Chapter 2

MEA SUBSTATIONS

Metropolitian Electricity Authority (MEA) recieves electrical power from Electricity Generating Authority of Thailand (EGAT) in the form of 3 phases 3 wire 69 kv.system. This power, which is generated from many sources such as dams, gas turbines, steam turbines and diesel plants, is transmitted to the MEA substations. From these substations the voltage is transformed to suitable level as 220 volt and then distributed to the people and factories throughout the metropolitan area.

The Metropolitan area are compossed of four provinces combined together. They are Greater Bangkok (Bangkok & Thonburi), Nonthaburi, Samuthprakal and some part of prathumthany. All substations of MEA are scatteringly located in these area.

In MEA system, the substations are classified according to their operation, into 3 types, they are

1. Terminal substations. This kind of substations receives 3 phase-3 wire-69kv power system from EGAT's power plants that are installed side by side with them and distributes this power to other substations along main transmission

lines. Some part of 69kv. power is transformed to 12kv system by their local 69/12 kv. transformers. This 12kv power will be distributed to the customer's factories and 12000/380v. transformers for house hold appliances. These substations are named as the places they are located as

1. North Bangkok. (N)
2. South Bangkok. (SK)
3. Bangkok Noi (K)
4. Bangkapi (B)

2. Switching substation. This type of substation receives 3 phares-3 wire- 69kv. power system from 2 or 3 distant EGAT's power station and transmits this power to other substations and 69kv. customer's factories, especially for steelwork factories. Some part of 69kv. power is also transformed to 12kv. power in the same way as done from the terminal substations. There is only one such substation at Samrong.

3. Distribution Substations These kind of substations receive 3 phases-3 wires- 69kv. powerfrom terminal andswitching substations and transformed this power by 69/24 kv. or 69/12kv. transformers to the 24kv or 12kv respectively for customer's factories and 12000/380 transformers for household uses. There are 24 --

substations which classified in this type as follows.

1. Paknam (R)
2. Phra Pradaeng (Q)
3. Tongkung (TK)
4. Rasburana (RN)
5. Bangna (BG)
6. Mahamek (MM)
7. Phrakanong (P)
8. Lumpini (L)
9. Thonburi (T)
10. Bang-Yee-Khan (SY)
11. Sapandam (SD)
12. Patumwan (PM)
13. Makasan (MS)
14. Sansab (SS)
15. Ramintra (RT)
16. Mochit (M)
17. Samsen (S)
18. Bangsue (BS)
19. Nonthaburi (NR)
20. Donmuang (D)
21. Bang pood (BD)
22. Rangsit 1 (RS 1)
23. Rangsit 2 (RS 2)

24. Watlieb (W)

The locations of all types of substation are shown in the map of Figure 1.

A substation is equiped with the following high voltage equipments: (Fig 3)

1. Oil Circuit Breakers (OCB)
2. Power Transformers
3. Potential transformers.(PT)
4. Current Transformers (CT)
5. Knife Switches
6. Bus bars.
7. Protective Relays.
8. Control Boards.

et.c.

These equipments are operated by men in the substation as ordered by the load dispatching center. The operations are :-

1. To close or trip the oil circnit breaker
2. To change the taps of the transformers.
3. To adjust the protective relay.
4. To open and close the knife switches.

etc.

All are done manually.

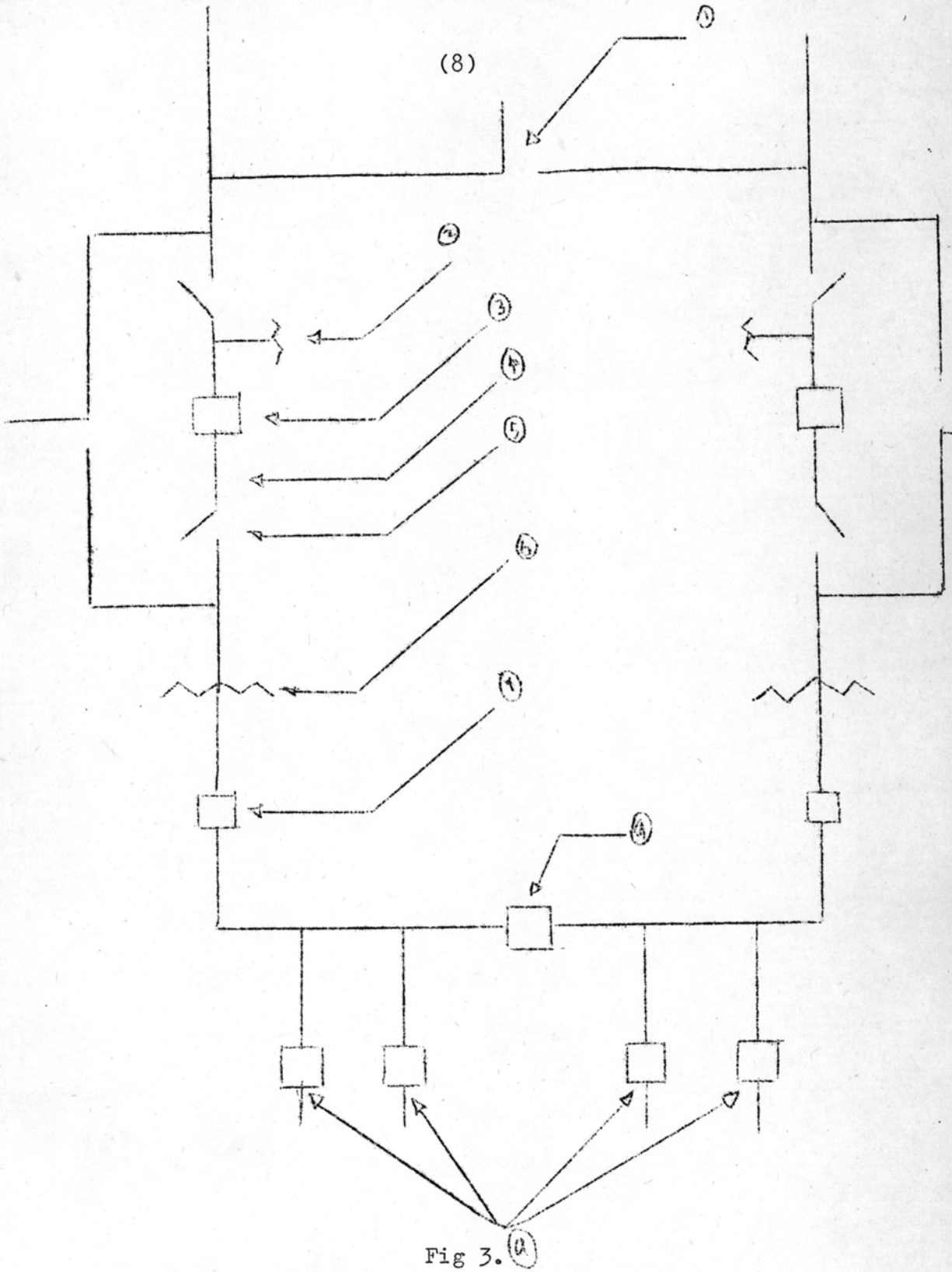

Fig 3.

Single Line Diagram Showing Locations of Equipments in a Substation.

1. Knife switch normally open.
2. Potential transformer.
3. 69kv. Oil circuit breaker.
4. Current transformer.
5. Knife Switch normally closed.
6. 69/12 or 69/24 kv. power transformer.
7. 12 kv.oil circuit breaker (Incomming)
8. 12 kv.oil circuit breaker (Bus section)
9. 12 kv.oil circuit breaker (Feeder)

2.1General Functions of the Substation Operators,

As previously described, the main duty of the substation operator is to operate the high voltage equipments, to report the load to the load dispatching center. When some faults occur in the transmission system, the protective relays will send the signals to trip the circuit breakers in orderto protect the system from damage, due to the rapid increasing of the short circuit current. It is also the duty of the operator to report the things such as;

1. What kind of faults occur, it may be
   a. Earth fault
   b. Over current
   c. Neutral displacement
   et c.
2. And the details of each fault such as;
   a. Which phase that fault occurs
   b. It occurs which side, time or instantaneous.
3. The number of oil circuit breaker tripping due to permanent faults or temporary faults.
4. The difference of load before and after the faults .

The details of the faults reported will be used in making decision of the load dispatching center in order to

maintain the system stability and to keep the system going on.

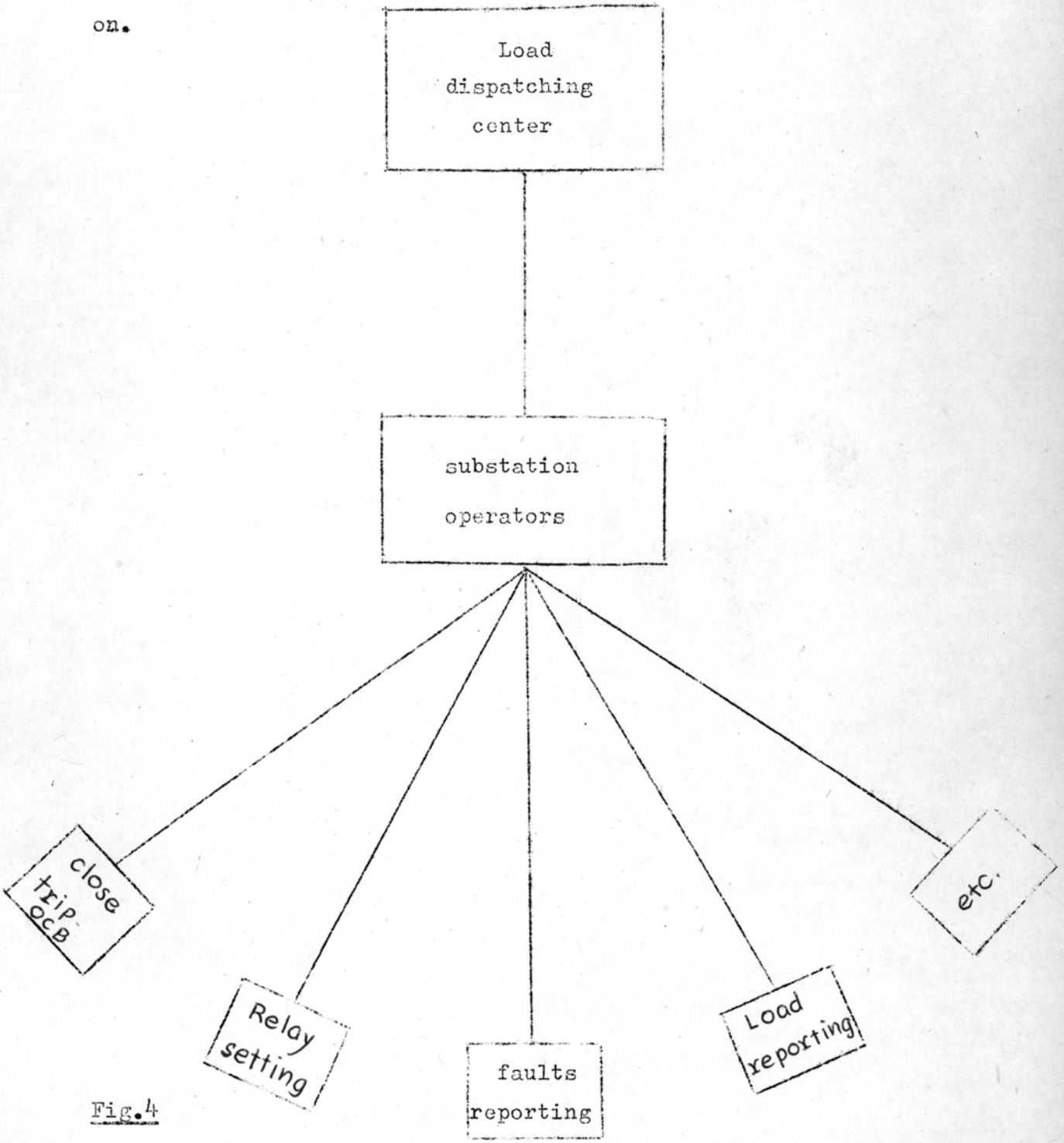

Fig.4

The diagram showing the General Functions of the Substation operator

2.2 Switching Operation

Another important duty of the substation operator besides the load reporting is the switching operation. Switching operation is the sequential operation in closing and tripping of oil circuit breakers and knife switches in order to control the electrical power. Consider Fig 5, it is the single line diagram of a substation composed of

2 - 69 kv. incomming lines.

2 - oil circuit breakers 69 kv. (2)

2 - 69/12 kv. Power transformer (5)

2 - incomming ocB 12 kv. (6)

1 - bus sectionalising (7)

4 - OCB. 12 k feeders (8), (9), (10), (11)

Suppose that the OCB 69 kv. (2) must be repaired, and the power transmission of the system must be maintained, the switching operation of this system must be in this manner.

1. Close the knife switch (4) Which used as by-pass switch for 69 kv. power.

2. Open the knife switches (1) and (3)

3. Trip the oil circuit breaker (2)

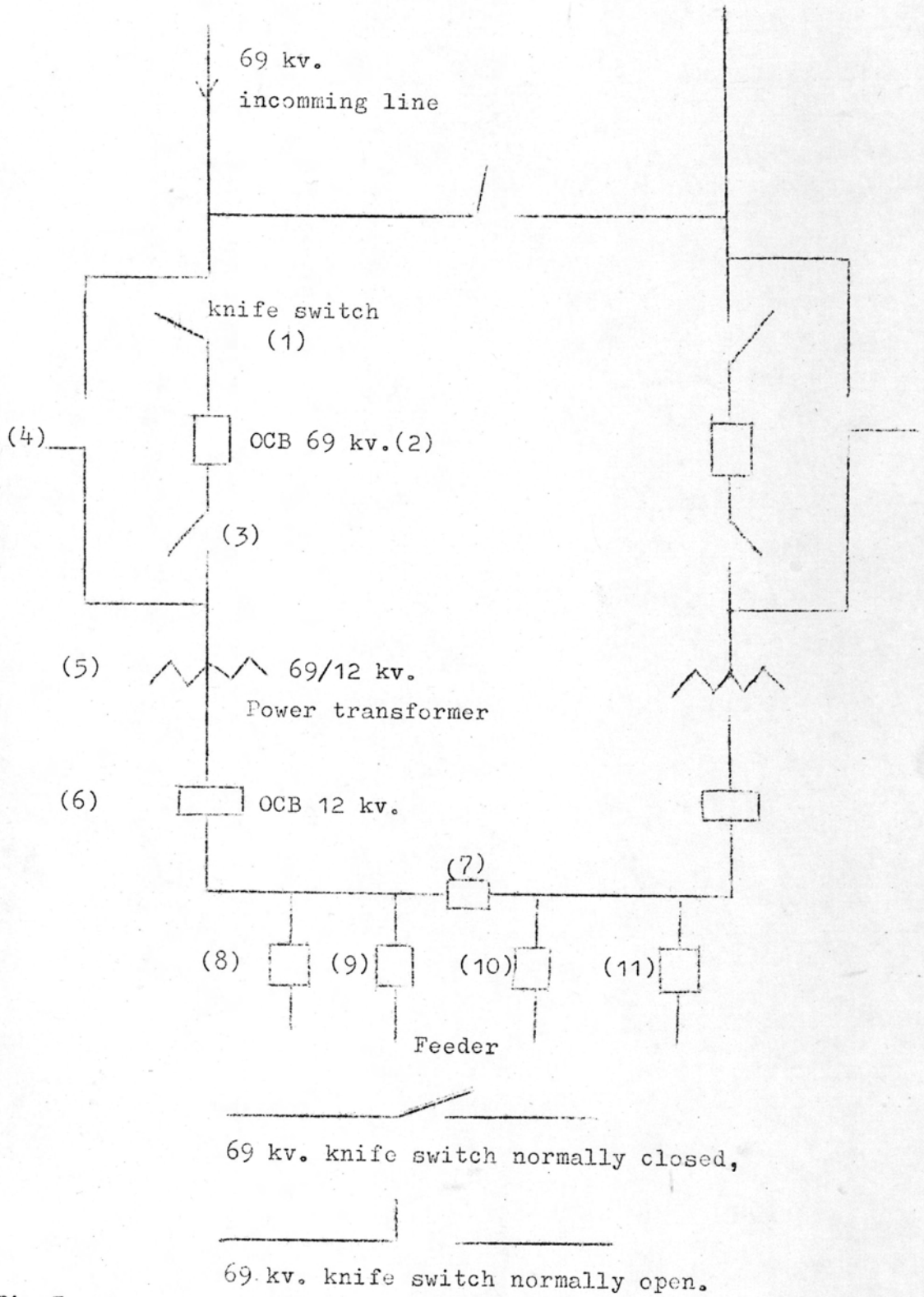

Fig 5. The single line diagram of a substation

The electrical power flows from the incomming line through the by-pass switch (4) to the power transformer, none of 69 kv. power flows to the oil circuit breaker (2) and it can be repaired. When the repair of OCB is finished the switching is done in backward order such as.

1. Close the OCB (2)
2. Close the knife switches (1) and (3)
3. Open the by-pass switch (4)

and the system is put in normal condition.