

March 7, 1967

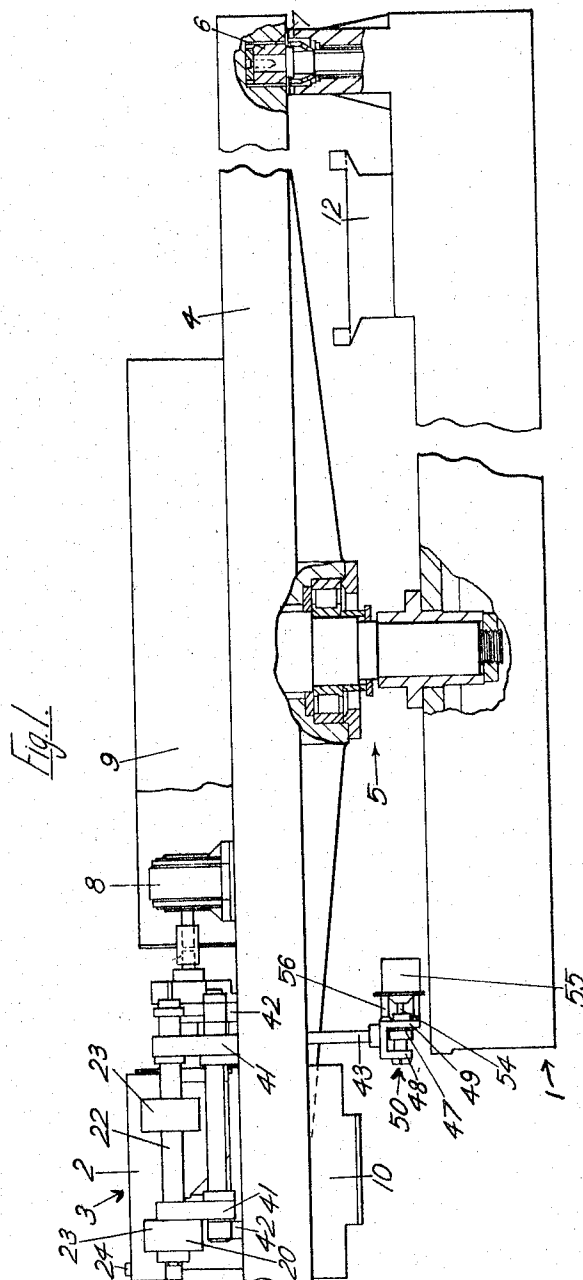
A. SELWOOD ETAL

3,307,694

DETECTION OF TACTILE SURFACE IRREGULARITIES ON BOBBINS

Filed Feb. 23, 1965

4 Sheets-Sheet 1



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Fig. 3

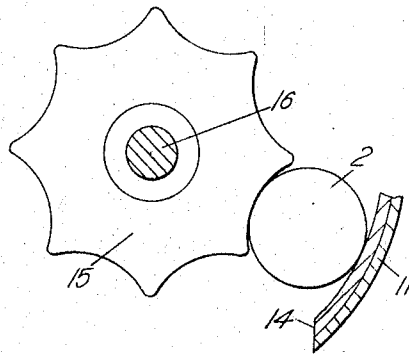


Fig. 5

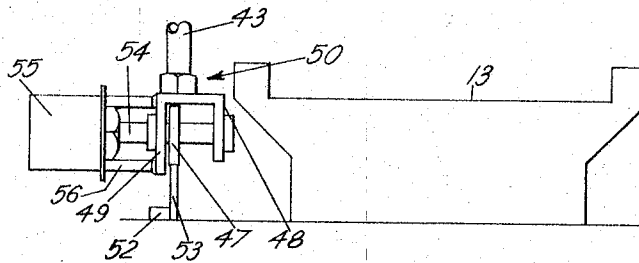
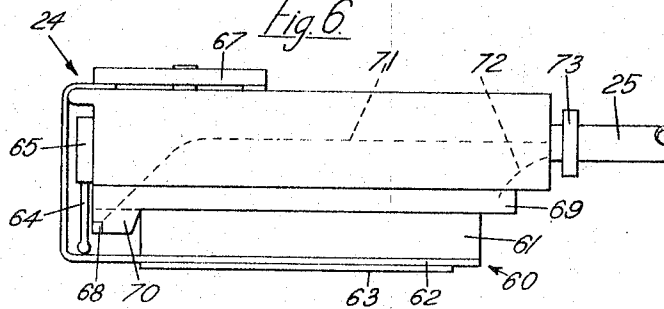


Fig. 6



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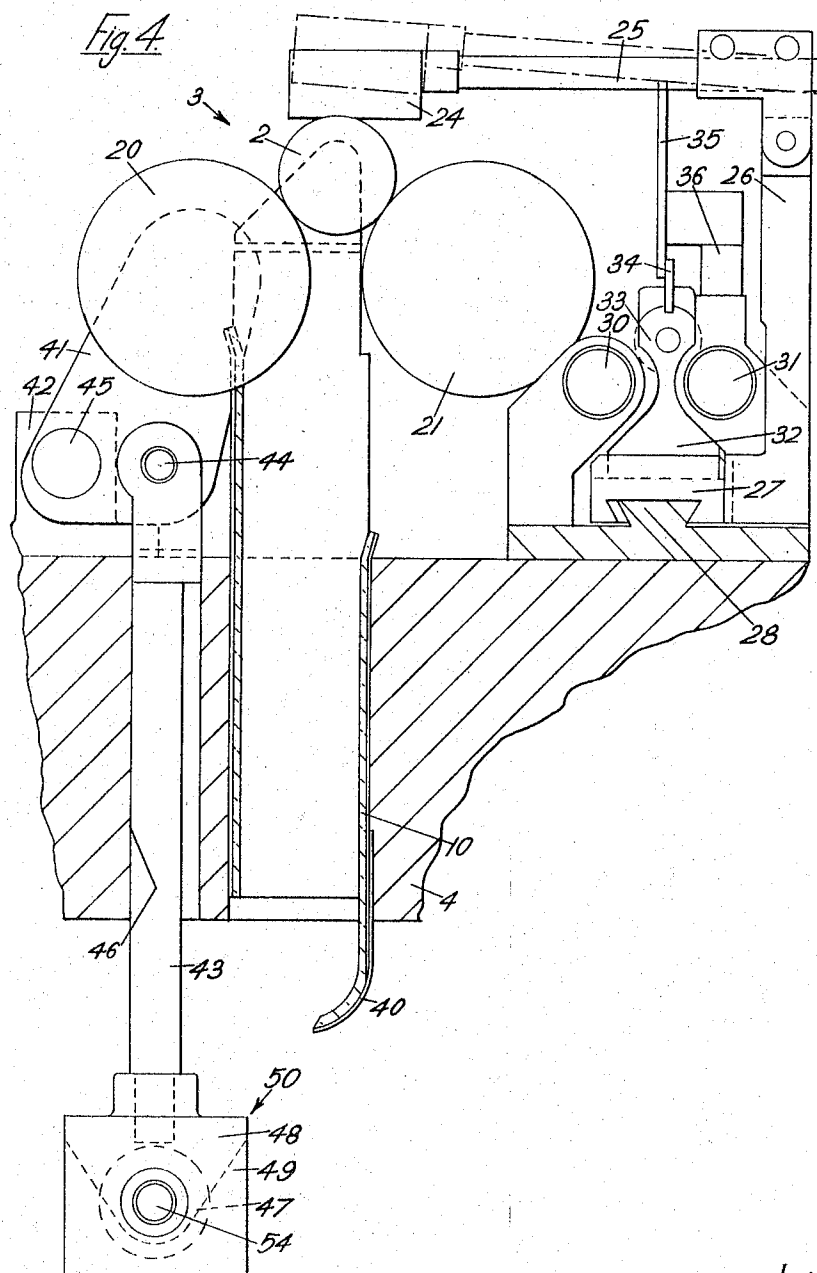
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Filed Feb. 23, 1965

4 Sheets-Sheet 4



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3,307,694

DETECTION OF TACTILE SURFACE IRREGULARITIES ON BOBBINS

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Filed Feb. 23, 1965, Ser. No. 434,481

Claims priority, application Great Britain, Mar. 11, 1964, 10,190/64

16 Claims. (Cl. 209—88)

The present invention concerns the detection of tactile surface irregularities on bobbins and which, if present, are responsible for the "snatching" or irregularity in take-off tension of the yarn during the unwinding of the yarn in the course of a textile process.

The detection of such irregularities assumes great importance when the bobbin is to be re-used many times and in the course of use is subjected to treatment or handling which is prone to give rise to surface irregularities.

The term "bobbin" will be used for convenience in this specification and will be considered to embrace all containers upon which yarn is wound, whether cylindrical or conical in shape and whether flanged, flared or unflanged at the ends thereof, and whether made of metal, plastic, cardboard, resin-treated paper or other solid material.

Usually either the user or the producer of the yarn will have to remove any remnants of yarn which are left on the bobbin after an unwinding procedure; and this action of removal, together with the normal incidents of transport from the user to the producer, often result in score marks and nicks in the surface of the bobbin upon which it is desired to wind more yarn, and such score marks and nicks can be responsible for the yarn "snatching."

Consequently, it has been the practice for returned bobbins to be visually inspected prior to their re-use; but such visual inspection is not a truly significant inspection owing to the fact that many irregularities that ought to be detected are not readily visible and that many visibly apparent irregularities are not such as would lead to "snatching" of the yarn during re-use. A human tactile inspection, though, is possibly more significant than a visual one.

An object of the present invention is to provide for automatic tactile inspection of the surface of the bobbin such as will give an indication the presence of any irregularities of such a nature as to cause the "snatching" of the yarn during its withdrawal from the bobbin.

According to the present invention, apparatus for the tactile inspection of the surface of a bobbin comprises at least one unit, each unit having at least one detecting head, and each head comprising an electrical device and a sensing element having a surface formed of an arrangement of yarns, the electrical device being arranged to produce an electrical impulse upon the detection of a tactile irregularity on the surface of the bobbin by the sensing element, and means to cause relative movement between the detecting head or heads and the bobbin, such that substantially the whole of the surface of the bobbin is contacted by the arrangement of yarns.

The electrical form of detection apparatus is the only known form capable of responding with the required degree of sensitivity to the "snatching" caused by the tactile bobbin surface irregularities on the arrangement of yarns, the apparatus being capable of detecting small transient changes in stress within the arrangement of yarns and being inherent quick-acting.

Conveniently the arrangement of yarns forming the sensing surface of the element, may comprise a textile fabric

The textile fabric must be capable of transmitting tran-

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sient changes in stress efficiently, and in one form a lock-knit or woven fabric of low denier nylon yarn is used.

The arrangement of yarns or textile fabric in the sensing element may be backed by a resilient mass, which mass enables the element to conform to the surface configurations of the container, and acts as a damping member, and this renders the detecting head relatively insensitive to vibrations within the apparatus, or due to contact with the bobbin.

In one form, the sensing element comprises a flexible lamina interposed between the textile fabric or arrangement of yarns and the resilient mass, the lamina being secured to the sensing surface and being capable of transmitting transient changes in stress from the sensing surface.

The electrical device may include a piezo-electric crystal, which crystal is secured within the head adjacent to the sensing element so that any transient change in stress within the surface of the sensing element, due to an irregularity on the surface of a bobbin, causes the crystal to flex and so to produce an electrical impulse.

In such an arrangement, in which the sensing element comprises a flexible lamina interposed between the sensing surface and a resilient mass, the lamina being capable of transmitting transient changes in stress from the sensing surface, this lamina may be arranged to be capable of displacing against biasing means, a member which abuts against the crystal, such that, upon detection of a significant surface irregularity on a bobbin, the member causes the crystal to flex.

Conveniently, this member comprises a spring rigidly secured at one end to the head, this end being remote from the point which abuts against the crystal and from the point at which it is acted upon by the flexible lamina.

The inertia associated with the system is the weight of the textile fabric or arrangement of yarns, so that the natural frequency of the device is high. This frequency can be distinguished easily from any electrical impulse due to vibrations of the apparatus or bobbin, which are usually of relatively low frequency, say 100 c.p.s. maximum value, and, by use of a low frequency filter, these frequencies can be eliminated or reduced in the signal of the device.

The presence of the resilient mass in the sensing element, further, ensures that a "snatching" fault on the bobbin surface causes an electrical impulse of a magnitude above a predetermined threshold value to be produced. Such an impulse, when produced by the electrical device, may be used to actuate a relay controlling other devices, for example, bobbin discharge means, recording devices, or alarms.

The relative movement between the detecting head or heads and the bobbin may be brought about by actual movement of either the head or the bobbin or both. In one arrangement, however, a bobbin to be inspected is caused to be rotated by a centreless drive device, the bobbin being rotated on a pair of driven rollers, and the head or each head is caused to scan along at least part of the bobbin's length, so that the head describes a helical path over the bobbin surface.

Each unit may have two or more detecting heads, the electrical outputs of the heads being combined and fed to a relay arranged to control other devices.

Conveniently, the apparatus referred to above may form part of apparatus for the tactile inspection of the surfaces of bobbins in a continuous manner, and for automatically segregating the acceptable bobbins from the remainder, after such an inspection, this automatic apparatus including loading means whereby the bobbins are released one at a time to be inspected, and bobbin discharge means comprising bobbin discharge actuating

mechanism and selection means, the bobbin discharge actuating mechanism causing the inspected bobbins to be discharged from the apparatus, and the selection means causing each bobbin, when being so discharged, to take one of two alternative paths according to whether a significant fault has been detected upon its surface, or not.

According to another aspect, the present invention comprises a process for the tactile inspection of the surface of a bobbin in which a sensing surface formed of an arrangement of yarns, is caused to have relative movement over the surface of a bobbin so as to contact substantially the whole of the bobbin surface, the sensing surface being part of a sensing element arranged to act on an electrical device which produces an impulse when a "snatching" tactile irregularity is detected on the surface of the bobbin.

One example according to the present invention will now be described, by way of illustration, but not limitation of the invention, and with reference to the accompanying "drawings," in which

FIGURE 1 is a partly sectional elevation of the apparatus, which has twelve detecting units, although only unit is shown in this figure,

FIGURE 2 is a plan view of the apparatus shown in FIGURE 1, with certain components removed for the sake of clarity,

FIGURE 3 shows an indexing device arranged to ensure that bobbins are fed individually to the detecting units, and at requisite intervals of time,

FIGURE 4 is a cross sectional elevation of a detecting unit,

FIGURE 5 is a section on the line V—V in FIGURE 2 and shows part of the bobbin-release mechanism of a detecting unit, and

FIGURE 6 is a side elevation of a detecting head associated with the apparatus.

Apparatus 1 for the tactile inspection of the surface of bobbins 2 comprises twelve detecting units 3 which are equi-angularly spaced, and radially disposed, on a rotatable circular table 4 mounted on the main body of the apparatus (only one unit 3 being shown in FIGURE 1).

The table 4 is rotated about an axle assembly, indicated generally at 5, and is driven by a friction drive wheel 6 which engages a channel-shaped groove 7 formed in the table adjacent to its periphery. The drive wheel 6 is driven by a main motor not shown, and each unit 3 is driven by an individual motor 8 which is housed in a common casing 9 supported on the central part of the table.

The table 4 rotates at a constant speed, say, 3 r.p.m. and the bobbins 2 to be inspected are fed individually to each unit 3 as it passes a predetermined loading position in each revolution of the table. The bobbin previously having been inspected by the unit is discharged automatically from the unit via a duct 10, after it has been inspected, and before the unit reaches the loading position.

As shown in FIGURE 2, in which the table 4 and detecting units 3 are omitted for the sake of clarity, the bobbins to be inspected are fed to the apparatus by a "charging" chute 11. After the bobbins have been inspected they are discharged from the apparatus either by a "reject" chute 12, for bobbins which during their inspection are discovered to have a significant surface irregularity such as will cause the snatching of yarn when unwound therefrom, or by an "accept" chute 13, for bobbins which are found not to have any such irregularity.

At the loading position, at the lower end 14 of the charging chute 11, there is a star-shaped indexing wheel 15, shown in FIGURE 3. This wheel 15 is rotatably mounted on a shaft 16, and is arranged to hold each bobbin 2 to be inspected (immediately before it is loaded onto a detecting unit 3), between the end 14 of the chute 11 and two adjacent constituent lobes of the wheel 15. As each detecting unit 3 passes through the loading position, the wheel 15 is rotated to its next index position,

causing the bobbin which had been held to be fed to the unit, and the next bobbin on the chute 11 to be held between the end 14 of the chute 11 and the lobes on the wheel 15.

The bobbin 2 is mounted on each detecting unit 3 on two substantially axially parallel horizontal rollers 20 and 21, which are driven by the motor 8, each roller comprising a metal spindle 22 having two spaced annular ground rubber blocks, 23 as shown in FIGURE 1.

As seen in FIGURE 4, a detecting head 24 is mounted above the bobbin 2, when carried by the rollers 20 and 21, the head 24 itself being carried by an arm 25 pivotally connected to a vertical extending support 26 which is rigidly secured to a movable carriage 27.

The carriage 27 is adapted to slide along a rail 28 which extends in a direction parallel to the roller axes, and is positioned below two worms 30 and 31 which extend along its length. A waisted tongue 32 integral with the carriage 27, extends between the worms 30 and 31, and carries a half-nut 33 arranged to engage either worm 30 or 31 separately. The worms are driven, in contra-rotating directions, by the motor 8, and thus the half-nut 33, and hence the carriage 27 and head 24, are driven axially along the rollers 20 and 21 and the bobbin 2 by one or other of the worms. At either end of the bobbin 2, the half-nut 33 engages a cam 34 which causes it to engage the other worm to the one it previously had been rotated by, and thus the half-nut 33 is caused to reciprocate along the length of the rollers 20 and 21, in conventional manner.

The rollers 20 and 21 provide a centreless drive for the bobbin 2, and the rotational movement of the bobbin 2, in combination with the traversing motion of the head is such that the head 24 describes a helical path over the bobbin surface and comes into a contact with substantially the whole of the bobbin surface. The head 24 moves in one direction only during the scanning of a bobbin, and in the reverse direction during the scanning of the next bobbin.

In one arrangement, the rollers 20 and 21 are rotated at a speed of 500 revolutions per minute and a bobbin 2 of 12 inches in length will be scanned by the apparatus in 12 seconds, the bobbin having rotated through 60 revolutions approximately in this time.

Depending on the size of the surface to be inspected, and on the time allowed for such inspection, it may be necessary to employ a plurality of detecting heads, the electrical outputs of which are fed to a common selection means referred to below. In particular, a second head may be provided in each unit, this head, which may be similar in form to the head 24, being supported on a carriage arranged to slide laterally across one end of the bobbin. Thus, if the bobbin has a curve re-entrant end portion to facilitate the unwinding of yarn from the bobbin (this end usually being the most likely part of the bobbin to suffer score marks or nicks in the course of use), then the provision of this second head will ensure conveniently that substantially the whole of the surface of the bobbin, which comes into contact with the yarn during the unwinding operation, is inspected by the apparatus.

The form of the ancilliary parts associated with the second head, and its manner of operation, may be similar to that described with reference to the head 24.

The arm 25 of the head 24 abuts against a cam 35 carried by a support 36 common with the worm 31. This cam 35 extends axially along the rollers 20 and 21, and its profile is substantially horizontal, except at either end, where there is provided an upwardly-inclined portion. The height and positioning of the cam 35 is such that the head 24 is supported by the bobbin 2 while the head 24 is caused to traverse substantially along the whole of the bobbin length, but is caused to be pivoted away from the bobbin when it approaches either end of the bobbin (to a position shown in chain-lines in FIGURE 4).

Thus, the head 24 is displaced once the inspection of the bobbin has been completed, and it remains so dis-

placed until the inspected bobbin has been discharged from the unit and another bobbin has replaced it.

Between the rollers 20 and 21 is positioned the vertically extending duct 10 for the bobbin 2 when it discharged from the unit 3, this duct 10 having a curved guide lip 40 at its lower end. The bobbin 2 is allowed to enter the duct 10 by the operation of bobbin discharge actuating mechanism, causing the displacement of the roller 20 away from the other roller 21, and thus permitting the bobbin 2 to fall between these two rollers.

In the bobbin discharge actuating mechanism, the displaceable roller 20 is mounted on two spaced levers 41, which are rigidly secured together and are rotatably connected to anchorages 42 carried by the table 4. An actuating rod 43 is pivotally secured to one of the levers 41 at a point 44 remote from its fulcrum 45, the rod 43 being slidably mounted in a vertical bore 46 in the table 4. While a bobbin 2 is being inspected, the displaceable roller 20 is held in horizontal alignment with the other roller 21, but, when the bobbin 2 is to be discharged, the rod 43 is caused to be moved upwardly and, consequently, the displaceable roller 20 is moved upwardly and away from the other roller 21 by the consequent rotation of the levers 41.

Movement of the rod 43 is caused by vertical displacement of a cam follower 47 carried between the two arms 48 and 49 of the forked lower end 50 of the rod 43.

As shown in FIGURES 2 and 5, two cams 51 and 52, which co-operate with the cam follower 47, are secured to the main frame of the apparatus, the cam 51 being positioned adjacent to the upper end of the "reject" chute 12, and the cam 52 adjacent to the "accept" chute 13. Both cams 51 and 52 are identical in form, each comprising a thin vertical portion 53 having an upwardly inclined cam surface, with respect to the direction of rotation of the table 4, each of these portions 53 forming a tangent to a circle concentric with the table 4, the cam 51 being further from the centre of the table than the cam 52.

The cam follower 47 is circular in shape and is secured to an axle 54 slidably mounted within the arms 47 and 48 of the forked end 50 of the rod 43.

This axle 54 extends away from the rod 43 in the side remote from the chutes 11 and 12, and comprises the armature of a relay device mounted within a housing 55, which is also carried by the forked end 50 of the rod 43, but is spaced therefrom by four members 56.

The relay forms part of bobbin discharge selection means and, in operation, the axle 54 is normally biased towards the relay housing 55, so that the cam follower 47 is positioned adjacent to the arm 49 of the fork, and will not be engaged by the cam 51 adjacent to the "reject" chute 12, over which it passes first, but will be displaced by the cam 52 adjacent to the "accept" chute 13, when the rod 43 passes over this cam 52. Thus, unless the relay is actuated (as the cam follower 47 passes over the cam 51), and the axle 54 and cam follower 47 are displaced away from the relay housing 55 against the action of the biasing means (not shown), the bobbin 2 will be discharged from the apparatus via the "accept" chute 13. However, if the relay is operated, the bobbin will be discharged via the "reject" chute 12.

In this manner, the actuation of the relay controls the bobbin discharge actuating mechanism, so as to cause the segregation of the rejected bobbins from satisfactory bobbins.

Summarising the manner of operation of the parts of the apparatus described so far:

Bobbins 2 to be inspected for surface irregularities, such as are liable to cause "snatching" of yarn when unwound therefrom, are fed in a continuous, but intermittent manner, from the chute 11 via the indexing wheel 15, to one of twelve detecting units 3.

The units 3 are carried on the rotating table 4 and after being inspected, the apparatus automatically segregates the bobbins, by causing them to be discharged

therefrom either via the "reject" chute 12 or the "accept" chute 13.

Each unit 3 comprises at least one detecting head 24, scanning means (including the rotating rollers 20 and 21) to cause the head or heads to move over substantially the whole surface of the bobbin, and bobbin discharge means.

This bobbin discharge means comprises bobbin discharge actuating mechanism and selection means the actuating mechanism comprising the cam follower 47, the connecting rod 43 and the co-operating lever 41, and is arranged to displace the roller 20 to allow the inspected bobbin 2 to fall between the rollers 20 and 21. The selection means determines whether the bobbin-discharge actuating mechanism is operated over the "reject" chute 12 or the "accept" chute 13, and comprises the electrical relay in the housing 55 on the rod 43. The actuation of the relay causes the cam follower 47 to be displaced into a path over the cam 51 positioned adjacent to the "reject" chute 12, and so causes the bobbin to be discharged while the unit is in that position, whereas, otherwise, the cam follower 47 would engage the cam 52 positioned adjacent to the "accept" chute 13.

The actuation of the relay is caused by a significant irregularity being detected by the head or heads on the bobbin, an electrical impulse being emitted by the head in such a case.

Within each head 24, illustrated in FIGURE 6, is carried a sensing element (indicated generally at 60), and which is transiently stressed when it passes over a "snatching" irregularity in the bobbin surface. This element 60 comprises a mass of resilient material 61, such as polyurethane foam, one surface of the mass bearing against a flexible lamina 62, while the other surface of the lamina 62 is partially covered by a textile fabric 63. The fabric 63 is arranged to be in contact with the surface of the bobbin 2 during the inspecting operation, and is caught or snagged on those irregularities on the surface of the bobbin 2 which will also cause "snatching" of the yarn as it is unwound therefrom, and this snagging of the fabric will result in transient changes in stress in the fabric 63.

A suitable fabric 63 for the sensing surface of the element 60 is a lock-knit fabric of low denier nylon yarn, for example, a fabric of 40 denier yarn of 13 filaments. The prominent ribs on this fabric are arranged to extend at right angles to the direction of movement of the head 24 over the bobbin 2, (most expected scores or nicks in the bobbin surface thus extending in a direction parallel to the fabric ribs).

Alternatively a woven fabric can be used, or an arrangement of yarns could cover the resilient mass. A woven fabric suffers from the disadvantage that some of the fibres may work loose during the inspecting operation.

In the illustrated embodiment, the fabric 63 is 1.25 inch long and 0.5 inch wide, and is secured to the flexible lamina 62 along its whole length. The resilient mass 61 is 1.25 inch long, 0.5 inch wide and 0.25 inch thick, and is secured to the flexible lamina by a narrow strip of adhesive positioned adjacent to its rear edge, with respect to the relative movement between the head and the bobbin.

Only a part of the flexible lamina 62 is positioned between the textile fabric 63 and the resilient mass 61, and, in fact, it comprises a thin strip 0.5 inch wide and of relatively elongated length. The remainder of the strip comprises a tongue which is clamped to the main body of the head 24 in a manner, referred to in greater detail below, by a clamping member 67.

The sensing surface 63 is of generally plane rectangular form, but the resilient mass 61 enables the fabric to conform, at least in part, to the curvature of the bobbin surface to be inspected.

The fabric 63 is secured by adhesive to the flexible lamina 62, which is a polyester film of 0.001 inch thickness, and the tongue part of the lamina 62 acts on a leaf spring

64 made of a plastics material, such as "Delrin," and which is rigidly secured at one end 65 to the body of the head 24. At a point remote from the end 65, the leaf spring 64 abuts against a piezo-electric crystal 68, due to action of the lamina 62 on the spring, the tongue part of the lamina being clamped so that the resilient mass 61 is pulled slightly out of shape and the spring 64 is brought into contact with the crystal 68.

Thus, when the textile fabric 63 makes contact with a tactile irregularity on the bobbin surface, and is snagged, the leaf spring 64 is displaced further by the lamina 62 so as to cause the crystal 66 to flex, and so to produce an electrical impulse which is fed to an amplifier (not shown).

The crystal 68 comprises lead zirconate, and is in the form of a flexible thin rod secured, by both its ends, to a channel-shaped end portion 70 of a bracket 69, which is slidably mounted on the body of the head 24.

The two contact faces of the crystal 68 are coated with silver, and one of these faces makes electrical contact with the bracket 69, while an electrical lead 71 is soldered to the other face. A second lead 72 is secured to the bracket 69, and both leads 71 and 72 are connected to a socket member 73, which forms part of the arm 25 of the head 24.

Preliminary adjustment between the crystal 68 and the spring 64 is made by sliding the bracket 69 along the body of the head 24, so that a detectable electrical signal is produced by the crystal when the spring is displaced towards the crystal by a small amount.

The crystal 68 is under a substantially constant load due to the lamina 62 being maintained in a taut condition due to the contact between the head 24 and the bobbin surface, with the consequent deformation in the resilient mass 61, but its electrical output corresponds only to changes in such a condition.

Thus, the apparatus described above is capable of producing a detectable high frequency electrical signal or impulse corresponding to each "snatching" fault on the bobbin surface. This signal from the electrical device comprises a group of high frequency pulses at approximately 4-10 kc./s. and maximum amplitude of about 0.4 volt peak-to-peak.

This impulse is fed to an amplifier (and possibly also modified), and is used to activate the relay of the bobbin discharge selection means. The electrical device of the apparatus is biased so that only impulses above a certain absolute level, or above a certain level relative to the value of background noise, are fed to the amplifier, and hence to the relay, which will be operated if the magnitude of the original impulse is above a predetermined threshold value.

The relay is capable of operating on a pulse of 0.5 volt peak-to-peak from the crystal, the crystal having a 2 M-ohm impedance.

The apparatus preferably employs transistors, and block circuitry principle is used in its construction, due to the advantages inherently associated with such as construction.

It is necessary for satisfactory operation of this apparatus, for the electrical noise level to be kept relatively low, and spurious electrical signals to be eliminated if possible.

Consequently, the vibrations between the moving parts of the apparatus, and these parts and the bobbin are damped whenever possible. In this connection, the head and its associated arm are made of a light metal alloy so that its inertia is kept as small as possible.

A low-frequency filter, passing only those frequencies above 200 c.p.s., is incorporated in the electrical device, and this effectively reduces the background noise level resulting from the vibration of the mounting arm for the head. However, in addition, the resilient mass substantially absorbs vibrations between the bobbin and the apparatus.

Further, it is desirable that the rotational movement of the bobbin should be as smooth as possible. Thus the centreless driving action of the rollers, and the resilient mass, allows the apparatus to accommodate bobbins of slightly oval cross-section, and features which are permanently moulded on to the bobbin surface for some particular function and which may cause the bobbin to bounce. Also, use of the mounting means provided on the bobbin, where manufacturing tolerances are relatively large, can be avoided by employing such driving means.

The bobbins may be provided with plastic sleeves, the surfaces of which sleeves are required to be inspected, but in any event, the surface of the bobbin may be formed with a rib-pattern or other mould marks which may possibly assist the winding operation and will not cause "snatching" while the yarn is being unwound therefrom. The apparatus, however, will not be sensitive to such patterning on the bobbin surface, due to the presence of the resilient mass.

The apparatus may give a visual or audible signal in response to a signal, or a plurality of signals, from the electrical devices. Recording means may also be coupled to the apparatus so that a permanent record of its operation is obtained.

After the inspection of a bobbin it is found that, with respect to some of the faults, the fabric, although only lightly pressed against the bobbin surface, has reduced the snagging nature of the faults by deformation of the surface.

Further, it is possible to arrange for any such automatic inspection and segregation to be carried out sequentially or concurrently with other inspection and segregation process, or with other processes which, in the particular case of bobbins, may for instance comprise yarn removal and bobbin surface abrading, polishing, burnishing or other re-finishing stages. The bobbins should have been cleared of waste yarn and cleaned, as a preliminary step to the inspection, and thus the textile fabric of the sensing surface will not be contaminated in use.

What we claim is:

1. Apparatus for the tactile inspection of the surface of a bobbin comprising at least one unit, each unit having at least one detecting head, and each head comprising an electrical device and a sensing element, and scanning means to cause relative movement between the detecting head and the bobbin to be inspected such that the whole of the surface of the bobbin is contacted by the head, the sensing element of the head having a surface formed of a textile fabric which contacts the bobbin surface, and the electrical device being arranged to produce an electrical impulse upon the detection of a tactile irregularity on the surface of the bobbin by the sensing element.

2. Apparatus as claimed in claim 1 in which the textile fabric is a lock-knit fabric of low denier nylon yarn.

3. Apparatus as claimed in claim 1 in which the textile fabric is a woven fabric of low denier nylon yarn.

4. Apparatus as claimed in claim 1 in which the textile fabric of the sensing element in the head is backed by a resilient mass.

5. Apparatus as claimed in claim 1 in which the electrical device includes a piezo-electric crystal, which crystal is secured within the head adjacent to the sensing element, so that any transient change in stress within the surface of the sensing element causes the crystal to flex and so to produce an electrical impulse.

6. Apparatus for the tactile inspection of the surface of a bobbin comprising at least one unit, each unit having at least one detecting head, and each head comprising an electrical device including a transducer and a sensing element, and scanning means to cause relative movement between the detecting head and the bobbin to be inspected such that the whole of the surface of the bobbin is contacted by the head, the sensing element of the head comprising a flexible lamina, a resilient mass back-

ing the lamina, and a textile fabric covering the face of the lamina remote from the resilient mass, the textile fabric constituting the sensing surface of the element and is arranged to make contact with the bobbin to be inspected such that it is transiently stressed by a significant irregularity on the bobbin surface, and the lamina being arranged to transmit such a change in stress to the transducer of the electrical device, which thereupon produces an electrical impulse.

7. Apparatus as claimed in claim 6 in which the transducer comprises a piezo-electric crystal, this crystal being secured within the head adjacent to the sensing element.

8. Apparatus as claimed in claim 7 in which a spring abuts against the crystal and is acted upon by the lamina, the spring being secured to the head, at a point remote from the crystal and the lamina, the arrangement being such that the lamina displaces the spring towards the crystal when transiently stressed by a fault on the bobbin surface, and an electrical impulse to be produced.

9. Apparatus as claimed in claim 6 in which the electrical device includes a relay arranged to control other devices and to be actuated by an electrical impulse from the transducer.

10. Apparatus as claimed in claim 6 in which the scanning means comprises a centreless drive device for the bobbin, and means to cause each head to move along the length of the bobbin, so that the head describes a helical path over the bobbin surface.

11. Apparatus as claimed in claim 6 in which each unit has at least two heads, the electrical outputs of the heads being combined and fed to a relay arranged to control other devices.

12. Apparatus for the tactile inspection of the surfaces of bobbins in a continuous manner, and for automatically segregating the acceptable bobbins from the remainder, after such an inspection, comprising at least one unit, each unit having at least one detecting head, and each head comprising an electrical device and a sensing element, scanning means to cause relative movement between the detecting head and each bobbin to be inspected such that the whole of the surface of the bobbin is contacted by the head, the sensing element of each head having a surface formed of a textile fabric which contacts the bobbin surface, and the electrical device being arranged to produce an electrical impulse upon the detection of

a tactile irregularity on the surface of the bobbin by the sensing element, loading means whereby the bobbins are released one at a time to be inspected, and bobbin discharge means comprising bobbin discharge actuating means and selection means, the bobbin discharge actuating mechanism causing the inspected bobbins to be discharged from the apparatus, and the selection means causing each bobbin, when being so discharged, to take one of two alternative paths according to whether a significant fault has been detected upon its surface, or not.

13. Apparatus as claimed in claim 12 in which each electrical device includes a piezo-electric crystal, which crystal is secured with the associated head adjacent to the sensing element, so that any transient change in stress within the surface of the sensing element causes the crystal to flex and so to produce an electrical impulse.

14. Apparatus as claimed in claim 12 in which each sensing element comprises a flexible lamina, a resilient mass backing the lamina, the face of the lamina remote from the resilient mass being covered by the textile fabric, and the lamina being arranged to transmit transient changes in stress within the fabric, due to the fabric making contact with a significant fault on a bobbin surface, to the piezo-electric crystal transducer included in the electrical device.

15. Apparatus as claimed in claim 12 in which a relay is included in each bobbin discharge selection means, this relay being actuated by an impulse from the electrical device and controls the discharge path of each bobbin when inspected.

16. Apparatus as claimed in claim 12 in which the scanning means of each unit comprises a centreless drive device for the bobbin and means to cause each head to move along the length of the bobbin, so that the head describes a helical path over the bobbin surface.

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