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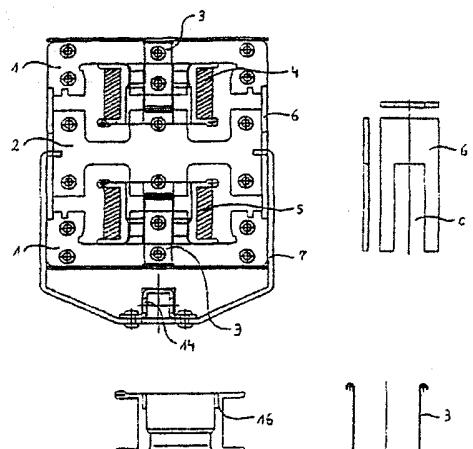
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(54) Title :
Star-to-triangle switching element.

(57) Abstract :
The invention refers to the star-triangle switching element that allows for switch-on, start-up and operation of asynchronous electromotors and successfully replaces the existing versions of contactor combinations for control of asynchronous motors with the power exceeding 4kW, which, however, does not limit its use elsewhere. The constructional concept of the switching element referred to in this invention provides for three independent positions, which is via the transmission elements transmitted into the contact section where the mobile support of flexible contacts with its movement closes the corresponding contacts, which first provides for electromotor power supply-star (Y)-with reverse connection to the star point, and upon the lapse of certain time, for power supply-triangle (D). This is achieved in such a way that the driving element consists of two fixed armatures (1) bearing, attached with special loops (3), the coils (4,5), separated by distance plates (6) that at the same time serve as a guide for the joint armature (2) with the opening (c) wherein fits the mobile metal support (7) in the way that the armature (2) is limited in its movement.



(56) Documents Cited : **WO 9601486**

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STAR-TO-TRIANGLE SWITCHING ELEMENT

The invention refers to the star-to-triangle switching element that allows

5 for switch-on, start-up and operation of asynchronous electromotors and successfully replaces the existing versions of contactor combinations for control of asynchronous motors with the power exceeding 4kW. In general, the invention is classified into class H 01 H and/or precisely into class H01 H 03/46 of the international patent classification.

10 The technical problem successfully solved by the invention in question involves the design and the construction of such switching element that will allow for successful replacement of a combination of several contactor elements, in particular in those applications where one element may replace a combination of two or three contactors, such as required in the

15 existing solutions and constituting an assembly where the power and the control sections between the contactors must be correctly wire-connected, unless the assembly may be damaged or even destroyed.

The existing solutions solving the imposed technical problem, e.g. that

20 of the start up and operation of electromotors with the power exceeding 4 kW, contain three standard contactors and a time switch relay for star-to-triangle switching. Correct operation of such assembly requires correct wire-connection of power contacts of all three contactors, which is

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physically more difficult in assemblies of greater powers that involve wires of bigger cross-sections.

The constructional concept of the switching element referred to in this invention provides for three independent positions, which is via the 5 transmission elements transmitted into the contact section where the mobile support of flexible contacts with its movement closes the corresponding contacts, which first provides for electromotor power supply – star (Y) – with reverse connection to the star point, and upon the lapse of certain time, for power supply – triangle (D) – which corresponds to the 10 rated voltage of the electromotor winding, double-step start-up Y – D. The contact system provides smooth operation and significantly simplifies the traditional contactor combinations through the use of three contactors and a time-switch relay. The switching time is adjustable and depends on the load driven by the electromotor, while the starter position is signalized. 15 The star-to-triangle switching element, such as referred to in this invention, will be explained in detail on the basis of the concrete example and the corresponding figures, showing the following:

20 **Figure 1** Star-to-triangle switching element, such as referred to in this invention, cross-section and front view;

Figure 2 Star-to-triangle switching element, such as referred to in this invention, cross-section and longitudinal view;

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Figure 3 Star-to-triangle switching element, such as referred to in this invention, cross-section and top view;

Figure 4 Star-to-triangle switching element, such as referred to in this invention, cross-section and lateral view.

The driving element consists of two fixed armatures 1 and one mobile armature 2. The fixed armatures 1 bear, attached with special loops 3, the coils 4,5, each of them in the make state representing one make state of the switching element referred to in this invention. Suspended between them is the armature 2 in the form of letter E; it moves along lateral metal guides 6 that at the same time provide for adequate spacing of the fixed armatures 1. The mobile armature 2 in the break state of the coils 4, 5 is idle, which represents the third, off position of the element. The mobile armature 2 transmits the force over a steel support 7 and over a transmission lever 8 to the mobile support 9 of the flexible contacts 10, 11, 12 in the contact section of the switching element.

The input fixed contacts L1, L2, L3 are located on one side of the switching element, and the output fixed contacts U1, V1, W1 and U2, V2, W2 on the other side, which corresponds to the marking of the electromotor connection plate. The contacts are covered by two insulation covers 31 with openings for connection wires.

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In case of the coil 4 in the make state the mobile support 9 bearing the contacts 10, 11 12 moves to position a. The load current flows from the input fixed contacts L1, L2, L3 via the mobile contacts 11 to the output fixed contacts U1, V1, W1 and through the wires to the electromotor 5 winding. The ends of the winding are connected to the fixed contacts U2, V2, W2, where the star-point 13 is closed via the mobile contacts 10. The electromotor winding is supplied with the voltage 230 V (Y) and the motor rotor achieves 2/3 rated rotations. Upon the lapse of the start-up time, the coil 4 becomes inactive, while the coil (5) becomes active and causes the 10 mobile support 9 with contacts 10, 11, 12 to move to the position b. Thereby the star-point 13 opens and the current flows via the flexible contacts 11, 12 and permanent contacts U1, V1, W1 and U2, V2, W2 into the electromotor winding. At this moment the electromotor winding is supplied with 400 V (D) voltage, which is the electromotor winding rated 15 voltage, the rotor achieves rated rotations and accordingly provides permanent operation.

The star-to-triangle switching element is controlled as every traditional contactor, either only with the switch 01 or via the ON/OFF key of the existing remote switch; it can be mounted on a standard carrier strip or 20 fixed with screws.

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PATENT CLAIMS

1. A star-to-triangle switching element, with a driving section containing two
5 fixed armatures (1) that bear, attached with special loops (3), coils (4,5),
characterized in that

the coils (4,5) are separated by a distance plate (6) that at the same time
serves as a guide of a joint armature (2) with an opening (c) into which
the mobile metal support fits in such a way that the armature (2) is limited
10 in its movement.

2. The star-to-triangle switching element as per claim 1,
characterized in that

the mobile metal support (7) moves vertically along the grooves of the
15 housing (32) and is in its lower part (14) adapted for mounting of the
round head (15) of the transmission lever (8).

3. The star-to-triangle switching element as per claims 1 and 2,
characterized in that

20 at mounting of the coil-formers (4, 5) to the armature (1) the two
removable loops (3) may get stuck into the respective two teeth (16)
on the coils (4, 5).

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4. The star-to-triangle switching element as per claims 1 through 3,

characterized in that

the transmission lever (8) is mobile by means of the round thick central part (17), moving inside the semi-round sliding bearing of the housing (18) as well as in the insertable sliding bearing (19), fixed with the steel snap ring (20) in the groove of the housing, while the two round heads (15, 21) on the sides of the transmission lever (8) allow for vertical movement of the mobile parts and for horizontal sliding.

10 5. The star-to-triangle switching element as per claims 1 through 4,

characterized in that

the contact system has two make positions and one break position whereby three input connections (L1, L2, L3) are positioned on one side and six output connections (U1, V1, W1, U2, V2, W2) on the other 15 side of the switching element in the way that the double two-line fixed contacts (22) have only one common connection point (23) per phase.

6. The star-to-triangle switching element as per claims 1 through 5,

characterized in that

20 due to their double function, the mobile contacts (11) are fixed between the springs (24), and the star-point (13) is placed in an insulating chamber (25) in the way to cover all three phase fields (26), such as enabled by the specially shaped mobile contacts (10).

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7. The star-to-triangle switching element as per claims 1 through 6,

characterized in that

the control of the driving coils (4, 5) is effected through wires along the
5 carrier wall (27) gasket into one part of control elements (28) and
terminals (29), while the neutral - OFF position of the element is
enabled by the springs (33).

8. The star-to-triangle switching element as per claims 1 through 7,

10 **characterized in that**

the covering part of the element (30) fixes also the lateral covering
insulating parts (31) of the fixed contacts (L1, L2, L3) and (U, V1, W1,
U2, V2, W2) with openings for power terminals inserted into the
respective grooves (32) of the housing.

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FISHER, CORMACK & BOTHA
Patent Agents for the Applicant
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2007.



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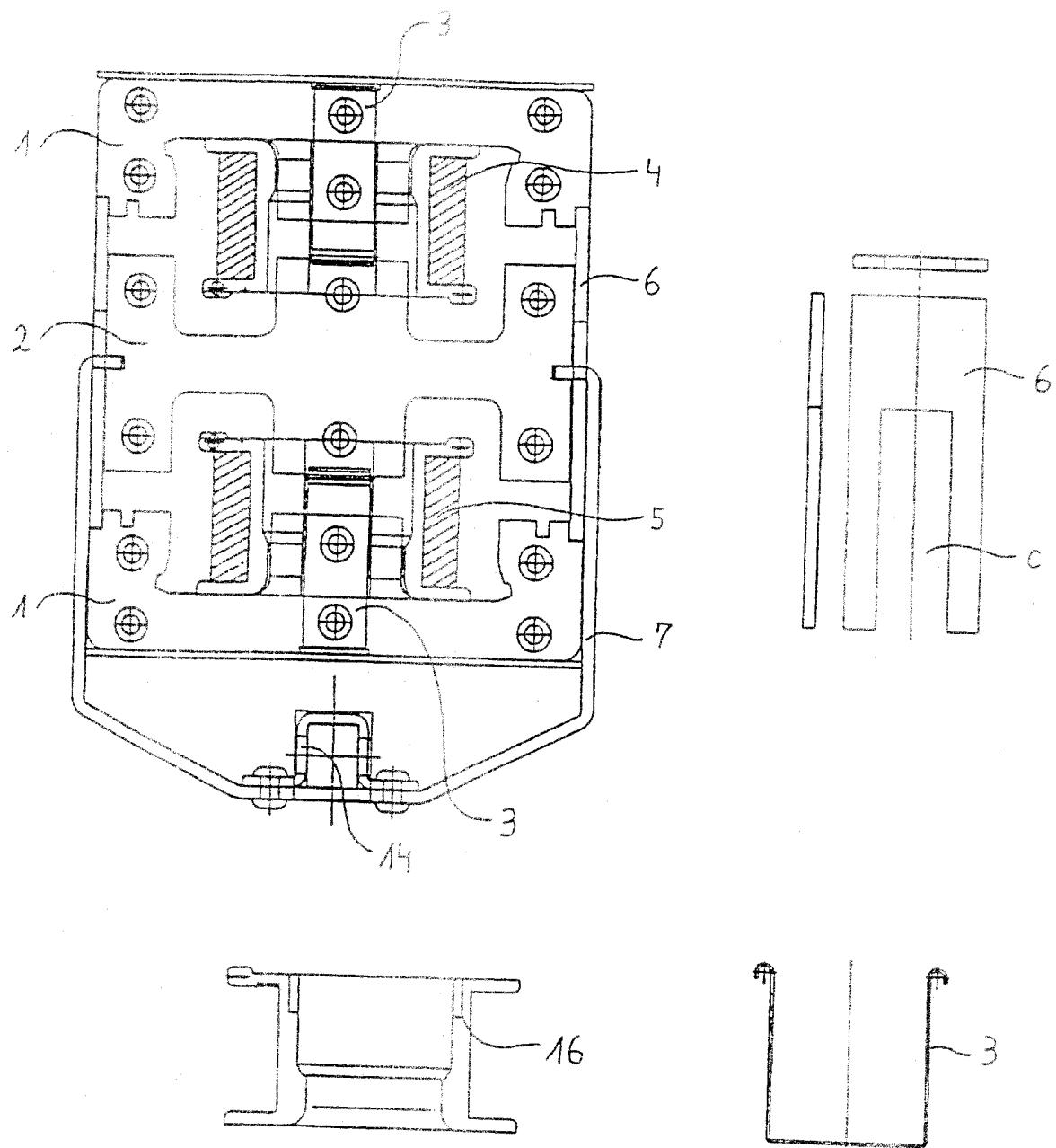


FIG. 1

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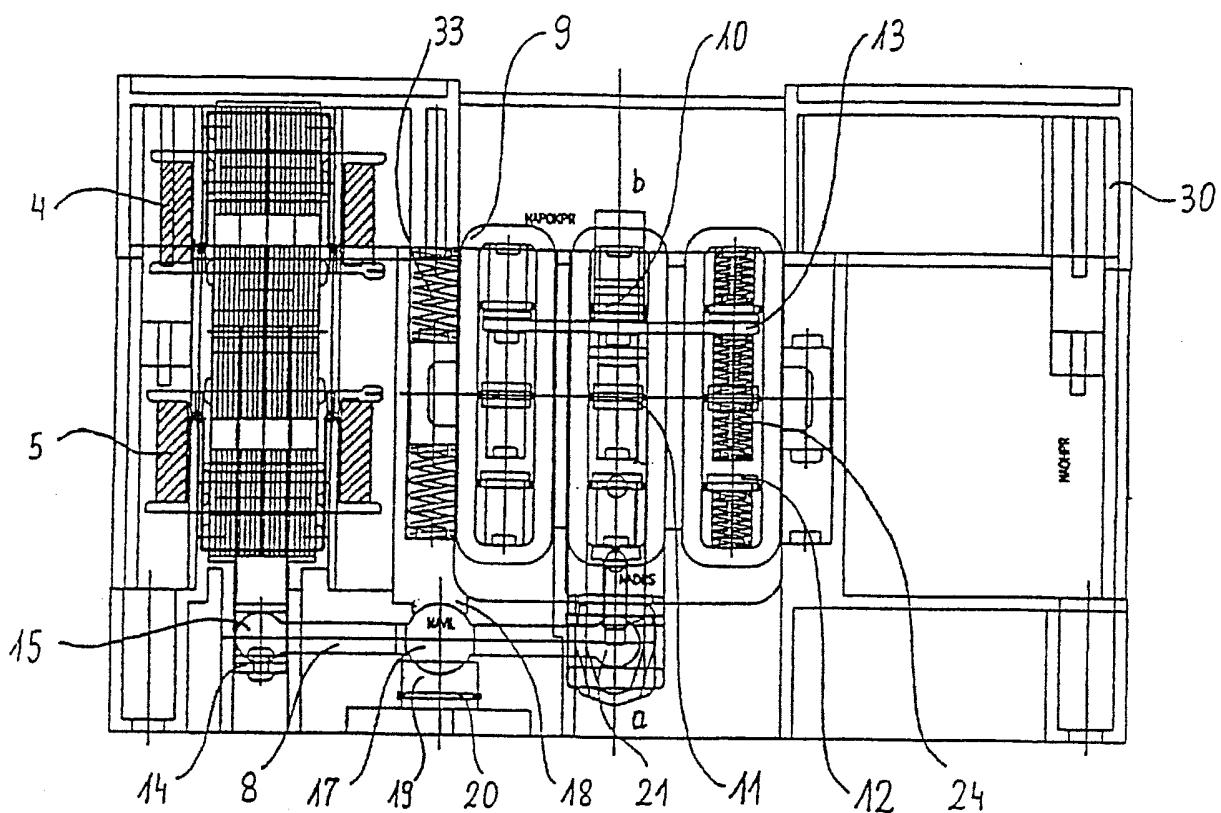
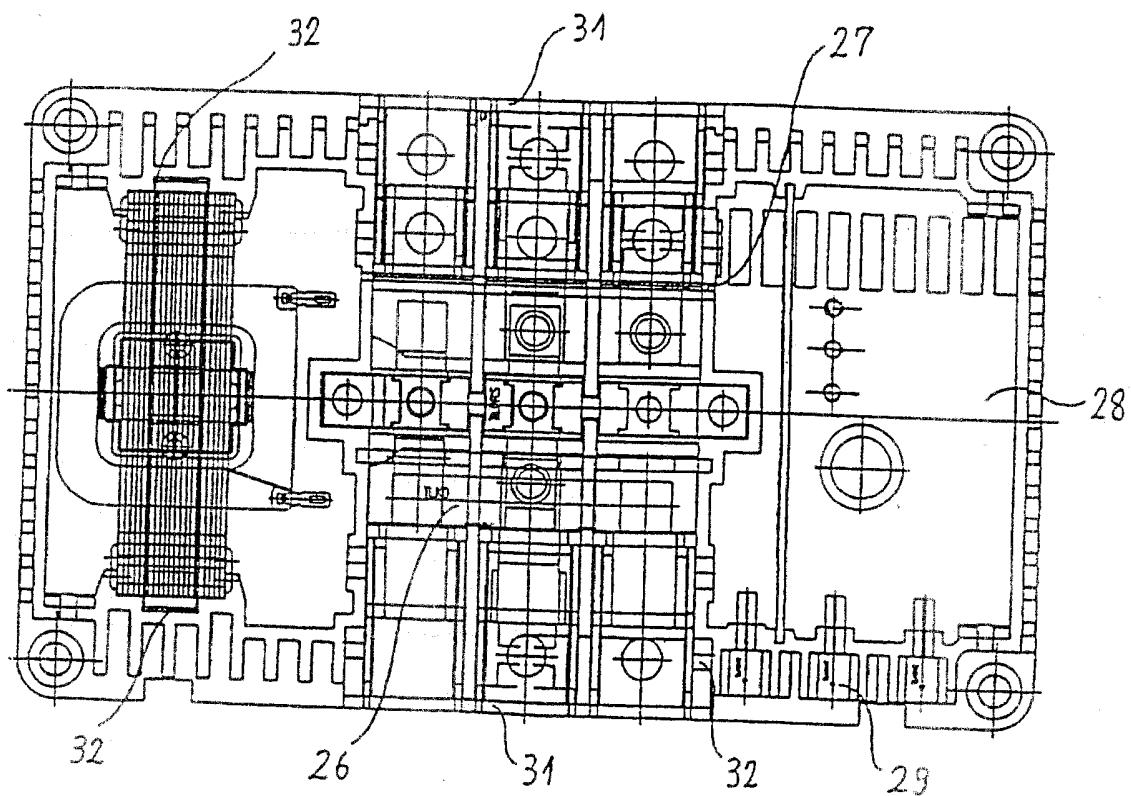


FIG. 2

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FIG. 3

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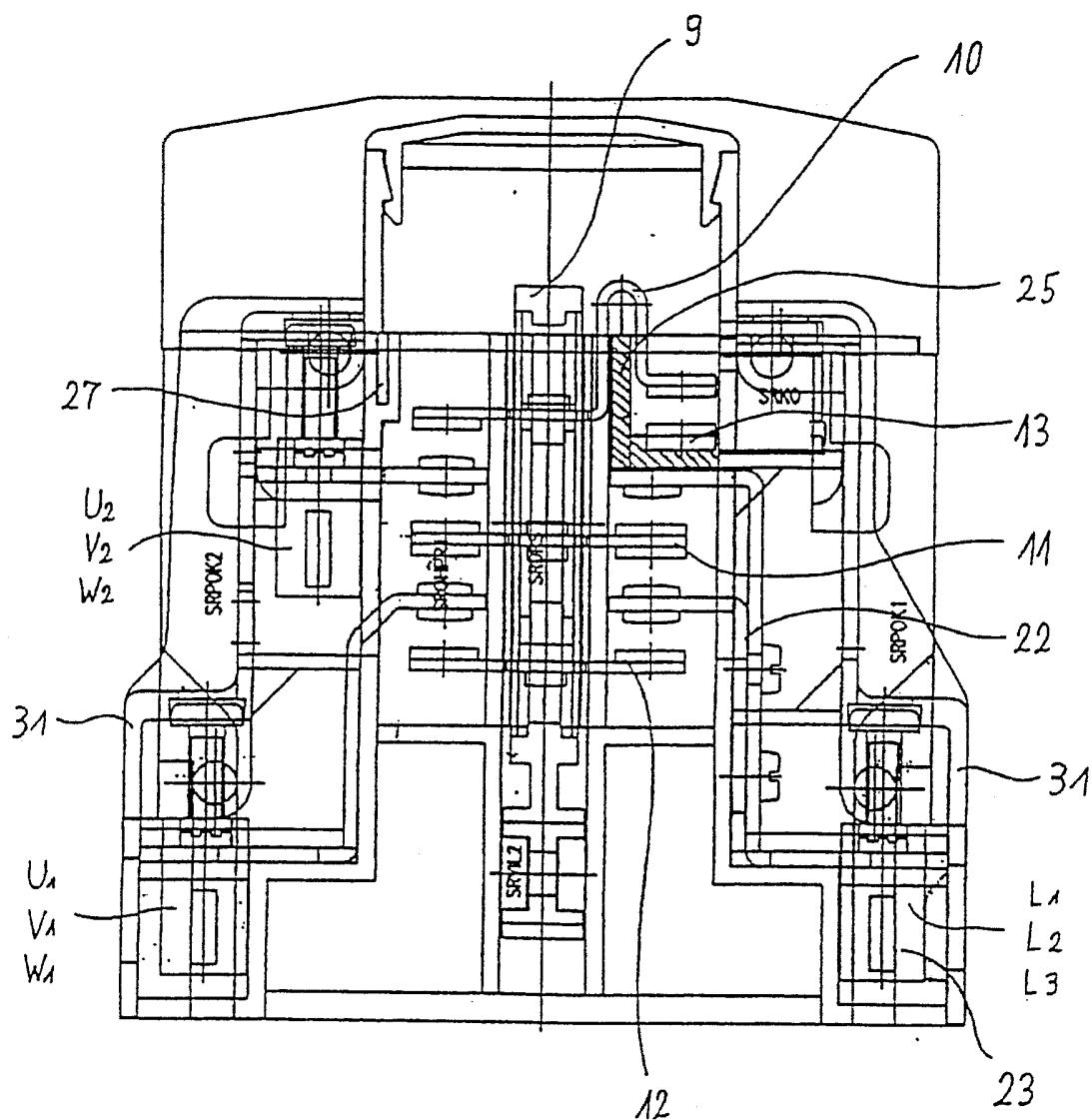


FIG. 4