

INSTRUCTIONS FOR SERVICE AND MAINTENANCE

HAND OR MOTOR-LOADED SPRING-OPERATED

CLOSING MECHANISMS TYPE "ER-ERM"

FOR MEDIUM VOLTAGE CIRCUIT BREAKERS

IN-820.12

F E D E R A L P A C I F I C E L E C T R I C C O M P A N Y

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C O N T E N T S

	<u>PAGE</u>
1. DESCRIPTION	1
1.1. General	1
1.2. Main features	1
1.2.1. Types of operating mechanisms	1
1.2.2. Operating cycles	2
1.2.3. Mechanical life	2
1.2.4. Frequency of operations	2
1.3. Operation	3
1.4. Overall dimensions and weights	4
1.5. Components of the operating mechanism	4
2. ACCESSORIES AND APPLICATIONS	5
2.1. Accessories	5
2.2. Fittings	5
3. INSPECTION ON ARRIVAL	5
4. STORAGE	6
5. FITTING OF THE OPERATING MECHANISM ONTO THE CIRCUIT BREAKER	6
6. OPERATION	6
6.1. Circuit breaker open with closing springs un- loaded	6
6.2. Circuit breaker open with closing springs loaded	7
6.3. Circuit breaker closed with closing springs un- loaded	8
6.4. Circuit breaker closed with closing springs loaded	8
7. MAINTENANCE AND INSPECTION DURING OPERATION . . .	9
7.1.1. General	9
7.1.2. Cleaning and lubrication	9
7.1.3. Inspection	10A- 10B
8. REPLACEMENTS	11
8.1. General	11
8.2. Replacement of closing springs	11

	<u>PAGE</u>
8.3. Replacement of hand-operated reloading pawl . . .	12
8.4. Repacement of reloading rod	12
8.5. Replacement of trace fitted with reloading springs	13
8.6. Replacement of loading lever complete with pin .	14
8.7. Replacement of limiting contact units	15
9. LIST OF SPARE PARTS	15
9.1. Standard shunt trip	16
9.2. Additional shunt trip	16
9.3. Closing release	17
10. SPECIFIC PARTS AND ILLUSTRATIONS.....	17

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 use it for partial reloading of the closing springs
- they form an entirely protected and isolated 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 types 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 type ER.

The operating mechanisms are designated as follows:

- ER 7 - ERM 7
- ER 8 - ERM 8
- ER 10 - ERM 10

These designs differ with 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.

Time required for automatic reloading of closing springs is less than 10 sec. This makes possible the quick reclosing cycle 0-0 sec.-CO-10 sec.-CO. Additional features of these operating mechanisms are:

- possibility to perform trip free to meet ANSI standard C37.4.
- 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.

1.2.4. Frequency of Operations

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

- 10 consecutive operations with a pause between operations lasting only the time required for loading the operating mechanism springs. After such a series of operations a pause of at least 30 minutes is recommended, to allow cooling of the spring charging motor.
- 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 (Fig. 1)

The mechanism may be operated only if fitted on the breaker it was designed for. Whatever the breaker model, operations are performed in the same way. The following description applies to right-hand horizontal installation (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).

Automatic Loading of closing springs: (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 is released. Closing is signalled by indicator (3) showing letter "C".

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 coils, 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 92lbs.
- Type ERM 106lbs.

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)
 - rear 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) limit contacts (29)
- i) auxiliary contacts (30) (32)
- j) terminal board (31)
- k) shock absorber (33) for closing operation
- l) 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

- a) shunt trip assembly
- b) closing release assembly
- c) Limit contacts for electric indication "springs loaded" - "springs unloaded" (regularly supplied on all types of operating mechanisms)
- d) Auxiliary contacts
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 the operation of the mechanism circuits.
- e) Spring loading motor
Spring loading time: less than 10 sec.
- f) Operations counter (without resetting device)

3. INSPECTION ON ARRIVAL

The operating mechanism is generally supplied already fitted onto its circuit breaker.
In case of separate shipment, its condition should be checked on arrival.

If any damage is ascertained, FEDERAL PACIFIC ELECTRIC 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

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

- 1- Insure that the operating mechanism is in the open position with the closing springs discharged.
- 2- 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.
- 3- Fit the 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 a closing operation immediately followed by an opening operation. On ERM operating mechanism, this is a transitory condition as the geared motor automatically provides for recharging of closing springs after a closing operation.

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 toothless 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 center. 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) 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, this 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 spring 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 overcurrent releases remote from the mechanism.

Opening is induced by release section (45) which, by shifting, turns lever (46) of trace (26), 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 discharged.
- c) to remove cover(10) of the operating mechanism by loosening screws (11) (figs. 1-2)
- d) after inspection ,to refitcover (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

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 (2) Lubrication	○ □					(1) "Cleaning" means removal of dust and excess grease to be performed by means of dry cloth and brushes (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	○ □					

	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
REPLACEMENTS	Closing springs (24) with fittings Closing spring (25) with guide heads (55-59) & 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 MECHANISM NOTE: After 50,000 operations, operating mechanisms should be sent back to FEDERAL PACIFIC ELEC. for overhauling, or else replaced.
 ■ SPECIAL MECHANISM

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 replacement is completed, to refit cover (10) locking it into place by means of screws (11).

NOTE: - When carrying out replacements, NEVER FORGET to replenish lubrication prescribed on Fig. 22.

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 mounting 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 dimension 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 violently 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 channel (61) and remove channel.
- 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 (27A)
- d) lubricate and refit new pawl (27A) and snap ring (63)
- e) remount group (27) onto channel (61) by means of screws (62) and washers (64) positioned as per b)
- f) secure complete channel (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 channel (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.
- i) should the event described under h) not occur, fit two setting screws (68) 8mm. dia. 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 channel (61) and shim only the two screws (62A) (fig. 15) by adding suitable washers.
 Re-tighten screws to the end.

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

Proceed as follows:

- a) unscrew screws (47) completely, 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 4MM 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 4MM screw 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 centers of the holes of the new trace (26) is 196 ± 0.75 mm. Otherwise screw or unscrew threaded stem till required distance is obtained.
- 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) once fitting is completed, remove 4MM screw 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 lever (37) 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 mechanism 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 shock-absorber mounting screws (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 crankshaft (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 mounting 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. LIST OF SPARE PARTS

NOTE: - When spare parts are required, always specify serial 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 DC.

- a) Closing springs group (24) dwg. 127432/801 for ER7 - ERM7 operating mechanism.
- b) Closing springs group (24) - (25) dwg. 127432/801 plus dwg. 130075/001 - 127396/801 - 127399/801 - 131177/002 for ER8 - ERM8 operating.
- c) Closing springs group (24) - (25) dwg. mechanisms 127432/801 plus dwg. 1274536/001 - 127396/801 - 127399/801 - 131177/001 for ER10 - ERM10 operating mechanisms.
- d) Hand-loading pawl (27A) dwg. 130393/801.
- e) Loading rod (36) dwg. 127492/801 (complete with roller cage).
- f) Trace (26) dwg. 127518/802, complete with re-loading springs (75) dwg. 130074/801.
- g) Standard shunt trip (44). Select from 1551A5584.
- h) Additional shunt trip (95) dwg. 127438/801.
- i) Closing release (42). Select from 1551A6824.
- j) Geared motor (28). Select from 1551B6816. Specify voltage.
- k) Limit contacts (29) Dwg. 131475/801.
- l) Anti-pump relay ass'y. Select from 1551B6362.
- m) Auxiliary switch. Select from 1551D6358.
- n) Hand crank adopter - 1551A6954.

9.1. 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). Turn safety plate back over screw heads after tightening.
- b) perform wiring as per wiring diagram, ensuring that cables do not touch moving parts of operating mechanism.
- c) supply shunt trip coil with proper rated voltage and check that it works properly.

9.2. Additional shunt trip (95) (Fig. 23)

For fitting or replacement, proceed as follows:

- a) secure shunt trip (95) to front plate (20) via screws (96) with safety plate (97). Turn safety plate 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 proper rated voltage and check that it works properly.

9.3. Shunt close 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). Turn back safety plate over screw heads after tightening.
- b) wire as per wiring diagram ensuring that cables do not touch moving parts of operating mechanism
- c) supply shunt close coil with proper rated voltage and check that it works properly.

10. SPECIFIC PARTS AND ILLUSTRATIONS (see figs. 1 to 23)

- 1) Opening knob
- 2) Closing knob
- 3) Mechanical "open" (O) and "closed" (C) signalling device
- 4) Opening for spring loading crank
- 5) Operations counter, without resetting device
- 6) Spring loading crank
- 7) Mechanical springs "loaded" (yellow) and "unloaded" (white) signalling device
- 10) Case
- 11) Case securing screws
- 12) Spacer for securing as per item 14 (fig. 2)
- 13) Securing with 4 holes 10mm dia.
- 14) Securing with 4 holes 8mm dia. (as an alternative to item 13) (fig. 2)
- 15) Outlet for signalling contacts cables
- 16) Main shaft
- 17) Control cables outlet
- 18) Release shaft
- 19) Pedal-operated release
- 20) Front plate
- 21) Intermediate plate
- 22) Bottom plate
- 23) Crankshaft
- 24) Standard closing springs set

- 25) Additional closing spring
- 26) Trace
- 27) Camshaft for hand-loading
- 27A) Hand-loading pawl
- 28) Geared motor
- 28A) Electric-loading pawl
- 29) Limit contacts
- 31) Terminal board
- 32) Auxiliary contacts
- ✓ 33) Closing shock-absorber
- 34) Brake
- 35) Gear wheel
- 36) Loading rod
- 37) Loading lever
- 38) Main shaft
- 39) Main closing hook
- 40) Roller
- 41) Closing hook
- 42) Closing release
- 43) Lever
- 44) Shunt trip
- 45) Release section
- 46) Trace lever
- 47) Closing springs securing screws
- 48) Contacts securing screws
- 49) Cotter pin for stud (50)
- 50) Stud for plugging closing springs group (24)
- 51) Cam
- 52) Stem for limiting contacts (29)
- 53) Staple securing screws (54)
- 54) Staple
- 55) Guide head
- 56) Snap ring
- 57) Pin
- 58) Washer
- 59) Guide head
- 60) Channel securing screws

- 61) Channel
- 62)-62a) Screws
- 63) Snap ring
- 64) Washers
- 65) Spring
- 66) Spacer
- 67) Holes for adjusting screws (68)
- 68) Adjusting screws
- 69) Cotter pin for stud (70)
- 70) Stud for plugging loading rod (36)
- 71) Washer
- 72) Snap ring
- 73) Washer
- 75) Trace (26) loading springs
- 76) Washer spacer for ERM10 - ER10
- 77) Spacer for ERM8 - ER8
- 78) Pin
- 79) Cotter pin
- 80) Washer
- 81) Pin
- 82) Stud
- 83) Spacer
- 84) Washer
- 85) Tang
- 86) Washer
- 87) Washer
- 88) Washer
- 89) Elastic pin
- 90) Nuts for securing limit contacts
- 91) Key
- 93) Screws for Item 44
- 94) Safety plate
- 95) Additional shunt trip
- 96) Screws for Item 95
- 97) Safety plate
- 98) Screws for Item 42
- 99) Safety plate

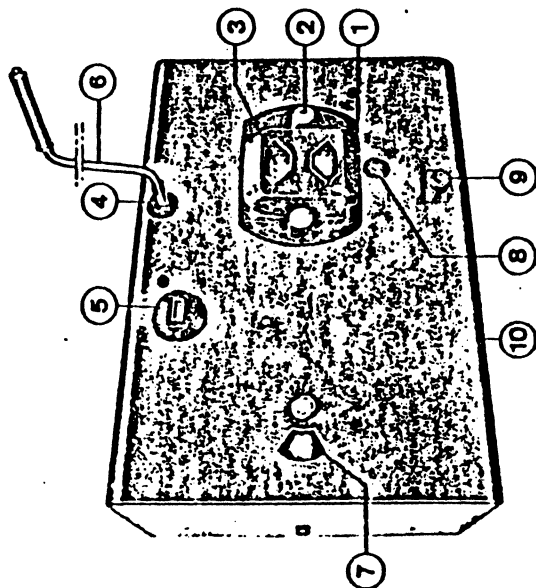


Fig. 1

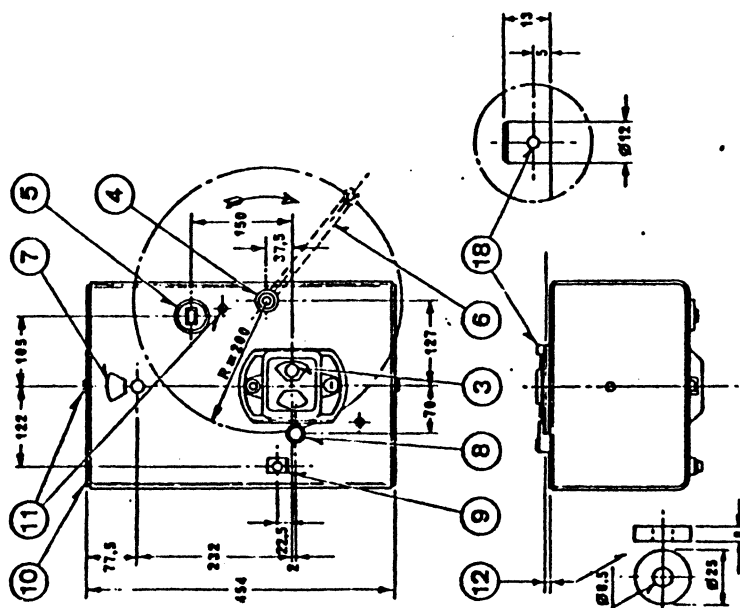
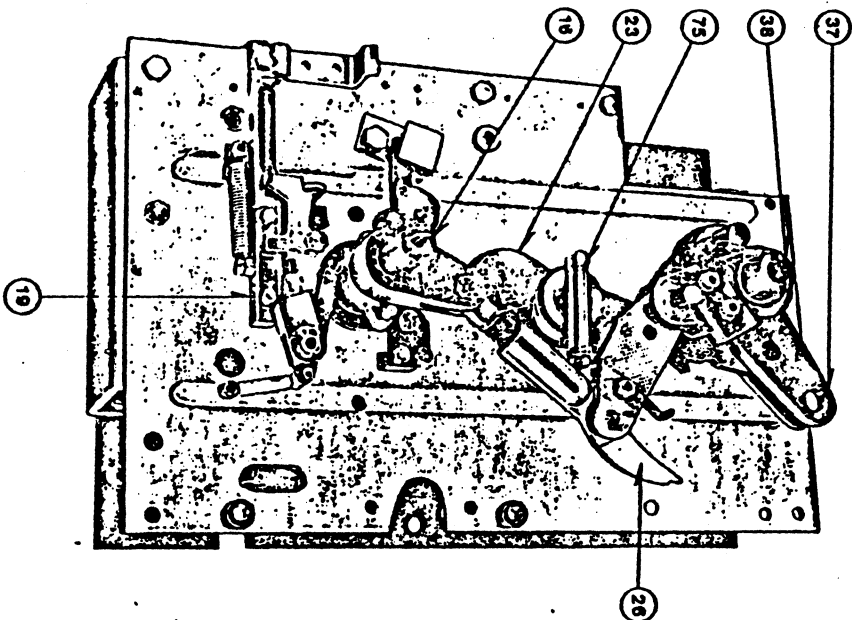


Fig. 2

CAPTION

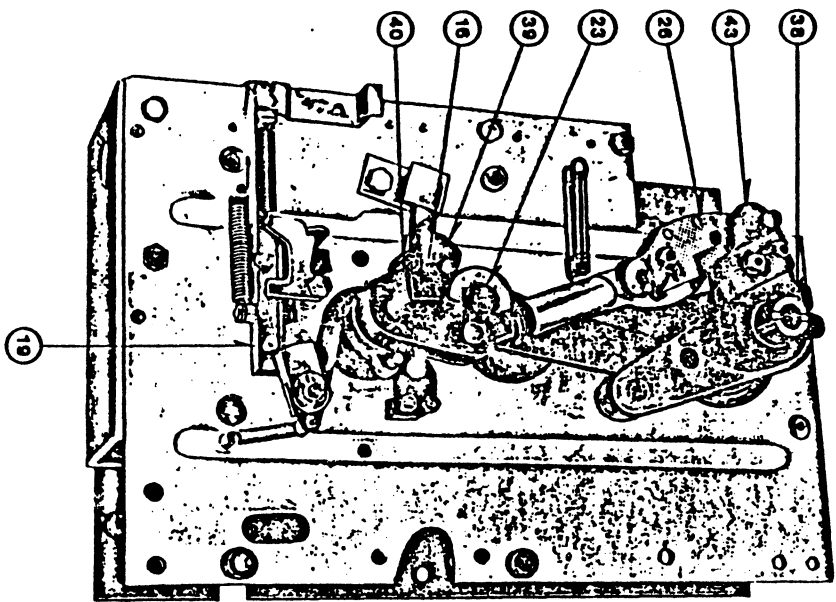
- 1) Opening knob
- 2) Closing knob
- 3) Mechanical "open" (O) and "closed" (C) signalling device
- 4) Opening for springs loading crank
- 5) Operations counter, with-out resetting device
- 6) Springs loading crank (yellow) and "unloaded" (white) signalling device
- 7) Mechanical "open" (O) and "closed" (C) signalling device
- 8) Main shaft
- 9) Control cables outlet
- 10) Pedal-operated release
- 11) Case securing screws
- 12) Spacer for securing as per Item 14 (fig. 2)
- 13) Securing with 4 holes Ø M10
- 14) Securing with 4 holes Ø M 8 (alternative to Item 13) (fig. 2)
- 15) Outlet for signalling contacts cables
- 16) Main shaft
- 17) Control cables outlet
- 18) Release shaft
- 19) Pedal-operated release

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



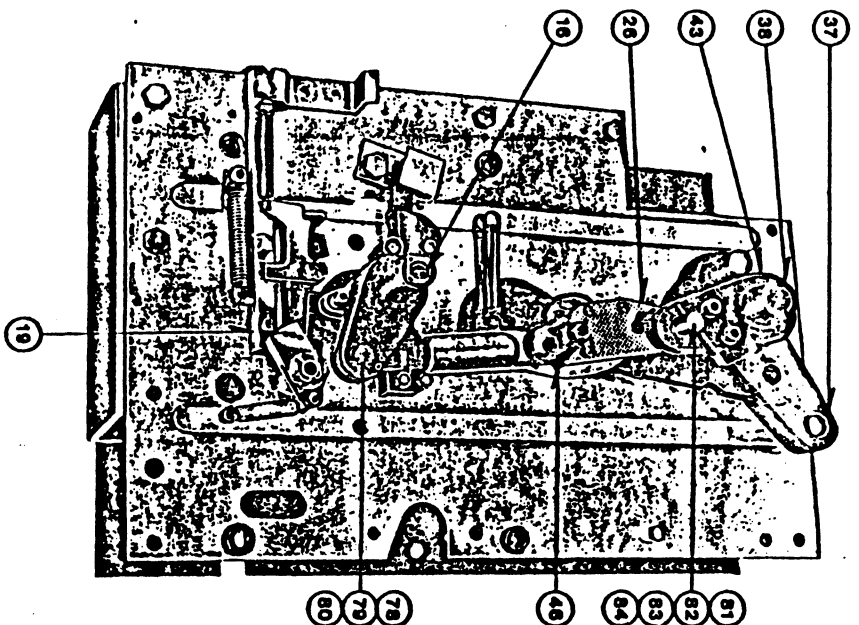
- 16) Main shaft
- 19) Pedal-operated release
- 23) Crankshaft
- 26) Trace
- 37) Loading lever
- 38) Main shaft
- 75) Trace (26) loading springs

Fig. 3



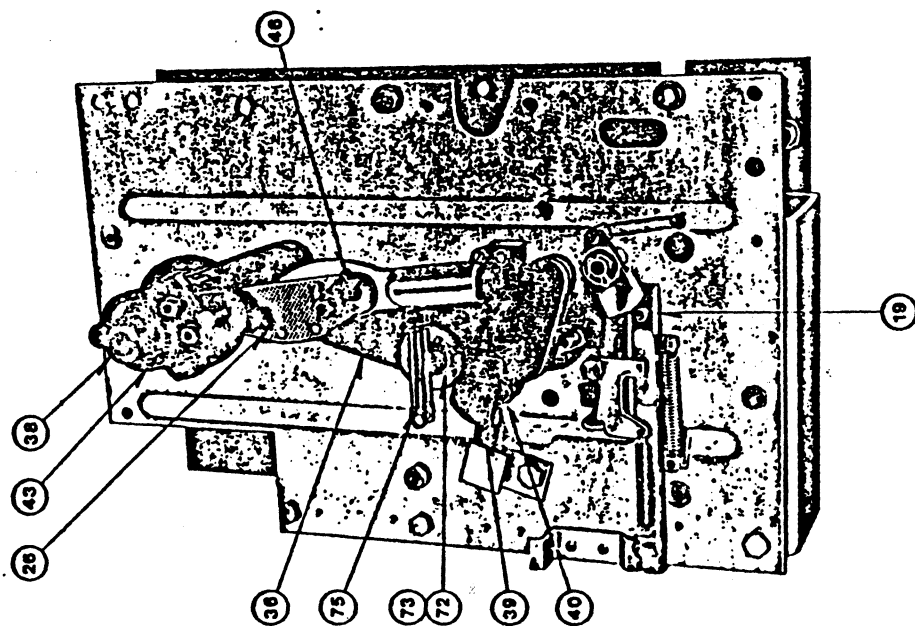
- 16) Main shaft
- 19) Pedal-operated release
- 23) Crankshaft
- 26) Trace
- 38) Main shaft
- 39) Main closing hook
- 40) Roller
- 43) Lever

Fig. 4



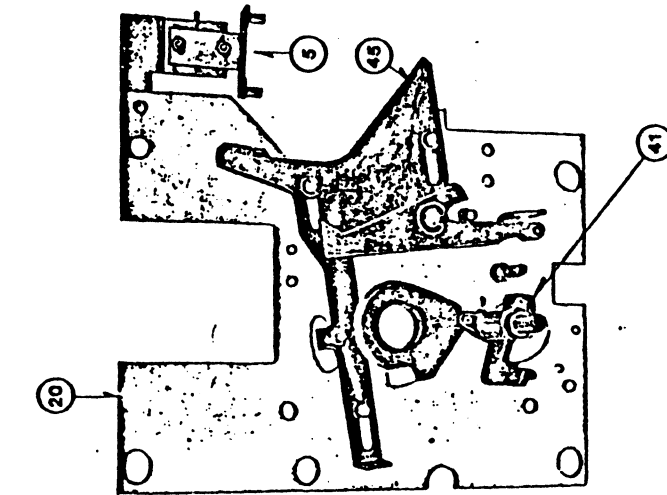
- 16) Main shaft
- 19) Pedal-operated release
- 26) Trace
- 37) Loading lever
- 38) Main shaft
- 43) Lever
- 46) Trace lever
- 77) Spacer for ERM6-ER8
- 78) Pin
- 79) Cotter pin
- 80) Washer
- 81) Stud
- 82) Pin
- 83) Spacer
- 84) Washer

Fig. 5



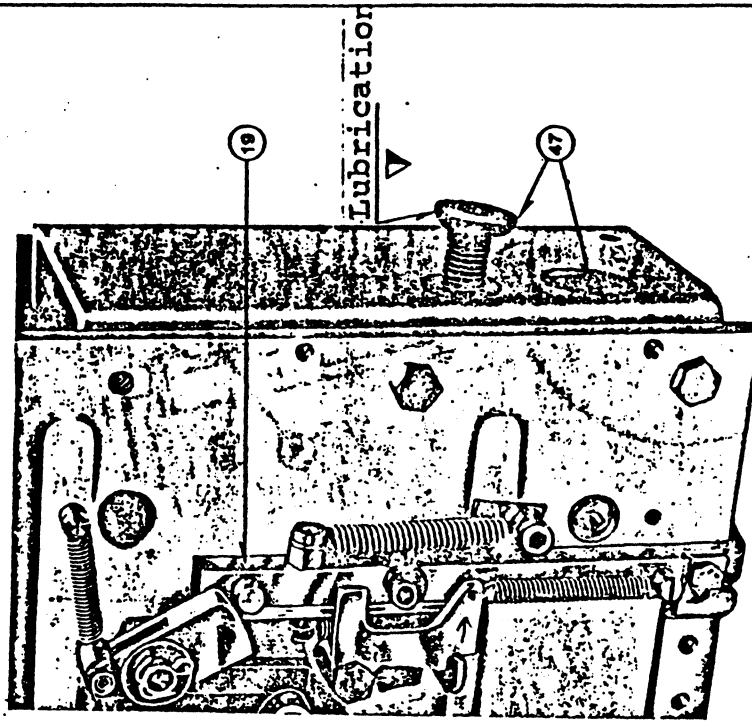
- 19) Pedal-operated release: 43) Lever
 26) Trace 46) Trace lever
 36) Loading lever 72) Snap ring
 38) Main shaft 73) Washer
 39) Main closing hook 75) Trace (26) reloading
 40) Roller springs

Fig. 6



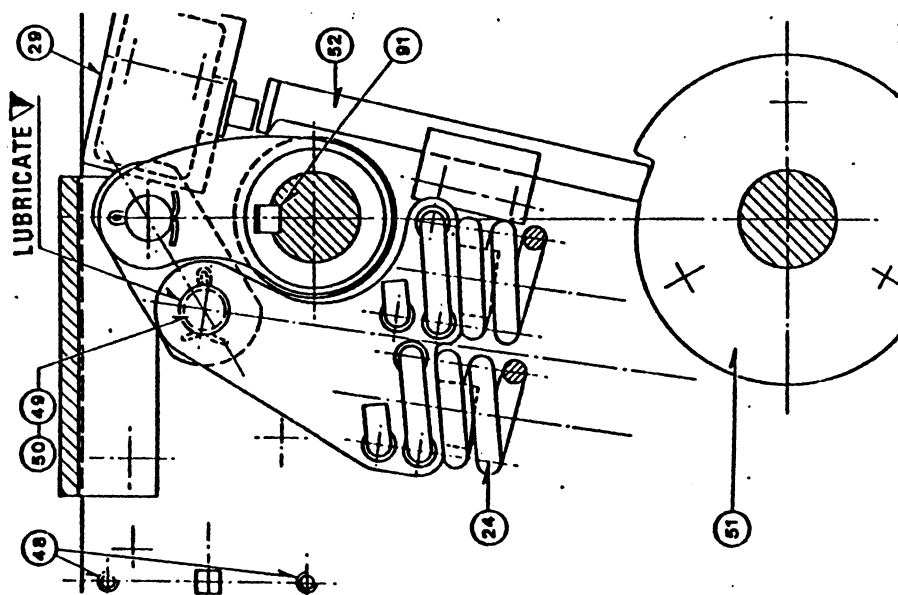
5) Operations counter, without resetting device
 20) Front plate
 41) Closing hook
 45) Hook section

Fig. 7



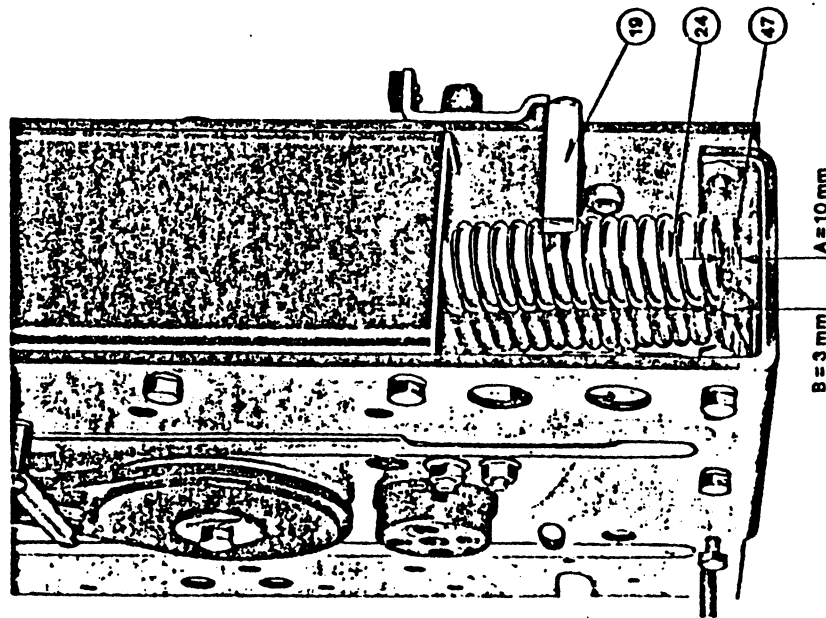
19) Pedal-operated release
 47) Closing spring securing screws

Fig. 8



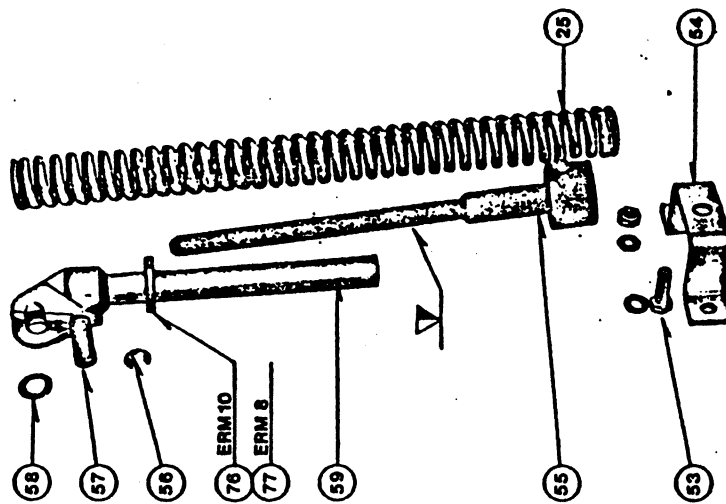
24) Standard closing springs 50) Stud for plugging closing springs set (24)
 29) Limit contacts 51) Cam
 48) Contacts securing screws 52) Stem for limit contacts (29)
 49) Cotter pin for stud (50) 91) Key

Fig. 9



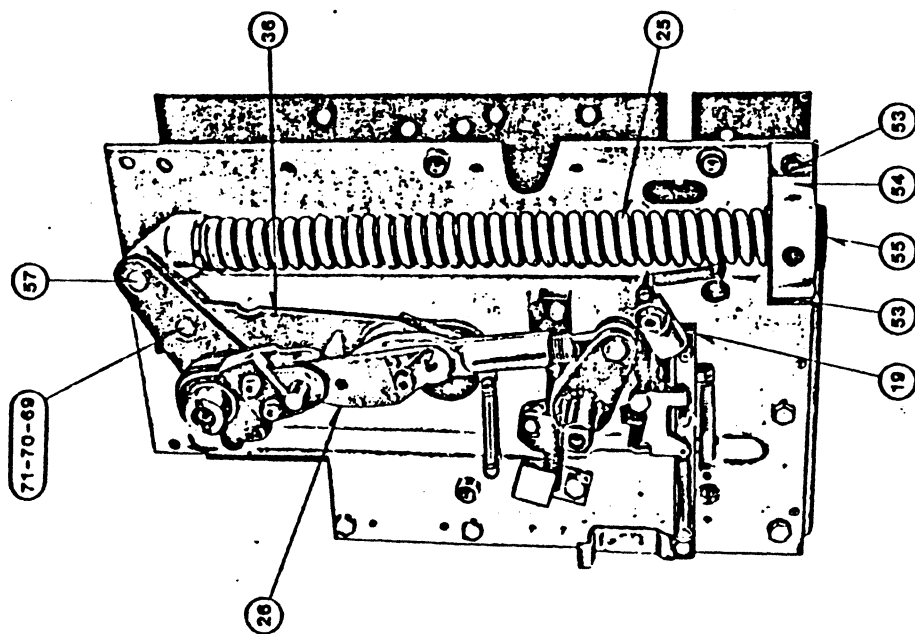
- 19) Pedal-operated release
- 24) Standard closing springs set
- 47) Closing springs securing screws

Fig. 10



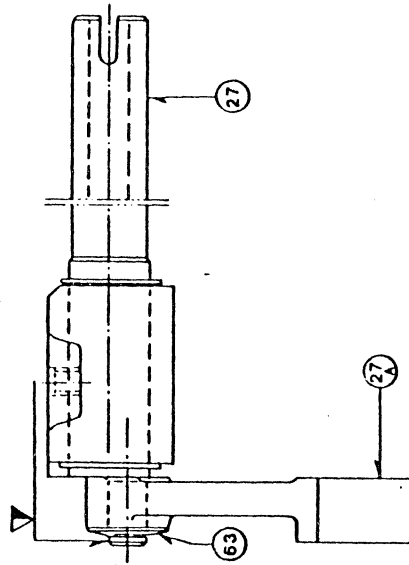
- 25) Additional closing spring
- 53) Staple (54) securing screws
- 54) Staple
- 55) Guide head
- 56) Snap ring
- 57) Pin
- 58) Washer
- 59) Guide head
- 76) Washer spacer for ERM10-ER 10
- 77) Spacer for ERM8 - ERM8

Fig. 11



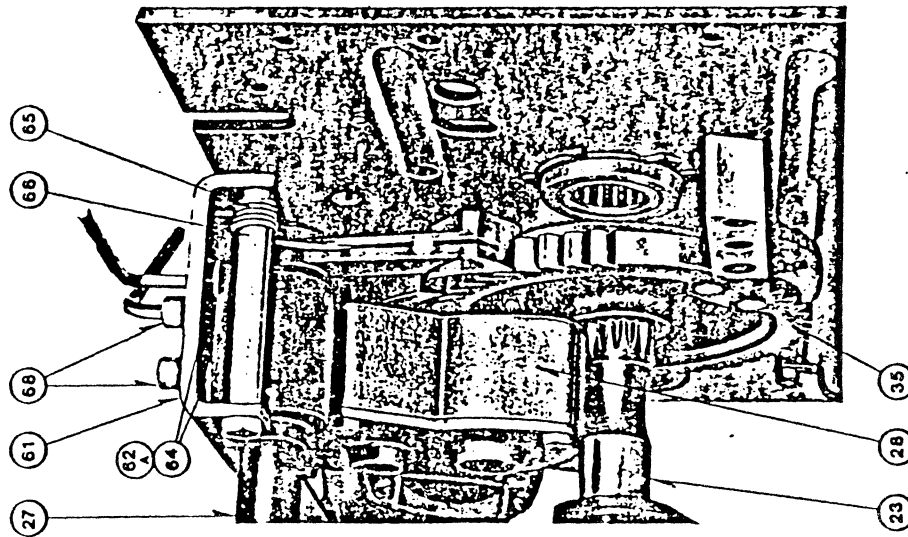
- 19) Pedal-operated release
- 25) Additional closing spring
- 26) Trace
- 36) Loading rod
- 53) Staple (54) securing screws
- 54) Staple
- 55) Guide head
- 57) Pin
- 69) Cotter pin for stud (70)
- 70) Stud for plugging loading rod (36)
- 71) Washer

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

Fig. 14

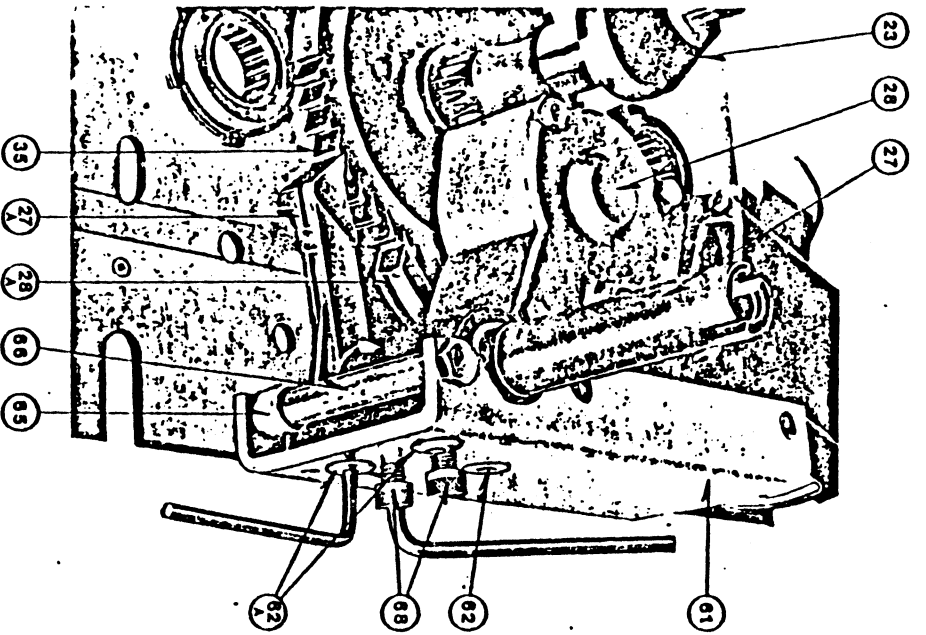
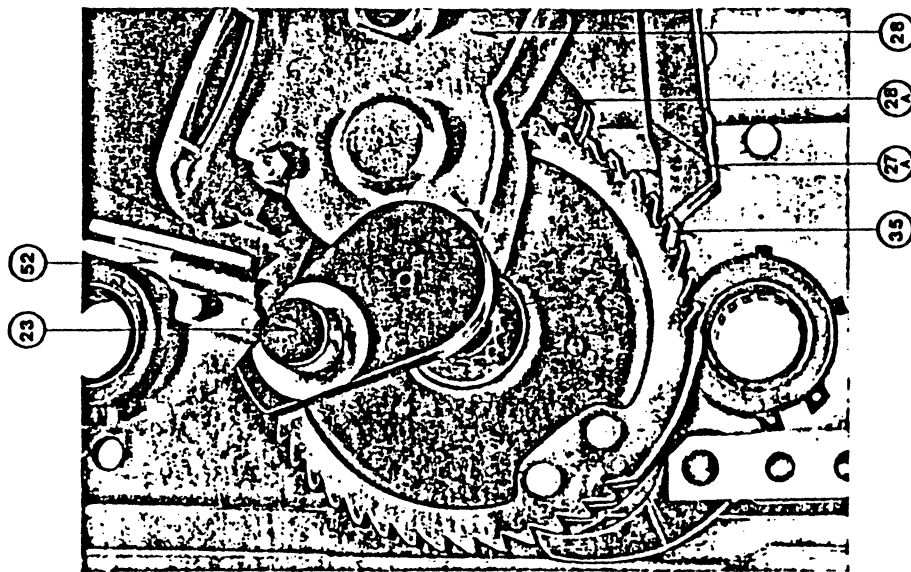


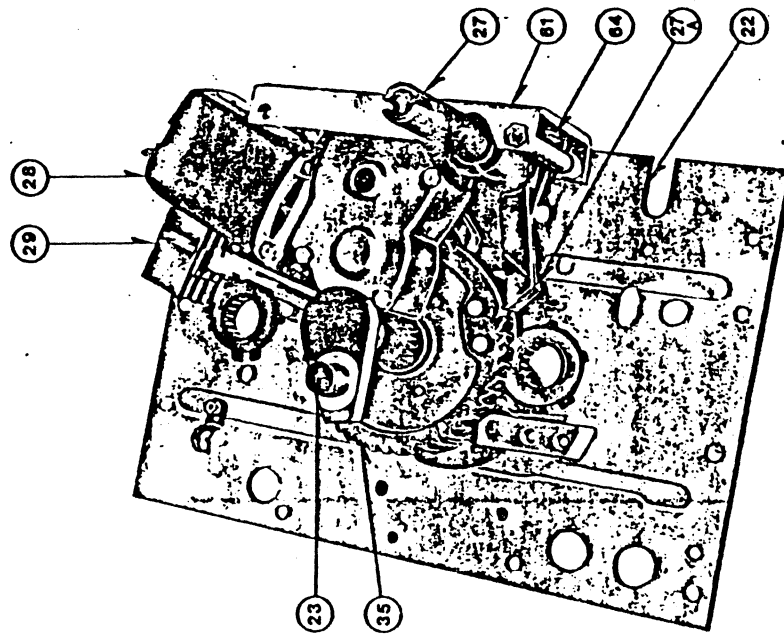
Fig. 15

- 23) Crankshaft
- 27) Camshaft for hand-loading
- 27A) Hand-loading pawl
- 28) Geared motor
- 28A) Electric-loading pawl
- 35) Gear wheel
- 61) Screws
- 62) Spring
- 65) Spacer
- 66) Adjusting screws
- 68) Adjusting screws



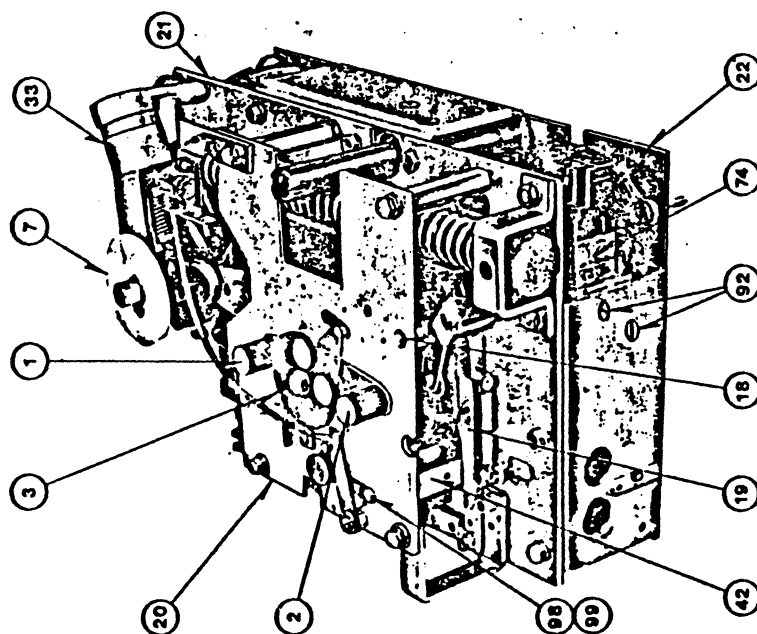
- 23) Crankshaft
- 27A) Hand-loading pawl
- 28) Geared motor
- 28A) Electric-loading pawl
- 35) Gear wheel
- 52) Stem for limit contacts (29)

Fig. 16



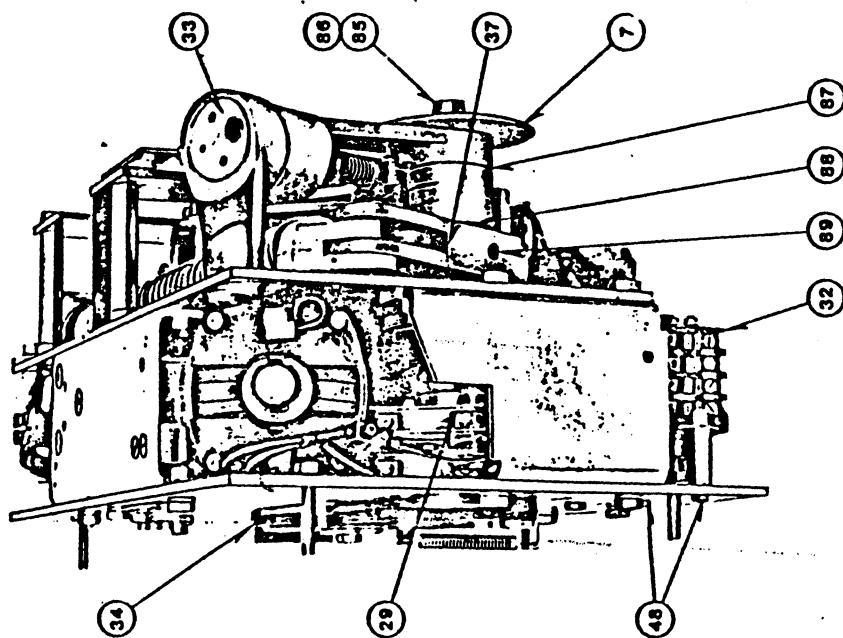
- 22) Bottom plate
- 23) Crankshaft
- 27) Camshaft for hand-loading
- 27A) Hand-loading pawl
- 28) Geared motor
- 29) Limit contacts
- 35) Gear wheel
- 61) Washers
- 64) Washers

Fig. 17



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

Fig. 18



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

Fig. 21

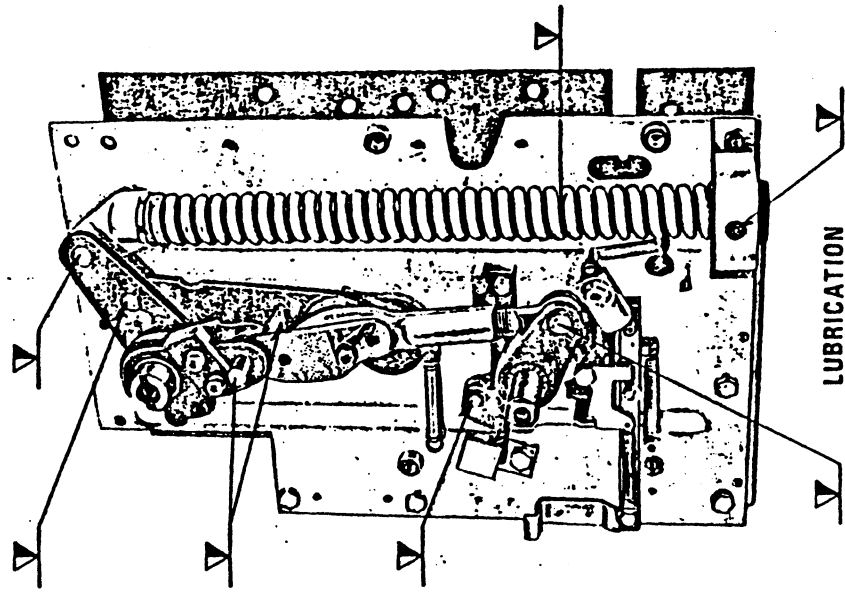
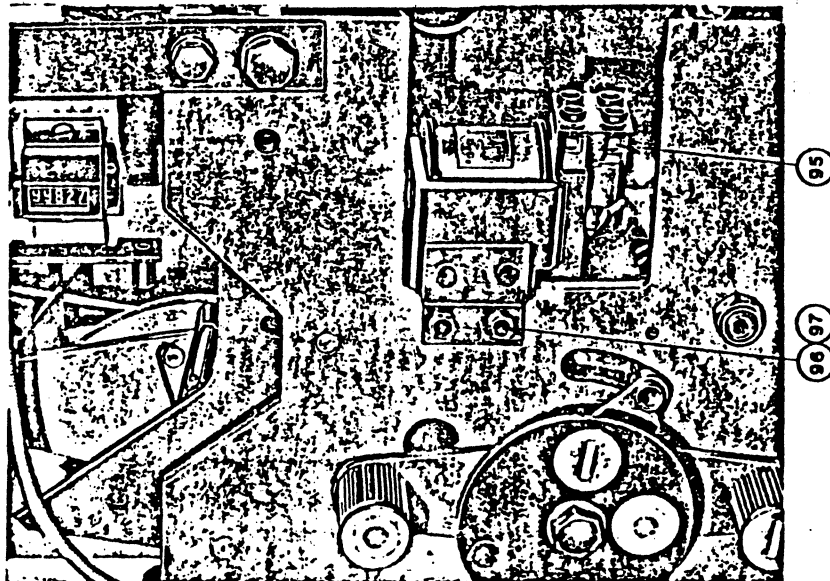


Fig. 22



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

Fig.