INSTRUCTIONS

CR2820-1054 TIME RELAY

GENERAL ELECTRIC
SCHENECTADY, N.Y.

CR2820-1054 TIME RELAY

The CR2820-1054 relay is designed primarily as a d-c instantaneous pick-up, time delay drop-out relay. It may also be utilized as a d-c volt-

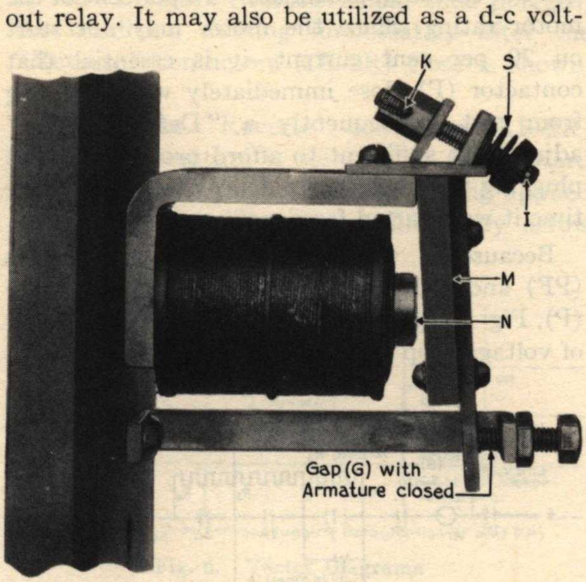


Fig. 1. CR2820-1054B Relay

age or current relay with an adjustable pick-up and relatively low drop-out voltage or current. If a source of d-c voltage is not available, the relay may be energized from an a-c source through a copper-oxide rectifier.

If the relay coil is short-circuited when energized, the current in the coil and the flux in the magnetic circuit will die out slowly. As indicated in Fig. 3, for armature spring force (P1), the armature will release at time (T1), while if the spring force is decreased to (P2), a further decrease in flux is necessary before the armature releases, and the time delay is increased to (T2). Since the flux density in the magnetic circuit is above the point of saturation when the armature is closed, the time adjustment is substantially independent of the usual variation in line voltage.

For certain applications it is more convenient to initiate the time-delay drop-out of the relay by opening the coil circuit instead of short-circuiting the coil as described above. For such applications coils are supplied which have a cylindrical copper jacket around the core of the relay. When the coil is de-energized, the decay of flux induces in the copper jacket a current which dies down relatively slowly, and the resulting slow decay of flux gives a time-delay drop-out in the same manner as described in the previous paragraph.

When applied to the usual type of d-c steel mill or crane control equipment, this relay serves three separate and distinct functions as described below.

(1) DEFINITE-TIME CONTROL OF ACCELERATION (CR2820-1054B)

Fig. 4 shows this application of this relay. It will be noted that the coils of the accelerating relays (1A) and (2A) are connected across divisions (R1-R2) and (R1-R3) respectively of the resistor.

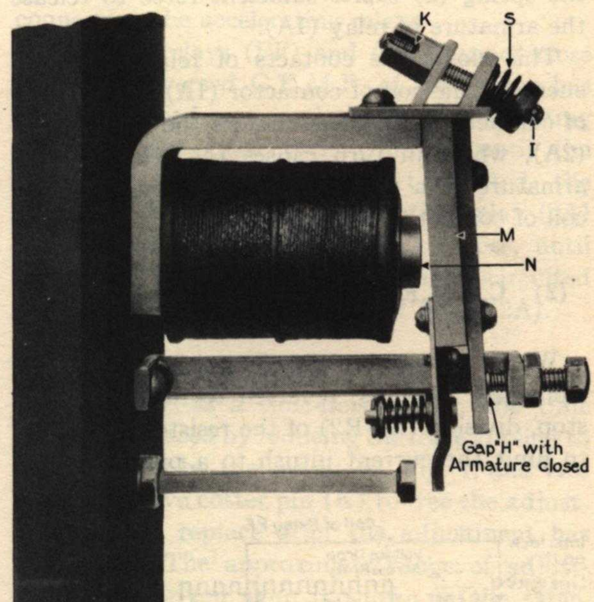


Fig. 2. CR2820-1054A Relay

When the forward contactors (1F-2F) close and establish the armature circuit through the resistor, the voltage drop across division (R1-R2)

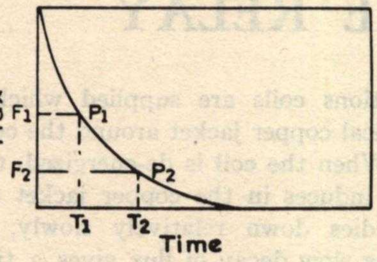


Fig. 3. Flux-time Curve

is applied to the coil of relay (1A), and the voltage drop across divisions (R1-R2), plus (R2-R3) is applied to the coil of relay (2A). The respective relay armatures close, opening the contacts of these relays.

Assuming contactor (P) to close, as explained later in Section 2, its tips will short-circuit resistor division (R1-R2), also the coil of relay (1A), and the magnetic energy stored in the relay (1A), due to the flux produced in the heavy iron frame, tends to dissipate itself as previously explained, until a density is reached such that the spring (S) exerts sufficient force to release the armature of relay (1A).

This closes the contacts of relay (1A) and energizes the coil of contactor (1A). The closing of contactor (1A) short-circuits the coil of relay (2A), which in turn causes the release of its armature in a definite time and energizes the coil of contactor (2A).

(2) C.E.M.F. CONTROL OF PLUGGING (CR2820-1054A)

When an equipment is subject to being "plugged," that is, reversed to insure a quick stop, division (R1-R2) of the resistor is adapted to limit the current inrush to a predetermined

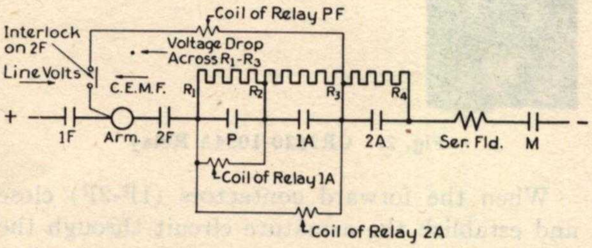


Fig. 4. Elementary Connection Diagram

safe value (approximately 140 per cent). The resistance of division (R1-R2) is such that in conjunction with divisions (R2-R3) and (R3-R4), the current inrush when starting from rest will not exceed approximately 70 per cent of the motor rating. Since the motor may not start on 70 per cent current, it is essential that contactor (P) close immediately when starting from rest, consequently a "Definite Time" adjustment sufficient to afford protection when plugging would seriously delay the motor every time it was started from rest.

Because of this the normally open relays (PF) and (PR) controlling plugging contactor (P), Fig. 4 and 5, are actuated by a combination of voltage drop across (R1-R2) and C.E.M.F. to

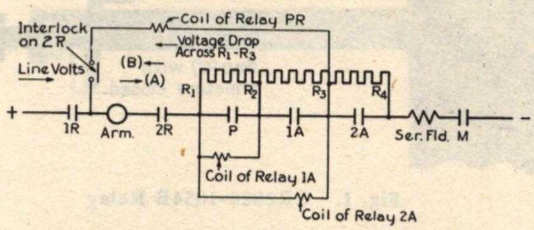


Fig. 5. Elementary Connection Diagram

afford protection when plugging and to give instantaneous closing when starting.

Referring to Fig. 4, the coil of relay (PF) is connected across the armature, the plugging division (R1-R2), and the first accelerating division (R2-R3) of the resistor, this circuit being established through the interlock only when the "Forward" contactors (1F-2F), are closed. The coil of relay (PR) is connected in a similar manner except that its circuit is established through an interlock only when the "Reverse" contactors (1R-2R) are closed.

Assuming contactors (1F-2F) and interlock to be closed, Fig. 4, the voltage drop across the resistor and the motor C.E.M.F. may be imagined as opposing the applied voltage as indicated by the arrows. The voltage drop across the resistor will produce instantaneous pickup of the relay, which will be held closed by the C.E.M.F. and voltage drop across resistor division (R2-R3) after division (R1-R2) is short-circuited by contactor (P). This is also shown by the vector diagrams (A) and (B) in Fig. 6.

If the motor is now accelerated to full speed in the "Forward" direction and then plugged, the condition existing immediately after the "Reverse" contactors (1R-2R) close is shown, Fig. 5.

Closing the "Reverse" contactors (1R-2R) while the armature is rotating in the forward direction results in the C.E.M.F. being applied in the opposite direction, as shown by arrow (A) in Fig. 5. This is also shown in the vector diagram (C) in Fig. 6.

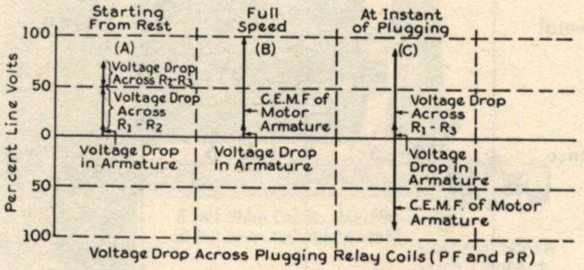


Fig. 6. Vector Diagrams

At the instant of plugging, therefore, the voltage across the coil of relay (PR) is practically zero, and it remains open.

During the time of deceleration, the motor acts as a generator, and the C.E.M.F. is opposite in effect to the voltage drop across (R1-R2). The C.E.M.F. falls off to zero as the motor comes to rest, while the voltage across (R1-R2) decreases from the maximum shown at instant of plugging to a similar value to that at starting from rest (vector diagram (A), Fig. 6). The relay (PR) will therefore pick up as the motor comes to rest (approximately) and will then energize the plugging contactor (P), and the acceleration is the same as previously described.

The CR2820-1054A relay, when used for plugging, should be adjusted to pick up on the voltage drop across the plugging resistor (R1-R2) when the motor is started from rest. It must not be set too low since, on plugging, the relay will close too quickly (producing an excessive current peak) while the motor is running at a considerable speed. This adjustment should be made entirely with spring (S), Fig. 2.

(3) SEQUENCE INTERLOCKING

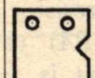
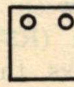
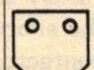
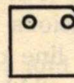
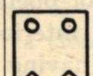
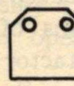
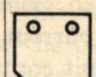
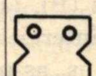
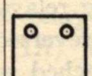
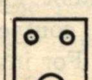
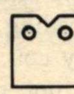
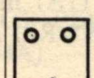
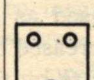
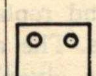
Because of the relation that must exist between resistor divisions (R1-R2), (R2-R3), and (R3-R4) to insure uniform accelerating peaks, that is, each succeeding division being proportionately smaller, it is necessary that the divisions be short-circuited in this order. After the line contactors close, contactors (P), (1A) and (2A) must close in sequence. This definite sequence of operation is ordinarily secured by means of interlocks on the contactors, each contactor having an interlock which must close before the coil of the succeeding contactor may be energized. Sometimes this interlock is part of a series "current limit" attachment providing current limit control and sequence.

Referring to Fig. 4 and 5, it will be noted that contactors (P), (1A) and (2A) are without any form of interlock and that the sequence of operation is assured through the method of connecting the accelerating relays.

Plugging relays (PF) and (PR) cannot close until the reversed C.E.M.F. of the motor has almost reached zero, and the time accelerating relays cannot close their contacts until the preceding contactor has short-circuited the relay coil. For instance, accelerating relay (2A) will not permit contactor (2A) to close, until contactor (1A) has closed and short-circuited division (R2-R3) and the coil of relay (2A).

ADJUSTMENTS

When used as a time-delay relay, the time may be increased by reducing the force applied to the armature by the spring (S), Fig. 1, and vice versa. Remove cotter pin (K) to free the adjusting nut and replace after the adjustment has been made. The approximate range of adjustment for a given shim is shown in the table, Fig. 7. The armature spring force must be strong enough to hold the armature positively against the back stop screw, but must not be increased to a value where the armature will fail to close if the coil is energized when at its maximum operating temperature.

Qty	Shim Cat. No.	Effective Thickness in Inches	Identification			Approximate Time Range—Seconds †		
						For Coils with Copper Jacket		For Coils Without Copper Jacket
			New	Old	Material	CR2820-1054B	Other Forms	
1	5354688	.0005			bimetal			
1	5155942	.001			bimetal			1.5–2.5
1	5354689	.0015			bimetal	1.3–2	1.5–2	1.3–1.9
1	2451597	.005		same	bronze	0.9–1.6	1.3–1.6	0.8–1.3
1	8616834	.007		same	bronze	0.75–1.4	1–1.4	0.65–1.15
1	2450533	.010*		same	bronze	0.6–1.25	0.75–1.25	0.5–1
1	8047765	.015			bronze	0.4–0.8	0.5–0.8	0.4–0.7
1	2439592	.020		same	bronze	0.35–0.7	0.4–0.6	0.25–0.45
2	8047765	.030ϕ			bronze	0.2–0.35	0.25–0.35	0.15–0.25
1	1453458	.060		same	bronze			

*Standard shim for steel-mill service.
†Maximum time is reduced about 30 per cent for relays having four double-break contacts, or two finger-type contacts and one or more double-break contacts.
ϕTwo shims each .015 inch thick

Fig. 7. Shim Data

If the desired time cannot be secured by adjustment of the armature spring pressure, it may be necessary to utilize a shim of different thickness. For the frequent operation encountered in steel-mill service, the use of shims thinner than 0.010 inch is not recommended. The 0.010-inch thick shim is ordinarily supplied with the relay unless a shim of different thickness is required to secure a longer or shorter time for certain applications.

If bimetallic shims are used, see that the bronze side of the shim is next to the armature, and make sure that brass screws (not steel screws) are used to fasten the shim in place on the armature. The effective air gap in the magnetic circuit when bimetallic shims are used is so small that such factors as accumulation of dirt particles, or mechanical wear will tend to affect the timing to a greater extent than when thicker shims are used.

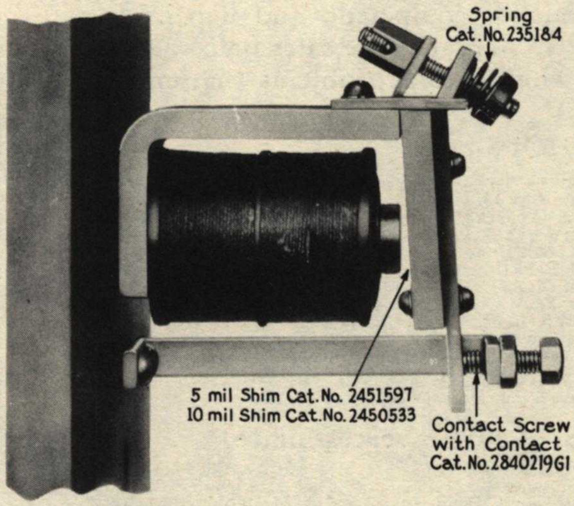


Fig. 8. Renewal Parts for CR2820-1054B Relay

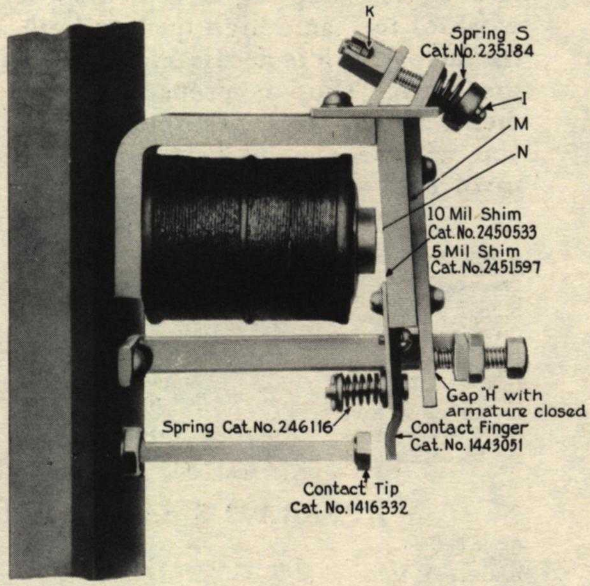


Fig. 9. Renewal Parts for CR2820-1054A Relay

In addition to affecting the amount of time delay, the shim prevents residual magnetism in the magnetic circuit from holding the armature closed indefinitely. A shim must always be used. While it may appear possible in some cases to secure a relatively long time delay by omitting the shim, the time is likely to be erratic, and it is probable that after a few operations the residual magnetism will prevent the armature from opening at all.

For the CR2820-1054B relay, the armature back stop screw is normally adjusted at the factory to give a gap of $\frac{1}{16}$ inch at (G), Fig. 1, with the armature closed, and it should not ordinarily be necessary to change this adjustment. For the CR2820-1054A relay, and for other forms without magnetic blowouts, gap (H), Fig. 2, should be ¼ inch. For CR2820-1054 relays with magnetic blowouts and arc chutes, this gap is usually $\frac{5}{16}$ inch.

Armature (M) may be easily removed without disturbing the calibration by removing cotter pin (I), while to change the calibration it is necessary to remove cotter pin (K).

RENEWAL PARTS

When ordering parts other than those shown in Fig. 8 or 9, give the complete nameplate rating of the relay and describe the part in detail.

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