United States Patent

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[54] **SIGNATURE FEED FOR HIGH-SPEED SIGNATURE GATHERING MACHINE**
5 Claims, 2 Drawing Figs.

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[51] Int. Cl. B65h 39/02
[50] Field of Search 270/54, 58; 271/11, 12, 37, 39, 82

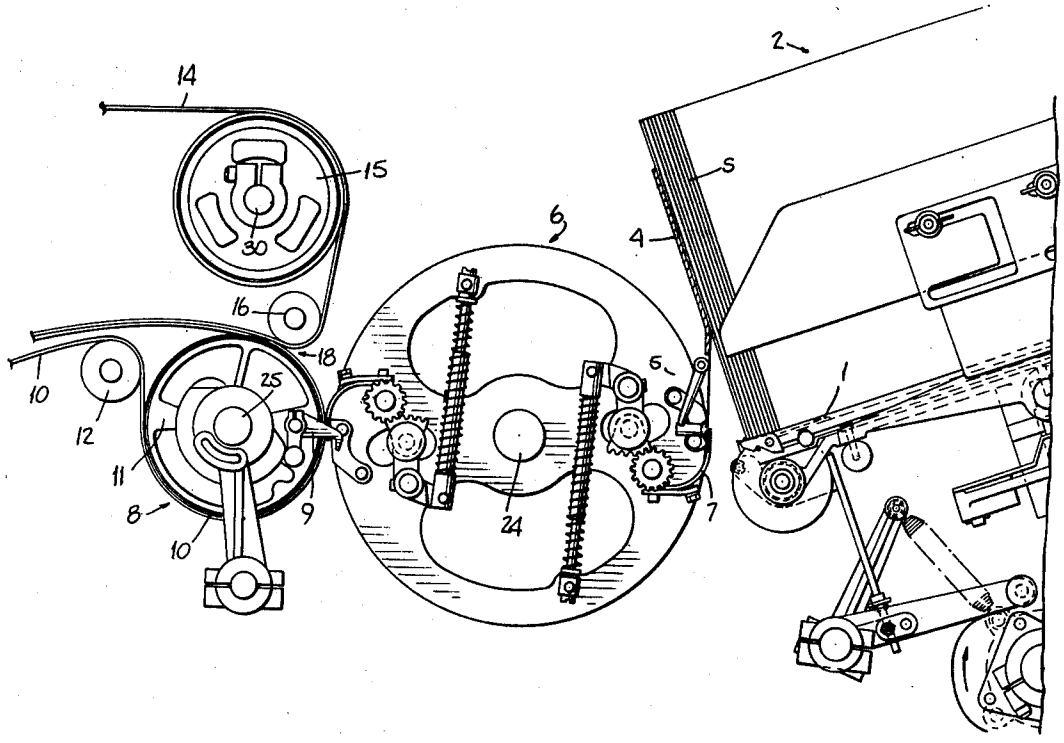
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ABSTRACT: A high-speed signature gathering machine has a rotary signature gripper drum which grips the foremost signature of a stack of signatures and pulls the signature from the stack downwardly and forwardly around the drum to a transfer location. Here a transfer rotary signature gripper drum rotating in an opposite direction grips the signature and transfers it forwardly without reversal or pause. The transfer drum pulls the signature positively into the nip of two forwardly moving belt spans which are superimposed to grip the signature between them. In this fashion the signature is pulled from the stack and while positively held at all times is conveyed forwardly without pause, change in velocity or reversal, permitting high-speed travel for ultimate gathering.



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SHEET 1 OF 2

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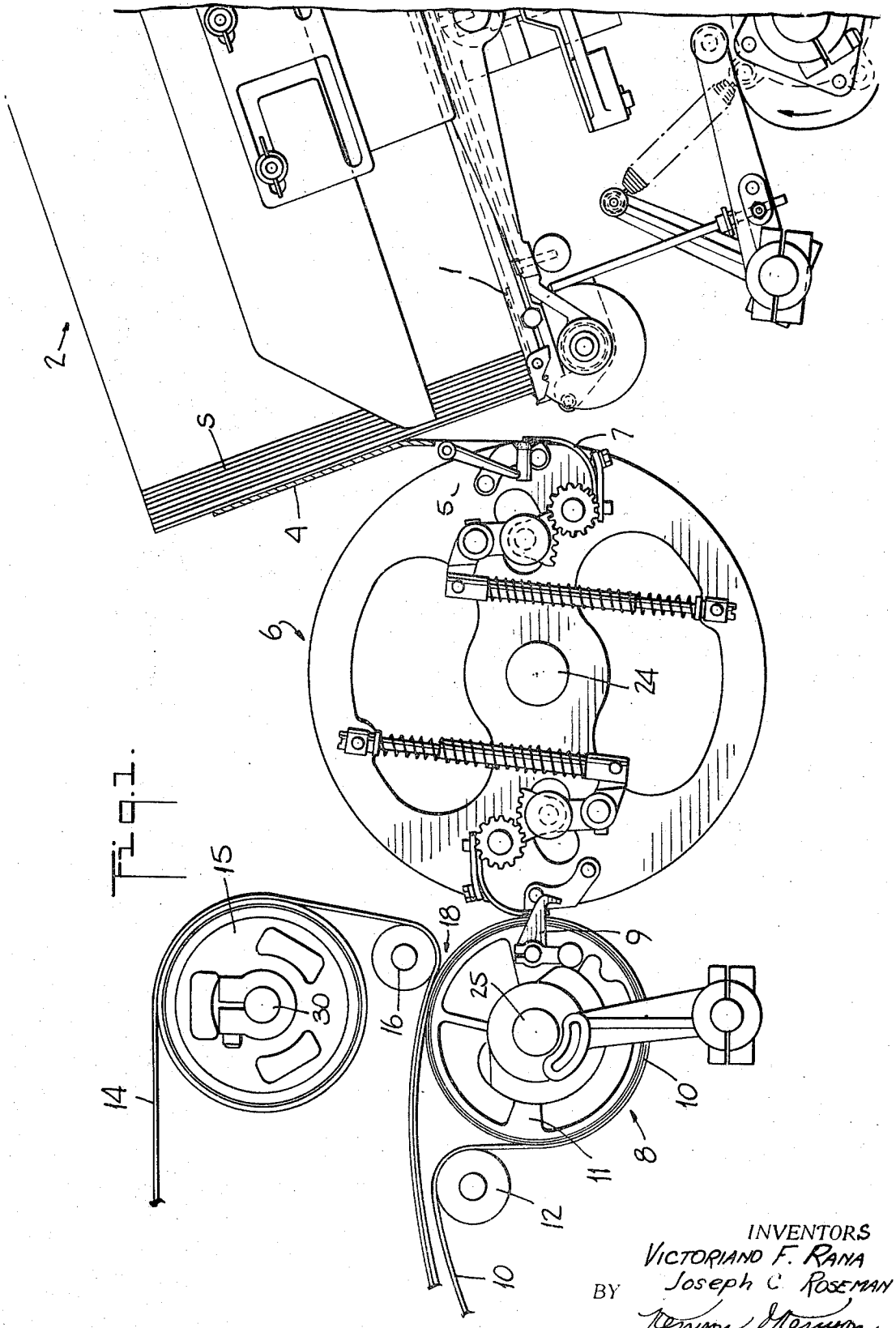


Fig. 1.

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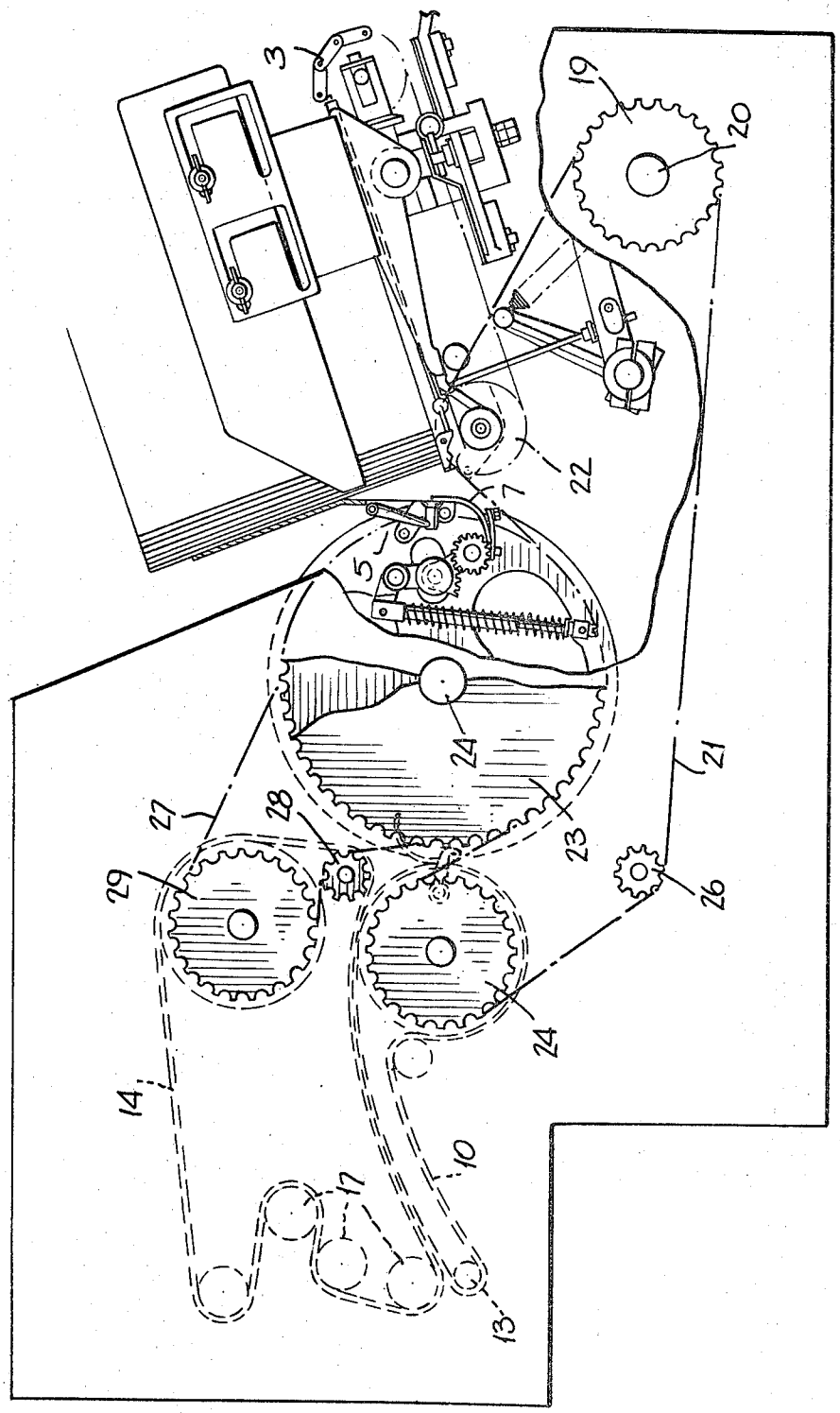


Fig. 2.

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SIGNATURE FEED FOR HIGH-SPEED SIGNATURE GATHERING MACHINE

This invention relates to a signature gathering machine of the kind disclosed by the Sarring et al. U.S. Pat. No. 3,311,368, dated Mar. 28, 1967.

This machine includes laterally interspaced, mutually parallel belt systems of which each has two endless belts running on pulleys forming two superimposed traveling belt spans with pulleys around which the belts run to form an entrance nip into which the signatures are fed for forward travel. The lowermost belt span extends further forwardly than does the upper one and the signatures are picked up from this lower span by a rotary signature feeder or accelerator which rotates the signature onto a pin chain so as to place the signature immediately in front of one of the chain's pins while traveling at substantially the same speed as the pin. These features, among others, permit the machine to operate at extremely high speed.

The signatures are stacked on edge in a signature feed hopper and a swinging sucker arm pulls the bottom edge portion of each foremost signature forward into the nip of pinch rolls which then feed it into the nip of the belts for travel forwardly while positively held between the superimposed belt spans. This arrangement has introduced a problem in that it is sometimes unreliable when handling certain kinds of signatures. Obviously it is desirable that the machine handle all kinds of signatures reliably and at the high speed of which the machine is inherently capable of attaining.

Today a gathering machine, or gatherer, is generally understood to be one which places the signatures flatly one on top of another in front of the pins of a pin chain so that they are conveyed along in a generally horizontal position in which they are maintained by a trough over which the signatures slide. The trough may be laterally inclined more or less, in which case a ledge keeps the signatures from sliding laterally downwardly, the term horizontal being used in the sense that each gathering pile of signatures is supported by its bottom side. Contrastingly, at it is known today a signature inserting machine, or inserter, gathers the signatures by removing them from a stack, spreading them open at their bottom edges and dropping them on a saddle where they are supported by their folds and over which they are slid by a wing chain for ultimate saddle stitching.

An example of a signature inserting machine is disclosed by the Kleineberg U.S. Pat. No. 2,251,943, dated Aug. 12, 1941. In this patent the machine is called a gathering machine but today it would be known as an inserter to distinguish it from the gatherer shown by the previously mentioned Sarring et al. patent.

As shown by the Kleineberg patent, an inserter uses a feed system which removes each foremost signature from a signature stack, after its bottom portion is bent forwardly by a sucker arm, by means of a signature gripper drum. The signatures are stacked so that they are supported by their bottom edges and this drum rotates so its periphery moves downwardly past the bent-out signature bottom portion. The drum's gripper grips this portion and pulls the signature downwardly from the stack and around under the drum in a forward direction. When free from the stack, a transfer signature gripper drum located below the main drum grips the retreating edge of the signature while the gripper drum releases its bottom edge, this transfer drum rotating in the same direction as the main gripper drum so that it then pulls the signature, by reversing its direction of travel, in a backward and downward direction for opening and dropping on the saddle which is beneath the transfer drum. The direction of travel of the signature is reversed.

In the present invention a modification of the above is applied to the high-speed signature gathering machine of the Sarring et al. patent for the purpose of solving the previously mentioned problem.

In doing this the transfer drum of the signature inserter is reversed in its direction and operation and placed axially substantially in the same horizontal plane as the axis of the main gripper drum, and the lower belt of the Sarring et al. machine is formed into a loop, by means of suitable pulleys, beside the transfer drum, coaxially therewith and with the same diameter, the upper belt being arranged to form the nip therewith.

With this arrangement the gripper drum pulls the signature downwardly, around under the drum, forwardly and upwardly to the transfer drum which without pause or direction reversal grips the same pulled bottom edge portion of the signature and pulls the latter upwardly and around the transfer drum so as to feed the signature into the nip of the belt spans. The rotational speeds of the main gripper drum and the transfer drum are timed to provide the same peripheral speeds which in turn coincide with the linear traveling speeds of the belt spans. As explained by the Sarring et al. patent, the signatures fed forwardly by the belt spans thereafter do not change in velocity with respect to the linear traveling speed of the pin of the pin chain. With this new arrangement the bottom edge of each signature in the stack is gripped firmly and positively, this grip is maintained until the transfer drum gripper grips the same edge portion and this positive engagement is maintained until the signature is pulled firmly into the nip of the two belts.

The foregoing is illustrated by the accompanying drawings in which:

FIG. 1 shows the general details of the two drums, this being a side elevation.

FIG. 2 is a partially broken away side elevation, on a smaller scale, showing the parts described hereinabove and particularly showing the chain drives effecting the timing of the main and transfer gripper drums and the belts.

These drawings show the stack of signatures with their lower edges supported by the bottom 1 of a feed hopper 2, the signatures being continuously urged forwardly by one or more chains 3 which keep the foremost signature of the stack pressed against the hopper's front wall 4 which is shaped to leave the bottom edge portion of this signature free so that the sucker arm 5 can bend this bottom portion forwardly from the stack. The signature gripper drum assembly 6 is positioned with its axis generally aligned horizontally with the bottom of the signature stack and so that its periphery rotates downwardly on the drum's side adjacent to the bottom of the stack. The drum has two signature grippers 7 which may be conventional in design and operation and timed as usual to grip the forwardly bent bottom portion of the foremost signature.

With the bottom edge portion of the signature gripped firmly, the signature is pulled downwardly from the stack and forwardly from the stack around the drum to the transfer location where the gripper releases the signature. The transfer signature gripper drum assembly 8 having the signature gripper 9 on its periphery is positioned and rotated so that this gripper 9 grips the bottom portion substantially simultaneously upon its release at the transfer location by the gripper 7, and thereafter pulls the signature upwardly around this transfer drum and further forwardly without pause or reversal of its feeding direction. In other words, the drum 8 rotates in a direction opposite to the drum 6. As previously indicated, the drums 6 and 8 have their respective axes located in the same horizontal plane and their axes are of course parallel to each other.

Hereinabove reference has been made to upper and lower endless belts which are actually one set of dual sets of belts laterally spaced apart as disclosed by the Sarring et al. patent. Although not shown by the present drawings, it is to be understood that this dual arrangement would ordinarily be used with the belts on opposite sides of the transfer drum 8.

With the above understanding, the lower belt 10 of each set is looped around a pulley 11 which is one of two formed as parts of the transfer drum 8 and therefore rotating with this drum as a unit at the same speed. This lower belt 10 loops around small guide pulleys 12 and 13 to form the bottom forwardly traveling belt span of the Sarring et al. patent. The superimposed upper span is formed by an upper belt 14 looped

over a pulley **15** having the same diameter as the pulley **8** and driven at the same speed, the upper span being formed with the aid of small pulleys **16** and **17** generally as in the case of the Sarring et al. patent. Preferably the upper span formed by the belt **14** is, with the aid of the pulley **16**, extended backwardly so as to overhang the nip **18** formed by the two belts and into which the signature is pulled positively by the gripper **9** of the transfer drum **8**.

Driving with proper timing, as shown by FIG. **2**, is effected by a sprocket wheel **19** mounted on a driven shaft **20** and around which a sprocket chain **21** passes, this sprocket chain extending over a guide sprocket wheel **22**, the chain then looping under a sprocket wheel **23** having a diameter twice the diameter of the wheel **19** and keyed to the latter's shaft **24**, the chain **21** then continuing around a sprocket wheel **24** having the same diameter as the sprocket wheel **19** and keyed to the latter's shaft **25**, the chain from there going downwardly and backwardly around a guiding sprocket wheel **26** back to the sprocket wheel **19**. The transfer drum **8** is half the diameter of the main drum **6** and turns twice as fast as the latter because the transfer drum has only the single gripper **9**. The sprocket wheel **23** is a dual wheel (not shown) so it can drive a second sprocket chain **27** which, with the help of a sprocket guide wheel **28**, loops around a sprocket wheel **29** keyed to the shaft **30** of the pulley **15**. The sprocket wheel **29** has half the diameter of the part of the dual wheel **23** which is not shown and so the pulley **15** turns twice for each turn of the drum **23**.

Now it can be seen that both the main and transfer signature gripper drums rotate at the same peripheral speeds which in turn match the linear speeds of the two superimposed belts. The driven shaft **20** is of course timed with respect to the overall machine so that each signature leaves the superimposed belt spans timed as required by the accelerator of the machine of the Sarring et al. patent. As required by this machine, the two superimposed belt spans extend forward horizontally in the same sense as described in connection with the horizontal position of signatures being slid over the trough of a gathering machine.

The details concerning the actuation of the parts required to feed the signature stack forwardly, to operate the sucker arm, and to operate and time the signature grippers of the two drums, are not shown in detail because they are well known. Other details not shown because well known include the signature guides which curve around the outer periphery of both drums to hold the signature against the drums' peripheries. In general the present disclosure is kept to the minimum required to understand the principle and operation of the present invention.

We claim:

1. A signature gathering machine having a hopper including a bottom with a front lip for supporting a stack of upstanding signatures by their lower edges, a device for bending forwardly away from the front lip the lower edge portion of each successively foremost signature of a stack of signatures supported by the hopper, and means for engaging this portion and pulling the signature downwardly and away from the stack and feeding the signature forwardly for gathering; wherein the improvement comprises:

said means including a signature gripper drum assembly having at least one signature gripper on its periphery and positioned and rotated in a first direction so that said signature gripper grips the signature lower edge portion and pulls the signature downwardly from the stack and forwardly around the drum to a transfer location;

a transfer signature gripper drum assembly having at least one transfer signature gripper on its periphery and positioned and rotated in a second direction opposite to said first direction so that said transfer signature gripper grips the lower edge portion at said transfer location prior to release of this portion by said signature gripper and thereafter pulls the signature upwardly around a portion of said transfer drum and further forwardly without pause or reversal of its feeding direction;

a first endless belt looped about a portion of said transfer drum assembly and extending forwardly with respect thereto to form a first span extending generally horizontally forwardly therefrom;

a second endless belt superimposed on a portion of said first endless belt in engagement with said transfer drum assembly in advance of said first span and having a portion forming a second span superimposed on said first span, said second endless belt forming an entrance nip with said first endless belt for receiving the signature on said transfer drum assembly and feeding the signature forwardly upon release thereof by said transfer signature gripper of said transfer drum assembly, said entrance nip being positioned adjacent said transfer location; and

means for rotating said drum assemblies in said first and second opposite directions.

2. The machine of claim **1** in which the front lip of the hopper and the axes of said drum assemblies are positioned in substantially the same horizontal plane and the transfer location is substantially in said plane and adjacent said entrance nip in order that the lower edge of the foremost signature is gripped at a point substantially in said plane and is pulled downwardly from said upstanding stack by said signature gripper of said gripper drum assembly, is transferred to said transfer gripper of said transfer drum assembly at the transfer location substantially in said plane, and is then transferred to the entrance nip of said first and second endless belts adjacent the transfer location, whereby the signature moves in the shortest path with minimum bending from said hopper to the entrance nip of said horizontally extending first and second endless belts.

3. The machine of claim **1** in which said means for rotating said drum assemblies in said opposite first and second rotative directions includes means for rotating the peripheries of said drum assemblies at the same linear speeds.

4. The machine of claim **1** in which said gripper drum assembly has two diametrically opposed grippers and said transfer drum assembly has one transfer signature gripper, the diameter of said transfer drum assembly being one-half the diameter of said signature gripper drum assembly, so that the circumferential distance between said signature grippers on said gripper drum assembly is the same as the circumference of said transfer drum assembly.

5. The machine of claim **1** and further comprising means for driving said first and said second endless belts at the same linear speed which corresponds to the linear speed of the gripper of said signature gripper drum assembly.