May 26, 1964 C. L. STILL 3,134,144

CARDING AND DRAFTING APPARATUS

Filed Dec. 30, 1960 4 Sheets-Sheet 1

FIG. 1

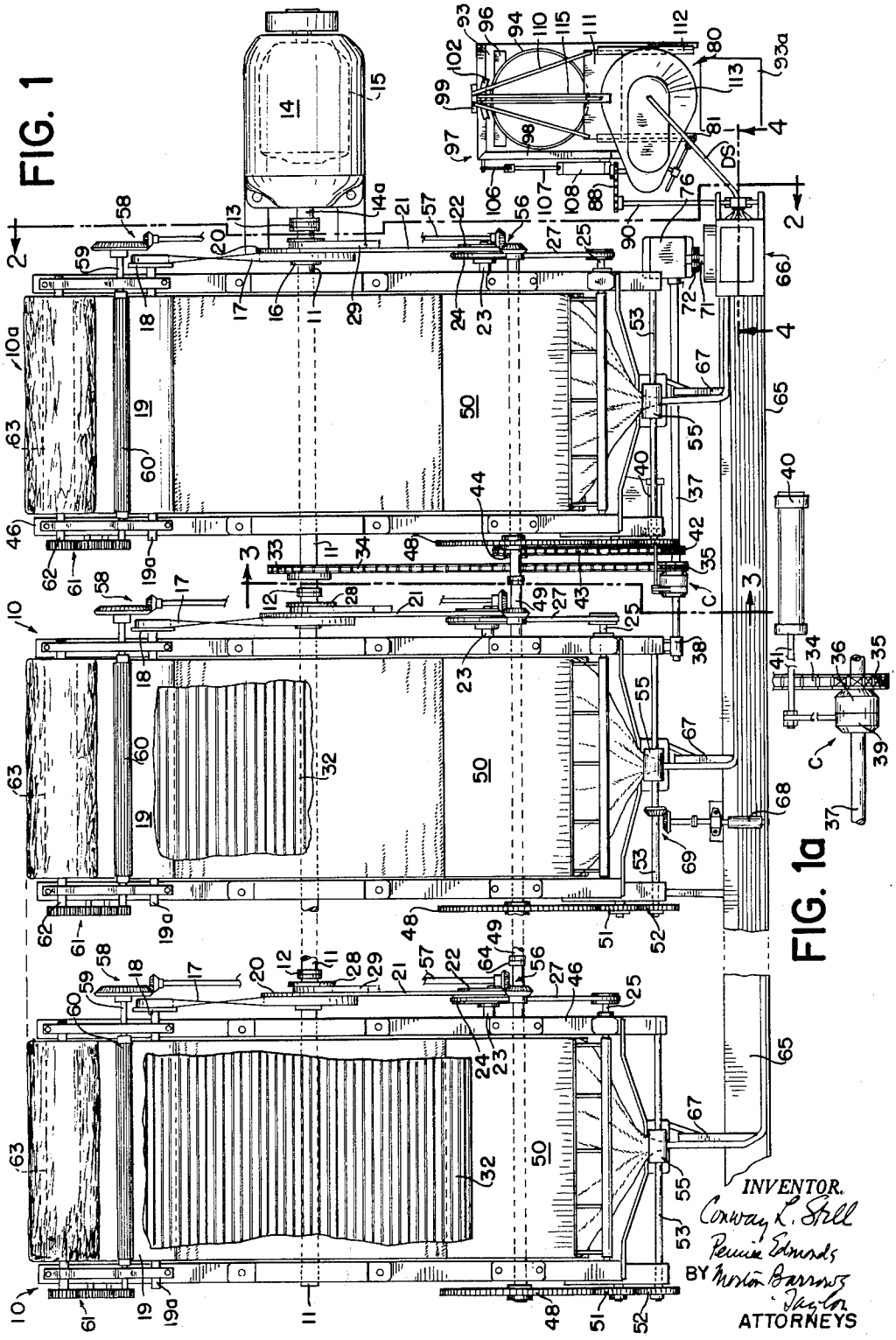

FIG. 1a

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FIG. 2

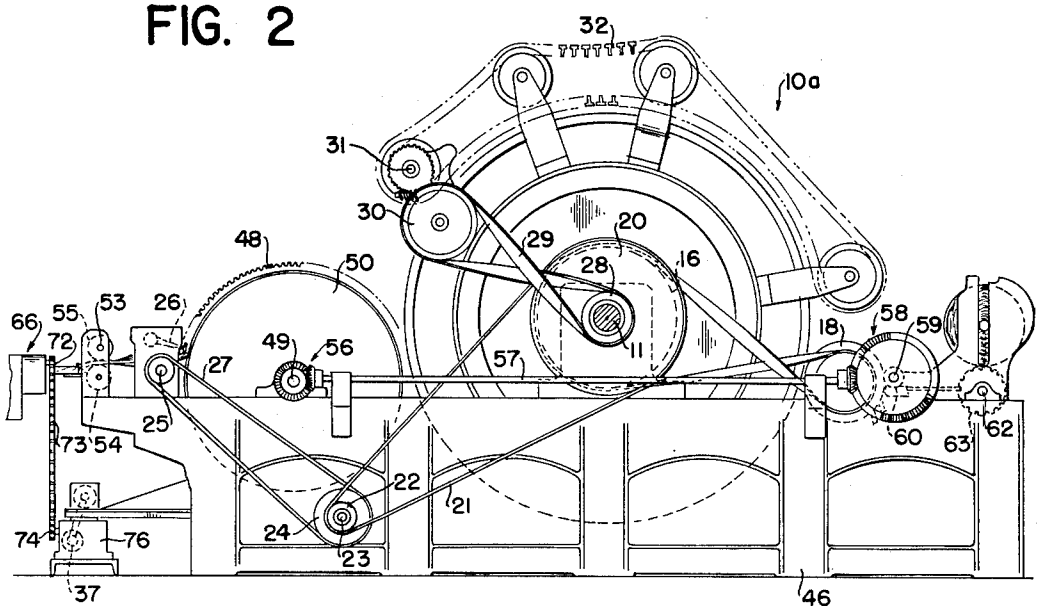

FIG. 3

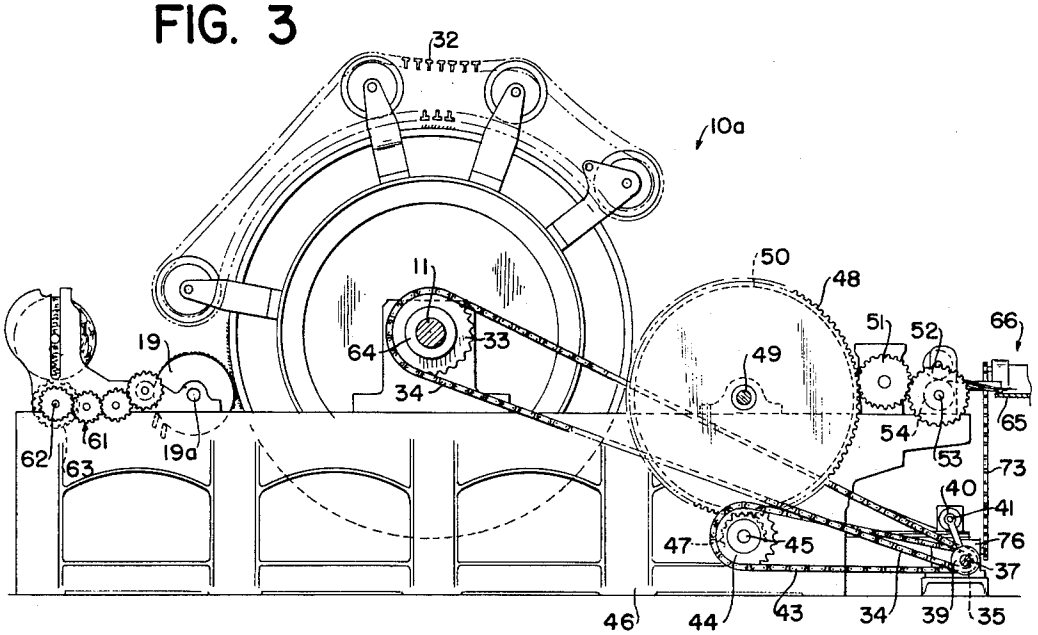

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FIG. 4

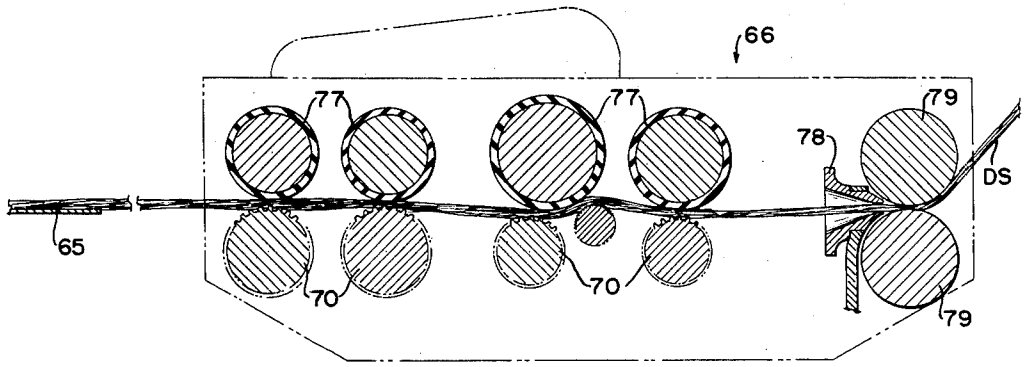


FIG. 5

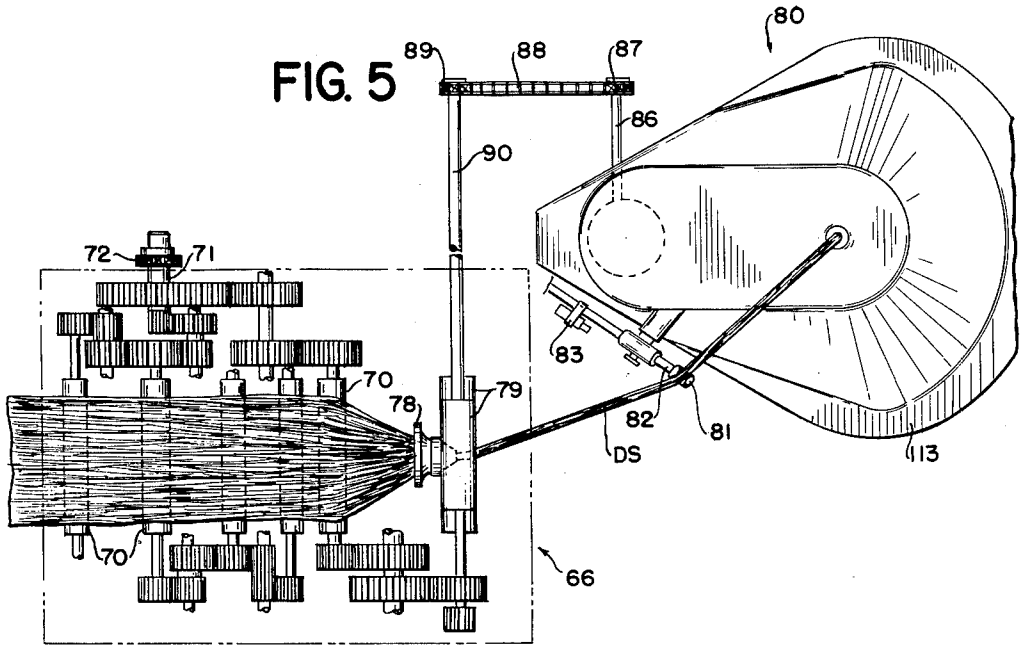
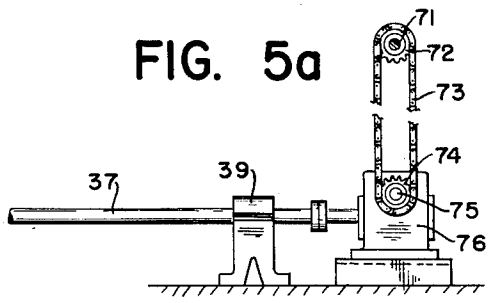


FIG. 5a



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CARDING AND DRAFTING APPARATUS

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FIG. 6

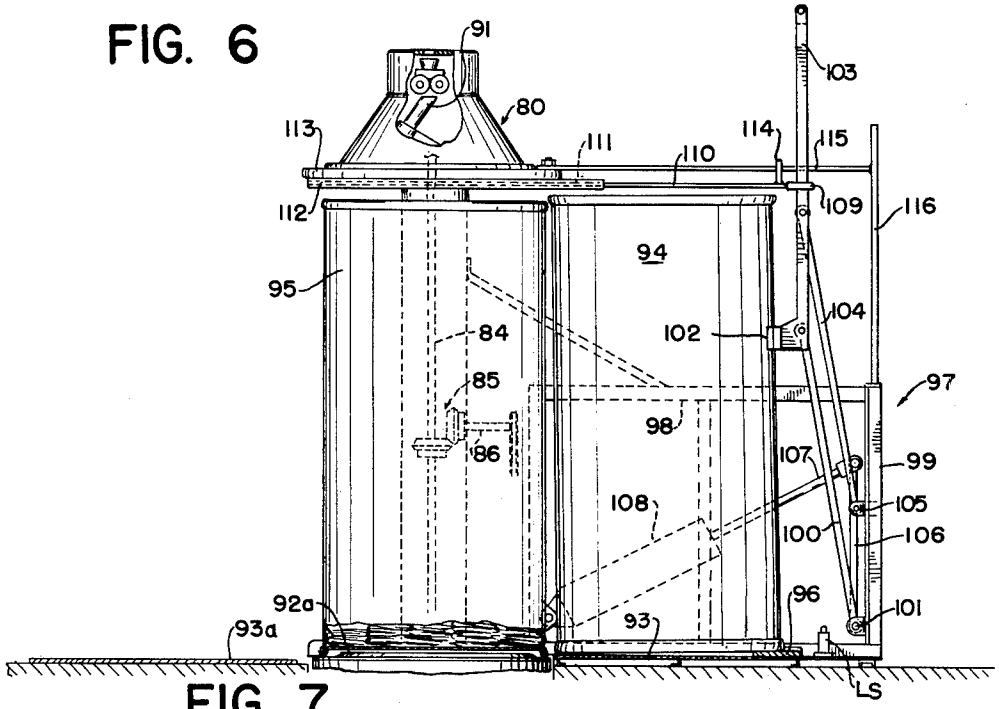


FIG. 7

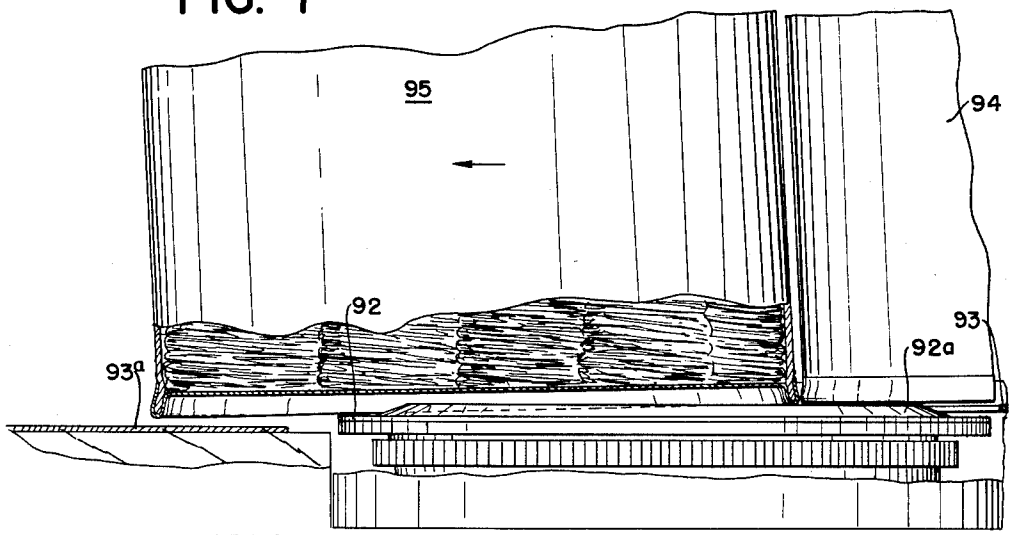
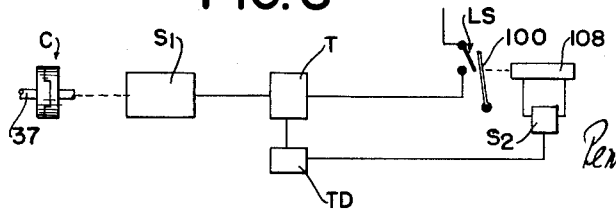


FIG. 8



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United States Patent Office

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3,134,144

CARDING AND DRAFTING APPARATUS

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Filed Dec. 30, 1960, Ser. No. 79,608
14 Claims. (Cl. 19—98)

This invention relates to the carding of fibers to produce a sliver and the drafting of the sliver so produced as those operations are carried out in the cotton system. More particularly, the invention is concerned with a novel apparatus, in which a plurality of carding operations are simultaneously performed and the slivers produced are drafted in a group and combined into a single sliver, which is deposited in a coil in a can. In the new apparatus, the carding operations are carried on by cards, which are of the revolving flat type and generally conventional in construction. The number of cards used, the rate of production of each card, and the draft, to which the group of slivers is subjected, are chosen with regard to the quality of the final single sliver to be produced and the apparatus may include from four to twelve cards. Ordinarily, six or more cards will be employed and a typical form of the apparatus includes eight cards and subjects the slivers to a draft of eight. The final sliver produced in the typical unit is of such quality that it may be converted into a combed yarn with a subsequent drawing operation eliminated and corresponding savings in machine investment, floor space, labor, and power consumption.

The cards in the apparatus of the invention are arranged side by side in a row with their cylinder shafts aligned and connected together and the shaft of the end card at one end of the row is connected to a prime mover. A draw box is disposed near the end card and the slivers produced in the several cards are advanced along a guide to the draw box, in which the slivers are drafted and combined into a single sliver. The sliver issuing from the draw box passes in contact with an element of a stop motion to a coiler, which deposits the sliver in a can, and, periodically, a can doffer operates automatically to replace the full can with an empty one. A novel drive is provided for the doffers, the feed, lap, and calender rolls of the several cards, and the draw box and the coiler. The use of this drive permits the components driven thereby to be slowed down or stopped in order that the sliver may be properly severed in the can doffing operation and a condition resulting in functioning of the stop motion can be corrected.

For a better understanding of the invention, reference may be made to the accompanying drawings, in which

FIG. 1 is a fragmentary plan view of one form of the new apparatus;

FIG. 1*a* is a fragmentary plan view on an enlarged scale showing a part of the card drive;

FIGS. 2, 3, and 4 are sectional views on the lines 2—2, 3—3, and 4—4, respectively, of FIG. 1;

FIG. 5 is a plan view of the draw box and coiler with the draw box shown diagrammatically;

FIG. 5*a* is a fragmentary elevational view showing the drive for the draw box;

FIG. 6 is a view in side elevation of the can doffer;

FIG. 7 is a fragmentary elevational view with parts broken away showing the action of the can doffer; and

FIG. 8 is a simplified wiring diagram of the device for controlling the novel drive.

The carding and drafting apparatus of the invention in the form shown in the drawings comprises a plurality of cards **10** (FIGS. 1–3, incl.) of the conventional revolving flat type. Each card is complete in itself and mounted on its own base and the apparatus may include four to twelve such cards. The cards are disposed side by side in a row with their cylinder shafts **11** aligned and connected by couplings **12** and the cylinder shaft of the card **10***a* at one end of the row is driven by a prime mover, such as a line shaft or a motor. In the apparatus illustrated, the cylinder shaft **11** of the end card **10***a* is connected through a coupling **13** to the output shaft **14***a* of a fluid drive gear reduction unit **14** which is disposed above and has its input shaft connected to the shaft of an electric motor **15**.

The cylinder shaft **11** of each card carries a compound pulley, part **16** of which is connected by a belt **17** to a pulley **18** on the shaft **19***a* of the licker-in **19** of the card, while the other part **20** of the compound pulley is connected by a belt **21** to an idler pulley **22** on a stud **23**. A pulley **24** also mounted on the stud **23** is connected to the pulley **22** and drives the shaft **25** of the comb **26** of the card through a belt **27**. A third pulley **28** on the cylinder shaft is connected by a belt **29** to a pulley **30** which is connected through gearing to the shaft **31** of the sprocket wheels driving the series of flats **32**.

The cylinder shaft **11** of the end card **10***a* carries a sprocket wheel **33** connected by a chain **34** to a sprocket wheel **35** attached to one element **36** of a clutch C. The clutch element is mounted for free rotation on a countershaft **37** but is held against longitudinal movement relative thereto. The countershaft lies at the delivery end of the end card **10***a* and is mounted for rotation in pillow block bearings **38**. The second element **39** of the clutch is mounted on the shaft to rotate therewith but may be moved longitudinally to engage the element **36** by a fluid cylinder **40** having a piston rod **41** connected to the clutch element **39**.

The countershaft **37** carries a sprocket wheel **42** connected by a chain **43** to a sprocket wheel **44** on a stud **45** mounted on the frame **46** of the card **10***a*. A gear **47** on the stud is attached to the sprocket wheel **44** and meshes with a gear **48** on the shaft **49** of the doffer **50** of the card. The gear **48** also meshes with a gear **51** which meshes with a gear **52** on the shaft **53** of the lower calender roll **54**. The shaft of the roll **54** is geared in the usual way to the shaft of the upper calender roll **55**.

The doffer shaft **49** of the end card **10***a* is connected through bevel gearing **56** to one end of a shaft **57**, the other end of which is connected through bevel gearing **58** to one end of the shaft **59** of the feed roll **60** of the card. The other end of the feed roll shaft is connected through a chain of gears **61** to the shaft **62** of the lap roll **63** of the card.

The shafts **49** of the doffers of the several cards are connected together by couplings **64** so that all the doffers are driven from the countershaft **37** through the chain **43**, the sprocket wheel **44**, and the gears **47** and **48**. The doffer shaft of each card carries a gear **48** for driving the calender rolls of the card through gears **51** and **52** and the doffer shaft of each card is also connected to drive the feed roll and lap roll of the card through driving connections described in connection with the card **10***a*.

A sliver guide **65** in the form of a flat strip of polished metal with a low side is mounted to extend along the row of cards at the delivery ends thereof and terminates close to a draw box **66**, such as is used in a comber. The draw box is mounted beyond the delivery rolls of the end card **10***a* and supported from the frame of that card. A guide **67** attached to the calender roll stand of each card extends over the sliver guide **65** to direct the sliver issuing from the card to its proper position on the sliver guide **65**. The guides **67** project different distances over the guide **65** and insure that the slivers deposited on the guide **65** will lie side by side and in contact. The slivers are drawn along the guide **65** partly by the action of the rolls in the draw box and partly by helper rolls **68** mounted to rest upon the group of slivers in the guide **65**. Each helper roll lies in front of a card and is driven through bevel gearing **69** from the calender roll shaft **53** of the card. The helper rolls are driven at a slightly higher surface speed than the speed of movement of the sliver along guide **65** produced by the action of the draw box **66** and only a few helper rolls are required.

The draw box (FIGS. 1, 3, 4, 5, 5*a*) is of conventional construction and includes a series of fluted bottom rolls **70** which are driven through gearing by a shaft **71** having a sprocket wheel **72** connected by a chain **73** to a sprocket wheel **74** mounted on a shaft **75** connected through bevel gearing within a casing **76** to the countershaft **37**. The draw box includes the usual covered top rolls **77** held in contact with respective bottom rolls by spring or weight loading and the pairs of rolls are driven at successively higher speeds to apply a draft to the slivers. The drafted slivers leaving the front pair of rolls of the draw box enter a trumpet **78** and are combined into a single sliver DS which passes between calender rolls **79** driven through gearing from the front bottom roll of the draw box.

The sliver DS leaving the calender rolls of the draw box travels to the top of a collar **80** (FIGS. 6, 7) and, on its way, rests upon the spoon **81** of a counter-weighted lever **82** pivoted on a suitable part of the coiler and carrying a mercury switch **83** in a stop motion circuit. So long as the drafted sliver DS is formed by the drafting of the slivers from all the cards in use, its weight is sufficient to maintain the lever **82** in such position as to hold the switch **83** open but, if the weight of the drafted sliver DS drops because of a failure of the sliver from one of the active cards to reach the draw box, the lever **82** will tilt so that switch **83** will be closed and the clutch member **39** will be moved by the cylinder **40** away from the clutch member **36** to disconnect the countershaft from the coupled cylinder shafts. As the doffer, the feed, lap, and calender rolls of the cards are all driven from the countershaft, the disengagement of the clutch will cause a stoppage in the delivery of sliver by the respective cards.

The collar has the usual vertical shaft **84** connected through bevel gearing **85** to a shaft **86** carrying a sprocket wheel **87** and a chain **88** connects the sprocket wheel to a sprocket wheel **89** on the shaft **90** of one of the calender rolls of the draw box. The coiler includes a tube gear driven from the shaft **84** and provided with the usual tube **91** acting as a rotary sliver guide, the gear having a flat bottom face. The coiler also includes a turntable **92** driven from the shaft **84** and the turntable may have a flat top or be provided with an upwardly tapered crown **92***a*. The turntable lies within a semi-circular opening in a base **93**, which is of sufficient size to support an empty can **94** in proximity to the can **95** on the turntable. The base is mounted on supports above the floor level and with its top lying above the plane of the top of the turntable and, preferably, in the plane of the top of the crown, if the turntable has a crown. The curved edge of the base adjacent the turntable is an arc with its ends lying at opposite sides of the center of the turntable and having a radius not substantially greater than that of a can, so that it acts to center the can on the turntable. A pad **96** is mounted on the top of the base at a distance from the curved edge of the base and in such position that, when the rear edge of the empty can rests on the pad, the can will be tilted toward the can on the turntable.

A framework **97** is mounted on the base and includes a side frame **98** extending along the side edge of the base adjacent the card **10***a* and a rear frame **99** extending upward from the base at the rear thereof. An arm **100** is rigidly attached at one end to a shaft **101** in bearing brackets on the front face of a cross-bar of the rear frame **99** and, at its other end, the arm is attached to a plate **102** serving as a can pusher and having a concave front face engageable with an empty can on the base above the center of gravity of the can. A rod **103** is attached to the pusher **102** and extends upwardly therefrom and a link **104** is attached at one end to the rod between the ends of the rod. The other end of the link is pivotally attached to a bracket **105** so mounted on the frame **99** that the link lies parallel to the arm **100**. A lever arm **106** attached rigidly to the shaft **101** has its free end connected to the piston rod **107** of a piston within a fluid-operated cylinder **108**.

The rod **103** projects through a ring **109** attached to a pair of rods **110** which extend forward divergently from the ring and are attached at their front ends to the rear edge of a sliver severing plate **111** having a serrated front edge and movable in guides **112** secured to the lower face of the head **113** of the coiler at opposite sides of the exposed lower face of the tube gear. The rods **110** are also connected by a ring **114** which encircles a guide rod **115** attached to the head **113** and to a rod **116** rising from the top of the frame **99**.

The operation of the can doffer is controlled electrically as shown diagrammatically in FIG. 8 and the control means includes means, such as a conventional sliver yardage counter or a timer T, which functions periodically to energize the solenoid S_1 controlling the fluid cylinder **40** to cause the cylinder to disengage clutch C, through which the countershaft **37** is connected to the coupled cylinder shafts. Upon disengagement of the clutch, the doffers and the feed, lap, and calender rolls of the cards and the draw box and the coiler begin to slow down. The counter or timer also actuates the time delay relay TD which functions after an interval to energize the solenoid S_2 to cause the cylinder **108** to swing the can doffer arm **100** counter-clockwise, as shown in FIG. 6. The pusher **102** then starts to push the empty can **94** while maintaining it tilted so that the top rim of the empty can engages the top rim of the full can **95**. As the pusher advances the empty can, the full can is tilted so that it rests upon the turntable only at one point and can be easily moved off the turntable over the crown thereof, if such a crown is present, and onto a wear plate **93***a* lying beyond the end of the base. In the forward movement of the pusher **102**, it moves the plate **111** across the flat lower face of the tube gear to sever the sliver issuing from the sliver guide tube **91**. When the arm **100** has moved forward to complete the replacement of the full can by the empty can, the arm actuates a limit switch LS which resets the timer and de-energizes the solenoids S_1 and S_2. The hydraulic cylinders **40** and **108** then operate to re-engage the clutch C and retract the pusher mechanism so that an empty can can be placed on the base with its rear edge resting on the pad **96**.

The inclusion in the preferred form of the carding and drafting apparatus of the invention of six or more cards of conventional size results in the discharge of sliver from the tube of the tube gear at a speed which may be as high as from 500 ft. to 600 ft. a minute. With the sliver leaving the tube at that rate, it is impractical to doff the cans manually because of the difficulty of breaking the sliver and the quantity of sliver which would pile up in the turntable after the full can was removed and before the empty can could be put in place. When the cans are doffed automatically, it is desirable that the delivery of

the slivers from the cards and the operation of the draw box and the coiler be slowed down so that the sliver can be properly severed in the doffing operation between the full and empty can. If desired, the interval between the disengagement and the re-engagement of the clutch C may be sufficiently long to permit the card doffers and the other components driven from the countershaft to come to a full stop and no damage will then be done to the individual slivers, so long as the card doffers are not stopped for more than a few seconds. However, it is preferable that the countershaft and the components driven thereby be slowed down and not stopped, since, with the parts in motion, less load is imposed on the driving connections upon resumption of normal operation.

While it would be possible to slow down the rate of delivery of the final sliver from the tube of the tube gear by cutting off the current supply to the motor, such action would require that all the moving components of all the cards be brought up to speed after each doffing operation and this would cause objectionable strains to be imposed on the driving connections. With the new drive, the operation of the cylinders, licker-ins, flats, and combs of the cards is uninterrupted during can doffing and, as these parts are heavy, their inertia affords substantial assistance to the motor in restoring the countershaft and the card components driven thereby to normal speed at the conclusion of a can doffing operation. The apparatus is thus able to function with frequent can doffing without damage to the motor and driving connections.

The cans used for receiving the drafted sliver in the new apparatus are larger than the can ordinarily used with a card and have a capacity several times that of the small can. The use of such large cans and the subjection of the slivers issuing from the cards to a drafting operation improve the quality of the drafted sliver because of the elimination of sliver splices and other defects caused by manual can handling and by errors by the operators.

As pointed out above, the typical apparatus of the invention including eight cards can be operated to produce a drafted sliver of such quality that it can be converted into a combed yarn with only a single drawing operation before combing instead of the two such operations normally required between the cards and the comber. A form of the new apparatus can be also used to advantage in the production of carded yarn and, in some instances in that application, the sliver issuing from the unit is so superior to that produced by the conventional card and a single drawing operation that the finisher drawing operation ordinarily used in the production of carded yarn can be eliminated.

I claim:

1. A carding and drafing apparatus, which comprises a plurality of cards producing respective slivers and each having a cylinder, a doffer, and a licker-in, the cylinder, doffer, and licker-in having respective shafts, the cards being arranged in a row with their cylinder shafts aligned, means for coupling the cylinder shafts, a prime mover connected to the coupled cylinder shafts, means for driving the licker-in shafts, a counter shaft parallel to the cylinder shafts, a driving connection between one cylinder shaft and the countershaft, the driving connection including a clutch, means for driving the doffer shafts from the countershaft, a draw box receiving the slivers issuing from the cards and discharging a single drafted sliver, a coiler receiving the drafted sliver and depositing it in a can, means for driving the draw box and the coiler from the countershaft, can doffing means for replacing a full can by an empty one, and means operating after the deposit of a selected quantity of sliver in the can to disengage the clutch and start the operation of the can doffing means.

2. The apparatus of claim 1, in which the draw box is disposed at the delivery end of a card at one end of the row, a stationary flat plate forming a sliver guide extends along the row of cards at their delivery ends and supports the slivers on their way from the cards to the draw box, helper roll means engage the slivers on the guide and help to advance them, and the helper roll means are connected indirectly and operatively to the countershaft to be driven thereby.

3. The apparatus of claim 2, in which each card has calender rolls, one of which has a shaft operatively connected to the doffer shaft of the card, and the helper roll means include at least one helper roll operatively connected to the shaft of a calender roll of an adjacent card to be driven thereby.

4. The apparatus of claim 1, in which the shafts of the doffers of the cards are aligned, means are provided for coupling the doffer shafts, and the coupled doffer shafts are driven by a connection between one of the doffer shafts and the countershaft.

5. The apparatus of claim 1, in which the draw box has calender rolls indirectly driven by the countershaft, the coiler has a drive shaft, and the draw box calender rolls are connected to the coiler drive shaft through a driving connection.

6. The apparatus of claim 1, in which the coiler includes a turntable for rotating the can being filled and a rotating sliver tube and the can doffing means includes a support for an empty can near the can being filled on the turntable and means for engaging the side of an empty can on the support and moving it against the full can and onto the turntable, the full can being pushed off the turntable at the same time.

7. The apparatus of claim 6, in which the can doffing means includes starting means for the can doffing means, such starting means including time delay means causing a delay in the functioning of the starting means following the disengagement of the clutch.

8. The apparatus of claim 6, which includes means for re-engaging the clutch, said means being operated by the means for engaging and moving the empty can, when the engaging and moving means has replaced a full can with an empty one.

9. The combination with a coiler having a turntable rotatable on a fixed vertical axis for supporting and rotating a can and a rotary sliver tube for directing sliver into the can on the turntable, of a stationary support adjacent to the turntable for supporting an empty can, means for engaging the side of an empty can on the support above the center of gravity only of the can and moving the empty can against a can full of sliver on the turntable and onto the turntable, the full can being pushed off the turntable at the same time, and means reciprocable over the turntable by the can engaging and moving means for severing the sliver between the rotary sliver tube and the full can.

10. The combination of claim 9, in which the can engaging and moving means includes a reciprocating pusher and a fluid-operated cylinder actuating the pusher and the severing means.

11. The combination of claim 9, which includes a tube gear having a flat lower face, the rotary sliver tube forming a part of the tube gear, a moveable plate forming a part of the severing means, and guides for guiding the plate across the face of the gear in the movement of the plate, the plate having a cutting edge engageable with sliver issuing from the rotary sliver tube.

12. The combination of claim 11, which includes a reciprocating pusher forming part of the can engaging and moving means and a connection between the pusher and the movable plate and in which the can engaging and moving means includes a fluid-operated cylinder for moving the pusher and plate.

13. The combination of claim 9, in which the empty can support is provided with means for tilting an empty can on the support toward the full can on the turntable and the can engaging and moving means advances the empty can in such tilted position whereby the empty can

engages and tilts the full can on the turntable and moves the full can in tilted position off the turntable.

14. The combination of claim 9, which includes means acting after the deposit of a selected quantity of sliver into the can on the turntable to initiate the operation of the can engaging and moving means.

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