Sept. 16, 1952 D. P. LARHAM 2,610,748

MACHINE FOR SORTING GOODS

Filed July 21, 1947 3 Sheets-Sheet 1

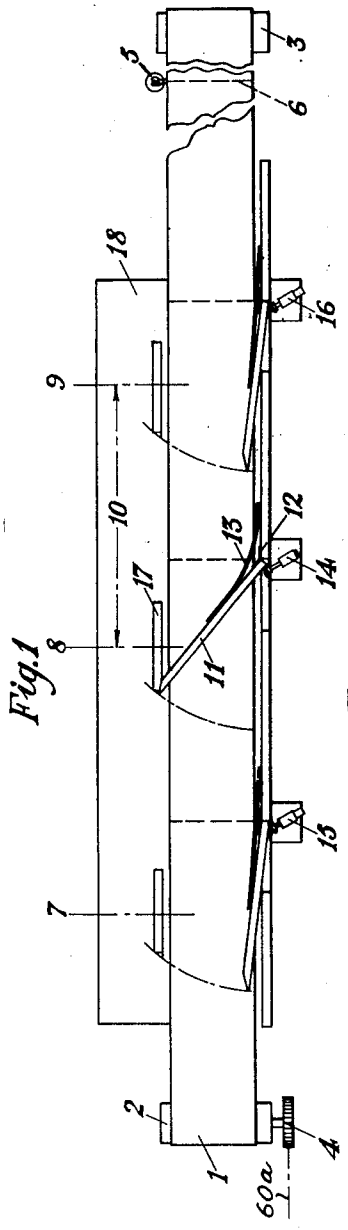


Fig. 1

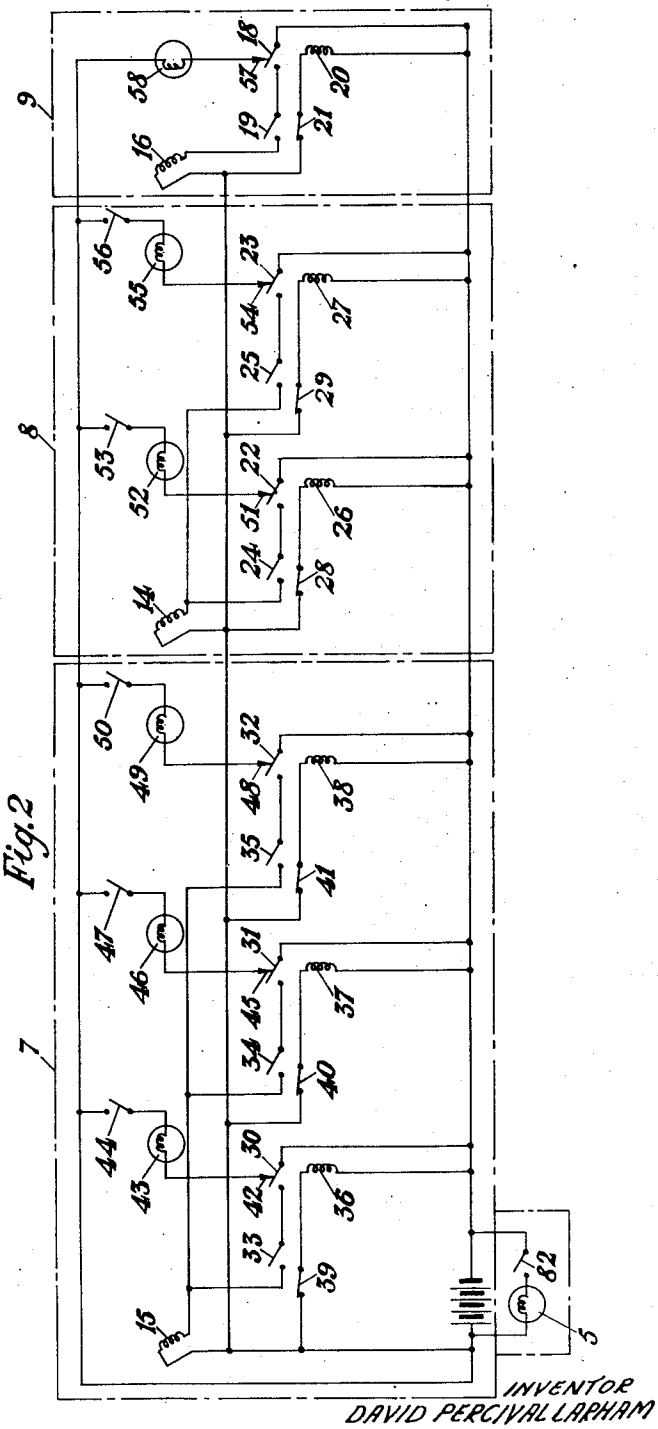


Fig. 2

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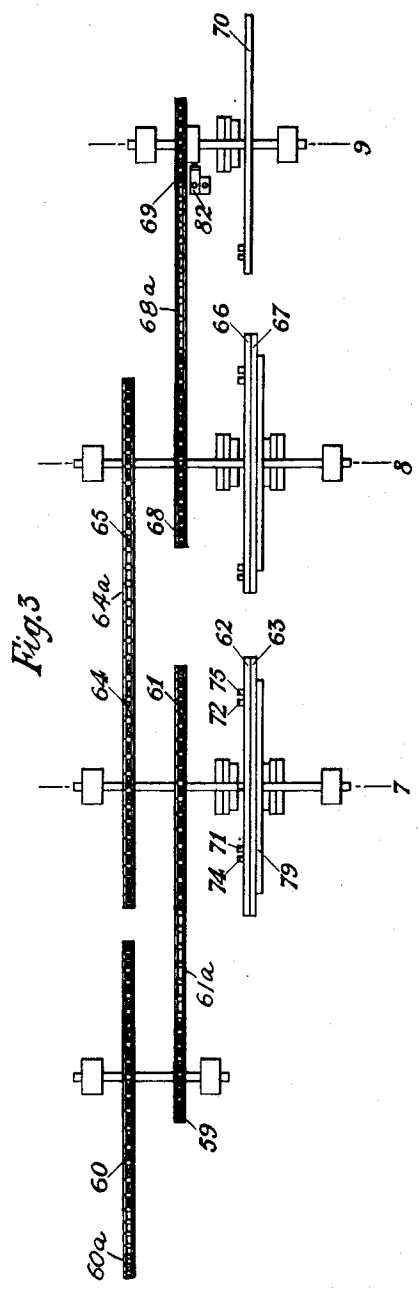



Fig.3

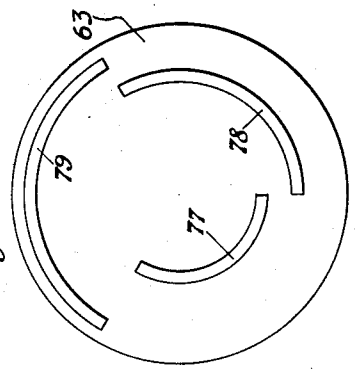



Fig.8

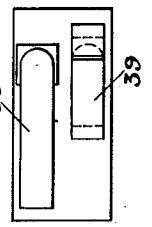



Fig.6

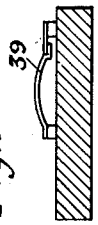



Fig.7

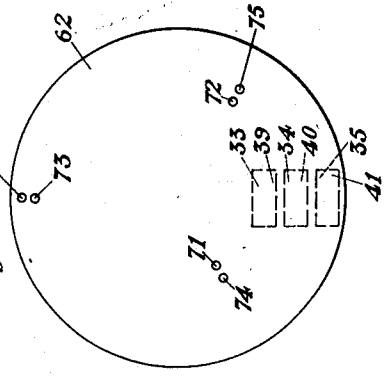



Fig.5

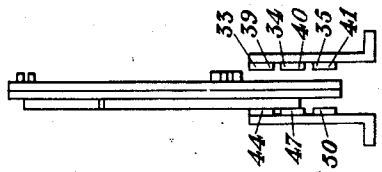



Fig.4

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MACHINE FOR SORTING GOODS

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*Fig.9*

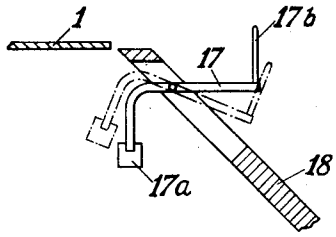



*Fig.10*

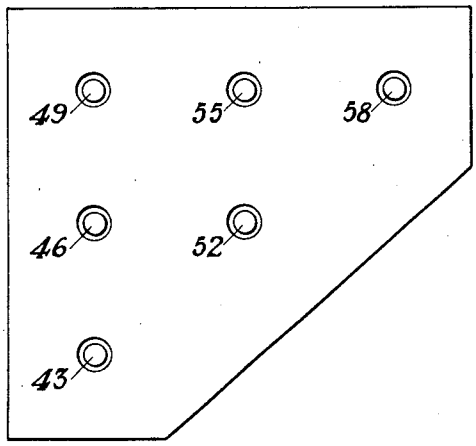
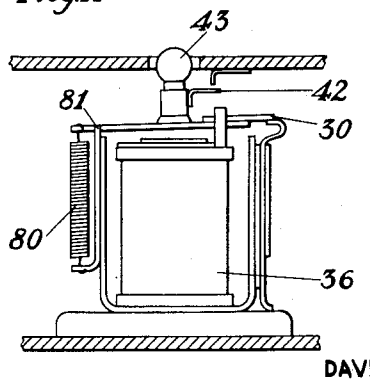



*Fig.11*




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# UNITED STATES PATENT OFFICE

2,610,748

## MACHINE FOR SORTING GOODS

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Application July 21, 1947, Serial No. 762,337
In Great Britain April 11, 1939

Section 1, Public Law 690, August 8, 1946
Patent expires April 11, 1959

6 Claims. (Cl. 214—11)

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This invention is for improvements in or relating to machines for sorting goods having differing characteristics and has for its object the provision of a machine operable in such a manner that goods are automatically collected at a plurality of positions each of which is reserved for goods having the same characteristic or for a group of goods the characteristic of which indicates that they are to be collected at a definite position.

In a manual system of sorting goods of different types the sorter expends a considerable amount of energy in transferring goods from a collection of goods having a number of distinguishing characteristics to positions where the goods have a single distinguishing characteristic or a predetermined range of characteristics. In a partially mechanical method of sorting goods, the articles are placed on a continuously moving conveyor band and a number of sorters each select therefrom goods having a particular characteristic, the goods so selected being placed, if desired, on separate moving conveyor bands each reserved for goods having a particular characteristic, but it will be realised that with this method a large number of sorters is required.

The present invention overcomes the disadvantages associated with the above methods of sorting in that only a single operator is required who, after examination of the goods to be sorted, can control the movements thereof into the appropriate channels without it being necessary for the operator to move from a particular position. This is achieved according to the present invention by a machine for sorting goods having differing characteristics, which consists in the combination with a continuously moving conveyor band upon which goods are placed at definite intervals and a plurality of deflectors spaced at definite intervals along the length of the band for deflecting the goods from the band into a plurality of channels each reserved for goods having the same characteristics or for a group of goods having a predetermined range of characteristics, of means for preselecting the sequence in which the deflectors are actuated in accordance with the individual characteristics of the goods so placed on the conveyor band, each deflector being actuated by electrical means connected in a circuit which includes in series therewith a main switch and a secondary switch, with means in an auxiliary circuit for retaining the main switch in an operative position when the same is actuated manually, means for closing and opening the secondary switch at regular intervals in synchronism with the intervals at which the goods are placed on the conveyor band, and means for controlling the auxiliary circuit so as to release the main switch after the energisation of the electrical actuating means, the deflector being returned to the initial position under the control of the goods passing into the associated channel. Thus, in a machine for sorting goods having $n$ specified characteristics, $n$ deflectors are actuated in a pre-selected sequence so as to deflect goods moving with the conveyor band by means of $n$ solenoid coils, the solenoid for the deflector most remote from the point on the conveyor band upon which the goods are first placed being connected in $n$ parallel electrical circuits each containing in series therewith a main switch and a secondary switch, with means, in $n$ auxiliary circuits, for retaining the main switch in an operative position when actuated manually, means for opening and closing the secondary switches in sequence at regular intervals in synchronism with the intervals at which the goods are placed on the conveyor band and means for controlling the auxiliary circuits in sequence so as to release the operative main switch after the energisation of the associated solenoid, whilst the solenoid next remote from the point on the band upon which the goods are first placed is similarly connected in $n-1$ auxiliary circuits and is similarly controlled, with corresponding $n-2$, $n-3$ etc. circuits for the remaining solenoids associated with the $n$ deflectors.

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In order that the invention may be readily understood, an example thereof will be described with reference to the accompanying drawings in which:

Figure 1 illustrates a plan view of a sorting machine constructed in accordance with the invention;

Figure 2 illustrates a circuit diagram of electrical selector mechanism for actuating the machine illustrated in Figure 1;

Figure 3 illustrates a plan view of the selector mechanism represented diagrammatically in Figure 2;

Figures 4 to 8 illustrate in detail the contactor mechanism illustrated in Figure 3;

Figure 9 illustrates a tripping member also illustrated in Figure 1;

Figure 10 illustrates in plan a supervisory control panel for the entire machine; and

Figure 11 illustrates in sectional side elevation on an enlarged scale the control panel illustrated in Figure 10.

The machine for sorting goods according to the

present invention can conveniently be divided into three separate parts, (1) a mechanical arrangement for transporting and sorting the goods; (2) an electrical circuit for controlling the actuation of the mechanical arrangement and (3) a supervisory control device for the operation of the electrical circuit in a predetermined manner. Referring to the drawings, Figure 1 illustrates in plan the mechanical sorting arrangement which comprises a conveyor band 1 continuously driven over rollers 2 and 3 by means of any desired prime mover through a gear wheel 4. An electric signal 5, shown as a lamp, is mounted adjacent to the conveyor band 1 and is so arranged and connected in an electrical circuit as to illuminate at regular intervals the surface of the conveyor band 1 in the region of the line 6. The purpose of the lamp 5 and the manner of connection thereof will be explained hereinafter in greater detail. In the machine illustrated in Figure 1 it is presumed that goods having three distinguishing characteristics are to be sorted into channels each reserved for goods having one of the said characteristics. Thus, for example, in sorting parcels which are ultimately to be delivered to three distinct destinations, such as London, Birmingham, Manchester, the three channels 7, 8 and 9 are reserved respectively for parcels addressed to London, Birmingham, and Manchester, respectively. The goods are placed individually upon that portion of the surface of the band 1 which is in the region of the line 6 at the instant when the band is illuminated by the lamp 5. The time interval between successive periods of illumination of the lamp 5 is equal to the time taken for a parcel to traverse the distance 10 between two adjacent channels, such as the distance between the channels 9 and 8, or 8 and 7. Assuming, therefore, that a parcel placed on the band in the region of the line 6 is to be deflected into channel 8, which in the example given above would relate to parcels destined for Birmingham, a device is actuated so as to arrest the movement of the parcel on the moving band and to deflect the parcel into that channel. The deflection is effected by a deflector 11 which is hinged at 12 and is loaded by a spring 13. In the inoperative position, the deflector 11 lies substantially parallel to the direction of movement of the conveyor band 1 and out of the path of any object there may be upon the band. In order to deflect a parcel, the deflector 11 is pivotally displaced so as to lie in a position transverse to the direction of movement of the band 1 and to deflect any parcel conveyed by the band into channel 8. The deflector 11 is moved about its pivot by means of a movable core solenoid 14, corresponding movable core solenoids 15 and 16 being associated with the deflectors for the channels 7 and 9. Upon the energization of the solenoid, the core moves transversely to the direction of movement of the conveyor band into a position shown by the solenoid 14 and swings the deflector 11 about its pivot into the position across the direction of movement of the conveyor band 1. In order to ensure that the deflector 11 returns to its initial position after the passage of the parcel into the channel 8, a tripping device 17 is mounted on a sloping chute 18 in the path of the parcel so deflected. The tripping device 17 is shown in greater detail in Figure 9 and comprises a light angle plate 17 pivoted in the sloping chute 18 and provided with a counterweight 17a which tends to maintain the plate 17 in a horizontal plane. At the exposed end of the plate 17 there is provided a lip 17b the height of which is arranged such that it can be engaged by the deflector 11 when the same has been fully deflected. When the deflector 11 has been moved into a position transverse to the direction of the movement of the conveyor, the end of the deflector remote from the actuating solenoid strikes the lip 17b and causes the angle plate 17 to swing into the position shown in dotted lines. On passing the lip 17b, the actuating solenoid ceases to move the deflector 11, but the plate 17 returns to the horizontal position under the influence of the counterweight 17a. The deflector 11 cannot, therefore, return to its initial position under the influence of the spring 13 since the movement thereof is arrested by the lip 17b. When a parcel moves down the surface of the sloping chute 18 it passes over one limb of the angle plate 17 and depresses it, thereby releasing the deflector 11 which returns to its initial inoperative position under the influence of the spring 13.

The manner in which the sequence of operation of the several deflectors can be preselected will now be described with reference to Figure 2 of the accompanying drawings. For convenience, the diagram in Figure 2 is divided into three sections corresponding to the three channels 7, 8, and 9 illustrated in Figure 1, channel 9 being nearest to the point upon the conveyor band 1 at which the goods are first applied and channel 7 being most remote therefrom. It will be understood that a parcel which has to be deflected into channel 9 has to travel a distance equal to one third of that traversed by a parcel which has to be deflected into channel 7 and, therefore, if parcels are placed at regular intervals in the region of the line 6 on the surface of the band 1, such intervals being equal to the time taken by a parcel to traverse the distance 10 between two adjacent channels, it is necessary for the control mechanism to preset the deflector associated with the channel 7 in a suitable condition so as to deflect after an interval equal to three times the period in which a parcel traverses the distance 10 and, similarly, the deflector 11 associated with the channel 8 must be preset in that condition after an interval equal to twice that period. Thus, in Figure 2 it will be seen that there is a single electrical circuit associated with the solenoid 14, and three such circuits connected in parallel for the solenoid 15. Referring initially to section 9, the movement of the deflector is effected when the solenoid 16 is energized and, for this purpose, there is arranged in series with the solenoid 16 a spring-loaded main switch 18 and a secondary switch 19. In parallel to this circuit is an auxiliary circuit containing a small solenoid coil 20 and a switch 21. The solenoid 20 is mounted directly under the switch 18 and is so designed that when energized it is capable of retaining the switch 18 in a closed position but is not capable of closing the switch once it is open. Assuming the switch 21 is closed with the solenoid 20 energized, then upon the main switch 18 being closed manually, it will be retained in the closed position by the solenoid 20. The switch 19 in the circuit of the solenoid 16 is arranged to be closed for a very short time and opened again at regular intervals, the instants of closing being synchronous with the instants of illumination of the lamp 5 illustrated in Figure 1. Upon the closure of the switch 19 whilst the switch 18 is closed, the solenoid 16 is energized and the deflector 11 is swung about its pivot so as to deflect the parcel

from the conveyor band 1 into the channel 9. As the parcel moves into the channel over the tripping device 17 the deflector 11 is returned to its initial position. In order to restore the electrical circuit of the solenoid 16 into its initial open condition, the switching mechanism is so constructed that the switch 21 is opened a fraction of a second after the switch 19 has been closed and the leading end of the deflector 11 has been caught by the lip 17b on the angle plate 17. When the switch 21 is opened, the small solenoid 20 is de-energised and the switch 18, being spring controlled, opens and the circuit of the deflector 11 is returned to its initial condition.

Referring to channel 8 of the machine, the solenoid 14 is associated with two circuits connected in parallel which are each similar to the circuit described with reference to the channel 9. Thus, the solenoid 14 has connected in series therewith, but in two parallel circuits, main switches 22 and 23 and secondary switches 24 and 25. In the two parallel auxiliary circuits there are connected in series small solenoids 26 and 27 and switches 28 and 29. Each solenoid circuit and associated auxiliary circuit operates in exactly the same manner as that described with reference to channel 9 but, in view of the fact that the distance between the channel 8 and the surface of the conveyor band 1 adjacent to the line 6 is double that of the distance between the line 6 and the channel 9, the switching sequence of the switches 24, 25 and 28, 29 is arranged so that the switches 25 and 29 are actuated at an interval after the switches 24 and 28 equal to the time taken for a parcel to traverse the distance 10.

In a similar manner, referring to channel 7, the solenoid 15 is associated with three parallel main circuits in which there are main switches 30, 31 and 32, secondary switches 33, 34 and 35 and there are three parallel auxiliary circuits including small solenoids 36, 37 and 38 having in series therewith switches 39, 40 and 41. In this case, owing to the fact that the distance between the channel 7 and the region of the conveyor band 1 in the neighborhood of the line 6 is three times that of the distance 10, it is arranged that the switches 33, 39 and 34, 40 and 35, 41 are actuated in sequence at time intervals corresponding to the time taken for a parcel to traverse the distance 10.

The switches 33, 39; 34, 40; 35, 41 are continuously closed and opened in sequence irrespectively of whether the switches 30, 31 and 32 are at any time closed. Similar conditions apply to the switches in channels 8 and 9. It is necessary that at the time of placing a parcel on the surface of the band in the region of the line 6, it should be possible to preset the switches, for example of the channel 7, so that the deflector of that channel is actuated when that parcel reaches the channel 7. Hence in view of the fact that the switches 33, 39; 34, 40 and 35, 41 are continuously actuated in sequence, it is necessary at the instant of placing the parcel on the band to ascertain which of those switches will be closed at the instant when the parcel reaches the channel 7 so that the appropriate main switch of the switches 30, 31 and 32 can be actuated at the instant of placing the parcel on the band. An indication of the sequence in which the switches are closed is obtained by means of an electric indicator circuit associated with each of the main switches 30, 31 and 32 with corresponding lamp circuits in channels 8 and 9. The



indicator circuit, which is energised from the main source of current supply for the entire machine, consists of a fixed contact 42 which co-operates with the movable member of the switch 30 when it is opened and in series with this contact there is a signalling device shown as a lamp 43, and a switch 44. Similarly, there are contacts 45, 48, lamps 46, 49 and switches 47, 50 associated with the main switches 31 and 32 with corresponding parts in the channels 8 and 9. The switches 44, 47 and 50 are continuously closed and opened in the same sequence as the switches 33, 34 and 35 are closed and opened and, therefore, as long as the switches 30, 31 and 32 are open, the lamps 43, 46 and 49 will be illuminated in the same sequence as the switches 33, 34 and 35 are closed. Hence, if, on placing a parcel on the surface of the band 1 in the region of the line 6, it is desired to deflect it into the channel 7, at the instant of placing the parcel thereon, that switch of the three switches 30, 31 and 32 is closed of which the associated lamp is at that instant illuminated. Thus, a parcel is firstly placed on the band 1 in the neighborhood of the line 6 and, assuming the lamp 43 to be illuminated, at the same instant the main switch 30 is closed. When the band 1 has carried the parcel forward such a distance that it is opposite the channel 9, the switch 34 is closed and the lamp 46 is illuminated. When the parcel is conveyed past the channel 8, the switch 35 is closed and the lamp 49 is illuminated. When the parcel reaches channel 7, however, the switch 33 is again closed but, since the main switch 30 is closed, the deflector will be moved about its pivot and displace the parcel into the channel 7. Thus, by always closing the switch of which the associated lamp is at that instant illuminated, it is possible to preset the switching mechanism so that one circuit of the plurality of parallel circuits associated with the solenoid to be actuated will be closed at the instant when the parcel has reached the channel into which it is to be deflected. In the case of section 8, two such indicator lamps 52, 55 are provided and the main switches 22 and 23 are closed only when their corresponding lamps are illuminated, the switches 53 and 56 again being closed and opened in sequence with the opening and closing of the switches 24 and 25. It is not necessary to provide a switch corresponding to the switches 44, 47, 50, 53 and 56 in the circuit of channel 9 since there is only one main switch to operate and, therefore, the lamp 58 is illuminated at all times except when the switch 18 is closed.

A mechanical arrangement for the actuation of the various switches described with reference to Figure 2 is illustrated in plan in Figure 3 in which the mechanism associated with the three channels 7, 8 and 9 is segregated. A toothed wheel 59 rotated through a coaxial toothed wheel 60 drives a toothed wheel 61 by means of a chain 61a. The wheel 60 is driven by chain 60a from the wheel 4 illustrated in Figure 1. On the shaft of the toothed wheel 61 is a contact plate 62 which controls the switches 33, 39; 34, 40 and 35, 41 illustrated in Figure 2. The contact plate 62 is illustrated in Figures 4 and 5 and is hereinafter described in greater detail. Coupled to the plate 62 is a further plate 63 which is hereinafter described in detail with reference to Figure 8. The plate 63 controls the switching sequence of the switches 44, 47 and 50 for the sequence of illumination of the lamps 43, 46 and 49. On the same shaft as the plate 63 is a further toothed

wheel 64 which drives a separate shaft through a chain 64a and toothed wheel 65. On this shaft there is a plate 66 which is similar to the plate 62 but differs in that it is employed to control only two sets of switches 24, 28 and 25, 29 as distinct from the three sets associated with the plate 62. The plate 66 forms the control for the switching sequence for channel 8. Coupled to the plate 66 is a plate 67 similar to the plate 63 but this also only controls two circuits, namely, the switches 53 and 56 in the circuits of the lamps 52 and 55. Finally, a toothed wheel 68 on the same shaft as the wheel 65 drives a further shaft through a chain drive 68a and a toothed wheel 69 and on the shaft thereof there is a plate 70 similar to the plates 62 and 66 except that it is only employed to control one set of contacts 19, 21 as distinct from the two sets and three sets in channels 8 and 7. There is no plate on this shaft, which corresponds to the plates 63 and 67 since, as is explained above, there is no switch provided in the circuit of the lamp 58.

Figure 5 illustrates in front elevation the plate 62 and a side elevation thereof is illustrated in Figure 4. The plate 62 co-operates with three banks of contacts which form the switches 33, 39; 34, 40 and 35, 41. Three studs 71, 72 and 73 are mounted spirally on the surface of the plate 62 and are relatively displaced by an angle of 120°. The stud 71 passes once in every revolution of the plate 62 over the surface of a contact spring illustrated in Figure 6 which together with a fixed contact forms the switch 33 and this is effected in such a manner that every time the stud presses on the contact spring 33 the switch is closed. In a similar manner, the stud 72 closes the switch 34 once in every revolution of the plate 62 and the stud 73 similarly closes the switch 35 once in every revolution of the plate 62. As stated above in connection with Figure 2, it is necessary to open the switches 39, 40 and 41 in succession slightly after the switches 33, 34 and 35 have been closed and this is achieved by means of studs 74, 75 and 76 mounted adjacent to the studs 71, 72 and 73 on the surface of the plate 62, but at a slightly greater distance from the axis thereof. These studs co-operate with a spring contact so as to open that contact when depressed. The switch 39, as illustrated in Figure 6, is opened by means of the stud 74 once in every revolution and this occurs slightly after the stud 71 has closed the switch 33. A sectional view of the switch 39 is illustrated in Figure 7 which shows that depression thereof by means of the stud 74 opens the contact, whereas depression of the spring contact 33 by the stud 71 closes that switch. The plates 66 and 70 are similar to the plate 62 except that provision is made respectively for two sets and one set of actuating studs, in the case of the plate 66 these being arranged at an angle of 180° to one another. The studs on the plate 66 actuate the switches 24, 28; 25, 29 in sequence and the studs on the plate 70 actuate the switches 19, 21 once in every revolution of the plate.

As explained above, the plates 63 and 67 are employed to control the actuation of the switches 44, 47, 50, 53 and 56 and the plate 63 is illustrated in greater detail in Figure 8. On the surface of the plate 63 there are arranged three raised elements 77, 78 and 79 each at a different distance from the axis of the plate and each extending over an angle of 120° of the surface of plate. These raised elements co-operate, as is shown in the side elevation illustrated in Figure 4, with contact 44, 47 and 50 so as successively to illuminate the lamps 43, 46 and 49 provided that the switches 30, 31 and 32 are open. The plate 67 is similar to the plate 63 except that two raised elements thereon extend around the surface of the plate through an angle of 180° and these control the switches 53 and 56 which are similar to the contacts 44, 47 and 50 illustrated in Figure 4.

Referring again to Figure 3, during every revolution of the plate 62 it is necessary for the plate 66 to effect one and one half revolutions and for the plate 70 to effect three revolutions since there are three times as many contacts on the plate 62 as there are on the plate 70 and one and one half times as many as there are on the plate 66. This speed ratio is conveniently obtained by employing the following gear ratio. The wheels 61 and 64 have twenty-four teeth, the wheels 65 and 68 have sixteen teeth and the wheel 69 has eight teeth. The gear ratio of the wheels 59 and 60 is dependent upon the number of teeth on the wheel 4 driving the roller 2 but the ratio must be so selected that the shaft associated with channel 7 rotates through one revolution during the time in which the conveyor band moves through the distance from the line 6 to the channel 7.

Figures 10 and 11 illustrate in plan and sectional side elevation the supervisory control device for the operation of the electrical circuit in a predetermined manner, this control device incorporating the switches 30, 31 and 32 and their associated solenoids 36, 37 and 38 as control members for channel 7 with corresponding switches 22, 23 and solenoids 26, 27 for channel 8 and a switch 18 and a solenoid 20 for channel 9. Referring to Figure 10, the lamps 43, 46 and 49 project above the surface of the control panel in one row and in an adjacent row there are two lamps 52 and 55 projecting above the panel and forming controls for channel 8. A single lamp 58 is provided for the control of channel 9. As shown in Figure 11, which illustrates a sectional view of the panel at the lamp 43, the main switch which in this case is the switch 30 is closed by depression of the lamp 43 against the action of a spring 80. In depressing the lamp and thus closing the switch 30, the contact 42 illustrated diagrammatically in Figure 2 is opened and, therefore, the lamp 43 is extinguished. The lamp holder is, however, mounted on a member of magnetic material pivoted at 81 and controlled by the spring 80 and when depressed this member of magnetic material is retained in position by the magnetic influence of a solenoid coil 36. On de-energisation of the solenoid 36 the spring 80 returns the lamp 43 into its initial position, thus opening the switch 30 and closing the contact 42. The solenoid and lamp circuits are all similar, that for the lamp 43 being illustrated in Figure 11 by way of example only.

The lamp 5 is illuminated periodically at intervals equivalent to the time taken for a parcel to traverse the distance 10 between two adjacent channels and this is achieved by means of a contact 82 which is connected in series with the lamp 5 across the main source of current supply for the machine and the contact is closed once in every revolution of the gear wheel 69 which is equivalent to closing the contact 82 so as to illuminate the lamp 5 each time a parcel arrives at one of the channels and, therefore, it is possible to place a further parcel on the conveyor band in the region of the line 6.

Thus, in order to sort parcels into the appro-

priate channels a parcel is placed on the band 1 in the neighbourhood of the line 6 at the instant when the lamp 5 is illuminated and after noting the destination of the parcel which may, for example, be channel 7, the operator depresses the lamp in the row of lamps associated with channel 7 which at that instant is illuminated. This is one of the lamps 43, 46 or 49. If the parcel is to be deflected into channel 8, the lamp of the two lamps 52, 55 which at the instant of placing the parcel on the band is illuminated, is depressed or finally, if the parcel is to be deflected into channel 9 the lamp 58 is depressed.

It is not essential for a single signal lamp 5 to be in the position shown in Figure 1 adjacent to the roller 3, it being possible with a long conveyor band for a lamp or a number of lamps in addition to the lamp 5 to be mounted adjacent to the band at distances from the line 6 equal to a multiple of the distance 10 so that one or a series, of operators can place goods on the band opposite to those lamps when they are illuminated, the supervisory control device still being actuated, however, at a position adjacent to the line 6 at the instants when the signalling lamp 5 is illuminated.

Complete preselection of the destination of the goods to be sorted can be achieved with the machine according to the invention, the operation thereof being extremely simple, efficient and rapid.

In the example described, the contacts are actuated by a plurality of studs mounted on plates as illustrated in Figure 5. This provides a compact contact construction but each stud can be mounted on a separate plate so as to co-operate with independent contacts. Similarly it is not necessary for the deflector 11 to be pivotally moved across the surface of the conveyor band in changing from the inoperative to the operative positions. This is of particular advantage when the conveyor band is very wide, as is necessary in dealing with goods of a bulky nature, since with a wide band the length of the deflector 11 has to be increased and, owing to the fact that the deflectors extend in the direction of movement of the conveyor band when they are in the inoperative position, the length of the band is thereby considerably increased. With deflectors arranged to pivot in a plane at right angles to the plane of the conveyor band the length of the band can be maintained small.

In order to standardize the components of the machine the plates 62, 66, 70 can be similar plates having a plurality of holes drilled therein into which the appropriate number of studs can be screwed with the necessary angular displacement.

In the following claims "articles" includes groups of articles and "characteristics" includes ranges of characteristics. "Characteristics" also includes characteristics as regards destination.

What I claim as my invention and desire to secure by Letters Patent of the United States is:

1. Article sorting machine comprising (A) a continuously moving conveyor from which the articles are removed at a series of $n$ removal stations spaced apart a basic distance or a multiple thereof and allocated respectively to the different characteristics of the articles; (B) $n$ deflectors, one at each removal station, said deflectors normally occupying an inoperative position in which they lie clear of the path of the articles on the conveyor and being selectively pre-settable to an operative position in which they lie in said path and are effective to deflect the articles from the conveyor, the articles being placed on the conveyor at a datum station or predatum station distant from the first of the series of deflectors by said basic distance or a multiple thereof and in such timed sequence as to result in the articles being spaced along the conveyor at a distance or distances apart equal to said basic distance or a multiple thereof, and the deflectors being automatically returned to the inoperative position by means operating under the control of the deflected article, and (C) a pre-setting mechanism comprising in respect of each deflector (*a*) an electromagnetic actuator therefor adapted to move the deflector to the operated position and (*b*) a system of control circuits for the actuator, said system comprising as regards the deflector most remote from the datum or pre-datum station (1) $n$ main circuits arranged in parallel with one another and each in series with the actuator and (2) $n$ auxiliary circuits, and as regards each successive deflector progressively nearer the datum or pre-datum station, a number of main circuits as (1) and auxiliary circuits as (2) which is one less than the number in the case of the preceding deflector, each main circuit comprising a main switch which is operated to close the circuit at the instant of placing an article on the conveyor at the datum station or of passage of an article therepast, and a secondary switch which is momentarily operated to close the circuit at time intervals which are proportional to the speed of the conveyor, and each auxiliary circuit, the function of which is, through the holding-in action of a coil in the circuit, to retain the main switch of the corresponding main circuit in the operated condition until the corresponding secondary switch has operated to complete the circuit, including, in series with said coil, a switch which is momentarily operated at the time intervals aforesaid to open the circuit upon completion of movement of the deflector to the operated position; the secondary switches of the main circuits and the switches of the auxiliary circuits being operated in seriatim and at the time intervals aforesaid by a mechanism operating synchronously with the conveyor, which mechanism in the case of each of the control circuits except the one associated with the first deflector of the series, operates also a selector switch functioning to determine which of the main circuits shall be operative to actuate the deflector in any given pre-setting operation.

2. Article sorting machine as specified in claim 1, wherein each main circuit of the sets thereof associated respectively with the various deflectors (i. e. excepting the one nearest the datum station) has associated with it an indicator circuit including an indicator effective to indicate to the operator of the machine which of the main switches of the set thereof associated with the deflector to be pre-set in a given pre-setting operation is to be operated in said operation, and a control switch therefor, the control switches of the indicator circuits being continuously opened and closed simultaneously with and in the same sequence as the secondary switches of the main circuits by mechanism operating synchronously with the conveyor.

3. Article sorting machine as specified in claim 1, wherein the instants at which the articles are to be placed on the conveyor are indicated by signals given by an indicator controlled by a mechanism operating synchronously with the conveyor.

4. Article sorting machine as specified in claim 1, wherein the main switches comprise in each case a fixed contact and a movable contact and said movable contact is carried on the armature of a solenoid constituting the coil in the auxiliary circuit having a holding-in action, which armature is spring loaded in opposition to the pull of the solenoid, the arrangement being such that whilst said pull is sufficient to retain the armature in the drawn position, in which position the main switch is in the closed condition, it is insufficient to move it thereto, the armature requiring to be moved to the drawn position by manual effort applied through a manipulating member associated with the switch, and the arrangement further being such that the loading spring of the armature normally maintains the latter in the switch-open position.

5. Article sorting machine as specified in claim 1, wherein (*a*) each main circuit of the sets thereof associated respectively with the various deflectors (i. e. excepting the one nearest the datum station) has associated with it an indicator circuit including a lamp effective to indicate to the operator of the machine which of the main switches of the set thereof associated with the deflector to be pre-set in a given pre-setting operation is to be operated in said operation, and a control switch therefor, the control switches of the indicator circuits being continuously opened and closed simultaneously with and in the same sequence as the secondary switches of the main circuits by mechanism operating synchronously with the conveyor, (*b*) each main switch comprises in co-operation with a fixed contact a movable contact carried on the armature of a solenoid constituting the coil in the auxiliary circuit having a holding-in action, which armature is spring loaded in opposition to the pull of the



solenoid, the arrangement being such that whilst said pull is sufficient to retain the armature in the drawn position, in which position the main switch is in the closed condition, it is insufficient to move it thereto, the armature requiring to be moved to the drawn position by manual effort applied through a manipulating member associated with the switch, and the arrangement further being such that the loading spring of the armature normally maintains the latter in the switch-open position, and (*c*) said manipulating member is constituted by said lamp.

6. Article sorting machine as specified in claim 1, wherein the secondary switches and the switches of the auxiliary circuits are in the form of spring contacts which are operated in succession by pressure thereon of studs mounted spirally around the surface of a rotating plate and displaced thereon at angles such that during the rotation of the plate the contacts are operated in sequence at regular intervals in synchronism with the intervals at which or at multiples of which the articles are placed on the conveyor, said plate forming part of the mechanism operating synchronously with the conveyor.

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## REFERENCES CITED

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

UNITED STATES PATENTS


| Number | Name | Date |
|---|---|---|
| 1,528,227 | Spooner | Mar. 3, 1925 |
| 1,868,894 | Glahn | July 26, 1932 |
| 2,011,827 | Regan | Aug. 20, 1935 |
| 2,307,712 | Schenk | Jan. 5, 1943 |