A machine for arranging cans or comparable objects in position has a first conveyor frictionally supporting round cans from the bottom. The first conveyor forms the bottom wall of a tunnel a side wall of which is a second, faster conveyor having partition walls extending partly across the tunnel and defining can receiving pockets. The tunnel is partly evacuated and air flows in through the tunnel portal. A can on the first conveyor, advancing at random, arrives at the portal and when opposite an advancing partition substantially blocks air ingress. Differential air pressure on the can accelerates the can toward the next advanced pocket. Movement of the accelerated can reduces air pressure and affects the air flow so as to tend to hold the can in registry with the pocket. As the can advances, it is also moved laterally into the pocket by transverse air flow or by a converging tunnel wall or both. The pocketed can emerges from the tunnel to the atmosphere in an appropriate position.

11 Claims, 5 Drawing Figures
MACHINE FOR ARRANGING CANS IN POSITION

There are many environments in which it is desired to handle a number of cans, either empty or full, at a relatively high speed. The purpose may be making, processing, labeling, filling or the like. To accomplish many of these functions, it is necessary to have the can related or positioned in a certain way. Furthermore, it is desirable to handle the cans at a relatively rapid rate and to prevent them from being damaged or injured in the machinery, or from having any previously applied labels battered or destroyed. There is a particular requirement for taking cans that arrive at random, either in close cans or in other configurations, and presenting them to later processing machinery in an orderly fashion along the cans each in a predetermined or selected position.

It is, therefore, an object of the invention to provide a machine for arranging cans in which the cans are handled quickly, although gently, and without damage, either to themselves or to the surrounding machinery.

Another object of the invention is to provide a machine which will accept cans arriving at random times or in random positions or both and then arrange the cans so that they proceed in predetermined or known positions for further work.

A further object of the invention is to avoid back pressure on a line of arriving cans and in general to provide an improved machine for arranging cans.

Other objects together with the foregoing are attained in the embodiments of the invention described in the accompanying description and illustrated in the accompanying drawings, in which:

FIG. 1 is a plan, somewhat diagrammatic, of one form of machine for arranging cans pursuant to the invention;

FIG. 2 is a cross section, the plane of which is indicated by the line 2—2 of FIG. 1 but drawn to an enlarged scale;

FIG. 3 is a diagram showing a portion of a mechanism similar to that shown in FIG. 1;

FIG. 4 is a diagram similar to that in FIG. 3 but showing an alternate form of a device; and

FIG. 5 is a cross section, the plane of which is indicated by the line 5—5 of FIG. 4.

While the machine for arranging cans, pursuant to this invention, can be embodied in a large number of different ways, it has successfully been incorporated in the forms indicated herein. The cans, for illustration only, are shown as generally circular cylindrical bodies having the usual proportions of cans customarily now in use but other shapes are acceptable.

Such cans are illustrated only for purposes of explanation, since the dimensions of cans can also be equally well handled in the machine. Furthermore, while there issue of the term "cans" herein, the intent is also to include other objects, such as bottles and containers which have characteristics sufficiently like those of the customary circular cylindrical cans, so that they can be handled in the present mechanism.

Pursuant to the invention, there is provided a main frame supported from the floor in any convenient way. Mounted on the frame is a runway affording a support for a first conveyor. This includes a conveyor chain (FIG. 2) having thereon a plurality of cross plates designed to support and frictionally engage the bottom of cans resting thereupon. The first conveyor has a straight portion and is of a width substantially greater than the can diameter. Cans passing into the device are directed along one side of the conveyor by a pair of guides and 13 and 14. Cans arrive at random on the conveyor and are frictionally advanced at a predetermined rate in the direction of the arrow 16 (FIG. 1).

A pair of upright shafts 18 and 19 are arranged on the frame 6 at a convenient distance apart and parallel to each other. Each of the shafts carries a pair of sprocket wheels 21 and 22. Around the pairs of wheels are trained link chains 23 and 24 having thereon cross cleats 26 all included in a second conveyor 27. The cleats are fastened to both of the chains 23 and 24 so that each of the cleats is upright. Each cleat has a back wall 28 and an outstanding partition wall 29 extending substantially at a right angle to the back wall 28. The partition walls 29 define between them a plurality of pockets 31 each of a size readily to receive one of the cans 12.

The second conveyor 27 is arranged on the frame 6 so that it has a straight portion extending along the straight portion of the first conveyor 8. In fact, the first conveyor 8 and the second conveyor 27 respectively define the bottom and one side of a tunnel, generally designated 32. The tunnel is also bounded by an opposite side wall 33 in a block 34 supported on the frame 6 and closed by a cover plate 36. The end margin 37 of the cover plate lies in a transverse plane intersecting the conveyors 8 and 27 as well as the block wall 33 and thus defines a tunnel entrance portal 38. The tunnel communicates with a chamber 39 joined to a duct 41 extending to a source of subatmospheric pressure indicated by the arrow 42 in FIG. 2. The interior of the tunnel is operated at less than atmospheric pressure and because of the lower pressure within the tunnel there is an inflow through the portal 38.

When this mechanism operates, the first conveyor 8 advances to the right, in FIG. 1, at a predetermined speed, usually constant, whereas the adjacent run of the second conveyor 27 advances through the tunnel toward the right, in FIG. 1, at a slightly greater speed. Cans 12 arrive at random, often close to each other or in contact with each other on the first conveyor 8. The cans may run exactly at the supporting conveyor speed but also may slip somewhat and lag in speed. The leading can finally arrives at the portal 38. As the leading can so advances, it is overtaken by the one of the partition walls 29 which enters the portal at about the same time. Since the partition walls extend for a substantial distance transversely of the tunnel and since the advancing can then occupies a large part of the remaining portal area, there is left only a small remaining area. The interior of the tunnel is partially evacuated so a can in the portal and substantially alongside a partition wall is promptly subjected to low pressure on the downstream projected area and the atmosphere acting on the upstream projected area thereof. The portal is not completely blocked by the partition and the can. Rather, there is a small space left around the sides of the can so that air at a relatively high velocity flows around the can. This rapidly flowing air tends to act as a cushion so that the can and the adjacent machine parts are held out of physical contact, thus protecting the can surface and any label or imprinting that may be present.

As shown in FIG. 1 and as illustrated, somewhat diagrammatically, in FIG. 3, at the portal 38 the randomly advancing, foremost can 12, as shown at the left of the figures, substantially is positioned between an overhanging partition wall 29 and the side wall 33. Air flowing into the tunnel 32 past the foremost can, flows on both sides thereof as shown by the arrows 43. As the can partially blocks the space in the portal between the passing partition 29 and the side wall 33, and the can is subjected to an accelerating force due to differential air pressure, substantially the only resisting force is the friction of the can bottom on the plates 11 of the first conveyor 8. This is not sufficient to hold the can in place on the plates 11 and the can begins to overtake the partition wall 29. As the can advances through the portal and ahead of the advancing partition wall 29 the air on the opposite sides of the can is throttled somewhat less than before, reducing the differential pressure and the acceleration due thereto. Some retarding is due to friction against the conveyor 8. Also, after the can has been accelerated through the relatively narrow aperture or portal, partly defined by the partition wall 29, there is a retarding force on the rear quarters of the can tending to hold the can somewhat in alignment with the pocket 31 momentarily alongside. This is believed to be skin frictional forces that hold a ball in place at the top of a rising fluid jet, often referred to as a Bernoulli effect which also tends to center the can between side boundaries. Also, there is believes to occur a force due to restricted air flow between the side of the can and the adjacent partition 29 which tends to pull the can into the next advanced pocket 29 and to keep the can away from the wall 33.
force is thought to be due to what is generally referred to as the Coanda effect.

The net result of the air flow is that as the can is briefly accelerated from a random position, it tends to achieve a position of equilibrium between successive partition walls 29 and opposite to or substantially in registry with one of the pockets 31. The can thus slides ahead of the plates 11 and tends to stay in transverse alignment with a pocket 31. This is the indexed or desired position of the previously random can.

As the positioned can advances under the influence of the bottom conveyor 8 and of the passing air, the can is gradually moved transversely into the pocket. The side wall 33 has a converging portion 44. As the can approaches the outlet of the tunnel 32 it is physically displaced lateral about halfway or more than halfway into the pocket. It is preferred to bring the converging portion 44 almost into physical contact with the ends of the partition walls 29, thus forming a fairly close vacuum seal at the outlet end of the tunnel. The cans leaving the tunnel in their individual pockets are properly spaced and positioned for subsequent handling.

Sometimes it is preferred to arrange the vacuum mechanism with the vacuum chamber at the side of the tunnel as shown in FIG. 4. In this instance, the second conveyor has backwall 46 provided with apertures 47. These walls 46 pass by an entrance block 48 at a portal 49 lateral vacuum chamber 51 likewise enclosed by side and end walls 52 and appropriate top and bottom walls 53 and 54, as shown in FIG. 5. In this instance, the air flow tends to be toward one side of the cans through the successive pockets 56, and tends to displace the cans into the pockets with less reliance upon the converging portion 44.

The forces due to air flow can, of course, be the result of operating the tunnel at atmospheric pressure and the surroundings at above atmospheric pressure, or any arrangement that results in the described air flow.

There is provided a mechanism effective to receive cans arriving on a friction conveyor, disposed in a random arrangement and arriving at random times and very often spaced quite closely together. The cans enter individually through a portal into a tunnel under the influence of differential air pressure by which they are subjected to a brief accelerating force and then to retarding and positioning due to friction and air flow forces. The can is appropriately positioned and located by air flow so as to register with a pocket on an adjacent conveyor, moving faster than the friction conveyor. The can is moved into and is captured by the pocket in an appropriate, predetermined, spaced position. The so-positioned can is then released from the mechanism for further handling. Since the difference in speed of the conveyors is small, the cans can arrive at a high speed relative to the frame and nevertheless be positioned properly without damage.

What is claimed is:

1. A machine for arranging cans in position comprising a frame, means for supporting a can on said frame, means on said frame defining a portal disposed in a plane and having an opening slightly larger than the outline of said can, means for establishing a current of air through said portal in a predetermined direction from the upstream side thereof to the downstream side thereof, means on said frame on the downstream side of said portal establishing for said can a predetermined capture location moving in said direction, and means for moving said can on the upstream side of said portal into a position in said current of air wherein said can is accelerated in said predetermined direction by said current of air to move through said portal onto the downstream side thereof substantially in registry with said predetermined capture location, one boundary of said portal being defined by the portion in said plane of a member having an undulatory surface extending in a direction generally normal to said plane and defining a capture pocket generated by a line element moving always parallel to said plane and to said one boundary, and means for moving said member relative to said frame in a direction normal to said plane.

2. A machine as in claim 1, in which one boundary of said portal is defined by the portion in said plane of said can supporting means and said can moving means and in which said can supporting means and said can moving means is a conveyor adapted frictionally to engage a can and is adapted to advance in said predetermined direction.

3. A machine as in claim 1 in which said means for establishing said capture location moving in said direction includes back walls extending generally normal to the plane of said portal and partition walls disposed generally parallel to the plane of said portal and adapted to lie close to a side of said can, said partition walls being spaced apart in a direction normal to the plane of said portal to define pockets adapted to receive said can.

4. A machine as in claim 1 in which said means defining said portal includes a wall having a surface downstream of said portal converging transversely of said predetermined direction and toward said capture location.

5. A machine as in claim 1 in which said means for moving said member advances said member in said predetermined direction at a predetermined rate and in which said can supporting means and said can moving means is a conveyor frictionally engaging said can and advancing said can in said predetermined direction at a rate slower than said predetermined rate.

6. A machine for arranging cans in position comprising a frame, a substantial enclosure on said frame defined on the bottom by a smooth conveyor belt adapted to support a can thereon, defined on one side by a conveyor having can capturing pockets therein, defined on the other side by a wall converging toward said one side, and defined on the top by a plate terminating at a predetermined location and with said conveyor belt, said conveyor and said wall establishing a portal having substantially the outline of a can passing therethrough, means for subjecting said enclosure to a subatmospheric pressure, and

7. A machine as in claim 6 in which said conveyor advances faster than a can on said conveyor belt.

8. A machine for arranging cans in position comprising a friction belt adapted to advance a can at a predetermined rate, a pocket conveyor having can capturing pockets therein, means for mounting said friction belt and said pocket conveyor to operate in juxtaposed substantially parallel paths, means for driving said friction belt and said pocket conveyor in the same direction and with said pocket conveyor advancing faster than said predetermined rate, and means operating in response to the presence of a can at a predetermined location on said friction belt for accelerating said can into a position advancing in registry with a pocket on said pocket conveyor.

9. A machine for arranging cans in position comprising a frame, an elongated means on said frame for supporting a can and defining the bottom of a planar portal disposed transversely of said supporting means, a wall on said frame extending along said supporting means and defining a side of said portal, a cover on said frame extending over said supporting means and along said wall and defining the top of said portal, a member on said frame extending substantially parallel to said wall, said member having an undulatory surface providing a can pocket facing said wall and defining the other side of said portal, means on said frame for moving said member parallel to itself whereby the size of said portal is varied in accordance with the variation in said undulatory surface, and means on said frame for flowing air through said portal in a direction substantially normal to the plane thereof.

10. A machine as in claim 9 in which said wall on the downstream side of said portal extends diagonally across at least part of said supporting means.

11. A machine as in claim 10 in which said wall extends diagonally across said supporting means into a location close to the side of a can in said can pocket.