United States Patent [19]

Mead

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[54] **PUNCH PRESS DISCHARGE FEEDER**

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[73] Assignee: **Lipe Rollway Corporation**, Liverpool, N.Y.

[22] Filed: **Nov. 14, 1972**

[21] Appl. No.: **306,292**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 136,386, April 22, 1971, abandoned.

[52] **U.S. Cl.** ..... **83/61**, 83/155, 83/149, 198/220 BA, 146/1 C

[51] **Int. Cl.** **B26d 5/26**

[58] **Field of Search** ..... 83/61, 158, 159, 160, 149, 83/155; 198/220 BA, 220 DB; 46/1 C

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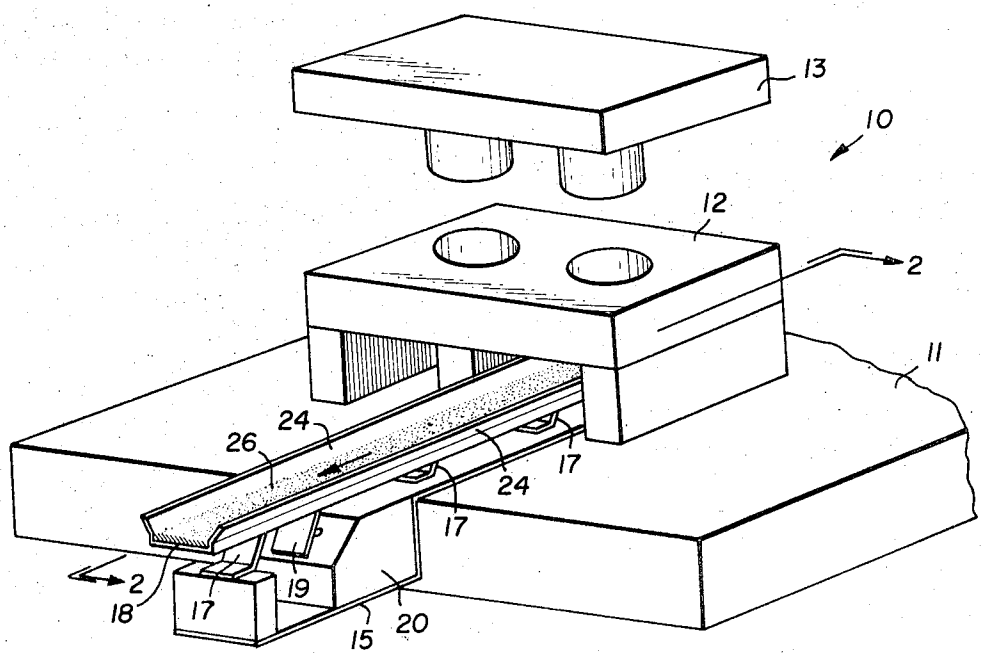
Primary Examiner—Donald R. Schran

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[57] **ABSTRACT**

A feed strip extends under the female die of a punch press above the bolster plate and leads to a discharge region. The feed strip is vibrated in a motion that includes a rise and fall, and the upper surface of the feed strip is covered with a pile material having flexible filaments uniformly inclined from the vertical toward the direction of feed so that objects discharged from the female die are fed along the strip to the discharge region.

10 Claims, 7 Drawing Figures



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SHEET 1 OF 2

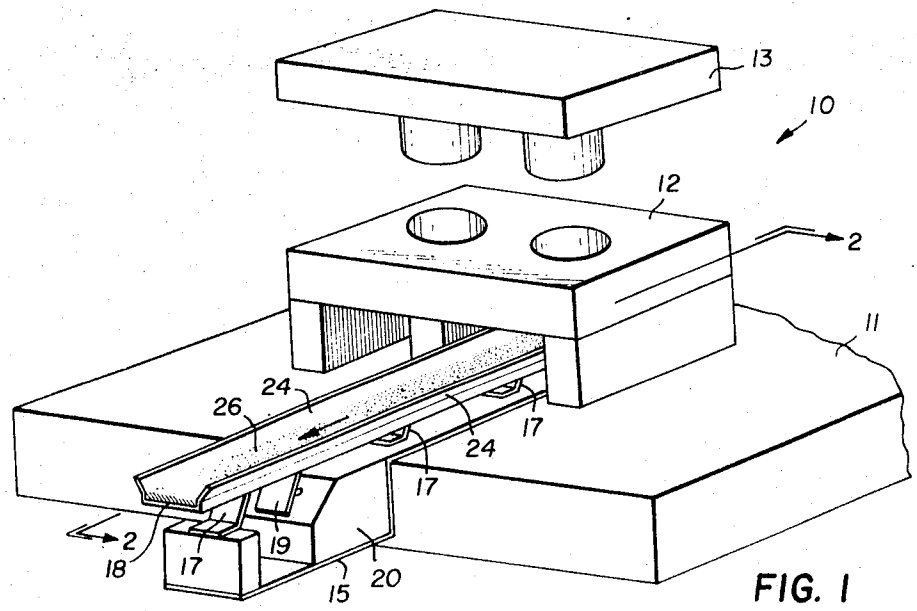


FIG. 1

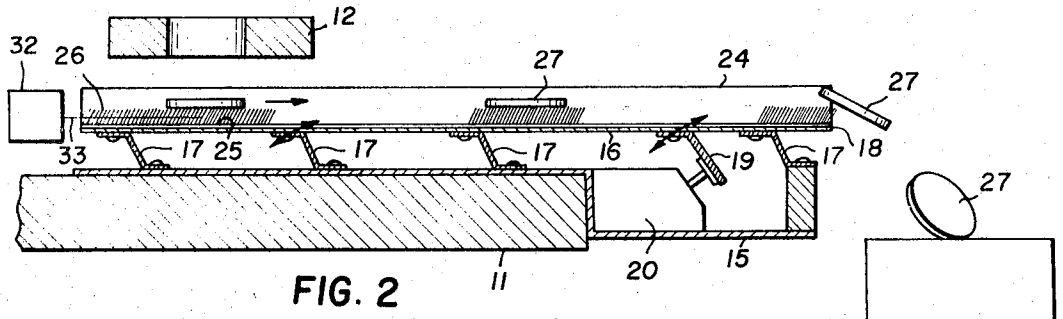


FIG. 2

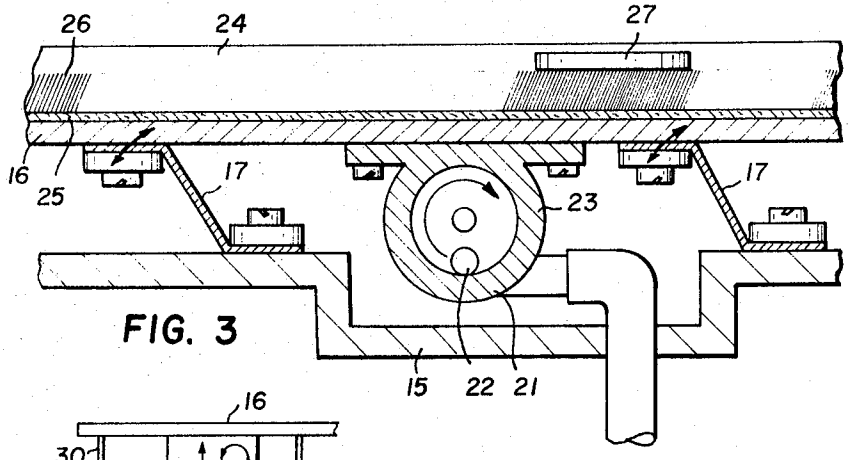


FIG. 3

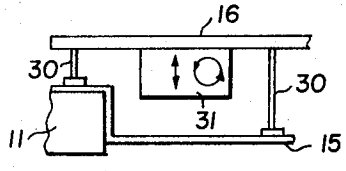


FIG. 4

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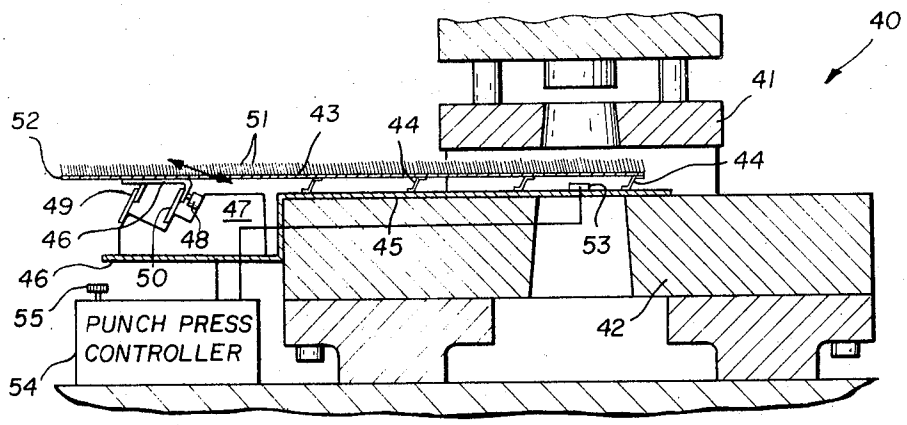


FIG. 5

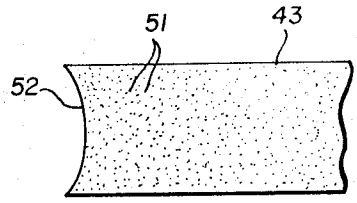


FIG. 6

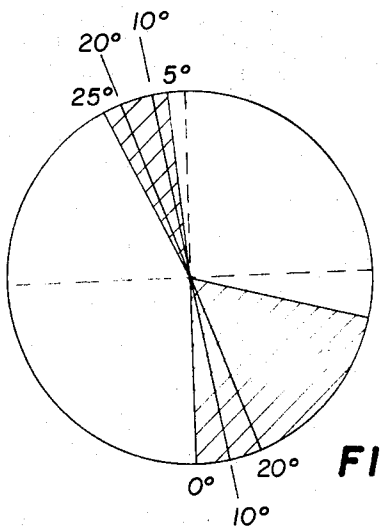


FIG. 7

PUNCH PRESS DISCHARGE FEEDER

RELATED APPLICATIONS

This application is a continuation-in-part of my parent application Ser. No. 136,386, filed Apr. 22, 1971, entitled: PUNCH PRESS DISCHARGE CONVEYOR and now abandoned.

THE INVENTIVE IMPROVEMENT

Punch presses are fairly standardized to include a bolster plate base and a female die spaced only a small amount above the bolster plate. There is only limited space under the bolster plate for objects discharged from the female die which are collected in relatively small tote boxes and manually removed from the machine. A different design of punch press might facilitate a conveyor discharge of objects from the female die, but the commitment to present design is too substantial to allow this. Belt conveyors have been proposed for removing discharged objects from the punch press but these have not been very satisfactory because of the cramped space and the hostile, oil-soaked environment.

The invention involves a recognition that a different sort of discharge conveyor can be made to fit into the low clearance under the female die of the punch press and be reliably operated in spite of the oily environment. In accomplishing this, the invention aims at simplicity, economy, reliability, durability, efficiency and quiet operation.

SUMMARY OF THE INVENTION

The inventive discharge conveyor uses a feed strip that extends under the female die of a punch press above the bolster plate and leads to a discharge region. The feed strip is supported for vibrational motion and vibrated in a motion that includes a rise and fall of the feed strip. The upper surface of the feed strip is covered with a pile material having flexible filaments uniformly inclined from the vertical toward the discharge region, and the filaments have a size, density and resilience so the tips of the filaments flexibly support and feed objects discharged from the female die. The discharge region is then spaced from the punch press in an area where relatively large containers can store the objects for transport by machinery rather than manual labor.

DRAWINGS

FIG. 1 is a partially schematic, perspective view of a preferred embodiment of the inventive conveyor in association with a punch press;

FIG. 2 is a cross-sectional view of the conveyor of FIG. 1 taken along the line 2 — 2 thereof;

FIG. 3 is a view corresponding to the view of FIG. 2 and showing an alternative preferred embodiment of the inventive conveyor;

FIG. 4 is a fragmentary, elevational view of an alternative preferred embodiment of the inventive conveyor;

FIG. 5 is a partially schematic, elevational view of another preferred embodiment of the inventive conveyor;

FIG. 6 is a fragmentary, plan view of the discharge end of the conveyor of FIG. 5; and

FIG. 7 is a schematic diagram of preferred pile and vibration angles for the inventive conveyor.

DETAILED DESCRIPTION

The inventive conveyor is applied to a punch press **10** such as generally known and schematically illustrated in FIG. **1.** Punch press **10** includes a base or bolster plate **11,** a female die **12** spaced close above bolster plate **11,** and a movable male die **13** operating above female die **12.** The clearance of female die **12** above bolster plate **11** is normally no more than 2½inches with the space under female die **12** being oil-soaked and cramped. Objects discharged from female die **12** normally drop through an opening in bolster plate **11** and into relatively small containers beneath the press. These must be manually removed frequently.

The inventive conveyor fits into the low clearance between female die **12** and bolster plate **11** to convey discharged objects out over bolster plate **11** to a discharge region removed from punch press **10** where relatively large containers can be used for such objects to eliminate manual toting of parts boxes. The inventive conveyor includes a base **15** extending over the top of bolster plate **11** and under female die **12.** A feed strip **16** is supported above base **15** by pairs of resilient springs **17** fastened to base **15** and to the bottom of feed strip **16.** Springs **17** are preferably inclined from the vertical so as to extend downward and toward the discharge region at the open end **18** of feed strip **16** at an inclination from the vertical of between 10° – 75° and preferably about 15° – 25°. The ends of springs **17** secured to feed strip **16** can vibrate in short arcs exaggerated by the arrows in FIGS. **2** and **3** with the vibration directions of such arcs inclined above the horizontal by the preferred angles previously mentioned. This means that feed strip **16** moves upward and toward discharge end **18** on one half cycle of vibration and moves downward and away from discharge end **18** on the other half cycle of vibration. Feed strip **16** can also be vibrated in a vertical reciprocal motion or in an orbital motion including a rise and fall.

Vibrator **20** is secured to base **15** and connected to the bottom of feed strip **16** by a drive bracket **19,** and vibrator **20** is reciprocated at an angle above the horizontal as shown in the arrows in FIG. **2** to drive feed strip **16** in the previously described vibration. Electric vibrators are currently available for accomplishing such motion, and vibrators producing other motions can drive feed strip **16.**

An alternative pneumatic vibrator **21** as shown in FIG. **3** is suspended from the bottom of feed strip **16.** Pneumatic vibrator **21** drives a ball **22** in an orbit in the direction of the arrow inside housing **23** to produce the preferred rising and falling motion for feed strip **16** under control of spring strips **17.**

Other types of vibrators can also be suspended from feed strip **16** or mounted on base **15,** and can use other motions to accomplish feeding. This is illustrated in FIG. **4** where feed strip **16** is shown supported above base **15** by vertically resilient legs **30.** Vibrator **31** is shown secured to the bottom of feed strip **16,** but can also be mounted on base **15** to drive a vibratory connection to feed strip **16.** Vibrator **31** can be any of several known vibrators that move either in a vertically reciprocal motion or an orbital motion in a vertical plane as shown by arrows to produce the desired rise and fall of feed strip **16.** Resilient legs **30** accommodate either of such motions, and each are effective in moving parts along feed strip **16.**

Guide rails 24 extend along the upper edges of feed strip 16 to keep objects on the top surface of feed strip 16, and the top surface of feed strip 16 is covered with a pile material 25 having filaments 26 that flexibly support objects 27. Filaments 26 are uniformly inclined from the vertical toward the discharge end 18 of feed strip 16 as illustrated, and the filament inclination angle is preferably between 5° – 25°, and preferably about 10° – 20° toward the direction of feed. As feed strip 16 rises, objects 27 bend filaments 26 downward and toward the direction of feed to urge objects 27 toward discharge end 18, and the rapid vibrations of feed strip 16 move objects 27 speedily along toward discharge. Filaments 26 have a size, density and resilience so that objects 27 are flexibly supported by the tips of filaments 26, and filaments 26 tend to be larger and stronger for heavier objects 27. Filaments 26 are preferably formed of monofilaments of a synthetic resin material, but many materials and many filament sizes and densities are available.

The inventive conveyor is readily and easily equipped with a safety device as shown in FIG. 2, to prevent damage to punch press 10. This consists of a micro switch 32 having a switch arm 33 extending into the region under female die 12 to detect any pileup of parts 27. Switch 32 is connected to inhibit operation of punch press 10 if such a pileup occurs. This could be caused by a malfunction of the conveyor or by a number of parts hanging up inside die 12 and dropping in a group onto the conveyor. Any such pileup of parts 27 bends filaments 26 downward sufficiently to operate switch arm 33 and inhibit operation of press 10.

Many possible arrangements of micro switch 32 and other safety switching devices are feasible with the inventive conveyor. As shown in FIG. 2, switch arm 33 is preferably arranged in a notch or channel cut into filaments 26 so as to lie under die 12 below the general plane of the tips of filament 26. There are several ways that such a micro switch could be properly positioned for acting as a safety sensor for a pile up of parts 27. Switch 32 could also be fastened to feed strip 16 and extend up through an opening in the bottom of feed strip 16, and photo cell and proximity switches can be used in place of micro switch 32. Also, switch 32, or an equivalent switching device can be arranged under the bottom of feed strip 16 to detect a pileup of parts 27 by the depression of feed strip 16 downward under the weight or force of the parts.

Oil spattering on feed strip 16 does not harm pile material 25 or impair its feeding capacity because such oil runs to the bottoms of filaments 26 and drains off of feed strip 16 without affecting the feeding force applied to objects 27 by the tips of filaments 26. In fact, the conveyor tends to shake off the excess oil and clean one side of the parts as they move over the filament tips. Vibrator 20 or 21 can be relatively quiet, and the conveyor is otherwise nearly silent, which is desirable in stamping plants where the noise levels are already too high.

Objects discharged from female die 12 are not marred or scratched by pile material 25, and a wide variety of sizes and shapes of objects can be fed successfully by pile 25. In many punch press operations, these objects include finished parts, scrap punchings and remnant scrap, and each of these is preferably directed to respective containers by separate vibratory conveyors each bearing pile 25. Also the inventive conveyor is easy to set-up or remove as desired.

Experience with the invention since the parent application was filed has led to some improvements illustrated in FIGS. 5 – 7. Punch press 40 as shown in FIG. 5 has a female die 41 arranged above a bolster plate 42 with parts or slugs dropping from female die 41 being fed out of punch press 40 by feeder strip 43. Strip 43 is mounted on angled spring strips 44 that are secured to the bottom of feed strip 43 and the top of a base 45 that extends over bolster plate 42 and under female die 41. Base 45 has a platform 46 outside of bolster plate 42 supporting vibrator 47 having a plunger 48 connected to a drive bracket 46 that is supported by a pair of resilient strips 49 and 50 to vibrate feed strip 43 in a reciprocal motion exaggerated by the arrows. Feed strip 43 is covered with a pile material having filaments uniformly inclined as illustrated to feed objects out of punch press 40 toward the discharge end 52 of feed strip 43. The reciprocal motion of the vibration is preferably generally aligned with the inclination of the pile filaments 51 for optimum feeding speed and force.

A micro switch 53 is preferably arranged on base 45 under feed strip 43 and under female die 41 as illustrated and is preferably connected to punch press controller 54. If a jam-up of parts or objects is driven downward by punch press 40 onto feed strip 43 under female die 41, the resilient mounting of feed strip 43 allows it to be driven downward under the force, and any excessive downward motion actuates switch 53 which is connected to punch press controller 54 for shutting down punch press 40. This prevents any damage from such a jam-up.

Vibrator 47 is preferably powered from punch press controller 54 as illustrated, and a rheostat schematically illustrated by knob 55 is preferably arranged on punch press controller 54 for adjusting the power to vibrator 47 to control its amplitude and the feeding force of strip 43.

The overall height of the inventive conveyor above bolster plate 42 measured from the top of bolster plate 42 to the tips of pile filaments 51 is preferably about 2 inches to fit into the available space in puch press 40. Oil, metal chips, and dirt that drop on feed strip 43 settle down well below the tips of filaments 51 and are slowly moved toward discharge end 52 by the vibrational force of feed strip 43. Such foreign materials do not impair the operation of the inventive feeder. Switch 53 is relatively protected from such foreign materials in its preferred mounting under feed strip 43, and the resilient spring strips 44 supporting strip 43 allow it to yield under any excess force without damaging the device.

Discharge end 52 of feed strip 43 is preferably curved as shown in FIG. 6 to connect the rounded end of a conveyor module (not shown) for moving parts or objects away from feed strip 43 onto a conveyor module where they proceed to a remote destination.

Fig. 9 is a diagram of preferred angles of inclination for pile and vibration that evolved during experience with the invention. The optimum pile filament angles lie between 5° and 25° as illustrated with a preferred range for most applications falling between 10° and 20°. Generally, the smaller angles produce greater speed at a sacrifice of feeding force, and the larger angles have a somewhat slower feed with greater force. Vibration angles are successful throughout a wider

range as illustrated, from vertical to 75° from the vertical. The optimum vibration angle tends to align generally with the pile angle, particularly at angles closer to vertical, but the vibration angle can incline further from the vertical and still be quite successful. The vibration angle should not be transverse to the pile angle, and should stay in the same quadrant and in the diametrically opposite quadrant as the pile inclination. With proper pile angle and vibration angle within the suggested ranges, the filaments **51** are flexed slightly on each vibrational upstroke, and their flexure moves objects in the feed direction for a forceful and rapid feed compared to vibration of a hard surface or vibration of a surface covered with soft or matted-down pile.

Persons wishing to practice the invention should remember that other embodiments and variations can be adapted to particular circumstances. Even though one point of view is necessarily chosen in describing and defining the invention, this should not inhibit broader or related embodiments going beyond the semantic orientation of this application but falling within the spirit of the invention. For example, those skilled in the art will appreciate the different materials, sizes and configurations possible in fitting the inventive conveyor to punch presses or other production machines for different conveying and feeding operations.

I claim:

1. In a punch press having a bolster plate and a female die close above said bolster plate, a discharge conveyor comprising:

a. a feed strip extending under said female die above said bolster plate and leading out of said punch press to a discharge region;

b. means for supporting said feed strip for vibrational motion;

c. the upper surface of said feed strip being covered with pile material having flexible filaments uniformly inclined by about 5° to 25° from the vertical toward said discharge region;

d. said filaments having uniform length and thickness and a sufficient density so that only the tips of said filaments support objects discharged from said female die of said punch press;

e. means for vibrating said feed strip in a generally reciprocal motion in the general direction of the inclination of said filaments; and

f. said filaments being sufficiently resilient to flex under said objects during upward movement of said feed strip in said reciprocal motion to increase the feeding speed and force of said feed strip in moving said objects out of said punch press.

2. The conveyor of claim **1** wherein said supporting means includes a base resting on said bolster plate and resilient strips secured to said base and the bottom of said feed strip.

3. The conveyor of claim **2** wherein the vertical distance from the top of said bolster plate to the tips of said pile filaments on said feed strip is about **2** inches.

4. The conveyor of claim **2** wherein said resilient strips and said vibrating means are oriented so that the direction of said reciprocal motion is from vertical to 75° from vertical in the plane of said inclination of said filaments.

5. The conveyor of claim **2** wherein said vibrating means is suspended from the bottom of said feed strip.

6. The conveyor of claim **2** wherein said vibrating means is mounted on said base beyond said bolster plate.

7. The conveyor of claim **1** wherein said reciprocal motion is oriented so said feed strip rises and moves toward said discharge region in one half cycle of said vibration, and falls and moves away from said discharge region on the other half cycle of vibration.

8. The conveyor of claim **7** wherein the angle of said resilient strips from the vertical is about 15° – 30°.

9. The conveyor of claim **8** including a switch arranged on said base under said feed strip in the region below said female die to actuate on excessive downward motion of said feed strip for shutting down said punch press.

10. The conveyor of claim **1** including a switch arranged on said base and under said feed strip in the region under said female die to actuate on excessive downward motion of said feed strip for inhibiting operation of said punch press.

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