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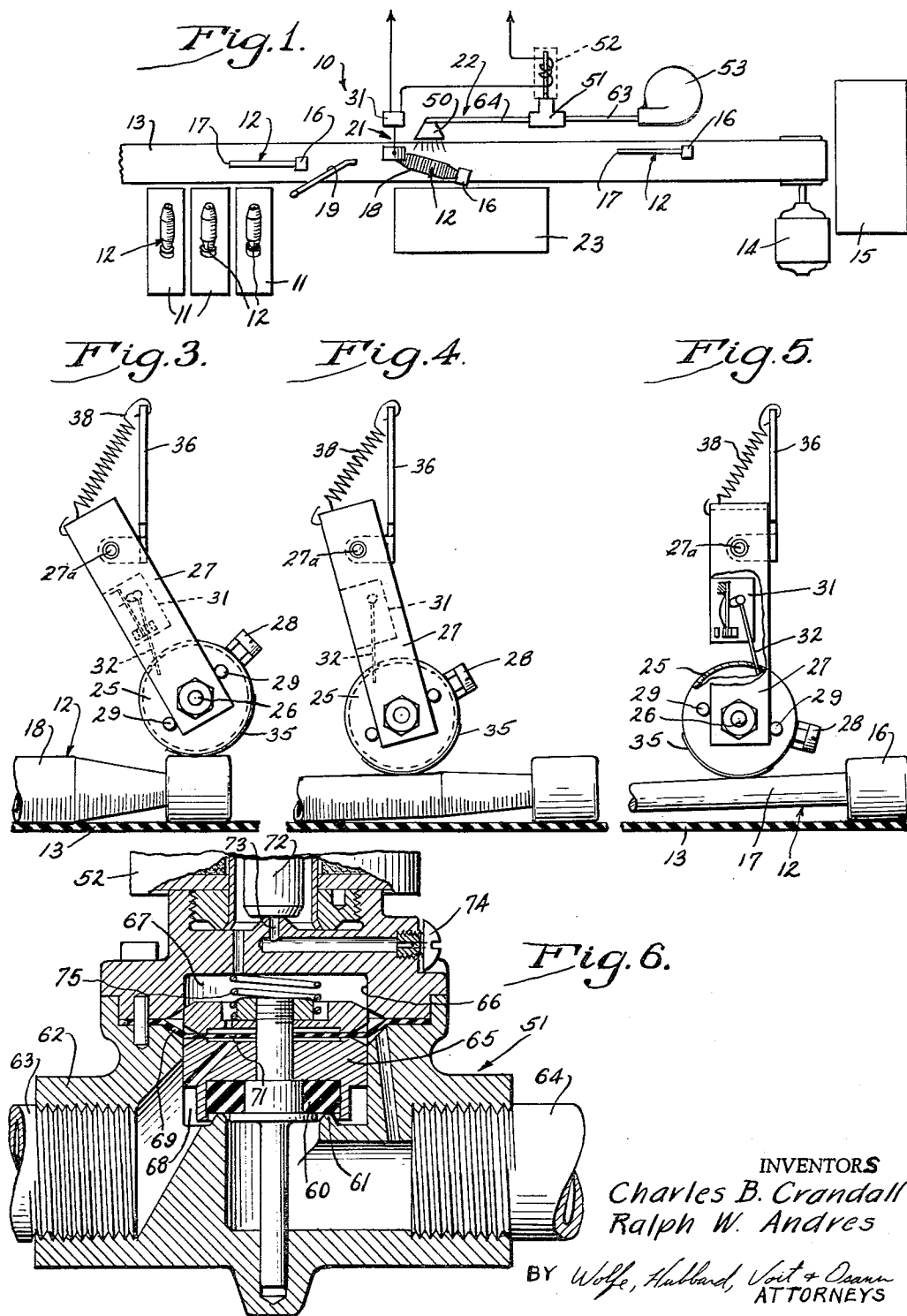
C. B. CRANDALL ETAL

3,049,231

BOBBIN SORTER

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2 Sheets-Sheet 1



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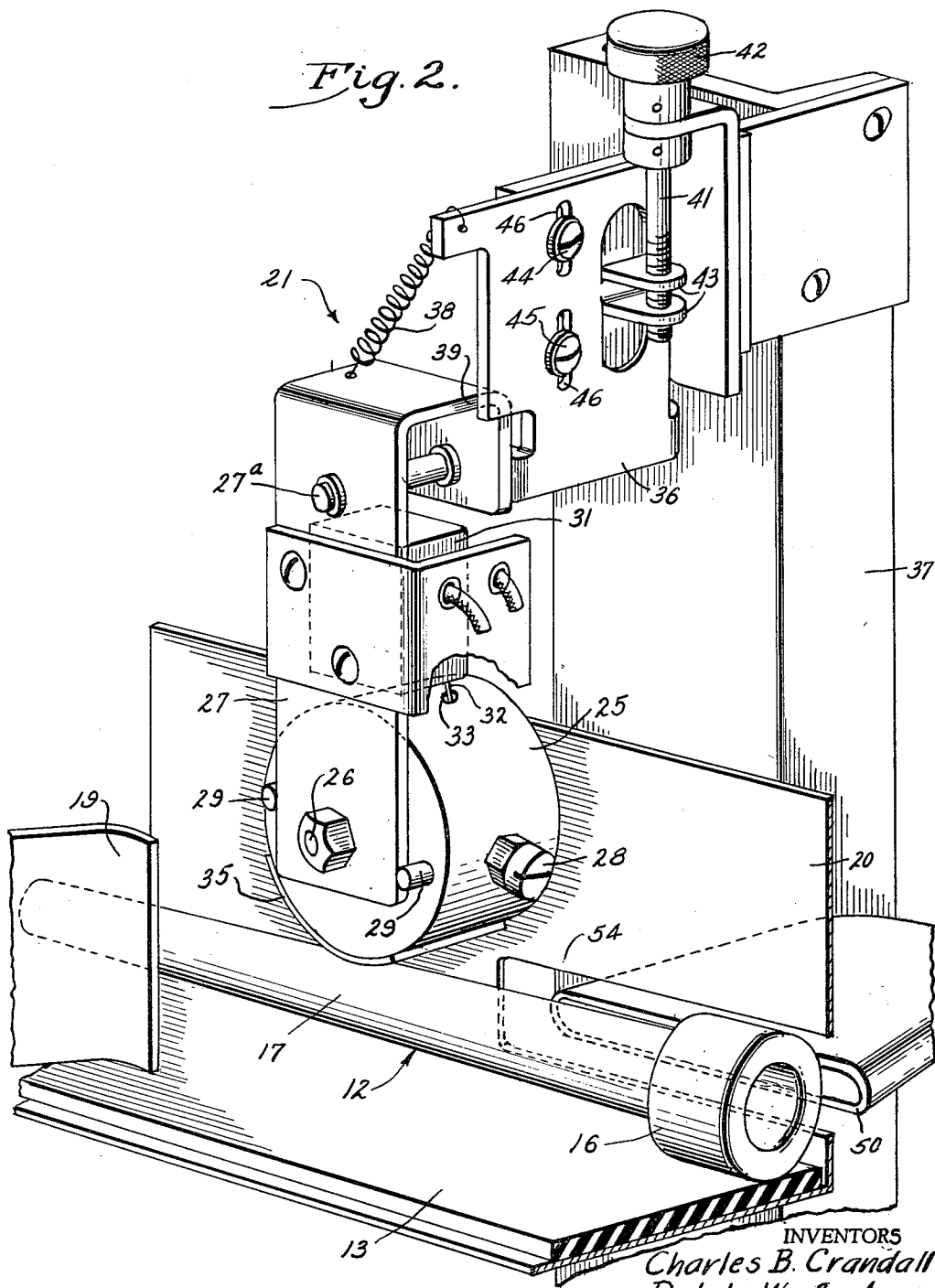
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BOBBIN SORTER

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This invention relates generally to thread handling equipment such as automatic spoolers which utilize thread supporting bobbins and concerns, more particularly, a mechanism for sorting thread bobbins in accordance with the presence or absence of thread on each bobbin.

In an automatic spooler, thread is unwound from successive bobbins to form large thread packages or cheeses. As each bobbin is emptied, it is discharged or doffed onto a moving belt which runs to a box or bin for collecting the empty bobbins. It is conventional to provide a spooler with mechanism which doffs a bobbin when a thread running therefrom breaks, so that a reserve bobbin may be automatically coupled to the cheese being wound just as when a bobbin is emptied. In this way, either emptying a bobbin or breaking the thread from a bobbin causes the bobbin to be doffed and a reserve bobbin brought into use without interrupting the spooling. In another form of spooler, bobbins are doffed after a predetermined operating interval, whether empty or not, and while the time interval is selected so that the average bobbin will have been emptied, often a usable length of thread remains on the doffed bobbins.

As a result of the above modes of operation, empty, full, and partially filled bobbins are deposited on the discharge belt leading to the empty bobbin box. It is highly desirable to separate those bobbins which still contain a substantial amount of thread and which can be further utilized in the spooling operation.

Accordingly, it is the aim of the present invention to provide a stable, reliable mechanism for separating or sorting empty thread bobbins from those having usable lengths of thread still wound thereon. It is an object of the invention to provide a mechanism as described above that is quite sensitive in distinguishing empty bobbins from those containing thread and which performs uniformly in sensing successive bobbins, quite rapidly, over long operating intervals.

Another important object of the invention is to provide a mechanism of the above character which is suitable for use with virtually all known types of bobbins, including those with enlarged head portions. A related object is to provide a mechanism as described above that can be easily adjusted for the particular bobbin size to be sorted and, hence, is well suited for use with machines capable of handling bobbins of virtually all standard sizes and shapes.

It is also an object to provide a mechanism as characterized above which is capable of completely reliable operation with rapidly traveling bobbins. As a result, the novel bobbin sorter mechanism can be efficiently utilized on large, high speed machines which require rapid discharge of exhausted bobbins.

Moreover, it is an object to provide a mechanism of the above type which segregates bobbins having usable lengths of thread from empty bobbins with minimum disturbance of the thread so that the thread is not frayed or tangled.

Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the drawings in which:

FIGURE 1 is a diagrammatic plan of a portion of a bobbin handling machine including a bobbin sorter embodying the present invention;

FIG. 2 is an enlarged perspective view of a portion of the bobbin sorter mechanism shown in FIG. 1;

FIGS. 3, 4 and 5 are fragmentary stop motion elevations of the assembly shown in FIG. 2; and

FIG. 6 is a fragmentary section of an air valve control utilized in the assembly shown in FIG. 1.

While the invention will be described in connection with a preferred embodiment, it will be understood that we do not intend to limit the invention to that embodiment. On the contrary, we intend to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

Turning first to FIG. 1, there is diagrammatically shown a portion of an automatic spooling machine including a bobbin sorter 10 constructed in accordance with the present invention. Those portions of the automatic spooler illustrated include three of the plurality of bobbin pockets 11 with which such machines are provided and which receive thread bobbins 12. A bobbin conveyor in the form of a belt 13 driven by a motor 14 is disposed adjacent the bobbin pockets 11 and runs to a bin or box 15 for collecting the empty bobbins.

Each bobbin 12 includes an enlarged head 16 and an elongated core or body 17 on which is initially wound a lengthy strand of thread 18. While not all commercially used bobbins are alike, the illustrated bobbins 12 are representative of the types normally encountered insofar as operation of the sorter 10 is concerned.

When in operation, the automatic spooler unwinds the thread 18 from the bobbins 12 which are disposed in the pockets 11. When the thread is unwound, the empty bobbins are discharged or doffed onto the traveling conveyor belt 13 where they are carried toward the collection box 15. As has been previously pointed out, because of a break in the thread or the expiration of a timed operating interval, bobbins still containing usable lengths of thread are sometimes doffed from the pockets 11 onto the conveyor belt 13. Thus, both empty bobbins and bobbins still containing usable lengths of thread are carried by the conveyor belt 13 past the bobbin sorter 10.

For directing the bobbins 12 into alignment with the bobbin sorter 10, a flexible guide 19 is disposed just above the conveyor belt 13 between the last pocket 11 and the bobbin sorter. The flexible guide 19 cams the bobbins to one side of the conveyor belt against a side wall plate 20 (see FIG. 2).

Pursuant to the invention, the bobbin sorter 10 includes a sensing unit 21 for detecting bobbins still containing thread, and a deflector unit 22 for diverting those bobbins with thread from the conveyor belt 13 and into a tailings box 23. In this way, only the empty bobbins are deposited in the box 15 and those bobbins containing usable lengths of thread are collected in the box 23 where they can be reinserted in the pockets 11 and the remaining thread drawn off by the automatic spooler.

In the illustrated construction, the sensing unit 21 includes an arcuate surfaced member in the form of a roller 25 journaled just above the conveyor belt 13 for oscillation in the direction of conveyor travel (see particularly FIG. 2). The roller 25 is journaled at 26 on an arm 27 and carries a peripheral weight 28 for urging the roller into a rest position. The rest position for the roller 25 is established by engagement of a pair of pins 29, which project axially of the roller, with the sides of the arm 27.

The roller 25 is associated with an actuator for the deflecting unit 22 which takes the form of a microswitch 31 mounted on the arm 27. The switch 31 includes an operating finger 32 which is received in a peripheral opening 33 formed in the roller 25. In the illustrated con-

struction, the switch 31 is normally open and the arrangement is such that oscillation of the roller 25 from its rest position (see FIGS. 2 and 5) swings the switch operating finger 32 so as to close the normally open contacts of the switch 31. To limit oscillation of the roller 25 and thus avoid damage to the switch finger 32, the pins 29 engage the sides of the arm 27 (see FIGS. 3 and 4).

Preferably, the roller 25 is provided with an arcuate bobbin engaging surface 35 which is textured so as to create little friction with smooth surfaces under the limited force of the weight 28 but sufficient friction with layers of thread to easily oscillate the roller 25 when a thread covered bobbin passes the sensing unit 21. In a practical case, the textured surface 35 is grainy and is provided by fixing a strip of emery cloth to the bottom periphery of the roller 25. The grainy texture of the emery cloth is easily gripped by the thread 18 wound on a passing bobbin so that the roller 25 is positively rotated against the force of the weight 28. However, the grainy surface 35 tends to slide over the smooth bobbin heads 16 under the light force exerted by the weight 28 and this minimizes the tendency of a passing bobbin head 16 to oscillate the roller 25.

So that the roller 25 can easily clear the enlarged heads 16 of the bobbins, the arm 27 is swingably mounted on a shaft 27a carried by a bracket 36 that it attached to a frame post 37 forming a part of the automatic spooler. A tensioned spring 38 extending between the arm 27 and the bracket 36 resiliently urges the bracket into a normal rest position established by the interengaging surfaces at 39 of the arm and bracket.

To adjust the sensing unit 21 for handling bobbins of differing size, the bracket 36 is mounted for precise vertical adjustment on the post 37. In the illustrated construction, a thumb screw 41 having an anchored head 42 threadably engages lugs 43 formed on the bracket 36. The bracket is thus raised and lowered by rotating the thumb screw 41 and is locked in adjusted position by tightening a pair of clamping screws 44 and 45 which pass through slots 46 in the bracket 36.

Turning to the deflecting unit 22, in the illustrated construction this unit includes a wide, narrow nozzle 50 arranged to direct a generally horizontal blast of air laterally across the conveyor 13. A control valve 51 operated by a solenoid 52 that is in circuit with the switch 31 supplies air to the nozzle 50 from a blower 53. Closing the contacts of the switch 31 upon oscillation of the roller 25 energizes the solenoid 52 and operates the valve 51 so that a blast of air is emitted from the nozzle 50. The nozzle 50 is disposed adjacent the sensing unit 21 and directs its air blast through an opening 54 formed in the side wall 20. By the provision of a long wide blast of laterally directed air, the bobbins containing thread are rolled quickly and reliably from the conveyor belt 13 into the box 23. Because of the length of the nozzle 50, a concentrated blast of air which could disrupt or tangle the yarn on the bobbin being deflected is avoided.

As has been explained, oscillation of the roller 25 from its rest position operates the normally open switch 31 so as to energize the control valve solenoid 52. Despite the limited friction between a smooth bobbin head and the surface 35 on the roller, the engagement of a head 16 with the roller surface does cause the roller 25 to roll up onto each passing bobbin head sufficiently far to operate the switch 31 for a short interval before the roller 25 drops onto either the thread 18 of the passing bobbin (see FIG. 4) or above the body 17 of an empty bobbin (see FIG. 5). To prevent the deflecting unit 22 from being falsely actuated by the passing heads of the bobbins 12, a predetermined time delay is interposed between the operation of the switch 31 and the release of an air blast by the control valve 51. In the preferred embodiment, this time delay is achieved by making the control valve 51 a delayed response type of valve. That is, and with

particular reference to FIG. 6, the valve 51 has a valve sealing member 60 that is not lifted from its valve seat 61 until after a predetermined interval following energization of the control valve solenoid 52.

To accomplish this mode of operation in the illustrated form of the invention, the valve sealing member 60 is carried by a piston 65 slidably received within a cylinder 66 formed in a body 62 of the valve 51 so as to define a cylinder chamber 67 above the piston 65 and a cylinder chamber 68 below the piston. A seal between the piston 65 and the cylinder 66 is provided by a flexible diaphragm 69. The chamber 68 is coupled by a line 63 to the blower 53 and engagement of the sealing element 60 with its annular seat 61 blocks the line 63 from a line 64 leading to the nozzle 50. In this position of the parts, shown in FIG. 6, the valve 51 is thus closed.

The control valve 51 is held closed by air pressure developed in the chamber 67 by air flowing from the line 63 through a small opening 71 in the diaphragm 69. It can be seen that when the sealing member 60 is on the annular valve seat 61, there is substantially more piston area exposed to the air pressure on the top of the piston 65 than on the bottom and, therefore, the greater force thus developed by the air in the chamber 67 against the piston holds the sealing element 60 firmly against the valve seat 61.

When the solenoid 52 is energized, an armature 72 is elevated so as to open a passage 73 venting the chamber 67 to the outside atmosphere through a bleed plug 74. As air pressure in the chamber 67 is thus exhausted through the plug 74, the then greater force exerted on the piston 65 by the air pressure in the underlying chamber 68 lifts the piston so as to unseat the sealing member 60 and open the control valve. It will, of course, be appreciated that the opening in the bleed plug 74 must be larger than the opening 71 so that the air is exhausted from the chamber 67 more rapidly than it can be replaced through the opening 71.

The desired time delay results from the relatively slow leakage rate of the air through the plug 74 from the chamber 67. In an exemplary commercial construction, the conveyor belt 13 moves at a speed of approximately 30 inches per second and the average bobbin 12 has a head 16 that is approximately 1 inch long. Thus, the size of the opening in the solenoid plug 74 is selected so that the sealing member 60 is lifted about $\frac{1}{30}$ of a second after energization of the solenoid 52. In this way, operation of the switch 31 for the full time interval required for the conveyor belt to carry the bobbin heads 16 beneath the roller 25 is ineffective to lift the sealing member 60 and cause a blast of air to be directed from the nozzle 50. Of course, due to the rolling action of the member 25 and the fact that its surface 35 tends to slip on the smooth head portion 16 of the bobbin, the switch 31 is normally not actuated, if actuated at all, until a bobbin head has traveled approximately one half its length beneath the roller 25 and has reached the approximate position shown in FIG. 3. At the speed at which the bobbins travel, the roller 25 clears each passing head 16 and is returned to its rest position by the weight 28 well within the time required to dissipate the air pressure in the chamber 67 through the plug 74. As a result, the solenoid 52 is de-energized and the passage 73 closed before the piston 65 is elevated to open the valve.

However, if the roller 25 drops from a bobbin head 16 onto a sufficient thickness of thread 18 still wound on the bobbin, the roller is again oscillated by the friction between the grainy surface 35 and the thread so as to operate the switch 31 (see FIG. 4). Due to the length of the bobbin, the switch remains operated sufficiently long to dissipate the air pressure in the valve chamber 67 and thus open the valve, thereby causing an air blast from the nozzle 50 to deflect the thread carrying bobbin into the box 23 (see FIG. 1).

Following operation of the valve 51 and upon reopen-

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ing of the switch 31, a compressed spring 75 urges the plunger 65 downwardly after the chamber 67 is again closed by the armature 72 so as to reseal the sealing element 60 and thus close the valve 51. Thereafter, the air pressure buildup in the chamber 67 holds the valve in closed position.

One of the most important advantages of the bobbin sorter 10 is the stability and reliability of the sensing unit 21. The bobbins 12, even when traveling at the fairly rapid speed of 30 inches per second, move smoothly beneath the sensing unit with the roller 25 rolling quickly and easily over the bobbin heads and onto the bobbin core or the thread wound thereon. There is no "bouncing" or free oscillation of either the roller 25 or its arm 27 as was experienced when attempts were made to sense bobbins with a simple pivoted finger. The rolling action of the roller 25, and its free swinging mounting on the arm 27, quickly and accurately determines if there is a sufficient thickness of thread on the passing bobbin cores 17 to oscillate the roller 25 and cause deflection of the bobbin into the tailings box 23. The precise adjustment afforded by the mounting of the bracket 36 has permitted practical embodiments of the invention to respond with complete reliability to variations in thread layer thicknesses of $\frac{1}{16}$ of an inch.

Because of the sensitivity and adjustability of the sorter 10, bobbins having differing amounts of thread can be considered "empty" and passed on to the collection box 15 by simply setting the spacing of the roller 25 above the belt 13 to the point where only those bobbins containing the desired amount of thread are thick enough to contact the grainy or granular texture of the surface 35. Thus, only substantially full bobbins can be considered to have "usable lengths of thread" and they may be separated from the other "empty" bobbins if desired. It is this sense in which these terms are used in the appended claims.

The slight time delay interposed between the operation of the actuator switch 31 and the generation of an air blast from the nozzle 50 is completely effective to permit the enlarged head portions 16 of the bobbins 12 to pass beneath the sensing unit 21 without causing "false" actuation of the deflecting unit 22. It will be appreciated that the duration of this delay can be easily extended by inserting an appropriate bleed plug 74 but, in a majority of instances, such an adjustment is not necessary since most types of bobbin heads are not longer than a commonly encountered maximum length.

We claim as our invention:

1. In a bobbin handling machine having a conveyor which carries empty bobbins and bobbins containing usable lengths of thread, a bobbin sorter for separating the thread carrying bobbins from the empty bobbins comprising, in combination, a vertically adjustable bracket suspended above said conveyor, an arm pivoted on said bracket for swinging movement from a rest position in the direction of conveyor travel, a roller journaled on said arm so that its periphery may be engaged and the roller oscillated from a rest position by a bobbin passing on said conveyor, means for urging said roller into its said rest position on said arm, means for urging said arm toward its said rest position on said bracket, said roller having a grainy peripheral surface creating little friction with smooth surfaces under the force of both said means but sufficient friction with layers of thread to easily oscillate said roller against the force of said roller urging means, means positioned adjacent said roller for discharging a bobbin laterally from said conveyor, a switch coupled to said roller so as to be operated upon oscillation of said roller from its said rest position, and means coupling said switch and said discharge means so that the latter is actuated only when said switch is operated and held operated for a short time interval.

2. In a bobbin handling machine having a conveyor which carries empty bobbins and bobbins containing usable

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lengths of thread, a bobbin sorter for separating the thread carrying bobbins from the empty bobbins comprising, in combination, a vertically adjustable bracket suspended above said conveyor, an arm pivoted on said bracket for swinging movement from a rest position in the direction of conveyor travel, a roller journaled on said arm so that its periphery may be engaged and the roller oscillated from a rest position by a bobbin passing on said conveyor, a guide for alining said bobbins on said conveyor with said roller, means for urging said roller into its said rest position on said arm, means for urging said arm toward its said rest position on said bracket, means positioned adjacent said roller for discharging a bobbin laterally from said conveyor, an actuator coupled to said roller so as to be operated upon oscillation of said roller from its said rest position, and means coupling said actuator and said discharge means so that the latter is actuated only when said actuator is operated and held operated for a short time interval.

3. In a bobbin handling machine having a conveyor which carries empty bobbins and bobbins containing usable lengths of thread, a bobbin sorter for separating the thread carrying bobbins from the empty bobbins comprising, in combination, an arcuate surfaced member pivoted above said conveyor so that said arcuate surface is engaged and the member oscillated from a rest position by the thread on a passing bobbin that holds a usable length of thread, said surface being just above the body of a passing bobbin that is empty, said member being swingably mounted so that engagement by the enlarged head of a passing bobbin causes the member to swing in the direction of conveyor movement to clear the bobbin head, means for acting on a bobbin passing beneath said member, a switch coupled to said member so as to be operated upon oscillation of said member through a predetermined arc, and a time delay connection for actuating said means only after said switch has been held operated for a predetermined time interval, said interval being greater than that required for a bobbin head to pass beneath said arcuate member after the member has rolled onto the head through said arc.

4. In a bobbin handling machine having a conveyor which carries empty bobbins and bobbins containing usable lengths of thread, a bobbin sorter for separating the thread carrying bobbins from the empty bobbins comprising, in combination, an arcuate surfaced member pivoted above said conveyor so that said arcuate surface is engaged and the member oscillated from a rest position by the thread on a passing bobbin that holds a usable length of thread, said surface being textured to create friction with layers of thread and being positioned just above the body of a passing bobbin that is empty, said member being swingably mounted so that engagement by the enlarged head of a passing bobbin causes the member to swing in the direction of conveyor movement to clear the bobbin head, means for deflecting a bobbin passing beneath said member from said conveyor, an actuator coupled to said member so as to be operated upon oscillation of said member through a predetermined arc, and a time delay connection for actuating said means only after said actuator has been held operated for a predetermined time interval, said interval being greater than that required for a bobbin head to pass beneath said arcuate member after the member has rolled onto the head through said arc.

5. In a bobbin handling machine having a conveyor which carries empty bobbins and bobbins containing usable lengths of thread, a bobbin sorter for separating the thread carrying bobbins from the empty bobbins comprising, in combination, a member pivoted above said conveyor so that it is engaged and the member oscillated from a rest position by the thread on a passing bobbin that holds a usable length of thread, said member being just above the body of a passing bobbin that is empty, a wide, narrow nozzle for directing a generally horizontal blast of

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air laterally across said conveyor, a control for supplying air to said nozzle upon actuation of said control, an actuator coupled to said member for activating said control upon oscillation of said member, and means for slightly delaying the supply of air to said nozzle following operation of said actuator so that said member must be oscillated for a longer interval than that required to pass a bobbin head thereunder but less than that required to pass a thread wound bobbin.

6. In a bobbin handling machine having a conveyor which carries empty bobbins and bobbins containing usable lengths of thread, a bobbin sorter for separating the thread carrying bobbins from the empty bobbins comprising, in combination, a member pivoted above said conveyor so that it is engaged and the member oscillated from a rest position by the thread on a passing bobbin that holds a

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usable length of thread, said member being just above the body of a passing bobbin that is empty, means for deflecting a bobbin laterally across said conveyor, a control for operating said means upon actuation of said control, an actuator coupled to said member for activating said control upon oscillation of said member, and means for slightly delaying the operation of said means following operation of said actuator so that said member must be oscillated for a longer interval than that required to pass a bobbin head thereunder but less than that required to pass a thread wound bobbin.

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