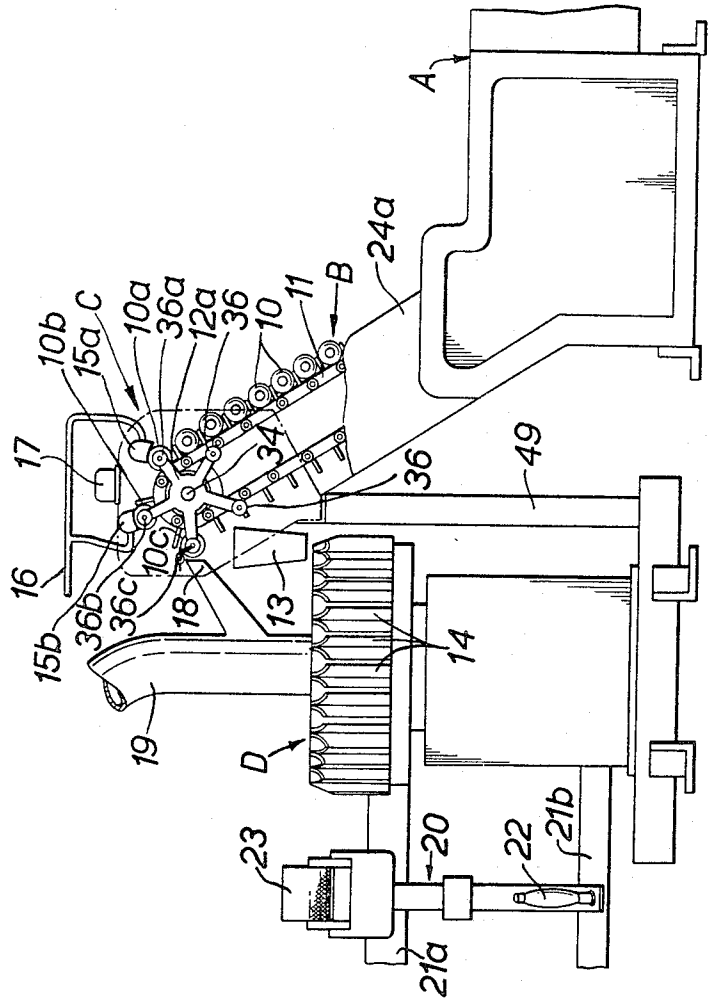
May 7, 1968 ROKUYA IGUSHI ETAL 3,381,908

AUTOMATIC COP FEEDER FOR A WINDING MACHINE

Filed Nov. 15, 1966 5 Sheets-Sheet 1

FIG. 1.

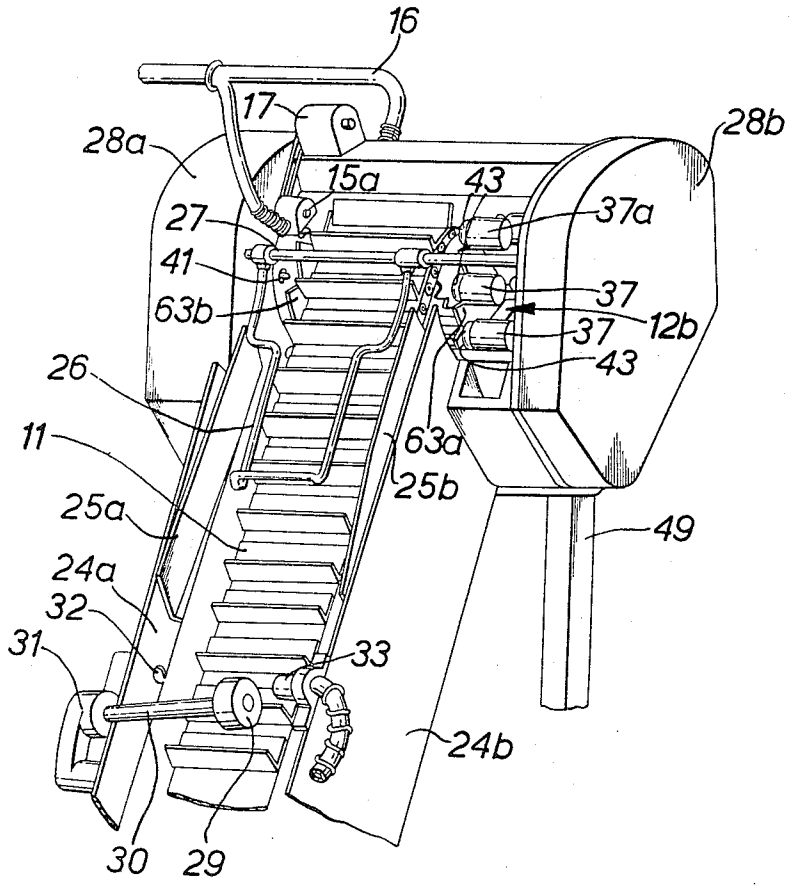


May 7, 1968 ROKUYA IGUSHI ETAL 3,381,908

AUTOMATIC COP FEEDER FOR A WINDING MACHINE

Filed Nov. 15, 1966 5 Sheets-Sheet 1

FIG. 2.



May 7, 1968 ROKUYA IGUSHI ETAL 3,381,908

AUTOMATIC COP FEEDER FOR A WINDING MACHINE

Filed Nov. 15, 1966

5 Sheets-Sheet 3

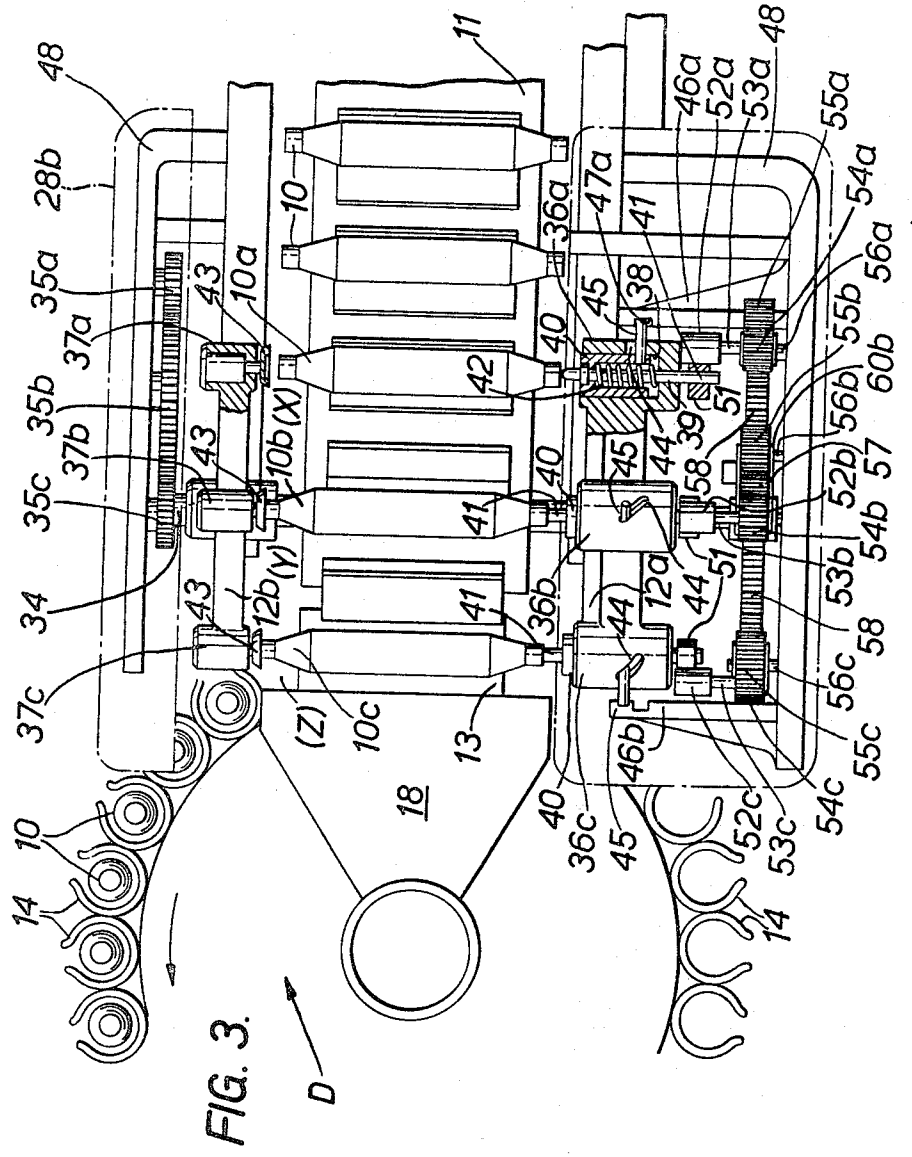



FIG. 3.

FIG. 4.

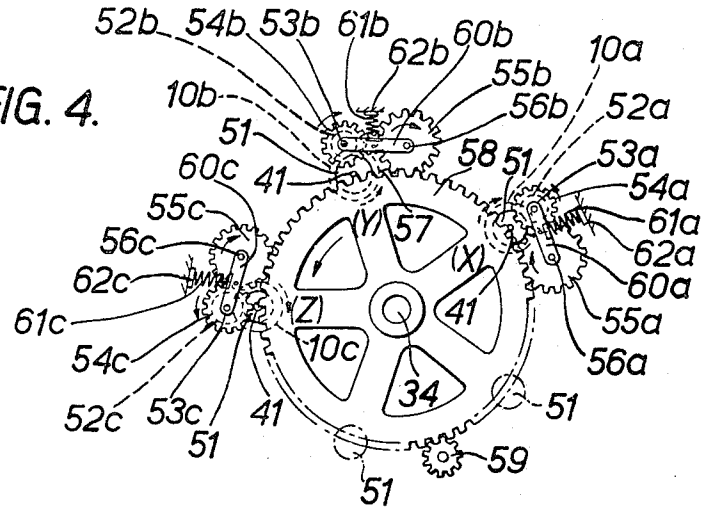
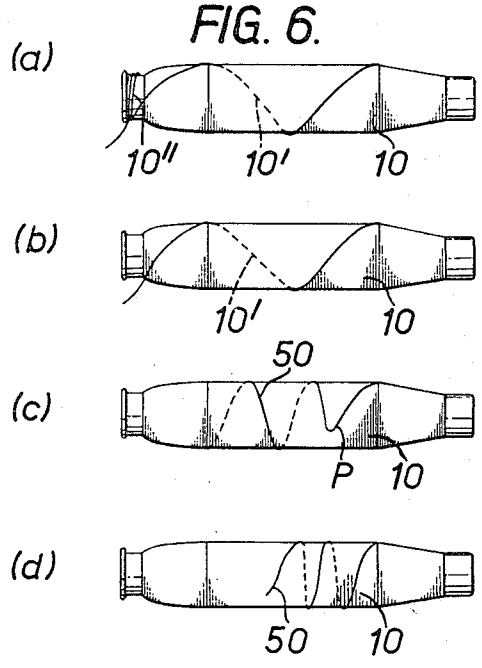

52b
54b
53b
61b
62b
60b
10a
55b
56b
52a
10b
51
58
51
53a
60c
41
54a
55c
(Y)
57
61a
56c
(X)
62a
62c
41
60a
(Z)
55a
61c
10c
56a
54c
34
52c
53c
41
51
51
59
51

FIG. 6.


(a)
10''
10'
10
(b)
10'
10
(c)
50
P
10
(d)
50
10

May 7, 1968 ROKUYA IGUSHI ETAL 3,381,908

AUTOMATIC COP FEEDER FOR A WINDING MACHINE

Filed Nov. 15, 1966 5 Sheets-Sheet 5

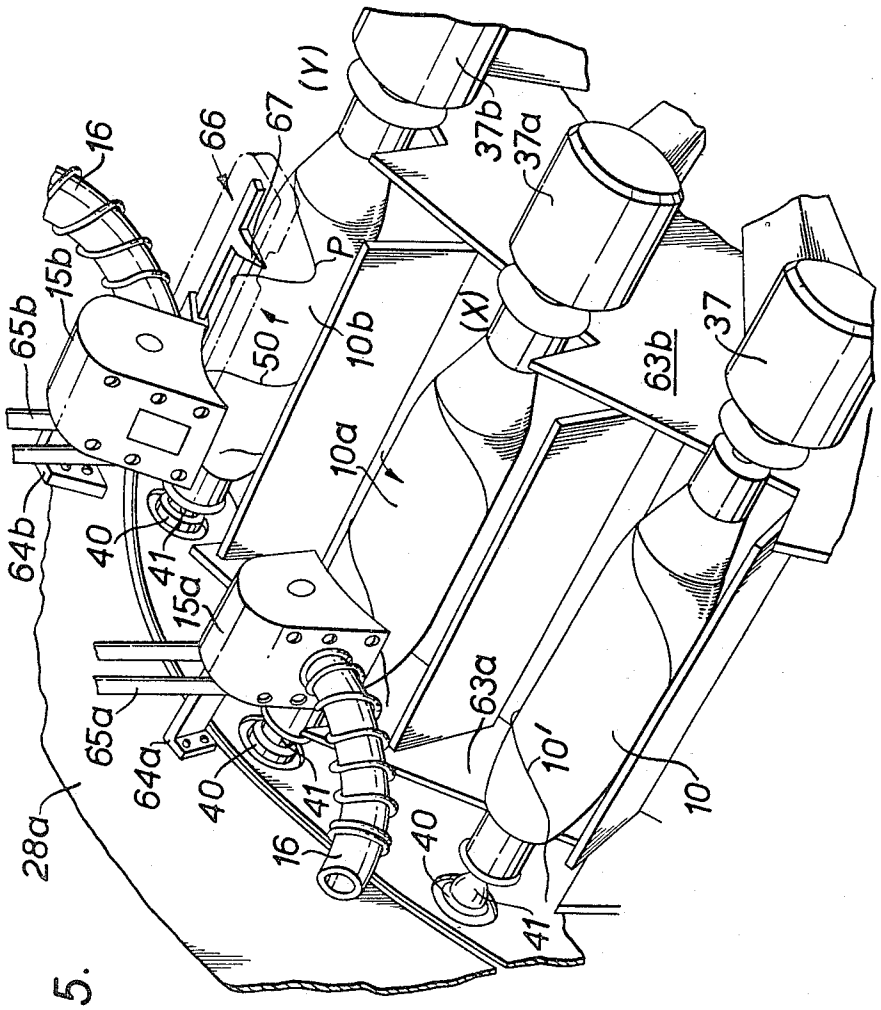



FIG. 5.

United States Patent Office

3,381,908

Patented May 7, 1968



3,381,908

# AUTOMATIC COP FEEDER FOR A WINDING MACHINE

Rokuya Igushi, Koichiro Kubo, and Iwao Banba, all % Gojo Factory, Shimadzu Seisakusho Ltd., 11 Saiin Umatsuka-cho, Ukyo-ku, Kyoto, Japan

Filed Nov. 15, 1966, Ser. No. 594,595

20 Claims. (Cl. 242—35.5)

## ABSTRACT OF THE DISCLOSURE

An automatic cop feeder for a winding machine having a cop magazine, a cop container and a cop conveyor means for conveying the cops from the container to the magazine. While the cop is associated with the cop conveyor means the yarn end is unwound from cop and a sufficient length thereof unwound from the cop for uniting with the yarn end of the bobbin of the winding machine. The yarn end of the cop is unwound in four stages. During the first, second and fourth stages the cop is rotated in the unwinding direction while suction is applied to the yarn end, and during the third stage of operation the cop is rotated in the direction of winding while suction is applied to the yarn end in the event the yarn is rewound in the reverse direction during the first two stages of yarn end unwinding.

This invention relates to an automatic cop feeder for a winding machine.

One existing type of automatic winding machine is provided with a magazine for supporting a plurality of cops supplied from a container and supplying them one after another to winding units, so that the yarn of each cop is unwound therefrom and wound onto a cheese on each winding unit as it circulates on an endless rail. When that cop has been consumed, a new cop is supplied from the magazine and the yarn end of the new cop is tied to the rear end of the yarn that has been wound onto the cheese, so that the new yarn is additionally wound onto the cheese. In order to enable the tying of the two yarn ends, there must be a sufficient length of yarn end drawn out of the new cop when it is supplied to the winding unit. Generally, however, a cop has its yarn end wound in a couple of turns in such a manner as to spirally traverse the previously wound turns in the backward direction and then in several more turns on one neck of the bobbin. Therefore, it is necessary to have the yarn end drawn out before the cop is supplied to the winding unit. Otherwise, continuous winding operation will be impossible.

Accordingly, it is the general object of the invention to provide cop feeder for a winding machine, which is capable of automatically unwinding the yarn end from cops received one after another from a cop container and supplying them to a magazine so as to feed the winding units of the machine. In accordance with the invention, cops are taken up from a container onto a conveyor which conveys them to the magazine. While the cops are being conveyed from the container to the magazine, the unwinding operation is performed by applying suction to the cops and at the same time rotating them about their axes. The operation is carried out in several steps. In the first step, a jet stream of air is applied to the cop axially thereof from one side, with a suction being applied thereto from the opposite side. At the same time the cop is rotated about its axis in such a direction as to unwind the yarn end wound on the bobbin neck so that the unwound yarn end is cut off. In the second step, the cop is rotated in the same unwinding direction, with suction being applied thereto to suck up an excess length of the yarn end



and cut it off. It often happens, however, that in the second step the yarn end being unwound is again wound on the cop in the unwinding direction. If in the third step, the cop were rotated in the same unwinding direction as in the previous step, the yarn end would never be paid out of the cop. In accordance with the invention, therefore, the cop is rotated in the winding direction in this step, with suction being applied thereto, so as to make it possible to unwind the yarn end that has been wound on the cop in the unwinding direction in the previous step and then re-wind it on the cop in the winding direction. In this connection, a searcher may advantageously be provided to act on the yarn end of the cop being rotated in this step so as to help the rewinding operation. Then, in the last step the cop is rotated in the unwinding direction, with suction being applied thereto, so as to draw out a sufficient length of yarn end from the cop.

Thus, it is one important feature of the invention to rotate the cop in the winding direction in the last but one step of the unwinding operation, thereby making it possible for a sufficient length of yarn end to be drawn out of the cop in the next and last step when it is supplied into the magazine.

The invention, with its above stated and other objects, features and advantages will be better understood from the following description of a preferred embodiment thereof with reference to the accompanying drawings, wherein:

FIG. 1 is a schematic side view, partly broken away, of an automatic cop feeder of the invention in combination with a winding machine;

FIG. 2 is an enlarged perspective view of the conveyor and the feeder sections of the invention;

FIG. 3 is an enlarged top plan view of the principal portion of FIG. 1, chiefly showing the interior mechanism of the feeder section;

FIG. 4 is a fragmentary side elevation of the feeder mechanism, as viewed from below FIG. 3;

FIG. 5 is a still enlarged fragmentary view of the upper portion of FIG. 2, as viewed from a little more above than in FIG. 2; and

FIG. 6 shows cops having their yarn ends unwound to different degrees in accordance with the unwinding process of the invention.

Reference has been and will often be made to the "winding direction" and the "unwinding direction" in the specification and claims. When "the winding direction" is referred to with respect to the yarn of a cop, it is defined as that direction in which the yarn is wound on the cop; while when it is referred to with respect to the rotation of a cop, it is defined as that direction in which the cop is rotated so as to wind yarn thereonto in the same direction as that in which the previously wound turns are wound. The "unwinding direction" is opposite in the above two senses to the "winding direction."

Referring now in detail to the drawings, there are shown in FIG. 1 a cop container section, a conveyor section, a feeder section and a magazine section generally designated by A, B, C and D, respectively. Cops **10** are picked up from the container section and delivered to the magazine section by means of a conveyor **11**. The feeder section includes a pair of spiders **12***a* and **12***b*, each having five radially extending arms. The spiders are adapted to pick up cops one after another from the upper portion of the conveyor and drop them into a hopper **13** disposed above the magazine. The magazine is provided with a plurality of open sided pockets **14** circumferentially arranged, into each of which the hopper directs one cop after another vertically as the magazine is intermittently rotated. Before the cops are dropped into the hopper **13**, a sufficient length of yarn end wound thereon is drawn out, as will be described in detail later. To this end the

feeder section also includes a pair of suction cutters 15*a* and 15*b* connected to a common suction tube 16, with a motor 17 for driving the cutters not shown, as well as a suction nozzle 18 connected to a suction pipe 19.

One of the winding units is designated at 20, which circulates along a vertically arranged pair of endless guide rails 21*a* and 21*b*. The unit receives from the magazine a cop 22, the drawn-out yarn end of the cop having been tied onto the yarn end of a cheese 23 so as to be continuously wound thereonto.

Referring to FIG. 2, a pair of side plates 24*a* and 24*b* extend along the opposite sides of the conveyor 11, with a pair of plates 25*a* and 25*b* provided inside the upper portion of the plates 24*a* and 24*b*. The distance between the inner plates 25*a* and 25*b* decreases as they go upward so as to define the position of the cops on the conveyor. Above the upper portion of the conveyor a U-shaped retainer memer 26 is swingably supported by a rod 27 so as to bear on the cops on the conveyor with a suitable pressure. Covers 28*a* and 28*b* protect the interior mechanism of the feeder section, the details of which will be described later with reference to FIGS. 3 and 4.

A suitable distance down the conveyor 11 from the inner side plates 25*a* and 25*b*, there is provided over the conveyor a roller 29 of a suitable material rigidly mounted on a shaft 30 which is rotated by a suitable drive 31. The roller 29 frictionally contacts the cop on the conveyor to rotate it. The roller is rotatable in opposite directions so as to rotate the cop in the winding or unwinding direction as occasions demand. Near the roller means there is formed a suction hole 32 in the side plate 24*a*, and over the opposite side plate 24*b* a nozzle 33 is directed toward the suction hole 32 across the conveyor. The nozzle jets a stream of air axially of the cop being rotated by the roller 29 so as to unwind the yarn end about the bobbin neck to be sucked into the hole 32, wherein the yarn end is cut off by a suitable cutter provided in the hole but not shown in the figure. The jet and suction perform the first step of the process for unwinding the yarn end of the cop, the succeeding steps of which are performed in the feeder section.

As shown in FIG. 3, the spiders 12*a* and 12*b* are rigidly mounted on a shaft 34 in an axially spaced apart relation at the opposite sides of the conveyor. The shaft is rotated by a suitable drive (not shown) through gears 35*a*, 35*b* and 35*c* in synchronism with circulation of the winding unit 20, FIG. 1. The shaft 34 also drives the conveyor 11. The spider 12*a* comprises five radial arms and five heads 36 formed on the outer ends of the respective arms, three of the heads being designated at 36*a*, 36*b* and 36*c*. The other spider 12*b* also comprises five radial arms with five heads 37, three of which are designated by 37*a*, 37*b* and 37*c*. Each head of the spider 12*a* is paired with and works in cooperation with a corresponding one of the heads of the other spider 12*b*. One cop after another carried on the conveyor is caught between one of the paired heads after another in the manner to be described hereinafter.

Each head of the spider 12*a* is formed with an axial bore 38 open toward the opposed head of the other spider 12*b* and closed at the opposite side by an end wall 39 having a central opening. In the axial bore 38 there is slidably enclosed a cylindrical block 40, which supports an axially extending shaft 41 for simultaneous axial movement with the block 40. The shaft 41 is rotatable relative to the block 40 as will be described later. The shaft 41 has its one end projecting through the block 40 toward the opposed head of the other spider 12*b* and its rear end projecting through the central opening of the end wall 39 of the head 36. A spring 42 coils around the shaft 41 inside the slidable block 40 and normally biases the block and consequently the shaft to its projecting position. Each head of the spider 12*b* is provided with a centrally depressed saucer 43, the center of which is always aligned with the axis of the slidable shaft 41 of the corresponding head 36 of the spider 12*a*. The saucer 43 is rotatable relative to the head 37.

A slot 44 is formed in the lateral wall of each head 36 of the spider 12*a*, and a pin 45 is rigidly secured to the cylindrical wall of the block 40 and projects through the slot 44. This slot is formed aslant so that as the pin 45 is moved along the slot 44, the shaft 41 is axially moved toward or away from the corresponding saucer, thereby holding a cop on the conveyor between the outer end of the shaft 41 and the saucer 43, or releasing the hold on the cop. The movement of the pin 45 is effected by means of stoppers 46*a* and 46*b*. When, upon rotation of the spider 12*a*, each head thereon is brought immediately before a position, like that of the head 36*a* in FIG. 1 or 3, where a cop 10*a* is to be held between the opposed heads, the pin 45 hits on the stopper 46*a* so as to be moved thereby along the slot 44 away from the cop, thereby retracting the shaft 41 to increase the distance between the outer end of the shaft and the opposed saucer 43 enough for the cop to come in therebetween, with the spring 42 in the head 36 being increasingly compressed. Upon further rotation of the spiders, the pin 45 on the head passes through a notch 47*a* formed in the stopper 46*a*, whereupon the force stored in the compressed spring 42 causes the block 40 and consequently the shaft 41 to project toward the bobbin end, with the pin 45 that has been in that end of the slot 44 farthest away from the bobbin end being moved to the opposite end of the slot. In synchronism with the projection of the shaft, the cop 10*a* is brought between the projected end of the shaft and the saucer so as to be held therebetween. Alignment of the axis of each cop on the conveyor with the shaft 41 and saucer 43 is effected by a pair of saw-toothed disks 63*a* and 63*b* rigidly mounted on the drive shaft 34 at opposite sides of the conveyor and inside the spiders. As each cop on the conveyor approaches a position where it is held between the shaft end and the saucer, the opposite necks of the bobbin are engaged by an opposed pair of teeth on the disks so that the cop is raised thereby from on the conveyor into axial alignment with the shaft and saucer, regardless of variation, if any, of the diameter of different cops.

Upon further rotation of the spiders, the pin 45 hits on the other stopper 46*b* and is moved thereby along the slot 44 toward the opposite end thereof so that the shaft is retracted, compressing the spring 42 and at the same time releasing the hold on the cop, whereupon the cop is dropped into the hopper 13 and the pin passes through a notch 47*b* formed in the stopper 46*b*. The stoppers 46*a* and 46*b* are mounted on a U-shaped yoke 48 which is in turn supported on a pair of columns 49.

Generally, a cop has its yarn end wound in a few turns 10′ spirally on the previously wound turns in a backward direction, and then in a few more turns 10″ on one neck of the bobbin, as shown in FIG. 6*a*. In order to have a sufficient length of yarn end drawn out of the cop when it has been supplied to the winding unit, it must have its yarn end unwound and cut off to the condition shown in FIG. 6*d* when it has been brought to a position in front of the suction nozzle 18. The process for unwinding the yarn end and cutting an excess length thereof so as to obtain the yarn end condition of FIG. 6*d* from that of FIG. 6*a* would ideally be carried out in a single step. However, each cop on the conveyor is continuously moved so that the period of time available for treatment of the yarn end is relatively short, and this is true in case the movement of the cops is intermittent. Practically, therefore, the treatment on the cops is performed in several steps, with the resulting advantage that any error in one step can be corrected in the following steps. In the prior art, although the process was carried out in several steps, it was nothing but mere repetition of the same treatment. For example, if in the first step the cop was rotated in such a direction as to unwind the yarn end therefrom, in the next step it was still rotated in the same

unwinding direction. Referring to FIGS. 1, 4 and 5, if the cop 10*a* at position X is rotated in the unwinding direction, that is, clockwise in FIG. 4, the unwound portion of the yarn end may sometimes be wound again on the cop in the unwinding direction as shown at 50 in FIGS. 5 and 6*c*. With such a rewound yarn end, even if the cop is rotated in the same unwinding direction at position Y, the yarn end 50 will never be unwound from the cop, but will be brought to position Z as it is. If at position Z the cop is further rotated in still the same direction, the yarn end will never be drawn out of the cop. In other words, no sufficient length of yarn can be drawn out of the cop by suction applied thereto through the nozzle 18.

The difficulty encountered in the prior art method was caused by rotating the cop at position Y in the unwinding direction even when the cop has its yarn end 50 wound in the unwinding direction. In accordance with the present invention, however, the cop having its yarn end wound in the unwinding direction as shown in FIG. 6*c* is rotated in the winding direction at position Y, so that the yarn end 50 is unwound from the top until the point *p* is reached, whereupon it is again wound on the cop in the winding direction as shown in FIG. 6*d*. The mechanism for accomplishing this result is shown in FIGS. 3 and 4. The shaft 41 of each head 36 of the spider 12*a* is provided at its rear end with a roller 51. When the spider is rotated, each head 36 and consequently the roller 51 thereof are moved along a circle concentric with the drive shaft 34. Three rollers 52*a*, 52*b* and 52*c* are provided so that the roller 51 comes into contact with those rollers to be frictionally rotated thereby when the roller 51 arrives at positions X, Y and Z, successively. The three rollers are rigidly mounted on shafts 53*a*, 53*b* and 53*c*, which in turn have gears 54*a*, 54*b* and 54*c*, respectively. The gears 54*a* and 54*c* mesh directly with pinion gears 55*a* and 55*c* rigidly mounted on shafts 56*a* and 56*c*, respectively, but the gear 54*b* meshes with a pinion gear 55*a* rigidly mounted on a shaft 56*b*, indirectly through an idle gear 57. The shafts 56*a*, 56*b* and 56*c* are journaled on the yoke 48 so that the pinion gears 55*a*, 55*b* and 55*c* mesh with a larger gear 58 which is freely mounted on the shaft 34 and driven by a drive gear 59. Three rods 60*a*, 60*b* and 60*c* connects the three pairs of shafts 53*a* and 56*a*, 53*b* and 56*b*, and 53*c* and 56*c*, respectively, so that the rods are pivotable about the shafts 56*a*, 56*b* and 56*c*, respectively. Springs 61*a*, 61*b* and 61*c* having their respective one ends secured to stationary supports 62*a*, 62*b* and 62*c* bear at their respective other ends on the connecting rods 60*a*, 60*b* and 60*c*, so that each of the rollers 52*a*, 52*b* an 52*c* bears on the roller 51 of each head 36 of the spider 12*a* with a sufficient pressure to effect a rotary drive connection between each contacting pair of rollers. The gear connections may be replaced by any other suitable means, such as belt means.

Suppose that the gear 58 is rotated counter-clockwise in FIG. 4. Then the gears 54*a* and 54*c* and consequently the rollers 52*a* and 52*c* are rotated in the same counter-clockwise direction, but the gear 54*b* and consequently the roller 52*b* are rotated in the opposite, clockwise direction due to the existence of the intermediate gear 57. Consequently, the roller 51 on each head 36 is rotated clockwise when it is contacted by the rollers 52*a* and 52*c*, but counter-clockwise when it is contacted by the roller 52*b*. The net result is that each cop is rotated clockwise in FIG. 4, that is, in the unwinding direction at position X, and then counter-clockwise, that is, in the winding direction at position Y, and finally in the unwinding direction at position Z where the cop faces the suction nozzle 18. Since the cop is rotated in the yarn-winding direction at position Y, any yarn end wound thereon in the unwinding direction in the previous step of the process will be properly rewound on the cop in the winding direction so as to be ready to be unwound therefrom in the next and final step of the process. Referring to FIG. 5, the suction cutters 15*a* and 15*b* are held in position by angle members 64*a* and 64*b* secured to the cover 28*a*. The cutters (not shown) are driven by belts 65*a* and 65*b*, respectively.

A searcher 66 may advantageously be provided to act on the yarn end 50 of the cop 10*b* at position Y. The searcher has a claw 67 extending substantially tangentially of the cop and directed oppositely to the rotational direction thereof so that the claw engages the yarn end 50 to help rewind it on the cop in the winding direction as shown in FIG. 6*d*.

Although in the above embodiment the cop is rotated in the unwinding direction in the first and second steps of the unwinding process, it may also be rotated in the winding direction either in the first or second step, or in both the first and second steps, depending upon the nature of the yarn, with necessary minor change of the concerned parts of the mechanism which will be apparent to those hwo have read the specification. In the latter case, the cop may be brought to position Y, with the yarn end wound in the winding direction and lying toward the left-hand end of the cop as shown in FIG. 6*b*. Experience shows that if the cop with that yarn end condition is brought to position Z and rotated in the unwinding direction, with suction being applied thereto through the nozzle 18, the yarn will never be drawn out of the cop. In accordance with the invention, however, as the cop is rotated in the winding direction at position Y, the claw 67 of the searcher 66 engages with the yarn end under the condition of FIG. 6*b* so as to bring the yarn end to the middle and the right-hand side of the cop to be drawn out therefrom by the suction applied thereto at position Z.

Having illustrated and described a preferred embodiment of the invention, it is to be understood that the invention is not limited thereto, and that there are many modification and changes thereof withoutt departing from the true scope of the invention as defined in the appended claims.

What we claim is:

1. An automatic cop feeder comprising, in combination with a winding machine including a cop magazine and a plurality of winding units fed by said magazine: means for containing cops, means for conveying said cops from said containing means to said magazine, means for taking up one of said cops after another from said conveying means and supplying them into said magazine; first suction means for applying suction to each said cop immediately before it is supplied into said magazine; first rotating means incorporated in said taking-up means for rotating each said cop being held by said taking-up means in the unwinding direction simultaneously with application of said suction; second rotating means incorporated in said taking-up means for rotating each said cop being held by said taking-up means in the winding direction before it is rotated by said first rotating means; second suction means for applying suction to each said cop while it is being rotated by said second rotating means; and means associated with said second suction means for cutting an excess length of the yarn end unwound from each said cop.

2. The automatic cop feeder as defined in claim 1, further including searcher means operable in cooperation with said second rotating means for engaging the yarn end of each said cop being rotated by said second rotating means.

3. An automatic cop feeder comprising, in combination with a winding machine including a cop magazine and a plurality of winding units fed by said magazine: means for storing cops, means for conveying said cops from said storing means to said magazine, means for taking up one of said cops after another from said conveying means and supplying them into said magazine; first suction means

for applying suction to each said cop immediately before it is supplied into said magazine; first rotating means incorporated in said taking-up means for rotating each said cop being held by said taking-up means in the unwinding direction simultaneously with application of said suction; second rotating means incorporated in said taking-up means for rotating each said cop being held by said taking-up means in the winding direction before it is rotated by said first rotating means; second suction means for applying suction to each said cop while it is being rotated by said second rotating means; third rotating means asociated with said conveying means for rotating each said cop on said conveying means in the unwinding direction before it is rotated by said second rotating means; means associated with said third rotating means for applying a jet stream of air to each said cop substantially axially thereof as it is being rotated by said third rotating means; third suction means operable in cooperation with said jet means for applying suction to each said cop in such a direction as to increase the efficiency of said jet stream of air; and means associated with said third suction means for cutting an excess length of the yarn end unwound from each said cop.

4. The automatic cop feeder as defined in claim 3, further including searcher means operable in cooperation with said second rotating means for engaging the yarn end of each said cop as it is being rotated by said second rotating means.

5. The automatic cop feeder as defined in claim 3, wherein said third rotating means is so arranged as to rotate each said cop in the winding direction.

6. The automatic cop feeder as defined in claim 4, wherein said third rotating means is so arranged as to rotate each said cop in the winding direction.

7. An automatic cop feeder comprising, in combination with a winding machine including a cop magazine and a plurality of winding units fed by said magazine: means for storing cops, means for conveying said cops from said storing means to said magazine, means for taking up one of said cops after another from said conveying means and supplying them into said magazine; first suction means for applying suction to each said cop immediately before it is supplied into said magazine; first rotating means incorporated in said taking-up means for rotating each said cop being held by said taking-up means in the unwinding direction simultaneously with application of said suction; second rotating means incorporated in said taking-up means for rotating each said cop being held by said taking-up means in the winding direction before it is rotated by first rotating means; second suction means operable in cooperation with said second rotating means for applying suction to each said cop while it is being rotated by said second rotating means; third rotating means incorporated in said taking-up means for rotating each said cop in the unwinding direction before it is rotated by said second rotating means; third suction means operable in cooperation with said third rotating means for applying suction to each said cop while it is being rotated by said third rotating means; fourth rotating means associated with said conveying means for rotating each said cop on said conveying means in the unwinding direction before it is rotated by said third rotating means; means asociated with said fourth rotating means for applying a jet stream of air to each said cop substantially axially thereof while it is being rotated by said fourth rotating means; and means asociated with said jet means for cutting an excess length of the yarn end unwound from each said cop.

8. The automatic cop feeder as defined in claim 7, further including searcher means operable in cooperation with said second rotating means for engaging the yarn end of each said cop as it is being rotated by said second rotating means.

9. The automatic cop feeder as defined in claim 7, further including a fourth suction means operable in cooperation with said jet means for applying suction to each of said cop in such a direction as to increase the efficiency of said jet stream of air.

10. The automatic cop feeder as defined in claim 8, further including a fourth suction means operable in cooperation with said jet means for applying suction to each said cop in such a direction as to increase the efficiency of said jet stream of air.

11. The automatic cop feeder as defined in claim 10, wherein said third rotating means is so arranged as to rotate each said cop in the winding direction.

12. The automatic cop feeder as defined in claim 10, wherein both said third and fourth rotating means are so arranged as to rotate each said cop in the winding direction.

13. The automatic cop feeder as defined in claim 9, wherein said third suction means is provided with means for cutting an excess length of the yarn end unwound from each said cop.

14. The automatic cop feeder as defined in claim 13, further including searcher means operable in cooperation with said second rotating means for engaging the yarn end of each said cop being rotated by said second rotating means.

15. The automatic cop feeder as defined in claim 13, wherein said third rotating means is so arranged as to rotate each said cop in the winding direction.

16. The automatic cop feeder as defined in claim 14, wherein said third rotating means is so arranged as to rotate each said cop in the winding direction.

17. The automatic cop feeder as defined in claim 13, wherein said second suction means is provided with means for cutting an excess length of the yarn end unwound from each said cop.

18. The automatic cop feeder as defined in claim 17, further including searcher means operable in cooperation with said second rotating means for engaging the yarn end of each said cop being rotated by said second rotating means.

19. The automatic cop feeder as defined in claim 17, wherein said third rotating means is so arranged as to rotate each said cop in the winding direction.

20. The automatic cop feeder as defined in claim 18, wherein said third rotating means is so arranged as to rotate each said cop in the winding direction.

**References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 3,224,694 | 12/1965 | Isao Oishi | 242—35.5 |
| 3,279,710 | 10/1966 | Raasch | 242—35.5 |

FOREIGN PATENTS

| | | |
|---|---|---|
| 6,429 | 6/1962 | Japan. |

STANLEY N. GILREATH, *Primary Examiner.*