lower-trolley redirecting pulley block 19 and the second lower-trolley redirecting pulley block 20 are arranged on a rear side of the lower trolley 3, and the third lower-trolley redirecting pulley block 21 and the fourth lower-trolley redirecting pulley block 22 are arranged on a front side of the lower trolley 3; wherein the lower-trolley redirecting pulley a 30, the lower-trolley redirecting pulley b 31, the lower-trolley redirecting pulley c 33 and the lower-trolley redirecting pulley d 35 are arranged at an equal horizontal height, the lower-trolley redirecting pulley a 30 and the lower-trolley redirecting pulley b 31 are arranged on a rear side of the lower trolley 3, and the lower-trolley redirecting pulley c 33 and the lower-trolley redirecting pulley d 35 are arranged on a front side of the lower trolley 3. An outer side surface of the second horizontal support 36 is further provided with a plurality of rope dragging frames 24. Specifically, each side may be provided with two rope racks 24. The ~~travelling drum A 11~~ forward travelling wire rope 15 and the reverse travelling wire rope 17 are arranged on the rope dragging frames 24, respectively.

**[0038]** Embodiment 2: As shown in Fig. 1 to Fig. 5, in a travelling wire rope winding system and travelling mechanism for an external lower trolley of a conventional quay crane, an upper-trolley travelling mechanism 7 of an upper trolley 2 is provided in a quay crane machine room 4. In the present disclosure, a lower-trolley travelling mechanism 5 and a lower-trolley travelling winding system 6 are included, and the lower-trolley travelling mechanism 5 is configured to drive a lower trolley 3 to travel along a double-trapezoidal four-track girder 1 by means of the lower-trolley travelling winding system 6. The lower-trolley travelling mechanism 5 is also provided in the machine room 4, wherein the lower-trolley travelling mechanism 5 includes a lower-trolley travelling mechanism A 8 and a lower-trolley travelling mechanism B 9, and the lower-trolley travelling mechanism A 8 and the lower-trolley travelling mechanism B 9 are provided on a left side and a right side of the upper-trolley travelling mechanism 7, respectively. Since the machine room 4 is limited in space, in the present disclosure, the lower-trolley travelling mechanism A 8 and the lower-trolley travelling mechanism B 9 that are newly added can be disposed without the need to build a new machine room and reduce the upgrading cost, so that the remaining space of the original machine room 4 is sufficiently utilized, the utility rate of space is increased, and the stable operation of the newly-added lower trolley can also be guaranteed. Through the special structural design of the lower-trolley travelling mechanism 5 and the lower-trolley travelling winding system 6, the lower-trolley travelling mechanism 5 and an upper-trolley travelling mechanism 7 are effectively staggered without mutual interference, and the lower-trolley travelling winding system 6 and an upper-trolley travelling winding system are effectively staggered without mutual interference. At the same time, the lower-trolley travelling winding system 6 and a lower-trolley hoisting

WHAT IS CLAIMED IS:

1. A system comprising:

a travelling wire rope winding system and travelling mechanism for an external lower trolley of a conventional quay crane~~,~~;

an upper trolley (2) comprising an upper-trolley travelling mechanism (7);

a quay crane machine room (4); and

a double-trapezoidal four-track girder (1),

wherein ~~an~~ the upper-trolley travelling mechanism (7) of ~~an~~ the upper trolley (2) ~~being~~ is provided in ~~a~~ the quay crane machine room (4),

wherein the travelling wire rope winding system and travelling mechanism comprises a lower-trolley travelling mechanism (5) and a lower-trolley travelling winding system (6), and the lower-trolley travelling mechanism (5) is configured to drive a lower trolley (3) to travel along ~~a~~ the double-trapezoidal four-track girder (1) by means of the lower-trolley travelling winding system (6);

wherein the lower-trolley travelling mechanism (5) is also provided in the machine room (4), wherein the lower-trolley travelling mechanism (5) comprises a lower-trolley travelling mechanism A (8) and a lower-trolley travelling mechanism B (9), and the lower-trolley travelling mechanism A (8) and the lower-trolley travelling mechanism B (9) are provided on a left side and a right side of the upper-trolley travelling mechanism (7), respectively;

wherein the lower-trolley travelling mechanism A (8) comprises a travelling drum A (11), a motor (28) and a speed reducer (29), wherein one side shaft of the speed reducer (29) is connected to the motor (28), and the other side shaft of the speed reducer (29) is connected to the travelling drum A (11); and the lower-trolley travelling mechanism B (9) comprises a travelling drum B (32), a motor (28) and a speed reducer (29), wherein one side shaft of the speed reducer (29) is connected to the motor (28), and the other side shaft of the speed reducer (29) is connected to the travelling drum B (32);

wherein the lower-trolley travelling winding system (6) comprises a lower-trolley travelling winding group A (26) and a lower-trolley travelling winding group B (27), the lower-trolley travelling mechanism A (8) drives the lower trolley (3) to travel forward by means of the lower-trolley travelling winding group A (26), and the lower-trolley travelling mechanism B (9) drives the lower trolley (3) to travel backward by means of the lower-trolley travelling winding group B (27);

wherein the lower trolley (3) comprises a first horizontal support (34), a second horizontal support (36), a first vertical support A (37) and a second vertical support B (38), wherein one end of the second horizontal support (36) is vertically provided with the first vertical support A (37), the other end of the second horizontal support (36) is vertically provided with the second vertical support B (38), the first horizontal support (34) is arranged above and parallel to the second horizontal support (36), one end of the first horizontal support (34) is connected to the first vertical support A (37), and the other end of the first horizontal support (34) is connected to the second vertical support B (38); and

the lower-trolley travelling winding group A (26) comprises a forward travelling wire rope (15), further comprises a first quay crane redirecting pulley (16) and a second quay crane redirecting pulley (18) mounted on two sides of the quay crane, further comprises a first girder redirecting pulley block (23) and a second girder redirecting pulley block (25) mounted on two sides of the double-trapezoidal four-track girder (1), further comprises a first lower-trolley redirecting pulley block (19) and a second lower-trolley redirecting pulley block (20) mounted on left and right sides of the first horizontal support (34), and further comprises a lower-trolley redirecting pulley a (30) and a lower-trolley redirecting pulley b (31) mounted on left and right sides of the second horizontal support (36), wherein one end of the forward travelling wire rope (15) is wound on the travelling drum A (11), and the other end of the forward travelling wire rope (15), after being first wound through the first girder redirecting pulley block (23), then wound through the first quay crane redirecting pulley (16) to be redirected by 180°, then wound through the first lower-trolley redirecting pulley block (19) to be redirected vertically downward, wound through the lower-trolley redirecting pulley a (30), then wound through the lower-trolley redirecting pulley b (31) to be redirected vertically upward, wound through the second lower-trolley redirecting pulley block (20) to be redirected, then wound through the second quay crane redirecting pulley (18) to be redirected by 180°, wound through the second girder redirecting pulley block (25), is finally wound on the travelling drum B (32).

2. The ~~travelling wire rope winding system and travelling mechanism for an external lower trolley of a conventional quay crane~~ system of claim 1, wherein the lower-trolley travelling winding group B (27) comprises a reverse travelling wire rope (17), further comprises a third quay crane redirecting pulley (10) and a fourth quay crane redirecting pulley (12) mounted on the two sides of the quay crane, further comprises a third lower-trolley redirecting pulley block (21) and a fourth lower-trolley redirecting pulley block (22) mounted on the left and right sides of the first horizontal support (34), and further comprises a lower-trolley redirecting pulley c (33) and a lower-trolley redirecting pulley d (35) mounted on the left and right sides of the second

horizontal support (36), wherein one end of the reverse travelling wire rope (17) is wound on the travelling drum A (11), a winding direction of the reverse travelling wire rope (17) is opposite to that of the forward travelling wire rope (15), and the other end of the reverse travelling wire rope (17), after being first wound through the third quay crane redirecting pulley (10) to be redirected by 180°, wound through the third lower-trolley redirecting pulley block (21) to be redirected vertically downward, then wound through the lower-trolley redirecting pulley c (33), then wound through the lower-trolley redirecting pulley d (35) to be redirected vertically upward, wound through the fourth lower-trolley redirecting pulley block (22), then wound through the fourth quay crane redirecting pulley (12) to be redirected by 180°, is wound on the travelling drum B (32).

3. The ~~travelling wire rope winding system and travelling mechanism for an external lower trolley of a conventional quay crane~~ system of claim 2, wherein a first tension device (13) is further provided above the first girder redirecting pulley block (23), and the first tension device (13) comprises a hydraulic cylinder and a push rod, wherein an end portion of the hydraulic cylinder is pivotally connected to one end of the push rod; the first girder redirecting pulley block (23) comprises a first pulley (101), a second tension pulley (102) and a third tension pulley (103), wherein the first pulley (101) and the third tension pulley (103) are arranged in tandem at an equal height, the second tension pulley (102) is provided above the first pulley (101) and the third tension pulley (103), the second tension pulley (102) is fixed to the other end of the push rod away from the hydraulic cylinder, and the second tension pulley (102) is capable of moving back and forth under the action of the push rod; wherein the forward travelling wire rope (15) is first wound through the first pulley (101) from below, goes vertically upward to be wound through the second tension pulley (102), and is redirected by 180° to go vertically downward to be wound through the third tension pulley (103).

4. The ~~travelling wire rope winding system and travelling mechanism for an external lower trolley of a conventional quay crane~~ system of claim 3, wherein a second tension device (14) is further provided above the second girder redirecting pulley block (25), and the second tension device (14) comprises a hydraulic cylinder and a push rod, wherein an end portion of the hydraulic cylinder is pivotally connected to one end of the push rod; the second girder redirecting pulley block (25) comprises a fourth pulley (104), a fifth tension pulley (105) and a sixth pulley (106), wherein the fourth pulley (104) and the sixth pulley (106) are arranged in tandem at an equal height, the fifth tension pulley (105) is provided above the fourth pulley (104) and the sixth pulley (106), the fifth tension pulley (105) is fixed to the other end of the push rod away from the hydraulic cylinder, and the fifth tension pulley (105) is capable of

moving back and forth under the action of the push rod; wherein the forward travelling wire rope (15) is first wound through the sixth pulley (106) from below, goes vertically upward to be wound through the fifth tension pulley (105), and is redirected by 180° to go vertically downward to be wound through the fourth pulley (104).

5. The ~~travelling wire rope winding system and travelling mechanism for an external lower trolley of a conventional quay crane~~ system of claim 4, wherein the first lower-trolley redirecting pulley block (19) comprises a seventh pulley (107), an eighth pulley (108), a ninth pulley (109) and a tenth pulley (110), wherein the forward travelling wire rope (15) is first wound through the seventh pulley (107) from below, is redirected by 180° to be horizontally wound through the eighth pulley (108), is then wound through the ninth pulley (109) arranged perpendicular to the eighth pulley (108), then goes vertically downward to be wound through the tenth pulley (110), and continues to go vertically downward to be wound through the lower-trolley redirecting pulley a (30); and

the second lower-trolley redirecting pulley block (20) comprises an eleventh pulley (111), a twelfth pulley (112), a thirteenth pulley (113) and a fourteenth pulley (114), wherein the forward travelling wire rope (15) is first wound through the eleventh pulley (111), goes vertically upward to be wound through the twelfth pulley (112), is then wound through the thirteenth pulley (113), is then wound through the fourteenth pulley (114) arranged perpendicular to the thirteenth pulley (113), and is redirected by 180° to be wound through the second quay crane redirecting pulley (18).

6. The ~~travelling wire rope winding system and travelling mechanism for an external lower trolley of a conventional quay crane~~ system of claim 5, wherein the third lower-trolley redirecting pulley block (21) comprises a fifteenth pulley (115), a sixteenth pulley (116), a seventeenth pulley (117) and an eighteenth pulley (118), wherein the reverse travelling wire rope (17) is first wound through the fifteenth pulley (115) from below, is redirected by 180° to be horizontally wound through the sixteenth pulley (116), is then wound through the seventeenth pulley (117) arranged perpendicular to the sixteenth pulley (116), then goes vertically downward to be wound through the eighteenth pulley (118), and continues to go vertically downward to be wound through the lower-trolley redirecting pulley c (33); and

the fourth lower-trolley redirecting pulley block (22) comprises a nineteenth pulley (119), a twentieth pulley (120), a twenty-first pulley (121) and a twenty-second pulley (122), wherein the reverse travelling wire rope (17) is first wound through the nineteenth pulley (119), then goes vertically upward to be wound through the twentieth pulley (120), continues to be wound

through the twenty-first pulley (121) arranged perpendicular to the twentieth pulley (120), is then wound through the twenty-second pulley (122) arranged perpendicular to the twenty-first pulley (121), and is redirected by 180° to be wound through the fourth quay crane redirecting pulley (12).

7. The ~~travelling wire rope winding system and travelling mechanism for an external lower trolley of a conventional quay crane~~ system of claim 6, wherein the third quay crane redirecting pulley (10) and the fourth quay crane redirecting pulley (12) are arranged in parallel at an equal height and arranged in front of the lower-trolley travelling mechanism (5); the first girder redirecting pulley block (23) and the second girder redirecting pulley block (25) are arranged in parallel at an equal height and arranged behind the lower-trolley travelling mechanism (5); the first quay crane redirecting pulley (16) and the second quay crane redirecting pulley (18) are arranged in parallel at an equal height and arranged behind the lower-trolley travelling mechanism (5); and the first girder redirecting pulley block (23) is provided between the travelling drum A (11) and the first quay crane redirecting pulley (16), and the second girder redirecting pulley block (25) is provided between the travelling drum B (32) and the second quay crane redirecting pulley (18).

8. The ~~travelling wire rope winding system and travelling mechanism for an external lower trolley of a conventional quay crane~~ system of claim 7, wherein the first lower-trolley redirecting pulley block (19), the second lower-trolley redirecting pulley block (20), the third lower-trolley redirecting pulley block (21) and the fourth lower-trolley redirecting pulley block (22) are arranged at an equal horizontal height, the first lower-trolley redirecting pulley block (19) and the second lower-trolley redirecting pulley block (20) are arranged on a rear side of the lower trolley (3), and the third lower-trolley redirecting pulley block (21) and the fourth lower-trolley redirecting pulley block (22) are arranged on a front side of the lower trolley (3); wherein the lower-trolley redirecting pulley a (30), the lower-trolley redirecting pulley b (31), the lower-trolley redirecting pulley c (33) and the lower-trolley redirecting pulley d (35) are arranged at an equal horizontal height, the lower-trolley redirecting pulley a (30) and the lower-trolley redirecting pulley b (31) are arranged on a rear side of the lower trolley (3), and the lower-trolley redirecting pulley c (33) and the lower-trolley redirecting pulley d (35) are arranged on a front side of the lower trolley (3).

9. The ~~travelling wire rope winding system and travelling mechanism for an external lower trolley of a conventional quay crane~~ system of claim 8, wherein an outer side surface of the second horizontal support (36) is further provided with a plurality of rope dragging frames (24), and the forward travelling wire rope (15) ~~travelling drum A (11)~~ and the reverse travelling wire

rope (17) are arranged on the rope dragging frames (24), respectively.