Feb. 28, 1956 J. W. HARVEY, JR., ET AL 2,736,184

MACHINE FOR REMOVING CORES FROM YARN CAKES AND THEN SUPPORTING AND WETTING THE CAKES

Filed June 28, 1950 3 Sheets-Sheet 1

Fig. 1.

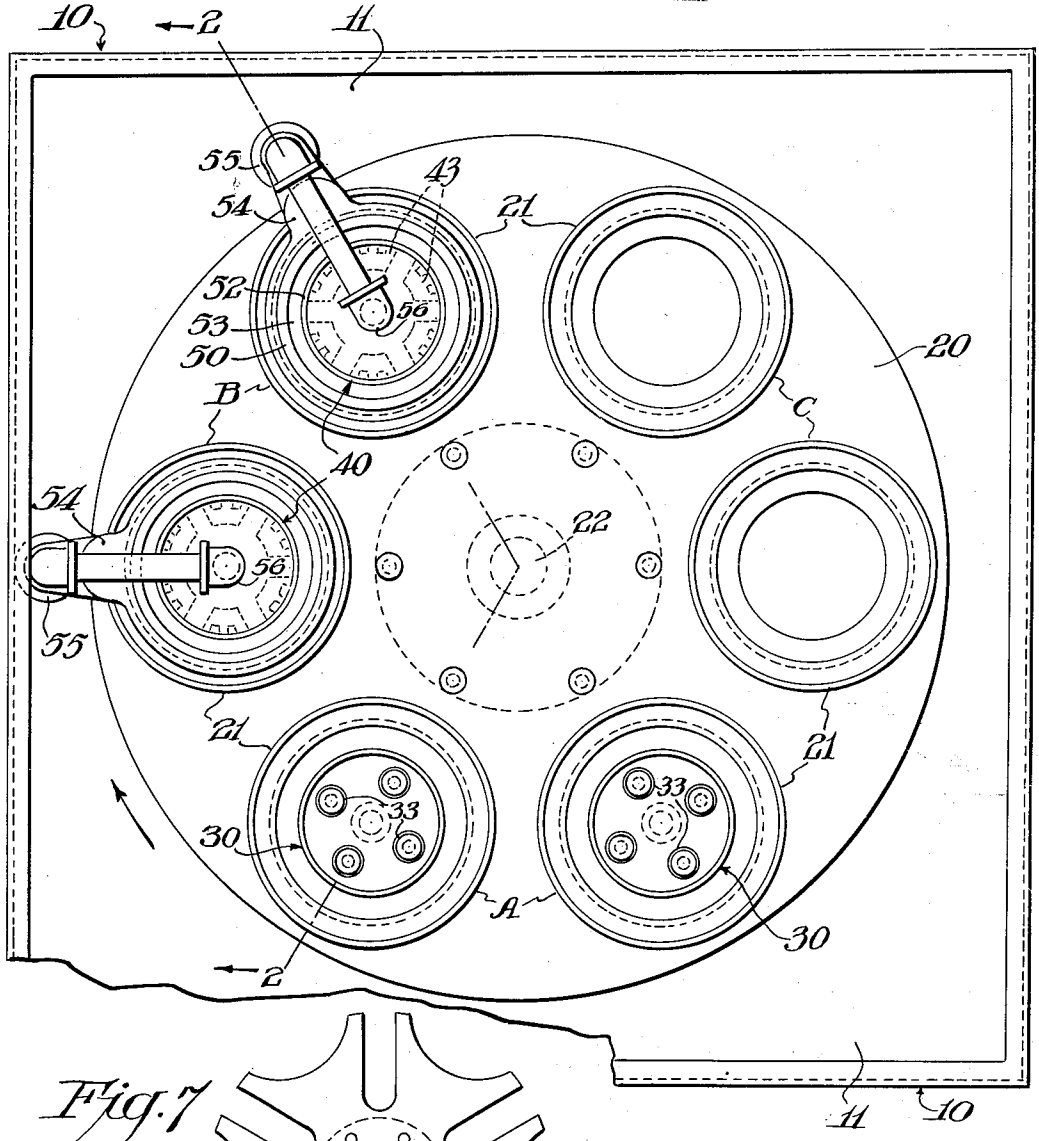
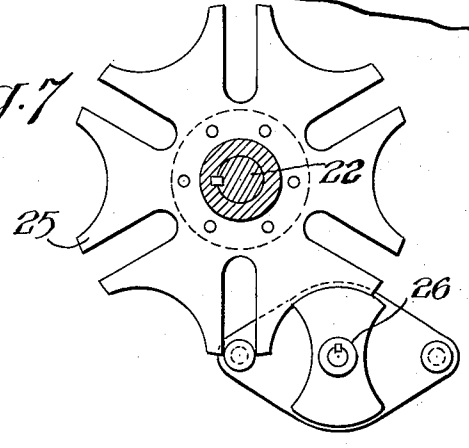


Fig. 7



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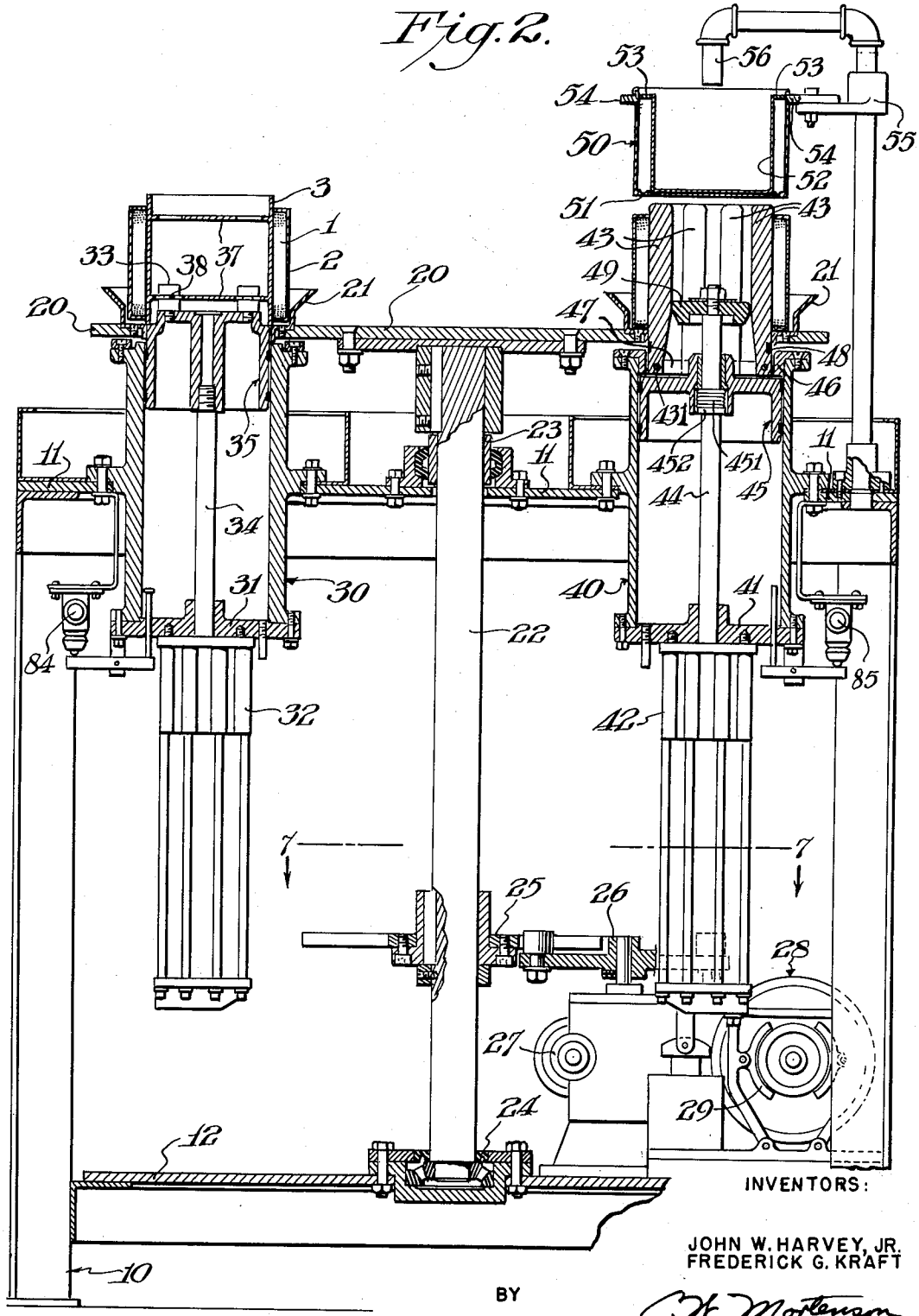
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Fig. 2.



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Fig. 3.

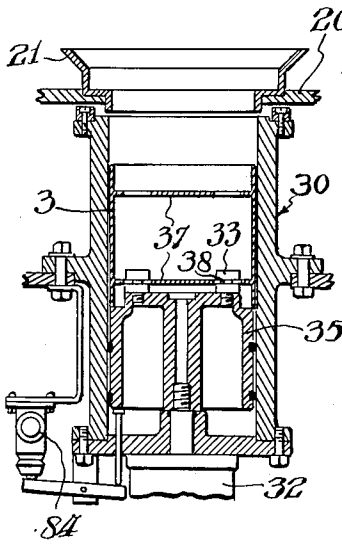


Fig. 4.

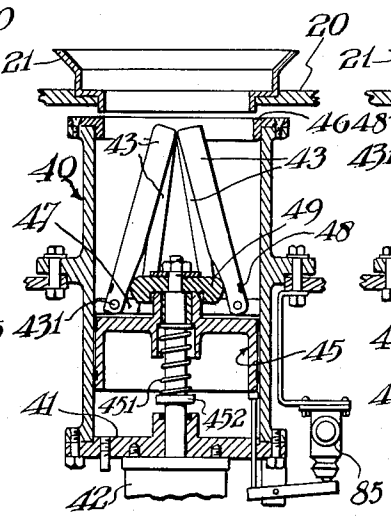


Fig. 5.

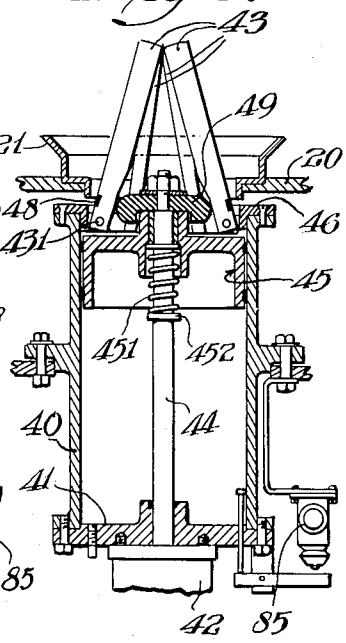
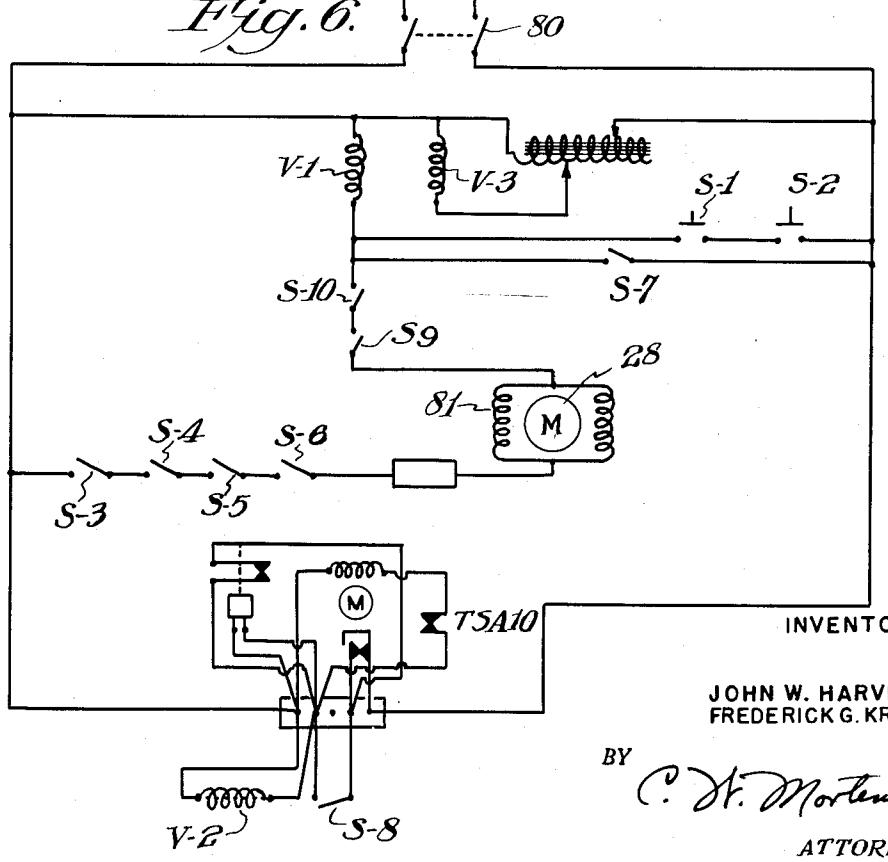


Fig. 6.



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MACHINE FOR REMOVING CORES FROM YARN CAKES AND THEN SUPPORTING AND WETTING THE CAKES

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Application June 28, 1950, Serial No. 170,838

6 Claims. (Cl. 68—205)

This invention relates to the processing of yarn, such as viscose rayon yarn, in annular cake form and, more particularly, relates to machinery for improved handling and fluid treatment of rewound rayon yarn cakes.

In the production of regenerated cellulose yarns by the bobbin process, the yarn is collected at nearly constant linear speed in the form of a wound package or "cake" of continuous parallel filaments. The spinning bobbin is usually perforated to permit subsequent pressure or vacuum liquid treatment of the yarn wound thereon. Inasmuch as the filaments comprising the yarn are in parallel relationship and not twisted together, the yarn is not capable of withstanding excessive handling or treatment without deleterious effect upon it, and the tightness of the cake makes purification difficult. It is, therefore, common practice to subject the bobbin of yarn as it comes from the spinning machine merely to a washing treatment to remove the bath liquor contained in the yarn, after which the yarn is dried on the bobbin.

The washed and dried yarn is next twisted. In one method of handling bobbin-spun yarn from this point, the twisting is done on an uptwister with small but definite tension applied to the yarn, and the take-up core on which the twisted yarn is wound is removable. By having the traverse guide "ride" the package, a self-supporting package or cake is formed when the core is removed. This core may be, for instance, about 5" in diameter and 5" or 6" long with a slight taper such as 1/16" in its length. Generally the core is covered by a knitted wrapper of sufficient length to be folded over the cake after the winding is completed, the ends of the wrapper being tucked in the ends of the core and suitably held during the winding process.

When the winding of these packages is completed, the wrapper is placed around the cake, the tapered core is slipped out and the unsupported cakes are strung on rods for subsequent subjection to drip washing. Yarn initially against the spinning bobbin is now on the outside of the cake; when the tapered core is slipped out, the tension on the outside layers of the cake tends to crush the cake. During stringing of the cake on the rod and subsequent transportation on that rod this crushing of the cakes results in the formation of a huge yarn bunch on the inner peripheral surface. This bunching makes subsequent winding difficult and creates very substantial amounts of yarn waste. Accordingly, it is highly desirable to circumvent these difficulties.

A primary object of this invention is to provide improved means for fluid treatment of rewound yarn cakes to ensure controlled limited wrinkling of the cake inner periphery, instead of uncontrolled localized bunching there. Another object is to provide suitable apparatus for pulling the inserts from the rewound package and for uniformly wetting the cake while maintaining its general cylindrical shape. A further object of this invention is to provide automatic control of the pulling and wetting steps, together with a controlled amount of water application, and interconnecting controls to avoid irregularities in processing. These and other objects will be apparent from the discussion that follows.

In the drawings:

Figure 1 is a plan view of the apparatus of this invention;

Figure 2 is a vertical cross-sectional view showing the means for removing inserts and the means for supporting the cake during wetting; said view taken on line 2—2 of Fig. 1;

Figure 3 is a detail of the means for removing inserts;

Figures 4 and 5 are details of the means for supporting the cake during wetting;

Figure 6 is an electrical diagram of the control circuit and

Figure 7 is a plan view of the geneva motion taken on line 7—7 of Figure 2.

The objects of this invention are accomplished by subjecting the cake of rewound yarn to a brief shower treatment with water carefully and uniformly applied immediately after the rewinding core is removed from the cake. The application (both rate and amount) of water is controlled so that the maximum swelling obtainable by rewetting the dried rayon in the cake is closely approximated. In this way, the inner surface of the cake does not become excessively deformed by one or more large waves or bunches; instead, very many small wrinkles are formed on the interior surface. While the process of this invention may be accomplished manually it is most advantageously done by the apparatus hereinafter described, which automatically supplies water at the proper rate and amount but only after the cake is properly positioned and supported. These control features add very materially to consistent and uniform results. At the same time the apparatus of this invention provides effective means for withdrawing the bobbins or cores from the cakes and interlocked controls to prevent misprocessing and damage to the yarn and to the apparatus.

There is shown in Figures 1 and 2 an assembly of a 6-position cake wetting machine with core pulling positions. The machine consists of a steel table about 36" square built of angle irons and iron plates. This table is generally designated by numeral **10**, the upper plate by numeral **11**, and the lower plate by numeral **12**. Above the table top is located a conveyor, preferably a 30" diameter aluminum turntable **20** supported by a heavy steel shaft **22**, which shaft is supported in bearing **23** fastened to the upper plate of the table and in a bottom thrust bearing **24** fastened in the bottom plate of the table. The turntable **20** has six holes in it spaced 60° apart with a cake supporting ring **21** mounted over each hole. The turntable is indexed and locked in position by a fixed slot geneva motion **25**, **26**, shown in Figures 2 and 7. This geneva is driven through a vertical output shaft gear reducer **27** by an electric motor **28** equipped with an electric brake **29**. The shaft of this motor extends from both ends, the drive to the gear reducer being at the end opposite from the shaft end driving the electric brake. The turntable rotates 120° for one complete cycle, its automatic intermittent rotation being controlled by micro switches, solenoid valves and a timer as explained hereinafter. For convenience the machine is equipped with two insert removing positions A, two wetting out positions B and two lag positions C, the turntable being rotatable to carry yarn cakes from positions A to positions B and thence to positions C.

Mounted on the fixed table with approximately half their length extending below the table plate **11** are four aluminum cylinders. Two of these, designated as **30** provide means for removing inserts; the other two, **40**, comprise means for supporting the cakes during washing. The first two of these aluminum cylinders have mounted therein a two-way air cylinder or piston **32** mounted to

the bottom cylinder cap **31** with a shaft **34** extending through the cap into the cylinder. At the top of the shaft **34** are heads **35** equipped with four locking lugs **33** which serve to pull the bobbing **3** from the cake **1** bearing wrap **2**, leaving the cake resting on the cake rings or seats **21**. The bobbins or cores **3** are tapered, as previously indicated, and near the ends have supporting discs **37**. The bobbin-supporting disc near the larger (diameter) end has four holes **38** uniformly spaced on a common circle, each hole being 1¼" in diameter. The location of this reinforcing disc relative to the bobbin end, together with the size of the holes and the diameter and shape of the locking lugs **33**, makes it a simple matter to place the cake with the bobbin still in it on one of the rings **21** in these positions A (Figure 1) so that the locking lugs project through the holes, and by a slight twist or rotation of the bobbin they are locked in position for pulling. At the proper time the air cylinder **32** retracts the shaft **34**, and pulling head **35** together with the bobbin drops down into cylinder **30** with nothing in the way to interfere with the turning of turntable **20**, as shown in Figure 3. When the turntable is moved 120°, the two cakes that have just had bobbins pulled from them are located in the wetting out positions B (Figure 1).

As in the case of the means for pulling, the two cylinders **40** for use in the wetting out step are also equipped with two-way air pistons generally designated **42** affixed to the lower wetting cylinder cap **41** so as to have shaft **44** extending into the cylinder **40**. On this shaft **44** is slidably connected the wetting head **45** to the upper surface of which is fastened a retainer **47** to which cake supporting fingers **43** are pinned at **431**. At the very end of this shaft is a cam **49** for maintaining the fingers in expanded position during the wetting out period. A heavy rubber band **48** is provided for retracting the fingers when the cam **49** is lowered relative to the fingers so that in the retracted position (Figure 4) the fingers collapse into the shape of a cone. Thus, when the head and fingers are down in the cylinder, cam **49** will be against the upper surface of retainer **47** and the spring **451** against the collar **452** will be fully extended. When the previously wetted cakes have been removed and a pair of unwetted cakes are presented for wetting by rotation of the turntable 120° and all the controls are in order, the head moves up. After the wetting head **45** moves up only a portion of the full stroke of the air cylinder it encounters a stop **46**. The fingers are elevated but not yet pushed outwardly (Figure 5). As the air cylinder stroke continues, the shaft **44** and the cam **49** push up between the several cake supporting fingers and press them outwardly into the vertical position shown (Figure 2). The fingers have smooth raised ribs on their outer surface and the perimeter around these fingers when expanded corresponds to the inside perimeter of the rayon cake. Also the inner surfaces of the fingers are cut on a slope to provide effective working surfaces for cam **49**, as shown in Figure 2.

Mounted directly above each of the two sets of fingers and the cake in its wetting position is an applicator which applies the fluid, usually water to the package. This applicator is preferably a 6" diameter aluminum pan **50** which has in the bottom thirty-six 7/16" diameter holes **51** spaced 10° apart on a 5⅜" diameter base circle. Inside of each pan **50** is a 5" diameter pan **52** with lugs **53** on the outside to keep it in the center of the perforated pan **50**. This inner pan **52** into which the water empties from pipe **56** overflows into pan **50** and serves two purposes, i. e., (1) to provide a greater head of water and thus reduce the shower time and (2) to eliminate turbulence in the perforated pan. The dimensions given should, of course, be varied to suit the specific conditions and it is to be understood that these dimensions are applicable only for a cake of nominal 5" inside diameter and about ½" in thickness. The shower pan is supported on a suitable ring **54** mounted on a bracket **55** affixed to pipe **56** through which water is led to the inner pan. The water flows out of the bottom holes onto the cake **1**. Practically all of the water is soaked up rapidly by the dry cake and no provision for drainage is necessary. For convenience, however, a drainage (not shown) is provided in the upper plate of table **20**.

The two additional positions for seats (Figure 1) or cake rings in the turntable are lag positions C. The wetting cakes are moved to these positions in the next 120° turn of the turntable and remain here while the pulling and wetting positions go through their sequence of steps. They are allowed to rest briefly to permit the even distribution of water throughout the cake. During the next 120° rotation of the turntable the operator removes the wet cakes so that he may refill these positions with dry cakes of yarn still on the bobbin, after removing the cores when the pulling heads come back up.

For an understanding of the electrical controls for the operation of this machine see the discussion below in reference to Figure 6, which is a schematic wiring diagram.

The line switch **80** is closed at all times except when the machine is down for maintenance. To start the cycle the operator closes push button switches **S–1** and **S–2**. Theses switches are in series and separated sufficiently to require both hands of the operator and thus insure that the operator has both hands away from parts of the machine that are hazardous while operating. Closing switches **S–1** and **S–2** completes the circuit through solenoid valve **V–1**. Energizing the solenoid of valve **V–1** opens the valve and supplies air to the top side of all four air cylinders causing the pistons to drop. When the pistons are down in the proper positions, interlocking switches **S–3**, **S–4**, **S–5**, **S–6**, **S-9** and **S-10** are closed. The first four switches are interlock switches in series to insure that all four heads are down properly before the motor can be energized, thus starting rotation of the turntable. Switches **S-9** and **S-10**, which are also in series with the motor **28**, insure that the pulling heads have actually pulled the bobbin out of the cake properly before the motor can be energized. With the interlocking switches closed, the motor brake solenoid **81** is energized through the operator push buttons **S-1** and **S-2** and the motor brake is released. At the same time and through the same circuit, the motor is energized and motion of the turntable starts. Motion of the turntable closes switch **S-7** by a cam action which is in parallel with the operator's push button switches **S-1** and **S-2**. The operator then releases switch buttons **S-1** and **S-2** and performs other manual duties.

The turntable is moved through 120° by the indexing mechanism shown in Figure 7 and, at the proper point, switch **S–7** is opened by cam detent action. Immediately prior to the stopping of the turntable, a cam detent closes switch **S–8** momentarily. This energizes the solenoid valve **V–2** and at the same time the timing cycle as set on the **TSA–10** timer. Energizing the solenoid valve **V–2** supplies water to the wetting positions. Opening of switch **S–7** de-energizes the motor circuit and the brake circuit thus applying the brake on the motor. Valve **V–1** is also de-energized, which exhausts air from the top of the cylinders and supplies air to the bottom of the cylinders. This raises the four pistons, and the cycle is ready to be repeated when wetting is completed. At the expiration of the set time cycle, the solenoid valve **V–2** is de-energized and the water is cut off. The timer simultaneously resets itself to the starting position ready for the next cycle.

Valve **V–3** is a safety valve installed so that in the event of power interruption all action of the moving parts of the turntable is immediately stopped. Without this feature a power interruption would cause the pistons to operate in an upward direction if they were down at the time of the power interruption. Unless the turntable

was indexed in one of the operating positions at the time, damage of the turntable might result. A transformer is provided to permit operation of the safety solenoid valve at its lowest dependable voltage to reduce heating of the solenoid, thus prolonging its life and increasing its dependability.

Assuming the machine is in production and that there are two cakes in the lag positions and two cakes under the shower pans with the fingers in them and the pulling heads are up and empty, the operator obtains two cakes with the bobbins in them from a supply conveyor belt, places them on the pulling heads and locks them, and then closes the two push button switches at the front of the machine. This energizes the main air valve and pulls all four pistons down, at which time circuit to the motor and brake is completed by micro switches, the brake is released and the motor starts. After the driver of the geneva motion (Figure 7) has rotated a few degrees, the auxiliary switch closes by action of the cam on the driver and completes the circuit to the air solenoid, brake and motor without necessity for keeping the push button switches closed. After the turntable travels through 60° there is a pause; at this point operator (who has released push buttons) picks up the two cakes from the lag positions and places them on a removal conveyor belt. After the table rotates a total of 120°, the switch S–7 opens by cam detent action and breaks the circuit to the motor and the circuit to the brake. Thus, the brake is applied and stops further rotation. Opening this switch S–7 also de-energizes the air solenoid, which releases air from the top of the air cylinder pistons and applies it to the bottom of them forcing the four heads up. As previously described, just before the turntable stops, the micro switch is momentarily closed by a cam on the turntable shaft to energize solenoid valve V–2, starting the water supply to the shower pan and starting the timer, which runs for a preset time, then cuts off the water flow and by de-energizing the solenoid and resets to zero. Meantime the operator removes the empty bobbins from the pulling positions, places them on a removal conveyor belt, and then takes up from another conveyor belt two cakes with the bobbins in them, places them on the pulling heads and locks them into position and is thus ready to push the starting buttons again and repeat the cycle.

The amount of water applied to the cake and the rate of flow will, of course, depend upon the size of the cake, its density, and possibly other factors. It has been found that a flow of 15 seconds per cake at the rate of 1 gal./min. or the application of ¼ gallon of water produces the desired effect without making the cake exessively sloppy for handling or disturbing the cake structure unduly. The ¼ gallon of water that is applied to the 1 lb. cake is very close to the calculated secondary swelling of the rayon. The secondary swelling is the maximum amount of water which washed and dried regenerated cellulose will take up. It may be determined by drying a sample of yarn in an oven at 105° C. and weighing the dried sample, then soaking the sample in water, centrifuging the wet sample at 1400 R. P. M. for one minute to remove excess water, and weighing the wet sample in a closed bottle. The temperature of the water may be varied, say from 20° to 50° C. but water at room temperature is very effective and is preferred. The effect of the treatment is to permit the strains in cake, apparently caused by the throwing of high shrinkage inside bobbin yarns to the outside of the cake, to be relieved in the form of a number of relatively harmless small wrinkles rather than one or two very undesirable large bunches.

An essential feature of the invention is the careful handling of the cake between the removal of the bobbin and the application of water. The machine above-described enables this to be carried out effectively. The supporting fingers in the cake during wetting prevent premature collapsing of the cake in the form of the undesirable large wrinkle, fold, bunch or blister, maintaining the cake in substantially cylindrical form until all sections of the yarn have become well wetted; the shrinkage of the yarn that occurs shows up as a very large number of small wrinkles around the inner perimeter of the cake, which does not interfere with subsequent unwinding nor adversely affect the physical properties of the yarn.

In one test of 300-denier 50-filament bobbin-spun rayon processed in accordance with this invention the number of breaks per cake in coning for the test lot was only .05 as compared with 0.35 for the control cakes processed the same except for wetting out immediately after removal of the rewind bobbin. Also cone rejects for broken filaments were reduced from 3.75% to 1.4% by this expedient. In another test 88% of the test cakes ran out clean (no yarn remaining) as compared with only 47% complete run outs from the control cakes.

Any departure from the procedure described herein which conforms to the principles of the invention is intended to be included within the scope of the claims below.

We claim:

1. Machine for treating annular yarn cakes, comprising first vertically reciprocable means mounted upon a fixed axis and adapted to remove from a yarn cake located about the axis thereof the core upon which the yarn was wound, and second vertically reciprocable means mounted upon a fixed axis parallel to the first axis and adapted to support the inner periphery of a core-free yarn cake located about the axis thereof.

2. The machine of claim 1 in combination with shower means located above the second vertically reciprocable means and with intervening intermittently actuated conveyer means including a movable supporting surface for locating yarn cakes successively about one end of the reciprocation path of the first vertically reciprocable means and then about one end of the reciprocation path of the second vertically reciprocable means.

3. The machine of claim 1 in which the first vertically reciprocable means is a first piston carrying at one end lugs adapted to engage the core of the yarn cake and the second vertically reciprocable means is a second piston carrying at one end support means adapted to move outwardly from the axis of the yarn cake into supporting contact with the inner periphery of the yarn cake.

4. The machine of claim 3 in which the support means carried by the second piston comprises a plurality of fingers pivoted individually at one end and displaceable outwardly thereabout, and the second piston also includes cam means adapted to displace the free ends of the fingers outwardly as the piston reaches the top of its reciprocation path.

5. Machine for treating annular yarn cakes, comprising a horizontal turntable intermittently rotatable to a plurality of rest positions, adjacent positions being separated by a constant angle of rotation, the turntable having apertures at a plurality of locations, adjacent locations being separated by a like angle on the turntable, with at each aperture the surrounding portion of the turntable providing a seat for a yarn cake to rest on edgewise co-axially with the aperture location; underneath the turntable, a first piston having lugs on the top thereof, and means to reciprocate said first piston vertically to raise the lugs to a location within one of the seats when the turntable is in one rest position, so as to bring the lugs into engagement with the core of a yarn cake resting on the seat, and a second piston having a plurality of fingers pivoted individually thereon for displacement outwardly near the top thereof, and means to reciprocate said second piston vertically to raise the fingers to within another of the seats when the turntable is in the same rest position, and means to displace the fingers outwardly from the axis of the yarn cake located on the seat, so as to support the inner periphery of the yarn cake in the absence of the core; and, spaced over the second piston and above a yarn cake on

the intervening turntable, shower means adapted to wet out the yarn cake so supported.

6. The machine of claim 5 in which the number of rest positions to which the turntable is rotatable intermittently and the aperture locations for seating yarn cakes occur in integral multiples of three.

References Cited in the file of this patent

UNITED STATES PATENTS

1,021,811	Windrath	Apr. 2, 1912
1,168,067	Haefely	Jan. 11, 1916
1,027,555	MacFarlane	May 28, 1919
1,775,922	Abbott	Sept. 16, 1930
1,812,805	Riley	June 30, 1931
1,932,913	Schieber	Oct. 31, 1933
1,989,562	Smith	Jan. 29, 1935
2,249,379	Ford	July 15, 1941
2,300,914	Flindt	Nov. 3, 1942
2,350,168	Karns	May 30, 1944
2,439,829	Tippetts	Apr. 20, 1948
2,467,555	Hornbostel	Apr. 19, 1949
2,620,141	Langbo	Dec. 2, 1952