Aug. 30, 1966 A. C. CLARK ETAL 3,269,534

COMBINED NAIL CONVEYOR AND CLEANER

Filed Aug. 11, 1964

FIG. 3.

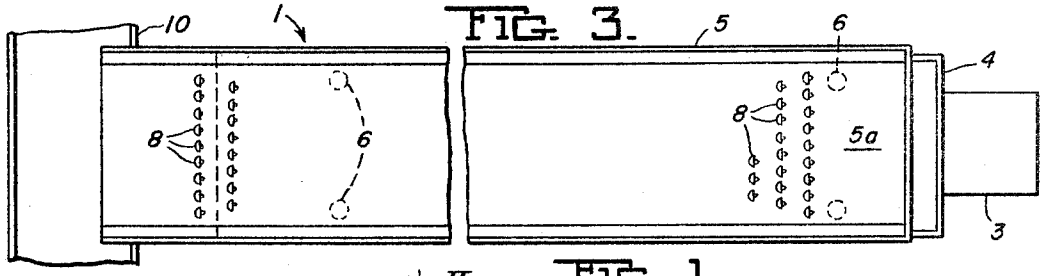


FIG. 1.

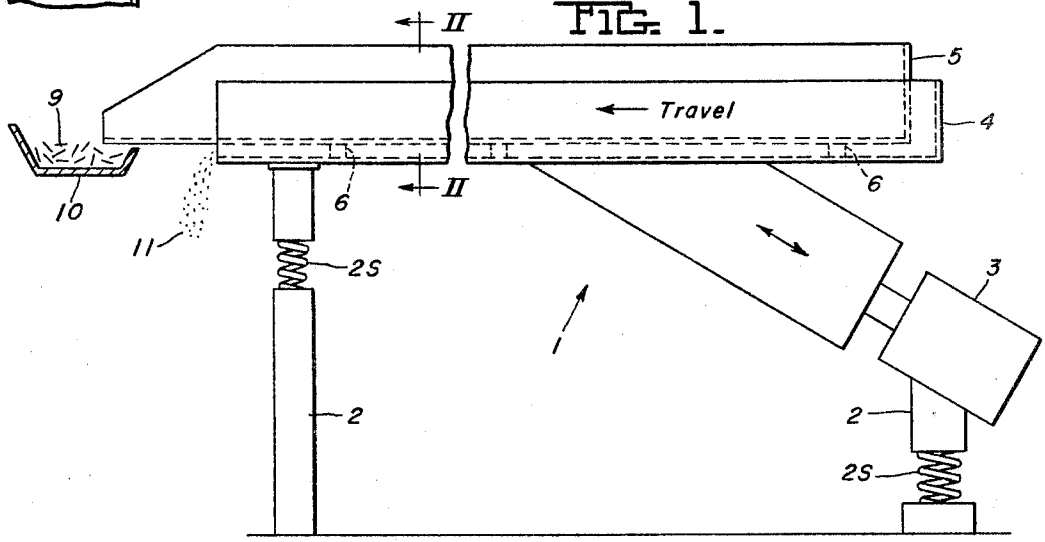


FIG. 4.

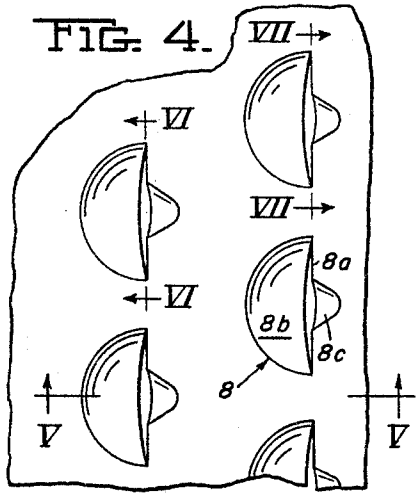


FIG. 2.

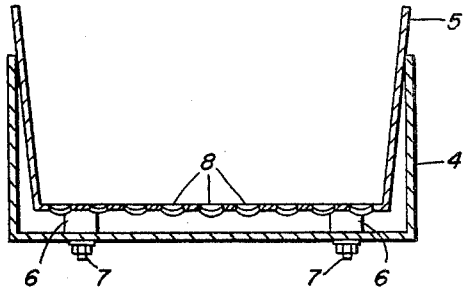


FIG. 5.

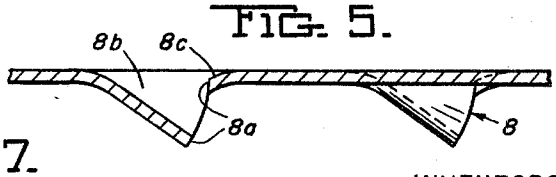


FIG. 6.

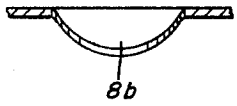
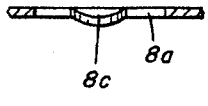


FIG. 7.



INVENTORS.
ARTHUR C. CLARK and
PETER S. MAGNA
By Donald G. Dalton
Attorney

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COMBINED NAIL CONVEYOR AND CLEANER

Arthur C. Clark, 244 Alves Lane, and Peter S. Magna, 154 Sierra Drive, both of Pittsburg, Calif.

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1 Claim. (Cl. 209—85)

This invention relates to a combined nail conveyor and cleaner, intended primarily for installation between polishing and packaging operations, in wire nail manufacture, with advantages in both conveying and cleaning. The invention affords means for rapid nail conveyance, while at the same time providing for removal and separation from the nails of whiskers, sawdust, and other small particles of foreign matter, which are present with the nails as a result of prior processing.

The invention is particularly directed to the manufacture of nails of the immaculate cleanliness required for use in automatic nailing machines, and it has been found that its employment permits the use of nails in such machines, without further cleaning, and eliminates the need, for example, of the employment of tumbling cleaners by nailing machine operators, which have heretofore been frequently employed to achieve the cleanliness required to prevent clogging of the nailing machines.

The invention may be viewed as a modification of a conventional smooth-surface vibrating conveyor to provide enhanced flow of nails as well as, more importantly, to provide simplified and effective means for nail cleaning, without the necessity for tumbling in an additional screening device, for example, to remove the metal particles and sawdust associated with the nails, after conventional tumbling with sawdust to polish and loosen whiskers. The whiskers are metal appendages at the points, which result from usual die forming and cutting operations in nail manufacture from wire. It is desirable to minimize the extent of nail tumbling operations in the interest of reduction in the point dulling incident thereto, if for no other reason.

In the case of tack manufacture, satisfactory cleaning of the tacks may be accomplished by the combination conveyor and cleaner of the invention, without any tumbling operation, with minimization of point dulling.

The invention will become more apparent by reference to the drawing, wherein:

FIGURE 1 is a side elevational view of the apparatus of the invention;

FIGURE 2 is a transverse section of the conveyor troughs of the apparatus, taken along the line II—II of FIGURE 1;

FIGURE 3 is a plan view of the apparatus of the invention;

FIGURE 4 is an enlarged fragmentary view illustrating the specially shaped openings in the upper trough; and

FIGURES 5, 6 and 7 are views taken along the lines V—V, VI—VI and VII—VII, respectively, of FIGURE 4, to further clarify the nature of the openings, or perforations, in the upper trough.

The vibrating conveyor **1** employed in the invention is illustrated somewhat schematically in FIGURE 1 wherein pedestals **2**, having springs **2***s*, support vibration actuator **3** and conveyor troughs **4** and **5**. A conveyor suitable for employment in the combination of the invention is exemplified by "Syntron Vibratory Feeder" Model F–152, described in booklet P.O. 11450, printed April 1961, of Syntron Co., Homer City, Pennsylvania.

Spacers **6** provide vertical spacing between the upper and lower troughs, and bolts **7** provide rigid attachment of the troughs to each other.

The surface of trough **4** is continuous, while that of

trough **5** carries a plurality of specially-shaped perforations **8**, in staggered relationship to each other, as shown in FIGURES 3 and 4.

As shown in FIGURES 4 to 7, individual perforations consist of slit **8***a* with arcuate depressions **8***b* and **8***c* extending fore and aft therefrom with gradually decreasing depth. These depressions are representative of impressions of a cylindrical body of appropriate diameter, formed by placing an end of the cylinder at the slit, with the axis of the cylinder at right angles thereto, and inclined to produce the desired fore and aft upward slope of depression, at right angles to the slit, as depicted in FIGURE 5.

In nail manufacture, the combined conveyor and cleaner of the invention may receive nails directly from the tumblers intended to loosen the die formed whiskers and to polish the nails. These tumblers conventionally employ sawdust in conjunction with the tumbling operation. Nails from the tumbler, together with sawdust, whiskers, and other foreign matter are unloaded directly upon the entrance end of trough **5** at area **5***a*, which area need not be perforated. Nails, and other material so unloaded thereupon, may desirably be subjected to an air-suction operation which removes and recirculates much of the sawdust.

In a typical conveyor suitable for use in the invention, a trough, mounted on leaf springs, not shown, is vibrated at high speed by an electromagnet within vibration actuator **3**. The magnet pulls the trough sharply down and back, as indicated by arrow on actuator **3** in FIGURE 1, and the springs return it up and forward to its original position. As the trough is pulled back and down, the materials being conveyed fall vertically to a new position forward in the trough. This action repeated at high speed causes the material to flow in the direction of the "travel" arrow in FIGURE 1.

As the nails and accompanying foreign matter are urged along by the vibration of the conveyor, they pass over perforations **8**, closely spaced in staggered relationship, whereupon the whiskers and waste fall through the perforations, while the nails remain above.

Even though the nails be deposited batch-wise, in a pile at **5***a*, they will spread out to about 1 nail deep as they advance along the trough. Nails **9** are discharged, at the far end of travel, into packaging conveyor **10**, for example. Waste **11** travels along trough **4** and discharges at the far end of travel, for collection and disposal.

In one example of the invention a conveyor having a trough **5** of 21 inch width at its entry end, 12 inch width at its delivery end, and 5 feet long, with sides flanged upward approximately 5 inches, has been installed immediately downstream from the polishing tumbler.

The rate of travel of the nails over the plain trough, without perforations, was 3 kegs per minute. When the perforated shaker trough was installed, the rate of travel increased to 5 kegs per minute. However, the most significant advantage of the perforations stems from the accompanying cleaning action, wherein, simultaneously with desired nail conveyance, nails of the immaculate cleanliness needed to prevent clogging of automatic nailing machines are produced.

In the example being discussed, trough **5** was formed of 18 gauge steel, and except for an entry portion **5***a*, had its bottom largely covered with closely spaced perforations **8**, arranged in staggered relationship as shown in FIGURE 4.

Each perforation was based on a transverse slit **8***a* about ¾ inch long, with depressions **8***b* and **8***c* extending fore and aft thereof.

Depression **8***b* extended forwardly about ⅜ inch from base to apex, with a sufficient depression at the slit to

provide a maximum opening clearance of about ¼ inch distance between the upper edge of depression 8*b* and the bottom edge of depression 8*c*. As shown in FIGURE 4, the apex of depression 8*b* is somewhat rounded to provide maximum entry area for waste particles.

Depression 8*c*, extending rearwardly from slit 8*a*, is desirably about one-third the width of depression 8*b* and, in the specific example under discussion, had a maximum depression at the slit of about 1/32 inch and extended about ⅛ inch from slit edge to apex.

After considerable experimenting, involving changing the pitch of the trough, frequency of vibration, size of perforations, and shape of perforations, it was finally discovered that by creating small lead-in depressions 8*c*, immediately upstream from perforations 8*b*, that all small particles were removed in a very short space and nails were completely clean for packaging. For instance, with depression 8*b* alone, some 3 to 5 percent of waste remained unseparated from the nails, while essentially none remained, even considerably short of total trough travel, when depressions 8*c* were incorporated.

The conveyor of the example is normally operated at about 7200 cycles per minute with a 1/32 inch stroke.

The combination conveyor and cleaner outlined in the foregoing example has been satisfactorily employed with common nails in sizes ranging from ¾ inch long and 15 gauge to 5 inches long and 4 gauge. Sizes of particles removed from the nails varied from powder to ⅛ inch in cross section, or thereabouts. The perforations of the example may be enlarged or reduced, in scale, to meet particular circumstances of product or waste size.

The example described herein is to be regarded as typical and illustrative only, and it is apparent that the

invention is capable of embodiments in other forms within the scope of the appended claim.

We claim:

A vibrating nail conveyor which incorporates means for separating nails from whiskers, sawdust, and other small particles of foreign matter, said conveyor comprising rigidly connected lower and upper troughs and means for high speed vibration thereof, said vibration being characterized by a movement of the troughs sharply down and back, and a subsequent return of the troughs upward and forward to their original position, whereby the nails are advanced, said lower trough having a continuous surface and said upper trough being provided with a plurality of perforations to permit the aforementioned foreign matter to pass therethrough, while excluding the nails, each of said perforations comprising a lateral slit, said slit having arcuate fore and aft depressions based thereon, which depressions gradually taper upwardly from said slit to depression apexes, said aft depressions being a small fraction of the size of said fore depression.

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M. HENSON WOOD, JR., *Primary Examiner.*

A. N. KNOWLES, *Assistant Examiner.*