July 15, 1952 S. OTTO 2,602,942

NAIL PACKAGING MACHINE

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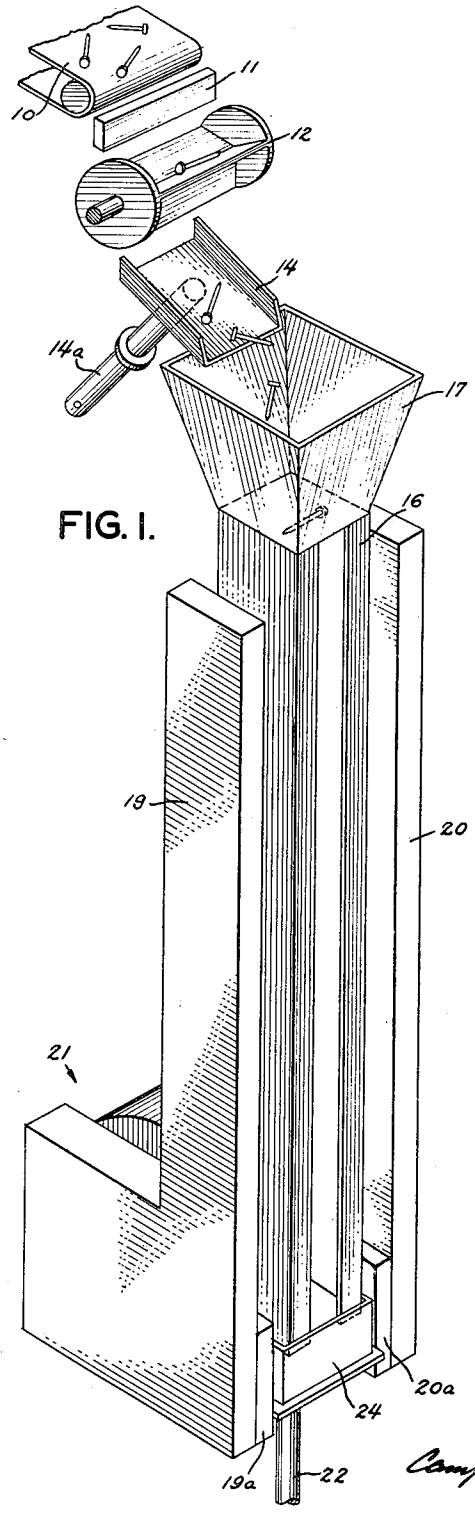


FIG. 1.

FIG. 2.

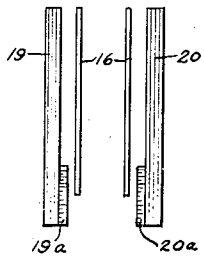


FIG. 3.

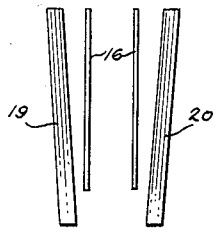


FIG. 4.

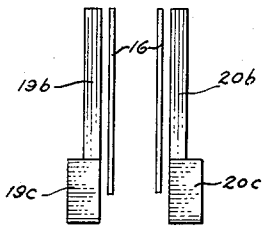
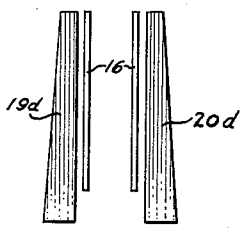


FIG. 5.



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NAIL PACKAGING MACHINE

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6 Claims. (Cl. 10—162)

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The present invention relates to a method and apparatus for packaging oblong magnetic objects such as nails, screws, bolts, pins, rivets, spikes and the like with said objects arranged in parallelism so as to utilize to the maximum all of the available space within the package or container.

While the apparatus described herein will also handle the packaging of metal powder, nuts, washers, short rivets and the like which may not be termed oblong objects, it will be hereinafter described specifically with reference to the packaging of nails. It is to be understood, however, that the specific description with reference to the packaging of nails is not intended as a limitation of the scope of this invention.

Machines have been designed heretofore for packaging nails wherein the nails are fed from a hopper or the like between the opposite poles of a magnet so as to orient them in substantial parallelism and wherein the nails so oriented are removed from the machines and packaged in suitable containers. All of the machines heretofore designed, however, require mechanical means, such as a plunger, to pack the suspended and oriented nails into the containers.

In accordance with the method and apparatus described in my copending application, Serial No. 691,266, filed August 17, 1946, now Patent No. 2,581,042 issued January 1, 1952, nails from any suitable source are divided into batches of predetermined weight or number by means of an automatic weighing mechanism and the nails in each batch are dumped, separately and in rapid succession, into a funnel terminating in a vertical chute of non-magnetic material. The chute has a width slightly greater than the length of the nails and a cross section slightly smaller than the container in which they are to be packed. It is disposed between two opposite poles of an electro-magnet and closed at the bottom by an empty container designed to hold the batch of nails when packed in substantial parallelism. The lines of force in the magnetic field passing through the chute are substantially parallel and horizontal so that as the separated nails pass down the chute, they will be brought into parallelism with one another along said lines of force. When all of the nails in a given batch have been thus deposited in the chute, they are pushed into the container by a plunger. The filled container is then removed from the bottom of the chute and replaced by an empty container to receive the next batch of nails.

It has now been found that the use of a plunger

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to force into the container the nails suspended in parallelism in the chute by the magnetic field can be avoided entirely without destroying the parallelism of the nails by terminating the bottom of the chute and positioning the bottom of the container above the lowest portion of the magnetic field having parallel lines of force and by generating a stronger field at the bottom of the chute than at the top. By means of this arrangement, a large proportion of the nails in the batch are concentrated near the bottom of the chute and are at once deposited in the container. The remaining nails, which remain suspended in the chute in the weaker portions of the magnetic field, are deposited in the container by demagnetizing the field. Ordinarily the container can be filled completely with one such demagnetization of the field. If the batches are large, however, i. e., of the order of five or ten pounds each, it may be necessary to reverse the field and thereby momentarily deactivate the field several times until all of the nails in the batch are deposited in the container.

The generation of a stronger field at the bottom of the chute than at the top can be accomplished in any one of several ways as described more specifically hereinafter and contributes to the desired result by concentrating most of the nails in the batch in the lower portion of the chute instead of uniformly along the length of the chute as would be the result if the strength of the field were uniform.

The positioning of the container above the lower extremities of the magnet poles contributes to the desired result by insuring the packing into the container of a considerable portion of the nails in the batch before the magnetic field is deactivated or reversed and thus minimizes the possibilities of having some of the nails enter the container out of parallelism with the others.

In the preferred embodiment of this invention, the center of the chute, i. e., an imaginary vertical plane of reference equidistant from the sides of the chute and generally parallel to the faces of the poles of the electro-magnet, is made to coincide with the magnetic axis of symmetry between the two magnetic poles so that the force exerted at any point on the plane of reference by one pole will be balanced by an equal and opposite force exerted by the other pole. As the nails enter the top of the chute, the heads of the nails will be pulled toward one pole or the other depending upon the position of each individual nail as it enters the magnetic field. Thus the nails entering the field with their heads

nearer to the north pole will, when passing down the chute, have their heads pointed toward the north pole and, similarly, those nails having their heads nearer to the south pole when entering the chute will have their heads pointed in that direction as they pass down the chute. As a consequence of the magnetic symmetry of the chute relative to the magnetic field, approximately 50% of the nails in the batch will have their heads pointing in one direction and the other 50% will have their heads pointed in the opposite direction. This is a particularly desirable result from the point of view of packing a given batch of nails into a container of the smallest possible volume.

When nails are packaged while they are in substantial parallelism, the saving in volume of containers for a given weight of nails varies from 20% for short, flathead nails to as much as 60% for some types of long, thin nails and generally averages about 35 to 40%.

Reference is now made to the accompanying drawing wherein:

Figure 1 is a view in perspective of a nail packaging unit constructed in accordance with the principles of this invention;

Figure 2 is a diagrammatic view showing the relationship between the chute and magnet poles of the unit shown in Figure 1; and

Figures 3 to 5 are schematic representations, similar to Figure 2, showing several alternative means of arranging the magnet poles to produce a concentration of magnetic flux at the bottom of the chute.

The unit illustrated in Figure 1 includes an intermittently moving conveyor 10, a dribble arrestor 11, a scale 12, a vibrating hopper 14, a chute 16 provided at the top with a funnel 17 and disposed between the opposite poles 19 and 20 of an electro-magnet 21, and an elevator 22 adapted to move empty containers successively to filling position at the bottom of the chute 16.

The intermittently moving conveyor 10 conveys the nails from any suitable source such as a supply hopper to the scale 12 and is provided with a dribble arrestor 11 at its end. At the moment that a predetermined weight of nails has been deposited upon the scale 12, the movement of the conveyor 10 is halted and the dribble arrestor 11 is actuated to prevent nails that have left the conveyor 10 but not yet reached the scale 12 from being deposited in the scale.

The batch of nails in the scale 12 is then deposited upon the vibrating hopper 14 and the scale 12 is made ready to receive another batch of nails from the conveyor 10 which is set into operation at the same time that the dribble arrestor 11 is deactivated. The vibrating hopper 14 is made to vibrate by means of a vibrator 14a to spread the nails out more or less uniformly and conduct them to the funnel 17. The vibrating hopper 14 has the function of bouncing the nails in the batch to such an extent that they become separated from one another. The nails are then individually, but in rapid succession, deposited in the funnel 17 and allowed to pass into the chute 16 wherein they are brought into substantial parallelism by the action of the magnetic flux between the magnet poles 19 and 20.

The poles 19 and 20 of the magnet 21 are so arranged that the magnetic field at the bottom of the chute is stronger than at the top. This can be accomplished in any one of several ways, such as illustrated schematically in Figures 2 to 5. In Figures 1 and 2, extra pole pieces 19a and 20a are inserted between the chute 16 and the pole pieces 19 and 20 to decrease the air space between the poles in the vicinity of the bottom of the chute. In Figure 3, for example, the magnet poles are tilted slightly so that they are closer to one another at the bottom than at the top. In Figure 4, the pole pieces are divided into relatively narrow pieces 19b and 20b and relatively thick pieces 19c and 20c, the thick pieces being in the vicinity of the bottom of the chute 16. Finally, in Figure 5 there are shown tapered pole pieces 19d and 20d which are thicker at the bottom than at the top so as to bring about a gradual increase in the concentration of the magnetic flux.

For the most efficient operation, it is important that the bottom of the chute 16 be above the bottom of the pole pieces so that the bottom of the container 24 in which nails are to be deposited will not be below the point at which the magnetic flux is strongest. In this way, most of the nails that are deposited in the chute 16 not only become concentrated in the lower portion of the chute but are actually moved into the container 24 before the magnet 21 is deactivated or reversed. As a result, the remaining nails do not have very far to fall when, for example, the polarity of the poles is momentarily reversed so as to completely demagnetize the magnet. The complete demagnetization of the magnet 21 in effect removes the magnetic field from the now filled container 24 so that it can be lowered for removal from the elevator 22 without the use of a plunger.

In operation, the magnetic field is deactivated or, if necessary, rapidly and successively reversed, and then deactivated, when all the nails in a given batch have been deposited in the chute 16. As soon as all the nails in the batch are deposited in the container 24, the elevator 22 supporting the filled container descends so that the filled container can be removed and replaced by an empty container. When this is accomplished, the elevator 22 rises to raise an empty container into receptive position at the bottom of the chute 16 and the magnetic field is reactivated.

In the meantime, i. e., while the container 24 is being filled with the nails in a given batch and then lowered, the scale 12 receives nails from the conveyor 10 and over the inactive dribble arrestor 11 until the predetermined weight of nails has been deposited therein. At the moment the scale is satisfied, the conveyor 10 is stopped and the dribble arrestor 11 is activated to catch any nails that may already have left the conveyor but not already have reached the scale so that the batch in the scale will not be overweight. At the same moment, or a short interval before the magnet is reactivated, whichever is later, the batch of nails is dumped from the scale 12 into the vibrating hopper 14, the "short interval" being no longer than the time it takes the first nail of a batch deposited in the funnel 17 to travel the length of the vibrating hopper. As soon as the scale 12 is in condition to receive another batch of nails, the dribble arrestor 11 is deactivated and the conveyor 10 is restarted.

The activation and deactivation of the conveyor 10, dribble arrestor 11, scale 12, magnet 21, and elevator 22 may be synchronized as described by means of any suitable arrangement. The particular means employed to bring about the described synchronization of these elements does

not form a part of the invention claimed herein.

It is obvious that many changes may be made in the construction of the apparatus illustrated without departing from the scope of this invention. Thus, for example, the minimum spacing between the magnet poles may be made adjustable to accommodate chutes adapted to receive longer or shorter nails. All such changes are intended to be included within the scope of the invention as defined in the appended claims.

I claim:

1. A nail packaging machine comprising an electro-magnet including a pair of substantially vertical, elongated, and oppositely facing pole pieces for producing a magnetic field of parallel lines of force horizontally between the pole faces, a pair of extra pole pieces, one adjacent the lower end of each opposed face, decreasing the gap between the pole pieces to produce a maximum concentration of parallel lines of force in the magnetic field between the lower portions of the pole faces; a vertical, elongated chute of non-magnetic material disposed between the pole faces and in the path of said parallel lines of force, the lower end of the chute terminating at a level above the lower ends of the pole pieces; means above the chute for introducing elongated magnetizable articles into the chute in rapid succession for mutually parallel orientation thereof along said parallel lines of force; means under the chute for elevating an empty container relative to the chute and positioning the container under and adjacent the lower end of the chute and between the pole pieces to receive the elongated articles from the chute; and means associated with the electro-magnet for deactivating the magnetic field and thereby permitting the oriented articles to fall into the container by gravity while they are in mutual parallelism.

2. A nail packaging machine comprising an electro-magnet including a pair of substantially vertical, elongated, and oppositely facing pole pieces for producing a magnetic field of parallel lines of force horizontally between the pole faces, the faces of said pole pieces being closer to one another at the lower end than at the upper end to produce a maximum concentration of parallel lines of force in the magnetic field between the lower portions of the pole faces; a vertical, elongated chute of non-magnetic material disposed between the pole faces and in the path of said parallel lines of force, the lower end of the chute terminating at a level above the lower ends of the pole pieces; means above the chute for introducing elongated magnetizable articles into the chute in rapid succession for mutually parallel orientation thereof along said parallel lines of force; means under the chute for elevating an empty container relative to the chute and positioning the container under and adjacent the lower end of the chute and between the pole pieces to receive the elongated articles from the chute; and means associated with the electromagnet for deactivating the magnetic field and thereby permitting the oriented elongated articles to fall into the container by gravity while they are in mutual parallelism.

3. A nail packaging machine comprising an electromagnet including a pair of substantially vertical, elongated, and oppositely facing pole pieces tilted slightly away from one another for producing a magnetic field of parallel lines of force horizontally between the pole faces, the faces of said pole pieces being closer to one another at the lower end than at the upper end to

produce a maximum concentration of parallel lines of force in the magnetic field between the lower portions of the pole faces; a vertical, elongated chute of non-magnetic material disposed between the pole faces and in the path of said parallel lines of force, the lower end of the chute terminating at a level above the lower ends of the pole pieces; means above the chute for introducing elongated magnetizable articles into the chute in rapid succession for mutually parallel orientation thereof along said parallel lines of force; means under the chute for elevating an empty container relative to the chute and positioning the container under and adjacent the lower end of the chute and between the pole pieces to receive the elongated articles from the chute; and means associated with the electromagnet for deactivating the magnetic field and thereby permitting the oriented elongated articles to fall into the container by gravity while they are in mutual parallelism.

4. A machine for packaging elongated magnetizable objects in parallelism comprising an electromagnet including a pair of substantially identical and symmetrically opposed vertical pole pieces for producing a magnetic field of parallel lines of force horizontally between the pole faces, the faces of said pole pieces being closer to one another at their lower ends than at their upper ends to produce a greater concentration of magnetic flux in the field between the lower portions of the pole faces; a vertical elongated chute of non-magnetic material disposed in symmetry between said pole pieces, the lower end of the chute terminating at a level above the lower ends of the pole pieces; means above the chute for intermittently introducing predetermined batches of elongated magnetizable objects into the chute in rapid succession for the mutually parallel orientation thereof as they fall into the magnetic field above the pole pieces; means below the chute for elevating an empty container relative to the chute and positioning the container under and contiguous with the lower end of the chute and between the pole pieces to receive the elongated magnetizable objects from the chute; means associated with the electromagnet for deactivating the magnetic field thereby permitting the mutually paralleled objects to fall en masse into the container by gravity; means for lowering the container to a point below the said magnetic field prior to reenergizing it for the successive batch.

5. A method of packaging magnetizable elongated articles in substantial parallelism which comprises generating, by actuation of an electromagnet including a pair of substantially vertical, elongated and oppositely facing pole pieces, a vertically extended and graduated magnetic field of substantially horizontal and parallel lines of force within and across a vertical, elongated guide chute of non-magnetic material between said pole pieces, said magnetic field having a maximum density at the lower end of said field, positioning a container for said magnetizable elongated articles within and above said lower end of said field and under and adjacent the lower end of the chute, introducing separately and in rapid succession into the upper end of said field the magnetizable elongated articles to be packaged to bring them into substantial parallelism with one another and to concentrate them at said lower end and within the container, and deactivating said magnetic field to pack said mag-

netizable elongated articles into said container by the action of gravity.

6. A method of packaging magnetizable elongated articles in substantial parallelism within a container which comprises generating a vertically extended magnetic field whose lower portion embraces a container wherein the articles are to be packaged and in which field the lines of magnetic flux are substantially horizontal and parallel and the flux density increases from the upper to the lower portion of the field, introducing said articles separately and in rapid succession from above the upper portion of said magnetic field to bring said articles into substantial parallelism as they fall into the magnetized area and to concentrate said articles in substantial parallelism within and above the container in the aforesaid highest density portion of the field, and then extinguishing the magnetic field to permit the articles further to concentrate in the container by the action of gravity.

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