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1975



HAND OR MOTOR-LOADED SPRING-OPERATED
CLOSING MECHANISMS TYPE "ER-ERM"
FOR MEDIUM VOLTAGE CIRCUIT BREAKERS

INSTRUCTIONS
FOR SERVICE AND MAINTENANCE

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1. DESCRIPTION

1.1. General

ER-ERM operating mechanisms are pre-loaded spring operated (stored energy closing operation) with independent tripping and closing action. Furthermore:

- they are fitted with a device that makes it possible to recover excess energy after a closing operation and exploit it for partial reloading of the closing springs
- they form an entirely protected and insulated unit, ensuring utmost safety of operators in charge of actuation and reliable running
- they are easy to remove from the breaker for repairs or replacements
- they can contain all fittings described under Item 2, without any increase of overall dimensions.

1.2. Main features

1.2.1. Types of operating mechanisms

The following main executions are available:

TYPE ER : spring loading is by hand, by means of a detachable crank

TYPE ERM : spring loading is automatic, by motor or, in case of emergency, by detachable crank as for design ER.

The operating mechanisms are designated as follows:

- ER 7 - ERM 7
- ER 8 - ERM 8
- ER10 - ERM10

These designs differ according to the circuit-breaker on which they are to be fitted.

1.2.2. Operating cycles

All types of operating mechanisms mentioned above feature performance of the following operating cycles without reloading the springs:

- CLOSING-OPENING starting from breaker "open" and "springs loaded"
- OPENING-CLOSING-OPENING starting from breaker "closed" and "springs loaded".

Both cycles may occur by remote control.

Minimum time gap (t) between "OPENING" and "CLOSING" is $t = 0.3$ sec. (0-0.3 sec.-CO).

Time required for automatic reloading of closing springs is less than 10 sec. This makes possible the quick reclosing cycle 0-0.3 sec.-CO-10 sec.-

Additional features of these operating mechanisms

- possibility to perform free opening to meet US Standard № 37.03
- possibility to perform slow closing operation for easy alignment of contacts during maintenance and inspections.

1.2.3. Mechanical life

10,000 "CLOSING-OPENING" operations without replacement of parts.

Only regular maintenance as described under Item 7 is required.

FOR A NUMBER OF OPERATIONS IN EXCESS OF 10,000, THE OPERATING MECHANISM IS AVAILABLE IN SPECIAL EXECUTION ON REQUEST.

At any case, the operating mechanism must be shipped to SACE for overhauling or else replaced after 50,000 operations.

1.2.4. Frequency of operations

For proper running of the operating mechanism and fittings, the following limits should not be exceeded:

- 10 consecutive operations with a gap between operations lasting only the time required for

loading the operating mechanism springs.

After such a series of operations a gap of at least 30 minutes is recommended

- 20 operations per hour
- 100 operations per day.

Should constant high frequency of operations be required, especially if heavy duty in dust-laden or polluted atmosphere is involved, it will be necessary to increase maintenance and inspection as listed under Item 7.

1.3. Operation

The mechanisms may be operated only if fitted on the breaker they were designed for. Whatever the breaker model (R or D series), operations are performed in the same way. The following description applies to the right-hand horizontal installation provided for D series breakers (see Fig. 1).

Loading of closing springs: by hand (see NOTE 1)
Fit detachable crank (6) into hole (4) and turn clockwise till it idles (completion of the operation is also signalled by a click at the end of loading.

Loading of closing springs: automatic (only for ERM type operating mechanisms (see NOTE 1)

Once the breaker's auxiliary circuits are connected to the source of supply, the geared motor automatically loads the springs after each closing operation. In case of voltage failure, the motor is always able to resume spring loading upon return of power or else, if necessary, the operation may be completed by hand.

NOTE 1: The end of the closing spring-loading operation (whether by hand or automatic) is signalled by appearance of the "YELLOW" flag visible through slot (7). If the springs are not completely loaded, the circuit breaker cannot be closed.

Closing operation: by hand (see NOTE 2)

Turn closing knob (2) clockwise till closing springs catch. Closing is signalled by indicator (3) showing letter "I".

Opening operation: by hand (see NOTE 2)

Turn opening knob (1) counter-clockwise till the catch is released.

Opening is signalled by indicator (3) showing letter "O" as per Fig. 1.

NOTE 2: If the operating mechanism is fitted with opening and closing release, the above operations may be remote-controlled electrically

1.4. Overall dimensions and weights

See Fig. 2 for overall dimensions.

Weight of operating mechanisms:

- Type ER 42 kg
- Type ERM 48 kg

1.5. Components of the operating mechanism (see figs. 10, 12, 16, 18, 19, 20, 21)

The main components making up the operating mechanism are the following:

- a) Bearing frame consisting of:
 - front plate (20)
 - intermediate plate (21)
 - bottom plate (22)
- b) crankshaft (23) for reloading the closing springs (24)
- c) power shaft (16) for connection to breaker
- d) primary shaft (38)
- e) Trace (26)
- f) Mechanism for hand-loading (27) and electrical loading via geared motor (28) of loading springs
- g) Helical closing springs (24) (25)
- h) Release pin (18) for undervoltage releases (100) or overcurrent releases (outside the operating mechanism)
- i) limit contacts (29)
- l) auxiliary contacts (30) (32)
- m) terminal board (31)
- n) shock absorber (33) for closing operation
- o) brake (34)

2. ACCESSORIES AND FITTINGS

2.1. Accessories

- Crank (6) for hand-loading of closing springs (always supplied with the operating mechanism)
- Lever for slow breaker-closing operation (supplied only on request) to make possible easy alignment of contacts during maintenance and inspection.

2.2. Fittings (for electrical specifications see CAT 8-3)

- a) standard shunt trip (Fig. A)
- b) closing release (Fig. B)
- c) undervoltage release (Fig. C)

The undervoltage release is available in two executions:

- for outgoing-side feeding: always with mechanical lagging device. The breaker can be closed even if the release is not energized. If release is energized after the breaker closes, the breaker remains closed; otherwise it opens again.
 - for incoming-side or independent-source feeding: on request, mechanical or capacitor lagging device. The breaker can close only if release is energized.
- d) Mechanical lagging device for undervoltage release.
Setting range for lagging times: 0.15 - 0.3 sec.
- 0.5-1 sec. - 1.5-3 sec.
- e) Electric capacitor lagging device for undervoltage release. Fitted outside the operating mechanism (overall dimensions on Fig. D).
Time lag: 0.2 - 0.5 - 1 - 1.5 sec.
On AC lagging devices, the undervoltage release must always be designed for 220 V DC.
- f) Microswitch for electric indication "breaker open by action of undervoltage release".
Upon automatic opening the microswitch remains closed for 80-100 ms.
- g) Limit contacts for electric indication "springs loaded" - "springs unloaded" (regularly supplied on all types of operating mechanisms)



Fig. A



Fig. B

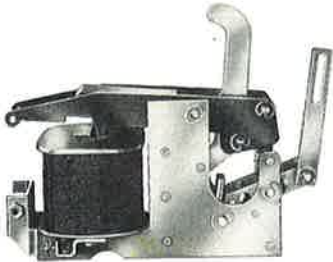


Fig. C

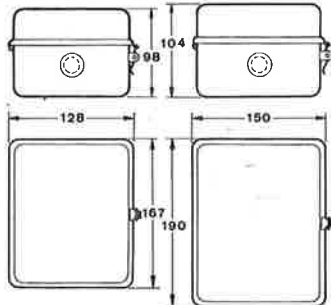


Fig. D



Fig. E

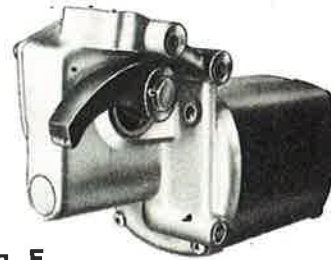


Fig. F



Fig. G

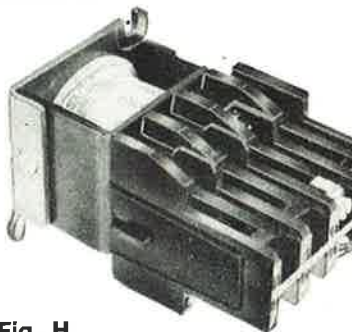


Fig. H

h) Auxiliary contacts (Fig. E)

One group available to user on request up to a maximum of 12 (6 NO and 6 NC). In case the additional shunt trip is applied, the maximum number of contacts available becomes 10 (4 NO and 6 NC). Another set of contacts is regularly supplied, and is limited to feeding the operating mechanism circuits.

1) Spring loading motor (+) (Fig. F).

Spring loading time: less than 10 sec.

1) Breaker for thermomagnetic motor-protection (Fig. G)

m) Anti-pumping device (+) (Fig. H)

n) Key interlock

When key is removed, it prevents manual and electric closing of breaker: when breaker is closed, key cannot be turned and removed. It provides key interlock between two or more breakers.

o) Operations counter (without resetting device)

p) Additional shunt trip

q) Undervoltage release cut-out device

r) Closing "accept" contact (Cb)

(+) Regularly supplied on ERM operating mechanisms.

3. INSPECTION ON ARRIVAL

The operating mechanism is generally supplied already fitted onto its circuit breaker.

In case of separate shipment, conditions should be checked on arrival.

If any damage is ascertained, SACE should be notified the earliest possible and in any case within five days from arrival of the goods, and conditions and registration number specified.

4. STORAGE

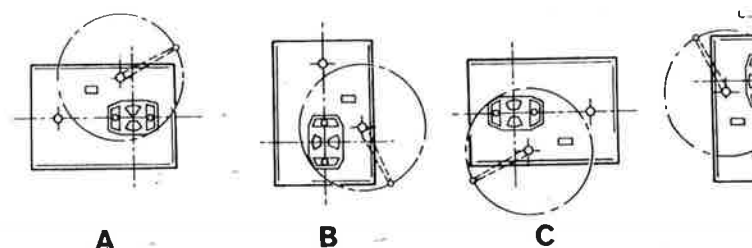
Should the operating mechanism be supplied unmounted and not be fitted immediately onto the breaker, the following is recommended for proper storage:

- utmost care in handling
- dry, dust-free atmosphere, without corrosive chemicals,

WARNING: - It is HIGHLY DANGEROUS for closing springs of the operating mechanism to be loaded before fitting onto the breaker

5. FITTING OF THE OPERATING MECHANISM ONTO THE CIRCUIT BREAKER

The operating mechanism is installed on magnetic low oil-content medium-voltage circuit-breakers may be fitted in four different positions as shown below, depending on the type of circuit breaker.



- A - right-hand horizontal
B - bottom vertical
C - left-hand horizontal
D - top vertical

To replace an operating mechanism with a new one proceed as follows: (see Figs. 1 - 2)

- 1) Remove screws (11), case (10) and the existing operating mechanism by disconnecting the flange of main shaft (16) and removing the securing screws corresponding to holes 13 or 14
- 2) fit the new mechanism following the above procedure in reverse order.

6. OPERATION

Basic operating positions of the mechanism are those shown on Figs. 3, 4, 5, 6.

6.1. Circuit breaker open with closing springs unloaded (see fig. 3)

The breaker is in this position after each "closing-opening" operation. On ERM operating mechanisms, this is a transitory condition as the geared motor automatically provides for reloading of closing springs.

6.2. Circuit breaker open with closing springs loaded (see fig. 4)

This is the regular condition of the open breaker during service. For spring loading proceed as follows:

- HAND LOADING (see figs. 1, 5, 6, 7, 9, 12, 15, 17, 19)
Fit crank (6) into hole (4) till shaft connects with cam (27); turn clockwise till the crank idles
- This operation actuates pawl (27A) (Fig. 13), which turns gear wheel (35) (fig. 14) in solid with crankshaft (23) which, via loading rod (36) makes loading lever (37) turn together with main shaft (38), thus loading the spring. During this operation, the "springs loaded" indicator disc (7) is turned and trace (26) linking system is reset.

Once springs are loaded, the following occurs:

- crank (6) idles since pawl (27A) contacts a cogless section of gear wheel (35)
- main closing hook (39), via roller (40), is opposed to closing hook (41) by effect of the thrust received from crankshaft (23) exceeding dead centre. This device ensures centering of the loaded springs.

If the springs are not fully loaded, the breaker cannot be closed either by hand or automatically.

- AUTOMATIC LOADING (see Figs. 9 - 16)

By feeding motor (28), pawl (28A) is actuated and induces gear wheel (35) to turn. The sequence of movements already described for hand loading of the springs then takes place.

Once the springs are loaded, a cam (51) is fitted on gear wheel (35) actuates stem (52) acting on limit contacts (29) and breaks the motor supply circuit.

Should power fail during loading, the motor is always in a position to resume spring loading upon return of power; if necessary, such operation can always be completed by hand.

6.3. Circuit breaker closed with closing springs unloaded (see fig. 5)

The breaker is in this position after each closing operation. On ERM operating mechanisms, the closing springs' unloaded condition is transitory as the geared motor provides for automatic reloading. Transition from the position on Fig. 4 to that on Fig. 5 occurs as follows:

- closing hook (41) (fig. 7) turns by action of electric closing operating mechanism (via closing release (42) or of hand closing via knob (2) (fig. 18)
- main closing hook (39) consequently drops and closing springs promptly trip while loading lever (37) in solid with main shaft (38) (figs. 5-6) turns counter-clockwise
- in turning, loading lever (37) actuates lever (43) and via trace (26) induces power shaft (16) to turn clockwise and closes the circuit breaker.

6.4. Circuit breaker closed with closing springs loaded (see fig. 6)

This is the standard condition of the closed breaker in service. Loading of closing springs occurs as described under Item 6.1.

The opening operation may be performed as follows (see figs. 5-6-19):

- by hand, turning opening knob (1) counter-clockwise
- by remote control via shunt trip (44)

- automatically, by action of undervoltage release (100) or of overcurrent releases outside the mechanism.

Opening is induced by release section (45) which, by shifting, turns lever (46) of trace (26), re-releases the linked system of the trace and makes possible counter-clockwise rotation of main shaft (16).
Resetting of trace (26) occurs via reloading springs (75).

7. MAINTENANCE AND INSPECTION DURING OPERATION

7.1.1. General

- Before performing any maintenance or inspection, it is always necessary:
- a) to disconnect the circuit breaker
 - b) to make sure the operating mechanism is in open position with closing springs unloaded
 - c) to remove case (10) of the operating mechanism by loosening screws (11) (figs. 1-2)
 - d) after the operation, to refit case (10) locking it into place by means of screws (11).

The frequency of maintenance operations is listed in Table I, which also shows the number of operations performable by components most subject to wear.

7.1.2. Cleaning and lubrication

The operating mechanism is supplied already lubricated and requires no special care in addition to the contents of Table I. However, at least once yearly, it is necessary to provide for thorough cleaning out and lubrication of the necessary parts marked ▽ on fig. 22 with lubricant:
BEACON EP 300-ESSO for regular operations
LOEX ARKTIS of MOLYKOT PRODUKTIONSGESELLSCHAFT for low-temperature running (-25°C max).

7.1.3. Inspection

Some trouble arising from imperfect setting of mechanical control elements, owing to constant vibrations and impacts, faulty tightening, etc., may be averted by periodically checking that connections of control and auxiliary circuits, of screws, nuts, etc. are properly tightened and inspecting the state of cotter pins and snap rings, as listed on Table 1.

TABLE I
TABLE FOR MAINTENANCE DURING SERVICE

Operation to be performed		every 2,000 ops.	every 5,000 ops.	every 10,000 ops.	every 15,000 ops.	every 20,000 ops.	NOTES
MAINTENANCE	(1) Cleaning and		○ ■				(1) "Cleaning" means removal of dust and excess grease to be performed by means of dry cloths and brushes
	(2) Lubrification						(2) "Lubrication" means restoration of grease to be applied by brush on points shown on lubricating diagram (fig.22); some drops of additive BARDAHL (BARDAHL MOTOR OIL ADDITIVE) should also be provided.
	Checking screws, nuts, etc.		○ ■				
	Checking cotter pins, snap rings		○ ■				
REPLACEMENTS	Closing springs (24) with fittings						
	Closing spring (25) with guide heads (55-59) and spacer (76 or 77)			○		■	See 8.2
	Hand-loading pawl (27A)					○ ■	See 8.3
	Loading rod (36) with washer (73) and snap ring (72)					○ ■	See 8.4
	Trace (26) with loading spring (75)					○ ■	See 8.5
	Loading lever (37) with pin (89)					○ ■	See 8.6
	Limit contacts(29)					○ ■	See 8.7

○ STANDARD EXECUTION NOTE: After 50,000 operations, operating mechanisms should be sent back to SACE for overhauling, or else replaced.
■ SPECIAL EXECUTION

8. REPLACEMENTS

8.1. General

Before performing any replacement it is always necessary:

- a) to disconnect the breaker
- b) to ensure that the operating mechanism is in open position with closing springs unloaded
- c) to remove case (10) of the operating mechanism, removing screws (11) (fig. 1-2)
- d) once the operation is over, to refit case (10) locking it into place by means of screws (11).

NOTE: - When carrying out replacements, NEVER FORGET to replenish lubrication prescribed on Fi

8.2. Replacement of closing springs (24-25)

On operating mechanism ER7 - ERM7, proceed as follows (see Figs. 8, 9, 10, 11, 19):

- a) unscrew bottom screws (47) till loose
- b) unscrew securing screws (48) of contacts (32) without detaching the cables
- c) by shifting the group of contacts (32) mentioned under item b), remove cotter pin (49) and slide out stud (50)
- d) remove spring group (24) from contact side (32)
- e) fit in the new group of springs (24)
- f) remount stud (50) and cotter pin (49)
- g) apply some drops of LOCTITE NUT LOCK 74 on screws (47) and a light film of lubricant (see Fig. 8) and screw them into the threaded seats incorporated in springs (24) till measures A and B shown on fig. 10 (A = 10 mm - B = 3 mm) are reached
- h) position group of contacts (32) and lock with screws (48).

On operating mechanisms ER8 - ERM8 - ER10 - ERM10

the same applies as under items a) to h), plus the following (see figs. 11 and 12):

- i) loosen screws (53) securing staple (54) and slide out guide head (55) ensuring that spring (25), which is partly loaded and therefore vio-

lently ejected, is handled with due care

- l) remove snap ring (56), placed close to intermediate plate (21) and slip out pin (57) checking washer (58) position, and remove guide head (59)
- m) refit the new pieces (25, 55, 59, 76 or 77) and lubricate the stem of guide head (55).

8.3. Replacement of hand-operated reloading pawl (27 A) (see figs. 13, 14, 15, 16, 17, 19, 20)

Proceed as follows:

- a) remove set of screws (60) securing tile (61) and remove tile
- b) remove screws (62) and remove group (27) checking presence and position of washers (64)
- c) carefully remove snap rings (63) and slide out pawl
- d) lubricate and refit new pawl (27A) and snap ring (63)
- e) remount group (27) onto tile (61) by means of screws (62) and washers (64) positioned as per b)
- f) secure complete tile (61) onto the operating mechanism by means of set of screws (60). Reposition spring (65) and spacer (66). Tighten screws (60) without locking to the end
- g) insert crank (6) into shaft (27) and spin clockwise to stress tile (61) in order to eliminate any clearance on holes. Tighten screws (60).
- h) spin crank (6) and check for proper running of the system. During this operation, disengage pawl (28A) from gear wheel (35) to avoid altering proper setting up
- i) should the event described under h) not occur, fit two setting screws (68) dia. M8 into holes (67) and proceed as follows:
Loosen again the three screws (62), tighten screws (68), retighten screws (62) and repeat the operation till the condition under h) is reached
Before removing adjusting screws (68), check amount of free space near washers (64) and tile (61) and shim only the two screws (62A) (fig. 15) by adding suitable washers.
Retighten screws to the end.

8.4. Replacement of reloading rod (36) (see figs. 6, 8, 12)

Proceed as follows:

- a) unscrew completely screws (47), remove staple (54) (on operating mechanisms ERM8 - ERM10) so as to unload spring action
- b) remove cotter pin (69), slide out pin (70) checking for position of washer
- c) remove snap ring (72) and washer (73)
- d) remove loading rod (36) fitted with roller cage
- e) fit new loading rod (36) with new roller cage reversing above procedure
- f) while re-positioning screws (47), proceed as described under para. 8.2, g).

8.5. Replacement of trace (26) fitted with reloading springs (75) (see fig. 5)

Proceed as follows:

- a) by spinning opening knob (1) counter-clockwise, screw one M4 screw through front plate hole on to pin (78) connecting trace to main shaft
- b) remove cotter pin (79) from pin (78)
- c) load closing springs by hand crank (6) till trace (26) is reloaded, ensuring that loading of such springs is NOT COMPLETE
- d) disconnect loading springs (75) from securing pin of front plate (20)
- e) slide out pin (82) and remove stud (81) checking position of washer (84) and spacer (83)
- f) keeping opening knob (1) turned counter-clockwise to the end, remove pin (78) by sliding it by means of screw M4 out of the hole on front plate (20), checking position of washer (80)
- g) remove trace (26): it is sufficient to spin release lever (46) counter-clockwise to open trace and make removal easier

- h) check that distance between centres of the holes of the new trace (26) is 196 ± 0.75 mm. Otherwise screw or unscrew threaded stem till required measure is obtained
For circuit-breakers RG-RGE 12 to 36kV - 800 to 2500A the distance between centres must be 193 ± 0.75 mm
- i) fit new trace (26) complete with reloading springs (75) by reversing the order of the above operations, bearing in mind that it is sufficient to spin release lever (46) counter-clockwise to open the trace and make mounting easier
- l) upon completion of fitting, remove screw M4 used for removal and refitting of pin (78)
- m) complete loading of closing springs by hand
- n) perform closing-opening operation checking for proper running of trace.

8.6. Replacement of loading (37) lever complete with pin (89) (see figs. 5, 8, 10, 12)

Proceed as follows:

- a) loosen screws (47) completely so as to unload spring action. On operating mechanisms ER8, ER10, ERM8 and ERM10, remove closing spring group (25) as well, proceeding as per para. 8.2 items i-l)
- b) unscrew tang (85) and remove it together with washer (86) and signalling device (7)
- c) unscrew screws securing shock-absorber (33) and slide out the unit
- d) via crank (6) for spring loading, make loading lever (37) perform one turn till trace (26) is reloaded
- e) release loading springs (75) of trace (26) from pin on front plate (20)
- f) slide out pin (82) and remove stud (81) checking position of washer (84) and spacer (83), thus freeing trace from lever (43) without altering the length of the trace
- g) remove washer (87), lever (43) and washer (88) from main shaft (38)
- h) remove cotter pin (69), slide out pin (70); check position of washer (71) and release loading rod (36) from loading lever (37)

- i) remove pin (89) and extract with force (owing to the presence of feather key (91) loading lever (37), noting that also inner bearing ring may be ejected at the same time; in this case remove said ring from hub of loading lever and refit it into place
- l) fit new loading lever (37) and new pin (89) proceeding as above, but in reverse order
- m) complete loading lever (37) rotation via crank (6) and by hand-cranking closing hook (41), lower main closing hook (39) and turn crank-shaft (23) clockwise once, to reset the group in the position on fig. 3. To spin the trace it is sufficient to spin release lever (46) counter-clockwise.
- n) remount closing springs as per para. 8.2
- o) perform some closing-opening operations and check for proper running of loading lever (37)

8.7. Replacement of limiting contact units (29) (see figs. 17, 20, 21)

Proceed as follows:

- a) unscrew the two securing screws (90) from bottom plate (22)
- b) remove limit contacts group (29)
- c) detach cables
- d) rewire the new contacts groups as per wiring diagram
- e) remount the new rewired group of limit contacts (29), locking it onto bottom plate (22) by means of nuts (90)
- f) perform some closing-opening operations, loading closing springs by hand, and check that contacts work properly.

9. TRANSFORMATION OF THE OPERATING MECHANISM

9.1. Transformation of operating mechanism ER into ERM

To perform this operation, the operating mechanism must be sent back to SACE or our specialized technician sent for.

10. LIST OF SPARE PARTS

NOTE: - When spare parts are required, always specify registration number, type of circuit-breaker and operating mechanism, and whether a new application or one already existing on the equipment is required. Where necessary, specify also voltage, indicating whether AC or

- a) Closing springs group (24) to dwg. 127432/801 for ER7 - ERM7 operating mechanisms
- b) Closing springs group (24) - (25) to dwg. 127432/801 plus dwg. 130075/001 - 127396/801 - 127399/801 - 131177/002 for ER8 - ERM8 operating
- c) closing springs group (24) - (25) to dwg. mechani 127432/801 plus dwg. 127436/001 - 127396/801 - 127399/801 - 131177/001 for ER10 - ERM10 operating
- d) Hand-loading pawl (27A) to dwg. 130393/801 mechani
- e) Loading rod (36) to dwg. 127492/801 (complete with roller cage)
- f) Trace (26) to dwg. 127518/802 complete with re-loading springs (75) to dwg. 130074/801
- g) Standard shunt trip (44) to dwg. 119003/803
- h) Additional shunt trip (95) to dwg. 127438/801
- i) Closing release (42) to dwg. 127955/801
- *l) Undervoltage release (100) to dwg. 124679/805
- *m) Geared motor (28) to dwg. 130126/801
- n) Circuit breaker (101) for thermomagnetic motor protection to dwg. 130909/801
- o) Limit contacts (29) to dwg. 131475/801
- p) Antipumping device (74) to dwg. 131161/001
- *j) For these applications the operating mechanism should be sent back to SACE or our specialized

10.1. Standard shunt trip (44) (fig. 19)

For fitting or replacement, proceed as follows:

- a) secure shunt trip (44) to front plate (20) via screws (93) with safety plate (94) placed between and turned back over screw heads after tightening
- b) perform wiring as per wiring diagram, ensuring the cables do not touch moving parts of operating mech
- c) supply shunt trip coil with its rated voltage and check it works properly.

10.2. Additional shunt trip (95) (fig. 24)

For fitting or replacement, proceed as follows:

- a) secure shunt trip (95) to front plate (20) via screws (96) with safety plate (97) placed between and turned back over screw heads after tightening
- b) wire as per wiring diagram, ensuring the cables do not touch moving parts of operating mechanism
- c) supply shunt trip coil with its rated voltage and check it works properly.

10.3. Closing release (42) (fig. 18)

For fitting or replacement, proceed as follows:

- a) secure release (42) to front plate (20) via screws (98) with safety plate (99) placed between and turned back over screw heads after tightening
- b) wire as per wiring diagram, ensuring the cables do not touch moving parts of operating mechanism
- c) supply shunt trip coil with its rated voltage and check it works properly.

10.4. Circuit breaker (101) for thermo-magnetic motor protection (25)

For fitting or replacement, proceed as follows:

- a) fit shock-resistant packing (102) on front plate (20)
- b) mount breaker unit by securing support (103) to intermediate plate (21) via two screws (104) with washer (105) and fit breaker into place on front plate, protected by shock-resistant packing (102)
- c) wire as per wiring diagram, ensuring the cables do not come into contact with moving parts of the operating mechanism
- d) supply motor circuit and during spring loading check for proper running of breaker by depressing the relevant pushbutton by hand.

NOTE: - For adjusting pushbutton of thermo-magnetic motor protection on draw-out breakers, see prescription 600354.

10.5. Anti-pumping device (74) (see fig. 18)

For fitting or replacement, proceed as follows:

- a) secure release group support (74) to operating mechanism tile by means of screws (92)
- b) after tightening screws (92), lock by calking
- c) wire as per wiring diagram, ensuring cables do not come into contact with moving parts of the operating mechanism
- d) supply antipumping release with its rated voltage and check it works properly.

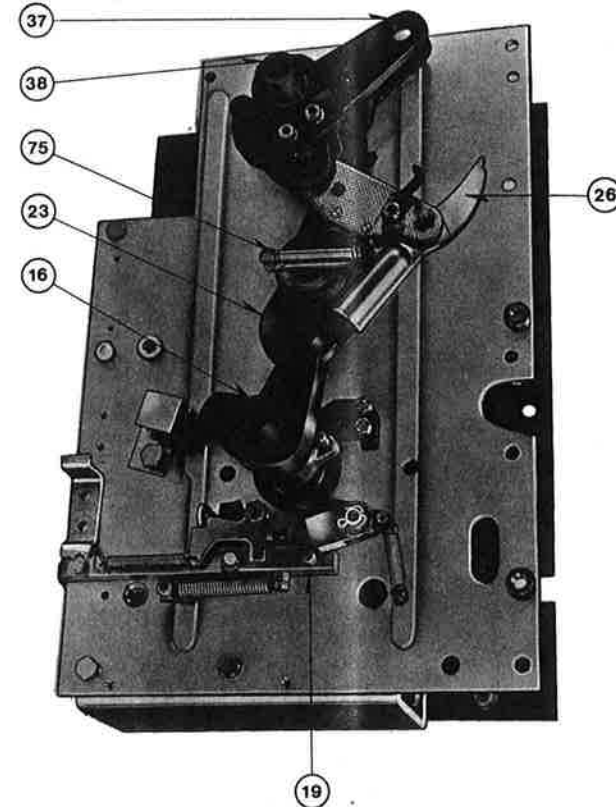
**11. SPECIFIC DENOMINATIONS AND ILLUSTRATIONS
(see figs. 1 to 25)**

- | | |
|--|--|
| 1) Opening knob | 24) Standard closing springs set |
| 2) Closing knob | 25) Additional closing spring |
| 3) Mechanical "open" (O) and "closed" (I) signalling device | 26) Trace |
| 4) Hole for the loading spring crank | 27) Camshaft for hand-loading |
| 5) Operations counter, without resetting device | 27A) Hand-loading pawl |
| 6) Spring loading crank | 28) Geared motor |
| 7) Mechanical springs "loaded" (yellow) and "unloaded" (white) signalling device | 28A) Electric loading pawl |
| 8) Key interlock | 29) Limit contacts |
| 9) Breaker operating pushbutton for motor protection | 30) Auxiliary contacts (regularly supplied for operating mechanism feed) |
| 10) Case | 31) Terminal board |
| 11) Case securing screws | 32) Auxiliary contacts (available on request) |
| 12) Spacer for securing as per item 14 (fig. 2) | 33) Closing shock absorber |
| 13) Securing with 4 holes Ø M10 | 34) Brake |
| 14) Securing with 4 holes Ø M8 (as an alternative to item 13) (fig. 2) | 35) Gear wheel |
| 15) Outlet for signalling contacts cables | 36) Loading rod |
| 16) Main shaft | 37) Loading lever |
| 17) Control cables outlet | 38) Main shaft |
| 18) Trip bar | 39) Main closing hook |
| 19) Pedal-operated release | 40) Roller |
| 20) Front plate | 41) Closing hook |
| 21) Intermediate plate | 42) Closing release |
| 22) Bottom plate | 43) Lever |
| 23) Crankshaft | 44) Shunt trip |
| | 45) Trip plate |
| | 46) Trace lever |
| | 47) Closing springs securing screws |
| | 48) Contacts securing screws |
| | 49) Cotter pin for stud (50) |
| | 50) Stud for plugging closing springs set (24) |

- | | |
|--|---|
| 51) Cam | 78) Pin |
| 52) Stem for limit contacts (29) | 79) Cotter pin |
| 53) Staple securing screws (54) | 80) Washer |
| 54) Staple | 81) Pin |
| 55) Guide head | 82) Stud |
| 56) Snap ring | 83) Spacer |
| 57) Pin | 84) Washer |
| 58) Washer | 85) Tang |
| 59) Guide head | 86) Washer |
| 60) Tile securing screws | 87) Washer |
| 61) Tile | 88) Washer |
| 62)-62a) Screws | 89) Elastic pin |
| 63) Snap ring | 90) Nuts for securing limit contacts |
| 64) Washers | 91) Feather key |
| 65) Spring | 92) Screws for item 74 |
| 66) Spacer | 93) Screws for item 44 |
| 67) Holes for adjusting screws (68) | 94) Safety plate |
| 68) Adjusting screws | 95) Additional shunt trip |
| 69) Cotter pin for stud (70) | 96) Screws for item 95 |
| 70) Stud for plugging loading rod (36) | 97) Safety plate |
| 71) Washer | 98) Screws for item 42 |
| 72) Snap ring | 99) Safety plate |
| 73) Washer | 100) Undervoltage release |
| 74) Antipumping device | 101) Circuit-breaker for magnetic-to-thermal protection |
| 75) Trace (26) loading springs | 102) Shock-resistant packing |
| 76) Washer spacer for ERM10-ER10 | 103) Support |
| 77) Spacer for ERM8 - ER8 | 104) Screw |
| | 105) Washer |

12. WIRING DIAGRAMS

For working diagrams and layout, see attached drawings.



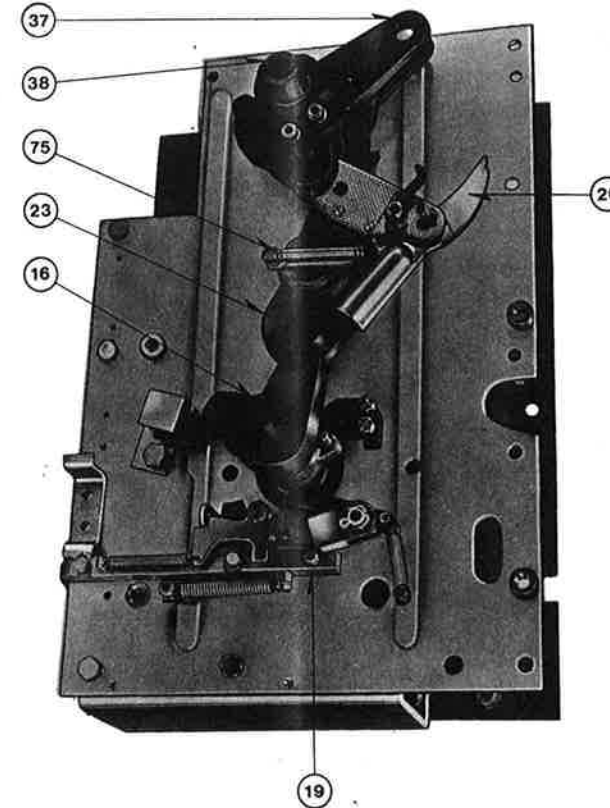
- 16) Main shaft
- 19) Pedal-operated release
- 23) Crankshaft
- 26) Trace
- 37) Loading lever
- 38) Main shaft
- 75) Trace (26) loading springs

Fig. 3

- | | |
|--|--|
| 51) Cam | 78) Pin |
| 52) Stem for limit contacts (29) | 79) Cotter pin |
| 53) Staple securing screws (54) | 80) Washer |
| 54) Staple | 81) Pin |
| 55) Guide head | 82) Stud |
| 56) Snap ring | 83) Spacer |
| 57) Pin | 84) Washer |
| 58) Washer | 85) Tang |
| 59) Guide head | 86) Washer |
| 60) Tile securing screws | 87) Washer |
| 61) Tile | 88) Washer |
| 62)-62a) Screws | 89) Elastic pin |
| 63) Snap ring | 90) Nuts for securing limit contacts |
| 64) Washers | 91) Feather key |
| 65) Spring | 92) Screws for item 74 |
| 66) Spacer | 93) Screws for item 44 |
| 67) Holes for adjusting screws (68) | 94) Safety plate |
| 68) Adjusting screws | 95) Additional shunt trip |
| 69) Cotter pin for stud (70) | 96) Screws for item 95 |
| 70) Stud for plugging loading rod (36) | 97) Safety plate |
| 71) Washer | 98) Screws for item 42 |
| 72) Snap ring | 99) Safety plate |
| 73) Washer | 100) Undervoltage release |
| 74) Antipumping device | 101) Circuit-breaker for magnetothermal protection |
| 75) Trace (26) loading springs | 102) Shock-resistant packing |
| 76) Washer spacer for ERM10-ER10 | 103) Support |
| 77) Spacer for ERM8 - ER8 | 104) Screw |
| | 105) Washer |

12. WIRING DIAGRAMS

For working diagrams and layout, see attached drawings.



- 16) Main shaft
- 19) Pedal-operated release
- 23) Crankshaft
- 26) Trace
- 37) Loading lever
- 38) Main shaft
- 75) Trace (26) loading springs

Fig. 3

- 8) Pin
- 9) Cotter pin
- 10) Washer
- 11) Pin
- 12) Stud
- 13) Spacer
- 14) Washer
- 15) Tang
- 16) Washer
- 17) Washer
- 18) Washer
- 19) Elastic pin
- 20) Nuts for securing limit con-
- tacts
- 21) Feather key
- 22) Screws for item 74
- 23) Screws for item 44
- 24) Safety plate
- 25) Additional shunt trip
- 26) Screws for item 95
- 27) Safety plate
- 28) Screws for item 42
- 29) Safety plate
- 30) Undervoltage release
- 31) Circuit-breaker for magne-
- to-thermal protection
- 32) Shock-resistant packing
- 33) Support
- 34) Screw
- 35) Washer

layout, see attached

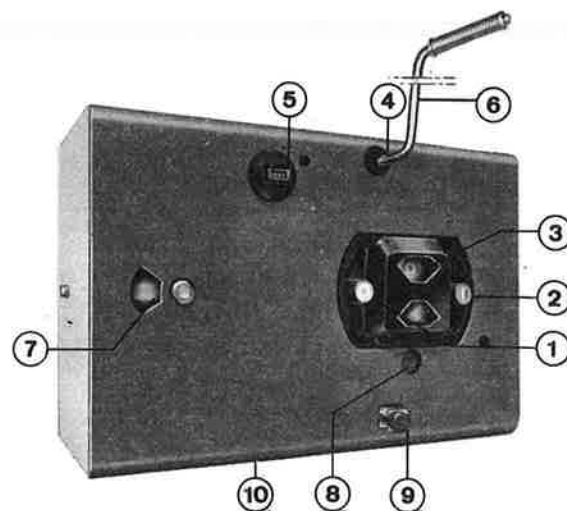
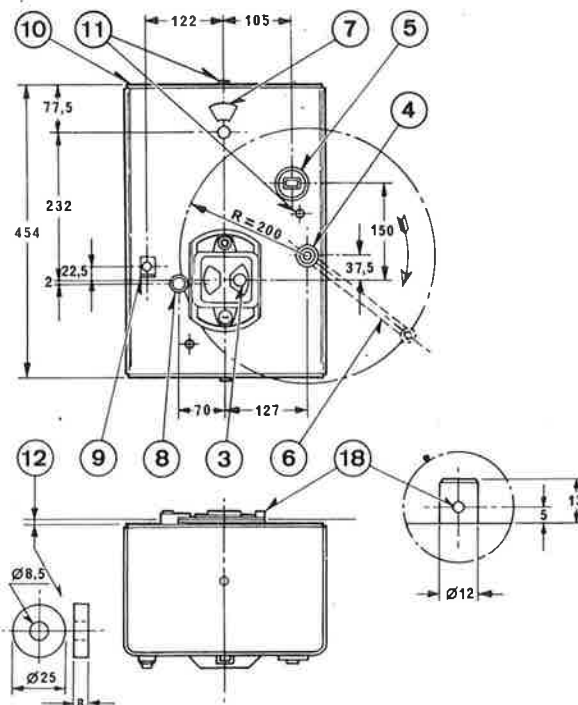


Fig. 1



CAPTION

- | | |
|--|---|
| 1) Opening knob | button for motor protection |
| 2) Closing knob | 10) Case |
| 3) Mechanical "open"(O)and "closed" (I) signalling device | 11) Case securing screws |
| 4) Opening for springs loading crank | 12) Spacer for securing as per Item 14 (fig. 2) |
| 5) Operations counter, without resetting device | 13) Securing with 4 holes Ø M10 |
| 6) Springs loading crank | 14) Securing with 4 holes Ø M 8 (alternative to Item 13) (fig. 2) |
| 7) Mechanical springs "loaded" (yellow) and "unloaded" (white) signalling device | 15) Outlet for signalling contacts cables |
| 8) Key interlock | 16) Main shaft |
| 9) Breaker operating push- | 17) Control cables outlet |
| | 18) Release shaft |
| | 19) Pedal-operated release |

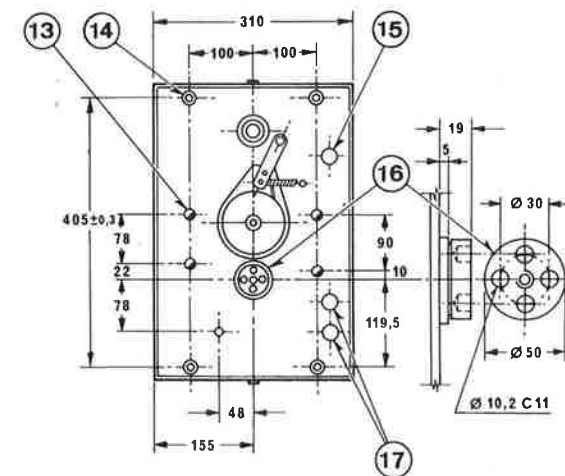
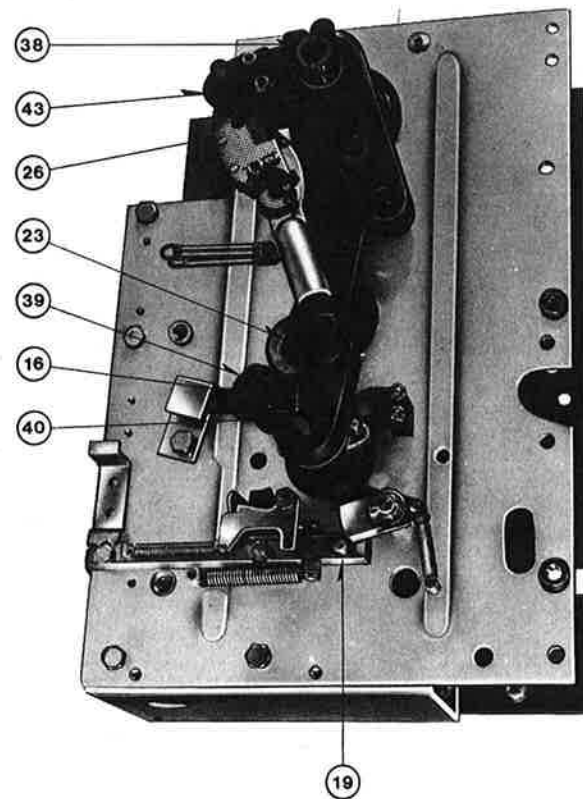


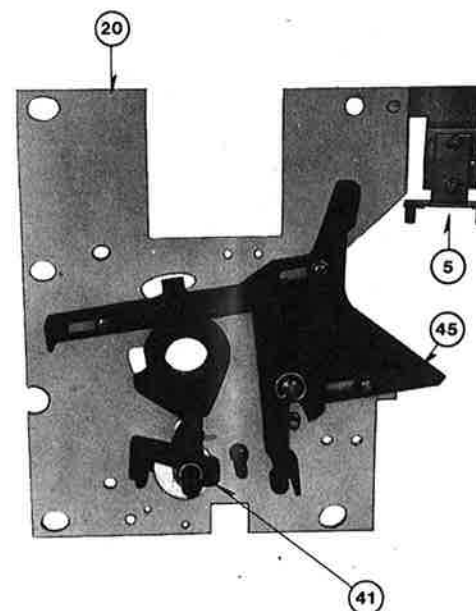
Fig. 2

Due to the continuous development of specifications as well as of materials, the characteristics and dimensions can be regarded as binding only on our confirmation



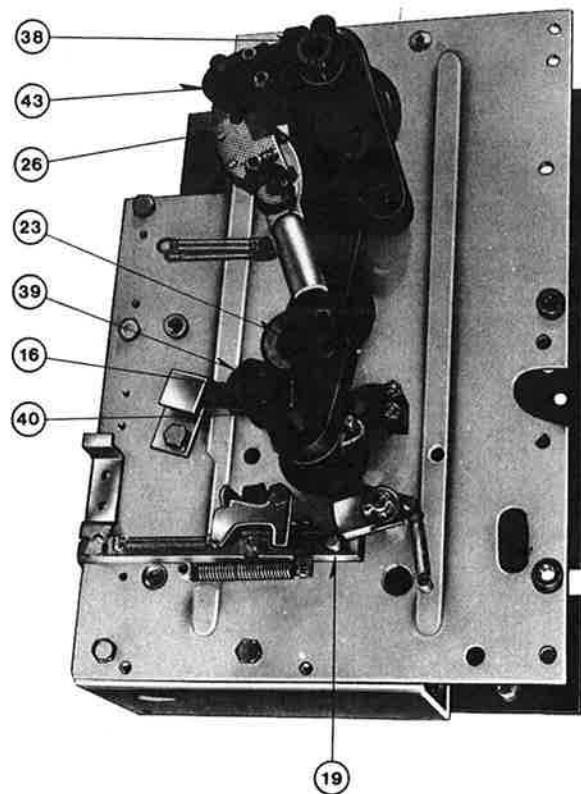
- 16) Main shaft
- 19) Pedal-operated release
- 23) Crankshaft
- 26) Trace
- 38) Main shaft
- 39) Main closing hook
- 40) Roller
- 43) Lever

Fig. 4



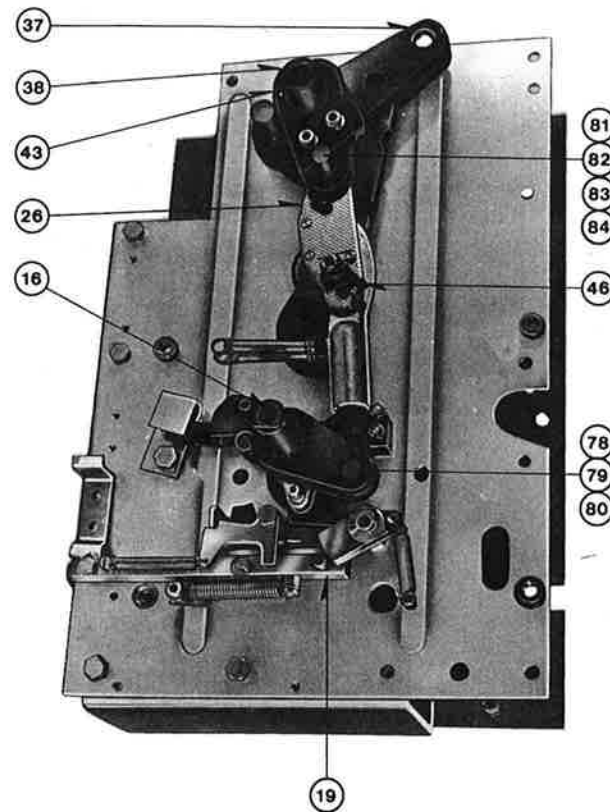
- 5) Operations counter, without resetting device
- 20) Front plate
- 41) Closing hook
- 45) Trip plate

Fig. 7



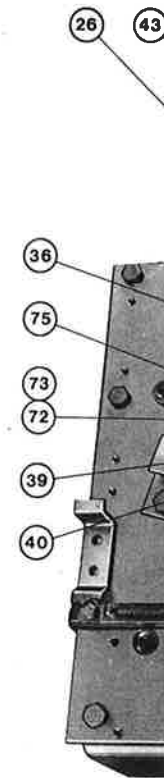
- 16) Main shaft
- 19) Pedal-operated release
- 23) Crankshaft
- 26) Trace
- 38) Main shaft
- 39) Main closing hook
- 40) Roller
- 43) Lever

Fig. 4

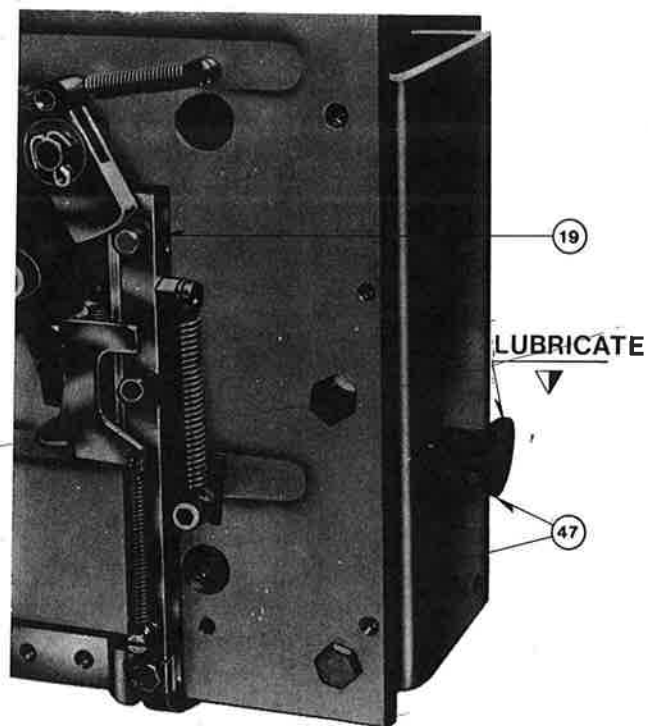


- 16) Main shaft
- 19) Pedal-operated release
- 26) Trace
- 37) Loading lever
- 38) Main shaft
- 43) Lever
- 46) Trace lever
- 77) Spacer for ERM8-ER8
- 78) Pin
- 79) Cotter pin
- 80) Washer
- 81) Stud
- 82) Pin
- 83) Spacer
- 84) Washer

Fig. 5

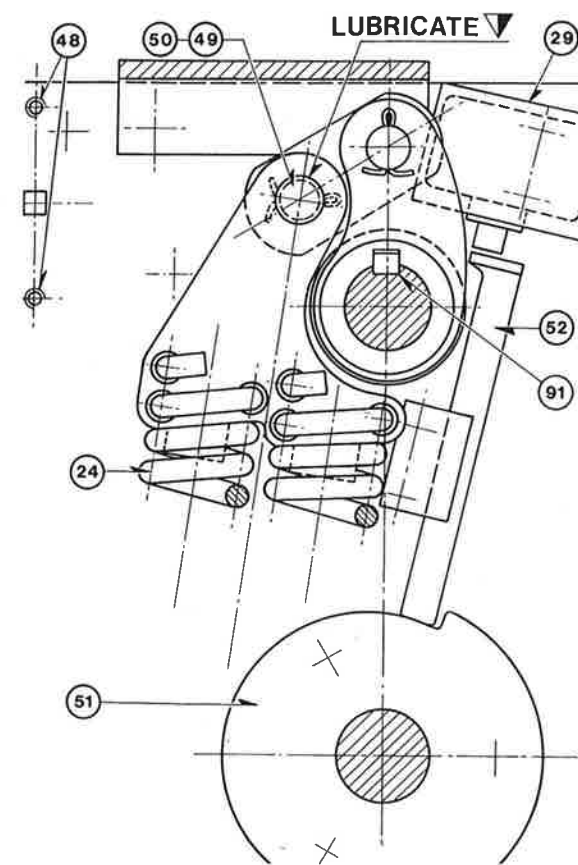


- 19) Pedal-operated release
- 26) Trace
- 36) Loading lever
- 38) Main shaft
- 39) Main closing hook
- 40) Roller



- 19) Pedal-operated release
47) Closing spring securing screws

Fig. 8

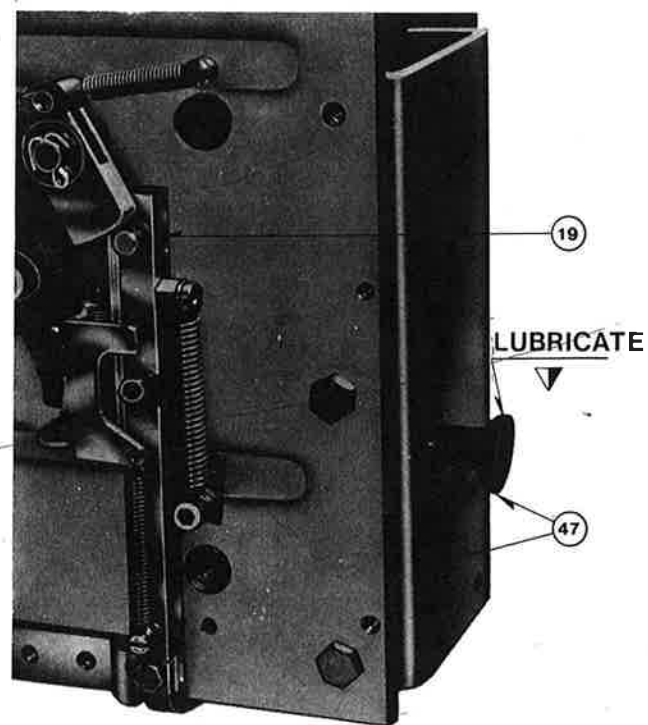


- 24) Standard closing springs
29) Limit contacts
48) Contacts securing screws
49) Cotter pin for stud (50)
50) Stud for plugging closing springs set (24)
51) Cam
52) Stem for limit contacts (29)
91) Key

Fig. 9

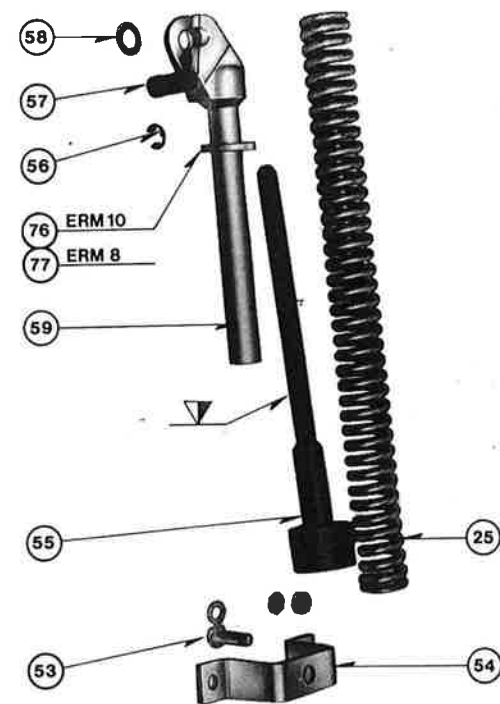


- 19)
24)
47)



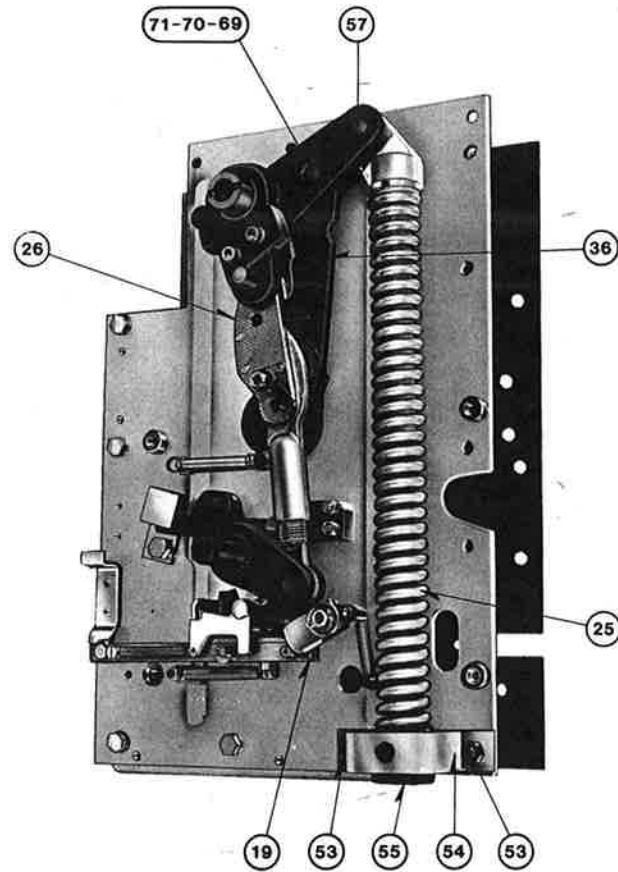
- 19) Pedal-operated release
47) Closing spring securing
screws

Fig. 8



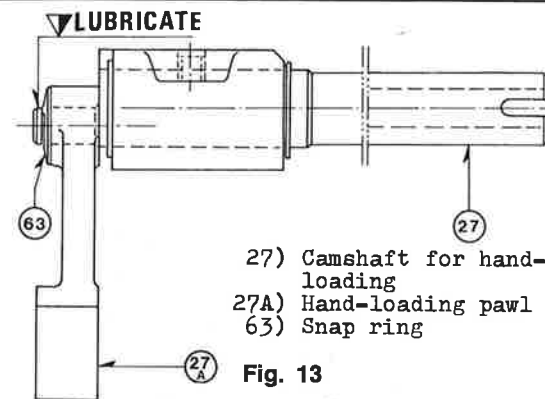
- 25) Additional closing spring
53) Staple (54) securing
54) Staple
55) Guide ring
56) Snap ring
57) Pin
58) Washer
59) Guide head
76) Washer spacer for
ERM 10
77) Spacer for ERM 8 -

Fig. 11



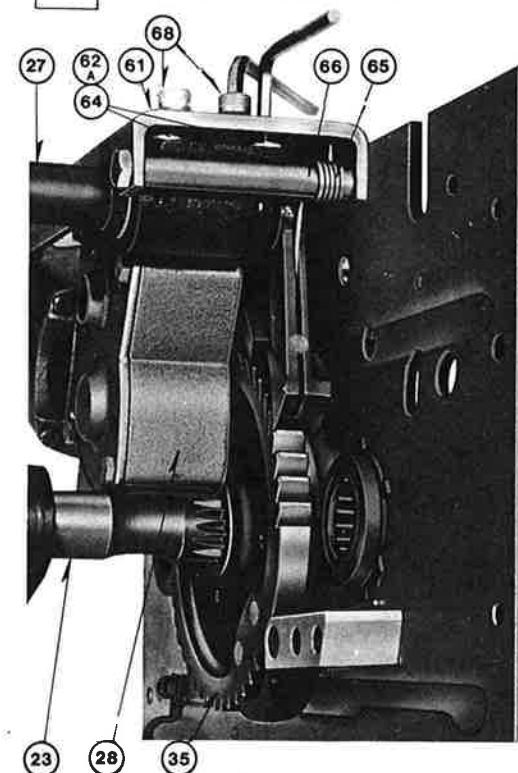
- | | |
|---------------------------------|-------------------------------|
| 19) Pedal-operated release | 55) Guide head |
| 25) Additional closing spring | 57) Pin |
| 26) Trace | 69) Cotter pin for stud (70) |
| 36) Loading rod | 70) Stud for plugging loading |
| 53) Staple (54) securing screws | rod (36) |
| 54) Staple | 71) Washer |

Fig. 12



- 27) Camshaft for hand-loading
27A) Hand-loading pawl
63) Snap ring

Fig. 13



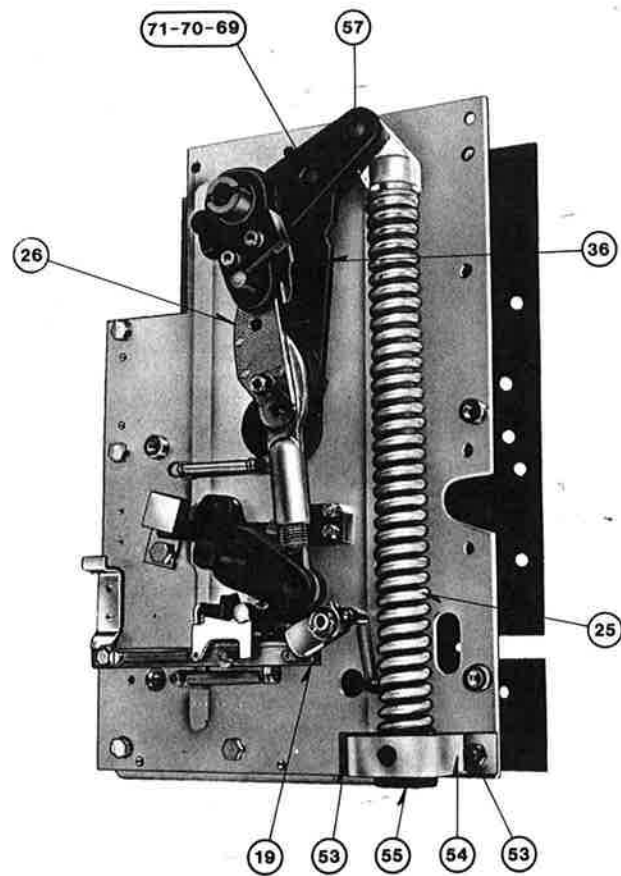
- 23) Crankshaft
27) Camshaft for hand-loading
28) Geared motor
35) Gear wheel

- 61) Tile
64) Washers
65) Spring
66) Spacer
68) Adjusting screws

Fig. 14

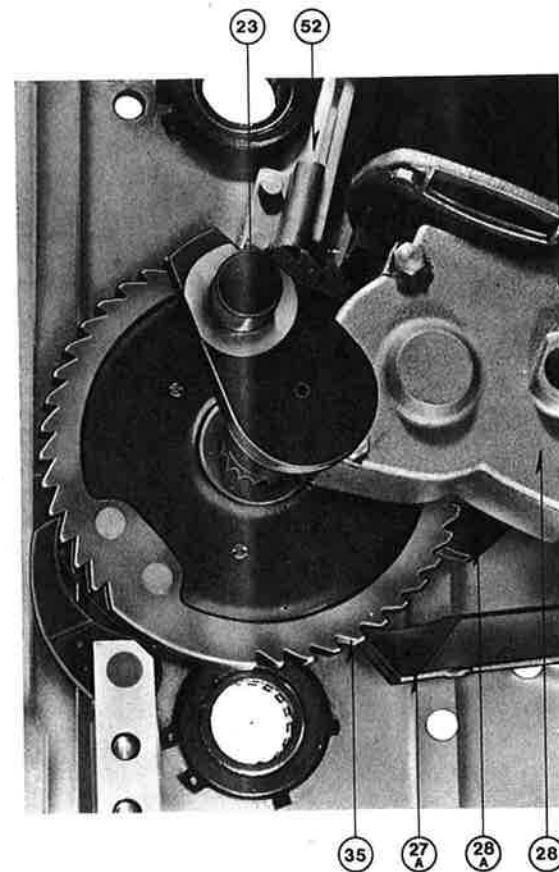


- 23) Crankshaft
27) Camshaft for hand-loading
27A) Hand-loading pawl
28) Geared motor
28A) Electric-loading



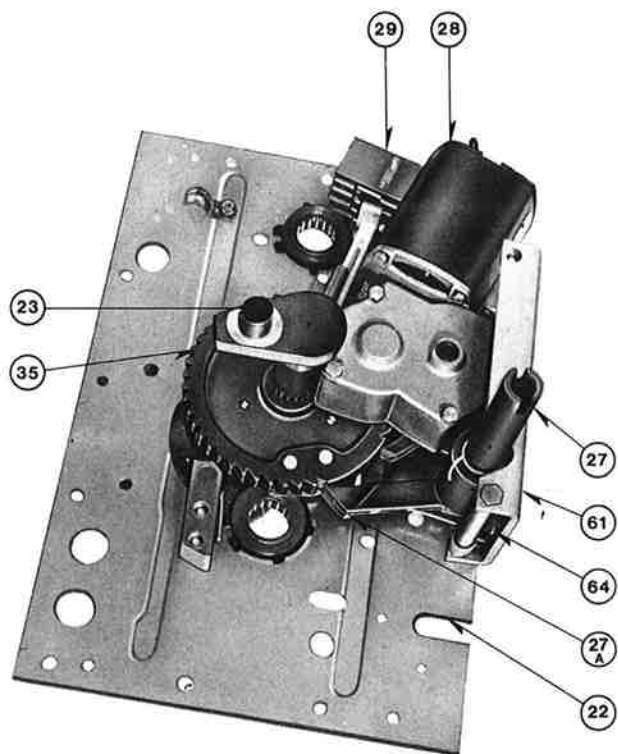
- | | |
|---------------------------------|-------------------------------|
| 19) Pedal-operated release | 55) Guide head |
| 25) Additional closing spring | 57) Pin |
| 26) Trace | 69) Cotter pin for stud (70) |
| 36) Loading rod | 70) Stud for plugging loading |
| 53) Staple (54) securing screws | rod (36) |
| 54) Staple | 71) Washer |

Fig. 12



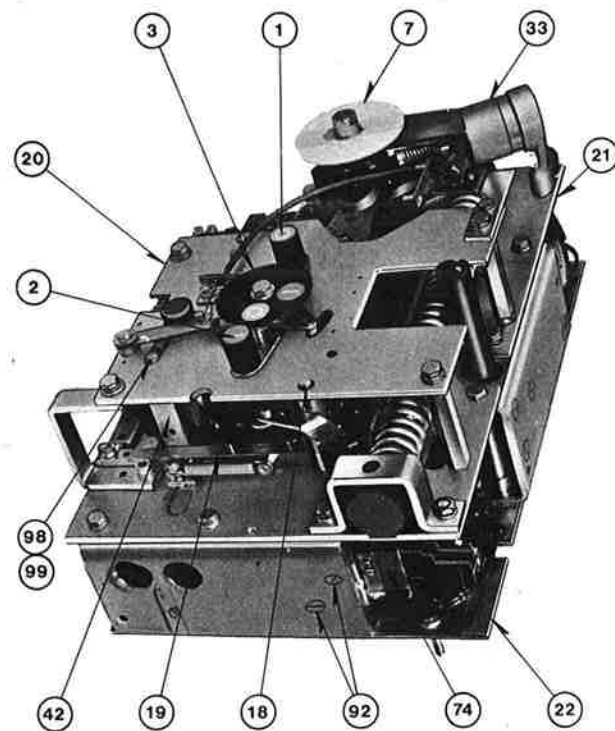
- | |
|----------------------------------|
| 23) Crankshaft |
| 27A) Hand-loading pawl |
| 28) Geared motor |
| 28A) Electric-loading pawl |
| 35) Gear wheel |
| 52) Stem for limit contacts (29) |

Fig. 16



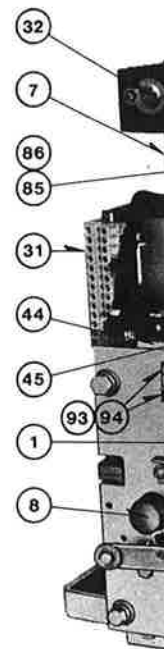
- 22) Bottom plate
- 23) Crankshaft
- 27) Camshaft for hand-loading
- 27A) Hand-loading pawl
- 28) Geared motor
- 29) Limit contacts
- 35) Gear wheel
- 61) Tile
- 64) Washers

Fig. 17

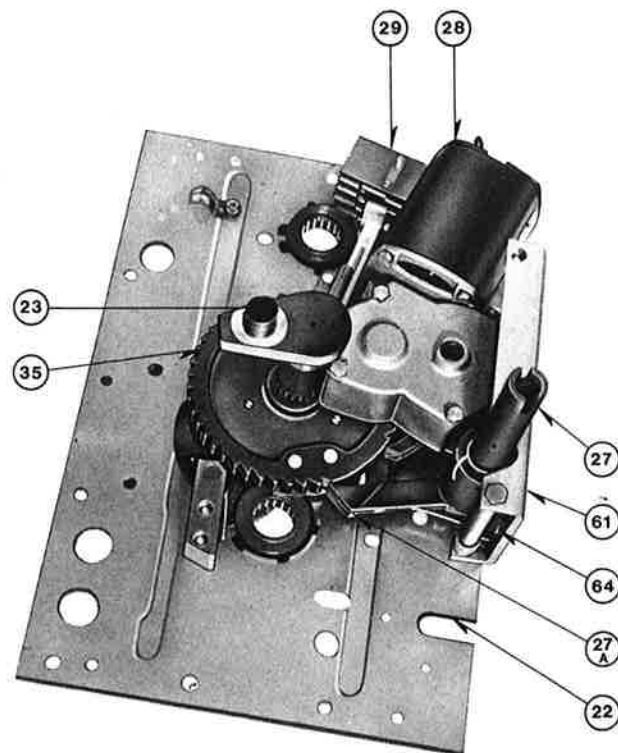


- | | |
|--|----------------------------|
| 1) Opening knob | 19) Pedal-operated release |
| 2) Closing knob | 20) Front plate |
| 3) Mechanical "open" (O) and "closed" (I) signalling device | 21) Intermediate plate |
| 7) Mechanical springs "loaded" (yellow) and "unloaded" (white) signalling device | 22) Bottom plate |
| | 33) Closing shock-absorber |
| | 42) Closing release |
| | 74) Antipumping device |
| | 92) Screws for Item 71 |
| 18) Release shaft | 98) Screws for Item 42 |
| | 99) Safety plate |

Fig. 18

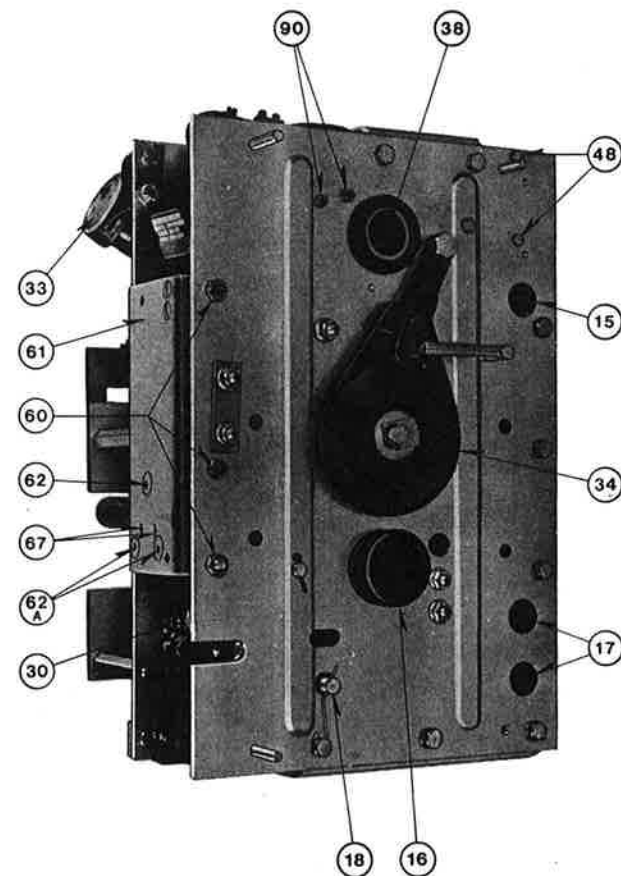


- 1) Opening knob
- 2) Closing knob
- 3) Mechanical "open" (O) and "closed" (I) signalling device
- 5) Operations counter resetting device
- 7) Mechanical spring "loaded" (yellow) and "unloaded" (white) signalling device
- 8) Key interlock
- 18) Release shaft
- 25) Additional closing device



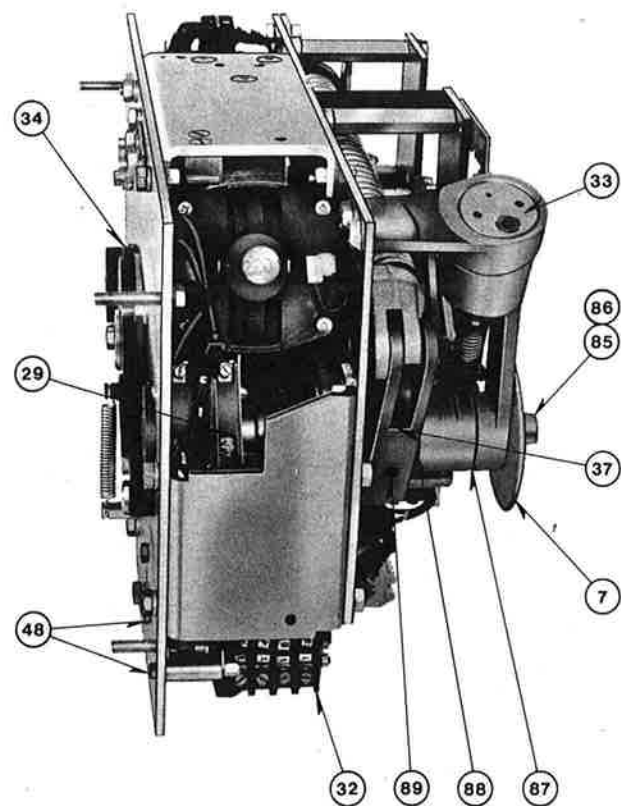
- 22) Bottom plate
- 23) Crankshaft
- 27) Camshaft for hand-loading
- 27A) Hand-loading pawl
- 28) Geared motor
- 29) Limit contacts
- 35) Gear wheel
- 61) Tile
- 64) Washers

Fig. 17



- | | |
|---|-------------------------------------|
| 15) Outlet for signalling contacts cables | 38) Main shaft |
| 16) Main shaft | 48) Contacts securing screws |
| 17) Control cables outlet | 60) Tile securing screws |
| 18) Release shaft | 61) Tile |
| 30) Limit contacts | 62) Screws |
| 33) Closing shock-absorber | 67) Holes for adjusting screws (68) |
| 34) Brake | 90) Limit contacts screws |
- N.B. Never lubricate

Fig. 20



- | | |
|---|---------------------------------|
| 7) Mechanical springs "load-
ed" (yellow) and "unload-
ed" (white) signalling
device | 37) Loading lever |
| 29) Limit contacts | 48) Contacts securing
screws |
| 32) Auxiliary contacts | 85) Tang |
| 33) Closing shock-absorber | 86) Washer |
| 34) Brake | 87) Washer |
| | 88) Washer |
| | 89) Pin |

Fig. 21

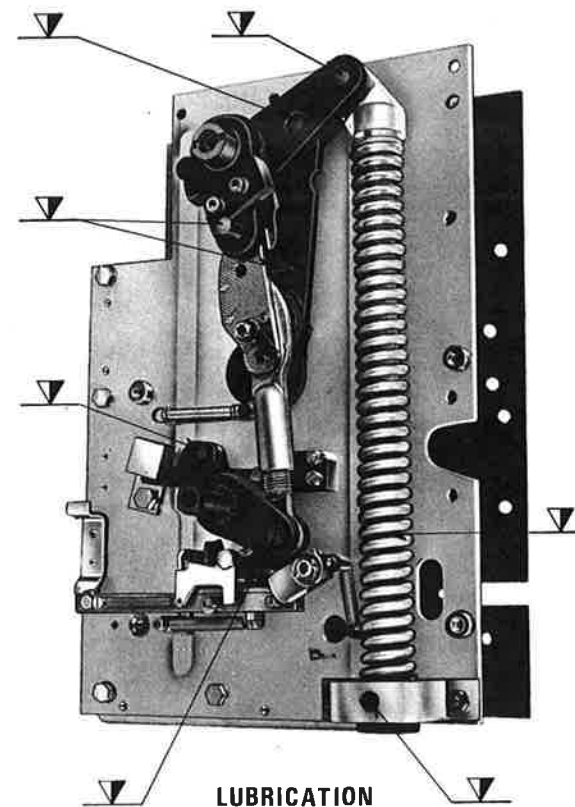
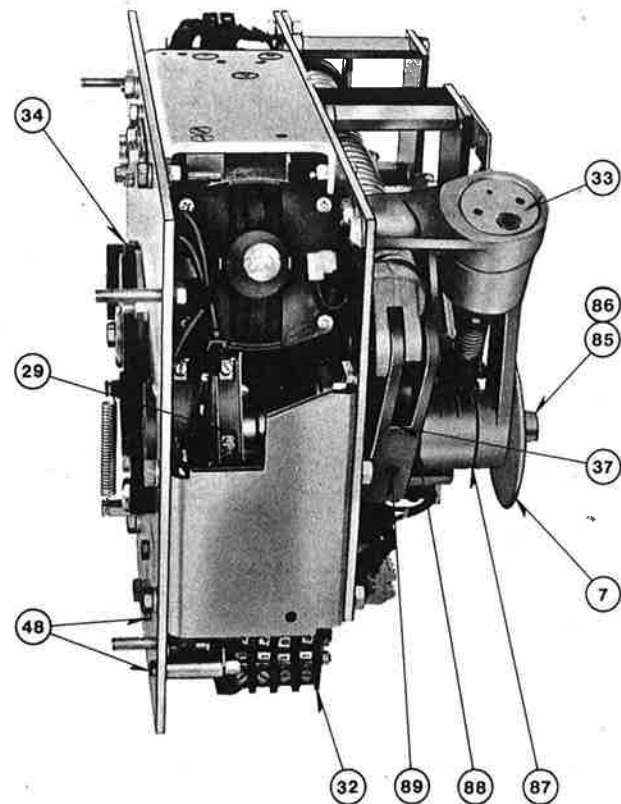


Fig. 22

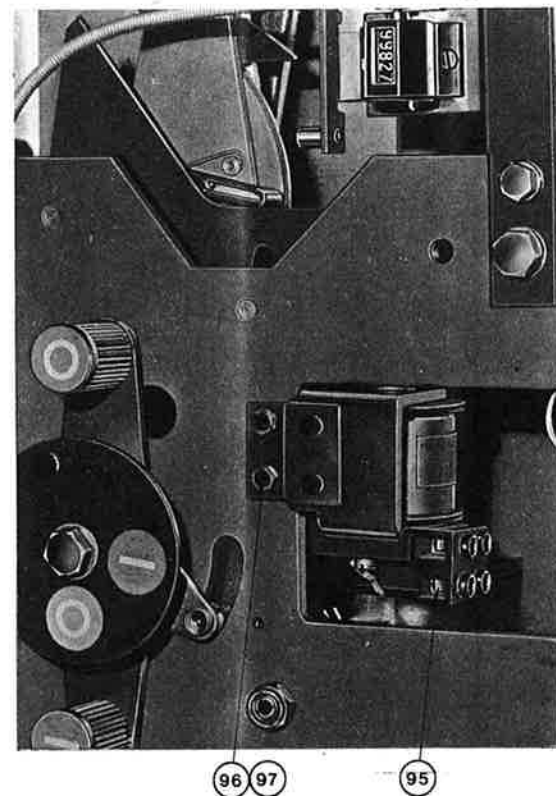


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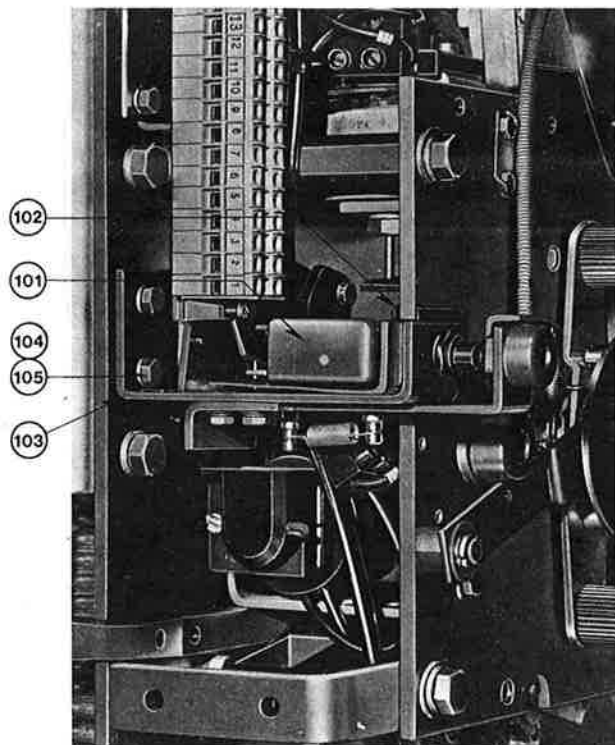
- | | |
|---|---------------------------------|
| 7) Mechanical springs "load-
ed" (yellow) and "unload-
ed" (white) signalling
device | 37) Loading lever |
| 29) Limit contacts | 48) Contacts securing
screws |
| 32) Auxiliary contacts | 85) Tang |
| 33) Closing shock-absorber | 86) Washer |
| 34) Brake | 87) Washer |
| | 88) Washer |
| | 89) Pin |

Fig. 21



- | |
|---------------------------|
| 95) Additional shunt trip |
| 96) Screws for Item 95 |
| 97) Safety plate |

Fig. 24

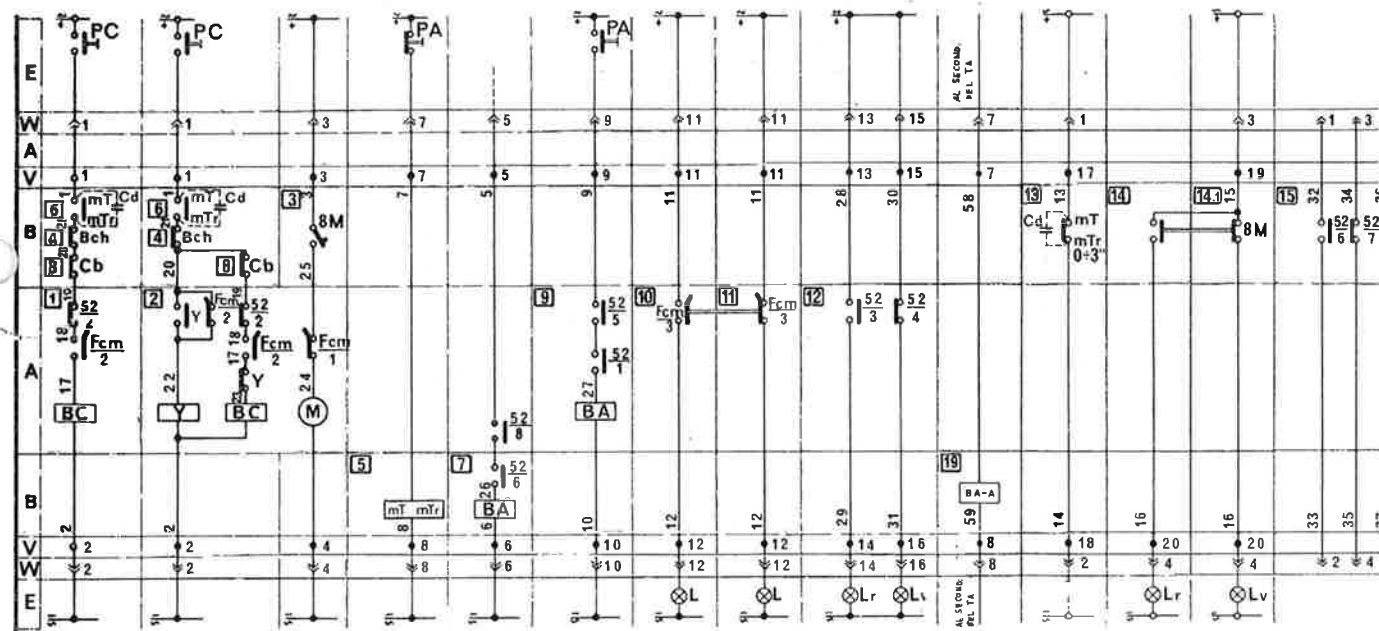


- 101) Breaker for thermo-magnetic protection
- 102) Shock-resistant packing
- 103) Support
- 104) Screw
- 105) Washer

Fig. 25

ELECTRICAL DIAGRAMS

Wiring diagram



- A Basic versions
- B Additional fittings
- V Operating mechanism terminal board
- W Plugs and sockets
- EmT Device cutting out the undervoltage release
- BA-A Current trip coil
- E Apparatus non supplied with the breaker
- Number of the wiring diagram figure

When the "accept" contacts to closing circuits mT or mTr, Bch, Cb do not exist or only one does, the numeration of cables becomes that of the wiring diagram
All the symbols are to be intended as preceded by number 52

NOTES

- a) The breaker is equipped only with the accessories listed on our confirmation of order
- b) For a draw-out or fixed breaker equipped with any of fittings of figures 1 to 12 a plug and socket SP1 is furnished, while for breakers equipped with fittings of the remaining figures a plug and socket SP2 is furnished
- c) The circuits of figures 1-2, 1-3, 6, 13, 10-11, 13-first contact of fig. 15, 14 or 14.1-second contact of figure 15 cannot be coupled

on the same operating mechanism

- d) The protection^a breaker 8M is operated manually on the fixed breakers, and is opened by pedal on draw-out breakers
The pedal is spring-return and is the same which serves for the translation of the breaker 52
When the pedal is pressed, the breaker 8M opens and remains open if the pedal is released; the breaker can be closed manually
- e) The undervoltage release is available in two versions:
 - outgoing side feeding: always provided with mechanical lagging device. The breaker can be closed even if the release is not energized. If, after closing the breaker, the release is energized, the breaker remains closed: if not, the breaker opens again
 - incoming side or independent source feeding: on request, with mechanical or capacitor lagging device. The breaker can be closed only if the release is energized
- f) With a lagged undervoltage release fitted on the outgoing side of the breaker 52, only the accessories shown on figs. 5 and 13 can be fitted; the contact shown on fig. 13 is transitory to de-energization therefore is fit only for energizing a card relay (if the release is fitted on the incoming side, the contact is persistent)

The circuit of the incoming circuit

g) The contact of the breaker

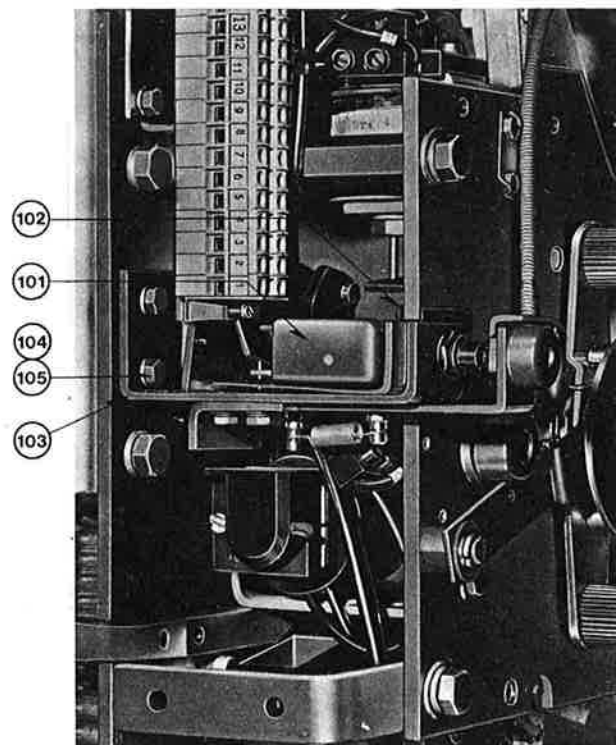
h) The plug of the breaker

i) The breaker releasing

j) When the breaker is closed

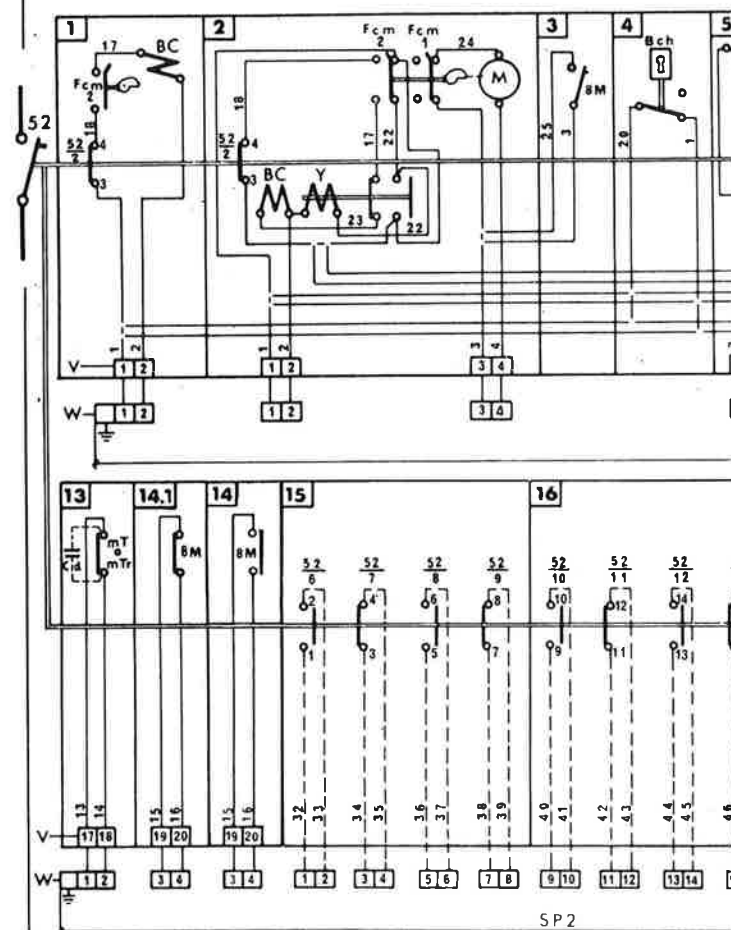
m) When the breaker is open

Caution -
cautionously for
prior to e



- 101) Breaker for thermo-magnetic protection
- 102) Shock-resistant packing
- 103) Support
- 104) Screw
- 105) Washer

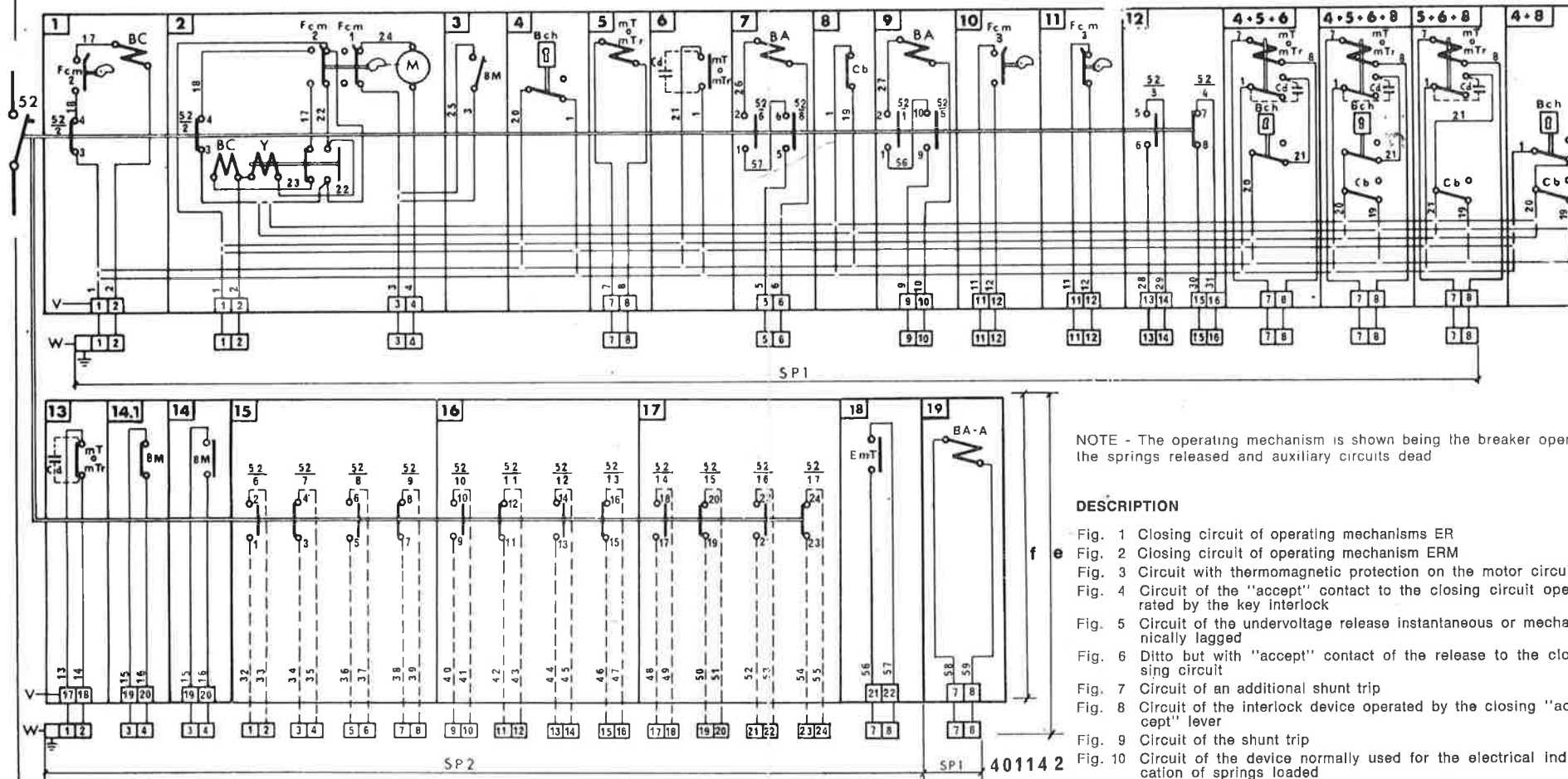
Fig. 25



CAPTION

- | | | | |
|------------|-----------------------------------|------------|---------------------------|
| f | Fixed circuit-breaker | 52 | Automatic circuit-breaker |
| e | Draw-out circuit-breaker | Bch | Key interlock |
| 52 1 to 17 | Auxiliary contacts of the breaker | Fcm 1 to 3 | Limit switch of spring |
| BA | Shunt trip | L | Indicating lamp |
| BC | Closing release | Lr | Red lamp |
| | | Lv | Green lamp |
| | | M | Motor for the closing |
| | | 8M | Breaker of the motor |
| | | mT | Undervoltage release |

Working diagram



NOTE - The operating mechanism is shown being the breaker open, the springs released and auxiliary circuits dead

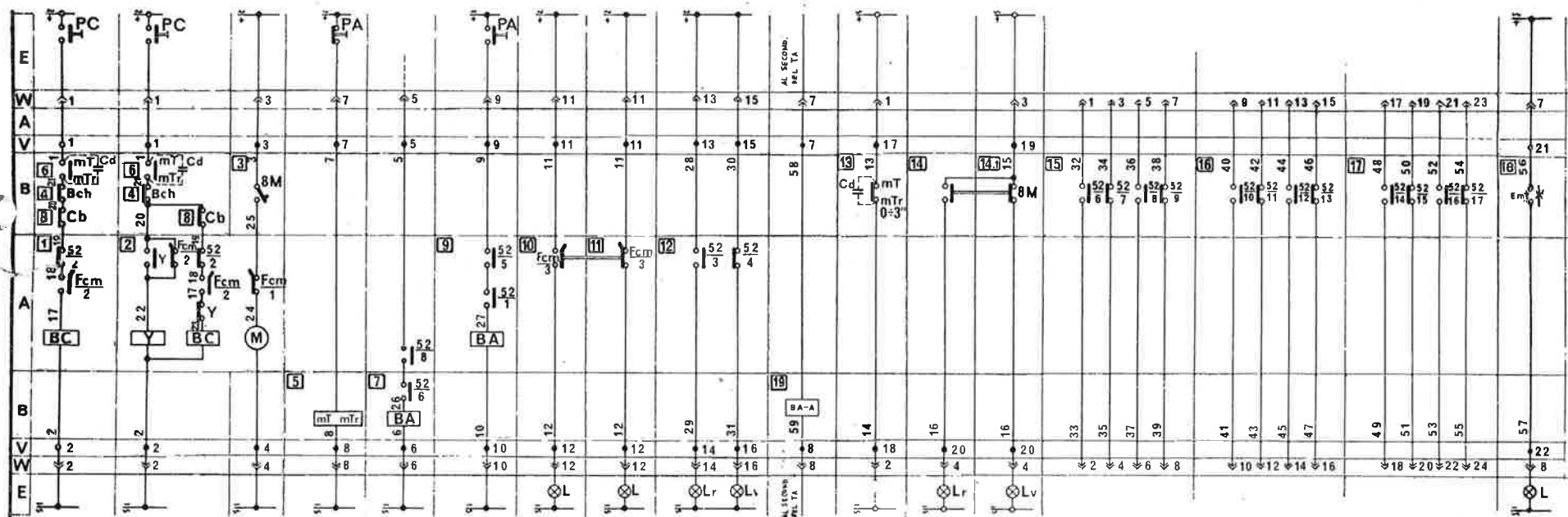
DESCRIPTION

- Fig. 1 Closing circuit of operating mechanisms ER
- Fig. 2 Closing circuit of operating mechanism ERM
- Fig. 3 Circuit with thermomagnetic protection on the motor circuit
- Fig. 4 Circuit of the "accept" contact to the closing circuit operated by the key interlock
- Fig. 5 Circuit of the undervoltage release instantaneous or mechanically lagged
- Fig. 6 Ditto but with "accept" contact of the release to the closing circuit
- Fig. 7 Circuit of an additional shunt trip
- Fig. 8 Circuit of the interlock device operated by the closing "accept" lever
- Fig. 9 Circuit of the shunt trip
- Fig. 10 Circuit of the device normally used for the electrical indication of springs loaded
- Fig. 11 Circuit of the device normally used for the electrical indication of springs released
- Fig. 12 Circuit of the auxiliary switches normally used for the electrical indications of breaker closed and open
- Fig. 13 Circuit of the device normally used for the electrical indication of "breaker tripped on instantaneous or lagged operation of the undervoltage release"
- Fig. 14 Circuit of the device normally used for indicating position of the motor protection breaker
- Fig. 15, 16, 17 Circuits of available auxiliary switches
- Fig. 18 Indication circuit for device cutting out the undervoltage release
- Fig. 19 Circuit of current trip coil

CAPTION

I	Fixed circuit-breaker	52	Automatic circuit-breaker	mTr	Undervoltage release with lagging device
ø	Draw-out circuit-breaker	Bch	Key interlock	PA	Opening push button or contact
52 1 to 17	Auxiliary contacts of the breaker	Fcm 1 to 3	Limit switch of springs loading	PC	Closing push button or contact
BA	Shunt trip	L	Indicating lamp	SP1	16-element plug and socket
BC	Closing release	Lr	Red lamp	SP2	24-element plug and socket
		Lv	Green lamp	Y	Antipumping relay
		M	Motor for the closing springs loading	Cb	Interlock operated by the "accept" lever to closing
		8M	Breaker of the motor circuit	Cg	Capacitor (d.c. only)
		mT	Undervoltage release		

Wiring diagram



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- When the "accept" contacts to closing circuits mT or mTr, Bch, Cb do not exist or only one does, the numeration of cables becomes that of the wiring diagram
- All the symbols are to be intended as preceded by number 52

a) The breaker is equipped only with the accessories listed on our confirmation of order

- b) For a draw-out or fixed breaker equipped with any of fittings of figures 1 to 12 a plug and socket SP1 is furnished, while for breakers equipped with fittings of the remaining figures a plug and socket SP2 is furnished.

- c) The circuits of figures 1-2, 1-3, 6, 13, 10-11, 13-first contact of fig. 15, 14 or 14.1-second contact of figure 15 cannot be coupled

on the same operating mechanism

- d) The protection breaker 8M is operated manually on the fixed breakers, and is opened by pedal on draw-out breakers. The pedal is spring-return and is the same which serves for the translation of the breaker 52. When the pedal is pressed, the breaker 8M opens and remains open if the pedal is released; the breaker can be closed manually.
- e) The undervoltage release is available in two versions:
 - outgoing side feeding: always provided with mechanical lagging device. The breaker can be closed even if the release is not energized. If, after closing the breaker, the release is energized, the breaker remains closed; if not, the breaker opens again.
 - incoming side or independent source feeding: on request, with mechanical or capacitor lagging device. The breaker can be closed only if the release is energized.
- f) With a lagged undervoltage release fitted on the outgoing side of the breaker 52, only the accessories shown on figs. 5 and 13 can be fitted; the contact shown on fig. 13 is transitory to de-energization therefore it fit only for energizing a card relay (if the release is fitted on the incoming side, the contact is persistent).

The circuits of fittings indicated by figs. 5-6 with mTr are possible only if the lagged undervoltage release mTr is supplied on the incoming side of the breaker 52 or through the auxiliary circuit.

- g) The contact Cb of fig. 8 is to fitted if the quick reclosing of the breaker is required
- h) The plugs and sockets SP1, SP2 and relevant connections indicated by hyphenated line are normally furnished only for draw-out breakers
- i) The breaker 8M of fig. 3 is always to be provided on drawout breakers equipped with springs loading motor and device releasing the springs when breaker is being withdrawn
- j) When the fig. 7 circuit is requested, the contacts 52-6 and 52-8 of fig. 15 circuit are no more available
- m) When the fig. 18 circuit is requested, the contact 52-9 of fig. 15 circuit is no more available

Caution - Do not start more ERM operating mechanisms simultaneously for loading the closing springs. Load the springs manually prior to energizing the auxiliary circuits