The present invention relates to an automatic machine for uniformly aligning in the same direction and packing neatly side by side tubular articles such as phials for medicines, in boxes or the like.

In many installations for mass producing tubular articles such as phials for medicines, it is necessary to fill them neatly in such manner that they are arranged side by side and all in the same direction.

In the particular case of phials, this arrangement is effected either before or after the filling thereof or during the various phases of preparation.

This demands an appreciable amount of labour, since packing has hitherto been performed by hand.

By means of the present invention, however, the boxes are automatically filled with maximum regularity and with minimum use of labour, because the operator can restrict himself to initially adapting the machine to the type and sizes of the phials or tubular bodies to be packed, after which it automatically carries the packing operation.

Another feature of the present invention is that it is possible to insert in the machine an automatic counting device for the packed phials or tubular bodies, which count is preferably effected by suitable scanners or feelers acting on individual phials, thus noting any irregularity in the packing.

More particularly, the object of the present invention is to convey on suitable belt conveyors tubular bodies disposed at random on an inclined loading surface and to provide a suitable aligning device which arranges them all in the same direction.

According to the invention, an automatic packing machine for packing tubular articles comprises a loading surface on which the articles are loaded at random, a conveyor belt divided into passages of a width similar to the diameter of the articles, movable suction pipes for drawing off the articles from the conveyor belt to drop them into downwardly inclined passages and a device which inserts the tubular bodies into a movable container.

The machine is provided with suitable control members which permit of rapid adaptation to various diameters, shapes and lengths of the tubular articles.

The invention will be described by way of example with reference to the accompanying drawings in which:

FIG. 1 is a perspective view of the machine;
FIG. 2 is a rear view thereof;
FIG. 3 is a schematic vertical section through the machine;
FIG. 4 shows schematically the mechanism which controls the movement of suction pipes;
FIG. 5 is a plan view of a belt conveyor;
FIG. 6 is a perspective view of the belt conveyor of FIG. 5;
FIG. 7 is a partial cross section of the belt conveyor of FIG. 5;
FIG. 8 shows a threaded supporting shaft of the suction pipes;
FIG. 9 is a cross section of the arranging mechanism of the tubular articles;
FIG. 10 is a front view of the mechanism of FIG. 9.
FIGS. 11 and 12 correspond to FIGS. 9 and 10, but with the tubular articles the other way round;
FIG. 13 is a cross section of a component of a counting mechanism;
FIG. 14 shows the electric wiring diagram of the counting mechanism;
FIG. 15 is a schematic view of the rear part of the machine;
FIG. 16 is a cross section of the packing mechanism.

The machine constructed in accordance with the present invention comprises substantially a casing 1 (FIG. 1) having an inclined plane 2 at the top on which there are loaded at random the tubular articles to be packed.

The tubes are fed by means of rotating flexible arms 3 into passages provided with belt conveyors 4 where they are drawn off by means of the suction pipes 5 which then drop them into the passages 6 (FIG. 2) disposed behind the machine.

The tubular articles which descend the passages 6 are arranged in the same direction by a suitable aligning device, counted by means of a counting mechanism and then packed in extractable boxes 7.

The tubular articles, fed by the rotating brushes 3 (FIG. 3) on conveyor belts 4 are drawn off by the suction pipes 5 provided with a reciprocating movement which terminates in the position outlined in FIG. 3. The pipes 5 are connected by tubes 8 to the suction device 9 actuated by the motor 10.

The tubular intake of the suction device 9 is provided with an external connection socket closed by a cover 11 opened by the lever 12 controlled by the eccentric 13.

The lever is keyed in such manner as to cause the opening of the cover 11 at the moment the suction pipe 5 in the position shown in accordance with which the tubular body is allowed to slide into the passage 6. The opening of the cover 11 causes air to enter the suction device which eliminates the vacuum in the tubes 8 and hence in the pipes 5.

The movement of the suction pipe 5 can be obtained with any type of mechanism. For example, FIG. 4 shows a mechanism formed of the eccentric 14 controlling the lever 15 which, by means of the draw bar 16 causes the rotation of the lever 17 and consequently of the toothed wheel 18.

The lever therefore receives a rotary reciprocating movement in opposite direction which, by means of the chain 19 is transmitted to the toothed wheels 20-21 which control, through the levers 22-23 the movement of the angle bar 24, to which are connected the pipes 5.

The latter are rotatably mounted on the pivot 25 and rest on the support bar 26 which may be raised or lowered by opening the clamp 27 so as to maintain the clearance between the pipe 5 and the belt relative to the diameter of the tubular articles. In turn, the pivot 25 may be removed from or brought nearer to the support bar 26 by means of the head screw 28 in such manner as to adapt the longitudinal position of the suction pipe 5 to the length of the tubular body to be packed.

The pipes 5 are mounted on a shaft 29 (FIG. 8) provided with alternate right and left threads in pairs in such manner that by turning a knob 30 the respective removal or approach of the pipes of each pair is caused in order to adapt their position to the various diameters of the tubular articles to be packed.

The conveyor belt 4 (FIG. 6) is formed of a single rotating woven belt on which there are disposed movable strips 31 and 32 separated by a stationary strip 33 which partly covers them and is secured to a frame.

The movable strips 31 and 32 are secured to the square section bars 34 and 35 respectively which are moved longitudinally towards each other in opposite directions by a single control wheel 36 keyed on a shaft 39 provided with right and left hand threads.

The movable strips 31 and 32 (FIG. 5) therefore leave uncovered two side strips of the conveyor belt 4 corre-
sponding with each passage, the latter being defined by the stationery partitions 37 and 38 secured to a frame. The tubular articles are fed in the free strips aforementioned of the conveyor belt 4 which moves at a speed sufficient to permit the tubular articles at the top when the pipes 5 are lowered to draw them off.

The hand wheel 36 operates the screws 39 provided with double right and left hand threads which engage the female screws formed in the blocks 40 and 41 fixed to the bars 35 and 34 respectively.

The tilting bar 42 which runs over the guide bar 44 (FIG. 7) together with the slide bars 45 and 46, guide the strips 31 and 32.

The tubular articles descend into the passage 6 (FIG. 9) and rest on a stop surface 45 fixed to the end of the rotatable bar 46, which is pivoted at 47.

The stop surface 45 is provided with inclined planes 48 (FIG. 10) on which the tubular articles rest.

If an article descends so that its plane base comes into contact with the inclined surface 48, it rotates on itself therefore falling into the following passage 49 without turning over.

However, if an article presents itself (FIG. 11) with the point of reduced diameter turned towards the support surface 45 it is moved with the displacement of the latter, as shown in broken lines, so as to turn round before falling into the passage 49.

It is possible to obtain the alignment of the tubular articles which therefore descend into the passage 49 all directed in the same direction.

The tubular articles descending into the passages 49 (FIG. 15) encounter a second impediment surface 50 provided with two shock absorbing surfaces which arrest the tubular bodies briefly so as to compensate the different dropping times due to the different length to be travelled in the various passages 49, and to the fact that some of the articles fall straight down and others are turned thus occupying more time.

When the impediment surfaces 50 are displaced, the tubular bodies continue their fall stopping on lower blocking surfaces 51 on which counting is effected.

Corresponding to the support surfaces 51, swing levers 52 descend as shown in FIG. 13, the raising of lever 52 is controlled by a bar 53 secured to levers 54.

The swing lever feelers 52 bear on the tubular article and thus remain in a position to prevent opening of a micro switch 55 inserted in an electric counting circuit.

However, when for any reason, a tubular body is missing or broken the swing lever 55 drops to the position shown in FIG. 13 by broken lines, causing the opening of the micro switch 55 which breaks the counting circuit shown in FIG. 14.

The ends of the feelers 52 are shown in FIG. 14 with the micro switches 55, each of which is connected in series with a second micro switch 56 which is controlled by the projection 57 on the disc 58.

The disc 58 by rotating causes the successive closing of the micro switches 56 which thus cause the sending of an electric impulse to a counter 59 provided that the corresponding micro switch 55 is closed.

When one of the micro switches 55 is not closed, the passage of the projection 57 over the corresponding micro switch 56 does not cause any electric impulse to the counter 59 so that counting is not effected in that passage.

Upon further descending the passage 49 (FIG. 16) the tubular articles are again arrested on the surfaces 59 which are then displaced in the direction of the arrow so that the articles all fall side by side on a screen surface 60 where presses 61, on rising from the wall 62, thrust them into a box 63 located them by the side of the tubular articles already contained therein.

The box 63 moves forward by an amount corresponding with each descent to a row of tubular bodies, whilst a pawl 64 engages with the rack 65, so as to prevent any return of the box under the action of a counter weight 66 and prevent damage to the tubular articles by the dropping back of the wall 62.

Arresting bars 67 provided with a handle retain the box 63 and are secured to a slide 65 which runs on a spindle 69.

The slide 68 is provided with two inclined surfaces 70, 71 which cause the respective opening of electric contacts 72 and 73.

The electric contact 72 opens first, causing the locking by means of an electromagnet 74, of the covering 11 (FIG. 3) in the open position inserted in the inlet of the suction device 9.

In this manner suction stops in the pipes 5 which therefore cease feeding the passage 6 with tubular articles.

The machine however continues its operation until all the tubular articles already in the passage 6 and the following passage 49 have been counted by the appropriate counter and packed in the box 63. Then the contact 73 opens causing the complete stoppage of the machine.

This arrangement ensures exact counting of the tubular articles packed by the machine which could otherwise be counted even if they were not packed.

The machine has been described and illustrated in the attached sheet of drawings with reference to a particular embodiment by way of example only, and the mechanical details concerning the construction of the machine may be modified without departing from the scope of the present invention. For example, the machine may be constructed without the counting device and with additional devices not described in the above embodiment, in accordance with the particular requirements of the use of the machine.

The machine as now described may form part of a device for feeding an apparatus comprising other stages in the preparation of tubular articles for example, an apparatus for filling or washing phials.

In other cases the tubular articles may be loaded by the machine into containers different from those described, for example undulated containers, with suitable constructional modifications.

What is claimed is:

1. An automatic packing machine for tubular articles, such as phials, comprising, in combination, means having a loading surface for the articles, a belt conveyor adjacent said loading surface, a rotary shaft, flexible radial arms carried by said shaft and located substantially between said loading surface and said belt conveyor for moving said articles from said loading surface and upon said belt conveyor, means for aligning the articles upon said belt conveyor, movable suction pipes, means forming downwardly inclined passages, said suction pipes being located substantially between said belt conveyor and the last-mentioned means for removing the articles by suction from said conveyor belt and dropping them into said passages, means located in said passages and engaging the dropped articles for aligning the dropped articles in the same direction, and movable container-carrying means for loading the aligned articles.

2. An automatic machine as claimed in claim 1, wherein the means aligning the articles upon the conveyor belt comprise a frame, stationary strips secured to said frame and movable strips adjacent said stationary strips, said movable and stationary strips subdividing said conveyor belt into passages in size almost equal to the diameters of the tubular articles to be conveyed, so that they are automatically arranged one following the other in the individual passages of the belt.

3. An automatic machine as claimed in claim 2 in which the movable suction pipes are arranged to correspond to each passage of the conveyor belt, the machine further comprising means connected with said suction pipes for moving them with a reciprocating continuous movement so as to draw off with each stroke a
tubular article to allow it then to slide into one of the inclined passages.

4. An automatic machine as claimed in claim 1, further comprising a suction device connected to the movable suction pipes, said suction device having an aperture, and means for opening the aperture outwardly at the moment it is desired to drop the tubular bodies sucked by the pipes, so as to cut off the suction and increase the air pressure in the pipes themselves.

5. An automatic machine as claimed in claim 1, wherein the means aligning the dropped articles comprise a device for the turning of the tubular articles and having a stop surface located transversely of the inclined passage in which the tubular article descends, and means moving said device with a synchronized reciprocating movement with that of the suction in the suction pipes so that the tubular articles rest thereon during their descent down the inclined passage thus causing an upright turning of the tubular articles disposed upside down, and the simple descent of the bodies disposed in the correct position.

6. An automatic machine as claimed in claim 5, in which the stop surface in the passage is inclined in a plane perpendicular to its direction of movement, thus causing the rotation of the tubular article which may fall thereon with a plane surface, so that it slides into the passage beneath without turning over.

7. An automatic machine as claimed in claim 6 in which the stop surface in the passage is adapted to cause the reversal of tubular articles resting on it with an end of reduced diameter.

8. An automatic machine as claimed in claim 5, comprising impediment surfaces connected with said means for providing reciprocating movement and disposed in an almost perpendicular direction to the inclined dropping passage so as to form a moving barrier which compensates the dropping times of the tubular articles.

9. An automatic machine as claimed in claim 8, comprising a series of inclined blocking surfaces disposed movably across the downwardly inclined passages, swingably mounted feelers associated with the last-mentioned surfaces and counting means actuated by the feelers swinging against the tubular articles and causing the automatic counting thereof.

10. An automatic machine as claimed in claim 9, further comprising a rotatable cam, a series of contacts actuated by said cam, an assembly of micro-switches, a further assembly of micro-switches connected in series with the first-mentioned assembly of micro-switches and connected with said counting means and which are adapted to be closed in synchronism with movement of the feelers, the contacts being adapted to be opened by the feelers in the absence of a tubular article so as to cause the sending of an electrical impulse to the counting means only when a tubular article is present in the corresponding downwardly inclined passage.

11. An automatic machine as claimed in claim 1, wherein said loading means comprise at the end of each passage a displaceable screen surface on which the tubular articles rest, and a movable presser synchronized with said screen surface and thrusting the presser which advances so as to thrust tubular articles into the container whereby they are duly disposed side by side.

12. An automatic machine as claimed in claim 4, comprising a sliding device for retaining the container and means connecting said sliding device with said suction device and operable shortly before the container is completely filled to eliminate the suction of the movable suction pipes which therefore cease to feed the dropping passages, causing successively the complete stoppage of the machine when the tubular articles have been securely loaded in the container.

13. An automatic machine as claimed in claim 3, comprising control means for adapting the width of the passages of the conveyor belt and the positions in depth, height and width of the movable suction pipes to the various diameters of the tubular articles to be packed.

References Cited by the Examiner

UNITED STATES PATENTS

2,179,648 11/1939 Thayer ------------ 53—166 X
2,846,830 8/1958 Bossi -------------- 53—35

TRAVIS S. McGEHEE, Primary Examiner,