Dec. 1, 1959

J. C. MATZEN

2,915,308

AUTOMATIC FEEDING MACHINES

Filed Dec. 26, 1957

3 Sheets-Sheet 1

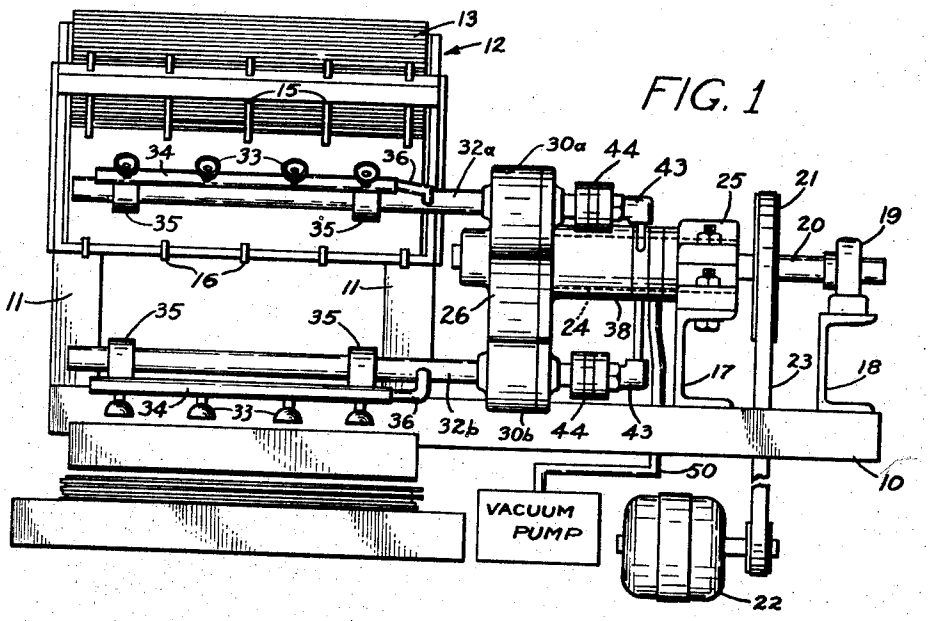


FIG. 1

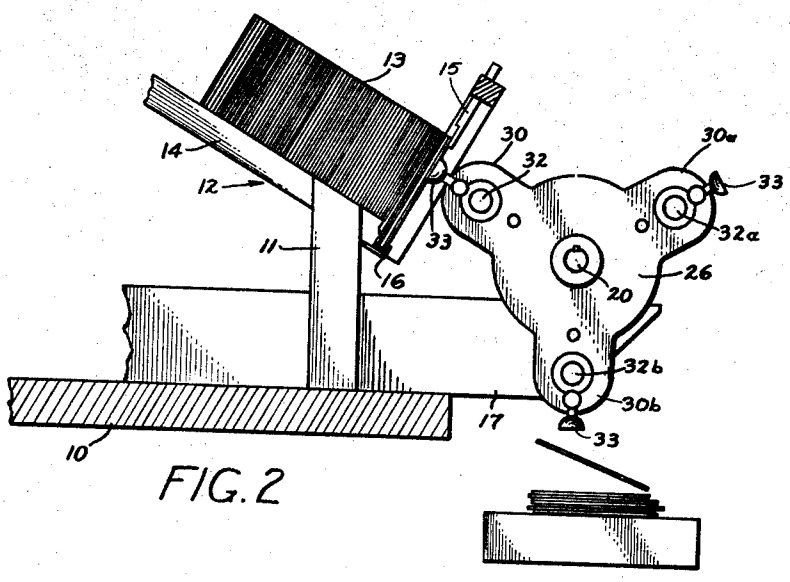


FIG. 2

INVENTOR.
JULIUS C. MATZEN
BY
AGENT

Dec. 1, 1959 J. C. MATZEN 2,915,308

AUTOMATIC FEEDING MACHINES

Filed Dec. 26, 1957 3 Sheets-Sheet 2

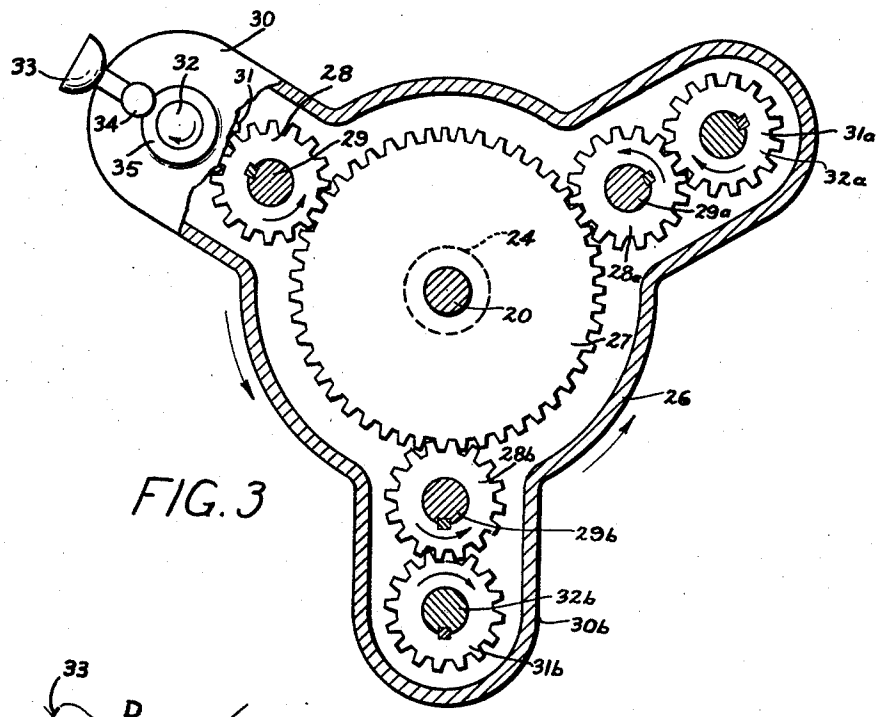


FIG. 3

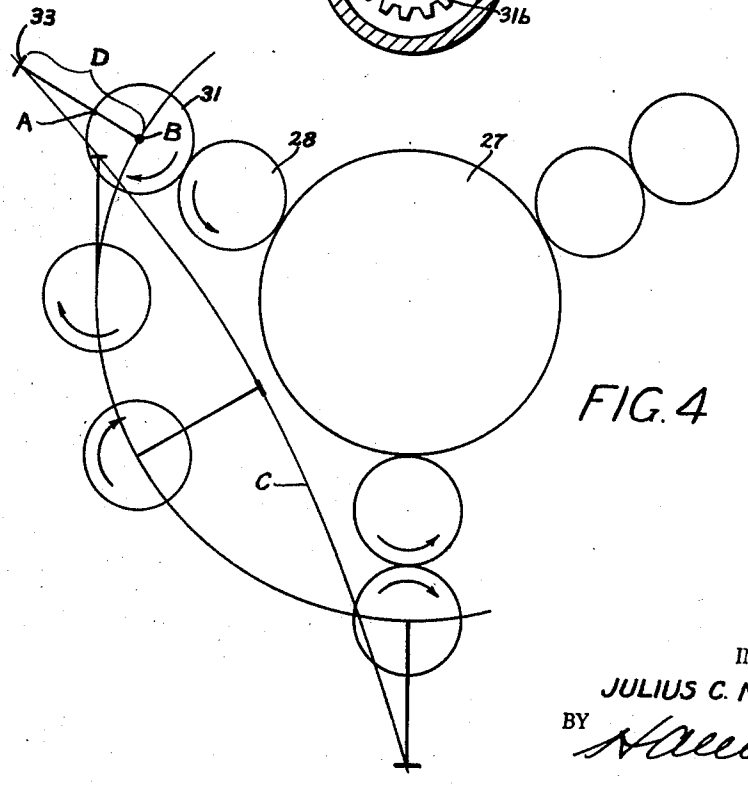


FIG. 4

INVENTOR.
JULIUS C. MATZEN
BY
AGENT

Dec. 1, 1959 J. C. MATZEN 2,915,308

AUTOMATIC FEEDING MACHINES

Filed Dec. 26, 1957 3 Sheets-Sheet 3

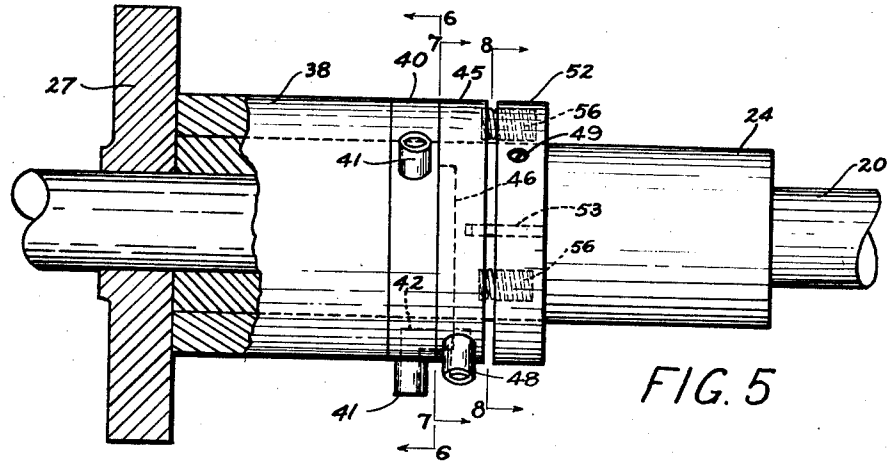


FIG. 5

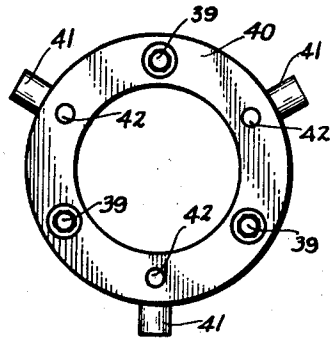


FIG. 6

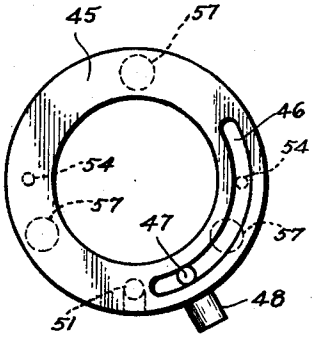


FIG. 7

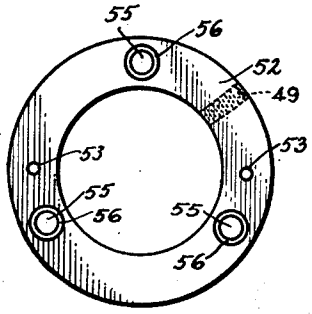


FIG. 8

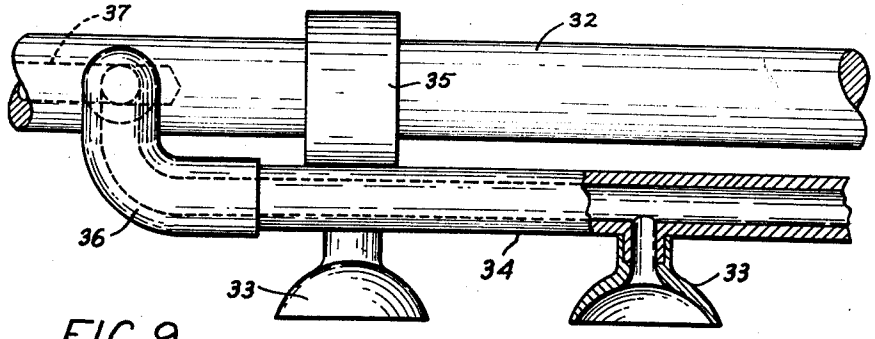


FIG. 9

INVENTOR.
JULIUS C. MATZEN
BY Hallemphy
AGENT

United States Patent Office 2,915,308
Patented Dec. 1, 1959

2,915,308

AUTOMATIC FEEDING MACHINES

Julius C. Matzen, Stamford, Conn.

Application December 26, 1957, Serial No. 705,389

5 Claims. (Cl. 271—5)

This invention relates to automatic feeding machines and has particular reference to a novel machine for automatically moving relatively flat sheet-like articles from one station to another, as is sometimes necessary in the printing or container-manufacturing industries, for example, for feeding paper, cardboard, plastic, or light metal articles singly from a magazine to a moving conveyor or the like.

The known prior art discloses many various types of devices which have been developed for removing single sheets or pieces of material from a pile thereof and advancing the single sheets to a subsequent station, such as in the printing industry where the devices remove a sheet of paper from the top or end of a pile thereof and transfer the sheet to a second location such as a conveyor which moves the sheet into a press or other machine. Such known devices have not been entirely successful for one or more reasons. Some of the devices are relatively slow and cumbersome, while others are intricate and complex and, consequently, relatively expensive.

It is, accordingly, a primary object of the present invention to provide a feeding machine having a novel mechanical arrangement whereby articles may be rapidly transferred singly from a first to a second station.

Another object is to provide a machine of the above character which is relatively simple in its construction and comparatively inexpensive to manufacture and operate.

A further object is to provide a feeding machine which embodies a selected number of continuously operating vacuum control units which successively function at a prelocated loading station to grip articles to be transferred and to singly transfer the articles rapidly and with a minimum of lost motion to a prelocated discharge station where the articles are automatically released.

Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawings, in which

Fig. 1 is a front elevational view of a machine embodying the invention.

Fig. 2 is a side elevational view of the machine shown in Fig. 1;

Fig. 3 is an enlarged side elevational view of the gear driving mechanism;

Fig. 4 is a diagrammatic illustration of the novel principle embodied in the machine;

Fig. 5 is an enlarged front elevational view of the vacuum control device;

Figs. 6, 7 and 8 are side elevational views of cooperating portions of the vacuum control device; and

Fig. 9 is an enlarged fragmentary view of one of the vacuum grips or suckers of the device.

Referring more particularly to the drawings, wherein like characters of reference designate like parts throughout the several views, the preferred embodiment of the invention as illustrated in Figs. 1 and 2 comprises a bed or base **10** upon which the major portion of the apparatus is adapted to be mounted. The base **10** is provided

with suitable supporting means, such as uprights **11**, for supporting a gravity-feed type of magazine **12** in which articles **13** to be transferred are located.

The articles may comprise any relatively flat sheet-like material such as paper, cards, plates, foils, or the like and may be placed in the magazine **12** by any selected means whereby they will be gravity fed down an inclined base **14** of the magazine toward one end thereof where suitable stop means such as adjustable pins **15** and fingers **16**, or the like, will prevent further advancement of the articles under the force of gravity. Article holding means such as described, or other suitable arrangement for holding a supply of articles to be transferred from one station to another, does not in itself comprise an essential part of the invention except insofar as means of some type must be provided for initially retaining a supply of the articles in a position where the articles may be individually removed by the machine in accordance with this invention.

Mounted upon the base **10** are a pair of spaced channel irons **17** and **18** or other suitable supports, the outer **18** of which carries bearing means **19** in which is journaled one end of a rotatable main shaft **20**. Shaft **20** carries a pulley **21** which is operatively connected to a driving motor **22** by conventional means such as a belt **23**. Operation of motor **22** causes rotation of shaft **20** through the belt and pulley arrangement in the usual manner.

Mounted over a portion of main shaft **20** is a tubular-shaped bushing **24** which is fixedly and immovably mounted on a support **25** carried by the second channel iron **17**, the shaft **20** extending through and being free to rotate within the bushing **24**.

The end of main shaft **20** opposite the bearing **19** is keyed to a gear box or housing **26** whereby the housing is rotatable with the shaft **20**. Within the housing **26** is located a stationary gear **27** carried by the adjacent end of bushing **24**, gear **27** being in operative engagement with a selected number of equally spaced idler gears **28**, **28***a* and **28***b* which are rotatably mounted upon respective short shafts **29**, **29***a* and **29***b* fixedly secured by keys or the like in radially extending portions **30**, **30***a* and **30***b* of the housing.

In radial alignment with each idler gear is a respective drive gear **31**, **31***a* and **31***b*, which drive gears are fixedly mounted upon relatively long drive gear shafts **32**, **32***a* and **32***b* which are rotatably mounted in the radially extending portions of the housing.

Therefore, upon operation of motor **22**, main shaft **20** will be rotated within bushing **24** and stationary gear **27**. Since the housing **26** is fixed to the shaft **20**, the rotary movement of shaft **20** will be transmitted to the housing, whereupon idler gears **28**, **28***a* and **28***b* will be moved in a circular path around the stationary gear **27**. Engagement between the teeth of the idler gears and the stationary gear will cause resultant rotation of each idler gear and consequently of each drive gear **31**, **31***a* and **31***b*. All rotary motions are indicated by arrows in Fig. 3.

The drive gear shafts **32**, **32***a* and **32***b* all extend parallel to one another outwardly from the housing **26** and overlie the adjacent portion of the magazine **12**, and when the machine is operated the shafts successively move past the supply of cards **13** or other articles to be transferred or fed to a second station.

In accordance with the present invention, it is desired that vacuum controlled suction means be employed to cause the outermost cards **13** to become affixed to the shafts as they pass by the magazine in sequence, which suction means is adapted to become inoperable when the cards are positioned at the second station, whereby the cards are released from the shafts. For this purpose each

shaft carries one or more suction cups or suckers 33 which are mounted upon suitable relatively rigid tubings 34 extending parallel with each shaft and attached to the shafts as by clamps 35. The suckers 33 are fixed to their respective supporting tubings so as to be in communication with the hollow interiors of the tubings, and the tubings are themselves connected at one end by elbows 36 whereby they communicate with longitudinal central bores 37 (Fig. 9) which are provided within the supported end portion of each shaft 32. Vacuum control means is connected with each bore 37, and consequently with each tubing 34 and sucker 33, as will be described hereinafter.

In the operation of the presently described device, it is desirous that as a sucker or group of suckers 33 approaches the loading station or magazine 12, the vacuum system will operate through the particular shaft 32, 32*a* or 32*b* to cause the suckers carried thereby to draw to them the adjacent card 13 in the front of the magazine. In order to do this the shaft must be at a particular point in its rotation so that the suckers are properly directed toward the magazine at the moment of loading, as indicated by the positions of the shaft 32 and suckers 33 in Fig. 3.

The operation of the device is continuous. Therefore, when a card is grasped by a group of suckers 33, shaft 32 will continue to rotate about its own axis and will be simultaneously moved downwardly about the axis of the main shaft 20. At the same time, the suckers 33 will be rotated with the shaft 32, first upwardly and inwardly so that when drive gear 31 has moved through an arc of about sixty-three degrees the card carried by the suckers will be directly between the shaft 32 and the axis of the main shaft 20. Then continued rotation of the suckers with shaft 32 will cause the suckers and card to be rotated downwardly and outwardly so that when another arc of approximately sixty-three degrees has been traversed by the drive gear 31 the suckers will be extended directly downwardly from the axis of main shaft 20, at which time the vacuum control means will operate to release the card, allowing it to drop to a conveyor, bin, or other receiving device.

The motions are illustrated diagrammatically in Fig. 4 wherein it will be seen that a sucker 33 will move along a hypotrochoidal path C. The actual point A on the circumference of drive gear 31, where a line from axis B to the sucker 33 intersects the circumference, will travel along a hypocycloidal path.

It will be apparent that when one group of suckers releases a card at the discharge station, the next succeeding group of suckers are in position to grip the next card in the magazine. This cycle is continued by all three groups of suckers as they scan the magazine in sequence, and the device can be operated at any desired speed by control of the ratio between the motor 22 and main shaft 20.

Although the device has been shown and described as having three transfer units, that is, three separate shafts carrying suckers, fewer or additional units may be used as desired. For three units as described it is necessary that the drive gears 31 be rotated at a 3-to-1 ratio with respect to the fixed gear 27 and that the length of arm D, between the effective surface of the sucker and the axis of the drive gear, be controlled. Thus the gears 31, together with their respective shafts and groups of suckers, will make three complete individual revolutions while traveling in a circle about the fixed gear 27. For different numbers of units it is, of course, necessary to compute the ratios and lengths of arms D so that the loading and discharge stations can be properly located.

The vacuum control means is arranged so that the groups of suckers will be operable sequentially as described and comprises a sleeve or spacer 38 which is mounted over the bushing 24 with one end fastened to

the adjacent side wall of and rotatable with the housing 26. Secured to the opposite end of the sleeve 38 as by bolts 39 (Fig. 6) is a valve ring 40. The periphery of the valve ring 40 carries three radially extending bosses 41 which are spaced apart at substantially equal distances around the periphery. The bosses 41 are bored longitudinally and the bores extend into the ring and are angled so as to emerge from the surface of the ring opposite the sleeve 38 in the form of ports 42. On the bosses 41 are mounted respective conduits 43 (Fig. 1) which are connected by revolvable couplings 44 to the adjacent ends of the respective sucker-carrying shafts 32, 32*a* and 32*b* whereby an air circulating system is completed from each of the groups of suckers through members 34 and 36, bores 37, couplings 44, conduits 43, bosses 41 and ports 42 externally of the ring 40.

Means is provided in the valve for causing operation of only one system at a time and comprises an annular valve control member 45 (Figs. 5 and 7) which has an arcuate slot 46 formed in one surface thereof, which slot communicates with an opening 47 extending outwardly of the periphery of the member through a boss 48. The control member 45 is mounted upon the bushing 24 with its slotted surface engaging the adjacent surface of the ring 40 in air-sealed relation thereto. Although the ring 40 is rotatable, member 45 is immovable and is fixed to the immovable bushing 24 by any suitable means such as screw 49.

The slot 46 in member 45 extends through an arc of approximately 120 degrees so that as the ring 40 is rotated, only one of the ports 42 will be connected with the slot at any one time. Since the slot 46 is connected to a vacuum pump, through boss 48, by a suitable pipe 50 (Fig. 1) it will be apparent that the vacuum pump will operate to evacuate only the particular system which happens to be connected with the slot.

With the pump and motor 22 both operating, as a port 42 is rotated into overlying relation with the slot, the system will be evacuated to the particular group of suckers which is adjacent the magazine 12. When the suckers have carried a card to the release point the port will move beyond the end of the slot 46, at which time it will pass over a small opening or vent 51 (Fig. 7) which will allow air to enter the system, causing the card to be released. From this it will be apparent that the actual length of the slot need not be critical since once the vacuum is created the engagement between the surfaces of ring 40 and member 45 will hold the vacuum until the port meets vent 51.

When the port is opposite the vent, the next succeeding port has been advanced to overlie the slot whereupon another card is removed from the magazine. This cycle may be continued indefinitely.

Also forming a part of the valve device is a pressure ring 52 (Figs. 5 and 8) which has one surface directed toward member 45 and its other surface engaging bearing 25. Pressure ring 52 is mounted for limited sliding movement on bushing 24 and is constantly held in alignment with member 45 by means of pins 53 which are slidably located in recesses 54 provided therefor in member 45. The ring 52 is supplied with a plurality of openings 55 in which are located one end of respective coiled springs 56 which are of such length that their other ends repose in recesses 57 provided therefor in the adjacent side of member 45. Springs 56 thus function to constantly urge member 45 toward ring 40 so that the air-sealed relation therebetween will be retained.

From the foregoing description it will be apparent that all of the objects of this invention have been accomplished by the novel machine shown and described herein which can be easily modified, within the scope of the invention, to embody any number of transfer units and vacuum control means therefor as may be desired for a particular installation.

It is also apparent that other modifications may be made within the scope of the invention by those skilled

in the art. Therefore, all matter shown and described is to be considered as illustrative and not in a limiting sense.

I claim:

1. A feeding machine comprising a fixed main gear, a drive gear connected with and rotatable in one direction about the fixed main gear and simultaneously rotatable in the opposite direction about its own axis, a suction device connected to and rotatable with the drive gear, the device being movable in an hypotrochoidal path through a plurality of remotely spaced stations in each of which it assumes a radially extending position with respect to the center of the fixed main gear, and vacuum control means connected with said suction device and operable to evacuate the suction device when the device is located at one station and to release the vacuum in the suction device when the device is located at the next successive remote station.

2. A feeding machine comprising a fixed main gear, a plurality of spaced drive gears connected with and rotatable in one direction about the fixed main gear and simultaneously rotatable in the opposite direction about their individual axes, suction devices connected to and rotatable with each of the drive gears, the suction devices being movable upon rotation of drive gears about the fixed gear in respective hypotrochoidal paths through a plurality of remotely spaced stations in each of which they assume a radially extending position with respect to the center of the fixed main gear, and vacuum control means connected with said suction devices and operable to evacuate the individual suction devices when the devices are located at one station and to release the vacuum in the suction devices when the devices are located at the next successive remote station.

3. A machine for bodily moving relatively flat articles singly from a first station to a second station remote from the first station, said machine comprising a base having a main shaft rotatably mounted thereon, an immovable sleeve encircling the main shaft, a housing fixed to the main shaft for rotation therewith, a fixed gear located within the housing and fixedly secured to the

immovable sleeve, an idler gear rotatably mounted in the housing and maintained in mesh with the fixed gear, a drive gear shaft rotatably mounted in the housing and extending therethrough, a drive gear fixed to the drive gear shaft within the housing and maintained in mesh with the idler gear, the drive gear and drive gear shaft being movable in an orbit around the fixed gear upon rotation of the housing in one direction and being simultaneously rotatable as a unit in the opposite direction about their common axis, suction means carried by the drive gear shaft and comprising a suction cup fixed to the shaft and rotatable therewith in a hypotrochoidal path through said stations, and vacuum means connected with the suction means and operable to evacuate the suction means when the cup is located at the first station and to release the vacuum in the suction means when the cup is located at the remote second station.

4. A machine substantially as set forth in claim 3 wherein the suction means embodies a plurality of suction cups mounted in alignment longitudinally of the supporting shaft and adapted to be simultaneously evacuated by the vacuum control means.

5. A machine as set forth in claim 3 wherein several spaced groups each comprised of an idler gear, a drive gear, a drive gear shaft and a respective suction cup are provided and each suction cup is directed radially outwardly of the axis of its respective drive gear shaft when positioned at each of the stations.

References Cited in the file of this patent

UNITED STATES PATENTS

622,106	Berry	Mar. 28, 1899
2,049,022	Reininger	July 28, 1936
2,262,109	Miller	Nov. 11, 1941
2,325,774	Hohl	Aug. 3, 1943
2,797,092	Welsh	June 25, 1957
2,810,575	Holmen	Oct. 22, 1957
2,817,519	Beck	Dec. 24, 1957