SECTION 2
LIST 3

"WESTINGHOUSE"

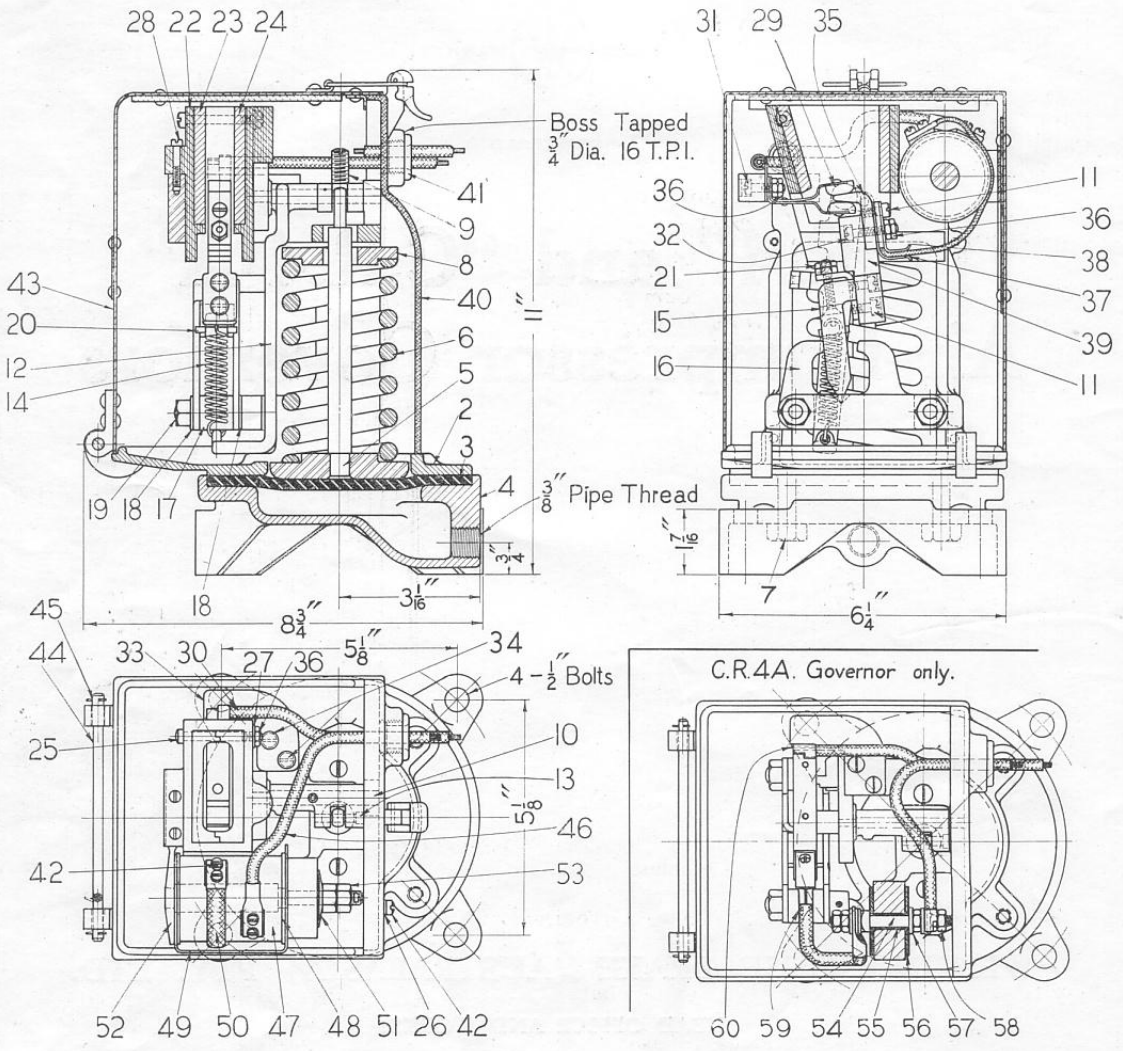
TRADE MARK.

REGISTERED

"C.R.4" and "C.R.4-A" Air Compressor Governors

WESTINGHOUSE BRAKE (AUSTRALASIA) PTY. LTD.
HEAD OFFICE AND WORKS:
CONCORD WEST, N.S.W.
1939.

"C.R.4" and "C.R.4-A" Governors



Net Weight 20 lbs.

CR-4 GOVERNOR

Piece No. C3266 CR-4 Governor complete (with aluminium base).
C3170 CR-4 Governor complete (with cast iron base).

Pc. No.	Ref. No.		£	s.	d.
C3172	2	Body			
C3601	3	Diaphragm			
C3179	4	Base (Cast Iron)			
C3267	4	Base (Aluminium)			
C3181	5	Piston Complete			
C3184	6	Piston Spring			
C3552	7	$\frac{3}{8}$" x $1\frac{1}{2}$" Set Screws (4 required)			
C3185	8	Spring Plate			
C3186	9	Headless Set Screws (2 required)			
C3190	10	Pin			
C3204	11	$\frac{3}{16}$" x $\frac{7}{16}$" Set Screws (3 required)			
C3187	12	Lever Complete			
C3191	13	Pin for Lever			
C3195	14	Toggle Spring			
C3199	15	Link			
C3193	16	Bracket (2 required)			
C3194	17	Spacer (2 required)			
C3192	18	Guide Plate (2 required)			
C3019	19	$\frac{5}{16}$" x $1\frac{7}{8}$" Stud & Nut (2 required)			
C3200	20	Adjusting Block Complete (including 2 of 21)			
C3210	21	$\frac{3}{16}$" Whit. Nuts (2 required)			
C3222	22	Arc Chute Body			
C3224	23	Arc Chute Lining, Outer (L.)			
C3225	24	Arc Chute Lining, Inner (R.)			
C3226	25	$\frac{3}{16}$" x $1\frac{3}{4}$" Screw			
C718	26	$\frac{3}{16}$" Washer			
C3227	27	$\frac{3}{16}$" Washer			
C3220	28	3 B.A. x $\frac{7}{8}$" Screw (2 required)			
C3207	29	Stationary Contact Complete			
C3214	30	Stationary Contact Lead			
C3218	31	$\frac{3}{16}$" x $\frac{3}{4}$" Set Screws			
C3205	32	$\frac{3}{16}$" x 1" Set Screws			
C3217	33	Insulation Bracket			
C3219	34	$\frac{3}{16}$" x $\frac{5}{8}$" Screws (2 required)			
C3197	35	Movable Contact			
C3203	36	$\frac{3}{16}$" Hex. Nuts (2 required)			
C3237	37	Lower Guard			
C3236	38	Upper Guard			
C3198	39	Insulation Block			
C3240	40	Rear Cover Complete (including 41)			
C3311	41	Bushing for Cable			
C3242	42	$\frac{3}{16}$" x $\frac{3}{8}$" Set Screw and Lock Washer (4 required)			
C3243	43	Front Cover Complete			
C3251	44	Hinge Pin			
C3252	45	$\frac{3}{32}$" x $\frac{1}{2}$" Split Pins (2 required)			
C3294	46	Blow-out Coil Lead			
C3239	47	Blow-out Coil Complete			
C3231	48	Blow-out Coil Fibre Collar			
C3975	49	Guard for Blow-out Coil			
C3232	50	Movable Contact Lead			
C3370	51	Spring Washer			
C3229	52	Blow-out Coil Support Complete			
C155	53	$\frac{5}{16}$" Hex. Nuts (2 required)			

Orders should state PIECE NUMBER and NAME of Part.

CR-4-A GOVERNOR

Pc. No. C-4117, CR-4-A Governor Complete (Cast Iron Base).

The CR-4-A Governor is identical with the CR-4 as regards operation and general construction. Its main difference is the omission of the Body, Ref. No. 2, Blow-out Coil, Ref. No. 47 (and its attendant parts 28, 48, 49, 50, 51, 52), the Arc Chute Complete (22, 23, 24, 25), and the Piston Spring, Ref. No. 6; and the replacement of these by the following parts:

Pc. No.	Ref. No.		£	s.	d.
C-4073	2	Body			
C-4369	6	Piston Spring			
C-4076	54	Moving Contact Cable Terminal			
C-4075	55	Terminal Insulating Bush			
C-4074	56	Insulating Washers (2 required)			
A8379/3	57	¼" Washers (6 required)			
C-594	58	¼" Nuts (5 required)			
18836	59	Flexible Cable			
C-4085	60	Cable and Terminal Complete			

DESCRIPTIVE PUBLICATION C28

SECTION 2
LIST 4

"WESTINGHOUSE"

TRADE MARK

REGISTERED

CR-4A Governor

WESTINGHOUSE BRAKE (AUSTRALASIA) PTY. LTD.
HEAD OFFICE AND WORKS:
CONCORD WEST, N.S.W.
Postal Address: P.O. Box 21, Burwood, New South Wales
1953

GENERAL ELECTRIC COMPANY

GENERAL OFFICE SCHENECTADY, N. Y.

Sales Offices—Address nearest Office

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Cincinnati, Ohio	215 West Third Street
Cleveland, Ohio	925 Euclid Avenue
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Duluth, Minn.	14 West Superior Street
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Erie, Pa.	10 East Twelfth Street
Fort Wayne, Ind.	1635 Broadway
Grand Rapids, Mich.	201 Monroe Avenue
Hartford, Conn.	18 Asylum Street
Houston, Tex.	1016 Walker Avenue
Indianapolis, Ind.	106 North Illinois Street
Jackson, Mich.	212 Michigan Ave., West
Jacksonville, Fla.	11 East Forsyth Street
Kansas City, Mo.	1004 Baltimore Avenue
Knoxville, Tenn.	602 South Gay Street
Little Rock, Ark.	223 West Second Street
Los Angeles, Cal.	5201 Santa Fe Avenue
Louisville, Ky.	455 South Fourth Street
Memphis, Tenn.	130 Madison Avenue
Miami, Fla.	25 Southeast Second Avenue
Milwaukee, Wis.	425 East Water Street
Minneapolis, Minn.	107 South Fifth Street
Nashville, Tenn.	234 Third Avenue, North
Newark, N. J.	20 Washington Place
New Haven, Conn.	129 Church Street
New Orleans, La.	837 Gravier Street
New York, N. Y.	120 Broadway
Niagara Falls, N. Y.	201 Falls Street
Oklahoma City, Okla.	15 North Robinson Street
Omaha, Neb.	409 South Seventeenth Street
Philadelphia, Pa.	1321 Walnut Street
Phoenix, Ariz.	11 West Jefferson Street
Pittsburgh, Pa.	535 Smithfield Street
Portland, Ore.	329 Alder Street
Providence, R. I.	76 Westminster Street
Richmond, Va.	700 East Franklin Street
Rochester, N. Y.	89 East Avenue
St. Louis, Mo.	112 North Fourth Street
Salt Lake City, Utah	200 South Main Street
San Antonio, Tex.	601 Navarro Street
San Francisco, Cal.	116 New Montgomery Street
Schenectady, N. Y.	1 River Road
Seattle, Wash.	811 First Avenue
Spokane, Wash.	421 Riverside Avenue
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Tampa, Fla.	112 Cass Street
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Toledo, Ohio	520 Madison Avenue
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Buffalo, N. Y.	318 Urban Street
Chicago, Ill.	509 East Illinois Street
Cincinnati, Ohio	215 West Third Street
Cleveland, Ohio	1133 East 152nd Street
Dallas, Tex.	1801 North Lamar Street
Detroit, Mich.	700 Antoinette Street
Kansas City, Mo.	819 East Nineteenth Street
Los Angeles, Cal.	5203 Santa Fe Avenue
Minneapolis, Minn.	410 Third Ave., North
New York, N. Y.	627 Greenwich Street
Philadelphia, Pa.	1223 Washington Avenue
St. Louis, Mo.	1009 Spruce Street
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Special service divisions are also maintained at the following works of the Company: Bloomfield, N. J.; Erie, Pa.; Ft. Wayne, Ind.; Oakland, Calif.; Pittsfield, Mass.; Schenectady, N. Y.; and West Lynn, Mass.—River Works and West Lynn Works.

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WGY, Schenectady, N. Y. KOA, Denver, Colo. KGO, Oakland, Calif.

Distributors for the General Electric Company outside of the United States and Canada

INTERNATIONAL GENERAL ELECTRIC COMPANY, INC.

New York City, 120 Broadway — General Sales Offices, Schenectady, N. Y.

FOREIGN OFFICES, ASSOCIATED COMPANIES AND AGENTS

ARGENTINA: General Electric, S. A., Buenos Aires, Cordoba, Rosario de Santa Fé, and Túcuman
AUSTRALIA: Australian General Electric Company, Ltd., Sydney, Melbourne, Adelaide, Brisbane, and Newcastle
BELGIUM AND COLONIES: Societe d'Electricite et de Mecanique (Procedes Thomson-Houston & Carels)
Societe Anonyme, Brussels, Belgium
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GREAT BRITAIN AND IRELAND: International General Electric Co., Inc., British Thomson-Houston Co., Ltd., London, W.C.2; British Thomson-Houston Co., Ltd., Rugby
GREECE AND COLONIES: Compagnie Francaise Thomson-Houston, Paris France
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JAVA: International General Electric Co., Inc., Soerabaia
MEXICO: General Electric, S. A., City of Mexico, Guadalajara, Monterrey, Tampico, Vera Cruz, and El Paso, Texas
NEW ZEALAND: National Electrical and Engineering Company, Ltd., Auckland, Dunedin, Christchurch, and Wellington
PARAGUAY: General Electric, S. A., Buenos Aires, Argentina
PERU: W. R. Grace & Company, Lima
PHILIPPINE ISLANDS: Pacific Commercial Company, Manila
PORTO RICO: International General Electric Company, Inc., San Juan
PORTUGAL AND COLONIES: Sociedade Iberica de Construcoes Electricas Lda., Lisbon
SOUTH AFRICA: South African General Electric Company, Ltd., Johannesburg, Capetown, and Durban
SPAIN AND COLONIES: Sociedad Iberica de Construcciones Electricas, Madrid, Barcelona, and Bilbao
SWITZERLAND: Trolliet Freres, Geneva
URUGUAY: General Electric, S. A., Montevideo
VENEZUELA: General Electric, S. A., Caracas

CR-4A GOVERNOR

DESCRIPTION: This is a diaphragm type governor having a quick action, single pole, single break, switch portion suitable for low voltage pilot gove nor service. It is, therefore, not connected in the main circuit but serves to control a starter, contactor, or relay, which in turn carries out the necessary switching operations.

OPERATION: Assuming that the electrical and pneumatic connections have been correctly made, when no pressure is present in the base 4 under diaphragm 3 the switch contacts 29 and 35 are closed. As the pressure underneath diaphragm 3 increases, the diaphragm carrying the piston and rod 5 is forced upward against the force exerted by the piston spring 6. The upper end of the piston rod is connected to an arm of the lever 12 by lever pin 13 and, as the piston and rod move upward, the lower end of lever 12 is forced to move about its fulcrum pin 10 from left to right (section xx) carrying with it the lower end of the toggle spring 14. When the lever has nearly completed its arc of movement, the toggle spring having passed its central position, a point is reached where the whole of the moveable contact assembly consisting of link 15, adjusting block 20, moveable contact 35 and insulation block 39, will snap over to the right, pivoting about the twin knife edges at the lower end of the link 15, and thus opening the switch.

In reverse, as the pressure falls and the piston and rod move downward under the force exerted by piston spring 6 the lever swings from right to left and the toggle spring wedges the moveable contact 35 between the jaws of the fixed contacts 29, thus closing the switch.

ADJUSTMENT: The cutting out pressure is increased by screwing down (clockwise rotation) the two headless setscrews 9, which thus force the spring plate 8 down and increase the force exerted by the piston spring 6 upon the diaphragm 3. Conversely, slackening off the setscrews 9 (anti-clockwise rotation) will reduce the cutting out pressure. Care should be exercised to see that the two screws are adjusted uniformly so that the spring plate 8 is maintained in a level position, or binding and erratic action may occur.

Variation in range (difference between cutting in and cutting out pressures) may be effected by increasing or decreasing the tension on the toggle spring 14. This is achieved by raising or lowering the adjusting block 20 by means of the two nuts 21. Increasing the spring tension by raising the adjusting block increases the range and vice versa. No attempt should be made to achieve less than 12 lbs. range or erratic operation may result.

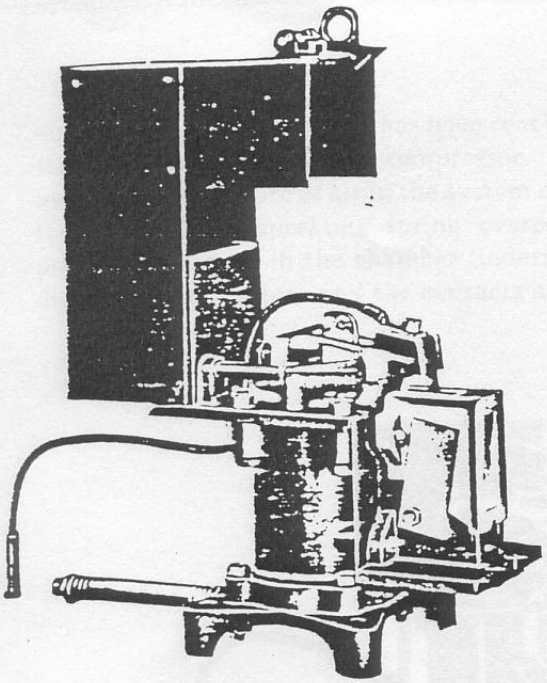
The contacts 29 and 35 should be inspected periodically for signs of burning or erosion and also to see that the moveable contact is accurately positioned between the upper and lower fixed contacts. When closed, the moveable contact 35 should engage the stationary contacts 29 by at least $\frac{1}{16}$", and when open, the minimum clearance between the moveable and stationary contacts should be $\frac{1}{8}$".

GENERAL: In normal operation the toggle spring 14 will cause the contacts to open as already described, but if for any reason the resistance to movement of the moveable contact assembly is such that the toggle spring cannot provide sufficient power to open the contacts, a small abutment provided on the lever 12 will engage the top of the link 15 and force the contacts to open.

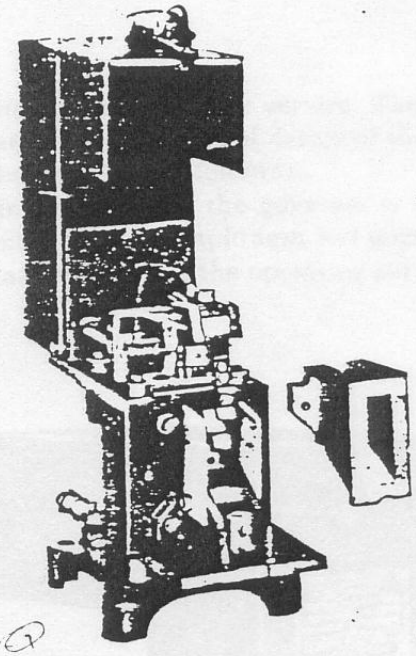
The sheet steel front cover 43 is hinged to the body 2 and retained in the closed position by a toggle action self-locking clip. This cover when open swings clear of all the working parts, providing maximum accessibility for inspection, maintenance, and adjustment. When installing the governor, sufficient clearance should be provided to enable the cover to be opened for inspection purposes.

The flexible connections are brought out through an insulated bush 41 screwed into the back cover 40, but in the event that a conduit connection is desired the bush may be removed and conduit screwed direct into the cover, the thread being $\frac{3}{4}$" dia., 16 threads per inch.

Air Compressor Governors
for
Railway and Industrial Service



(Cover Raised)



(Arc Chute Removed)

Two Views of Type ML Form A Governor

The General Electric Company manufactures a nplete line of governors for motor-driven air npressors to operate at 600 volts, with various rrent-carrying capacities ranging from 0.1 am- e to 20 amperes, and with opening pressures rying from 40 to 140 lb. gauge.

These governors are standard equipment for use h any 600-volt, direct-current, motor-driven air mpressor manufactured by the General Electric mpany for either railway or industrial service, ovided the normal full-load current comes within e limits of the governor. They may also be used th any other 600-volt, d-c. motor-driven com- essor under the same conditions. For voltages eater than 600 volts or currents in excess of 20 mperes, the proper governor may be used to terrupt an auxiliary circuit to a contactor, e latter controlling the main compressor rcuit.

The two types of governors herein described are signated as Types ML and MJ. These governors ffer only in size, weight, and pressure limitations as shown in the table on page 3. The Type ML governor is the one most widely used because of its broader application. The Type MJ governor is used where the available space for installation is limited and where the opening pressures of the governor will come between 65 and 85 lb. inclusive. It will be noted by comparing the photographs of the Type ML and Type MJ governors on pages 1 and 2, that the former has a swinging cover whereas the latter has a sliding cover which makes it especially suitable for installation under a car seat.

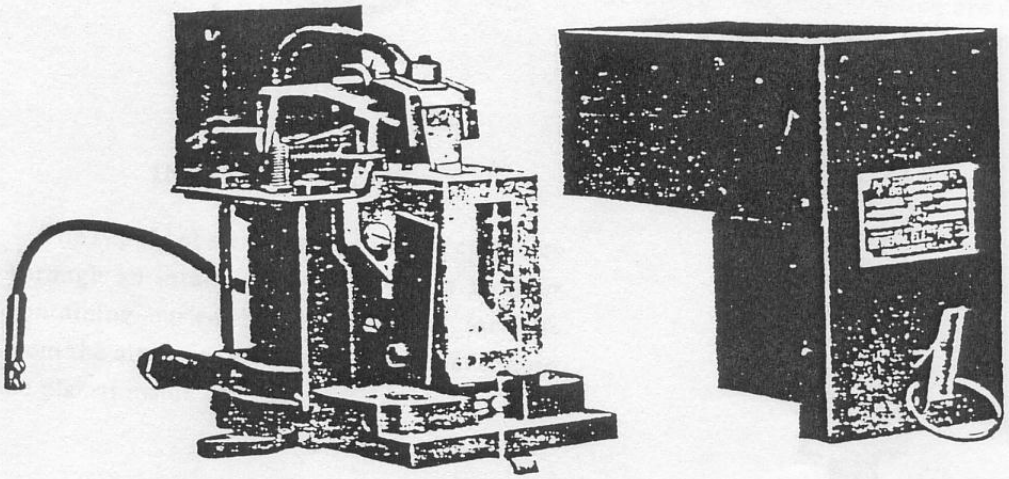
DESCRIPTION OF OPERATION

Both ML and MJ governors are single-pole switches of the quick make-and-break type. Air from the main reservoir enters a chamber under a diaphragm and piston, and, as the compressor operates, increases in pressure, forcing the piston upward against the compression of an operating spring. A piston rod attached to the piston acts on a set of operating levers which, when the cutting-

out pressure of the governor has been reached, open the contacts and stop the compressor. As air is used and the pressure of air in the system decreases, the force of the operating spring overcomes the pressure of the air in the chamber underneath the diaphragm and piston, and the contacts are closed.

requirements of railway service. The outstanding advantageous features of design of these governors are briefly listed as follows:

Air for operating the governor is confined to a chamber below a diaphragm and does not come in contact with any of the operating parts. Therefore,



Type MJ Form A Governor

REGULATION OF SETTING AND RANGE

Governors of the various types can be very easily set to cut out at any pressure within the range of their rating by turning two headless set screws located at the top of the governor in the mechanism base. The range, or difference between cutting-in and cutting-out pressures, can be adjusted by placing the range pin, which regulates the movement of the operating levers, in the proper hole of the fulcrum. The rating and range limitations of the various governors are listed in the table on page 3.

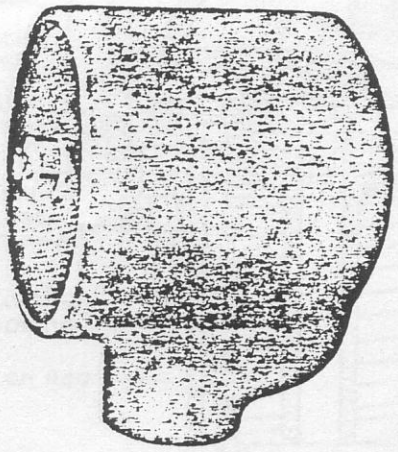
CONSTRUCTION AND PRINCIPAL ADVANTAGES

Types ML and MJ governors are designed and constructed with the sole object of producing a mechanism that will give uninterrupted satisfactory service with the minimum of attention and which, when attention is necessary, will facilitate inspection and replacement of parts. This object is accomplished by the strictest attention to the moisture and foreign particles from this source are excluded.

The arc formed at the contacts when the circuit is broken is confined to the space between walls of an arc chute made of a highly refractory moulded compound, and is immediately extinguished by a powerful magnetic blowout. The arc chute can be removed to facilitate inspection or replacement of the contacts, without disturbing any other part.

The contact tips are prevented from pitting by a wiping action that takes place between them when the contact is made or broken. Arrangement of the operating levers is such that a constant pressure is maintained between the tips until the moment they separate, further preventing the possibility of burning. Either upper or lower tip can be replaced by removing the arc chute and taking out one screw.

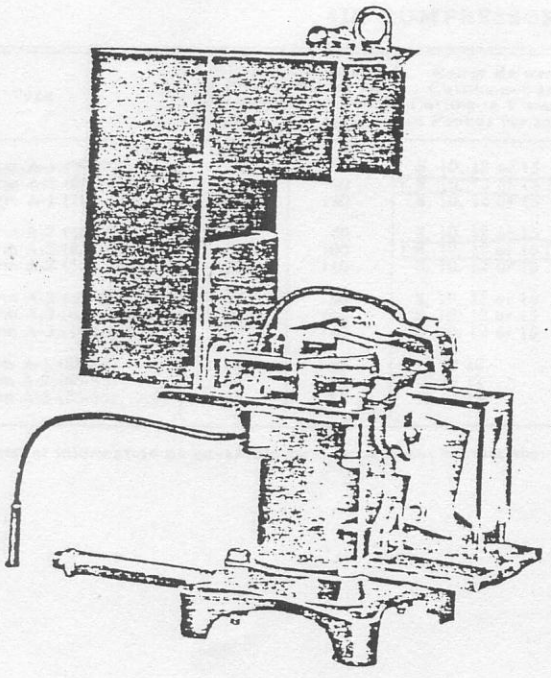
The operating levers are made of sherardized steel and the knife-edge bearings are hardened, as are all the principal bearings on the governor.



INTAKE STRAINER

INTAKE STRAINER

The supply of air is drawn into the cylinders through an intake pipe which has a strainer containing curled hair on the end farthest from the air compressor. This strainer should be placed inside the car.

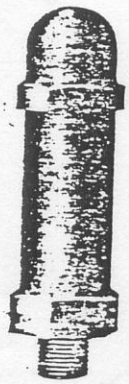


AIR COMPRESSOR GOVERNOR

AIR COMPRESSOR GOVERNOR

The governor is essentially a single-pole switch of the contactor type, operated by means of a rubber diaphragm, a piston, and a set of levers. The operating mechanism is simple, compact, and reliable. The construction of this governor is such that air does not pass through, or come in contact with the operating mechanism, but is restricted to a chamber below the diaphragm, hence troubles resulting from condensation are eliminated.

The essential points of advantage in this type of governor are:



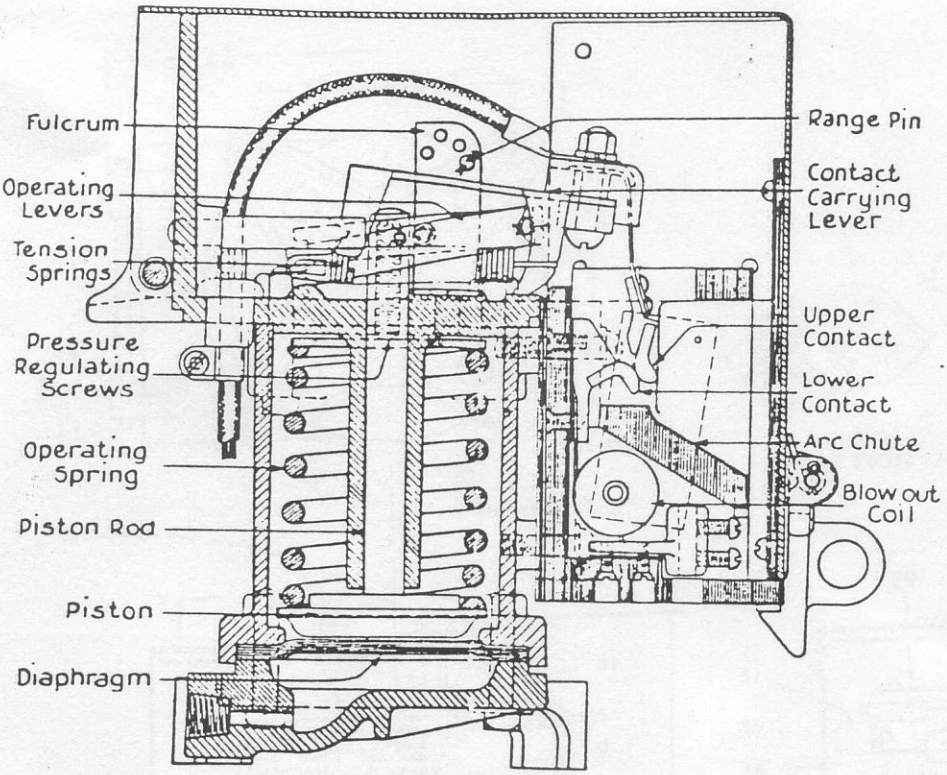
SAFETY VALVE

Interrupting switch provided with an arc chute of highly refractory material, an effective magnetic blowout, and easily renewable contacts. Arc chute can be quickly removed for inspection or repairs without disturbing any other part or any electrical connections.

Operating mechanism arranged so as to maintain constant pressure on contact tips until point of tripping is reached, insuring a quick break of the contacts when opening the circuit.

A wiping action takes place between the contact tips when the compressor circuit is opened or closed. This action prevents pitting and materially increases the life of the tips.

All principal bearings are provided with hardened knife edges to reduce friction and to insure a quick snap action.

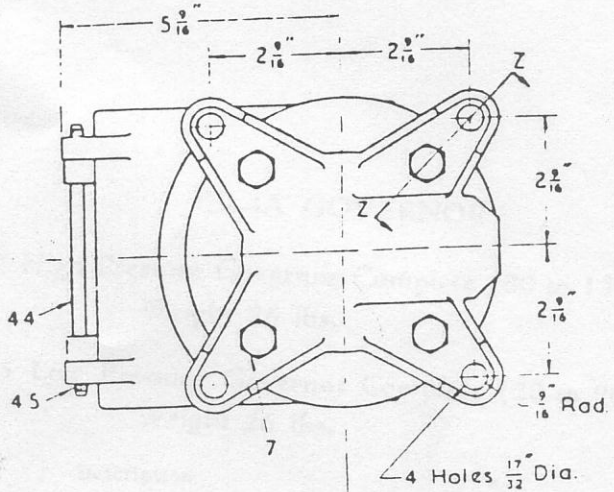


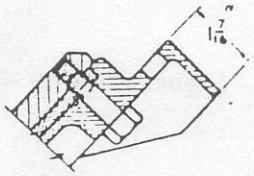
Sectional View of Type ML Governor

AIR COMPRESSOR GOVERNORS

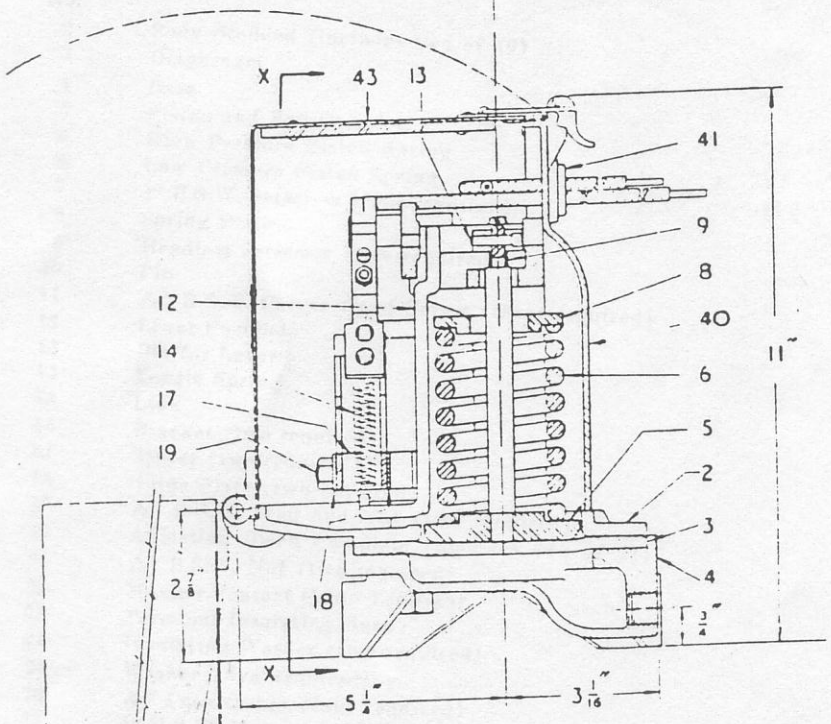
Type	Cutting-out Pressures in Pounds per sq. in.		Range Between Cutting-out and Cutting-in Pressures in Pounds per sq. in.	AMPERES		Net Wt. in Lb. (Apprx.)	Over-all Dimensions in Inches		
	Min.	Max.		Min.	Max.		Height	Width	Length
Type ML Form A-1 (40-60)	40	60	8, 10, 12 or 15	3	12	30	11¾	6⅛	12¼
Type ML Form A-1 (65-100)	65	100	8, 10, 12 or 15	3	12	30	11¾	6⅛	12¼
Type ML Form A-1 (100-140)	100	140	8, 10, 12 or 15	3	12	30	11¾	6⅛	12¼
Type ML Form A-2 (40-60)	40	60	8, 10, 12 or 15	10	20	30	11¾	6⅛	12¼
Type ML Form A-2 (65-100)	65	100	8, 10, 12 or 15	10	20	30	11¾	6⅛	12¼
Type ML Form A-2 (100-140)	100	140	8, 10, 12 or 15	10	20	30	11¾	6⅛	12¼
Type ML Form A-3 (40-60)	40	60	8, 10, 12 or 15	0.1	3	30	11¾	6⅛	12¼
Type ML Form A-3 (65-100)	65	100	8, 10, 12 or 15	0.1	3	30	11¾	6⅛	12¼
Type ML Form A-3 (100-140)	100	140	8, 10, 12 or 15	0.1	3	30	11¾	6⅛	12¼
Type MJ Form A-1 (65-85)	65	85	10 or 12	3	12	20	8 11/16	6¾	9⅛
Type MJ Form A-2 (65-85)	65	85	10 or 12	10	20	20	8 11/16	6¾	9⅛
Type MJ Form A-3 (65-85)	65	85	10 or 12	0.1	3	20	8 11/16	6¾	9⅛

All requests for information on governors for direct-current circuits above 600 volts should be referred to the General Office.

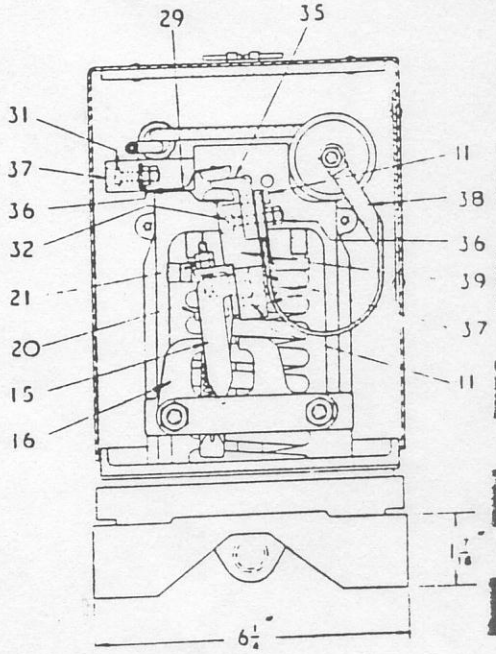




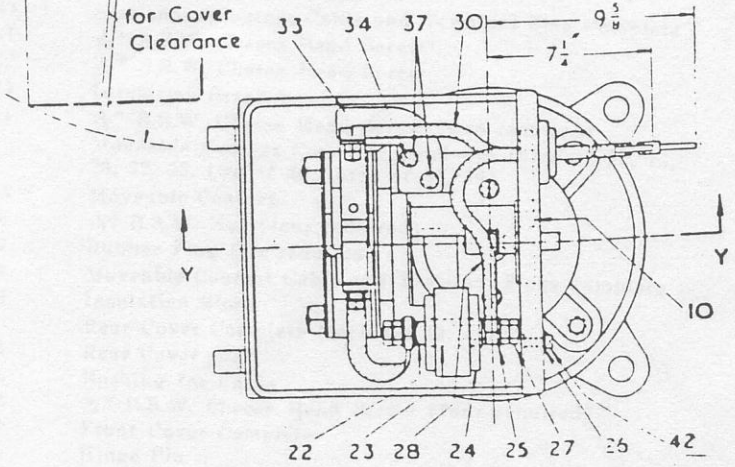
PART SECTION Z-Z



SECTION Y-Y



SECTION X-X



PLAN VIEW
(With Cover Removed)

CR-4A GOVERNOR

Piece No. C4117 High Pressure Governor Complete (80 to 150 lbs. pressure range) Weight 26 lbs.

Piece No. C8663 Low Pressure Governor Complete (20 to 90 lbs. pressure range) Weight 26 lbs.

Piece No.	Ref. No.	Description.
C6598	2	Body Studded (includes two of 19)
C3601	3	Diaphragm
C3179	4	Base
C3181	5	Piston and Rod Complete
C4369	6	High Pressure Piston Spring
C3184	6	Low Pressure Piston Spring
C3552	7	¼" B.S.W. Setscrew (four required)
C3185	8	Spring Plate
C3186	9	Headless Setscrew (two required)
C3190	10	Pin
C1798	11	3/16" B.S.W. Cheese Head Screw (three required)
C3187	12	Lever Complete
C3191	13	Pin for Lever
C3195	14	Toggle Spring
C3199	15	Link
C3193	16	Bracket (two required)
C3194	17	Spacer (two required)
C3192	18	Guide Plate (two required)
C3019	19	3/16" B.S.W. Stud and Nut (two required)
C3200	20	Adjusting Block Complete (includes two of 21)
C3210	21	3/16" B.S.W. Nut (two required)
C4076	22	Moving Contact Cable Terminal
C8087	23	Terminal Insulating Bush
C8088	24	Insulating Washer (two required)
A8379/3	25	Washer (five required)
C718	26	3/16" Lockwasher (four required)
C594	27	¼" B.S.W. Nut (five required)
C4085	28	Cable and Terminal Flag Complete
C3207	29	Stationary Contact Complete
C3214	30	Stationary Contact Cable and Terminal Flag Complete
C3218	31	3/16" B.S.W. Cheese Head Screw
C3205	32	1/4" B.S.W. Cheese Head Screw
C3217	33	Insulation Bracket
C3219	34	3/16" B.S.W. Cheese Head Screw (two required)
C3196		Moveable Contact Complete (includes three of 11, 15, 20, 32, 35, two of 36, three of 37, 39)
C3197	35	Moveable Contact
C3203	36	3/16" B.S.W. Nut (four required)
C3206	37	Rubber Plug (six required)
C7612	38	Moveable Contact Cable and Terminal Flags Complete
C3198	39	Insulation Block
C3240		Rear Cover Complete (includes 40, 41)
C3241	40	Rear Cover
C3311	41	Bushing for Cable
C3242	42	3/16" B.S.W. Cheese Head Screw (four required)
C3243	43	Front Cover Complete
C3251	44	Hinge Pin
C3252	45	3/32" dia. Split Pin (two required)

Orders should state PIECE NUMBER and NAME of Part.

Donald R. Pettigrew Pty. Limited, Printers, The Broadway, Enfield.