Dec. 19, 1961 H. CATLING ET AL 3,013,313

PRODUCTION OF TEXTILE YARNS

Filed June 10, 1959 5 Sheets-Sheet 1

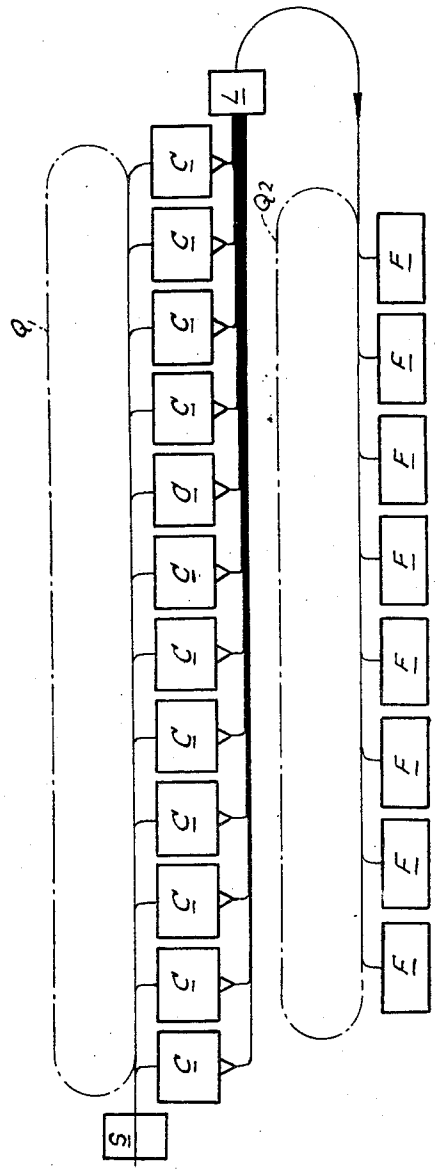

FIG. 1

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Dec. 19, 1961 H. CATLING ET AL 3,013,313

PRODUCTION OF TEXTILE YARNS

Filed June 10, 1959 5 Sheets-Sheet 2

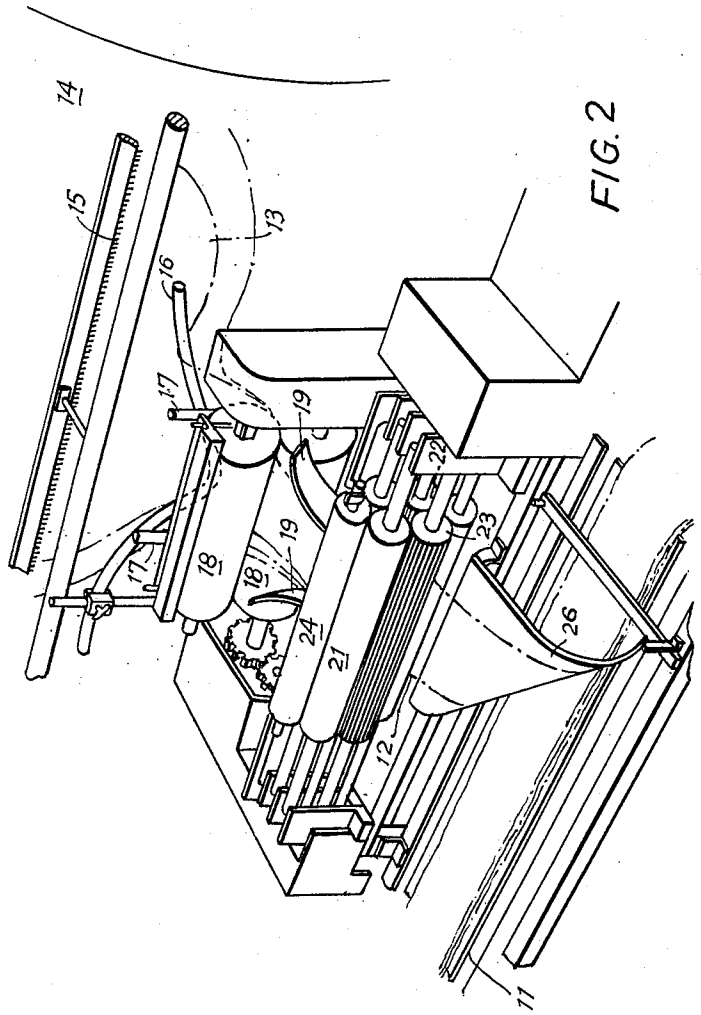

FIG. 2

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Dec. 19, 1961 H. CATLING ET AL 3,013,313

PRODUCTION OF TEXTILE YARNS

Filed June 10, 1959 5 Sheets-Sheet 3

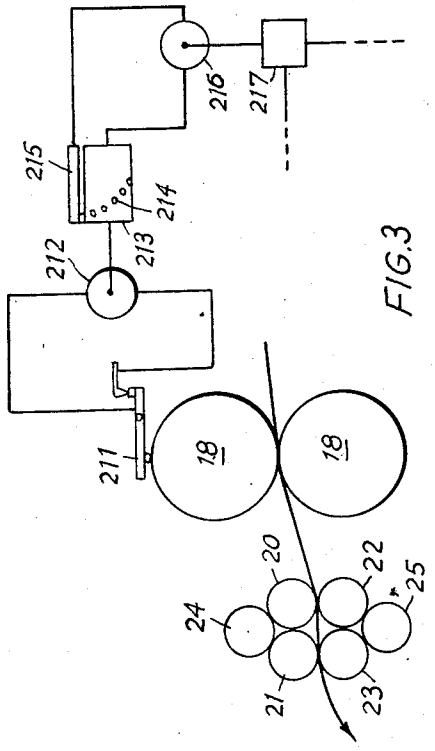

FIG.3

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PRODUCTION OF TEXTILE YARNS

Filed June 10, 1959 5 Sheets-Sheet 4

FIG. 7

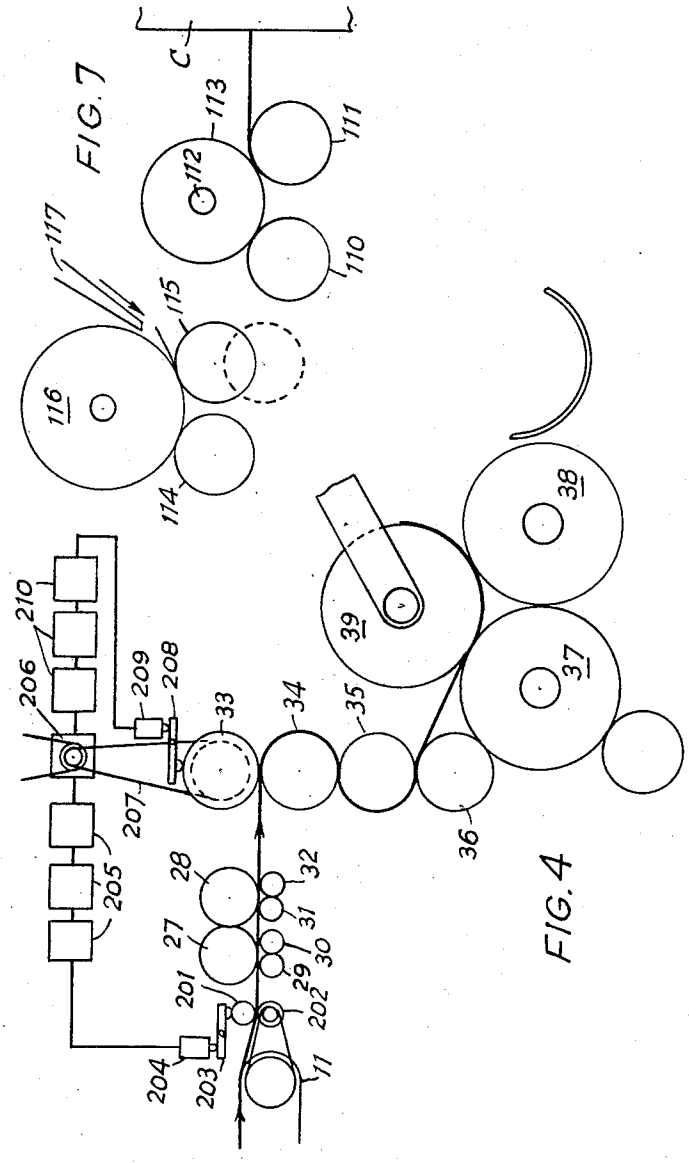

FIG. 4

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Dec. 19, 1961 H. CATLING ET AL 3,013,313

PRODUCTION OF TEXTILE YARNS

Filed June 10, 1959 5 Sheets-Sheet 5

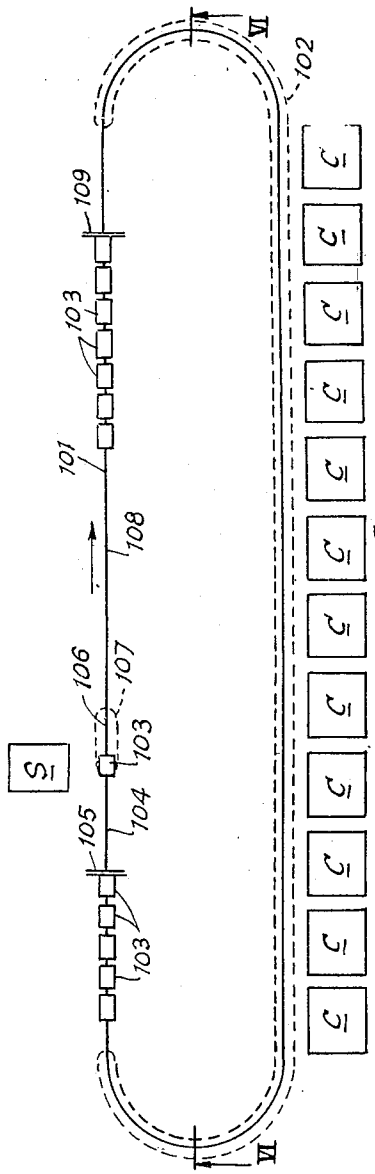

FIG. 5

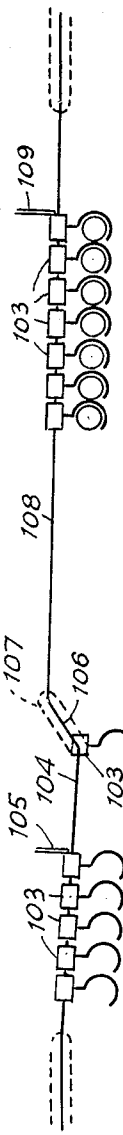

FIG. 6

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United States Patent Office 3,013,313 Patented Dec. 19, 1961

3,013,313

PRODUCTION OF TEXTILE YARNS

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Claims priority, application Great Britain June 19, 1958
11 Claims. (Cl. 19—155)

This invention concerns the production of textile yarns. More particularly it concerns the production of such yarns by a process which includes the steps of carding a mass of staple fibres on each of a plurality of carding machines and then drafting the carded masses (hereinafter called "a process of the type described"). Cotton fibres, for example, are so carded and drafted as steps in the production of cotton yarn from heterogeneous masses of cotton staple fibre.

It is a common feature of processes of the type described that the individual machines used have widely varying capacities. For example in the manufacture of cotton yarn one scutcher may supply, say, twelve carding engines, and the total output from the twelve carding engines in turn may be supplied to say, eight draw frames. Thus, problems concerning the feeding of the material produced at one stage, to the next stage, have presented themselves, and it is the main object of the present invention, in a process of the type described, to provide an efficient method of and means for processing in a plurality of carding engines and preparing same for further processing. A broader object of the invention however, is to provide generally far more efficient material movement from machine to machine, in processes of the type described, and especially in the manufacture of cotton yarn.

According to the present invention in a process of the type described, a plurality of masses of staple fibre are carded simultaneously to produce a corresponding number of fibrous webs (as distinct from slivers), and said webs are then superimposed and then drafted together to form a single lap, these operations proceeding continuously in sequence, the drafting effect on said superimposed webs being adjusted according to the number of said webs at any given time so that a single lap of substantially constant characteristics is always produced for further processing.

The invention also includes means for effecting the carding, superimposing and lap-forming steps.

We have found it preferable to carry out some roller drafting of the individual webs as they are formed by each carding operation, and before superimposition.

We prefer to provide automatic arrangements for material movement between certain processing steps up to and including the carding step and also between certain of the steps comprising lap-forming and subsequent steps.

In order more fully to illustrate the scope of our invention there is now described, by way of example only, and with reference to FIGS. 1 to 4 of the accompanying drawings, a processing system for the manufacture of cotton textile yarn which embraces all the steps from the production of a scutcher lap to the finished yarn.

In the drawings:

FIG. 1 is a diagram of the layout of part of the system;

FIG. 2 is a perspective view showing the movement of the web of material from a carding engine;

FIG. 3 is a diagram showing the exit roller system of the carding engine illustrated in FIG. 2 and incorporating control means for the lap-forming machine capable of compensating for run-out of lap;

FIG. 4 is a diagram showing the feeding of the composite web from the carding engines to a lap forming machine;

FIG. 5 is a diagrammatic plan view of a feeding arrangement between a scutcher and a number of carding engines;

FIG. 6 is a diagrammatic view in the direction of the arrows VI—VI in FIG. 5, and

FIG. 7 is a diagrammatic view of an automatic creel for a carding engine.

In this system a scutcher S operates in normal manner on the staple fibre and supplies twelve carding engines C. The lap is doffed automatically from the scutcher and conveyed, suspended from an overhead runway, over the back of the carding engines C, which are disposed parallel to each other in side-by-side alignment. The conveying mechanism may be adapted to drop the laps into a reserve creel at the back of each carding engine in rotation or as required. Alternatively there may be appropriate control mechanism on each carding engine which indicates to the conveying mechanism whether there are one, two, three or more laps in the reserve creel thereof. After each lap is doffed from the scutcher the conveying mechanism is arranged to begin a circuit Q, of all the carding engines and only deposit the lap where there is only one lap in the reserve creel. If there is no carding engine with only one lap in its reserve creel, the conveying mechanism is adapted to begin a second circuit and deposit the lap where there are only two laps in the reserve creel, and so on.

At each carding engine, as the lap being processed (the old lap) is running out, the next lap (the new lap) from the reserve creel is automatically moved onto the feed lattice or roller, and the end of the new lap separated from the body thereof and placed in such a position that it exactly abuts the end of the old lap as the latter moves from the feeding station. The lap rod or shell for the old lap is removed and the new lap substituted therefor.

Special arrangements are provided at the output ends of the carding engines C. An endless moving conveyor **11** (FIG. 2) is disposed at right angles across the front ends of the engines and suitable guiding and condensing means are provided on each so that a web **12**, as distinct from a sliver is produced. The web will have a width several times its thickness. As the fibrous mass, in the form of a soft sheet **13** extending across the width of the doffer **14**, is removed under the action of the comb **15**, it passes over a V-shaped rod **16** of circular section and between two posts **17**, before entering the nip of a pair of calender rolls **18**. As the mass of fibres, now narrower and more compact, emerge from the calender rolls **18** it moves along a channel **19** with curved converging walls to a set of drafting rollers consisting of two upper rollers **20**, **21** and two lower rollers **22**, **23**. Above the upper pair is a cleaner **24** and below the lower pair a cleaner **25**.

The drafting rollers **20**, **21**, **22**, **23** bring the web up to the edge of the conveyor **11** and of course still moving at right angles to the direction of movement thereof. In order to reorient the web **12** so that it may be deposited on the conveyor **11** a curved plate **26** is mounted between the exit region of the drafting rollers and the region immediately above the conveyor.

The drafting rollers are driven so as to give a small draft, say about 1.4.

The twelve webs thus become superimposed and pass together, without interruption, in this manner from the conveyor to and through a lap forming machine L comprising, successively, a system of drafting rollers **27**, **28**, **29**, **30**, **31**, **32** geared to give the complete web N a draft of, say 1.5, calender rolls **33**, **34**, **35**, **36**, and bobbin support rolls **37**, **38**. The latter carry a bobbin **39** on which

the lap formed by the lap forming machine is wound under pressure to ensure tight winding.

It will of course be necessary to take carding engines C out of commission for cleaning and adjustment from time to time and in order to ensure that a lap of constant characteristics continues to be produced by the lap forming machine L we provide suitable means for controlling the draft of the latter. Thus means for measuring the thickness of the composite web entering the lap forming machine may be provided, which automatically varies the draft to compensate for variations (an open loop control system). Alternatively or additionally a closed loop system may be used, the thickness of the lap coming from the lap forming machine being the controlling factor. In another arrangement the knock-off control of each carding engine could be adapted to alter the draft of the lap-forming machine to compensate for the reduced thickness of the composite web.

Full bobbins from the lap forming machine L, in the particular system being described, are doffed automatically when full and fed by circuit Q2 to eight draw frames F in the same manner as the laps from the scutcher are fed to the carding engine, as hereinbefore described.

For further processing several alternatives present themselves, as

(*a*) Conversion at each draw frame into a sliver and then into yarn in the conventional way,

(*b*) Conversion into a sliver and winding onto a bobbin instead of, as is usual, into a can to allow automatic doffing and distribution before conversion into yarn.

(*c*) Processing into a lap, and collection on a bobbin, to allow automatic doffing and feeding to, for example, a speed frame or sliver-to-yarn frame, or even to further draw frames, before conversion into yarn.

Having now described this processing system according to the invention and having indicated how the material may be progressed and controlled as it passes through the various stages of modification, it is convenient to describe in some further detail how certain of the successive operations may be performed.

(1) *Automatic doffing from scutcher*

This may be performed in a number of ways. According to one such way the web coming from the scutcher is wound on a lap shell (hollow tube) and the lap being formed is supported for rotation on two other rollers, the axes of all three being parallel. Means are provided to come into operation when the lap reaches the required size to speed up the drive to the lap, which causes the web to break, and in synchronism, to cause the lap shell carrying the lap to be moved away for feeding to the cards, and a new lap shell to take its place.

(2) *Feeding of laps to carding engine reserve creels and from carding engine reserve creels to carding engines.*

This can be arranged, for example, by providing an endless run-away system behind the back of carding engines, associated and operating in conjunction with an automatic creel behind each carding engine.

This arrangement is illustrated in FIGS. 5 to 7 of the accompanying drawings.

The run-way system **101** is disposed, as shown in the plan view (FIG. 5) behind the carding engines C. the front run thereof adjacent the carding engines is horizontal as are to the side runs, but a chain **102** is provided at these parts of the system capable of progressing pans **103** therealong in a clockwise direction around the system. The back run of the system commences with a downwardly inclined portion **104** down which the pans **103** can run freely under the influence of gravity, a gate **105** being provided for a purpose to be described hereinafter. Then follows an upwardly inclined portion **106** which also is provided with a chain **107** by means of which the pans **103** are moved therealong. Finally there is a second downwardly inclined portion **108**, similar to portion **104** and likewise provided with a gate **109**. These portions are more clearly illustrated in FIG. 6.

At the bottom of the portion **106** is a loading point, opposite which the scutcher S is disposed, and in operation one pan **103** is in position at this point. A lap, on its hollow shell, as it is doffed from the scutcher, is deposited on the pan **103** (which pans have been shown, for the sake of clarity, rotated by 90° from their operative position, in which the hook end thereof is presented so as to receive the lap doffed from the scutcher).

The pan is constructed so that it is depressed by the weight of the lap and then operates a switch which is adapted to start the drive to chain **107**, which progresses the pan to the top of the portion **108** of the run-way where it is accumulated by gate **109**, along with any other full pans already on this portion of the runway, in a reserve of full pans. The drive to chain **107** is arranged to stop automatically after a short period whereupon gate **105** is arranged to operate automatically to release one empty pan from a series of empty pans **103** on the portion **104** of the run-way. When a carding engine requires a lap, gate **109** is arranged to operate (in the manner shortly to be described) to release one of the full pans from the portion **108** of the runway, which pan is then carried by the chain **102**, running continuously, to the appropriate carding engine to be deposited thereon, after which the empty pan is carried around to join the empty pans on portion **104** of the run-way.

Referring now to FIG. 7, there is illustrated diagrammatically the automatic creel arrangement provided between each carding engine C and the run-way system **101**. Lap rollers **110**, **111** are provided at the back of each engine C in normal manner except that they are spaced apart by a distance just greater than the diameter of the shell **112** which carries the lap **113** being fed to the respective carding engine C. Rollers **114** and **115** are rollers similar to rollers **110** and **111** disposed in the illustrated relationship thereto. These rollers are driven via an electrically operated clutch at the same surface speed as rollers **110**, **111**. Roller **114** is arranged to be depressed slightly by the weight of the lap **116** and to operate a switch with an effect shortly to be described. Roller **115** is arranged so that it may assume an alternative position indicated in dotted line. An air nozzle **117** is provided, and suitable mechanism is associated therewith for the purpose of swinging the nozzle into and out of position.

In operation, when there is no lap on rollers **114**, **115** the switch operated by roller **114** causes gate **109** to operate as previously described. At the same time the switch operates a solenoid which moves a suitably disposed deflector so that the pan **103**, released by gate **109** is tipped as it passes the carding engine C and the lap carried thereby rolls onto rollers **114**, **115**. The lap then begins to rotate and a jet of air blows on it from the nozzle **117** to separate the lap end as shown. The lap end as it separates from the lap interrupts a light beam which is part of a photo-electric circuit, which circuit in turn operates switches causing the drive to rollers **114**, **115** to disengage so that the lap **116** remains at rest in the position shown.

As the old lap **113** is used up it becomes smaller and finally the empty shell falls between rollers **110**, **111** and the end of the lap hangs over roller **111** between rollers **111**, **112**. The falling lap shell **113** is arranged to operate a switch which restarts rollers **114**, **115** and also causes the air nozzle mechanism to lift the nozzle **117** clear of the lap **116**. The end of the new lap **116** passes over rollers **115**, **110**, **111** to the carding engine C and abuts the end of the old lap **113**. The disposition of the various rollers and the speed of rollers **114**, **115** are arranged to ensure this. The following sequence of operations is then started and carried out by a timing circuit and the necessary switches and mechanical arrangements.

(*a*) Roller **115** descends to its alternative position

(*b*) The lap **116** rolls down over rollers **115**, **116** to

assume the position on rollers **110, 111** previously occupied by lap **113**

(*c*) Roller **115** returns to its normal position, and

(*d*) The air nozzle **117** returns to its normal position.

Roller **114** is now no longer depressed and so its associated switch operates gate **109** to start a new lap on its journey to the card, and the cycle is repeated.

(3) *Control of draft in the lap forming machine*

Several methods suggest themselves, some of which are now set out.

(*a*) An open loop control could be employed. In this case an additional pair of acurately machined rollers **201, 202** are provided at the feed end of the lap-forming machine L (FIG. 4). The upper roller **201** is mounted so as to be sensitive to any change in thickness of the lap coming from the conveyor **11** to the lap-forming machine. Such changes are adapted to cause a corresponding vertical movement of the roller **201** and this movement is transmitted by lever **203** to a transducer **204**, which in turn causes electromechanical system **205** so to operate a variable speed gear **206** in the drive **207** to rollers **31, 32, 33, 34, 35, 36, 37** and **38** that the speeds of these rollers and thus the draft are adjusted to give an output from the machine of substantially constant characteristics.

A closed loop control could be used. In this case the top calendar roller **33** is mounted to be sensitive to any change in thickness of the lap coming from the draft rollers of the lap forming machine. As in the case of the open loop control just described, such changes are adapted to cause a corresponding vertical movement of the calender roller **33** and this movement is transmitted to a lever **208**, to a transducer **209**, which in turn causes an electromechanical system **210** to operate a variable speed gear **206** in the drive **207** to rollers **31, 32, 33, 34, 35, 36, 37** and **38** so that the speeds of these rollers and thus the draft are adjusted to give an output from the machine of substantially constant characteristics.

Both the open loop and closed loop controls have for convenience been illustrated diagrammatically in FIG. 4, and can be used as indicated above as alternative arrangements. However they can also be used together as the third example of draft control means namely

(*c*) Combined open and closed loop control

(*d*) Another method of draft control of the lap-forming machine is a control associated with the carding engine C. Each such engine has its upper calender roll **18** mounted so as to be sensitive to the presence of the lap. If the lap runs out the roll moves downwards and causes a switch **211** in a circuit of a motor **212** to energize the motor. The motor rotates a cylinder **213** provided with studs and the switch is also arranged to render an appropriate stud **214** electrically live. The stud is so positioned that as the lap runs out at the drafting zone of the lap-forming machine the stud **214** makes contact with a bar **215** and closes a further circuit which starts a motor **216** to drive the normally stationary side of a differential gear **217** through which the drafting rollers of the lap-forming machine are driven to alter the draft in such manner that the output from the lap-forming machine remains substantially constant. When starting the carding engine after stripping, say, it will be necessary to allow for the slow build up of lap weight. Thus, the lap can be run to waste until the weight has reached its constant value or arrangements can be made to ensure that the draft of the lap-forming machine returns gradually to its original value.

(4) *Doffing from the lap forming machine*

This may be carried out in a similar manner as the doffing from the scutcher.

(5) *Feeding of laps from the lap forming machine to the drawframes*

This could be carried out by an arrangement which is, in principle, similar to that which is used between the scutcher and the carding engines.

It is to be appreciated that the particular methods and means described for operating the five stages referred to above are quoted as examples only. Their details are in no way essential to the present invention, since other alternative methods and means could be devised and used.

We claim:

1. In a process for producing yarn, the steps of continuously and simultaneously carding each of a plurality of masses of staples fibre to form a corresponding number of fibrous webs, continuously superimposing said webs, continuously drafting said superimposed webs to form a single lap, and so adjusting the drafting effect on said superimposed webs according to the number of webs at any given time that a single lap of substantially constant characteristics is always obtained.

2. In a process for producing yarn, the steps of continuously and simultaneously carding each of a plurality of masses of staple fibre to form a corresponding number of fibrous webs, drafting each said web to improve its regularity and attenuate it, continuously superimposing said webs, continuously drafting said superimposed webs to form a single lap, and so adjusting the drafting effect on said superimposed webs according to the number of webs at any given time that a single lap of substantially constant characteristics is always obtained.

3. In a process for producing yarn, the steps of continuously and simultaneously carding each of a plurality of masses of staple fibre to form a corresponding number of fibrous webs, roller drafting each said web to improve its regularity and attenuate it, continuously superimposing said webs, continuously drafting said superimposed webs to form a single lap, and so adjusting the drafting effect on said superimposed webs according to the number of webs at any given time that a single lap of substantially constant characteristics is always obtained.

4. In a process for producing yarn, the steps of automatically feeding a plurality of masses of staple fibre to a corresponding series of carding stations, continuously and simultaneously carding each of said masses of staple fibre to form a corresponding number of fibrous webs, continuously superimposing said webs, continuously drafting said superimposed webs to form a single lap, automatically feeding said lap for further processing, and so adjusting the drafting effect on said superimposed webs according to the number of webs at any given time that a single lap of substantially constant characteristics is always obtained.

5. Apparatus for carrying out steps in a process for producing yarn from a plurality of masses of staple fibre comprising means for carding each of said masses simultaneously, to produce a corresponding number of fibrous webs, means for continuously superimposing said webs as they travel from the carding means and then drafting same together to form a single lap, and means whereby the drafting effect on said superimposed webs is adjusted according to the number of said webs at any given time so that a single lap of substantially constant characteristics is always produced.

6. Apparatus for carrying out steps in a process for producing yarn from a plurality of masses of staple fibre comprising a plurality of carding engines, each adapted to card one of said masses to produce simultaneously from each mass a corresponding number of fibrous webs, means for continuously superimposing said webs as they travel from the carding engines and then drafting same together to form a single lap, and means whereby the drafting effect on said superimposed webs is adjusted according to the number of said webs at any given time so that a single lap of substantially constant characteristics is always produced.

7. Apparatus for carrying out steps in a process for producing yarn from a plurality of masses of staple fibre comprising a plurality of carding engines, each adapted to card one of said masses to produce simultaneously from each mass a corresponding number of fibrous webs, roll-

er means for drafting the individual webs as they are formed by each carding engine, means for continuously superimposing said webs as they travel from the carding engines and then drafting same together to form a single lap, and means whereby the drafting effect on said superimposed webs is adjusted according to the number of said webs at any given time so that a single lap of substantially constant characteristics is always produced.

8. Apparatus for carrying out steps in a process for producing yarn from a plurality of masses of staple fibre comprising a plurality of carding engines, each adapted to card one of said masses to produce simultaneously from each mass a corresponding number of fibrous webs, roller means for drafting the individual webs as they are formed by each carding engine, means for continuously superimposing said webs as they travel from the carding engines and then drafting same together to form a single lap, and open-loop control means whereby the drafting effect on said superimposed webs is adjusted according to the number of said webs at any given time so that a single lap of substantially constant characteristics is always produced.

9. Apparatus for carrying out steps in a process for producing yarn from a plurality of masses of staple fibre comprising a plurality of carding engines, each adapted to card one of said masses to produce simultaneously from each mass a corresponding number of fibrous webs, roller means for drafting the individual webs as they are formed by each carding engine, means for continuously superimposing said webs as they travel from the carding engines and then drafting same together to form a single lap, and closed-loop control means whereby the drafting effect on said superimposed webs is adjusted according to the number of said webs at any given time so that a single lap of substantially constant characteristics is always produced.

10. Apparatus for carrying out steps in a process for producing yarns from a plurality of masses of staple fibre comprising a plurality of carding engines, each adapted

to card one of said masses to produce simultaneously from each mass a corresponding number of fibrous webs, roller means for drafting the individual webs as they are formed by each carding engine, means for continuously superimposing said webs as they travel from the carding engines and then drafting same together to form a single lap, and a knock-off control on each carding engine which is adapted to cause said drafting effect to be altered to compensate for the reduced thickness of the composite web occasioned by the taking out of commission of the respective engine.

11. Apparatus for carrying out steps in a process for producing yarn comprising means for automatically feeding web-like masses of staple fibre material to each carding engine of a plurality of such engines, said carding engines being disposed in side-by-side alignment and adapted simultaneously to card the masses fed thereto to produce a corresponding number of fibrous webs, roller means associated with each said carding engine adapted to draft each said fibrous web, means for continuously superimposing all said fibrous webs as they are produced, means for continuously drafting said superimposed webs together to form a single lap, means whereby the drafting effect on said superimposed webs is automatically adjusted according to the number of said webs at any given time so that a single lap of substantially constant characteristics is always produced, and means for automatically feeding said single lap to subsequent processing means.

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