

"HYUNDAI HEAVY INDUSTRIES BULGARIA" CO

41, Rojen Blvd., 1271 Sofia, Bulgaria

(+359 2) 8033390

TYPE TEST REPORT

№ RS9 1R 034/16.12.2014

TEST PERFORMED:

Temperature rise test

CLIENT:

"National Grid- SA"

P.O. Box 5190 Dammam 31422, Kingdom of Saudi Arabia

MANUFACTURER:

"HYUNDAI HEAVY INDUSTRIES Co. BULGARIA"

1271 Sofia, 41 Rojen blvd., Bulgaria

TEST OBJECT:

On-load tap-changer

Type:

RSV9.3-III-700-123/L 14.27.1W

Serial №

617

RATINGS:

Rated through current: - 656A

Maximum rated through current: - 700A

Rated step voltage: - 794V

Maximum rated step voltage - 3200V

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Registration No.

Date

B4028593

13 December, 2014

TESTING CONDITIONS: *The type test is carried out in accordance with IEC 60214-1:2014, item 5.2.2.*

Date of the test: **12.12. 2014**

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Results:

The tested OLTC type RSV9.3-III-700-123/L 14.27.1W serial №617 passed successfully the temperature rise test, in accordance with IEC 60214-1:2014, item 5.2.2.

The test results apply only to the tested object. The responsibility for conformity of any product, having the same designation with the tested one rests with the manufacturer.

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In the entire test report the symbol for decimal marker used is the comma on the line.

Tested by:

/PhD eng. T. Dimmitrova/

Chief of TC Labs:

/eng. St. Stannev/



Ratings, stated by the manufacturer:

Type:	RSV9.3-III-700-123/L 14.27.1W
Serial №	617
Year of manufacturing:	2014
Highest voltage for equipment:	123 kV
Short circuit current, peak value	25 kA
Short circuit current, r.m.s. value:	10 kA
Rated duration of the short circuit test:	3 s
VI type	HVC 00710

Test result:

Temperature rise at a current, equal to 1,2 times the maximum rated trough current (840A) did not exceed 20 K on any of the contacts. The maximum temperature rise of 17,5 K was measured at point №4.

Test conditions:

The temperature rise test of a complete OLTC was carried out in an epoxy-resin test vessel ($\phi=1$ m; h=2 m), filled with pure transformer oil at ambient temperature 19 °C. During the test thermocouples type „T” were used. The temperature measurement was made using measurement and registration system based on *Measurement Computing* hardware. The measurement points are shown on photographs. Frequency of the test current was 60 Hz. The OLTC was in position 14. Tested phase was X. Serial number of the VI subjected to test was IZ11-08194.

Documents, presented by the manufacturer:

The manufacturer presented documents listed in *List of drawings RS9 7R 003* and they were found to correspond to the tested object.

The report consists of:

1. Sheets - 22
2. Temperature curves - 5
3. Photos - 19

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Measuring equipment used during the test:

№	Kind of equipment	Manufacturer	Type	Manuf №	Valid until:
1.	Current transformer	USSR	YTT6M2	67116	27.02.2017
2.	Ammeter	USSR	Д-5090	231	08.03.2015
3.	Frequency meter	Bulgaria	ЧС 1000	00174	28.06.2015
4.	Thermocouples	-	"T"	See column <i>Thermocouple</i> № in Table 1.	10.09.2015
5.	Temperature and Voltage	Measurement Computing	USB-2416	00096747	
6.	Device (DAQ)			00096750	



More details are given in the tables and snapshots applied

All the contacts of different kind belonging to the current carrying path of a complete OLTC were connected in series in the test circuit.

The temperature was measured using thermocouples type "T", attached to the contacts (see the snapshots applied). The thermocouples, measuring the temperature of the surrounding medium (transformer oil) were placed at not less than 25mm below the contacts. The test is carried out in transformer oil at environmental temperature not less than 10 °C. Before the test at least 3 switching operations of the OLTC under no load were performed

The power supply is applied using leads with paper insulation with cross- section 240MM². The steady temperature is defined according to IEC 60214-1:2014, item 5.2.2 at a current, equal to 1,2 times the maximum rated trough current (840 A).

Table 1 shows the results of the temperature- rise test of the contacts of the selector; the change- over selector and the diverter switch for the maximum rated current 700 A.

No temperature rises of the contacts exceeded the admissible value of 20 K (IEC 60214-1:2014, item 5.2.2).

Test witnesses:

The test was witnessed by:

Dr. Ali H. Al- Mohammed:

National Grid- SA, Division manager, Engineering & Design Division – EOA,
Engineering & Design Division – EOA

Eng. Amer M Al Anazi:

National Grid- SA, Power Transmission Engineer, Assets Maintenance Dept –
Madina & North West

Eng. Eyad M Al- Mogbel:

National Grid- SA, Standard & Specification department

Giancarlo Gorlini
CESI- Milan- Italy



Table for temperature rise test for OLTC RSV9.3-III-700 with current 840A

Point of measurement №	Thermocouple №	Channel №	Designation of contacts	Start °C	1h after beginning			2h after beginning			3h after beginning			Steady temperature rise, K
					T, °C	ΔT,K	T, °C	ΔT,K	T, °C	ΔT,K	T, °C	ΔT,K		
Change-Over Selector														
1	VI-1	1	Fixed contact	18,0	29,4	10,6	30,4	11,0	31,3	11,7	12			
2	2	2	Upper front movable contact	18,0	34,2	15,4	35,2	15,8	36,1	16,5	16,5			
3	3	3	Upper front movable contact	18,0	35,2	16,4	36,1	16,7	36,8	17,2	17			
4	4	4	Fixed contact	18,0	35,5	16,7	36,5	17,1	37,1	17,5	17,5			
5	5	5	Lower front movable contact	18,0	32,9	14,1	33,7	14,3	34,2	14,6	15			
6	6	6	Lower front movable contact	18,0	31,4	12,6	32,1	12,7	32,6	13,0	13			
7	7	7	Upper rear movable contact	18,0	34,6	15,8	35,6	16,2	36,3	16,7	17			
8	8	8	Upper rear movable contact	18,0	31,8	13,0	32,9	13,5	34,0	14,4	14			
9	9	9	Lower rear movable contact	18,0	34,5	15,7	35,2	15,8	35,6	16,0	16			
10	10	10	Lower rear movable contact	18,0	34,2	15,4	34,9	15,5	35,3	15,7	16			
11	11	11	Fixed contact	18,0	32,2	14,0	33,9	14,5	35,0	15,4	15			
12	12	12	Oil temperature for 1÷11	18,0	18,8	-	19,4	-	19,6	-	-			
Selector and Oil Vessel of the Diverter switch														
13	13	13	Fixed contact	18,0	32,3	13,4	33,4	13,3	34,1	13,2	13			
14	14	14	Upper front movable contact	18,0	29,2	10,3	30,0	9,9	30,8	9,9	10			

Table for temperature rise test for OLTC RSV9.3-III-700 with current 840A -continuation

Point of measurement №	Thermocouple №	Channel №	Start °C	1h after beginning		2h after beginning		3h after beginning		Steady temperature rise, K
				T, °C	ΔT,K	T, °C	ΔT,K	T, °C	ΔT,K	
15	15	15	18,0	34,0	15,1	35,0	14,9	35,9	15,0	15
16	16	16		35,1	16,2	36,2	16,1	37,1	16,2	16
17	17	17		26,7	7,8	27,8	7,7	28,6	7,7	8
18	18	18		30,4	11,5	31,6	11,5	32,4	11,5	11,5
19	19	19		33,2	14,3	34,3	14,2	35,3	14,4	14
20	20	20		30,0	11,1	31,3	11,2	32,3	11,4	11
21	21	21		27,1	8,2	28,3	8,2	29,0	8,1	8
22	22	22		31,5	12,6	32,7	12,6	33,4	12,5	12,5
23	23	23		33,9	15,0	35,3	15,2	36,1	15,2	15
24	24	24		29,3	10,4	30,8	10,7	31,7	10,8	11
25	25	25		18,9	-	20,1	-	20,9	-	-
26	26	26		31,8	12,3	33,8	12,6	35,5	12,7	13
27	27	27		36,4	16,9	38,4	17,2	40,0	17,2	17
28	28	28		19,5	-	21,2	-	22,8	-	-
29	29	29		28,1	8,6	30,4	9,1	32,6	9,7	10
30	30	30		22,2	2,7	24,3	3,0	25,8	2,9	3

Table for temperature rise test for OLTC RSV9.3-III-700 with current 840A -continuation

Point of measurement №	Thermocouple №	Channel №	Start °C	1h after beginning		2h after beginning		3h after beginning		Steady temperature rise, K
				T, °C	ΔT,K	T, °C	ΔT,K	T, °C	ΔT,K	
31	31	31	Oil temperature for 29,30	19,5	-	21,3	-	22,9	-	-
Diverter switch										
32	32	33	Main fixed contact of oil vessel- inside	35,7	12,1	40,9	12,4	44,6	12,6	13
33	33	34	Main fixed contact of diverter switch	37,3	13,7	42,3	13,8	45,8	13,8	14
34	34	35	Oil temperature for 32, 33	23,6	-	28,5	-	32,0	-	-
35	35	36	Fixed contact to the disconnecting contact	40,2	12,4	45,0	12,2	48,6	12,1	12
36	36	37	Front upper movable disconnecting contact	31,7	3,9	36,6	3,8	40,4	3,9	4
37	37	38	Front upper movable disconnecting contact	32,8	5,0	37,4	4,6	41,1	4,6	5
38	38	39	Front lower movable disconnecting contact	31,1	3,3	35,7	2,9	39,2	2,7	3
39	39	40	Front lower movable disconnecting contact	33,8	6,0	38,3	5,5	41,8	5,3	5
40	40	41	Fixed contact to the disconnecting contact	33,7	5,9	37,9	5,1	41,6	5,1	5
41	41	42	Rear upper movable disconnecting contact	32,1	4,3	36,6	3,8	40,2	3,7	4
42	42	43	Rear upper movable disconnecting contact	32,8	5,0	37,2	4,4	40,8	4,3	4
43	43	44	Rear lower movable disconnecting contact	36,3	8,5	40,7	7,9	44,3	7,8	8
44	44	45	Rear lower movable disconnecting contact	34,1	6,3	38,8	6,0	42,3	5,8	6
45	45	46	Fixed vacuum interrupter contact	33,4	5,6	38,1	5,3	41,5	5,0	5

Table for temperature rise test for OLTC RSV9.3-III-700 with current 840A -continuation

Point of measurement №	Thermocouple №	Channel №	Start °C	1h after beginning		2h after beginning		3h after beginning		Steady temperature rise, K
				T, °C	ΔT,K	T, °C	ΔT,K	T, °C	ΔT,K	
46	46	47	Oil temperature for 35÷45	27,8	-	32,8	-	36,5	-	-
47	47	48	Movable vacuum interrupter contact	37,5	13,2	41,8	12,5	45,5	12,9	13
48	48	49	Contact plate to the vacuum interrupter (VI)	37,9	13,6	42,4	13,1	45,8	13,3	13
49	49	50	Flexible connection to the movable VI	38,5	14,2	42,8	13,5	46,2	13,6	14
50	50	51	Oil temperature for 47÷49	24,3	-	29,3	-	32,6	-	-
51	63	52	End flexible connection to the movable VI	39,7	16,0	43,9	15,6	47,4	15,4	15
52	51	53	Flexible connection-- block	38,3	14,6	42,2	13,9	46,0	14,0	14
53	52	54	Oil temperature for 51, 52	23,7	-	28,3	-	32,0	-	-
54	53	55	Flexible connection to the neutral contact	32,1	9,1	36,5	8,0	39,9	7,5	7,5
55	54	56	Flexible connection to the neutral contact	31,3	8,3	35,8	7,3	39,2	6,8	7
56	55	57	End flexible connection to the neutral contact	30,0	7,0	35,3	6,8	38,8	6,4	6
57	56	58	End flexible connection to the neutral contact	30,6	7,6	35,9	7,4	39,3	6,9	7
58	57	59	Oil temperature for 54÷57	23,0	-	28,5	-	32,4	-	-
59	58	60	Diverter switch neutral contact	30,5	7,6	35,2	8,1	38,4	8,1	8

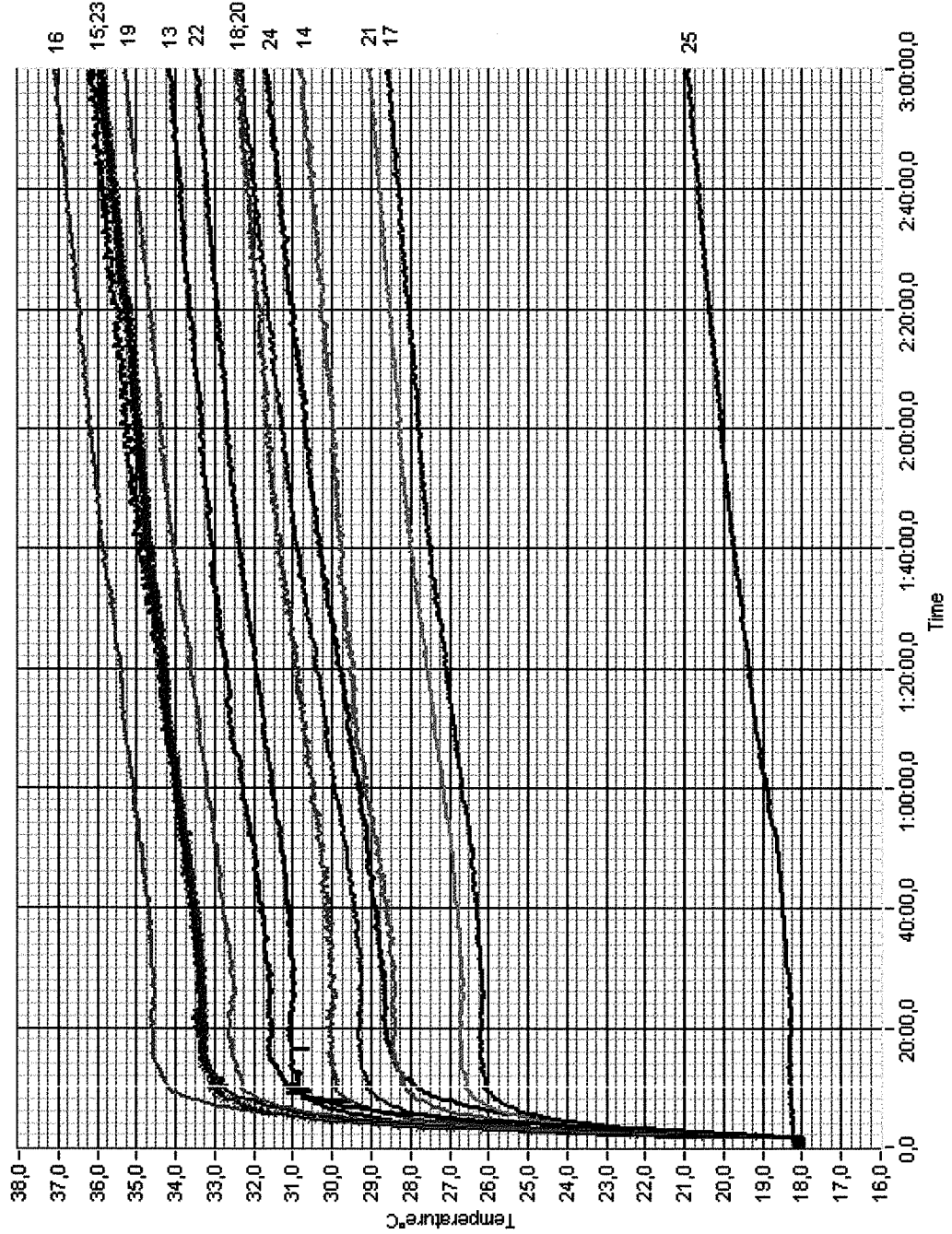
Temperature rise test of RVS 9.3-III-700 with current 840A

Measurement point № 1÷12



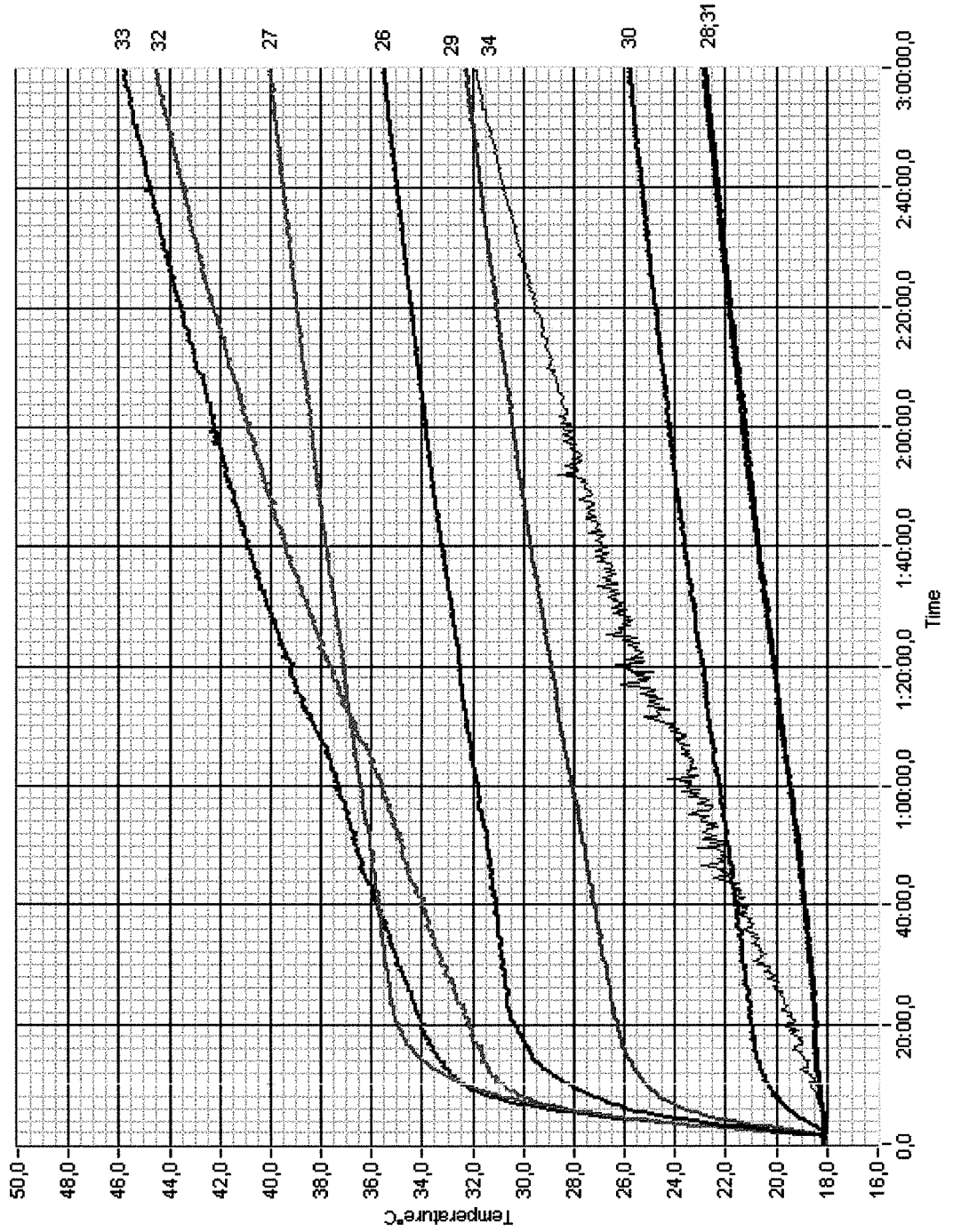
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Temperature rise test of RVS 9.3-III-700 with current 840A (continuation)
Measurement point № 13÷25



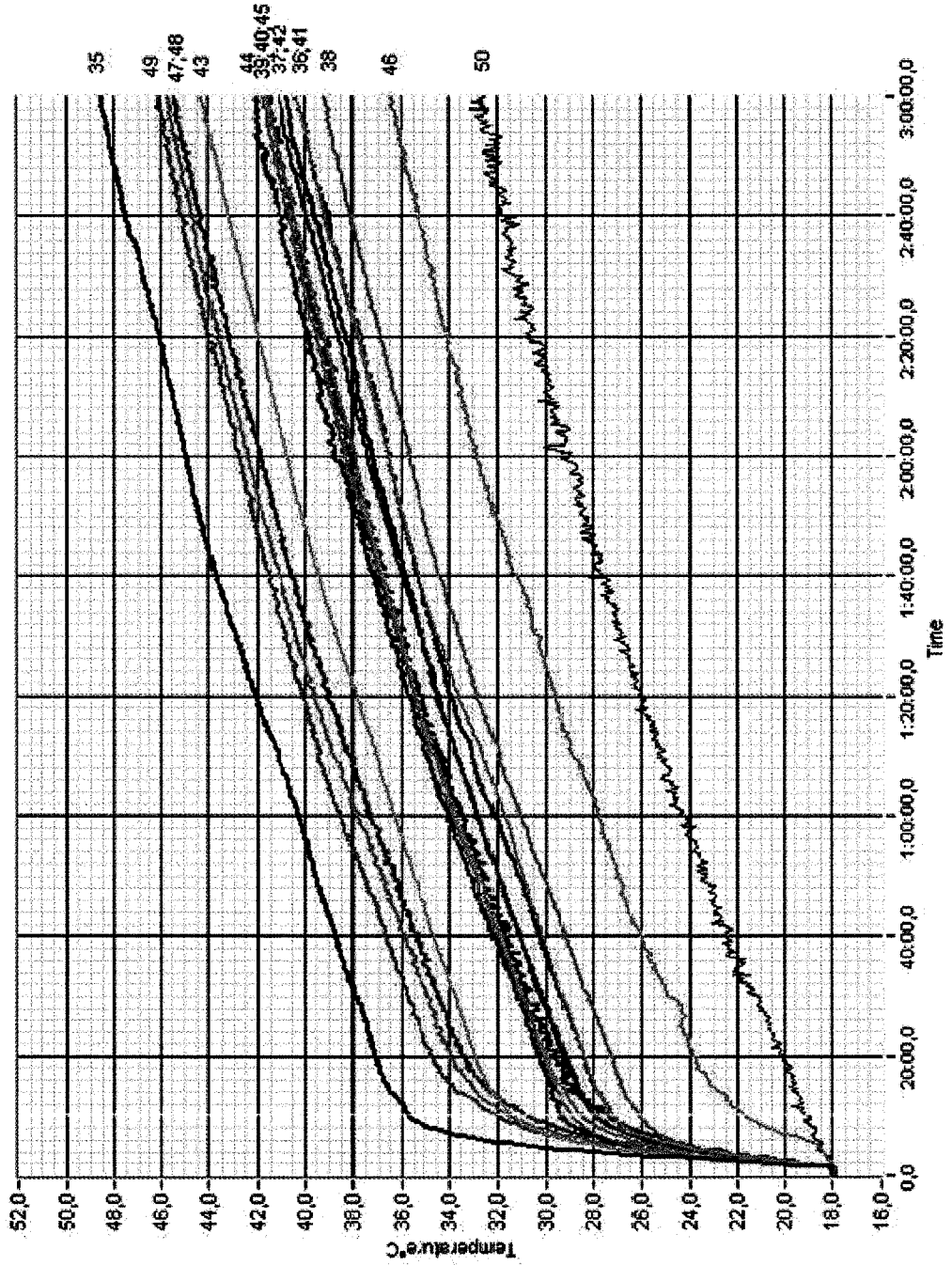
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Temperature rise test of RVS 9.3-III-700 with current 840A (continuation)
Measurement point № 26÷34



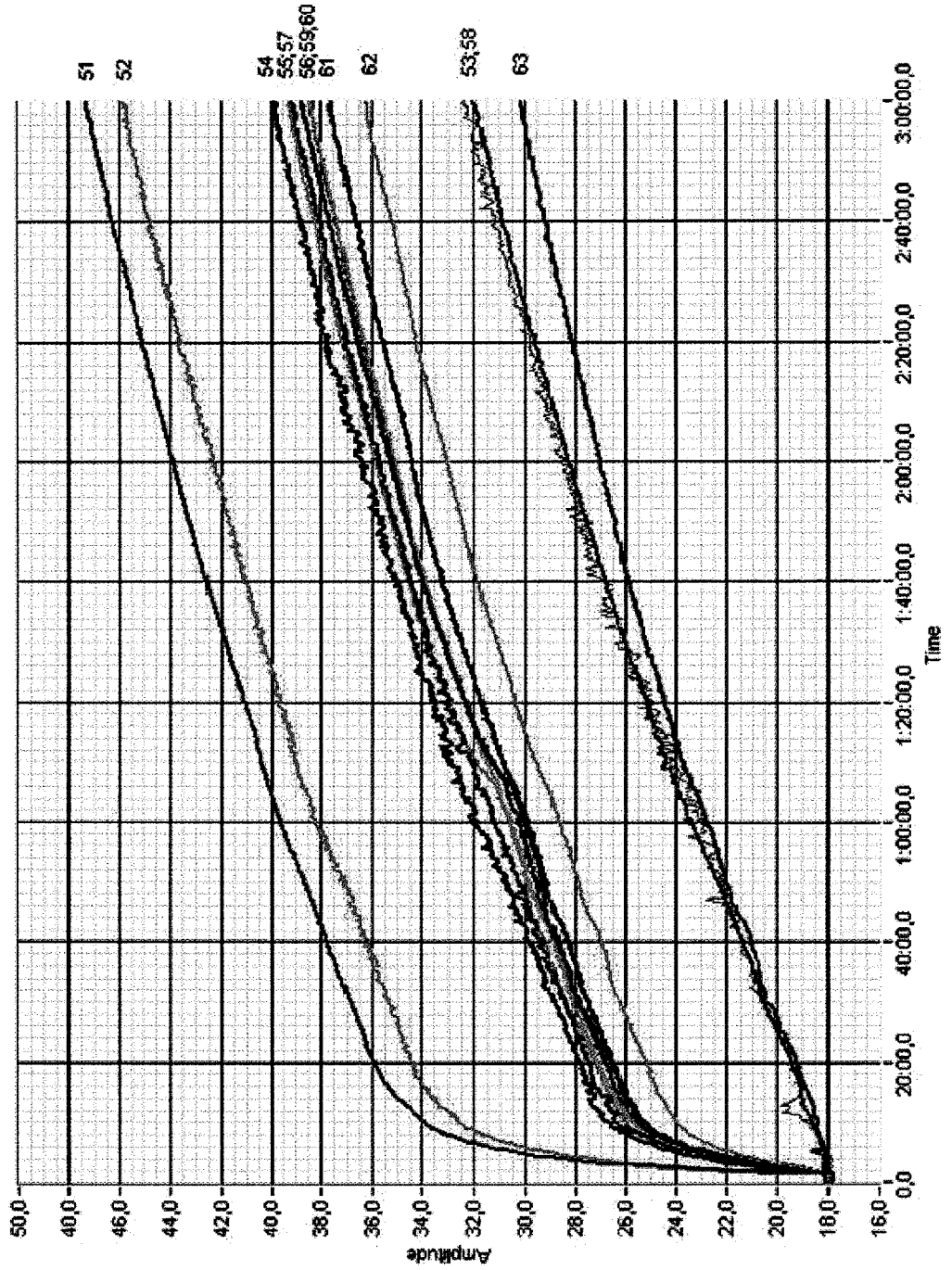
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Temperature rise test of RVS 9.3-III-700 with current 840A (continuation)
Measurement point № 35÷50

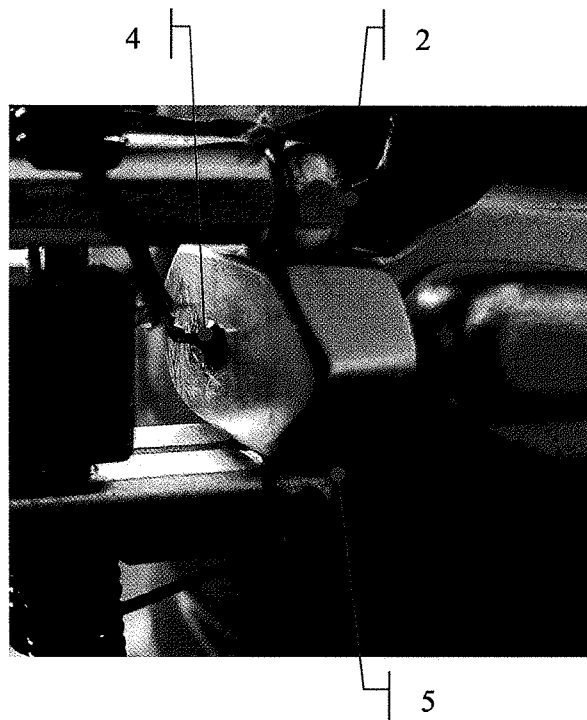
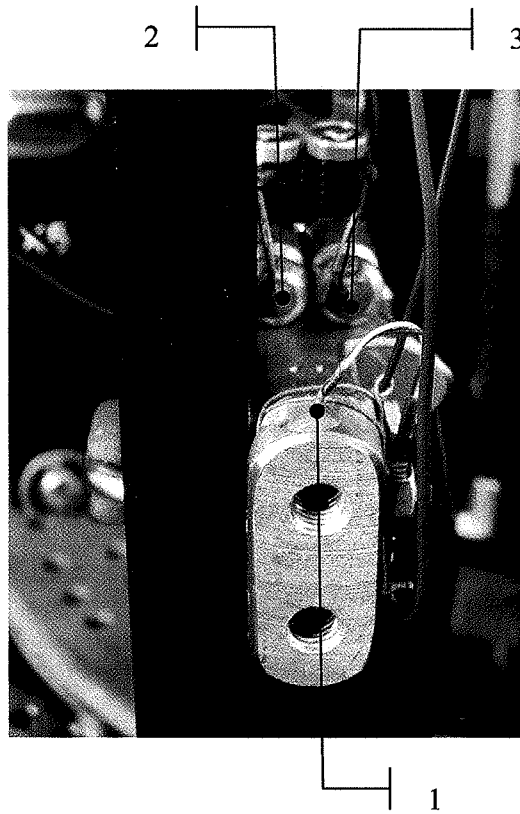


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Temperature rise test of RVS 9.3-III-700 with current 840A (continuation)
Measurement point № 51÷63



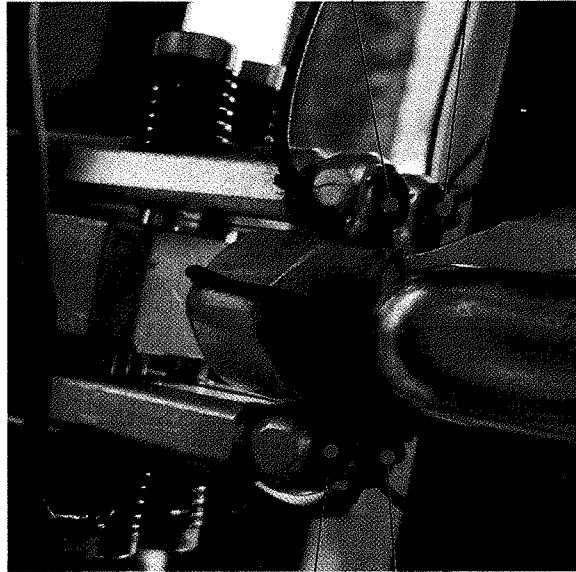
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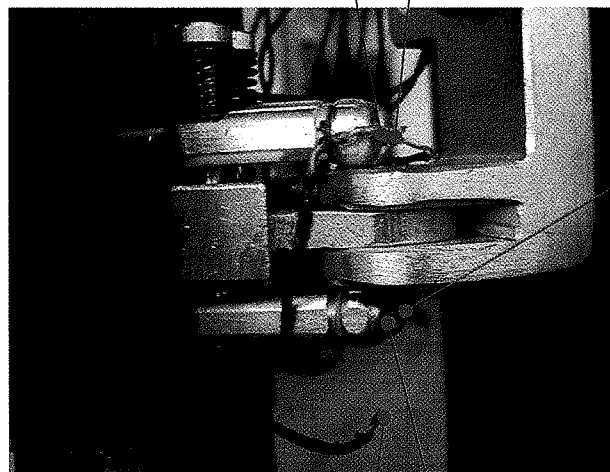


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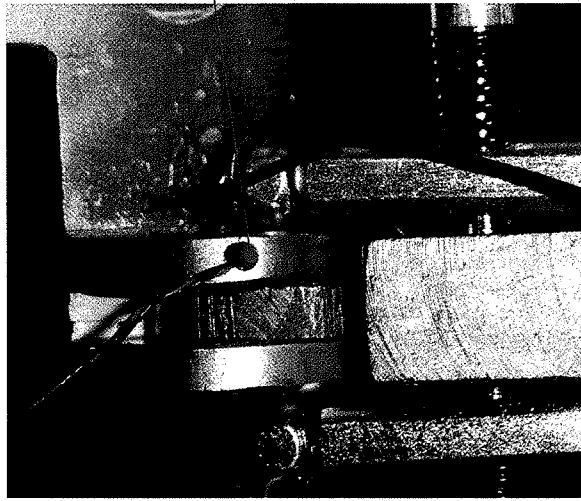
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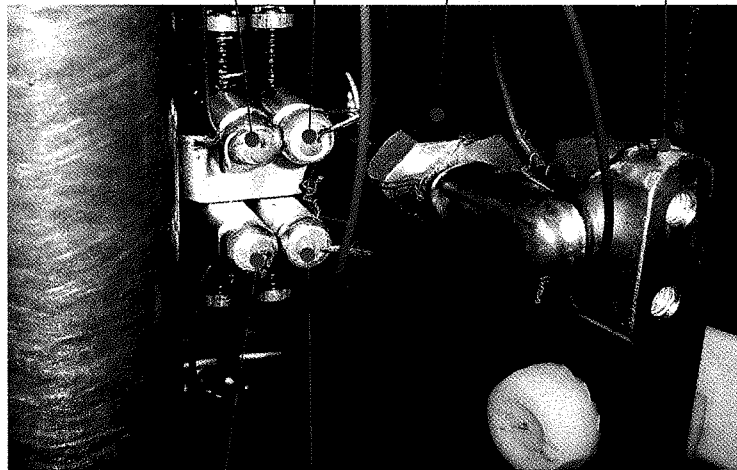


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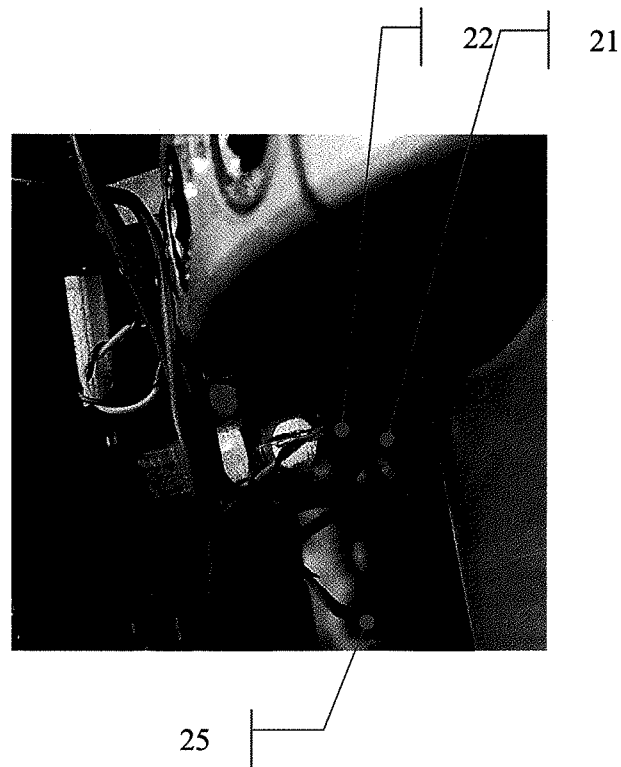
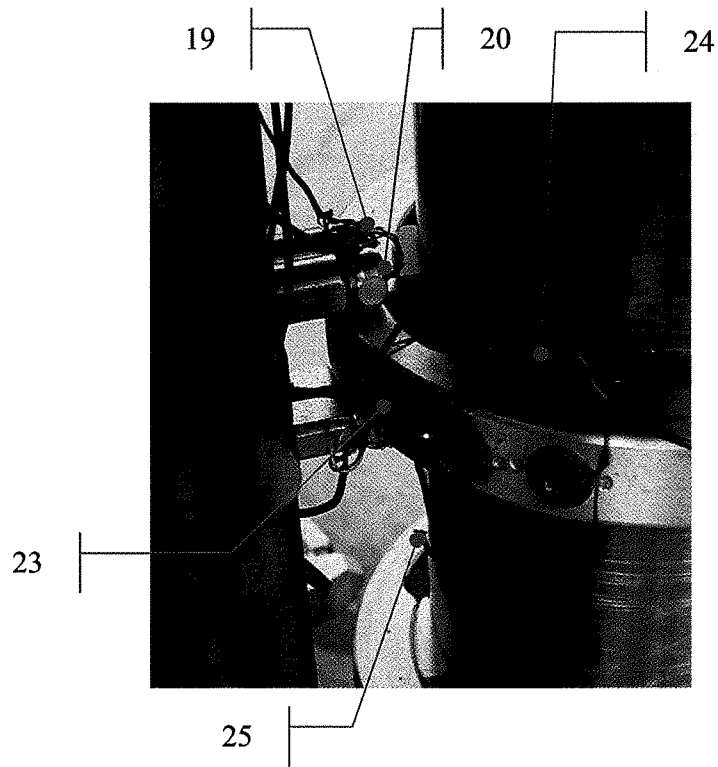
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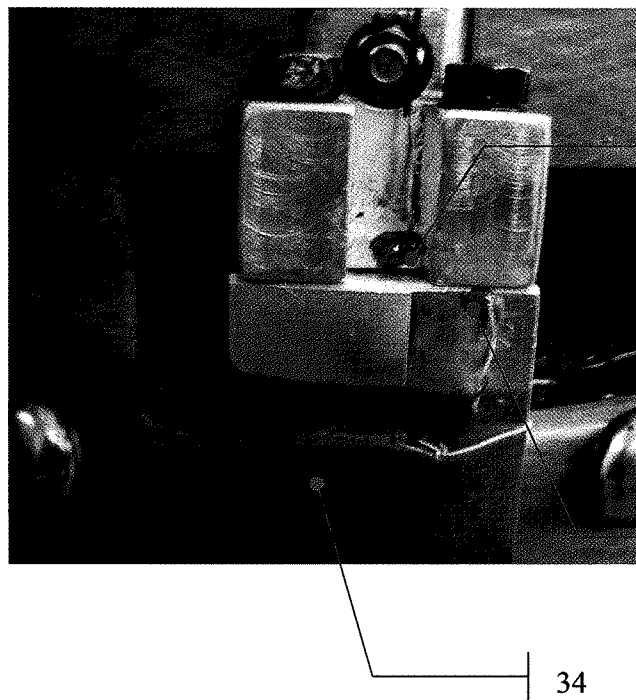
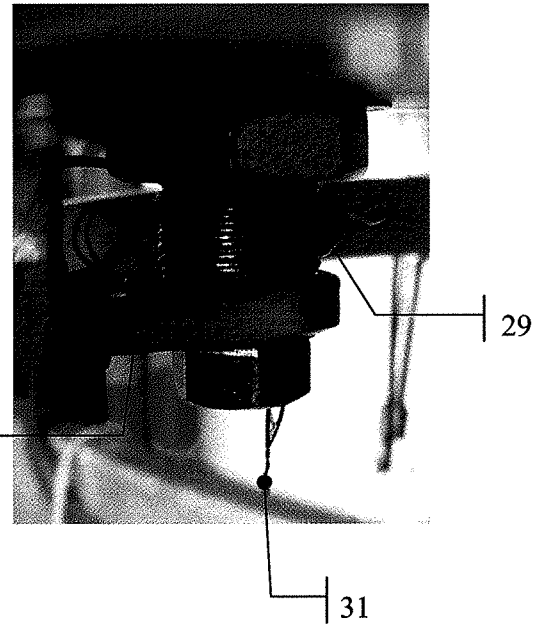
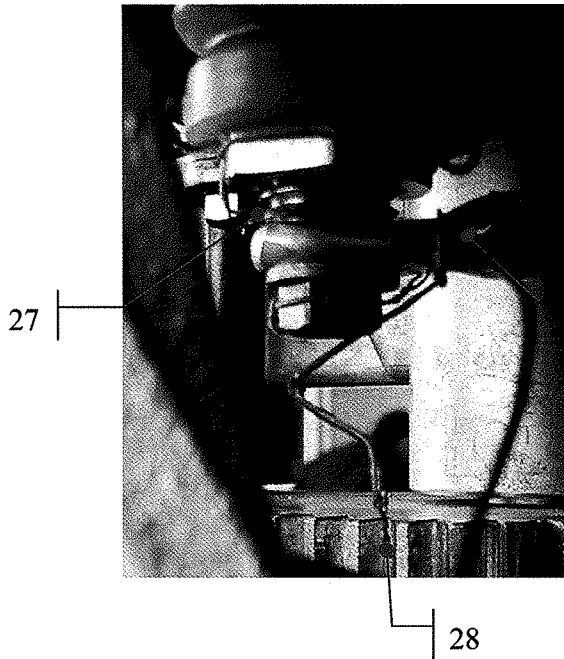
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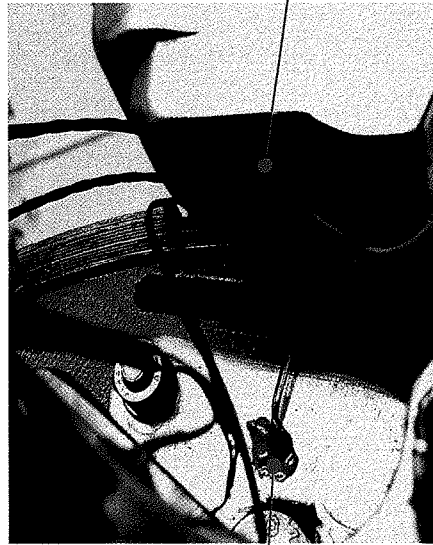


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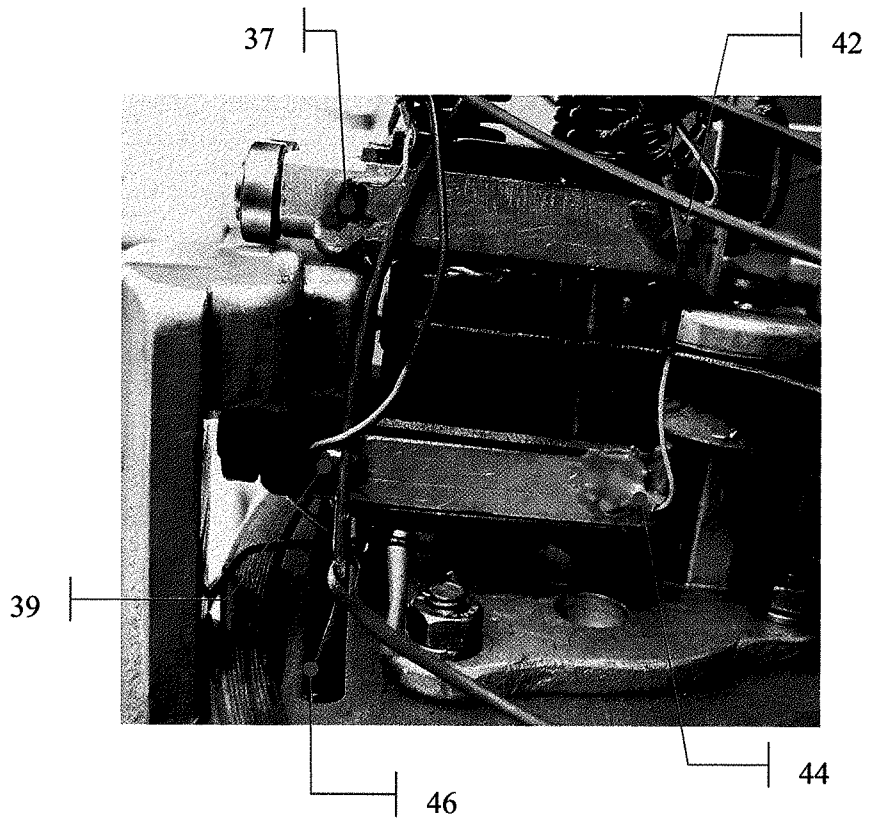
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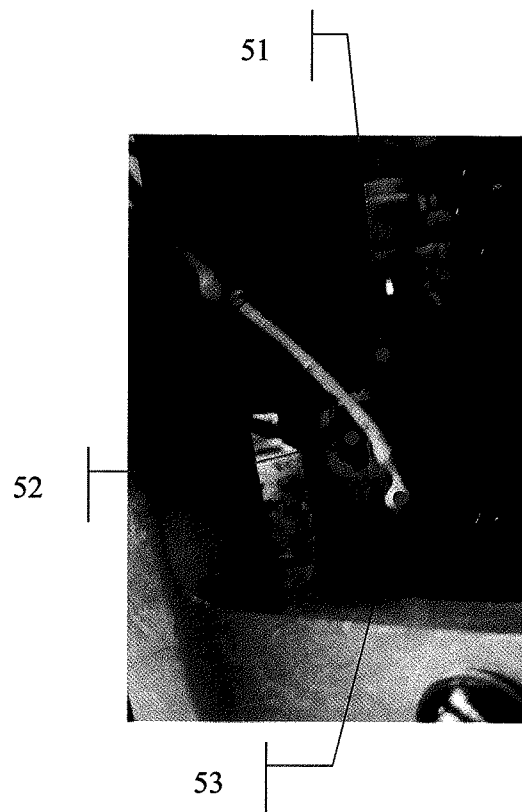
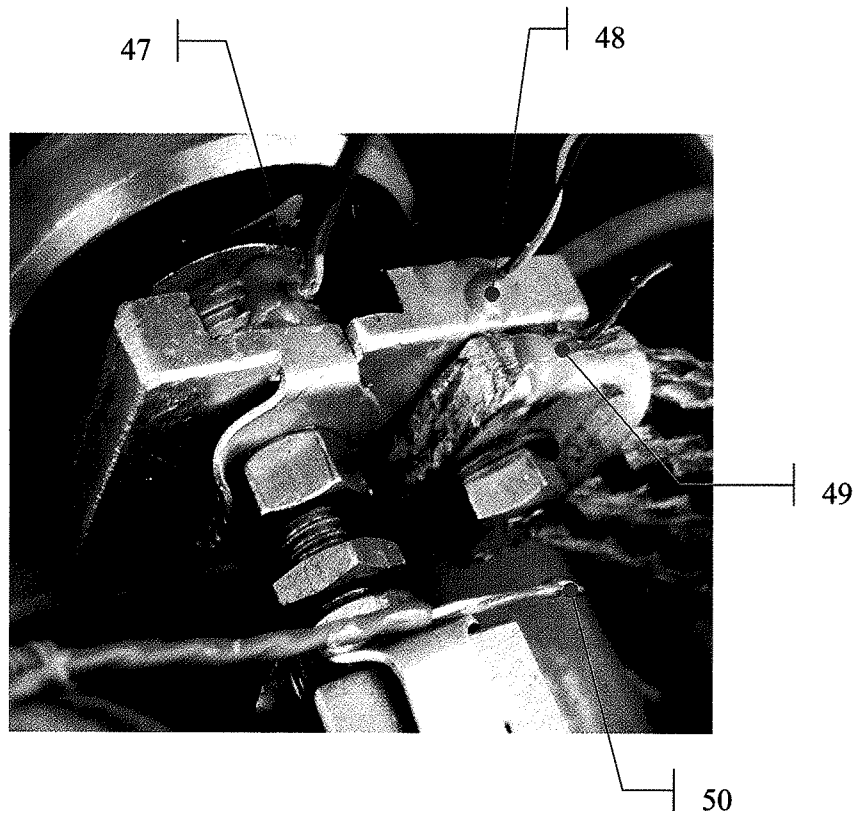
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