controlled via a remote control desk. This enables an automatic operation of the container bridges. The target positions for loading and unloading to be approached are communicated to the crane controller via shipping orders.

The object of the present invention consists in specifying an operating method for a crane installation, whereby in particular in automatic crane operation a cargo transshipment is possible which is faster compared to previously known operating methods.

The object is achieved by means of an operating method having the features of claim 1. Advantageous embodiments of the operating method form the subject matter of the dependent claims 2 to 10.

According to the invention, the operating method specified in the introduction is embodied such that the trolley controller controls acceleration and braking operations during the travel movement of the trolley as a function of the loading of the trolley and the maximum drive force available. This leads to motion characteristics which are optimal in terms of time, because during all acceleration and braking operations the maximum drive force of the travel drive can be used at all times in the motion characteristics. In this context, at least one acceleration operation has two sections of equally sized positive acceleration and an intermediate section of equally sized negative acceleration in terms of amount, and at least one braking operation has two sections of equally sized negative acceleration and an intermediate section of equally sized positive acceleration in terms of amount.

This operating method leads to a time-optimized cargo transshipment, in particular in an automatic operation of the crane installation. The invention is based on the recognition that the masses to be moved may change considerably during the individual travel procedures. For example, one container may have a mass of 25 t, while another container may have a mass of 10 t. In addition, there are also what are known as empty

as a function of the rotational speed n, with a first operating point AP1 in normal field operation and a second operating point AP2 in field-weakening operation. At operating point AP1, a moment M_1 is generated at a rotational speed of n_1 and at operating point AP2 a moment M_2 is generated at a rotational speed n_2. At operating point AP2, although the generated torque is reduced, the rotational speed is simultaneously increased.

By using electric motors and the operation thereof in the field-weakening range, it is possible to increase the time saving during the transshipment of cargo even further, in particular with long travel distances of the trolley 4. A typical case of this is shown in Fig. 5. Longer travel distances can then be traveled at a constant, increased speed. With an electromotive travel drive without field-weakening operation or without using the field-weakening operation, it is possible for a speed profile 50 to be realized for example, in which a maximum travel speed v_1 can be attained with the drive moment M_1. A further time saving during the transshipment of cargo can now be achieved if, during approach, when the rated rotational speed n_1 has been attained at operating point AP1, there is a switch to the operating point AP2 of the field-weakening operation. Then, although the drive moment M_2 is reduced, the maximum travel speed v_2 is increased further. In a similar manner, during braking, when the travel speed v1 has been attained, there is a switch back to the operating point AP1. This relationship is illustrated by the speed profile 52. Also represented in FIG 5 is the time saving Δt_{vmax} which can be achieved by the field-weakening operation.

FIG 6 shows the acceleration profiles associated with the speed profiles 50 and 52. In this context, at least one acceleration operation has two sections of equally sized positive acceleration and an intermediate section of equally sized negative acceleration in terms of amount, and at least one braking operation has two sections of equally sized negative acceleration and an intermediate section of equally sized positive acceleration in terms of amount. Owing to the higher drive moment M_1

Claims

1. An operating method for a crane installation, in particular for a container crane, with a trolley (4) for transporting a load (6), wherein the load (6) to be transported determines a loading of the trolley (4), a travel drive (8) connected to the trolley (4) and a trolley controller (28) connected to the travel drive (8) for controlling travel movements of the trolley (4),
characterized in that the trolley controller (28) controls acceleration and braking operations during the travel movement of the trolley (4) as a function of the loading of the trolley (4) and the maximum available drive force of the travel drive (8),
wherein at least one acceleration operation has two sections of equally sized positive acceleration and an intermediate section of equally sized negative acceleration in terms of amount and
wherein at least one braking operation has two sections of equally sized negative acceleration and an intermediate section of equally sized positive acceleration in terms of amount.

2. The operating method as claimed in claim 1,
characterized in that the loading of the trolley (4) is acquired by a load measuring device (26) connected to the trolley (4).

3. The operating method as claimed in claim 1 or 2,
characterized in that the travel movement of the trolley (4) comprises at least one accelerated and a braked section and that the positive and/or negative acceleration of the travel movement takes place as a function of the loading.

4. The operating method as claimed in one of the preceding claims, characterized in that a maximum possible acceleration of the travel movement is determined by the maximum drive force of the travel drive (8) connected to the trolley (4) and a minimum loading of the trolley (4).

10. The operating method as claimed in claim 9, characterized in that the at least one electric motor (10) is operated in the field-weakening range after attaining a rated rotational speed (n_1) to increase the speed of the travel movement.

11. A computer program, which comprises machine code, which is able to be executed by a trolley controller (28), wherein the execution of the machine code by the trolley controller (28) causes the trolley controller (28) to receive a loading of a trolley (4) controlled by the trolley controller (28) and the trolley controller (28) to control acceleration and braking operations during the travel movement of the trolley (4) as a function of the loading of the trolley (4) and the maximum available drive force of the travel drive (8), wherein at least one acceleration operation has two sections of equally sized positive acceleration and an intermediate section of equally sized negative acceleration in terms of amount, and wherein at least one braking operation has two sections of equally sized negative acceleration and an intermediate section of equally sized positive acceleration in terms of amount.

12. The computer program as claimed in claim 11, characterized in that the execution of the machine code by the trolley controller (28) causes the trolley controller (28) to implement the features of one of claims 2 to 10.