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The invention relates to a conveyor system according to the preamble of Claim 1.

Conveyor systems of the kind cited in the preamble of Claim 1 are known from several prior art documents, for example US-A-3 340 821 and US-A-3 502 038. The target codes in a conveyor system of this kind consist of single electro-magnets or a plurality thereof which are arranged on the conveyor car and set in the form of a target code. On the movable guide rail part of switches, there are receiving devices which scan the target codes of the conveyor cars during travel and directly influence the switch-control device as a function of each target code scanned. Conveyor systems of this kind function well, but it is not possible to monitor the operating state, for example whether a despatched conveyor car actually reaches the destination set.

Up-to-date conveyor systems, however, are known from EP-OS- 0 164 302. They have a central control unit which not only enables the control of the conveyor cars until they reach the destination set, but simultaneously also ensures a monitoring of the conveyor system, the conveyor cars being provided with individual identification codes which are also scanned and fed into the central control unit. The identification and target codes are processed in the central control unit and serve to control the switches and to monitor the conveyor system. Such a control device cannot be incorporated into an existing conveyor system of the above kind.

The invention has the object of providing a conveyor system as cited in Claim 1, which, as before, uses the same control of a conveyor car by means of the target code until it reaches its destination and which, additionally simply enables a monitoring of a conveyor

system.

This object is achieved by the features of Claim 1. In this way it is possible to improve existing conveyor systems and to make them into up-to-date equipment without having to change the control system hitherto used. The previous control system of the conveyor system and the supplementary monitoring system may, basically, operate independently, but additionally may, optionally, complement one another. By means of the added-on monitoring system, it is possible to monitor the path of the conveyor car from the despatch station to the receiving station and to reprogram e.g. a car to take the shortest path, using a code-setting device, or return a car which, for example has got lost, to the sending station or to direct it to a central collecting station.

Preferred embodiments of the conveyor system are disclosed in Claims 2 to 7.

Basically, in simple conveyor systems, it may suffice if only the stations are provided with receivers of the above kind. In more complicated conveyor system, a construction according to Claim 2 is recommended, since this enables continuous monitoring of the cars as they travel along the conveying track. Such receivers arranged along the conveying track may, if necessary, only provide reading devices for identification codes, but preferably they also contain reading devices for target codes.

It is also of advantage if the receivers comprise microprocessors which process the received signals and supply the data to the central computer. This would also enable a construction as cited in Claim 4, so that in the event of a malfunctioning, the monitoring device is able effectively to influence the operation of the conveyor system. Here, a construction according to Claim 5 is appropriate, so that the despatch of the car may be stopped at the sending station, for example in

the event of the target station being occupied or in the event of an incorrectly set target code; a construction according to Claim 6 is of particular advantage.

A construction according to Claim 7 is also particularly advantageous. It makes it possible to display the operational sequence of the conveyor system on a screen or to indicate malfunctioning or to record the operation of the conveyor system.

Embodiments of the invention are explained hereinafter in greater detail with reference to schematic drawings which illustrate:

Figure 1 a section of a conveyor system equipped with a monitoring system, and

Figure 2 the block diagram of the monitoring system as shown in Figure 1.

The conveyor system shown in section in Figure 1 corresponds with that disclosed by US-PS 3 340 821 and 3 502 038. One of the variants thereof may, for example, be in the construction as shown in Figure 10 of EP-OS 0 164 302.

In a conveyor system of this kind the target codes at the stations A and B are set by slide magnets provided on the conveyor car 1 and scanned by relevant scanning devices 2₁, 2₂ arranged on the switches 4₁, 4₂, the switches are then switched according to the required target code. The target codes are used both to direct a car from a side track 6₁, 6₂ onto a main track 8₁, 8₂ and vice versa. In the example shown, the conveying tracks are rails, but they may also be guide tracks provided on or in the ground and which a car follows as disclosed in US-PS 3 628 624, 3 948 342 and 4 015 680. Reversing switches 10₁, 10₂ are arranged in the main track 8₁, 8₂ in order to direct a car from the main track 8₁ onto the main track 8₂ or vice versa.

The monitoring system with which such a conveyor system may be equipped comprises receivers $12_1, 12_2, 12_3$ which are arranged, on the one hand, at the stations A and B and, on the other hand, along the main track $8_1, 8_2$. Such receivers $12_1, 12_2, 12_3$, are provided with reading devices 14 for the target codes as well as with reading devices 16 for the identification codes, such an individual code identifying the conveyor car being associated with each car. This identification code, may, for example, be a bar code which is scanned by an optical reading device 16. The scanned target code and the scanned identification code are processed in the receiver by means of a microprocessor and are fed, via a connecting line $18_1, 18_2, 18_3$, to a data bus line 20 which leads to a central computer 22 which may, for example, be a personal computer. A screen 24 and a printer 26 are connected to the central computer 22.

The receivers $12_1, 12_2$ at the stations A, B are connected with the relevant switches $4_1, 4_2$ via a control line $28_1, 28_2$. The receiver 12_3 along the main track $8_1, 8_2$ may be connected with a code-setting device 32, via a control line 30, and/or with a reversing switch 10_2 , via a control line 34. The code-setting device 32, may for example, be of a construction as disclosed in US-PS 4 566 390 and be used for resetting the codes to the starting position. This reset code may then correspond to the target code of the collecting station. But a code-setting device 33 of this kind may also be constructed as disclosed by US-PS 4 056 063 or GB-PS 2 084 757. It sets the target code so as to be that of a collecting station or optionally to that of a starting station.

The receivers $12_1, 12_2$ of the stations A, B, in particular, may be provided with acoustic or optical signalling devices 36 which indicate malfunctioning, for example if the intended target station is occupied or the target code set does not exist.

The monitoring system may be added onto an existing conveyor system without having to change the control mechanics of the existing conveyor system, itself. The individual units of the monitoring system may be attached to a known conveyor system without, in some cases, even having to disconnect the operation. The monitoring system does not carry out any control tasks of the known conveyor system and is operated independently of the conveyor system, that is to say it only supplements the known conveyor system. In the event of a failure of the monitoring system, the conveyor system remains functionable.

The target codes and identification codes need not only consist of slide magnets and bar codes but they may comprise any of the known coding devices. The reading devices may be constructed accordingly. If necessary, the existing scanning devices 2₁, 2₂ may be directly used for the reading device 14 of the monitoring system.

The monitoring system is able to achieve many different tasks which also include those mentioned in EP-OS 0 164 302:

1. Determining the time of travel for each conveying operation and comparing this value with a fed-in maximum time value for completing the operation;
2. Ascertaining whether a conveying car has actually reached the set target and indicating if an incorrect station has been approached;
3. If a conveying car travels with a target code not provided in the system, the conveying car may be returned to the starting station or directed to a collecting station;
4. If a conveying car misses a receiver several times, the code-setting device may, in this case, change

the target code of the receiver to the target code of a collecting station or substitute station. The original target code may remain stored in the central computer and this information may be supplied to a printer at the substitute station;

5. All the operational sequences in the conveyor system may be stored over a specific period in the central computer, indicated on the screen and printed by the printer;
6. The data stored in the central computer may be selected and evaluated using different criteria for example all the movements of a specific conveyor car may be indicated and printed out during a predetermined time;
7. The data stored in the central computer may be evaluated for maintenance instructions;
8. With a suitable distribution of receivers along the conveyor system, it is possible to record and calculate the path a conveying car needs to travel until it reaches its target. It is also possible to indicate, in each case, the position of a container in the conveyor system. If a car goes past a receiver arranged along the path, it is clear that each time it goes past the receiver the computable additional path has to be added to the path already travelled by the car. If the car goes past a control point set by a receiver several times and the target code is correct, it means that the target station was occupied and the car must travel an extra round.
9. It is possible to ascertain, indicate and take account of the occupied state of each station.

List of reference numerals

A	Station
B	Station
1	Conveying car
2 ₁	Scanning device
2 ₂	Scanning device
4 ₁	Switch
4 ₂	Switch
6 ₁	Side track
6 ₂	Side track
8 ₁	Main track
8 ₂	Main track
10 ₁	Reversing switch
10 ₂	Reversing switch
12 ₁	Receivers
12 ₂	Receivers
12 ₃	Receivers
14	Reading device for target code
16	Reading device for identification code
18 ₁	Connecting line
18 ₂	Connecting line
18 ₃	Connecting line
20	Data bus line
22	Central computer
24	Screen
26	Printer
28 ₁	Control line
28 ₂	Control line
30	Control line
32	Code-setting device
34	Control line
36	Alarm system

Claims

1. A conveying system with track-bound conveying cars (1) which may be moved from one station (A,B) along tracks (6₁,6₂,8₁,8₂), via switches (4₁,4₂,10₁,10₂), to another station (A,B) by means of adjustable target codes provided on the conveying cars, scanning devices (2₁,2₂) with reading devices for the target codes being associated, in each case, with the switches for the direct control of the cars, characterised in that the conveying system is provided with a monitoring system for monitoring the conveying system, comprising

- receivers (12₁,12₂) which are each provided with a reading device (16) for reading the identification codes, such an identification code being associated with each conveying car (1)
- a central computer (22) which is connected with the receivers (12₁,12₂); and
- a code-setting device (32) which is mounted along the track and is used for reprogramming the target codes of the cars running along the track (8₁,8₂), as a result of a control signal of the central computer (22).

2. A conveying system according to Claim 1, characterised in that it comprises other receivers (12₃) which are connected with the central computer (22) and are arranged along the track (8₁,8₂), and a reading device (16) for the identification codes and preferably a reading device (14) for the target codes.

3. A conveying system according to Claim 1 or 2, characterised in that the receivers (12₁,12₂,12₃) have



microprocessors.

4. A conveying system according to any one of Claims 1 to 3, characterised in that the receivers (12₁, 12₂, 12₃) are constructed to control devices (4₁, 4₂, 32) as a function of control signals emitted by the central computer.

5. A conveying system according to Claim 4, characterised in that the receivers (12₁, 12₂) are connected with control devices of stations and/or switches (4₁, 4₂, 10₁, 10₂).

6. A conveying system according to any one of Claims 1 to 5, characterised in that the code-setting device (32) is connected with a receiver (12₃) arranged along the conveying track (8₁, 8₂).

7. A conveying system according to any one of Claims 1 to 6, characterised in that a screen (24) and/or printer (26) is/are connected to the central computer (22).

