releasably holding the reel support **170** in its indexed position.

Normally, carriers are supplied from a reel in the position **182** most nearly adjacent the rotor **88**, and a second reel of carriers is held in reserve in the position **184**, as illustrated in FIG. 6.

All three reel positions **172**, **182** and **184** are located laterally to one side of the path **112** of incoming containers. Interconnected carriers **58** are guided from a reel in either of the positions **182**, **184** to the carrier feeding means **166** adjacent the rotor **88** by means which transfers the carriers over into the vertical medial plane of the carrier applying means **86** and the path of the containers through the assembly station **84** from the position of the supply reel support structure, which, as stated, is located laterally to one side of said plane. Moreover, the guide means **190**, FIG. 1, which directs the carriers from a supply reel to the carrier feeding means **166**, causes the interconnected carriers to move through a path **192**, FIGS. 1 and 2, in which the carriers are fully exposed and which for the most part has a zig-zag form providing for the carriers moving through the path **192** a total distance of travel within the path which is a multiple of the spacing of the carrier supplying reels from the carrier feeding means **166**.

The carrier directing means **190** comprises a series of pulleys alined with each other and alined with both supply reel stations **182**, **184** and the feeding means **166**.

Having reference to FIGS. 1 and 2, interconnected carriers move from either of the reel positions **182**, **184** into underlying engagement with a first pulley **194** from which the carriers are directed over a second pulley **196**, both pulleys **194**, **196** being rotatable about horizontal axes and alined with the supply reel position **182**, **184**.

From the horizontal pulley **196** the train of carriers moves to a pulley **198** horizontally alined with the pulley **196** and rotatable about a vertical axis. The pulley **198** is located near the rotor **88** in a position spaced several feet from the pulley **196**, the spacing between the pulleys **196**, **198**, as shown, being approximately one ond one-half times the diameter of the rotor **88**, FIGS. 1 and 2.

The train of carriers is trained around the pulley **198** and extends back to a pulley **200** rotatable about a vertical axis in vertical alinement with the pulley **198**, and being positioned horizontally to discharge the carriers substantially in the vertical medial plane of the carrier applying means **86**. The carriers are trained around the pulley **200** and move from the pulley **200** to pulley means **202**, adjacent the rotor **88**, which directs the carriers to the feeding means **166**. As illustrated, the pulley **200** overlies the container path **112** near the pulley **194**, so that the course of the carrier moving from a reel to the feeding means **166** is virtually three times the spacing of the reel from the feeding means **166**.

In the unlikely event of a break in the train of carriers in the supply path **192**, or an interruption in the supply carriers, the extensiveness of the fully exposed carrier supply path **192** can be of decided advantage in minimizing the duration of any required stoppage of the machine. Thus, it is feasible, in the event of a discontinuity in the supply of carriers, to stop the machine before the carriers in the path **192** have been consumed. When the machine is stopped, leaving the rear end of a carrier train in the path **192**, the matter of connecting the rear end of the carrier train in the exposed path **192** to the leading end of a continuing train of carriers and placement of the connected train around the exposed pulleys is quick and easy to accomplish, thus avoiding prolonged delays, which might ensue were it not for the opportunity afforded by the extensive carrier path **192** to stop the machine before the trailing end of the carrier train was carried wholly or partly around the rotor **88**, which would make time consuming rethreading of the carrier train necessary.

The trailing end of carriers wound on a reel in the position **182**, FIG. 6, is connected to the leading end of carriers on a reel in the position **184** without stopping the machine. As illustrated on an enlarged scale in FIG. 6, a few feet of the trailing end of the train of carriers on each reel are folded back on the connected carriers. The folded back segment of the trailing end of the carrier train on each reel is identified by the number **206** in FIG. 6. Upon unwinding of the folded trailing end of the carriers from a reel, the fold **206** at the end drops down into an inclined trough element **208**, as indicated by phantom lines in FIG. 6. The fold **206** dropping into the trough **208** operates a switch **210** which is connected to a control circuit **212**, indicated diagrammatically in FIG. 2, for the motor **92** to effect temporary slowing of the machine.

While the machine continues to operate at a reduced speed, the operator or attendant picks up the free end of the fold **206** and lays it briefly in a splicing station **214** where it is connected to the leading end of a train of carriers **58** on a reel in the station **184**. Preferably, the splicing station **214**, which is located, as shown in FIG. 6, on a level with the container path **112** between the reel positions **182**, **184**, is equipped with a multiple stapler **216** which quickly makes the desired attachment of carriers together to continue the supply of carriers from the reel in the station **184**. As soon as the connected train of carriers is released from the splicing station **214**, the machine is speeded up to its normal speed.

Then, the operator releases the reel support **170** and indexes it counterclockwise with reference to FIG. 6 to move the supplying reel from the position **184** to the position **182** and bring the unloaded reel into the loading station **172**, where it is replaced with a loaded reel, that subsequently is moved to the station **184**.

The moving containers **54** discharged from between the star wheels **136**, **138**, FIG. 7, are supported for movement through the assembly station **84** by a flexible endless conveyor element **220** which carries the containers on past the assembly station **84**, FIGS. 2 and 36, through a handle applying station **222**, FIGS. 1, 2 and 36, and through a container severing station **224**, all of which are located along a straight path for the containers. As shown in FIG. 36, the endless conveyor element is trained around two spaced conveyor wheels **226**, **228** which are positively driven from the common drive **90** for the machine by interconnecting transmission structure not specifically illustrated.

The endless conveyor **220** is designed to positively effect movement of the containers through the stations **84**, **222** and **224**, while at the same time avoiding interference with the removal of the completed container packs from the conveyor.

For this purpose, the conveyor element **220** is constructed to form thereon a succession of container engaging lugs **230** which have a spacing from each other along the circulating element **220** which is equal to a multiple of the span of an individual container on the element **220**. Preferably, the spacing along the element **220** between successive container engaging lugs **230** is equal to the longitudinal span along the conveyor **220** of an individual carrier **58** into which two rows of three containers each are assembled.

After being applied to containers in the assembly station **84**, the interconnected carriers remain connected as the assembly of carriers and containers is moved along by the conveyor.

As illustrated in FIGS. 36, 37 and 38, each lug **230** is designed to fit against the rear of the containers assembled in each carrier **58**, while at the same time avoiding the positive creation of a space between the two rearmost containers in each carrier from the two leading containers in the succeding carrier which exceeds the space between containers which are adjacent each other along the length of the same carrier. To avoid positive spacing of containers in adjacent carriers, the lugs **230** are shaped and dimensioned, as illustrated in FIGS. 37 and 38, so that the dimensions of each lug in a direction transverse to the conveyor element **220** is less than the space between the centers of laterally adjacent containers. This allows each lug to fit substantially into an interstice **232** between the rearmost containers in a carrier so as to avoid the lack of uniformity in the spacing of successive containers in the double file moving through the assembly station **84**.

In the preferred construction illustrated, the endless conveyor element **220** is formed of a broad flat chain of pivotally connected links **234**. The lugs **230** are suitably secured fixedly to adjacent links **234** in the conveyor element **220**.

The conveyor **220**, including the lugs **230**, thus provides for movement of the containers **54** through the assembly station **84** with a uniform spacing between successive containers in each file, while at the same time providing positively for continuous movement of the containers along the path extending through the handle applying station **222** and severing station **224** in synchronism with the machine. Since the lugs **230** are spaced apart to engage only the rear containers assembled in each carrier, removal of the completed packs after application of the handles and severance of the carriers is made easy and not interfered with by the lugs **230**.

In the handle applying station **222**, FIG. 36, handles are applied to successive carriers by high speed handle applying structure, FIG. 8, which maintains positive control of each successive handle throughout the handle applying operation. As illustrated in FIG. 8, strips **76** of handles are stacked in a magazine **82** which is designed to minimize resistance to downward movement of the strips of handles stacked in the magazine, and to provide substantially free access to all of the handles stacked in the magazine.

For this purpose, the magazine 82 is formed of a plurality of vertical guides 240 supported in parallel spaced relation to each other, so that the sides and ends of the magazine are largely open, as shown in FIG. 8.

As viewed from one end, each strip 76 of handles 64 has an "open-U" shape, the legs 62 of each handle diverging downwardly at an obtuse angle to each other. Barbs 66 on the lowermost strip of handles in the magazine 82 are connected together by webs 78 in straight lines along opposite sides of the strip of handles, as previously intimated.

All the handles stacked in the magazine 82 are normally supported by a pair of movable handle supports 244, 246 extending longitudinally along opposite sides of the lower end of the magazine, as shown in FIGS. 9, 10 and 11. Each handle support 244, 246 is formed by a relatively narrow plate, identified with the same reference numeral used to denote the handle support, and having a normal position which is generally horizontal, as indicated in FIG. 11.

The inner longitudinal edge of each handle support 244, 246 is designed to (1) engage and normally support the adjacent line of barbs 66 on the lowermost handle strip in the magazine, (2) facilitate release of the lowermost handle strip, and (3) engage and support the barbs on the handle strip next above a handle strip released from the magazine.

As shown in FIGS. 11 and 12, the inner marginal edge of the support 244, which is similar in construction to the support 246, is notched to receive the pointed tips 248 on the barbs 66 of a handle strip. Moreover, the longitudinal notch in the support 244 provides a normally horizontal ledge 250 having just sufficient width to fully support the tips 248 of the adjacent handle barbs 66. A normally vertical surface 252 defined on the support 244 in generally perpendicular relation to the ledge 250 engages the barbs 66 on the ledge 250 to hold the barbs against horizontal outward movement by the applied load of handles.

As illustrated in FIG. 12, the ledge 250 is progressively undercut or relieved from its inner edge by a longitudinal relief 254 which facilitates reengagement of the support 244 with a new line of handle barbs after release of a handle strip, as will be presently described.

The supports 244, 246 are operated to release individual strips of handles in synchronism with means which positively extracts successive strips of handles from the magazine and effects movement of the handles along a horizontal handle feeding path underlying the magazine.

As shown in FIGS. 10 and 11, a horizontal handle support or skid plate 260 underlies the magazine 82 in a position spaced a short distance downwardly from the central grip portion 70 of the lowermost strip of handles resting on the supports 244, 246.

Strips of handles deposited on the skid plate 260, in a manner to be described, are positively moved along the skid plate toward a handle feeding or pickup station 262 located horizontally beyond the magazine, FIGS. 9, 10 and 23. Positive movement of the handles along the skid plate 260 is effected by a pair of endless handle pushing elements 264, 266 located generally at opposite sides of the plate 260, as shown in FIGS. 9, 10 and 11. The elements 264, 266 are substantially symmetrical in construction. The endless flexible element 264 comprises an endless carrier or sprocket chain 268 which supports, in laterally offset relation to the main portion of the chain 268, an endless series of projecting carrier handle pushing prongs 270. The prongs 270 are designed to engage successive handles in individual strips of handles deposited on the skid plate 260, and have a spacing from each other when the chain 268 is straight that is equal to the spacing between adjacent handles in a strip 76.

Components of the endless handle moving element 266 corresponding to similar components of the element 264 are identified with the same reference number, with the addition of the suffix *"a."*

The carrier chains 268, 268*a* of the elements 264, 266 are trained respectively around two sprocket wheels 272, 274, non-rotatably mounted on a rotary shaft 276 supported in a position located below the magazine 82 and somewhat horizontally beyond the narrow side of the magazine opposite from the handle supplying station 262, as shown in FIGS. 9 and 11.

From the sprocket wheels 272, 274, the carrier chains 268, 268*a* extend through generally horizontal chain support guides 280, 282 underlying the skid plate 260. The carrier chains 268, 268*a* extend beyond the guides 280, 282 and are trained around an upper pair of sprocket wheels 280, 282 mounted on a shaft 284 located downwardly and inwardly of the handle supply station 262, FIG. 9, and a lower pair of sprocket wheels 286, 288 mounted on a shaft 290 located below the shaft 284.

The shaft 276 is rotated in synchronism with other elements of the machine by positive transmission means driven from the common machine drive 90, as previously explained. The shaft 276 powers handle strip handling means which positively extracts successive handle strips from the magazine 82 and deposits the handle strips on the skid plate 260 so as to maintain a continuous succession of handles moving across the skid plate.

Operation of the previously mentioned handle supports 244, 246 to release successive strips of handles from the magazine is effected by a drum cam 292 on the shaft 276. A cam track 294 on the cam 292 is engaged by a cam follower 296 on a rocking lever 298 extending downwardly from an oscillatable support shaft 300 for the handle support 246, FIGS. 9, 10 and 11.

Oscillatory movements of the shaft 300 by the cam 292 are transmitted to an oscillatable support shaft 302 for the handle support plate 24. This transmission of motion is effected by a rocking arm 304, FIGS. 10 and 11, non-rotatably fixed to the shaft 300 and extending to connecting means 308 which transmits motion of the arm 304 to a rocking arm 310 non-rotatably fixed to the shaft 302.

The longitudinal handle support 246 is supported on the shaft 300 by suitable brackets 312 which hold the support plate 246 in spaced relation to the axis of the shaft 300 in a position normally located downwardly and inwardly from the shaft 300, as shown in FIG. 11. The other longitudinal handle support 244 is similarly supported by brackets 314 on the shaft 302.

The projecting ends of the prongs 270, 270*a* on the handle moving or advancing elements 264, 266 are pointed and extend upwardly between the legs 62 of successive handles on the strips lowered onto the plate 260. The sprocket wheels 272, 274 are dimensioned to effect for each rotation of the shaft 276 movement of handles along the plate 260 to an extent equal to an individual handle strip. Once during each rotation of the shaft 276, the barrel cam 292 rotates the shafts 302, 300 clockwise and counterclockwise, respectively, to swing the supports 244, 246 out of supporting relation to the stack of handle strips, to release the lowermost handle strip for downward movement, and to turn the shafts 302, 300 counterclockwise and clockwise, respectively, back to their original positions, to bring the supports 244, 246 back into supporting relation to the stack of handles, as will be more fully described.

Each revolution of the shaft 276 also operates means which positively extracts the lowermost handle strip from the magazine and deposits it on the skid plate 260.

Extraction of handle strips from the magazine is effected by structure coordinated with the handle supports, as will be described presently in relation to FIGS. 12 through 17.

The handle extracting structure comprises two parallel horizontal extractor bars 320, 322 which operate in generally underlying parallel relation to the handle supports 244, 246, as shown in FIGS. 9, 10 and 11. The extractor bars 320 are moved and positioned horizontally by a disk cam 324, non-rotatably mounted on the shaft 276, FIGS. 10 and 11. Vertical movement and positioning of the extractor bars 320, 322 are effected by a circular cam 326 non-rotatably mounted on the shaft 276.

As shown in FIG. 10, the cam 324 which moves the extractor bars 320, 322 horizontally engages a cam follower 328 connected to effect horizontal movement of a longitudinal slide bar 330, that is connected to a pair of pivoted bell-cranks 332, 334 to effect swinging movement of the bell-cranks about vertical axes in opposite directions. The bell-cranks 332, 334 are connected, respectively, by slides 336, 338 with slide plates 340, 342 supported in guides 344, 346 for transverse horizontal movement toward and away from each other. Movement of the element 300 in opposite directions by the cam 324 effects movement of the slides toward and away from each other.

Each of the slides 340, 342 supports two upwardly extending guide standards or posts 348.

The cam 326 which effects vertical movement and positioning of the extractor bars 320, 322 engages a cam follower 350 on one end of a rocker lever 352 supported on a medial support pivot 354, FIG. 9. The end of the lever 352 opposite from the follower 350 operates through a slide 356 to rock an arm 358 supported on a transverse rock shaft 360, FIGS. 9 and 10.

A pair of arms 362, non-rotatably fixed to the shaft 360, connect with a pair of support shoes 364 which are laterally movable with respect to the arms, while at the same time being vertically movable by the arms. The respective shoes 364 connect with the lower ends of extractor actuating plungers 366 extending upwardly through the respective slides 340, 342, and connecting with the extractor bars 320, 322. The extractor bars 320, 322 are bored vertically to slidably receive the guides 348 on the respective slides 340, 342.

Thus, the cam 324 operates through the slides 340, 342 to move the bars 320, 322 toward and away from each other, while the cam 326 operates through the plungers 366 to move the bars 320, 322 vertically.

Each of the extractor bars 320, 322 supports a plurality of puller fingers 370, FIGS. 9, 10, 11 and 12 spaced longitudinally along the bar. Each puller or extractor finger 370 is formed of spring metal and is clamped to the underside of the coacting extractor bar and shaped as illustrated in FIG. 12.

The inner marginal edge 372 of the extractor bar 320, for example, is undercut inwardly and downwardly for clearance purposes. A typical extractor finger 370 is secured to the underside of the bar 320 by a clamp 374, FIG. 12, and extends upwardly and inwardly in diverging relation to a guard or abutment blade 376 secured to the inner marginal edge 372 of the bar 320 and projecting somewhat upwardly and inwardly of the bar edge 372, as shown in FIGS. 11 and 12.

At a level above the bar 320, the finger 370 is turned at a right angle to form a straight, handle barb engaging segment 378 which is inclined upwardly and outwardly and extends through a notch 380 in the guard 376 to project upwardly and outwardly beyond the guard, as shown in FIG. 12. The extracting fingers and coacting elements on the bar 322 are identified with the same reference numerals as those applied to similar parts supported on the bar 320.

The motion of the extractor bars 320, 322 in relation to the handle supports 244, 246, and the action of the fingers 370 in positively moving the lowermost handle strip from the magazine 82 onto the skid support 260 can be best visualized with reference to FIGS. 11 through 17. Normally, the extractor bars 320, 322 occupy a position below the hand supports 244, 246, as illustrated in FIGS. 11 and 12, only the bar 320 and the support 244 being illustrated in FIG. 12. The shaft 276 turns continuously. Under the action of the horizontal positioning cam 324 and the vertical positioning cam 326, FIGS. 10 and 11, the extractor bars 320, 322 depart from their normal positions and move toward each other and upwardly, as depicted by the arrows 384, 386 in FIG. 12. This upward and inward movement of the bars 320, 322 continues until the tips of the fingers 370 reach a position horizontally inward of the barbs 66 resting on the supports 244, 246, as depicted in FIG. 13, which illustrates only one side of the machine. At this time, the barb engaging portions 378 are in proximity to the adjacent barbs 66, as illustrated in FIG. 13.

The bars 320, 322 are then caused to move upwardly and outwardly in a direction generally parallel to the barb engaging finger portions 378 on the respective bars, to effect insertion of the finger portions 378 into the interstices between adjacent barbs 66. This is effected by horizontal outward movement of the bars 320, 322, as indicated by the arrows 388 in FIGS. 13 and 14, while upward movement of the bars 320, 322 is continued, as indicated by the arrows 390 in FIGS. 13 and 14. This moves the finger elements 370 into extracting positions in which the finger portions 370 project into overlying relation to adjacent barbs, as illustrated in FIG. 14A. In this manner, the fingers 370 "hook" the bars 320, 322 to the lowermost handle strip on the supports 244, 246. The tips of the barbs 66 of the hooked handle strip overlie the inner marginal edges of the bars 320, 322. The extractor bars 320, 322 then move downwardly, as indicated by the arrow 392 in FIG. 15. At the same time, the shafts 302, 300 are rotated in opposite directions by the cam 292 to swing the supports 244, 246 downwardly and outwardly to positions located horizontally outward of the handle barbs 66, as illustrated in FIG. 15. At this time, the barbs 66 rest on the bars 320, 322 and support all the handle strips in the magazine.

After the barbs 66 on the lowermost handle strip have beem moved downwardly sufficiently to clear the ledges 250 on the supports 244, 246, the cam 292 swings the supports 244, 246 back toward their normal positions. This motion is timed so that the ledges 250 on the supports 244, 246 engage the barbs 66 on the handle strip just above the hooked handle strip and support the new strip 76 which then becomes the lowermost strip in the magazine 82, as illustrated in FIG. 16. Since the supports 244, 246 engage the barbs of the new lowermost strip before the supports 244, 246 have fully returned to their normal positions, the newly engaged strip may be elevated somewhat as return movement of the supports 244, 246 is completed.

Downward movement of the extractor bars 320, 322 continues until the handles are deposited on the skid plate 260 and fully engaged by the prongs 270 of the endless conveyor elements 264, 266, as depicted in FIG. 16. The bars 320, 322 are then moved downward and inwardly, as indicated by the arrows 400, 402, FIG. 16, to unhook the fingers 370 from the previously engaged barbs.

The cams 324, 326 return the bars 320, 322 to normal positions outwardly of the deposited handle strip, which is advanced along the skid plate 260 by the prongs 270, as illustrated in FIG. 17. This action is continued cyclically to maintain an uninterrupted procession of handles moving across the plate 260. Each handle strip includes a predetermined number of handles.

The conveyor prongs 270 positively translate the handles along the skid plate 260 in a horizontal path to a handle severing zone 410 located beyond the magazine 82, as indicated in FIG. 9. The conveyor prongs 270 remain in engagement with the legs 62 of the handles as the handles progress through the severing zone 410. The barbs 66 of the handles moving through the severing zone are engaged by two helical barb pacing and spreading elements 412, 414, FIGS. 20 and 21. Each of the elements 412, 414 has an over-all cylindrical form and defines a helical worm 416 which engages and extends between adjacent barbs on opposite ends of handles moved into the zone 410.

The elements 412, 414 are rotatably supported within a compartment 418, FIGS. 8, 9, 20, 21 and 23, in a housing 420 for the handle feeding structure. The elements 412, 414 are journalled by means of shafts 422, 424 extending through the rear of the housing compartment structure 418 and supporting driving gears 426, 428 for the elements 412, 414. Opposite ends of the grip portions 70 of successive handles entering the severing zone 410 are engaged by helical blades 430, 432 supported on cylindrical hubs 434, 436 rotatably disposed within the housing compartment 418, as shown in FIGS. 20, 21 and 23. The helical blades 430, 432 are located generally above opposite longitudinal edges of the handle support 260.

The hubs 434, 436 are supported and rotated by shafts 438, 440 extending through the back of the compartment 418 and supporting drive gears 442, 444. The driving gears 426, 428, and 442, 444 for the rotary parts housed within the compartment 418 are driven in synchronism with the shaft 276 by a power train which, as illustrated in FIG. 22, comprises a shaft 450, miter gears 452, shaft 454 and four gears 456, 458, 460 and 462, rotatably disposed on the back side of the compartment 418, as shown in FIGS. 8, 9, 20 and 22. The gear 456 is mounted on the shaft 454 and meshes with the drive gears 426, 442, and operates through two idle gears 458, 460 to rotate the gear 462 which meshes with the drive gears 444 and 428.

The rear ends of the hubs 434, 436, i.e., the ends first approached by handles entering the zone 410, support radially projecting knife or severing blades 464, 466 which engage and sever the two webs 80, FIG. 9, connecting the hand grip portions of successive handles fed into the handle severing zone 410. The helical blades 430, 432 enter between the severed hand grip portions of successive handles to pace continued movement of the severed hand grip portions through the zone 410. The barbs 66 on the handles entering the zone 410 remain connected and are engaged by the helical worms or threads 416 on the rotary elements 412, 414.

The positive control maintained over the handles moving through the zone 410 is best visualized with reference to FIGS. 20, 21 and 22. The legs 62 of the handles are engaged and moved along by the carrier prongs 270. The hand grip portions 70 of the handles are supported by an underlying skid support 260 and held against upward displacement by an overlying holddown plate 470, FIGS. 21 and 22. The legs 62 on opposite ends of the handles are engaged and held against upward displacement by overlying hold-down plates 472, 474. At the same time, the worms 416 on the rotating elements 412, 414, positively pace movement of the barbs 66 to the forward end of the elements 412, 414, where the connecting webs. 78, FIG. 4, between the barbs 66 are severed by radially projecting knives or severing blades 476, 478, secured to the forward ends of the elements 412, 414.

Movement of the severed handles 64 is continued beyond the severing zone 410 by the conveyor prongs 270 which remain in engagement with the handle legs 62, FIG. 23.

The conveyor prongs 270 move the severed handles from the severing zone 410 into the handle dispensing or discharge zone 490 wherein the spacing between successive handles is progressively increased. The wheels 280, 282 over which the endless conveyor elements 264, 266 are trained underlie the path of the handles moving into the zone 490. As the sprocket chains 268, 268*a* of the elements 264, 266 move around the sprocket wheels 280, 282, the attached prongs 270 assume radially diverging positions with respect to the wheels 280, 282, as illustrated in FIG. 23. This increases the spacing between portions of the prongs 270 in engagement with the adjacent handle legs 62.

The effect is to accelerate the movement of successive handles within the zone 490, to separate the handles and move each successive handle into a position 492, FIG. 23, in which the hand grip 70 of the handle is disposed within the circular path of three radially projecting prongs 494 supported on each of two hubs 496, 498, mounted in axially spaced relation to each other on a transverse shaft 500, FIGS. 18, 23 and 26. The shaft 500 extends transversely across the path of the handles 64, and is driven in synchronism with other components of the machine from a transmission 502, FIGS. 18 and 19, powered by the common machine drive 90. The prongs 494 on the two hubs 496, 498 move in circular paths extending through two upwardly open parallel grooves 504 formed in a horizontally reciprocable support plate 506 forming a continuation of the stationary handle support 260, FIGS. 10 and 23 through 27.

Each handle 64 moved into the position 492, FIG. 23, by the prongs 270, as described, is engaged by a pair of prongs 494 on the hubs 496, 498 and moved forwardly to the handle supplying or pickup station 262, as indicated in FIG. 24.

Before reaching the position 492, FIG. 23, the successive handles move into underlying relation to a pair of relatively narrow horizontal handle hold down members 510. Disposed in spaced parallel relation to each other, as shown in FIGS. 18 and 23, the hold down elements 510 are supported from a transverse bar 512 to closely overlie the path of the handle grip 70 in parallel relation to the direction of handle movement. The hold down elements 510 extend all the way out to the handle supplying or pickup station 262, to remain in engagement with the handle grip 70 even after it has been moved to the pickup station 262 by a coacting pair of prongs 494, as illustrated in FIG. 24.

Each handle moved into the pickup station 262 is picked up by handle applying structure which moves downwardly through the station 262.

The previously mentioned shaft or support plate 506, FIGS. 10 and 23, is advanced from a retracted position, illustrated in FIGS. 10 and 23 to an extended position illustrated in FIG. 24 in synchronism with movement of a handle 64 by coacting prongs 494 to the pickup position 262. In its extended forward position, FIG. 24, the plate 506 underlies and supports the grip 70 of a handle in the station 262. Once the handle is engaged by pickup and applying structure, to be described, the plate 506 is quickly retracted to its normal position, as illustrated in FIG. 25, to provide clearance for downward movement of the handle applying structure through the pickup station 262 and through the space occupied by the plate 506.

Extension and retraction of the plate 506 in synchronism with coacting components of the machine is effected by means of a medially pivoted lever 520, FIG. 10, having one end articulated with a reciprocable support bar 522 for the plate 506, FIGS. 9, 10 and 27. The opposite end of the lever 520 supports cam follower 524 which engages an actuating cam 526 which is rotated in synchronism with the machine and is shaped to provide the desired advancement and retraction of the plate 506.

Successive handles 64 moved into the pickup station 262, as described, are picked up in the station 262 and applied to carriers 58 in the handle applying station 222, FIG. 28, by means of a rotary assembly of six handle applying units 530, FIGS. 8 and 28.

The six handle applying units 530 are identical in construction and are mounted in an annular array or pattern on a supporting rotor 532 which is driven by a shaft 534 extending from the transmission 502, FIGS. 8, 18 and 19.

Rotation of the rotor 532 about a horizontal axis orbits the units 530 through an annular path in which handle applying structure on each individual unit is moved downwardly through the handle pickup station 262 to pick up a handle, and is then carried through the applying station 222 to apply the handle to a carrier 58. As indicated in FIG. 28, the handle pickup station 262 is located substantially on a level with the horizontal axis 536 of the rotor 532.

Each unit **530** is stabilized so that it does not turn or rotate with reference to a horizontal or vertical plane as the unit is orbited through its annular path. As illustrated in FIGS. 29 and 31, each handle applying unit **530** comprises a generally T-shaped central frame or support element **540** which is mounted on a horizontal support shaft **542** suitably journalled on the rotor **532**. The support shafts **542** for the respective units **530** are equally spaced circumferentially on the rotor **532**, as illustrated in FIG. 28.

Rotation of the several support shafts **542** is positively prevented by gearing housed within the rotor **532**. This gearing includes a stationary sun gear **544** concentric with the rotor **532**, FIG. 28, and a gear **546** nonrotatably secured to each of the shafts **542**. The pitch diameter of each of the gears **546** is equal to that of the gear **544**. Three intermediate gears **548** are journalled on the rotor **532** for rotation with the rotor to mesh with the sun gear **544** and with adjacent pairs of the gears **546**, as illustrated in FIG. 28. This gearing positively holds the shafts **542** against rotation as the rotor **532** rotates, thus holding the orbiting units **530** against rotation.

The non-rotary frame **540** on each unit **530** supports two boot shaped handle leg engaging elements **550** in horizontally spaced relation to each other, FIGS. 28 and 29. The pair of elements **550** on each unit **530** are supported on the projecting ends of two rock shafts **552**, journalled in the frame **540** of the unit on opposite sides of the support shaft **542**, FIGS. 29 to 31. The boot shaped elements are fixed at their upper ends to projecting ends of the shaft **552** and extended downwardly for swinging movement toward and away from each other upon rotation of the shaft **552** to an opposite direction.

The shafts **552** are moved in opposite directions by means of a cam **554** provided on the rotor **532** for each of the units **530**, FIGS. 8, and 29 to 33. Each cam **554** rotates with the rotor **532** and defines a closed cam track **556**, FIGS. 8, 31 and 33 encircling the support shaft **542** for the adjacent unit **530**.

The closed cam groove **556** of each cam **554** receives a follower **558**, FIGS. 29, 31, 32 and 33, supported on a radial arm **560** non-rotatably fixed to a shaft **562** journalled in the lower end of the coacting frame **540**. The end of the shaft **562** opposite from the arm **560** is non-rotatably connected with a radial arm **564**, much longer than the arm **560**, FIGS. 29 and 32.

The projecting end of the arm **564** is connected by a link **556**, FIGS. 29, 31 and 32, with a gear **568** non-rotatably supported on one of the shafts **552**. The gear **568** meshes with a gear **570** of equal diameter non-rotatably supported on the other of the shafts **552**.

Upon rotation of the rotor **532**, the cam follower **558** of each unit **530** moves through the cam track **556** which moves the follower **558** toward and away from the axis of the coacting shaft **542** in timed relation to orbiting of the unit through its annular path. Movement of the follower **558** of each unit toward the axis of the adjacent shaft **542** operates through the linkage and gearing described to swing the handle leg engaging elements **550** toward each other. A portion **572** of the cam track **556** for each unit **530** is positioned and shaped to move the follower **558** and swing the handle engaging elements **550** toward each other as the handle engaging elements **550** move past the handle pickup station **262**.

Another portion **574** of each cam track **556** is shaped to move the follower **558** outwardly to swing the coacting handle engaging elements **550** away from each other as they are carried through the handle applying station **222**.

As illustrated in FIGS. 28 and 29, the inner, generally vertical side **576** of each boot shaped handle engaging element **550** defines a notch **578** designed to receive a coacting handle leg **62**, and having an effective depth which increases toward the bottom of the element. The lower end of each element **550** is formed to define a bifurcated inwardly projecting toe **580**. Opposite half-sections of each toe diverge away from each other, as shown in FIG. 30, to assist in guiding a handle leg **62** into the adjacent slot **578**, upon swinging of the elements **550** toward each other.

As previously described, each successive handle **64** is supported in the pickup station **262**, FIG. 28, by the shifter plate **506** which engages the underside of the handle grip **70**, FIGS. 24 and 28, and by the hold down elements **510** which engage the topside of the handle grip **70**. The legs **62** of the handle supported in the station **262** cantilever in diverging relation to each other, as illustrated in FIG. 28. The rotor turns in the clockwise direction with reference to FIG. 28. The handle leg engaging elements **550** of oncoming applying units **530** are held in diverging relation to each other as they are moved in a downward direction toward the diverging legs **62** of a handle in the station **262**.

The legs **62** of a handle in the station **262** occupy positions in the paths of the notches **578** in the elements **550**. As a pair of elements **550** approach the handle legs **62**, the elements **550** are swung toward each other by the coacting cam segment **572**, FIG. 33, to engage the respective handle legs **62** inwardly of the handle barbs **66**. The inward swinging movement of the elements **550** against the handle legs received into the notches **578** of the elements **550** swings the legs into generally vertical positions, as they are carried along in an arcuate path toward the handle applying station **222**. As previously mentioned, the shifter plate **506** is retracted to allow the handle grips **70** to move downwardly.

The two barbs **66** on a handle picked up in the station **262** are moved downwardly in arcs which intersect the paths of the two handle apertures **60** in a carrier **58** moving into the assembly station **222**. The elements **550** acting on the handle legs **62** guide movement of the barbs **66** through the carrier apertures **60** as the coacting unit **530** progresses toward its lowermost position in its circular path.

As the barbs **66** of a handle are brought into alinement with handle openings **60** in a carrier in the station **222**, the handle is moved downwardly by three pusher fingers **590** which engage and act downwardly on the handle grip **70**.

As shown in FIGS. 29, 30 and 31, the pusher fingers **590** on each unit **530** are mounted on a bracket **592** supported on a swingable yoke **594** pivotally mounted on the frame **540** of the handle applying unit. Normally, the yoke **594** and handle pusher fingers **590** of each unit occupy retracted positions, shown in solid lines in FIG. 31. As each unit **530** moves through the handle applying station **222**, the yoke **594** is swung in a counter clockwise direction with reference to FIG. 31 to the position shown in phantom lines in FIG. 31. This moves the tips of fingers **590**, which point downwardly, downwardly against the coacting handle grip **70** to drive the handle "home," so that the handle grip **70** lies near the coacting carrier **58**.

Actuation of the yoke **594** is effected by a cam follower **596**, FIGS. 29, 30 and 31, supported on the yoke **594** is spaced relation to the pivotal axis **598**, FIG. 31, of the yoke. The follower **596** is positioned to extend radially beyond the periphery of the annular cam **554** for the coacting unit **530**.

As the unit **530** moves through the handle applying station **222**, the follower **596** engages a cam **600** secured to the periphery of the cam **554**, as illustrated in FIGS. 29 and 30, and projecting axially in the direction of the follower. The cam **600** is supported by screws **602** extending through slots **604** which provide for circumferential adjustment of the cam **600** on the supporting cam or cam plate **554**.

The yoke **594** is yieldably held in its normal position by a spring **606**, FIG. 30. As a unit **50** moves through the assembly station **222**, the coacting cam follower **596** rolls over the cam 600 to swing the yoke 594 and drive the carrier "home," as recited.

Beyond the station 222, the elements 550 swing away from each other and the fingers 590 move up to receive another handle upon moving through the station 262.

It is noteworthy, with reference to FIGS. 25 and 26, that the fingers 590 in moving through the pickup station 262 have an interleaved relationship with parts which position handles in the station 262 to be picked up. Thus, the fingers 590 clear the hubs 496, 498 and the hold down elements 510, all of which project outwardly beyond the path of the fingers 590. The shifter plate 506 is retracted to clear the downwardly moving fingers 590, as shown in FIG. 25.

From the station 222, the assembled containers and carriers are moved by the conveyor 220, FIG. 36, to the carrier severing station 224 where the containers pass between two carrier severing star wheels 620, 622, FIGS. 1, 34 and 36, forming part of the previously mentioned carrier severing means 108. The star wheels 620, 622, are rotated in opposite directions in synchronism with the machine by the common drive 90 operating through transmission means, which for the purpose of illustration includes the worm 104 and worm wheel 106, FIG. 2.

The star wheels 620, 622 and carrier severing structure mounted in association with these wheels, as will be described, sever successive carriers moving through the station 224 with an inherent accuracy which avoids weakening of any of the carriers.

As illustrated in FIG. 3, the carriers 58 are formed so that there is no significant excess of material at the junctures 74 between successive carriers. As the carriers are formed in integrally connected relation to each other, the amount or area of structural material which exists in the unsevered carriers between the last two apertures 56 of each carrier and the first two apertures 56 of each succeeding carrier is just sufficient to provide, upon severance of the carriers, retaining bands or elements of the desired strength encircling the containers at the ends of the carrier packs formed by the carriers. Hence, any substantial inaccuracy in the severing of the junctures 74 between successive carriers will cause a weakening of one of the carriers, so that it does not have the container restraining strength for which it is designed. In the interests of saving materials and in having a substantially uniform spacing between successive rows of apertures 56 in the unsevered carriers 58, it is desirable that the junctures 74 between successive carriers be narrow, as recited. At the same time, it is highly desirable that the junctures between two successive carriers be severed with precision, to avoid weakening of either carrier.

Accurate severing of successive carriers is achieved at a high production rate in the severing station 224 by the star wheels 620, 622 and severing means associated with the respective star wheels. The two star wheels are generally identical in construction, and the severing structure associated with the respective star wheels is substantially symmetrical.

Each of the star wheels 620, 622 defines twelve radial projections 624 intervening respectively between twelve generally semi-cylindrical pockets 626 formed in the periphery of the star wheel. Upon rotation of the star wheels, the projections 624 enter into spaces between containers in the adjacent file of containers, to pace movement of the containers through the station 224. Every third one of the projections 624 enters between a container 54 in the trailing end of one carrier 58 and an adjacent container in the leading end of the succeeding carrier.

Thus, every third protuberance or projection 624 on each star wheel enters between containers assembled into succeeding carriers. Each of the projections 624 which repeatedly enters between containers in successive carriers is designed to create tension in the adjacent juncture 74 between the adjoined carriers. For this purpose, each of the four equally spaced protuberances, which enters between containers in adjacent carriers, is designed to a have a thickness, measured circumferentially with reference to the star wheel, which exceeds the corresponding thickness of the projections 624 which enter between containers in the same carrier. For the purpose of identification, the circumferentially thickened projections which serve to tension the junctures 74 between successive carriers, are identified in FIG. 34 with the number 628.

Each of the star wheels 620, 622 carries four carrier severing blades or knives 630 mounted in the star wheel in circumferential alinement with the four thickened projections 628, for radial movement with respect to the star wheels.

Each of the severing knives 630 is slidably disposed within a radial slot 632 formed in the supporting star wheel, to position the knife for radially outward movement through the center of the associated projection 628.

The four knives 630, slidably mounted in the star wheels 620, 622, are retracted and extended radially automatically as an incident to rotation of the star wheels, Thus, as shown in FIGS. 34 and 35, the severing blades or knives 630 for each star wheel are operated by a stationary cam 634 defining an endless cam track 636 underlying the coacting star wheel. Four pivot pins 638 projecting downwardly from each star wheel 620, 622 pivotally support four bell-cranks 640 which actuate the respective blades 630 on the star wheel. As shown in FIG. 35, a relatively long leg 642 of each bell-crank 640 connects with a blade holder 644 for the coacting blade 630. A cam following roller 646 on a shorter leg 648 of each bell-crank 640 extends down into the cam groove 636. The relationship of the parts is such that radially inward movement of each cam following roller 646 effects a radially outward movement of the coacting carrier severing blade 630.

As shown in FIG. 34, each cam groove 636 is circular except for a short segment 650 which is diverted radially inward. The effect of this shaping of the cam groove is to normally hold all of the coacting knives 630 in radially inward retracted positions and to extend the individual knives radially outward in timed relation to movement of the knives through the carrier severing station 224.

Hence, as each of the thickened protuberances 628 moves into engagement with containers assembled in successive carriers and tensions the adjacent juncture 74 of the carriers, the associated carrier severing knife 630 is radially extended by the action of the cam groove segment 650 on the actuating follower 646 for the knife.

It will be appreciated that the motion of each knife 630 in moving through the severing zone 224 has both a rotary or circumferential component imparted by the rotation of the supporting star wheel and a radial component imparted by the action of the cam groove segment 650 on the coacting follower. The shaping of the cam groove segment 650 is such that the edge of the knife 630 moves through the adjacent carrier juncture in a straight path which is perpendicular to the longitudinal dimension of the coacting carriers. Also, the path of the knife blade edge is located midway between the adjacent containers by virtue of the engagement of the coacting protuberance 628 with both containers and the shaping of the cam groove segment 650.

Severance of the carriers in the station 224 completes formation of the individual carrying packs 52. These are moved on beyond the severing station 224 by the lugged endless conveyor 220. The positive container engaging lugs 230 on the conveyor 220, FIGS. 36 and 37, effect an unfailing movement of the completed carrier packs on beyond the station 224, while the previously described spacing between the successive lugs 330 avoids interference with removal of the completed packs from the conveyor.

It will be appreciated that the invention is not limited to use of the particular construction illustrated, but includes the use of equivalents and alternatives within the spirit and scope of the invention as defined by the claims.

The invention is claimed as follows:

1. In a machine for assembling a procession of containers into packs for carrying, means for moving a procession of containers along a predetermined container path to a container and carrier assembly station, endless carrier applying means, means for continuously circulating said endless carrier applying means through a closed path free of abrupt changes in direction and extending through said assembly station, carrier reel support means disposed in a laterally offset position in relation to said path for containers, said carrier reel support means including a plurality of carrier reel supports, means supporting said carrier reel support means for rotary indexing movement to effect indexing movement of the reel supports through a circular path to locate the reel supports successively in a reel loading position disposed below the level of said container path and in a carrier supplying position disposed above the level of said container path, and means for directing an interconnected series of carriers from said reel support means to said endless carrier applying means for application by the latter to containers moving through said assembly station.

2. In a machine for assembling a procession of containers into packs for carrying, the combination of means for moving a procession of containers along a predetermined container path to a container and carrier assembly station, endless carrier applying means, means for continuously circulating said endless carrier applying means through a closed path free of abrupt changes in direction and extending through said assembly station, a plurality of carrier reel supports laterally offset to one side of said container path, means movably supporting each carrier reel support for movement between a reel loading level disposed below the level of said container path for convenient loading of a reel of carriers and a carrier supplying level disposed above the level of said container path, and means for directing an interconnected series of carriers to said endless carrier applying means from a carrier supply reel supported on one of said reel supports in a position laterally offset from said container path.

3. In a machine for continuously assembling containers into packs for carrying, means for moving a procession of containers along a container path to a container and carrier assembly zone for continuous movement through said zone, endless carrier applying means, means for circulating said endless carrier applying means continuously through a closed path extending through said assembly zone, carrier reel support means including a plurality of carrier reel supports, means mounting said support means for indexing movement to move said reel supports between positions located laterally to one side of said container path, and a plurality of carrier directing pulleys supported in spaced alined relation to each other and to said reel support means and said carrier applying means to direct interconnected carriers from a reel on one of said reel supports into coacting relation to said carrier applying means for application by the latter to containers moving through said assembly zone.

4. In a machine for continuously assembling containers into packs for carrying, means for moving a procession of containers along a generally horizontal container path to a container and carrier assembly zone for continuous movement through said zone, endless carrier applying means positioned above and aligned with said container path, means for circulating said endless carrier applying means continuously through a closed path extending through said assembly zone, reel support means for supporting a reel of connected carriers in a carrier supplying position disposed alongside said container path and laterally to one side of said container path so that containers moving along said path pass by said carrier supplying position, and a plurality of carrier directing pulleys supported in spaced generally alined relation to each other and to said reel support means and said carrier applying means to direct interconnected carriers from said reel support means disposed alongside said container path to said endless carrier applying means positioned above and aligned with said container path for application by the latter to containers moving through said assembly zone.

5. In a machine for assembling a continuously moving procession of containers into packs, the combination of a rotor, means for rotating said rotor continuously, an annular array of carrier applying means supported on said rotor to extend continuously through a container and carrier assembly station, means for continuously supplying a procession of containers to said assembly station for continuous movement through said assembly station in synchronism with movement therethrough of said carrier applying means on said rotor, a plurality of carrier reel supports disposed in spaced relation to said rotor for supporting simultaneously a plurality of reels of interconnected carriers, carrier connecting means positioned in relation to said reel supports for convenient connecting together of the trailing end of a connected series of carriers from one of said reel supports with the leading end of a connected series of carriers from another of said reel supports, and machine slowing means positioned to sense the unwinding of a connected series of carriers from one of said supports.

6. In a machine for assembling containers into packs for carrying, the combination of means for supplying a procession of containers, means for supplying a succession of interconnected container carriers, means for assembling a succession of interconnected container carriers with a procession of containers in a container and carrier assembly station, means for moving assembled containers and carriers away from said assembly station along a predetermined path, two rotatable container spacing elements disposed in container engaging positions on opposite sides of said path at a carrier severing station located downstream from said assembly station with reference to the direction of movement of containers along said path, and a plurality of carrier severing elements mounted on each of said container spacing elements in circumferentially spaced positions thereon for severing successive carriers on containers moving through said severing station.

7. In a container and carrier assembly machine, the combination of means for directing a procession of assembled containers and interconnected carriers along a path to a carrier severing station, a pair of rotary star wheels positioned on opposite sides of said path at said severing station for engagement with containers moving through said severing station, each of said star wheels supporting a plurality of carrier cutters in circumferentially spaced positions on the star wheel for movement in generally radial directions with respect to the star wheel, and actuating means coacting with said cutters to intermittently extend the individual cutters radially in timed relation to rotation of the star wheels to effect severing of adjacent carriers moving through said severing station.

8. In a machine for assembling containers into packs for carrying, the combination of means for assembling together a procession of containers and a succession of interconnected carriers, means for directing assembled containers and carriers along a predetermined path to a carrier severing station, a pair of container engaging star whels disposed on opposite sides of said path at said carrier severing station, means for rotating said star wheels, a plurality of carrier severing cutters mounted in association with each of said star wheels in circumferentially spaced positions thereon for rotation therewith, and cam means coacting with said cutters associated with each star wheel to effect intermittent operation of the cutters in timed relation to rotation of the star wheel to effect severing of successive carriers moving through said severing station.

9. In a machine for assembling containers into carrying packs, the combination of means for assembling a procession of containers and interconnected carriers together in a container and carrier assembly station, means for directing movement of assembled containers and interconnected carriers from said assembly station to a carrier severing station, rotary container engaging means positioned at said carrier severing station to engage containers moved to said severing station, carrier severing means mounted on said rotary container engaging means for rotation therewith, and means coacting with said severing means to effect intermittent carrier severing operation of the latter in synchronized relation to rotation of said container engaging means to cut apart successive carriers on containers moving through said severing station.

10. In a machine for assembling containers into carrying packs, the combination of a rotor, an annular array of carrier applying means on said rotor, means for continuously rotating said rotor to effect continuous movement of said carrier applying means through a container and carrier assembly station, means for supplying a procession of containers to said assembly station for continuous movement through said assembly station in synchronism with the continuous movement of said carrier applying means through the assembly station, supply means for supplying a succession of interconnected apertured carriers to said carrier applying means for application to containers moving through said assembly station, a pair of rotary star wheels mounted in generally opposed relation to each other in a carrier severing zone spaced from said assembly station, means for directing assembled containers and interconnected carriers from said assembly station in a continuous procession to said severing zone to cause the containers to pass between said star wheels, each of said star wheels including a plurality of protuberances thereon adapted to extend between successive containers in a procession of containers moving between the star wheels, a plurality of carrier severing elements mounted movably on each of said star wheels in circumferentially spaced relation thereon and in circumferential alinement with protuberances on the star wheel, and cam means coacting with said severing elements to effect as an incident to rotation of the star wheels intermittent carrier severing movements of the severing elements to sever successive carriers on containers moving through said carrier severing zone.

11. In a machine for assembling containers into individual carrying packs, the combination of means for assembling a procession of containers and interconnected carriers together in a container and assembly station, means for directing movement of assembled containers and interconnected carriers from said assembly station to a carrier severing station, two rotary container engaging elements positioned at said carrier severing station in opposed relation to each other to engage and move therebetween containers directed to said severing station, each of said container engaging elements including thereon a plurality of circumferentially spaced container pack spacing protuberances adapted to enter between adjacent containers assembled in successive carriers on containers moving between the container engaging elements, said pack spacing protuberances on each container engaging element having a circumferential spacing from each other around the container engaging element which corresponds generally to the span of each carrier and can assembly along the path of the containers between said engaging elements, a plurality of carrier severing cutters supported on each of said container engaging elements in circumferential alinement with said respective pack spacing protuberances thereon for movement in a generally radial direction with respect to the container engaging element, each of said container engaging elements including a plurality of radially extending container spacing protuberances intervening circumferentially between said pack spacing protuberances on the container engaging element for individual engagement with adjacent containers moving between said engaging elements in assembled relation to the same carrier, said individual container spacing elements having a circumferential width which is substantially smaller than the corresponding circumferential width of the individual pack spacing protuberances, and means for extending said cutters intermittently in synchronism with rotation of said container engaging elements to effect severing of successive carriers on containers moved between said container engaging elements.

12. In a machine for assembling containers into individual carrying packs, the combination of means for assembling a procession of containers and interconnected carriers together in a container and assembly station, means for directing movement of assembled containers and interconnected carriers from said assembly station to a carrier severing station, two rotary star wheels positioned at said carrier severing station to engage and move therebtween containers directed to said severing station, each of said container star wheels including a plurality of circumferentially spaced protuberances adapted to engage containers moving between the star wheels, a submultiple of the protuberances on each star wheel constituting container pack spacing protuberances evenly spaced around the star wheel and having a container spacing size exceeding that of the intervening protuberances and a plurality of carrier severing cutters supported on each of said star wheels in circumferential alinement with said respective pack spacing protuberances thereon to effect as an incident to rotation of the star wheels severing of successive carriers on containers moving between the star wheels.

13. In a machine for assembling containers into individual carrying packs, the combination of means for assembling a procession of containers and interconnected carriers together in a container and assembly station, means for directing movement of assembled containers and interconnected carriers from said assembly station to a carrier severing station, means for directing containers through said carrier severing station and including a rotary star wheel, said star wheel including a plurality of circumferentially spaced protuberances adapted to engage containers moving through the carrier severing station, a submultiple of the protuberances on said star wheel constituting container pack spacing protuberances evenly spaced around the star wheel and having a container spacing size exceeding that of the intervening protuberances, a plurality of carrier severing cutters supported on said star wheel in circumferential alinement with said respective pack spacing protuberances for movement with respect to the star wheel, a stationary cam, and a plurality of cutter actuators coacting with said respective cutters and said cam to effect as an incident to rotation of said star wheel carrier serving movements of the cutters which sever successive carriers on containers moving past the star wheel.

14. In a machine for assembling containers into packs for carrying, the combination of means for assembling a procession of containers and a succession of carriers together in an assembly station, means for directing assembled containers and carriers from said assembly station to a handle applying station spaced from said assembly station, a rotor supported at said handle applying station for rotation about a generally horizontal axis, a plurality of handle applying units rotatably supported on said rotor in circumferentially spaced positions thereon located radially outward of the axis of the rotor, means for rotating said rotor to orbit said handle applying units through a circular path extending through said handle applying station, means coacting with all of said handle applying units to maintain the latter in non-rotating positions as the units are orbited in said circular path upon rotation of said rotor, means for feeding a succession of handles to said handle applying units at a handle supply station disposed in said circular path at a position spaced from said handle

applying station, and said individual units including means for picking up handles at said supply station and inserting individual handles into carriers moving through said applying station as an incident to rotation of said rotor.

15. In a machine for assemblying containers into packs for carrying the combination of means for assembling together containers and carriers in an assembly station, means for directing assembled containers and carriers from said assembly station to a handle applying station, a plurality of handle applying units, a rotor supporting said units in an annular array thereon for movement by the rotor through a circular path extending through said handle applying station, means for supplying a succession of carrying handles to said units at a handle supply station disposed along said path at a position spaced from said handle applying station, and means for driving said rotor to move said applying units in succession past said handle supply station and through said handle applying station to pick up successive handles at said supply station and apply the handles to carriers in said handle applying station.

16. In a machine for assembling containers into packers for carrying, the combination of means for assembling containers and carriers in an assembly station, means for directing assembled containers and carriers from said assembly station to a handle applying station, a plurality of handle applying units, a rotor supporting said handle applying units in an annular array thereon for movement by the rotor through a circular path extending through said handle appyling station, means for rotating said rotor, orientation means coacting with said handle applying units to maintain the latter in substantially non-rotating positions as the units are carried through said circular path upon rotation of said rotor, handle supply means for supplying successive handles to said units as the latter pass in succession through a handle supply station located in said circular path in spaced relation to said handle applying station each of said units including opposed handle grasping elements movable toward and away from each other, means for moving the handle grasping elements of each unit toward each other to pick up a handle supplied at said handle supply station and for moving the handle grasping elements of each unit away from each other to disengage a handle applied to a carrier by the unit in said handle applying station, each of said units including a depressible handle pushing element thereon, means for effecting the location of said handle pushing element of each unit in a retracted position for receiving into the unit a handle in said handle supply station, and means for depressing said handle pushing element of each unit as the unit is carried through said handle applying station to apply a handle to carrier in said applying station.

17. In a machine for assembling containers into packs for carrying, the combination of means for assembling a procession of containers and a succession of carriers together in an assembly station, an endless conveyor extending from said assembly station to move assembled containers and carriers from said assembly station to a handle applying station spaced from said assembly station, said conveyor including a plurality of container engaging lugs thereon positioned along the conveyor so that the spacing along the conveyor between adjacent lugs is a multiple of the span of an individual container along the conveyor, a plurality of individual handle applying units, a handle applying rotor supporting said applying units in an annular pattern on the rotor for movement by the rotor in a circular path extending through said handle applying station, means for supplying a succession of U-shaped handles to a handle supply station in the circular path of said handle applying units, each of said units including a pair of handle engaging elements movable toward and away from each other, means for moving said handle engaging elements of each unit toward and away from each other in timed relation to rotation of said rotor to pick up a handle in said handle supply station and to release a handle after application of the handle to a carrier on containers moving through said applying station, each of said carrier applying units including a handle pushing element, cam means coacting with the handle pushing element of each unit to effect retraction and advancement of the pushing element in synchronized relation to rotation of said rotor to provide clearance for receiving an individual handle into the unit at said high handle supply station and to force movement of a handle into applied relation to a carrier in said assembly station as an incident to rotation of said rotor.

18. In a machine for assembling containers into packs for carrying, the combination of means for assembling a procession of containers and a succession of carriers together in an assembly station, means for directing assembled containers and carriers from said assembly station to a handle applying station, a plurality of individual handle applying units, a rotor supporting said applying units for movement by said rotor in a circular path extending through said handle applying station, means for supplying a succession of handles to a handle pickup station in the path of said handle applying units, each of said units including means for picking up a handle in said pickup station as an incident to movement of the unit past the pickup station, each of said carrier applying units including a movable handle pushing element, and actuating means coacting with the handle pushing element of each unit to effect cyclic operation of the latter in synchronism with rotation of said rotor to force movement of individual handles into applied relation to carriers in said assembly station as an incident to successive movements of the handle applying unit through the applying station.

19. In a machine for assembling containers into packs for carrying, the combination of means for assembling a procession of containers and a succession of carriers together in an assembly station, means for directing assembled containers and carriers from said assembly station to a handle applying station, a plurality of individual handle applying units, a rotor suporting said applying units for movement by said rotor in a circular path extending through said handle applying station, means for supplying a succession of handles to a handle pickup station spaced along said path from said applying station, and each of said units including means for picking up a handle in said pickup station and applying the handle to a carrier in said applying station as an incident to movement of the unit by the rotor past said pickup station and through said applying station.

20. In a machine for assembling containers into carrying packs, the combination of means for assembling containers and carriers together in an assembly station, means for directing assembled containers and carriers from said assembly station to a handle applying station, handle applying means positioned at said handle applying station for assembling a succession of handles with successive carriers on containers moved into said applying station, a handle supply magazine, handle strip support means in said magazine for supporting a stack of strips of interconnected carrying handles, means for intermittently operating said handle strip support means to release the lowermost strip of handles in said magazine, handle extracting means, means for operating said handle extracting means in synchronized relation to operation of said handle support means to positively lower the lowermost strip of handles from said magazine to a handle strip traversing level, positive conveyor means positioned to advance to a handle severing zone each successive strip of handles lowered to said traversing level, a plurality of rotary helical elements disposed in the handle severing zone to engage handles and pace movement thereof through said zone, hand severing means rotatable with said helical elements to sever successive handles moved through said zone, an extendable handle support positioned at the discharge side of said helical elements to support successive handles in a handle pickup station, said handle applying means including pickup structure movable through said pickup station to pick up individual handles therein, and means for extending and retracting said handle support in synchronism with said handle applying means to support successive handles in said pickup station and provide for movement of said pickup structure through the pickup station.

21. In a machine for forming carrying packs of containers, the combination of means for directing assembled containers and carriers through a handle applying zone, handle applying means positioned to apply individual carrying handles to successive carriers on containers directed through said zone, said carrier applying means including means for accepting individual handles at a handle supply station therefor, handle moving means positioned to move a succession of handles along a predetermined path to handle storage means for supporting a stack of strips of interconnected handles in overlying relation to said handle moving means; said storage means including movable handle strip support means, positive handle strip extractor means, and power driving means connected to said extractor means and said support means to operate said extractor means and said support means in synchronism to positively extract individual handle strips from said storage means one-at-a-time and positively place the successively extracted strips in coacting relation to said handle moving means for positive movement thereby toward said handle supply station.

22. In a machine for assembling containers into carrying packs, the combination of means for directing assembled containers and carriers through a handle applying zone, handle applying means positioned to apply individual carrying handles to successive carriers on containers directed through said zone, said carrier applying means including means for accepting individual handles at a handle supply station therefor, endless conveyor means positioned to advance strips of interconnected handles toward said handle supply station, said endless conveyor means including a succession of positive handle driving elements adapted to positively engage handles for positively transmitting motion thereto, handle storage means for supporting a stack of strips of interconnected handles in overlaying relation to said conveyor means; said storage means including movable handle strip support means, handle strip pulldown means, and power means connected to said pulldown means and said support means to operate said pulldown means and said support means in synchronism to positively deposit the lowermost handle strip from said storage means into coacting relation to said conveyor means for advancing movement thereby; handle severing means positioned to cut apart successive handles advanced toward said station by said conveyor means, and handle transfer means mounted to transfer successive individual handles from said conveyor means to said handle supply station.

23. A container carrying pack forming machine capable of assembling containers into carrying packs at a rate in excess of one thousand containers per minute in a single pack forming channel and comprising, in combination, endless carrier applying means, means for continuously circulating said endless carrier applying means through a closed path free of abrupt changes in direction and extending through a container and carrier assembly station, means for supplying a succession of carriers to said carrier applying means for application by the latter to containers in said assembly station, container feeding means adapted to receive containers in a single file and discharge the containers in a double file of containers two abreast for movement through said assembly station; said container feeding means comprising a first pair of star wheels supported for rotation in opposed relation to each other to receive therebetween a single file procession of containers and including on each star wheel means for retaining on the periphery thereof every second container received between the star wheels, a second pair of rotary star wheels positioned to direct a double file of containers toward said assembly station, and a third pair of star wheels intervening between said first and second pairs of star wheels to effect a transfer of containers from said first pair of star wheels to said second pair of star wheels upon rotation of all said star wheels; endless conveyor means positioned for moving assembled containers and carriers from said assembly station to a handle applying station and a carrier severing station, a handle applying rotor including an annular array of handle applying means thereon and being rotatably mounted to effect upon rotation of the rotor movement of the handle applying means through said handle applying station to apply handles to carriers on containers moving through said handle applying station, means for supplying handles to said handle applying means, rotary container engaging means positioned at said carrier severing station to engage containers moving through said severing station, carrier severing means rotatable with said container engaging means for movement into alignment with junctures between successive carriers moving through said carrier severing station, and means for operating said carrier severing means automatically as an incident to rotation of said container engaging means to sever successive carriers moving through said severing station.

24. A container carrying pack forming machine comprising, in combination, endless carrier applying means, means for continuously circulating said endless carrier applying means through a closed path free of abrupt changes in direction and extending through a container and carrier assembly station, means for supplying a succession of carriers to said carrier applying means for application by the latter to containers in said assembly station, container feeding means including a plurality of rotary start wheels shaped and positioned to receive containers through an inlet for a single container and to discharge containers in a double file for movement through said assembly station, means for moving assembled containers and carriers from said assembly station to a handle applying station and a carrier severing station, rotary handle applying means supported and driven to rotate continuously through said handle applying station to apply handles to carriers on containers moving through said handle applying station, means for supplying handles to said handle applying means, rotary container engaging means positioned at said carrier severing station to engage containers moving through said severing station, and container severing means rotatable with said container engaging means to sever successive carriers moving through said severing station.

25. A container carrying pack forming machine comprising, in combination, endless carrier applying means, means for continously circulating said endless carrier applying means through a closed path which extends continuously through a container and carrier assembly station, means for supplying a succession of carriers to said carrier applying means for application by the latter to containers in said assembly station, rotary container feeding means positioned to receive containers and to discharge containers in a double file procession for movement through said assembly station, means for moving assembled containers and carriers from said assembly station to a handle applying station and a carrier severing station, rotary handle applying means supported and driven to rotate continuously through said handle applying station, means for supplying handles to said handle applying means, rotary container engaging means positioned at said carrier severing station to engage containers moving through said severing station, and container severing means rotatable with said container engaging means to sever successive carriers moving through said severing station.

26. Container handling means for receiving a succession of containers through inlet space for a single contianer and discharging containers in a double file procession, said handling means comprising, a first pair of wheels supported rotatably in opposed relation to each other to receive therebetween a succession of containers in a single file, each of said wheels including container retaining means for causing every second container entering between the wheels to be picked up by the periphery of the wheel whereby a succession of containers entering in single file between the rotating wheels are divided to move with the peripheries of the respective wheels, a second pair of wheels supported rotatably in opposed spaced relation to each other to discharge through the space between the discharge wheels a procession of containers in a double file, each of said wheels of said second pair including container retaining means associated therewith to effect retention of containers on the periphery of the wheel for movement therewith, a pair of intermediate wheels disposed between said first and second pairs of wheels to form between the periphery of each intermediate wheel and the periphery of the coacting wheel of each of said first and second pairs a container transfer zone, each of said intermediate wheels including container retaining means associated therewith to effect retention of containers on the periphery of the wheel for movement therewith, means for effecting a transfer of containers from the periphery of each wheel of said first pair to the coacting intermediate wheel in the transfer zone therebetween, means for effecting a transfer of containers from each intermediate wheel to the coacting wheel of said second pair in the transfer zone therebetween, and means for rotating all of said wheels.

27. Container handling means for receiving a succession of containers in a single file and discharging containers two abreast in a double file procession, said handling means comprising, a pair of container receiving wheels supported rotatably in opposed relation to each other to define therebetween a receiving space for containers in a single file, each of said wheels including container retaining means for causing every second container entering said receiving space to be picked up by the periphery of the wheel whereby a succession of containers entering said receiving space are divided and carried away from said receiving space by the peripheries of said wheels, a pair of container discharge wheels supported rotatably in opposed spaced relation to each other to define therebetween a discharge space for a procession of containers in double file, each of said discharge wheels including container retaining means associated therewith to effect retention of containers on the periphery of the wheel for movement therewith, a pair of intermediate wheels disposed between said first and second pairs of wheels to form between the periphery of each intermediate wheel and the periphery of the coacting wheel of each of said first and second pairs a container transfer zone, each of said intermediate wheels including container retaining means associated therewith to effect retention of containers on the periphery of the wheel for movement therewith, means for effecting a transfer of containers from the periphery of each wheel of said first pair to the coacting intermediate wheel in the transfer zone therebetween, means for effecting a transfer of containers from each intermediate wheel to the coacting one of said discharge wheels in the transfer zone therebetween, means for rotating all of said wheels; and said intermediate wheels being dimensioned and positioned so that the lengths of the container paths around said respective intermediate wheels between said container receiving and discharge spaces are unequal by a dimensioned degree equal to substantially one-half of the dimension of an individual container measured in the direction in which containers enter said receiving space.

28. Container handling means adapted to receive a succession of containers in a single file and to discharge a procession of containers in a double file, said handling means comprising, a pair of container dividing wheels supported rotatably in opposed spaced relation to each other to receive therebetween containers in a single file, each of said wheels defining on the periphery thereof a circumferential series of pockets, means on each of said wheels magnetizing alternate ones of said pockets therein to magnetically retain in the magnetized pockets containers encountered in the space between said wheels, the magnetized pockets in each wheel having a spacing which is equal to at least twice the dimension of containers to be handled measured circumferentially with respect to the wheel; a pair of container discharge wheels supported rotatably in opposed spaced relation to each other to discharge through the space between said discharge wheels a procession of containers in a double file, each of said discharge wheels defining a circumferential series of pockets having a spacing which is approximately one-half that of the spacing of magnetized pockets in each of said dividing wheels, a pair of intermediate wheels rotatably disposed between said pair of dividing wheels and said pair of discharge wheels to form between the periphery of each intermediate wheel and the periphery of the coacting dividing wheel a transfer zone and to form between the periphery of each intermediate wheel and the coacting discharge wheel a transfer zone, each of said intervening wheels defining a circumferential series of pockets and protuberances disposed in alternate relation to each other, the pockets in each intervening wheel having a spacing that has an intermediate dimensional value between the dimensional spacing of the pockets in the coacting dividing wheel and the dimensional spacing of the pockets in the coacting discharge wheel, each of said protuberances on each intermediate wheel defining a generally straight trailing edge extending substantially radially outward to the end of the projection and a generallly convex leading edge extending outwardly to the end of the projection, means for effecting a transfer of containers from the magnetized pockets of each dividing wheel to pockets in the coacting intermediate wheel in said transfer zone therebetween, means for effecting a transfer of containers from the pockets of each intermediate wheel to the pockets in the coacting discharge wheel in the transfer zone therebetween, and means for rotating all of said wheels at pocket speeds therefor which generally are proportional to the chordal spacing of pockets in the respective wheels.

29. Container handling means adapted to receive a succession of containers in a single file and to discharge a procession of containers in a double file, said handling means comprising, a pair of container dividing wheels supported rotatably in opposed spaced relation to each other to receive therebetween containers in a single file, each of said wheels defining on the periphery thereof a circumferential series of pockets, means on each of said wheels for retaining in alternate ones of said pockets containers encountered in the space between said wheels, said alternate pockets in each wheel having a spacing which is equal to at least twice the dimension measured circumferentially with respect to the wheel of containers to be handled, a pair of container discharge wheels supported rotatably in opposed spaced relation to each other to discharge into the space between said discharge wheels a procession of containers in a double file, each of said discharge wheels defining a circumferential series of pockets having a spacing which is approximately one-half that of the spacing of magnetized pockets in each of said dividing wheels, a pair of intermediate wheels rotatably disposed between said pair of dividing wheels and said pair of discharge wheels, each of said intervening wheels defining a circumferential series of pockets and protuberances disposed in alternate relation to each other, the pockets defined in each intervening wheel having

a spacing that has an intermediate dimensional value between the dimensional spacing of the pockets in the coacting dividing wheel and the dimensional spacing of the pockets in the coacting discharge wheel, each of said protuberances on each intermediate wheel defining a generally convex leading edge extending outwardly to the end of the projection, means for effecting a transfer of containers from the dividing wheels to the respective intermediate wheels, means for effecting a transfer of containers from the intermediate wheels to the respective discharge wheels, and means for rotating all of said wheels.

30. Container handling means for transforming a single file procession of containers into a double file procession of containers traveling two abreast at a speed approximately one-half that of the single file procession, said container handling means comprising means for receiving an incoming single file procession of containers and dividing the incoming procession into two intermediate single file processions of containers, container directing means for directing the two intermediate single file processions along two separate paths to two juxtaposed outlets of the respective paths from which juxtaposed outlets containers move in a double file procession, and said container directing means including means for reducing the spacing and speed of containers moving along said respective paths and for advancing one of said intermediate processions in relation to the other intermediate procession so that containers emerge from said outlets of both paths two abreast to form a double file procession of containers moving at a speed reduced to approximately one-half the speed of the incoming single file procession of containers.

31. Container handling means for transforming a single file procession of containers into a double file procession of containers traveling two abreast, said container handling means comprising means for receiving an incoming single file procession of containers and dividing the incoming procession into two intermediate single file processions of containers, container directing means for directing the two intermediate single file processions along two separate paths to two juxtaposed container outlets of the two paths from which juxtaposed outlets containers move in a double file procession, and said container directing means including means for advancing one of said intermediate processions in relation to the other intermediate procession so that containers emerge simultaneously from both of said path outlets to form a procession of containers two abreast in a double file.

32. Container handling means for receiving an incoming procession of containers in a single file and discharging a procession of containers in double file, said container handling means comprising, in combination, dividing means positioned to receive an incoming procession of containers in single file and effect separation of the incoming procession of containers into two intermediate processions of containers, and means coacting with said dividing means to direct said respective intermediate processions of containers from said dividing means through two separate paths leading to juxtaposed outlets from the respective paths to form a double file procession of containers.

33. Container handling means according to claim **32** in which the claimed combination includes means for reducing the speed and spacing of containers moving through said intermediate processions to form a double file of closely adjacent containers.

References Cited by the Examiner

UNITED STATES PATENTS

2,237,119	4/41	Smith	53—178 X
2,752,027	6/56	Gentry	53—48 X
2,828,000	3/58	Herbert	53—48 X
2,864,212	12/58	Bruce	53—48 X
2,920,739	1/60	Woldin	198—31
3,032,943	5/62	Reimers	53—48
3,032,944	5/62	Hull	53—48

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