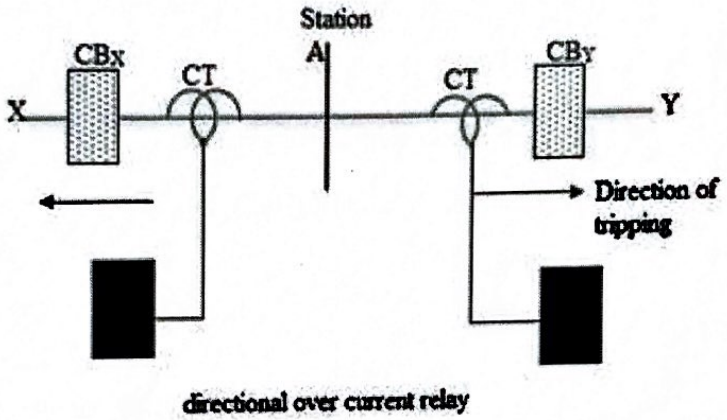
Directional Over Current Relay

This is also a special type of over current relay with a directional features. This directional over current relay employs the principle of **actuation of the relay**, when the fault current flows into the relay in a particular direction. If the power flow is in the opposite direction, the relay will not operate. Normally, the **conventional over current relay** (non-direction) will act for fault current in any direction.

The *directional over current relay* recognizes the direction in which fault occurs, relative to the location of the relay. The principle of directional protection is as under:



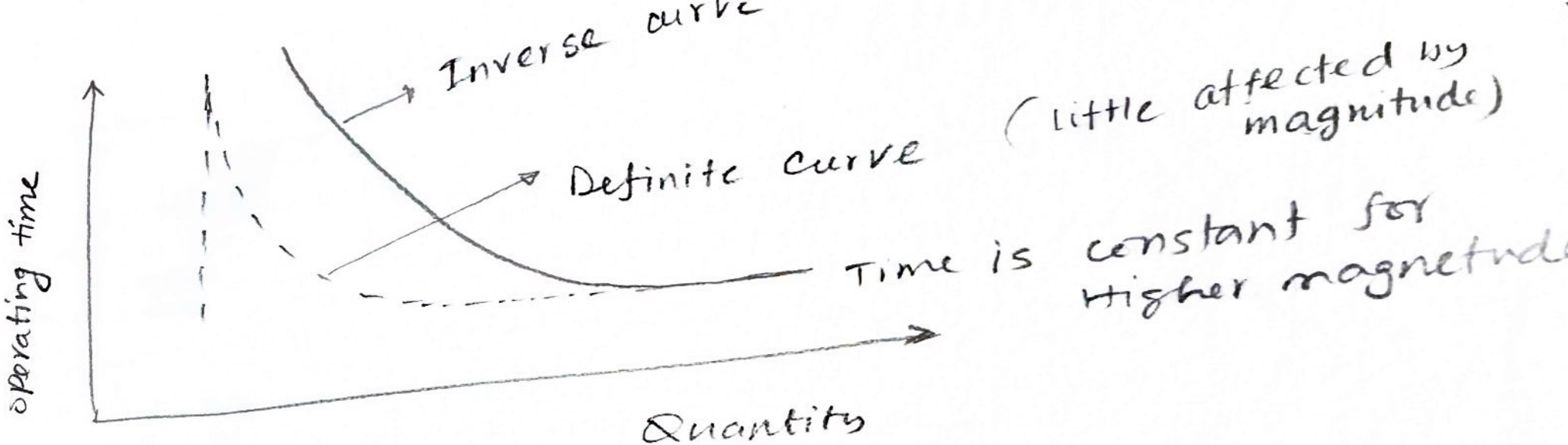
directional over current relay

Consider a feeder XY, passing through station A. The circuit breaker in feeder AY is provided with a directional relay R, which will trip the breaker CB_y, if the fault power flow is in the direction AY alone. Therefore, for faults in feeder AX, the **circuit breaker** CB_y, does not trip unnecessarily. However, for faults in feeder AY, the circuit Breaker CB_y trips, due to direction feature of the relays, set to act in the direction AY. This type of relay is also called **reverse power relay**, So far as the direction of fault current (power) flow is concerned.

Reverse power flow relays with directional features, not only senses the direction flow, but also measures magnitude of power flow.

Directional Relay Connections

Whenever a near or close-up fault occurs, the voltage becomes low and the directional relay may not develop sufficient torque for its operation. To get sufficient torque during all types faults, irrespective of locations with respect to relays, the relays connections are to be modified. Each relay is energized by current from its respective phase and voltage. One of the methods of such connections is 30° connection and other is 90° connection.



operating time Vs magnetude of actuating Quantity

1. **Instantaneous over current relay.** no intentional time lag and operate in less than 0.1 second

2. **Definite time over current relay.** Time of operation almost definite
$I^0t = K$

3. **Inverse time over current relay.** — IDMT, VIT, EIT

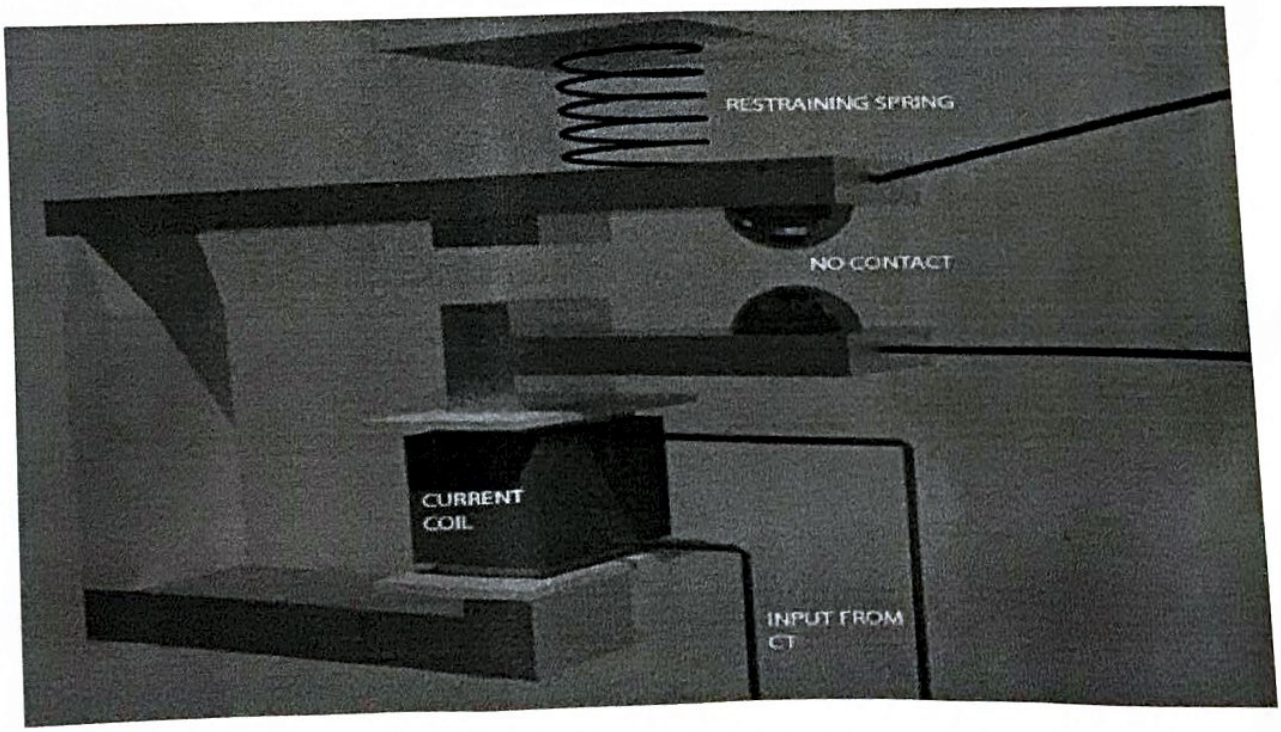
$I^1t = K$

In more inverse time, $I^nt = K$ $[n = 2-8]$

Inverse time over current relay or simply inverse OC relay is again subdivided as inverse definite minimum time (IDMT), very inverse time, extremely inverse time over current relay or OC relay.

Instantaneous Over Current Relay

Construction and working principle of **instantaneous over <u>current</u> relay quite simple.**



Over Current Relay- Working Principle Types

In an over current relay or o/c relay the actuating quantity is only current. There is only one current operated element in the relay, no voltage coil etc. are required to construct this protective relay.

Working Principle of Over Current Relay

In an over current relay, there would be essentially a current coil. When normal current flows through this coil, the magnetic effect generated by the coil is not sufficient to move the moving element of the relay, as in this condition the restraining force is greater than deflecting force. But when the current through the coil increased, the magnetic effect increases, and after certain level of current, the deflecting force generated by the magnetic effect of the coil, crosses the restraining force, as a result, the moving element starts moving to change the contact position in the relay.

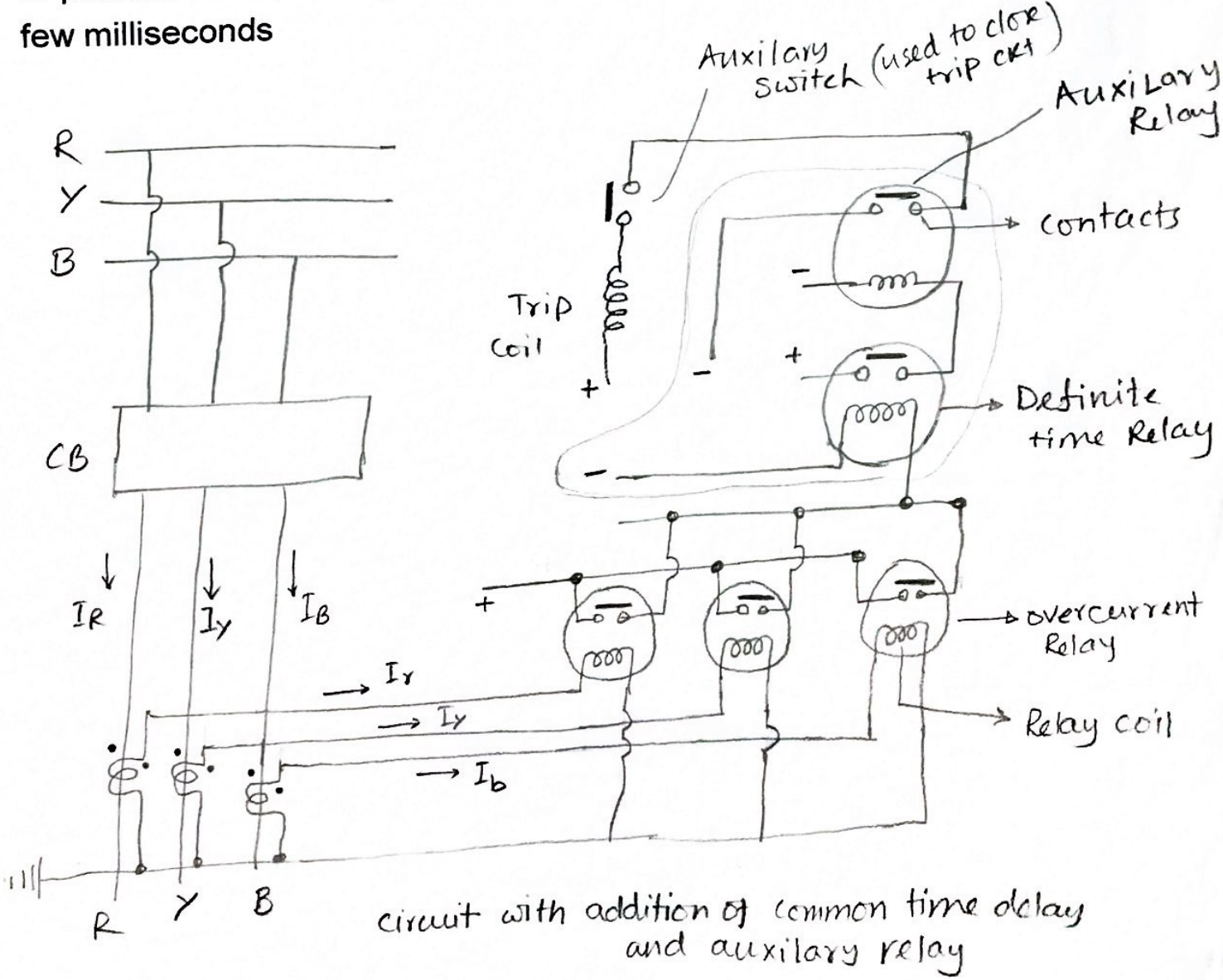
Although there are different **types of over current relays but basic working principle of over current relay** is more or less same for all.

Types of Over Current Relay

Depending upon time of operation, there are various **types of OC relays**, such as,

Here generally a magnetic core is wound by current coil. A piece of iron is so fitted by hinge support and restraining spring in the relay, that when there is not sufficient current in the coil, the NO contacts remain open. When current in the coil crosses a present value, the attractive force becomes sufficient to pull the iron piece towards the magnetic core and consequently the No contacts are closed.

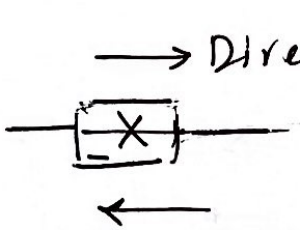
The preset value of current in the relay coil is referred as pick up setting current. This relay is referred as instantaneous over current relay, as ideally, the relay operates as soon as the current in the coil gets higher than pick up setting current. There is no intentional time delay applied. But there is always an inherent time delay which can not be avoided practically. In practice the operating time of an instantaneous relay is of the order of a few milliseconds

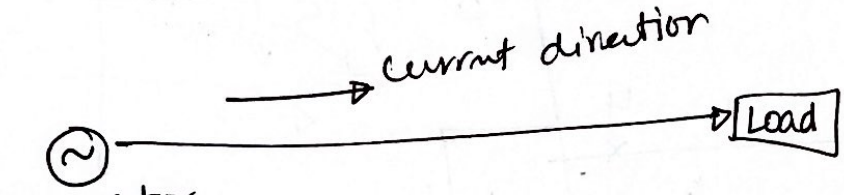


circuit with addition of common time delay and auxilary relay

Which will only

Directional Relay operate when current flows in a particular direction and no operate if current flows in other direction





generator which supplies power to the Load

But if generator absorb power from Load or Load create a current flow in the opposite direction there is fault.

In overcurrent relay if the current is above Pick up value, the relay will work.

Direction of current is reverse or not reverse can be observed based on the fault occurance.

when a fault occur entire current, going to the fault. from every possible source

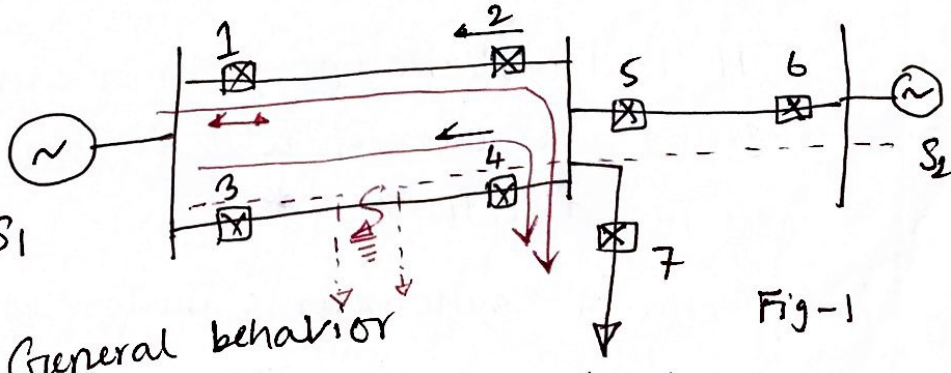


Fig-1

General behavior

when fault occur current sigh -------

Load

for (2)

at the Relay ① and ② we need a directional from right to left

In general operation time or at the fault occurance time current will exist the source. so we need non-directional relay at ③ & ①

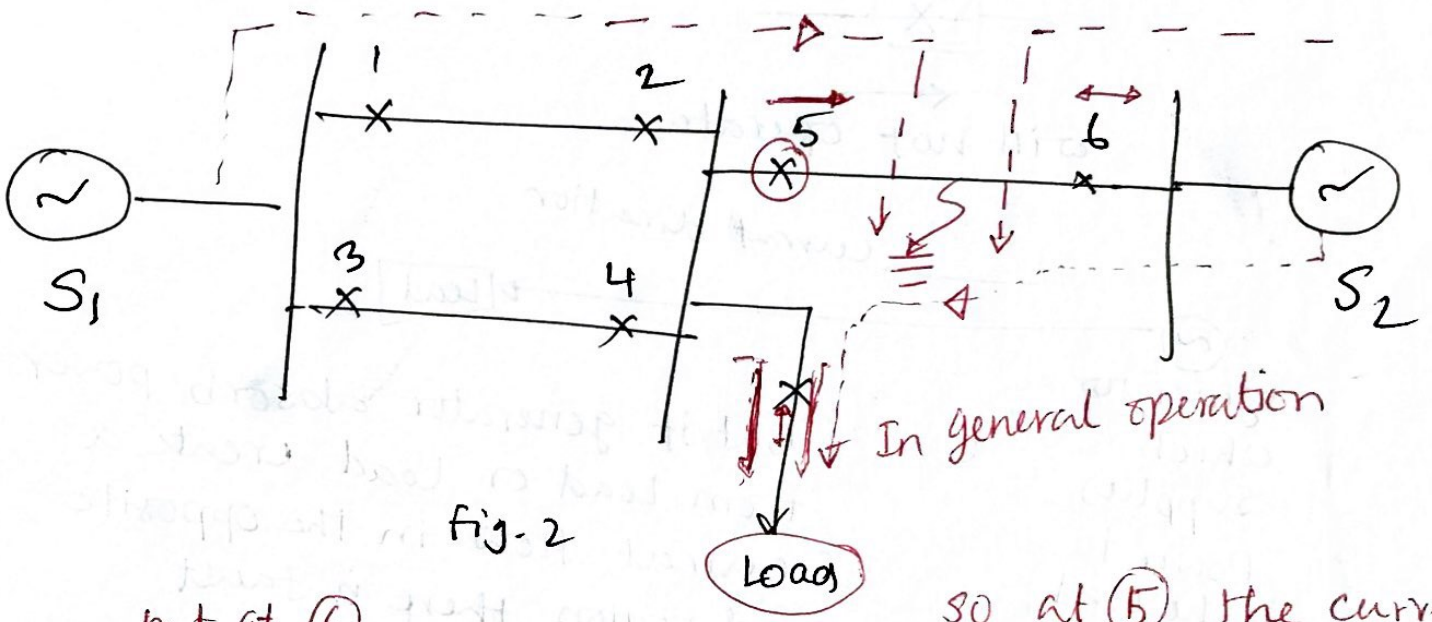


fig. 2

but at ⑥ both current in the same direction so a non directional relay is placed there

so at ⑤ the current is in the reverse direction so a directional relay need to be placed at ⑤

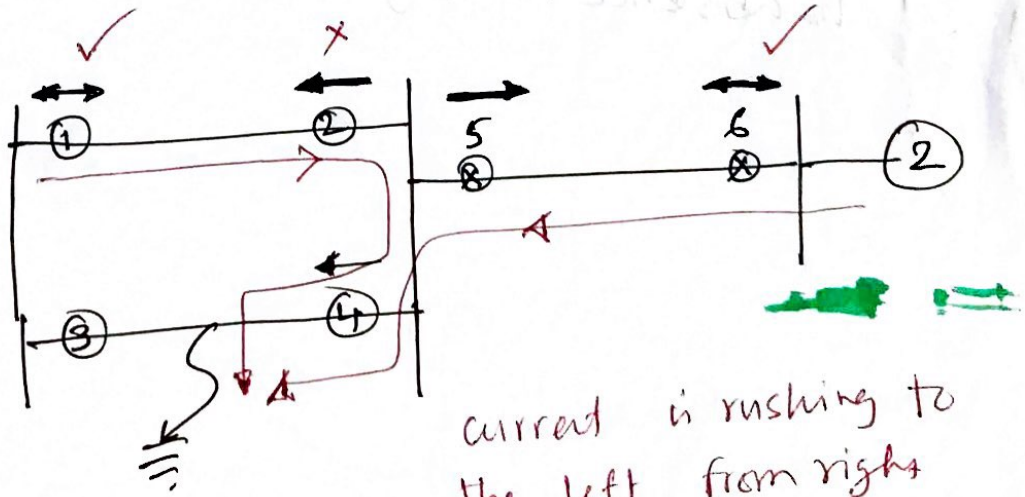
* So at Load side ~~Fault~~ ~~or~~ directional relay at source side non directional relay

* If Load is passive no power or current will flow to Source so current will be allway downwords so non directional. *

In case of synchronus motor load is capable of acting as generator so directional relay

back up protection

as directional relay and non directional relay has been set up according to the direction. so if a fault occur between ③ & ④ both operate simultaneously and fault will be cleared. But if ④ fails to operate than what? among ①, ②, ⑤ & ⑥ which will be in operation (as ⑤ and ② directional so it will not operate as it is not going with the direction principle. current is not in the direction specified to me. I can not work)
but ① & ⑥ are non directional, so it does not care about which direction current is flowing and will consider that there is a high current at the line



current is rushing to the left from right as ⑤ works from Right to left so ⑤ will not work. same logic for ②

direction relay at 2

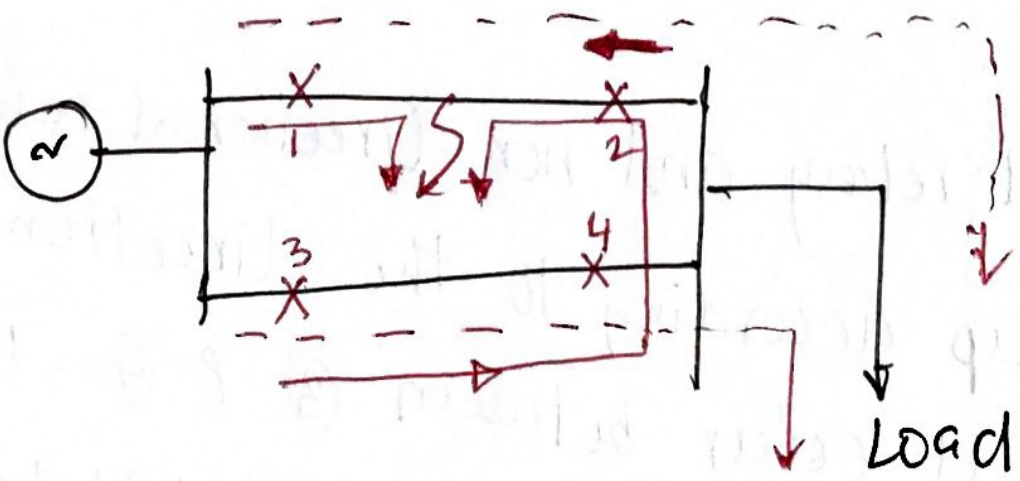


fig-3

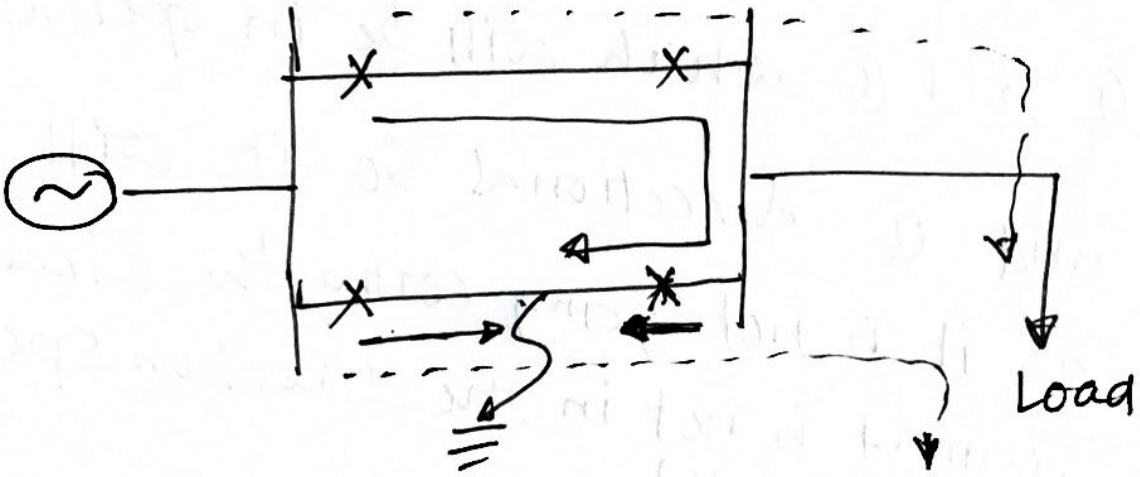


Fig-4

non

Though we already said directional relay at Load side at Fig-2, in the above cases Fig-3 & 4 we use directional coz there is close loop at the return of current which is absence in Fig-2