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Goldammer et al.

[11] **3,806,990**

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[54] **FIBROUS MATERIAL MIXING APPARATUS**

[75] Inventors: **Georg Goldammer,** Friedrichshofen; **Günter Mahrt,** Etting, both of Germany

[73] Assignee: **Schubert & Salzer Maschinenfabrik Aktiengesellschaft,** Ingolstadt, Germany

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[52] **U.S. Cl.** **19/145.5**

[51] **Int. Cl.** **D01g 13/00**

[58] **Field of Search** ..... 19/80 R, 81, 145.5

[56] **References Cited**

UNITED STATES PATENTS

3,577,599 5/1971 Goldammer et al. 19/145.5

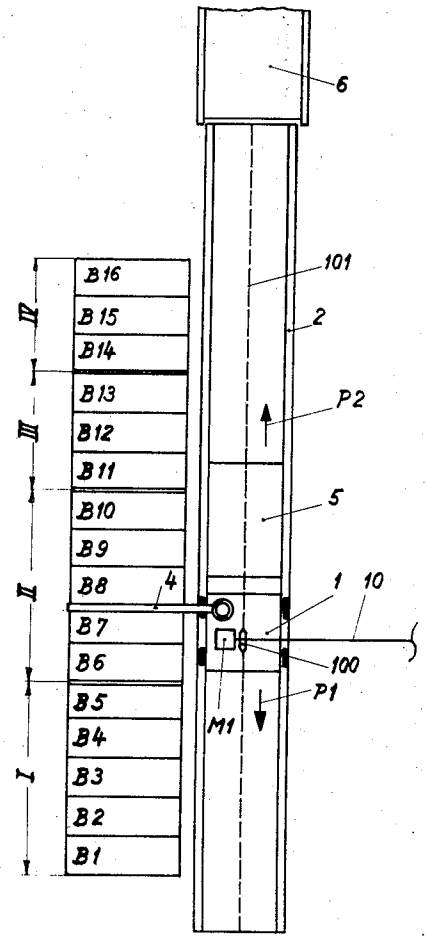
Primary Examiner—Dorsey Newton

Attorney, Agent, or Firm—Robert W. Beach

[57] **ABSTRACT**

A program control for a carriage reciprocable along rows of fiber bales is mounted on the carriage and includes switch actuating strips which cooperatively reproduce the path of carriage travel. A slide reciprocable relative to the actuating strips is driven by the carriage drive motor for movement corresponding to the carriage movement, but along a path of reduced scale. The slide carries a plurality of switches which are actuated by corresponding strips to effect control of the carriage movement. A clamp carried on the slide is selectively actuated to position switching lugs to control the carriage location relative to the bales in each grade of fiber upon commencement of succeeding fiber-mixing cycles.

7 Claims, 4 Drawing Figures



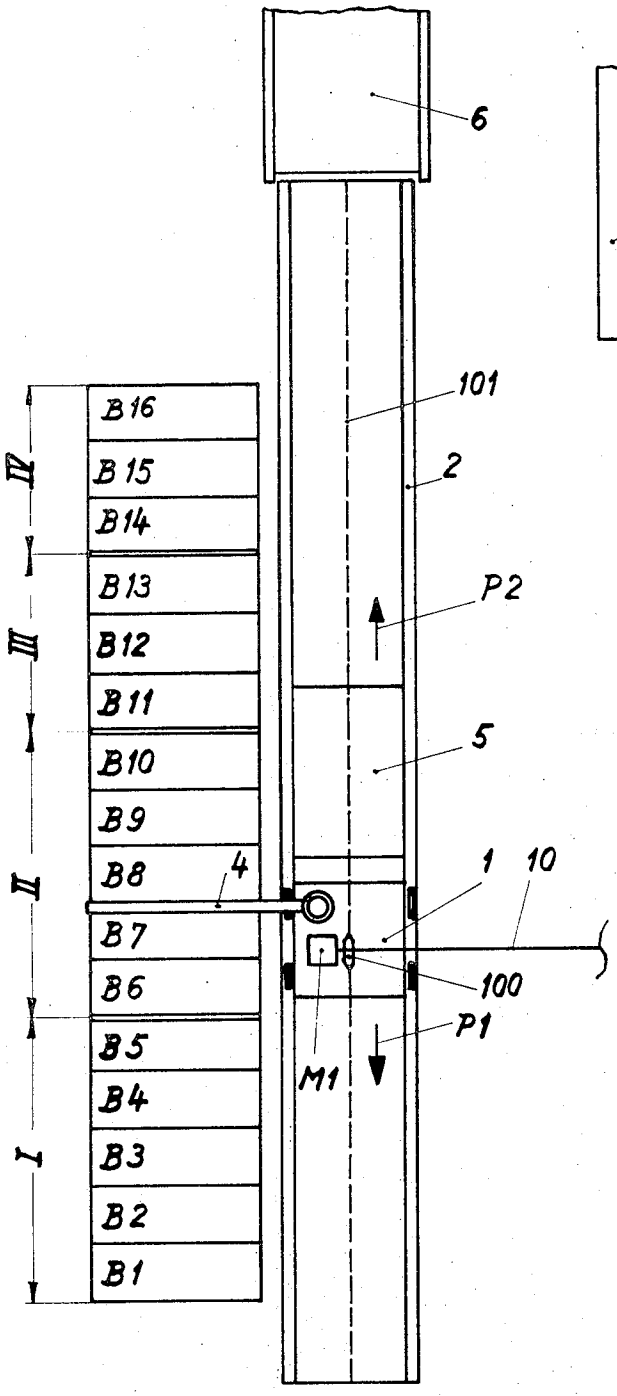


Fig. 1

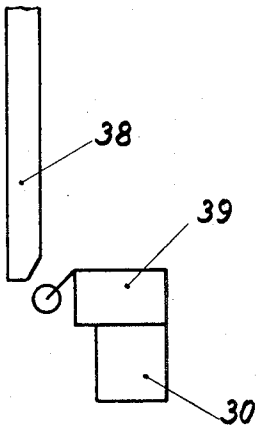


Fig. 4

INVENTORS
GEORG GOLDAMMER
GÜNTER MAHRT
BY
Robert W. Beach
ATTORNEY

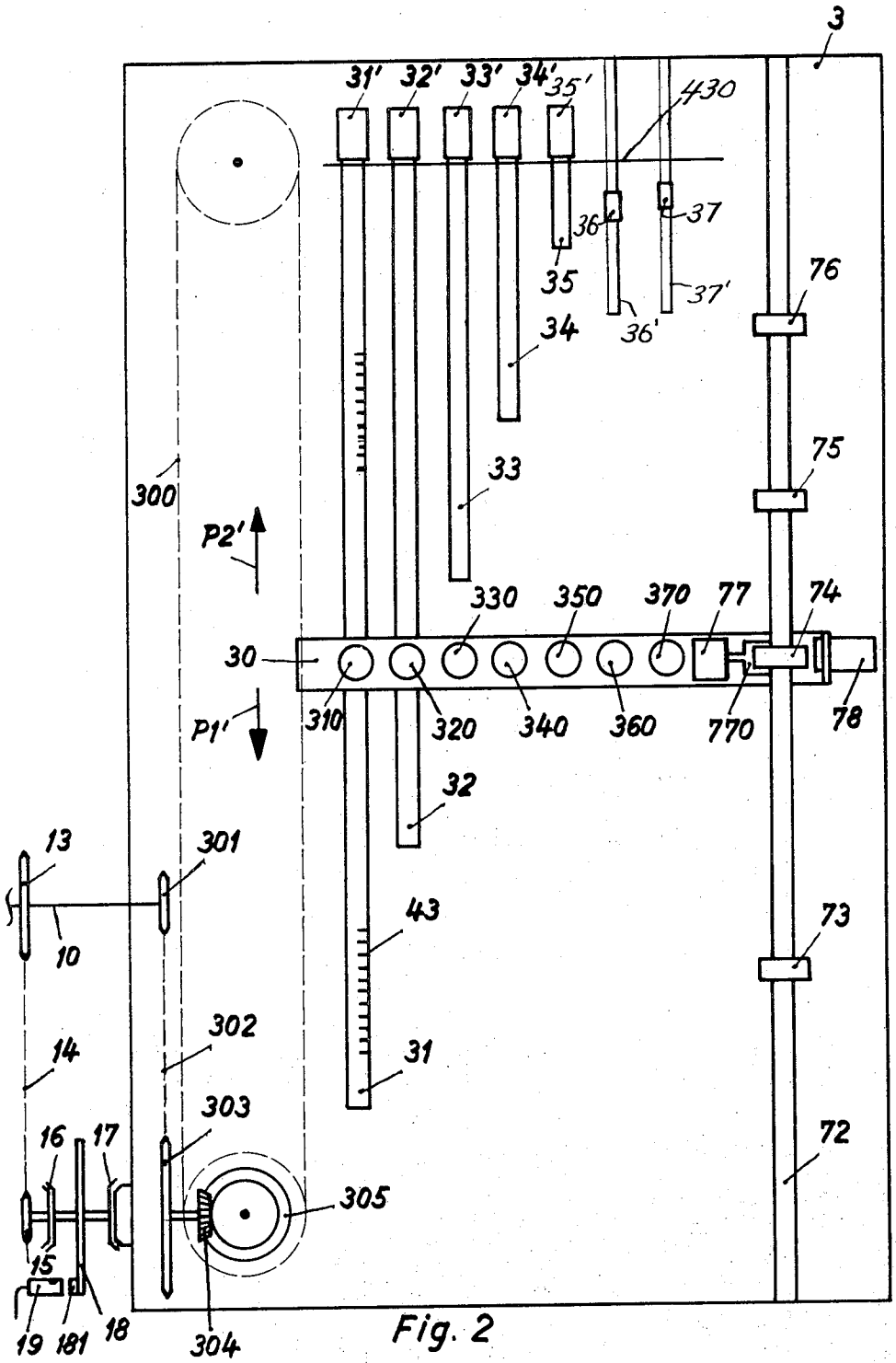


Fig. 2

INVENTORS
GEORG GOLDAMMER
GÜNTER MAHRT
BY
Robert W. Beach
ATTORNEY

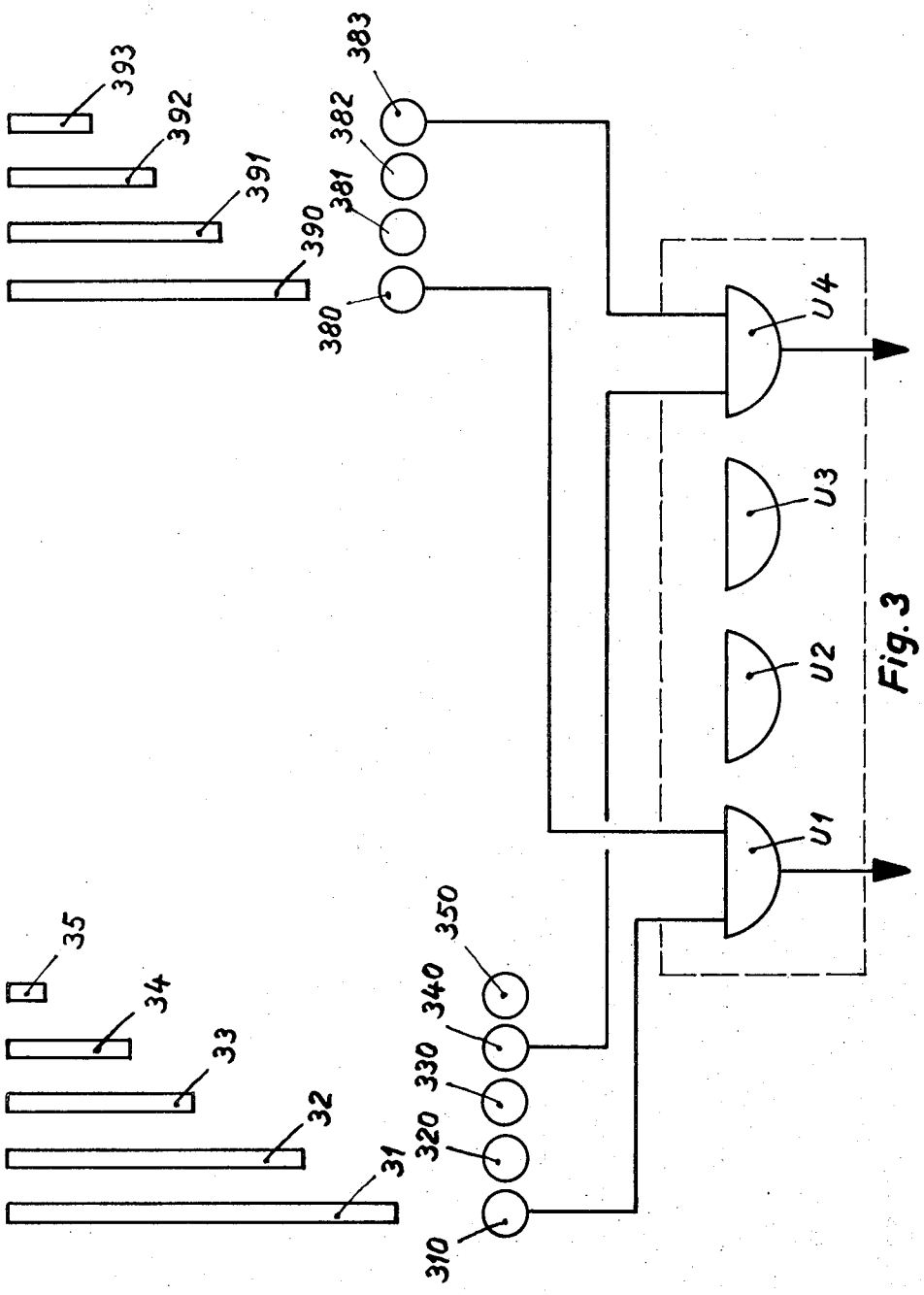


Fig. 3

INVENTORS
GEORG GOLDAMMER
GÜNTER MAHRT
BY
Robert W. Beach
ATTORNEY

FIBROUS MATERIAL MIXING APPARATUS

BACKGROUND OF INVENTION

1. Field to which invention relates

The present invention relates to apparatus for automatic mixing of fibrous material components in a certain pre-established mixing ratio with means for removing material from different bales of fibrous materials to be mixed as components of the mixture. Quantity measuring means are adapted to cooperate with the removing means; and program control means control the manner of operation of the fibrous material removing means in accordance with the quantity measured by the quantity measuring means.

2. The prior art

In accordance with the U.S. Pat. No. 3,577,599, the program control means comprises a switching means, which consists of switching cams cooperating with switches, and there is the provision of at least one switching cam track for the limitation of the total travel or displacement of the carriage for the birrous material removing means, another track for the limitation of the respective positional range of the carriage relative to bales of each type of fibrous material components, and another for the limitation defining various zones for removal of the fibrous material layers. With this switching means it is possible to fulfill the control functions which have to be performed.

It has now been found that damage and dirt collection may occur on the switching pieces arranged along the rows of bales and on the switches, to be actuated by the switching pieces, on the carriage for the fibrous material removing means, so that the function of the installation becomes impaired. Furthermore, resetting the switching pieces, which is necessary when the supply bales are changed, and reclamping of the switching pieces is tedious owing to the great distances between them.

SUMMARY OF INVENTION

One aim of the present invention is to provide a program control means for the fibrous material removing means which avoids these disadvantages.

The present invention provides program means to control an apparatus for automatically mixing of fibrous material components in a certain pre-established mixing ratio with means for removing material from different bales of fibrous materials to be mixed as components of the mixture. Quantity measuring means cooperates with the control means to control the manner of operation of the fibrous material removing means in accordance with the fiber quantity measured. The program control means includes switch actuating strips, reproducing the path of travel of the fibrous material removing means on a reduced scale, and switching means, for sensing the position of the strips. Preferably the switching means are actuated without contact by the strips.

In order to adapt the positions of the switching strips to the respective length of the path of travel of the fibrous material removing means, such strips can be adjustable. The adjustment of the switching strips can be facilitated by providing on them scale marks dividing the strips on a reduced scale true to the length of the path of travel of the removing means. In accordance with a further form of the invention the program control means is provided, instead of the switching strips, with switching cams; and, instead of the switching means operating without making contact, a mechanically operated switching device is provided. A drive operating without play or backlash and connecting the program control means with a carriage of the fibrous material removing means enables the switching information imparted by the program control means to be fully reproduced.

LIST OF SEVERAL VIEWS OF DRAWINGS

Further details of the invention will be gathered from the following description referring to the accompanying drawing.

FIG. 1 is a diagrammatic plan view showing the path of travel of a fibrous material removing device.

FIG. 2 is a diagrammatic front elevation of the program control means in accordance with the invention.

FIG. 3 is a schematic of a portion of a circuit showing the manner of operation of the program control means with one type of switching means.

FIG. 4 is a fragmentary diagrammatic side elevation of modified switching means arranged to be operated mechanically.

DESCRIPTION OF PREFERRED EMBODIMENTS

The carriage **1**, which travels along the rails **2** (FIG. **1**) in the direction of the arrows P_1 and P_2, is driven by a reversible drive motor **M1**. The gripping device **4** of the carriage **1** extends along the length of the fibrous material bases **B1** to **B16**. The row of bales is divided up for instance into four grades I, II, III, IV. The carriage is driven via a sprocket wheel **100** attached to the drive shaft **10** of the motor M1 and the sprocket wheel engages a chain **101** parallel to the rails **2**. Accordingly the drive is free of backlash.

The carriage **1** travels within a grade from bale to bale; and, when the driving motor **M1** has been stopped, the gripping device **4** removes fibrous material from the individual bales and throws it into the container **5** attached to the carriage **1** until the predetermined amount of the particular grade required for the mixture has been reached. Following this the carriage **1** changes over to the next grade.

The stopping of the drive motor **M1** when the carriage arrives at the individual bales is brought about by a switching disc or cam **18** (see FIG. **2**) which is caused to rotate by means of a sprocket-wheel **13**, attached to the drive shaft **10**, via a chain **14**, a sprocket-wheel **15** and an electromagnetic clutch **16**. The switching disc **18** carries a switching lug **181** which on passing a switch **19** effects a pulse by which the drive motor **M1** is switched off. The transmission ratio between the sprocket-wheels **13** and **15** and thus the point in time of stopping the drive motor **M1** is determined in accordance with the distance between the individual bales. The stopping of the motor, however, only occurs when the carriage **1** moves in the direction of the arrow P_2. If it moves in the direction of the arrow P_1 the switch **19** is overridden by means of a contactor and is therefore not capable of responding to the respective switching lug **181**. After each removing operation and the throwing of fibre material into the container **5** the carriage or traveling motor **M1** switches itself on and the carriage **1** travels to the next bale of the grade concerned.

In order to ensure that the gripping device **4** does not remove fibre material on each passage at the same location on the bales and therefore to prevent removal of material from the bales unevenly across their breadth, after each passage the position of the switching lug **181** is offset in relation to the drive shaft **10.** This offsetting is effected by disengagement of electromagnetic clutch **16** and application of a brake **17** upon reversing of the drive motor M1 for travel in the direction of the arrow P_1 by means of a time relay operated via a contactor. Brake **17** is arranged on the shaft carrying the switching disc **18.** The size of the offset of the switching lug **181** in relation to the drive shaft **10** can be adjusted and is determined by the time during which the clutch **16** is declutched and the brake **17** is applied.

The removing device for the removal of the fibrous material from the bales of the individual grades in partial quantities to effect the desired mixing ratio is shown as a gripping device **4** of known construction such as shown in German Pat. No. 2,130,497. Such device may also be of the type shown in U.S. Pat. No. 3,577,599. The program control device for controlling movement of carriage **1** is preferably arranged in the carriage for the fiber removing device. Its chief parts are a number of adjacently placed switching strips and a switching device sensing the switching strips. The switching strips are so arranged and dimensioned that they reproduce the traveling part of the removing device in a certain reduced scale. The program control device described with reference to FIGS. **2** and **3** by way of example makes it possible to mix up to four grades in partial quantities, corresponding to the desired mixing ratio.

The program control device **3** is shown as having seven metal switching strips **31, 32 ... 37** and the same number of switches **310, 320 ... 370** operable by induction. The switches **310, 320 ... 370** are arranged on a slide **30** which is attached to a chain **300** and can be moved in a vertical direction. The slide **30** is d driven by the drive motor M1 by means of a sprocket-wheel **301** attached to the drive shaft **10.** The rotation of the sprocket-wheel **301** is transmitted by means of a chain **302,** a sprocket-wheel **303** and bevel gearing **304** to the sprocket-wheel **305** engaging the chain **300.** By means of this sprocket chain drive, which produces the drive connection between the program control device and the carriage of the removing device free of backlash, the slide **30** is driven with a certain speed which can be selected. The drive speed is in accordance with the scale in which the program control device **3** or its switching strips **31, 32 ... 37** reproduces the length of the travel path, formed by the rails **2,** of the carriage **1** with the removing device **4.**

The switching strip **31** and the switching lug **37** limit the total travel of the carriage **1** with the removing device **4** along the row of bales B1 to B16, and the switching strips **31** and **35** limit the relative overall movement between the removing device and the bales. The switching strips **32, 33, 34** arranged between the switching strips **31** and **35** delimit the respective storage positions of the fibre components or grades. The lower ends of the switching strips **32, 33, 34** thus lie in the transition position between the individual grades I–II, II–III, and III–IV, respectively, while the lower end of the switching strip **31** lies at the start of the grade I and the lower end of the switching strip **35** lies at the end of the grade IV. By means of the switching lug **36** acting on the switch **360** the drive motor M1 is switched over to slow running.

The switching strips **31, 32 ... 35** consist of thin metal tapes and are guided in guide means which are not shown. In order to be able to set the switching strips to suit the respective positions of storage of the fibre components or grades, they can be wound up into housings **31', 32' ... 35'.** The switching lugs **36** and **37** are arranged on rails **36'** and **37'** to allow of displacement and are thus also capable of being adjusted. Adjustment of the switching strips **31, 32 ... 35** is facilitated by true-to-scale division of the length of the track, the division being reproduced on these switching strips in the form of marks **43.** A measuring edge **430** serves as a reference line for the setting.

The pulses generated by the actuation of the switches **310, 320, 330, 340** by the switching strips **31, 32, 33, 34** act, in a manner described below, on AND-gates U1, U2, U3, U4 (FIG. 3). The AND-gates U1, U2, U3 and U4 are also acted upon by pulses from the four further switches **380, 381, 382** and **383** which are actuated by the switching members **390, 391, 392** and **393.** These switches and switching means cooperate to produce signals indicating preset incremental quantities of fiber. The latter switching members are arranged on the container **5** which moves downwards under the weight of the fibrous material thrown on to it by the gripping or removing device **4.** The arrangement of the switching members **390 ... 393** on the container **5** is such that on reaching the respective predetermined weight parts of the individual grades I, II, III and IV the switches **380, 381, 382** and **383** are actuated in this sequence. In order to make the drawing easy to follow, in FIG. 3 only the connection of the switches **310** and **380** with the AND-gate U1 and of the switches **340** and **383** with the AND-gate U4 are shown. The switches **320, 381** and the switches **330, 382** are, however, connected in a similar manner with the AND-gates U2 and U3, respectively.

Uneven removal of material from the individual bales is avoided by a so-called memory which remembers at which bale of the respective grade the weight proportion corresponding to the predetermined mixing ratio has been achieved. This memory consists of a rail **72,** on which the switching lugs **73, 74, 75** and **76** corresponding to the grades I – IV are arranged in a sliding manner. The sliding or displacement of the switching lugs is carried out following the release of a clamp **770.** The clamp is brought into engagement with the switching lugs **73 ... 76** by means of a lifting magnet **77** and can be released again. The lifting magnet **77** is actuated by a switch **78** carried on the slide **30** when a switching lug **73, 74, 75** or **76** acts on the switch **78.**

In what follows the manner of operation of the program control device will now be described. The carriage **1** with the gripping or removing device **4** travels in the direction of the arrow P_2 into the grade I and the slide **30** driven by the drive motor M1 moves in the direction of the arrow $P_{2'}$. When the carriage **1** moves into the grade I, the switching strip **31** acts on the switch **310** which transmits a pulse to the AND-gate U1. This pulse simultaneously activates the switch **78** attached to the slide **30.** The carriage **1** travels into the grade I until the switch **78** is acted upon by the switching lug **73** arranged on the rail **72** and associated with the grade I. Such switch actuation deenergizes the lifting magnet **77** to release the clamp **770** which there-

upon engages and entrains the switching lug **73.** The switching lug **73** is displaced in accordance with the movement of the slide **30** on the rail **72** until the gripping device **4,** driven from bale to bale in the manner already described, has removed the predetermined weight proportion of the grade I from the bales B1 to B5.

If the gripping device **4** has removed fibre material from the bale B5 of the grade I and has passed it to the container **5** without the predetermined weight proportion of the grade I being reached to actuate switch **380** by the switching member **390** arranged on the container **5,** the drive motor M1 is reversed. This reversal occurs when the end of the switching strip **32,** arranged at the transition from grade I to grade II, acts on the switch **320.** The carriage **1** now travels with a high speed in the direction of the arrow P_1 and the slide **30** moves downwards in the direction of the arrow P_1'. As soon as the switch **310** is clear of the switching strip **31,** there is a further reversal of the drive motor M1. The carriage **1** now travels again in the direction of the arrow P_2 as far as the bale B1 in which, owing to the cooperation of the switching lug **181** with the switch **19,** it stops and the gripping device **4** removes fibre material and throws it into the container **5.** When the desired weight of grade I has been achieved, for example following removal of fibre material from bales B3, the switching member **390** on the container **5,** which has reached a correspondingly lower position, acts on the switch **380.** The pulse which is consequently generated passes to the AND-gate U1 as well the signal from switch **310** so that the AND-gate gives an output signal via a contactor to the drive motor M1. The signal causes the carriage **1** with the gripping device **4** and the container **5** to travel at high speed in the direction of the arrow P_2 to the grade II. Simultaneously with the fulfillment of the condition necessary for the AND-condition at the AND-gate U1 the switch **78** is switched off. The lifting magnet **77** acts on the clamp **770** so that the latter releases the switching lug **73** at the position of the last engagement of the gripping device, for example at bale **3.**

As soon as the carriage **1** with the gripping device **4** and the container **5** has passed the transition between grade I and grade II, the switching strip **32** acts on the switch **320** so that a pulse is transmitted to the AND-gate U2 and simultaneously the switch **78** is switched on again. The carriage **1** thus travels into the grade II such a distance that the switch **78** is actuated by the switching lug **74** and the latter is engaged by the clamp **770,** whereupon the removal of fibre material from the bales of the grade II commences. Removal from grades II, III and IV occurs in a manner similar to that described in the case of grade I. When the predetermined weight of grade IV has been achieved, additionally to the pulse produced when the carriage moves into the grade IV by the action of the switching strip **34** on the switch **340,** a second pulse is transmitted to the AND-gate U4, which comes from the switch **383** actuated by the switching member **393** arranged on the container. Accordingly the AND-logical function is fulfilled and the AND-gate U4 sends a control pulse via a contactor to the drive motor M1, which is consequently switched on for high speed travel. The carriage **1** travels at high speed in the direction of the arrow P_2 and the slide **30** of the program control device **3** moves in the direction of the arrow P_2'.

As soon as the switching member **36** acts on the switch **360,** the drive motor M1 is switched over to a slow speed travel by the pulse which is generated. At slow speed the carriage **1** travels as far as the throw-off position indicated by a conveyor belt **6.** The throwing-off of fibre material from the container **5** is initiated by a switching member **37,** which is arranged within the program control device **3,** reproducing the end of the length of the track **2,** at a certain reduced scale, adjacent the throw-off position **6** and which actuates the switch **370.**

After the throwing-off of the fibre material the emptied container **5** returns into its starting position. The switching members **390, 391, 392** and **393** are moved clear of the switches **380, 381, 382** and **383** so that the transmission of pulses by them to the AND-gates U1, U2, U3 and U4 is interrupted, the drive motor M1 is reversed, and the switch **78** is switched off. The carriage **1** now travels at a high speed in the direction of the arrow P_1 back to the grade I. Simultaneously the slide **30** of the program control device **3** moves downward in the direction of the arrow P_1, until the switch **78** is actuated by the switching lug **73.** Such lug indicates the last actuating position of the gripping device **4** on its preceding passage through the grade I. The carriage **1** thus comes to a standstill at such position, and the removal of fibre material from the bales of the grade I by the gripping device **4** begins again.

Naturally the program control device can have other switching means operating on an inductive basis, for example switching means which operate capacitatively, photoelectrically, or magnetically. It is also possible to provide, instead of switching means operating without making contact, a mechanically actuated switching device. In this case the switching strips **31, 32 ... 37** are replaced by elongated cam strips **38** shown in side elevation in FIG. **4** which actuate the switches **39** arranged on the slide **30.**

We claim:

1. In an apparatus for selecting and mixing in a predetermined ratio at least two types of fibers from several bales arranged in a predetermined pattern, including a carriage, drive means moving said carriage on a path along rows of fiber bales, removing means mounted on said carriage for ablating fibers in minimal unit amounts from said bales, quantity-determining means for receiving fibers ablated by the removing means and determining the quantity thereof and having indicating means for producing signals upon determination of present incremental quantities, and program control means including switch-actuating means and switch means actuatable by said switch-actuating means for acting on the drive means to position the removing means with respect to the bales in response to signals from said quantity-determining means, the improvement comprising the switch-actuating means including a plurality of elongated elements cooperating to reproduce the path of travel of the carriage on a reduced scale, and a slide movable relative to the switch-actuating means in synchronism with movement of the carriage, the switch means being carried by said slide for sensing the positions of said elongated elements and effecting through the drive means positioning of the removing means in accordance with such sensed positions.

2. In the apparatus defined in claim **1,** the elongated elements being metal strips.

3. In the apparatus defined in claim 2, means for adjusting the effective length of the metal strips.

4. In the apparatus defined in claim 3, the metal strips having indicia representing divisions in true scale of the length of the path of travel of the carriage.

5. In the apparatus defined in claim 1, the elongated elements being switching cams engageable with the switch means.

6. In the apparatus defined in claim 1, the drive means including a motor and connecting means connecting the carriage and the slide to said motor for driving the carriage and slide without backlash.

7. In the apparatus defined in claim 1, the program control means further comprising information storage means for registering the last bale containing one type of fibers from which fibers were removed including a rail, second switch-actuating means movable along said rail, clamp means for moving said second switch-actuating means along said rail in response to selected movement of the carriage to register the last bale of one type of fibers from which fibers were removed, and second switch means actuatable by said second switch-actuating means to effect engagement of said clamp means with said second switch-actuating means for movement thereof along said rail.

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