June 24, 1952 J. GREGORY ET AL 2,601,386

MACHINE FOR DOFFING SPINNING AND LIKE MACHINES

Filed July 14, 1948 4 Sheets-Sheet 1

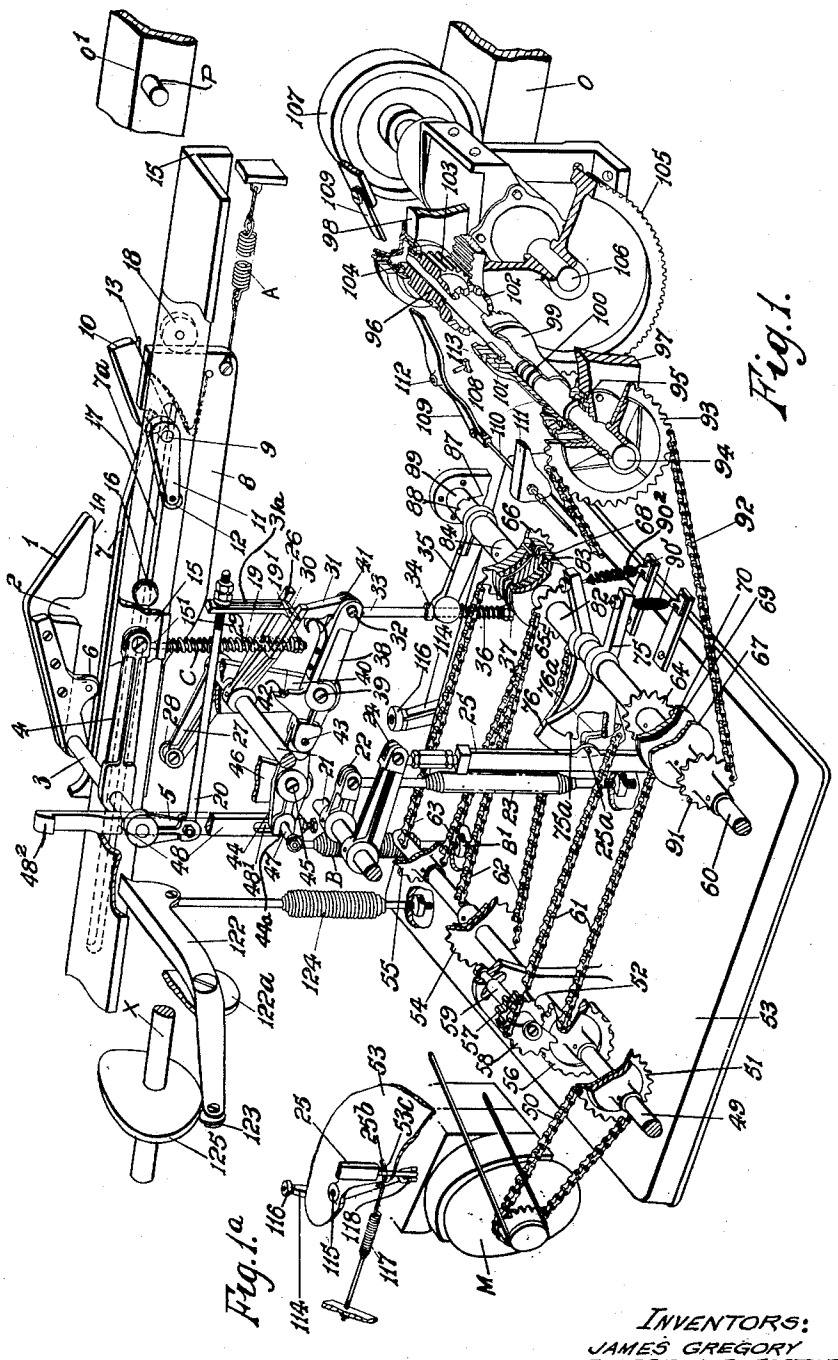


Fig. 1.

Fig. 1a.

INVENTORS:
JAMES GREGORY
GEORGE A. R. FOSTER
HAROLD CATLING
BY Francis E. Boyce
ATTORNEY

June 24, 1952 J. GREGORY ET AL 2,601,386

MACHINE FOR DOFFING SPINNING AND LIKE MACHINES

Filed July 14, 1948 4 Sheets-Sheet 2

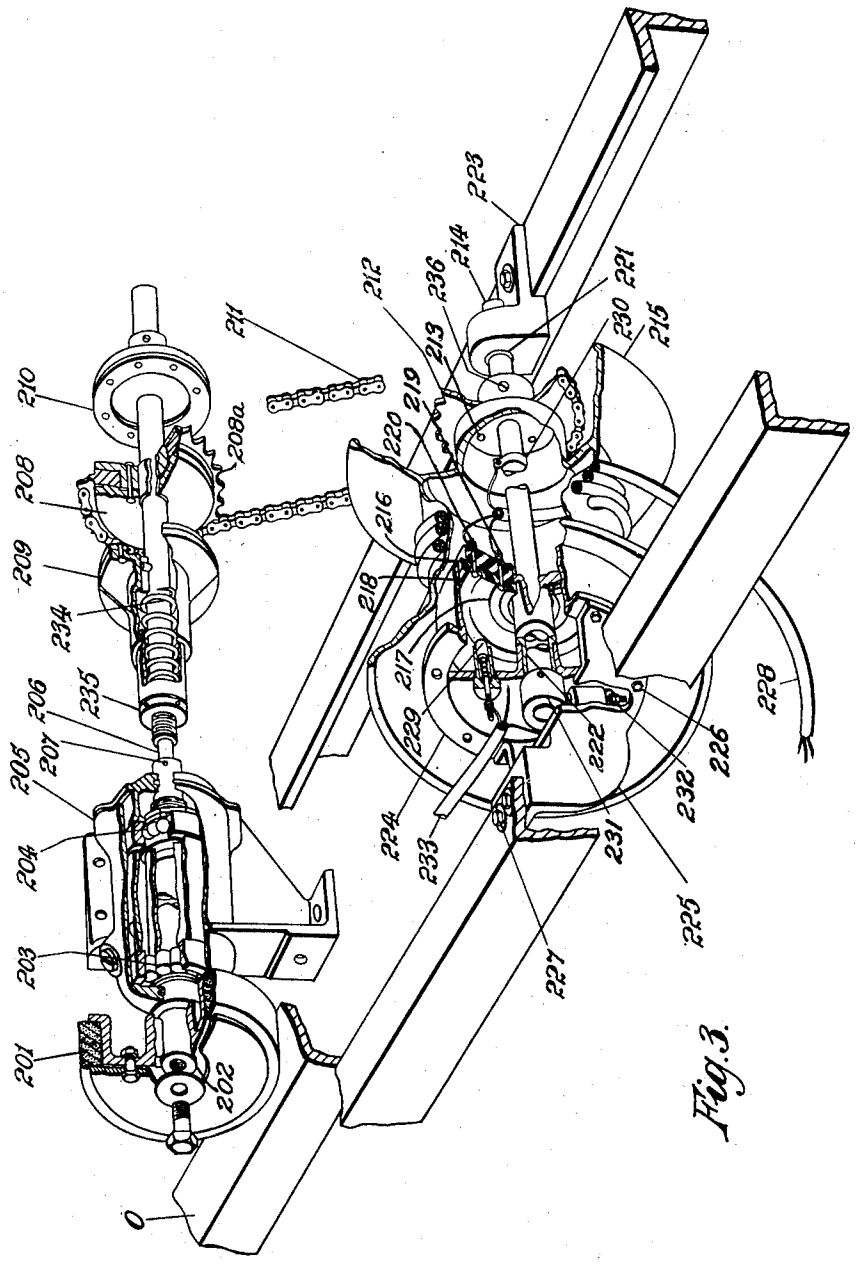


Fig. 3.

INVENTORS:
JAMES GREGORY
GEORGE A. R. FOSTER
HAROLD CATLING

BY Francis E. Boyce
ATTORNEY

June 24, 1952 J. GREGORY ET AL 2,601,386

MACHINE FOR DOFFING SPINNING AND LIKE MACHINES

Filed July 14, 1948 4 Sheets-Sheet 3

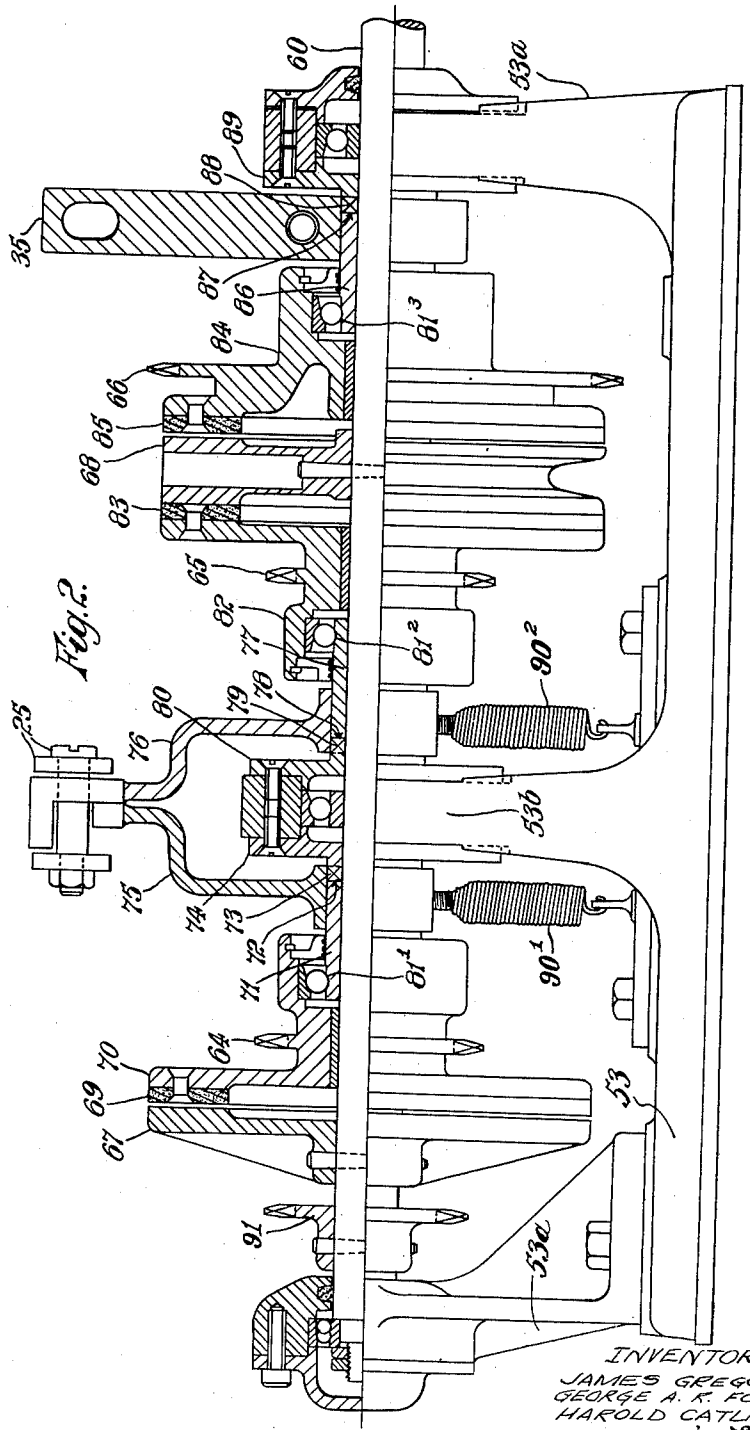


Fig. 2.

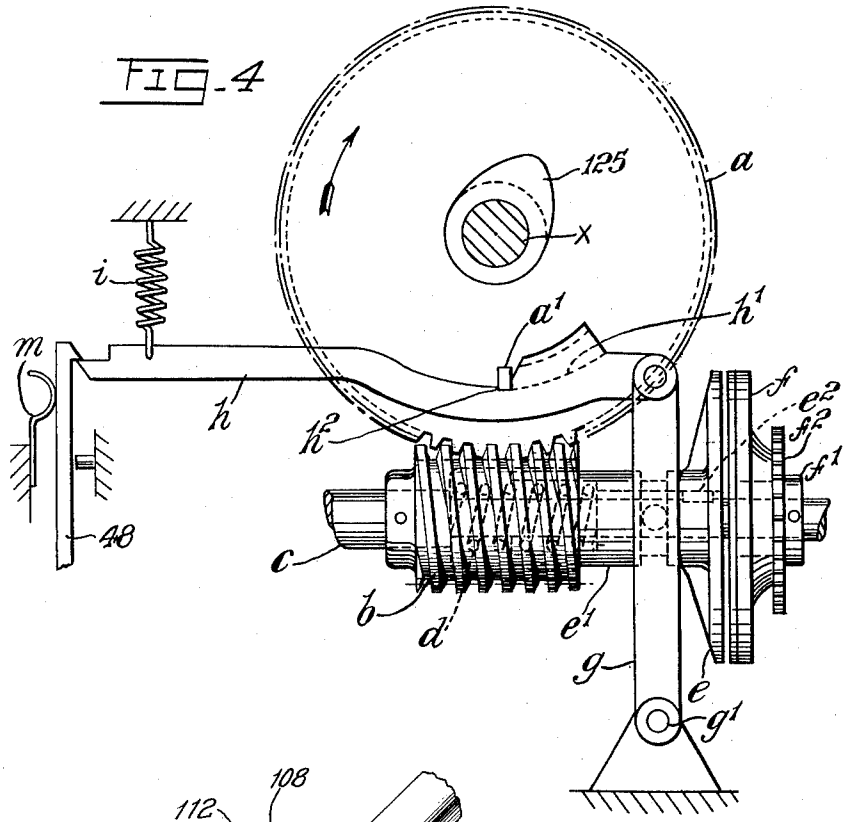
INVENTORS:
JAMES GREGORY
GEORGE A. K. FOSTER
HAROLD CATLING
BY Francis E. Boyce
ATTORNEY

June 24, 1952 J. GREGORY ET AL 2,601,386

MACHINE FOR DOFFING SPINNING AND LIKE MACHINES

Filed July 14, 1948 4 Sheets-Sheet 4

FIG. 4



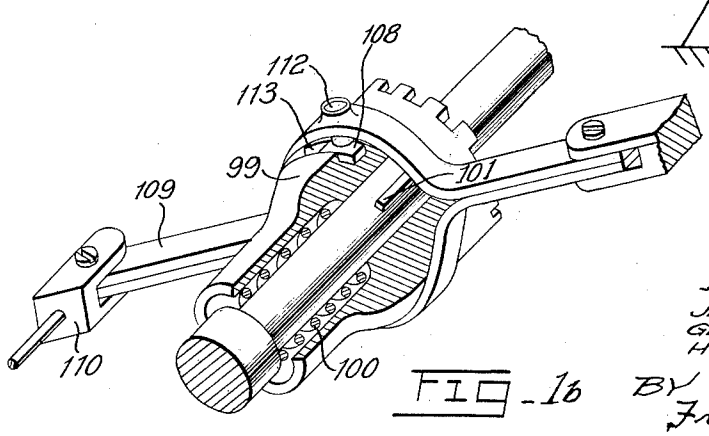


FIG. 16

INVENTORS:
JAMES GREGORY
GEORGE A. R. FOSTER
HAROLD CATLING

BY Francis E. Boyce
ATTORNEY

Patented June 24, 1952

2,601,386

UNITED STATES PATENT OFFICE

2,601,386

MACHINE FOR DOFFING SPINNING AND LIKE MACHINES

James Gregory, George Alfred Rea Foster, and Harold Catling, Didsbury, England, assignors to The British Cotton Industry Research Association, Didsbury, Manchester, England, a British association

Application July 14, 1948, Serial No. 38,636
In Great Britain July 16, 1947

14 Claims. (Cl. 57—53)

1

This invention relates to doffing apparatus for spinning, doubling and twisting frames, with particular reference to the improved method of doffing incorporated in Patent No. 2,449,742 dated September 21, 1948, wherein a method and machine are described, the use of which eliminates the necessity for manual doffing of such spinning, doubling and twisting frames. In the specification of the aforesaid patent, particular reference is made to a "carriage doffer," which carried the doffing mechanism and was moved step by step to predetermined fixed positions along the frame and at each such position the doffing mechanism was caused to perform a cycle of movements for doffing a set or group of the bobbins of the frame, a cycle of events hereinafter termed a "doffing cycle," after which the carriage was moved along the frame to the next set of bobbins and so on until the whole of one side of the frame was doffed; it was convenient, though not essential, to have two doffers, one left handed and one right handed for doffing opposite sides of the frame. It is with mechanical doffers of the kind having a doffer carriage moving step-by-step as aforesaid to positions determined by latching mechanism that the present invention is concerned.

Hitherto, in mechanical doffers of the kind above referred to, the traversing of the carriage doffer from one position to another, and ultimately its return to the starting point, has been effected manually and inevitably with some loss of time and absorption of labour.

The object of the present invention is to provide for automatic traverse of the doffer carriage between each doffing cycle, whereby on completion of a doffing cycle the traverse will be initiated and on completion of a traverse the next doffing cycle will be initiated, and whereby the whole doffing operation may be more rapid, and a saving of time and labour may be effected.

One problem is, therefore, to apply a driving force for moving the carriage as quickly as possible in each step-by-step movement, and to discontinue such driving force and bring the carriage to rest accurately at each required position. It has been found that in order to achieve this object and at the same time to prevent severe vibration and shock at the moment when the moving carriage is brought to rest, it is necessary to arrange that at this moment the velocity of the carriage should be reasonably low.

According to the invention doffing apparatus of the kind comprising a doffing carriage mounted on wheels and movable step-by-step to

2

predetermined positions along a spinning, doubling or twisting frame, doffing mechanism on the carriage, means for driving the doffing mechanism through a doffing cycle, means for starting and stopping the doffing mechanism, and latching mechanism for locating and securing the carriage in the said positions, is characterised by driving means for moving the carriage, starting and stopping means for the carriage, means actuated by the doffing mechanism for (1) unlatching the carriage, and (2) actuating both the means for stopping the doffing mechanism and the means for starting the drive to the carriage on completion of a doffing cycle, and means in timed relation with the re-engagement of the latching mechanism at the next position to actuate both the means for stopping the drive to the carriage and the means to start the drive to the doffing mechanism for the next doffing cycle.

In a preferred embodiment of the invention the latching mechanism is arranged so that unlatching is effected by the doffing mechanism just before completion of the doffing cycle and such unlatching movement of the latch initiates the traverse and so that re-engagement of the latch stops the traverse and restarts the doffing mechanism for the next doffing cycle.

The doffing apparatus aforesaid may be further characterised by means for returning the carriage to the starting end of the frame after completing the doffing of the last set of spindles.

According to one embodiment of the invention applicable to ring frames, and as applied to the apparatus described and illustrated in the specification and drawings of the earlier patent specification No. 2,449,742, hereinbefore referred to, this may be achieved by the mechanism described below, the motive power being provided by an electric motor which is mounted on the carriage, and which may also be used to operate the remainder of the mechanism on the carriage. Power is delivered by a cable wound on a drum fixed to the carriage, and which is permitted to unwind when the carriage moves forward by means of a freewheel device, and rewound on the drum during the reverse movement of the carriage by means of a continuously operated slipping-clutch. Two different ratio gears are employed to drive the carriage forward. Over most of each traverse the high gear is engaged, but as the next latching position is approached a lower gear comes into operation; this low gear (about one-tenth of the high gear ratio) acts largely as a brake to the momentum of the car-

riage, and ensures that the shock of the sudden stopping of the carriage is reduced to a reasonable value.

The accompanying drawings illustrate one embodiment of this invention in which:

Fig. 1 is a diagrammatic isometric view, partly in section, of that part of the mechanism which includes the latching system, the transport drive, the three speed shaft and the road wheel gear, the road wheel driving mechanism being raised for convenience of illustration.

Fig. 1*a* shows diagrammatically the method of engaging reverse gear.

Fig. 1*b* is a perspective view showing certain of the parts in operative position.

Fig. 2 is a diagrammatic view in elevation of the three speed shaft.

Fig. 3 shows the cable drum mechanism.

Fig. 4 shows the timing shaft and clutch mechanism for the doffing cycle.

It is to be assumed that when employing this embodiment of the invention, a special lower rail O (see Figs. 1 and 3) is fitted to the ring frame, on which the road wheels of the doffer carriage will run. In addition, the ring frame has a special upper rail O^1 fitted with a series of pegs P placed accurately and at fixed intervals, so as to locate the carriage accurately with respect to each set of spindles to be doffed.

Referring to Fig. 1, 1 is an upper latching element (with a notch 2 which closes over the pegs P mentioned above) which is carried on a shaft 3 in journalled bearings (not shown but attached to the rail 15 described later) to which shaft 3 are fixed two levers 4 and 5. The upper latch element 1 also carries a cam bowl 6 which is free to run on the top surface 7 of a sliding member 8. The member 8 is drilled and carries bearings in which a short rotatable shaft 9 is carried. Secured to the shaft 9 are a lower latch element 10 and a trip lever 11, the latter being fitted with a cam bowl 12. The lower latch element 10 is spring-loaded by means of a spring 13 against a stop not shown, which stop prevents the latch 10 from rotating in an anti-clockwise direction beyond the position in which it is drawn. 15 is a rail which forms part of a frame of the carriage doffer, and is arranged so that the sliding member 8 can slide along the vertical face of the rail 15 by means of studs of which 16 is one, and which studs slide in a slot 17 cut in the rail 15. The shaft 9 also passes through this slot 17. These studs 16 also serve to maintain the sliding member 8 in contact with the vertical face of the rail 15. Lateral movement of the member 8 is limited at one end by a rubber buffer 18. The sliding member 8 is normally held against the buffer 18 by means of a spring A, shown diagrammatically in Fig. 1 but arranged in practice to permit the full movement of the sliding member 8. The upper latch element 1 is spring-loaded in a "down" position through the lever 4 to which is attached a spring C carried on a rod 19 passing through a hole 15^1 in the rail 15, the upper end of the spring abutting against the rail and the lower end of the spring engaging an adjustable nut 19^1; the actual position taken up by the latch 1 at any moment is determined by the movement of the bowl 6 along the top surface 7 of the sliding member 8, one end 7*a* of which surface slopes downwards as shown. The lever 5 carries an adjustable trip-rod 20 which will be referred to below.

A spring-loaded shaft 21 is carried in bearings not shown on the carriage and to it is attached a lever 22 which by means of a tension spring 23 maintains the shaft normally in the position shown. To the shaft 21 is fixed a lever 24 to which is attached a pre-selecting lever 25 for high-sped forward and high speed reverse gear described later. At its lower end there is secured to the lever 25 a pin 25*a*. To the shaft 21 are also attached a lever 26 which oprates a clutch described later for a slow speed mechanism, and a lever 27, the end of which carries a bowl 28, the movement of which bowl against a lower face 29 of the sliding member 8 determines the position of the lever 27 and the rotational position of the shaft 21. The lever 26 is forked and across the fork is a peg 30 which engages a stepped lever 31, to the lower end of which is secured, by a pin 32, a link 33 which passes through a slow-speed clutch operating lever 35 and is located with respect to the lever 35 by a collar 34, a buffer spring 36 and a nut 37. The trip rod 20 carried in a fixed bearing, not shown, towards its right-hand end is located in a slot 31*a* in the upper end of the stepped lever 31. At the pin 32, the junction of the link 33 and the lever 31, there is also pinned a lever 38 which is carried at a fulcrum pin 39 by a bearing support 40 to which the pin 39 is secured. The lever 38 also carries a leaf spring 41 which spring loads the lever 31 against the peg 30. The movement of the lever 38 is limited in one direction by a pin 42 which is attached to the bearing bracket 40. A pin 43 connects the end of the lever 38 to a short lever 44, both ends of which are slotted, the slot 44*a* at one end only being shown, and which is carried at its fulcrum by a pin 45 which is secured to a bracket 46. One slotted end of the lever 44 engages a rod 47 to one end of which is secured a spring B, and the other end of which is adjustably secured in a slot 43^1 in a link 48 having a hook 48^2. The hooked link 48 is a trip member, the downward movement of which is arranged to initiate the doffing cycle, as described later. The spring B is adjustably secured at its lower end by a nut B^1 to a base casting 53 of the doffer carriage described below.

A transport drive shaft 49 carried by the doffer carriage is at all times rotated by means of a sprocket 51 and a chain 50 from a motor, as indicated at M (Fig. 1). This shaft 49 is carried in two end bearings (not shown) and in a centre bearing 52 in the base casting 53 of the doffer carriage. To this shaft 49 are secured a high speed sprocket 54, a slow speed sprocket 55 and a reverse-gear driving pinion 56, the latter engaging a second pinion 57 to which is attached a reverse gear sprocket 58. The parts 57 and 58 rotate together on a short shaft 59 which is secured at one end in a slot in the centre bearing 52. A three speed shaft 60 carried in brackets 53*a* on the base 53 (see Fig. 2) has sprockets 64, 65 and 66 secured to it. The transport shaft 49 transmits its drive to the three speed shaft 60 by one or other of three chains 61, 62 or 63 which engage respectively the reverse sprockets 58 and 64, the high speed forward sprockets 54 and 65 or the slow speed sprockets 55 and 66.

To the shaft 60 (see Figs. 1 and 2) are pinned a cast iron flange 67 of the reverse gear clutch and a cast iron disc 68 of the forward gear clutch, 68 being common to both high speed and low speed forward gears. 69 is a friction face complementary to the flange 67 and is carried by a flanged outer sleeve 70, which can rotate about an inner sleeve 71 (see Fig. 2) which inner sleeve can rotate about the shaft 60. The outer sleeve 70 carries the driving sprocket 64 and the end

of the inner sleeve 71 is profiled to form the movable face cam 72. The method of employing the various face cams is illustrated in Fig. 1 at 87 and 88. 74 is a circular flange, the end of which is profiled at 73 to form the fixed face cam complementary to 72, the flange 74 being carried by a centre bearing bracket 53b. A high speed reverse operating lever 75 is clamped to the inner sleeve 71, the lever 75 being notched at 75a to receive the selector-lever pin 25a previously described. Adjacent to the lever 75 is a high speed forward lever 76 in which is cut the profiled slot 76a. This lever 76 is clamped to an inner sleeve 77 which can rotate about the shaft 60 and the end of which is profiled to form a movable face cam 78. This face cam 78 engages a fixed face cam 79 carried by a circular flange 80 which is secured with the flange 74 to the bracket 53b. A flanged outer sleeve 82 carries the high speed forward sprocket 65 and also carries a friction face 83 which can make contact with one side of the cast iron disc 69. A flanged outer sleeve 84 carries the slow speed forward sprocket 66 and a friction face 85. The flanged outer sleeve 84 can rotate about an inner sleeve 86 which in turn rotates about the shaft 60. 86 is profiled at one end to form the movable face cam 87. A fixed circular flange 89 is profiled to form the fixed face cam 88 complementary to the movable face cam 87. The flange 89 is secured to the end bracket 53a of base casting 53. The slow speed forward operating lever 35 is clamped to the inner sleeve 86. By means of three thrust races 81^1, 81^2, and 81^3 the flanged outer sleeves 70, 82 and 84 and the inner sleeves 71, 77 and 86, are located respectively to ensure that the fixed and movable face cams are in their correct relative positions. The reverse lever 75 and the high speed forward lever 76 are spring-loaded at one end by tension springs 90^1 and 90^2 secured to the base casting 53. Pinned to the shaft 60 is a driving sprocket 91 which transfers the drive through a chain 92 to a driving sprocket 93 which is pinned to a lay shaft 94.

This shaft 94 carried at one end in a bearing 95 in the bearing housing 97 carries a spring-loaded clutch member 99, the loading being carried out by a spring 100. The clutch member 99 is located on the shaft 94 by a key 101 and the clutch member 99 is normally in engagement with another clutch member 102. These clutch members are shown widely spaced for the sake of clarity. To the clutch member 102 is secured a pinion 103, this assembly being free to rotate about the shaft 94 and being carried in bearings 104 in the bearing housing 98 mounted on the doffer carriage. The pinion 103 engages a reduction gear wheel 105 which transfers the drive through a shaft 106 to a driving wheel 107. The spring-loaded clutch member 99 can be disengaged from the member 102 by a shoe 108 which for clarity is shown disengaged from the groove 113 and from the lever 109. Such lever is carried by a Bowden cable 110, which cable is located by a casting 111 fixed on the housing 98. One end of the shoe 108 fits into a hole 112 in the lever 109 and the other end engages a groove 113 in the clutch member 99. The lever 109 is also shown raised and broken to avoid obscuring other parts.

Referring to Fig. 1a, the selecting-lever 25 has, at its lower extremity, a stem 25b which passes through a slot 53c in the base casting 53. This stem 25b is engaged by the forked end 118 of a lever 114. This lever 114 is secured to the casting 53 by a fulcrum pin 115 and carries at its other end, a cam bowl 116. It is spring-loaded by a spring 117, so that the pin 25a (see Fig. 1) is normally engaged at the end of the horizontal portion of the profiled slot 76a in the high speed forward lever 76.

As shown in Figs. 1 and 4, the doffing mechanism includes a timing shaft X (which is also given the same reference in the granted Patent No. 2,449,742), having a cam 125 adapted to engage a bowl 123 at one extremity of a lever 122, the other end of which is adapted to engage the bowl 12 when the sliding member 8 is at the left hand position with the lower latch element 10 resting against a peg P with the upper latch member 1 also engaged with the same peg. The lever 122 is pivotally carried by a bracket 122a on the doffer carriage and is loaded by a tension spring 124. The timing shaft is arranged for a single revolution for each doffing cycle by mechanism (see Fig. 4) as follows:

On the cam shaft X is a worm wheel *a*, in mesh with which is a worm *b* fixed to a shaft *c*. The worm is hollow and forms a housing for a spring *d* which is also partly housed in the hub e^1 of a friction clutch member *e* which is slidably keyed to the shaft *c* by a key e^2. Rotatably journalled on the shaft is a complementary clutch member *f* positioned by a retaining collar f^1, said clutch member having a chain sprocket f^2 by which it is continuously driven from the motor provided for driving continuously the shaft 49 previously described.

The slidable clutch member *e* is adapted to be moved, for disengagement, against the spring *d* by means of a lever *g* pivotally mounted on the doffer carriage at g^1 which lever at its upper end is pivotally connected to a catch link *h*. This link *h* is supported at its free end by a spring *i* and is formed with an internal cam face h^1 and shoulder h^2, the latter adapted to cooperate with a peg a^1 fixed in the face of the worm wheel *a*. The extreme end of the lever *h* is adapted to be engaged by the hooked link 48 which is shown also in Fig. 1. The hooked link 48 is tensioned by the spring *m* as shown.

In Fig. 4 the doffing mechanism is shown just prior to the commencement of a doffing cycle, the clutch being positively disengaged by the peg a^1 engaging the shoulder h^2.

In operation, as soon as the lever *h* is depressed by means of the hook link 48, operated as described later, on the engagement of the latch, the shoulder h^2 is disengaged from the peg a^1. The clutch part *e* is, as a result, forced by the spring *d* into frictional engagement with the continuously rotating complementary clutch part *f* and the consequent rotation of the worm *b* commences to rotate the cam shaft X starting the doffing cycle. As the shaft X nears the completion of one revolution the peg a^1 passes beneath the cam face h^1 and thereby ensures that the peg a^1 engages the shoulder h^2 on the lever *h*. The hooked link 48 previously pulled down to initiate the doffing cycle is returned to its normal position to engage the lever *h* ready for starting the next doffing cycle, as described later. As soon as the peg engages the shoulder h^2 it commences to withdraw the sliding part *e* of the clutch against the action of the spring *d* until there is no longer sufficient frictional engagement to rotate the worm and thereby stops further rotation of the cam shaft.

Meanwhile the cam 125 has depressed the lever 122 thereby lowering the lower latch element 10

until it disengages from the peg P whereupon the sliding member 8 is moved to the right by the spring A thereby initiating the start of the traverse of the doffer carriage, as described below, the parts of the traverse mechanism now being in the position shown in Fig. 1.

The sequence of events during the operation of the traversing and latching mechanism is as follows:

The motor, which has been running to drive the doffing mechanism now operates to effect the traverse, the high speed forward gear being engaged by engagement of the friction disc 83 with the cast iron disc 68 and all the other parts being in the position shown in Fig. 2. The motor therefore effects the start of the traverse at high speed through the chains 62 and 92 to the driving wheel 107.

The doffer carriage then moves along the rail to the right in Fig. 1 in high speed forward gear until the lower latch element 10 strikes the next peg P along the frame. The sliding member 8 now moves back (to the left in Fig. 1) with respect to the carriage (the carriage continuing to move forward with respect to the frame), the studs 16 moving along the slot 17. During this movement of the sliding member 8, the lower face 29 of the member 8 strikes the cam bowl 28 and thereby depresses the lever 27. This in turn causes the shaft 21 to rotate in an anti-clockwise direction against the tension of the spring 23 and this rotation causes the lever 24 to lift. This, through the pin 25a on the lever 25 lifts the lever 76 and in doing so rotates the inner sleeve 77 and its cam face 78 in a direction such that this cam face 78 and the fixed cam face 79 previously partially separated now move together, with the result that by means of the thrust race 81, the flanged outer sleeve 82 moves back with the inner sleeve 78 allowing the clutch face 83 to move out of contact with the fixed clutch face 68. The high speed forward gear is thus disconnected. While the lever 24 has been moving up, the lever 26 has also moved up, the pin 30 engaging the stepped lever 31 and moving this upwards with the result that the link 33 also moves upwards, taking the lever 35 with it and rotating the inner sleeve 86. By a mechanism complementary to that described above for the disengagement of high speed forward gear, slow speed forward gear is engaged when the movable friction face 85 makes contact with the complementary face of the cast iron disc 68 (see Fig. 2). Slow speed forward gear is thus engaged and it may be pointed out that the necessary gear ratios are obtained by adjusting the relative diameters of the sprockets 54 and 65, 55 and 66, and (for reverse gear described below) 58 and 64. It will also be seen that whatever the speed and the direction of rotation of the relevant sprocket on shaft 60, the drive is transferred to the lay shaft 94 by means of the sprocket 91 and the chain 92.

The upward movement of the lever 31 also moves the levers 38 and 44 so that the pin 47 held in the forked end of the lever 44 moves the hooked link 48 in an upward direction and this movement of the link 48 springs its hooked end over the end of the lever *h* to the position shown in Fig. 5. In the meantime, the continued relative movement of the carriage to the frame has resulted in the latch element 1 arriving at a position in which the bottom face 1a of such latch element is above the peg P and by reason of the engagement of the lower latch element 10 with the peg P, the cam bowl 6 has been moving over the sliding member B until said cam bowl has moved over the sloping face 7a, such bowl being prevented from running down this face by the presence of the peg beneath the surface 1a of the upper latch element 1. Further movement of the carriage brings the notch 2 over the peg and the upper latch element 1 then drops over the peg and the cam bowl 6 drops on to the sloping face 7a under the action of the spring C. At the same time, the short shaft 3 is rotated and the trip lever 20 is moved by the lever 5 so that the stepped lever 31 is moved off the peg 30, allowing the link 33 to be pulled down by the action of the spring B through the levers 44 and 38, thereby disengaging slow speed forward (by a reversal of the process described earlier on) and pulling down the hooked link 48. This pulling down of the link 48 to its previous position by the engagement of the upper latch member 1 over the peg P initiates the doffing cycle as already described with reference to Fig. 4. While the carriage is latched on the frame, both forward gears are in a neutral position. The backward movement of the sliding member 8 has also brought the bowl 12 of the lower latching member 10 over the end of the lever 122 ready for tripping thereby as previously described just before completion of the doffing cycle. The cam 125 depresses the bowl 123 thereby raising the other end of the lever 122 against the bowl 12 lowering the catch lever 10 away from the peg P allowing the spring A to pull the sliding member to the right.

During this movement to the right of the sliding member 8 the cam bowl 6 moves up the sloping surface 7a with the result that the upper latch element 1 is moved off the peg and with the further result that the cam bowl 28 ceases to be in contact with the face 29, and the shaft 21 with the various components it carries moves back under the action of the spring 23 to the positions shown in Fig. 1. The stepped lever 31 also re-engages with the peg 30. The unlatching of the element 1 also has the result that by a movement opposite to that described above for the disengagement of high speed forward gear, high speed forward gear is now re-engaged. The carriage therefore moves off.

During the movement of the carriage towards the last peg on the frame rail o^1 and after high speed forward gear has been disengaged for the last time, it is arranged that the cam bowl 116 (see Fig. 1a) comes into contact with a fixed cam (not shown) on the ring frame. As a result, the forked end 118 of the lever 114 is moved and thereby causes the stem 25b to move along the slot 53c against the tension of the spring 117. The pin 25a then moves along the horizontal portion of the profiled slot 76a in the lever 76 until it engages the notch 75a in the lever 75, remaining in this position until the doffing cycle is completed. It will be understood that the gear selecting lever 25 has been raised to disengage high speed forward gear and therefore has brought the pin 25a opposite the notch 75a. On the sliding member 8 moving to the right on the completion of the last doffing the pin 25a takes with it the lever 75 but does not move the lever 76 because it is positioned so that it moves down the vertical portion of the profiled slot 76a. As a further result the inner sleeve 71 is rotated and the movable cam face 72 climbs up the fixed cam face 73 thus transferring a movement through the thrust race 81 to the outer sleeve 70 and engaging the movable clutch face 69 with the

fixed clutch face 67. As a result reverse gear is engaged, for by means of the pinion 57, it is arranged that the sprocket 64 rotates in a direction opposite to that of sprockets 65 and 66. The carriage therefore moves back along the frame and the upper latch element 1 being in the raised position, the carriage has a clear run back to its starting point. The lower latch element 10 is depressed by each peg as it passes under them. The clutch members 99 and 102 being normally in engagement, the drive is transferred to the pinion 103 and the reduction gear wheel 105 and thence through the shaft 106 to the road wheel 107.

In order to make it convenient to manipulate the machine on to and off the frame by hand, the clutch member 99 can be disengaged through the Bowden cable 110.

Having now described the essential traversing and latching mechanisms, it is necessary to explain how electric power is conveyed to the doffer carriage while it is operating. This is achieved by fitting the doffer carriage with a rotating cable drum, a slip ring electrical contact device and a combined free wheel and slipping clutch mechanism for winding and unwinding the cable on the drum. In considering Fig. 3 let us assume that the doffer carriage has just been hand manipulated on to the frame preparatory to doffing. A driving wheel 201 which is not positively driven but by friction between it and the auto-doffer rail O turns in clockwise direction, thereby causing a shaft 202 to rotate, this shaft being carried by roller and ball races 203 and 204 in a casting 205 which is secured to the doffer carriage. The shaft 206 is pinned to the shaft 202 at 207 and carried at its other end in a bearing (not shown). The shaft 206 drives friction clutches 209 and 210 which though for convenience shown widely separated are adapted to transmit the drive to a free wheel 208 by engaging the opposite faces thereof. The sprocket 208a of the free wheel 208 is connected by a chain 211 to a sprocket 212 which is itself fastened to a cable drum 215 at 213. A shaft 214 to which the cable drum 215 is pinned at 236 carries the cable drum assembly which comprises the rotating drum 215 (which carries the cable 228) and insulating piece 216 fastened to the inner side of the drum 215. This insulating piece 216 carries two brass rings 217 and 218 which, as will be seen, act as conductors for the electric supply of the motor. The shaft 214 is carried in bearings 221 and 222, a block 223 which houses bearing 221 being secured to the doffer carriage. Bearing 222 is carried by a fixed casting 224 which is in turn secured by a bolt 226 to another fixed casting 225 which is itself secured to the doffer carriage by bolts 227. Spring-loaded plungers 229 (only one shown) which make permanent contacts with the rings 217 and 218 are fitted into the fixed casting 224. The shaft 214 carries a grounding clip 230. A boss 231 with which contact is made by another similar spring plunger 232 is carried by the fixed casting 225.

The sequence of events during the outward run of the carriage is therefore as follows:

The clockwise rotation of wheel 201 results in the clockwise rotation of the free wheel 208, it being arranged that this free wheel idles and no drive is transmitted through the chain 211. The cable drum 215 is therefore free to be rotated in a clockwise direction by the pull of the cable 228 which is connected to the mains supply, as it unwinds. This cable is a three-cored cable, two cores being connected to the rings 217 and 218 by means of terminals 219 and 220 which pass through the insulating piece 216 and through the drum 215 but being insulated from the latter. The third core or ground lead is connected to the shaft 214 by means of the clip 230. The fixed spring plungers 229 (one not shown) carry the current as the rings rotate with the drum to two of the cores of the three-cored cable 233 which is connected to the motor. The third core of 233 is connected to the earthing boss 231 through the spring plunger 232, thereby ensuring that the motor is itself grounded through the shaft 214.

On completion of the outward run of the doffer (i. e. when the doffing of one side of the ring frame is complete) reverse gear is engaged as explained above and the wheel 201 rotates in an anti-clockwise direction. The friction clutches 209 and 210 now transmit an anti-clockwise rotation to the free wheel 208 which in turn positively drives the sprocket 212 by means of the chain 211. The cable drum therefore rotates in an anti-clockwise direction with the result that the cable rewinds on the drum 215. It is arranged that the gear ratio between the sprockets 208 and 212 is such that the cable tends to be wound on the drum at a speed slightly in excess of the speed of the carriage along the frame. Also, as the cable builds up on the drum, the surface speed of the cable would increase if the speed of rotation of the shaft 206 remains constant. To prevent excess pull on the cable, it is arranged that the friction clutches 209 and 210 can slip against the free wheel 208. To regulate the maximum tension on the cable during winding the pressure of the clutches 209 and 210 against 208 can be adjusted by means of the adjusting collar 235.

While the invention has been described in its application to a ring frame it could be applied to a mule, for example by having right-hand and left-hand doffing carriages, each operating to the centre of the mule, beyond which neither could conveniently be arranged to move because of the driving mechanism for the mule carriage.

We declare that what we claim is:

1. In a doffing apparatus of the kind comprising a doffer carriage mounted on wheels and movable step-by-step to predetermined positions along a spinning, doubling or twisting frame, doffing mechanism on the carriage, means for driving the doffing mechanism through a doffing cycle, including a timing shaft and driving mechanism for rotating said shaft through one revolution for each cycle, and means for starting and stopping the driving mechanism for the timing shaft at the beginning and end of each doffing cycle, the combination of traversing and latching mechanism for moving the carriage step-by-step and locating and securing said carriage in each of said predetermined positions, comprising driving means for moving the carriage, drive control means for engaging and disengaging said driving means, complementary engageable and disengageable latching members on the doffer carriage, means associated with the timing shaft of the doffing mechanism for disengaging said latching members immediately before completion of each revolution of the shaft and for actuating the drive-control means to start the drive to the carriage, and means in timed relation with the re-engagement of the latching members at the next predetermined po-

sition of the carriage to actuate both the drive control means for stopping the drive to the carriage and the means to start the drive to the timing shaft of the doffing mechanism for the next doffing cycle.

2. In apparatus as set forth in claim 1, the combination of traversing and latching mechanism set forth in said claim, said latching mechanism comprising a pivoted latch having a notch, pegs on the frame at each latching position adapted to be engaged by the notch, a slide adjacent to the latch, means urging the slide into a position in advance of the latch and a spring-loaded pivoted feeler member on the slide adapted to abut against a peg when in its advanced position and thereby to arrest the slide so that it is pushed back relative to the carriage against said urging means while the carriage continues to move, means on the slide for holding the latch in an inoperative position during at least part of such continued movement of the carriage and for subsequently releasing the latch for engagement of its notch with the peg, when it comes into register therewith.

3. In apparatus as set forth in claim 1, the combination of traversing and latching mechanism set forth in said claim, said latching mechanism comprising a pivoted latch having a notch, pegs on the frame at each latching position adapted to be engaged by the notch, a slide adjacent to the latch, means urging the slide into a position in advance of the latch and a spring-loaded pivoted feeler member on the slide adapted to abut against a peg when in its advanced position and thereby to arrest the slide so that it is pushed back relative to the carriage against said urging means while the carriage continues to move, means on the slide for holding the latch in an inoperative position during at least part of such continued movement of the carriage and for subsequently releasing the latch for engagement of its notch with the peg, when it comes into register therewith, further characterised by high and low speed gearing in the driving means for the carriage, means for engaging the high speed gearing on actuation of the starting means for the carriage and means for changing to low speed gearing as the carriage approaches the next latching position.

4. In apparatus as set forth in claim 1, the combination of traversing and latching mechanism set forth in said claim, said latching mechanism comprising a pivoted latch having a notch, pegs on the frame at each latching position adapted to be engaged by the notch, a slide adjacent to the latch, means urging the slide into a position in advance of the latch and a spring-loaded pivoted feeler member on the slide adapted to abut against a peg when in its advanced position and thereby to arrest the slide so that it is pushed back relative to the carriage against said urging means while the carriage continues to move, means on the slide for holding the latch in an inoperative position during at least part of such continued movement of the carriage and for subsequently releasing the latch for engagement of its notch with the peg, when it comes into register therewith, further characterised by high and low speed gearing in the driving means for the carriage, means for engaging the high speed gearing on actuation of the starting means for the carriage and means for changing to low speed gearing as the carriage approaches the next latching position, further characterised in that the gear change is actuated by part of the latching mechanism.

5. In apparatus as set forth in claim 1, the combination of traversing and latching mechanism set forth in said claim, said latching mechanism comprising a pivoted latch having a notch, pegs on the frame at each latching position adapted to be engaged by the notch, a slide adjacent to the latch, means urging the slide into a position in advance of the latch and a spring-loaded pivoted feeler member on the slide adapted to abut against a peg when in its advanced position and thereby to arrest the slide so that it is pushed back relative to the carriage against said urging means while the carriage continues to move, means on the slide for holding the latch in an inoperative position during at least part of such continued movement of the carriage and for subsequently releasing the latch for engagement of its notch with the peg, when it comes into register therewith, further characterised by high and low speed gearing in the driving means for the carriage, means for engaging the high speed gearing on actuation of the starting means for the carriage and means for changing to low speed gearing as the carriage approaches the next latching position, further characterised in that the gear change is actuated by part of the latching mechanism, further characterised by mechanism coupling the pivoted latch to the control means for starting and stopping means for the carriage drive and to the starting means for the timing shaft of the doffing mechanism whereby pivoted movement of the latch to engage the peg stops the drive to the carriage and starts the drive for the doffing cycle.

6. In apparatus as set forth in claim 1, the combination of traversing and latching mechanism set forth in said claim, said latching mechanism comprising a pivoted latch having a notch, pegs on the frame at each latching position adapted to be engaged by the notch, a slide adjacent to the latch, means urging the slide into a position in advance of the latch and a spring-loaded pivoted feeler member on the slide adapted to abut against a peg when in its advanced position and thereby to arrest the slide so that it is pushed back relative to the carriage against said urging means while the carriage continues to move, means on the slide for holding the latch in an inoperative position during at least part of such continued movement of the carriage and for subsequently releasing the latch for engagement of its notch with the peg, when it comes into register therewith, further characterised by high and low speed gearing in the driving means for the carriage, means for engaging the high speed gearing on actuation of the starting means for the carriage and means for changing to low speed gearing as the carriage approaches the next latching position, further characterised in that the gear change is actuated by part of the latching mechanism, further characterised by mechanism coupling the pivoted latch to the control means for starting and stopping means for the carriage drive and to the starting means for the timing shaft of the doffing mechanism whereby pivoted movement of the latch to engage the peg stops the drive to the carriage and starts the drive for the doffing cycle, further characterised by mechanism coupled with the timing shaft of the doffing mechanism for actuation at the end of the doffing cycle to release the slide so that it is urged to an advanced position and means operably connected with such slide for lifting the

latch and thereby starting the drive for the carriage.

7. In apparatus as set forth in claim 1, the combination of traversing and latching mechanism set forth in said claim, said latching mechanism comprising a pivoted latch having a notch, pegs on the frame at each latching position adapted to be engaged by the notch, a slide adjacent to the latch, means urging the slide into a position in advance of the latch and a spring-loaded pivoted feeler member on the slide adapted to abut against a peg when in its advanced position and thereby to arrest the slide so that it is pushed back relative to the carriage against said urging means while the carriage continues to move, means on the slide for holding the latch in an inoperative position during at least part of such continued movement of the carriage and for subsequently releasing the latch for engagement of its notch with the peg, when it comes into register therewith, further characterised by high and low speed gearing in the driving means for the carriage, means for engaging the high speed gearing on actuation of the starting means for the carriage and means for changing to low speed gearing as the carriage approaches the next latching position, further characterised in that the gear change is actuated by part of the latching mechanism, further characterised by mechanism coupling the pivoted latch to the control means for starting and stopping means for the carriage drive and to the starting means for the timing shaft of the doffing mechanism whereby pivoted movement of the latch to engage the peg stops the drive to the carriage and starts the drive for the doffing cycle, further characterised by mechanism coupled with the timing shaft of the doffing mechanism for actuation at the end of the doffing cycle to release the slide so that it is urged to an advanced position and means operably connected with such slide for lifting the latch and thereby starting the drive for the carriage, further characterised in that the means for releasing the slide comprises means for raising the feeler member to disengage it from the peg.

8. In apparatus as set forth in claim 1, the combination of traversing and latching mechanism set forth in said claim, said latching mechanism comprising a pivoted latch having a notch, pegs on the frame at each latching position adapted to be engaged by the notch, a slide adjacent to the latch, means urging the slide into a position in advance of the latch and a spring-loaded pivoted feeler member on the slide adapted to abut against a peg when in its advanced position and thereby to arrest the slide so that it is pushed back relative to the carriage against said urging means while the carriage continues to move, means on the slide for holding the latch in an inoperative position during at least part of such continued movement of the carriage and for subsequently releasing the latch for engagement of its notch with the peg, when it comes into register therewith, further characterised by high and low speed gearing in the driving means for the carriage, means for engaging the high speed gearing on actuation of the starting means for the carriage and means for changing to low speed gearing as the carriage approaches the next latching position, further characterised in that the gear change is actuated by part of the latching mechanism, further characterised by mechanism coupling the pivoted latch to the control means for starting and stopping means for the carriage drive and to the starting means for the timing shaft of the doffing mechanism whereby pivoted movement of the latch to engage the peg stops the drive to the carriage and starts the drive for the doffing cycle, further characterised by mechanism coupled with the timing shaft of the doffing mechanism for actuation at the end of the doffing cycle to release the slide so that it is urged to an advanced position and means operably connected with such slide for lifting the latch and thereby starting the drive for the carriage, further characterised in that the means for releasing the slide comprises means for raising the feeler member to disengage it from the peg, further characterised in that the means for releasing the slide comprises a cam on the timing shaft of the doffing mechanism and a lever actuated by such cam for tripping the feeler.

9. In apparatus of the kind comprising a doffer carriage mounted on wheels and movable step-by-step to predetermined positions along a spinning, doubling or twisting frame, doffing mechanism on the carriage, means for driving the doffing mechanism through a doffing cycle, including a timing shaft and driving mechanism for rotating said shaft through one revolution for each cycle, and means for starting and stopping the driving mechanism for the timing shaft at the beginning and end of each doffing cycle, the combination of traversing and latching mechanism for moving the carriage step-by-step and locating and securing said carriage in each of said predetermined positions, comprising driving means for moving the carriage, drive-control means for engaging and disengaging said driving means, complementary engageable and disengageable latching members on the doffer carriage, means associated with the timing shaft of the doffing mechanism for disengaging said latching members immediately before completion of each revolution of the shaft and for actuating the drive-control means to start the drive to the carriage, and means in timed relation with the re-engagement of the latching members at the next predetermined position of the carriage to actuate both the drive-control means for stopping the drive to the carriage and the means to start the drive to the timing shaft of the doffing mechanism for the next doffing cycle, characterized in that the latching mechanism includes a peg on the frame for each predetermined position and a latch on the carriage adapted to be engaged by said peg, and further characterized by the provision of reverse gears for the carriage drive, and means for engaging the reverse gear on disengagement of said latch from the last peg.

10. In apparatus of the kind comprising a doffer carriage mounted on wheels and movable step-by-step to predetermined positions along a spinning, doubling or twisting frame, doffing mechanism on the carriage, means for driving the doffing mechanism through a doffing cycle, including a timing shaft and driving mechanism for rotating said shaft through one revolution for each cycle, and means for starting and stopping the driving mechanism for the timing shaft at the beginning and end of each doffing cycle, the combination of traversing and latching mechanism for moving the carriage step-by-step and locating and securing said carriage in each of said predetermined positions, comprising driving means for moving the carriage, drive-control means for engaging and disengaging said driving means, complementary engageable and dis-

engageable latching members on the doffer carriage, means associated with the timing shaft of the doffing mechanism for disengaging said latching members immediately before completion of each revolution of the shaft and for actuating the drive-control means to start the drive to the carriage, and means in timed relation with the re-engagement of the latching members at the next predetermined position of the carriage to actuate both the drive-control means for stopping the drive to the carriage and the means to start the drive to the timing shaft of the doffing mechanism for the next doffing cycle, characterized in that the latching mechanism includes a peg on the frame for each predetermined position and a latch on the carriage adapted to be engaged by said peg, and further characterized by the provision of reverse gears for the carriage drive, and means for engaging the reverse gear on disengagement of said latch from the last peg, further characterized in that the means for starting the forward drive for the carriage includes pre-selector mechanism for coupling such means alternatively to the forward or reverse gearing and means for actuating such pre-selector to engage the reverse gearing when the carriage approaches the last peg.

11. In apparatus of the kind comprising a doffer carriage mounted on wheels and movable step-by-step to predetermined positions along a spinning, doubling or twisting frame, doffing mechanism on the carriage, means for driving the doffing mechanism through a doffing cycle, including a timing shaft and driving mechanism for rotating said shaft through one revolution for each cycle, and means for starting and stopping the driving mechanism for the timing shaft at the beginning and end of each doffing cycle, the combination of traversing and latching mechanism for moving the carriage step-by-step and locating and securing said carriage in each of said predetermined positions, comprising driving means for moving the carriage, drive-control means for engaging and disengaging said driving means, complementary engageable and disengageable latching members on the doffer carriage, means associated with the timing shaft of the doffing mechanism for disengaging said latching members immediately before completion of each revolution of the shaft and for actuating the drive-control means to start the drive to the carriage, and means in timed relation with the re-engagement of the latching members at the next predetermined position of the carriage to actuate both the drive-control means for stopping the drive to the carriage and the means to start the drive to the timing shaft of the doffing mechanism for the next doffing cycle, further characterised by an electric motor on the carriage for driving both the timing shaft of the doffing mechanism and the carriage, and clutch means associated therewith for coupling such motor to the timing shaft of the doffing mechanism and to the carriage.

12. In apparatus of the kind comprising a doffer carriage mounted on wheels and movable step-by-step to predetermined positions along a spinning, doubling or twisting frame, doffing mechanism on the carriage, means for driving the doffing mechanism through a doffing cycle, and including a timing shaft and driving mechanism for rotating said shaft through one revolution for each cycle, and means for starting and stopping the driving mechanism for the timing shaft at the beginning and end of each doffing cycle, the combination of traversing and latching mechanism for moving the carriage step-by-step and locating and securing said carriage in each of said predetermined positions, comprising driving means for moving the carriage, drive-control means for engaging and disengaging said driving means, complementary engageable and disengageable latching members on the doffer carriage, means associated with the timing shaft of the doffing mechanism for disengaging said latching members immediately before completion of each revolution of the shaft and for actuating the drive-control means to start the drive to the carriage, and means in timed relation with the re-engagement of the latching members at the next predetermined position of the carriage to actuate both the drive-control means for stopping the drive to the carriage and the means to start the drive to the timing shaft of the doffing mechanism for the next doffing cycle, further characterised by an electric motor on the carriage for driving both the timing shaft of the doffing mechanism and the carriage, and clutch means associated therewith for coupling such motor to the timing shaft of the doffing mechanism and to the carriage, further characterised by a cable drum for the cable to the electric motor, a cable drum therefore mounted on the carriage and means operably coupled to a wheel of the carriage for turning the said drum to rewind the cable on return movement of the carriage and to permit the drum to turn for unwinding as the carriage moves forward.

13. In apparatus of the kind comprising a doffer carriage mounted on wheels and movable step-by-step to predetermined positions along a spinning, doubling or twisting frame, doffing mechanism on the carriage, means for driving the doffing mechanism through a doffing cycle, and including a timing shaft and driving mechanism for rotating said shaft through one revolution for each cycle, and means for starting and stopping the driving mechanism for the timing shaft at the beginning and end of each doffing cycle, the combination of traversing and latching mechanism for moving the carriage step-by-step and locating and securing said carriage in each of said predetermined positions, comprising driving means for moving the carriage, drive-control means for engaging and disengaging said driving means, complementary engageable and disengageable latching members on the doffer carriage, means associated with the timing shaft of the doffing mechanism for disengaging said latching members immediately before completion of each revolution of the shaft and for actuating the drive-control means to start the drive to the carriage, and means in timed relation with the re-engagement of the latching members at the next predetermined position of the carriage to actuate both the drive-control means for stopping the drive to the carriage and the means to start the drive to the timing shaft of the doffing mechanism for the next doffing cycle, further characterised by an electric motor on the carriage for driving both the timing shaft of the doffing mechanism and the carriage, and clutch means associated therewith for coupling such motor to the timing shaft of the doffing mechanism and to the carriage, further characterised by a cable drum for the cable to the electric motor, a cable drum therefor mounted on the carriage and means operably coupled to a wheel of the carriage for turning the said drum to rewind the cable on return movement of the carriage

and to permit the drum to turn for unwinding as the carriage moves forward, further characterised in that the means operably coupling the wheel of the carriage to the drum comprises a slipping clutch and free wheel whereby the drum may be caused, as the carriage returns, to wind on turns of cable of varying diameter without applying undue tension to the cable and so as not to leave any slack, and to enable the carriage to move forward without unwinding excess length of cable.

14. In apparatus of the kind comprising a doffing carriage movable step-by-step to predetermined positions along a spinning, doubling or twisting frame, doffing mechanism on the carriage, means for driving the doffing mechanism through a doffing cycle, including a timing shaft and driving mechanism for rotating said shaft through one revolution for each cycle, the combination of latching mechanism for locating and securing the carriage in the said positions characterised by driving means for moving the carriage from one said position to the next, means

actuated by the timing shaft of the doffing mechanism for stopping itself on completion of a doffing cycle, means actuated by the timing shaft of the doffing mechanism just before it stops for releasing the latching mechanism and thereby initiating movement of the carriage to the next latching position and means, actuated by the re-engagement of the latching mechanism, for interrupting the drive to the carriage and for re-starting the timing shaft of the doffing mechanism to initiate the next doffing cycle.

JAMES GREGORY.
GEORGE ALFRED REA FOSTER.
HAROLD CATLING.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,408,587	Tucker	Oct. 1, 1946
2,449,742	Foster et al.	Sept. 21, 1948