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(54) IMPROVEMENTS IN OR RELATING TO WORKPIECE PROCESSING SYSTEMS

(71) We, AXIS S.p.A., an Italian Body Corporate, of Hamlet Morrocco, Tavarnelle Val De Pesa, Firenze, Italy, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to workpiece processing systems.

According to the present invention, there is provided a workpiece processing system comprising means defining an active conveyor path passing adjacent a plurality of processing stations, means defining an endless conveyor movable along said path, said conveyor having means defining seats for workpieces to be conveyed along said path, means operative to feed workpieces to predetermined seats of the conveyor, means associated with the processing stations for removing workpieces from the seats for processing at the corresponding stations and to deposit the processed workpieces into the seats, said seats consisting of a plurality of groups of seats, in each said group of seats individual seats being designated to receive only workpieces which are at a predetermined stage in the processing station, detecting means for detecting filled and empty seats in predetermined positions of the seats along the path, said detecting means being operable to control the operation of the workpiece removal and depositing means only remove workpieces from, said deposit workpieces into, the designated seats, and means enabling incompletely processed workpieces to be returned to the beginning of the active conveyor path.

Further according to the present invention, there is provided a workpiece processing system comprising means defining an endless conveyor path passing adjacent a plurality of processing stations, means defining an endless conveyor movable along said path, said conveyor having means defining seats for workpieces to be conveyed along said

path, means operative to feed workpieces to predetermined seats of the conveyor, means associated with the processing stations for removing workpieces from the seats for processing at the corresponding stations and to deposit the processed workpieces into the seats, said seats consisting of a plurality of groups of seats, in each said group of seats individual seats being designated to receive only workpieces which are at a predetermined stage in the process, and means for sensing the presence of filled and empty seats in specific positions of the conveyor, said sensing means controlling the workpiece removal and depositing means, whereby the workpiece removal and depositing means only remove workpieces from, and deposit workpieces into, the appropriate designated seats.

The invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a side elevation of a workpiece processing system according to a first embodiment of the invention;

Figure 2 is an enlarged view showing sensing means of the system;

Figure 3 is a view of the sensing means along line III—III of Figure 2;

Figure 4 is a fragmentary transverse section through a conveyor of the system;

Figure 5 shows schematically the conveyor and an associated working station; and

Figure 6 shows a modified form of conveyor for the system of Figures 1 to 5.

The workpiece processing system in Figures 1 to 5 comprises a main frame 1 having guide means 3 (see Figure 4) for an endless conveyor movable in a vertical plane and comprising two conveyor chains 5. The two chains 5 are driven in unison, the chains 5 being parallel and being suitably connected to each other. The chains are driven by means of a motor 6 which effects stepwise movement of the conveyor or continuous movement, with controls to stop and start the conveyor depending upon the condition

of control means as will be described hereinafter. The conveyor chains 5 carry saddle shaped, i.e. V-shaped, seats 7, the seats 7 of the two chains being aligned to receive workpieces 9. These workpieces may be electric motor rotors which are to be subjected to various operations along the path of the conveyor, including winding of insulated wires and welding of the ends thereof to the commutators. The workpieces are fed to the conveyor by feed means 10.

Two successive winding stations 12 and 14 include winding machines of conventional type having means for picking-up the workpieces 9 from the seats 7 and for depositing the workpieces 9 into the seats 7 after the winding operation. References 16 and 18 denote two successive welding stations including conventional welding machines also provided with pick-up and depositing means for the workpieces. Discharge means 20 are provided at the end of the conveyor to pick-up workpieces for delivery to further processing stations or for delivery to further conveyors.

The conveyor has means for retaining certain workpieces which are to be moved along the lower run of the conveyor in a direction f_2 opposite to the advance direction f_1 of the upper run for reasons which will be explained hereinafter. These means may be constituted by profiles 22 extending along the whole of the lower run, from the discharge means 20 to the feed means 10.

When the system is being used for the manufacture of electric motor rotors (as described) the following are present on the conveyor-workpieces in an unwound state, wound workpieces still to be welded, and wound and welded workpieces. For this purpose, the conveyor has groups of three seats 7, in each of which the respective seats are designated to receive, respectively, the unwound workpieces, the wound and unwelded workpieces, and the wound and welded workpieces. In particular, in a group of three successive seats, one seat designated O is intended to receive an unwound workpiece, a second seat I is intended to receive a wound and unwelded workpiece, and a third seat II is intended to receive a wound and welded workpiece. Successive groups of said seats follow each other along the conveyor, whose seats are therefore arranged in groups of three, designated O, I, and II. In order to designate the different seats, suitable marks may be provided on the same seats so that they can be recognised by sensor means, such as microswitches, or selection means may be provided which are linked to the transmission means of the chain conveyor. In this latter case, as shown in Figures 2 and 3, on a shaft 24 which carries driving sprockets of the transmission means, there is provided a group of three cams 26, 28, 30 which are associated with three microswitches 32, 34 and 36. The cams 26, 28, 30 each correspond to one of the three seats in each group and are so arranged that the angular position of the respective cams will be representative of the instantaneous positions of the respective seats in each group. At each of the stations 12, 14, 16 and 18 sensing means are provided to detect the presence or absence of a workpiece on a given seat positioned with respect to the corresponding group. Such sensing means may be microswitches 38, 40, 42, and 44, which detect the presence of a workpiece or the empty seat in the desired position at which the picking-up or the depositing of the workpiece must be accomplished in the respective group.

The unwound and unwelded workpieces from the feed means 10, are deposited in the seats which are designated O. The workpieces on the seats designated O can be picked-up for the winding operation at either of the stations 12 and 14, at which their presence is detected by the sensing means 38 and 40. At the stations 12 and 14 the then wound but unwelded workpieces are deposited into empty seats designated I which are also detected by the sensing means 38 and 40. At the stations 16 and 18, the sensing means 42 and 44 detect the presence of the workpieces in the seats designated I so that these workpieces are picked up for the welding operation; the then wound and welded workpieces are deposited into empty ones of the seats designated II and which are presented before the depositing position in the stations 16 and 18.

The selection among the O, I, and II seats and among occupied and empty seats is determined by the operative cooperation between the sensing means 32, 34, 36 and the sensing means 38, 40, 42, and 44, respectively.

Feeding and unloading of the conveyor can be controlled in response to means detecting the presence of empty seats O to operate the feed means 10, and means detecting the presence of occupied seats II to operate the discharge means 20.

The feed means 10 can accumulate workpieces ready for winding and welding so as to act as a storage unit between the conveyor and means upstream of the conveyor for the production of feeding of the workpieces. It may occur that certain workpieces are not wound, or welded at the stations 12, 14 or 16, 18, and these workpieces may be recycled along the lower run of the conveyor so that these workpieces can be presented again to the stations 12, 14 and 16, 18 until these workpieces are finished and deposited in the seats II and finally discharged. If more than a certain number of workpieces are accumulated at the feed means 10, there can

be a stop in the production or of the feeding of further workpieces to the feed means 10.

Figure 5 shows schematically the station 14 having a turret 14A movable around a vertical axis and carrying a double collet 14B which can be horizontally moved. In a pick-up and/or depositing zone associated with the stations 14 there is a lift 50 responsive to the controls already described and operative to lift a workpiece from the seat 7 to present it to a collet 14B (and/or to present a workpiece to the seat 7 after receiving the workpiece from one of the collets 14B).

In a modified arrangement as shown in Figure 6, instead of providing the profiles 22, the seats (designated 70) are shaped with a saddle 72 to support the workpiece 9 along the upper run TA and with a reversed saddle 74 to support the workpiece along the lower run TR, the workpiece sliding from the saddle 72 to the saddle 74 along a curved portion C1 of the conveyor path by sliding along a portion 76 of the seat.

In order to retain the workpieces when moving along the other curved portion C2 of the conveyor path, electromagnetic means 78 can be provided, possibly energized by the passage of the seats of the groups O and I. The workpieces 9 are deposited and picked up along paths shown by the double arrow f10.

Attention is hereby directed to our co-pending Application No. 46373/77 (Serial No. 1590919). We disclaim from the scope of the claims of this application, the subject matter claimed in the claims of Application No. 46373/77. (Serial No. 1590919)

WHAT WE CLAIM IS:—

1. A workpiece processing system comprising means defining an active conveyor path passing adjacent a plurality of processing stations, means defining an endless conveyor movable along said path, said conveyor having means defining seats for workpieces to be conveyed along said path, means operative to feed workpieces to predetermined seats of the conveyor, means associated with the processing stations for removing workpieces from the seats for processing at the corresponding stations and to deposit the processed workpieces into the seats, said seats consisting of a plurality of groups of seats, in each said group of seats individual seats being designated to receive only workpieces which are at a predetermined stage in the processing operation, detecting means for detecting filled and empty seats in predetermined positions of the seats along the path, said detecting means being operable to control the operation of the workpiece removal and depositing means whereby the workpiece removal and depositing means only remove workpieces

from, and deposit workpieces into, the designated seats, and means enabling any incompletely processed workpieces to be returned to the beginning of the active conveyor path.

2. A processing system according to claim 1, wherein the detecting means comprises first sensor means for determining the instantaneous positions of the respective seats in each group, second sensor means associated with the workpiece depositing and removal means for detecting the presence and absence of filled and empty seats at predetermined positions, and third sensing means for sensing the presence of predetermined empty seats and to control the feed means to deposit the workpiece into said predetermined empty seats.

3. A processing system according to claim 1 or claim 2, further comprising means defining a return conveyor ipath vertically spaced from the active conveyor path.

4. A processing system according to claim 3, further comprising profiles following the return conveyor path to retain within their seats workpieces which are being returned along the return path to the beginning of the active path for completion of processing.

5. A processing system according to claim 1, wherein the seats are shaped to retain workpieces which are being returned along the return path to the beginning of the active path for completion of processing.

6. A processing system according to claim 5, further comprising means defining curved path portions interconnecting adjacent ends of the active and return path, and electromagnetic means for retaining in their seats, workpieces moving along one of the curved portions.

7. A workpiece processing system comprising means defining an endless conveyor path passing adjacent a plurality of processing stations, means defining an endless conveyor movable along said path, said conveyor having means defining seats for workpieces to be conveyed along said path, means operative to feed workpieces to predetermined seats of the conveyor, means associated with the processing stations for removing workpieces from the seats for processing at the corresponding stations and to deposit the processed workpieces into the seats, said seats consisting of a plurality of groups of seats, in each said group of seats individual seats being designated to receive only workpieces which are at a predetermined stage in the process, and means for sensing the presence of filled and empty seats in specific positions of the conveyor, said sensing means controlling the workpiece removal and depositing means, whereby the workpiece removal and depositing means only remove workpieces from, and deposit work-

pieces into, the appropriate designated seats.

8. A workpiece processing system substantially as hereinbefore described with reference to Figures 1 to 5, or Figure 6 of the accompanying drawings.
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COMPLETE SPECIFICATION

2 SHEETS

This drawing is a reproduction of the Original on a reduced scale

Sheet 1

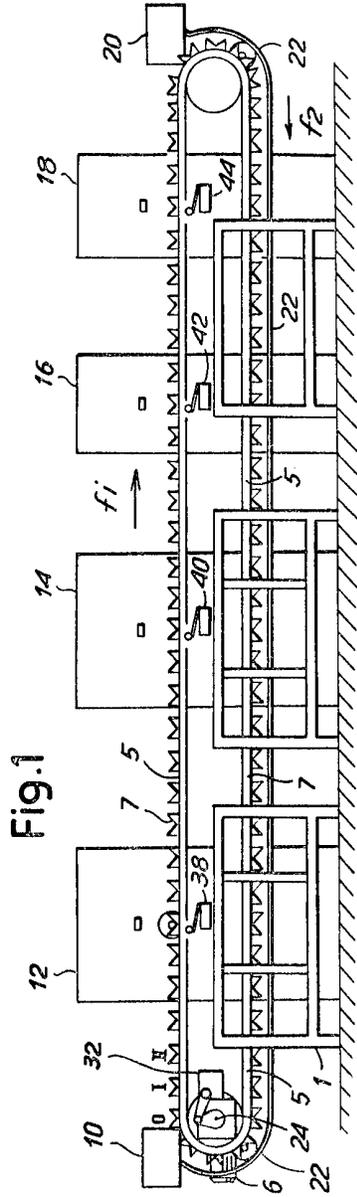


Fig. 1

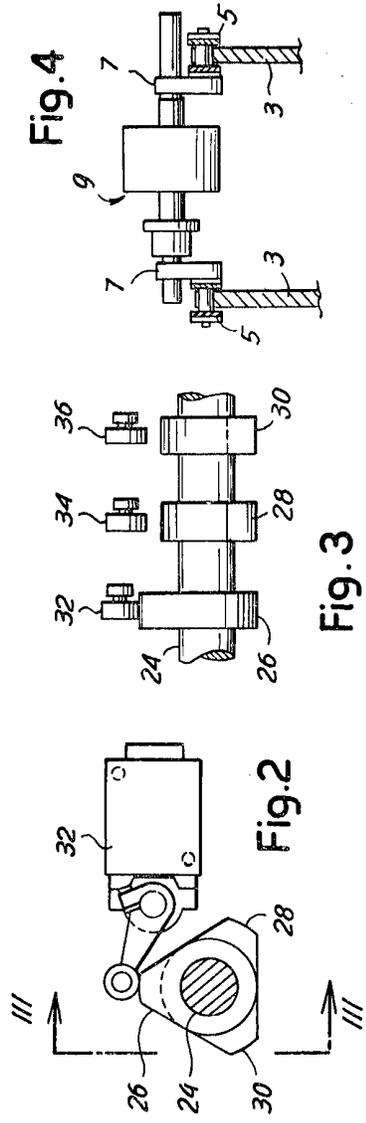


Fig. 2

Fig. 3

Fig. 4

