Toyoda Continuous Auto-doffer

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1. Introduction

Toyoda Automatic Cop Doffer, model ACD, specially built to cope with the modernization of spinning mills, has two outstanding advantages. First, it is simple in build although it is not single-cop doffer. Second, it doffs several cops at a time and keeps the relative velocity between the doffing head and the spindles zero.

It saves the operatives a tremendous amount of work hitherto required to doff cops. It has high doffing efficiency and works reliably. Not only can it be worked easily, but it is equipped with a safety apparatus to take care of any mishap. It is a high-efficiency, trouble-free automatic cop doffer of a continuous movement wagon type multi-doffing system.

2. Performance

Fig. 1 shows a side view of the doffing and donning heads of the automatic cop doffer, viewed from the side on which the spindles are arrayed.

Eleven bobbin catchers go round the donning head along a built-in race. Eleven cop catchers go around the doffing head along a built-in race.

The doffer moves forward in the reverse direction to the five catchers of each head, which are placed on the spindle line of the spinning frame, but the doffer and catchers move at the same speed.

Therefore, cops are doffed and bobbins donned as if the doffer were at a standstill. This completely avoids stress to the spindles. Another great advantage is that doffing and donning can be done slowly and surely, because the five catchers of each head are always in operation.

The cop catcher lowers to reach the top of the cop at the position ①, as shown in Fig. 1. Then, the elastic ring fitted inside the catcher firmly grips the cop when the cop kicker kicks up the cop. The cop is completely removed from the spindle at the position ② and rapidly carried away from the spindle line to keep the yarn wound on the spindle.
Before the cop catcher reaches the opposite side of the doffing head, the yarn is severed by the cutter and the thread end from the spindle is kept in contact with the front face of the spindle by the thread-end-holding brush. As this brush also moves at the same speed in the opposite direction to the doffer itself, the thread end kept on the brush is in static stage toward the spindle.

The bobbin held by the bobbin catcher of the donning head is slowly inserted into the spindle by the downward motion of the bobbin catcher and firmly fitted to the spindle at the position \( \Theta \), where the bobbin releasing and pressing device actuates itself to give proper pressure to the bobbin.

At this time, the brush continues to hold the thread end until the insertion of the bobbin gives tension to the thread held in the brush. Therefore, the thread is pieced up completely.

The second conveyor moves at the same speed as the bobbin catchers. Both the bobbin catchers and the pegs on the second conveyor are of the same pitch. For these reasons, bobbins are easily picked up. Cops removed from the spindles by the doffing head are transferred to the empty pegs on the second conveyor.

Cops lined up in a row in the lower part of the second conveyor and spaced as widely as the spindle gauge are kicked off the pegs by adjusting the time for kicking, so that there may be 16 cops in a line.

Each bottom plate of the two cop boxes, supported upward by the fork, descends by the diameter of the cop to leave a space for arrangement of the subsequent cops when kicked-off cops are fully lined up in a single row on the bottom plate. This movement of the bottom plate is automatically made by the fork provided on the automatic cop doffer. The fork automatically works to raise the bottom plate of the empty cop box, which is replaced with a full cop box after doffing is completed.

If misdoffing takes place because a bobbin is deformed, the empty bobbin to be inserted into the spindle in which misdoffing has occurred is not caught by the peg on the second conveyor but held in a space box. The automatic cop doffer keeps moving, leaving the full spindle unsupplied with an empty bobbin.

When an empty bobbin is put reversely in the bobbin hopper, the doffer keeps doffing without a stop.
3. Inter-operation between Auto-doffer and Spinning Frame

To achieve the maximum effect of the automatic cop doffer, the ring spinning frame is equipped with a number of automated devices, including an automatic full bobbin stop, a ring rail winding-down motion, an automatic ring rail re-raising motion, an automatic lappet angle-tilting and repositioning motion, an automatic forward motion for the auto-doffer, and an automatic restarting motion for the spinning frame.

An operative is required only for the following stages of work:
1) Push-button operation to move the wagon equipped with both doffing and donning heads to the out-end of the frame, on which a signal lamp indicating a full bobbin is lit.
2) Replacement of the bobbin hopper and bobbin boxes.
3) Operating a handle to connect the wagon with the rail of the spinning frame by means of a short rail.

Thus, one set of Toyoda Automatic Cop Doffer can do doffing and donning for 13,000 spindles for 40's yarn. Moreover, it can be easily connected with the subsequent process, i.e., the automatic spooler.

Fig. 3 shows the inter-operation between the automatic cop doffer and the ring spinning frame.

a) Lighting of the yellow lamp at the out end as a call signal for the auto doffer.
b) Lighting of the red lamp at the gear end indicating full bobbin.
c) Automatic ring rail winding-down.
d) Stopping the machine operation.
e) Automatic lappet angle-tilting motion.
f) Automatic ring rail re-raising motion.
g) Alarm-raising.
h) Automatic forward motion for the automatic cop doffer.
i) Completion of doffing and donning.
j) Failure of the red lamp at the gear end.
k) Automatic lappet angle re-positioning.
l) Automatic ring rail heaving motion.
m) Automatic re-starting of the spinning frame.
n) Failure of the yellow lamp at the out end.
o) Operation of the automatic cop doffer stops.

4. Specifications

Briefly Toyoda Automatic Cop Doffer is of the following specifications:
(1) Cop-doffing and bobbin-donning heads, a device to raise and lower them.
(2) First and second conveyors.
(3) Cop-arranging device.
(4) Misdoффing detection device.
(5) Misplaced-bobbin detection device.
(6) Automatic forward motion for auto doffer.
(7) Re-starting motion for spinning frame.
(8) Motors:
   - Main motor 400 W
   - Head lifting motor 200 W
   - Cop-arranging motor 200 W
   - Wagon motor 750 W
(9) Time required for doffing (spinning frame with 400 spls.).
   Forward motion (from O.E. spindle to G.E. one) 2 mins. & 40 secs.
   Return motion 1 min & 20 secs.

(10) Wagon speed 30 m/min.

Fig. 4 gives the main dimensions of the auto-doffer used for a ring spinning frame 940 mm in width and 178 mm in lift.