WESTINGHOUSE

ELECTRIC COMPRESSOR GOVERNOR TYPE E.S. 16

For Single Circuits and for Double Circuits.

CONTROL GOVERNOR TYPE E.S. 16 C

For Single Circuits and for Double Circuits.

GOVERNOR TYPE N.S.16

For Compressors Fitted with Unloaders or Clutch Drives.

Patented

THE WESTINGHOUSE BRAKE & SAXBY SIGNAL Co. LTD.

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Telegrams: "Westinghouse, Kincross, London". Telephone 2415 North (6 lines)

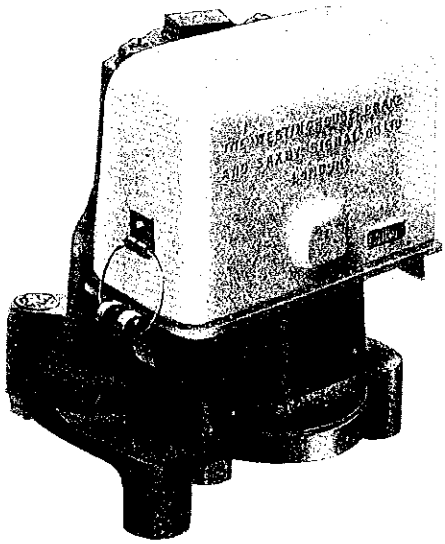
WORKS: CHIPPENHAM

January, 1933

Superseding issue of January, 1926.

THE WESTINGHOUSE
TYPE E.S.16
ELECTRIC COMPRESSOR GOVERNOR

(for single circuits)



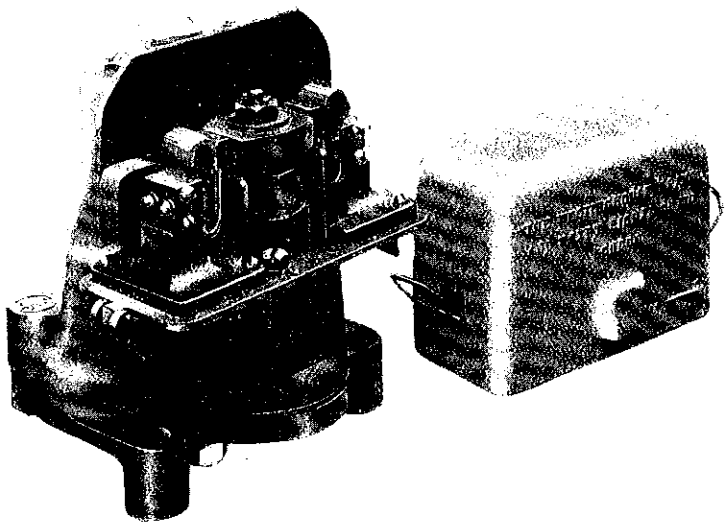
With the increasing use of small air compressors driven by electric motor, there has arisen a need for a suitable governor which will control the operation of the compressor, so as to maintain automatically a constant supply of compressed air.

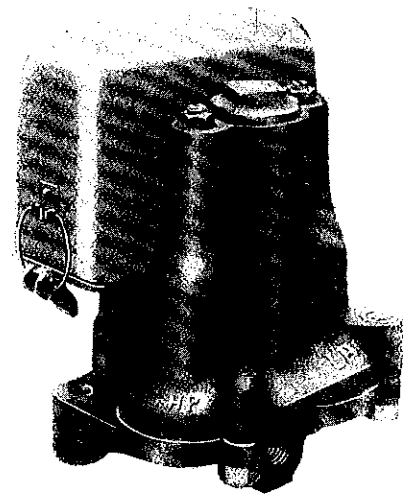
The Westinghouse type E.S. 16 Governor, which has been produced to meet this need, is of the double safety valve type, and automatically makes and breaks the circuit to the electric motor driving the compressor as the pressure in the reservoir falls below, or rises above, the predetermined limits to which the governor is set.

It embodies also an effective and efficient pneumatic blow-out, which prevents damage to the contacts by arcing when the governor cuts out.

It is suitable for controlling air compressors, the motors of which do not require over 15 amperes at 600 volts direct current or single phase alternating current.

It is also suitable for operation as a master governor to control starting contactors where compressors are operated in multiple on a train.





CONSTRUCTION

The apparatus comprises two distinct parts; an operating portion, which includes the electrical parts and the regulating mechanism; and a pipe bracket or base.

The electrical portion which controls the motor circuit consists essentially of a switch spider, with contacts carried by the switch piston rod. The contacts form the connection between the contact fingers when the governor is cut in, as illustrated.

The contact fingers are complete units, their supports and cable connections being encased in a moulded insulating block, which is fixed into position by two screws. An insulating shield, forming part of the moulded block, provides insulation between the contact fingers and the switch piston cylinder casing. The contact finger adjustment is permanent, the use of screws, which may loosen in service, being avoided.

The design of air cylinders and cut-out mechanism provides for a pneumatic blow-out of such efficiency that no coils are required to effect a magnetic blow-out. This is especially advantageous, as the governor can be used, as previously stated, with either direct or alternating current, and may, in addition, be connected to either the positive or negative side of the circuit.

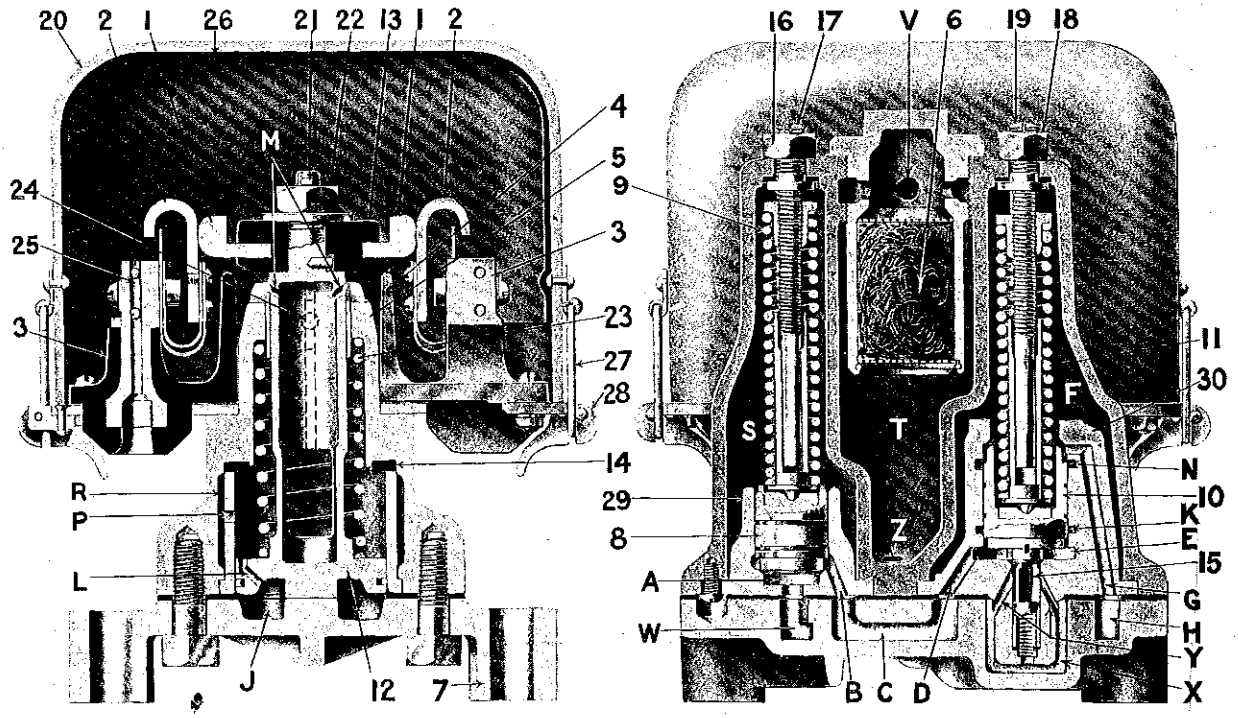
All electrical parts are thoroughly insulated, and are protected by an asbestos lined aluminium cover, which is quickly and easily secured in place by spring rings and toggle latches.

Pressure adjustment is simple and particularly accessible.

The air strainer is a self-contained unit and screws direct into the top of the casting.

The regulating valves and their seats are also self-contained units, and can be quickly removed when the body is detached from the base by loosening one or two small screws, the purpose of which is to ensure that the valve seats are replaced in their proper positions.

No pipe connection need be broken to remove the operating parts, these being all contained in the body, which is detachable from the base or pipe bracket.



OPERATION

While the compressor is running, the main reservoir pressure is applied to the underside of cut-out valve 8 in chamber A (*via* port Z, chamber T—which is connected to the main reservoir—strainer 6, port V, and passage W) and builds up until it overcomes the pressure of regulating spring 9, when the valve opens. This allows air at main reservoir pressure to flow by port B, passage C, and port D, to the under side of cut-in valve 10 in chamber E, causing that valve to move up to its seat on the upper side against the action of spring 11. The lifting of valve 10 to its upper seat closes communication between the face of the switch piston 12 and atmosphere (*via* chamber F which communicates with atmosphere, and a port—not shown—located in chamber N which is connected to chamber J), and allows the main reservoir pressure already admitted to chamber E to pass to the face of the switch piston 12 (*via* chamber K which is also in communication with chamber J) causing it and its hollow piston rod to move upwards, carrying with it switch spider 13 and contacts 1, thus breaking the motor circuit. The action, which is rapid, is accompanied by a discharge of compressed air through port L in piston 12, and this air, entering the hollow piston rod, is projected through ports M at the arcs caused by the opening of the contacts, effectively extinguishing them. When the piston reaches its full stroke it seats on gasket 14, which seals port L, thus preventing any further blow of air.

The upward movement of the switch piston 12 uncovers port P, allowing main reservoir pressure to pass *via* chamber R to chamber S, with which it is in connection. The pressure therefore equalises above and below valve 8, which then seats downwards under pressure of spring 9. Main reservoir pressure, however, is maintained on the underside of switch piston 12 from chamber X (which is directly connected to chamber T through port V) by ports Y, tail valve 15 (which is released by the valve 10 being in its up position, and is opened by the pressure of air under it) and chambers E and K, the latter of which, as previously stated, is in connection with chamber J.

The mechanism remains in this condition until the main reservoir pressure drops low enough to be overcome by the pressure of spring 11 in chamber F, above the cut-in valve 10, which then moves rapidly downwards, seating the tail valve 15 below it. This shuts off the communication between the main reservoir and chamber J. This latter chamber will then be vented to atmosphere (*via* chamber N, past the now open face of valve 10, and through chamber F). The switch piston then returns to its cut-in position under the influence of spring 23, thereby closing the motor circuit.

The exhaust port from chamber F vents into the switch portion under the cover 20. This arrangement ensures that any copper gases caused by the arcing of the contacts are expelled from under the cover.

REGULATION and ADJUSTMENT

The ordinary range for service is 15 lbs., the cutting-in point being usually at 85 lbs. per square inch, cutting-out at 100 lbs.; and governors will be set to these values before despatch, unless other values are specified.

It is undesirable that adjustments be tampered with. If, however, it becomes necessary to make alterations, the changes can be carried out as follows :—

By turning regulating stem 17 or 19 to the right (or clockwise), regulating springs 9 or 11 are compressed and their resistance to pressure increased; and the contrary effect is obtained by turning the regulating stem to the left : therefore :—

To raise or lower the cutting-out point, loosen check nut 16, and with a screwdriver turn the cut-out regulating stem 17 to the right or left as the case may be until the governor cuts out at the required pressure.

To raise or lower the cutting-in point, loosen check nut 18 and similarly turn the cut-in regulating stem 19 to the right or left until the governor cuts in at the required pressure.

Care should be taken to ensure that the check nuts are properly tightened after each adjustment.

INSTALLATION and MAINTENANCE

The governor must be fixed in a vertical position. It is recommended that it be placed inside the vehicle wherever possible, as there may be otherwise a risk of freezing due to precipitation of moisture caused by the expansion of air. The piping to the governor should be arranged so that moisture deposited in the pipe can drain away from the governor.

Two $\frac{1}{2}$ in. bolts or screws are required for mounting, and the pipe connection, which is tapped for $\frac{3}{8}$ in. pipe, should be connected to the main reservoir or reservoirs *on the side furthest from the compressor.* This position is essential as the governor will then be unaffected by impulses due to the strokes of the compressor.

The governor needs very little attention after being properly adjusted, except to be cleaned and oiled at regular intervals, say, once a year. When cleaning and oiling, a few drops of good oil should be placed on the surfaces passed over by the cutting-in and cutting-out valves. The exhaust opening in the switch portion should be examined to ensure that it is free and unobstructed.

The switch piston will probably require less cleaning than the valves. The piston can be removed by taking off base 7, removing top cover 20, taking out cotter 21 and unscrewing nut 22. The spring 23 will then push the piston out through the bottom end of the cylinder. When replacing the cylinder, care should be taken to see that the groove in the piston rod registers with the T-shaped guide pin 24. Also see that the flattened sides of the pin are vertical, otherwise it will not enter the groove and the piston will not slide into position. The purpose of this pin is to ensure, by preventing the piston and rod from rotating, that the contacts are always in their correct relative positions.

It is essential that the valve faces and seats be kept clean. Therefore the strainer should be removed and examined periodically, the hair being cleaned and dried thoroughly, or entirely replaced, depending on its condition. A dirty or inefficient strainer may cause or allow foreign matter to pass to the operating portions of the governor and affect its working.

For the sake of satisfactory operation it is necessary to emphasize once again the undesirability of interfering, or experimenting, with adjustments once the governor is in good condition and adjustment, and properly installed in position.

CONTROL GOVERNOR TYPE E.S.16 C

(for Single Circuits)

The use of protective systems has increased to such an extent that most electrically-driven railway vehicles are now provided with Control Governors.

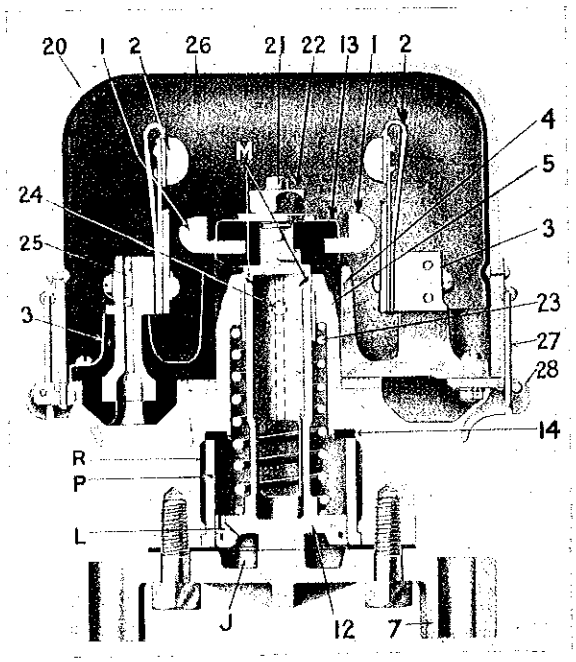
This piece of apparatus provides a means of preventing the vehicle from being moved unless the air-brake system is properly charged.

It is similar in principle to the air compressor governor, but has its sequence of operations reversed, so that when the air pressure reaches a predetermined value the circuit is made, instead of broken, and *vice versa*.

The circuit controlled by this governor is usually the traction motor control circuit, and the governor generally is connected to, and operated by the pressure in, the brake pipe. This ensures that the vehicle cannot be moved until the brake pipe is charged, and also that the traction motors are cut out of circuit after an emergency application of the brakes.

The governor, of course, can be connected to the main reservoir pipe, instead of the brake pipe, if preferred.

There are other purposes to which this governor may be applied, such as, for instance, the cutting out of regenerative braking following an emergency application of the air brakes.



CONSTRUCTION and OPERATION. This governor is identical with the Type E.S.16 Governor as described on pages 3 and 4, except that the contact fingers 2 are arranged so that the contact spider 1 makes circuit in its upper position, and breaks circuit in the lower position. The form of contact is the only difference between the two types of governor, which are therefore interchangeable.

Since the circuit is broken on the downward movement of the piston, however, the pneumatic blow-out is not available with this form of governor.

REGULATION and ADJUSTMENT This also is identical with that of the E.S.16 Governor as described on page 5, with the exception that the cutting-in and cutting-out points usually are different. For a brake pipe control governor, working on a normal brake pipe pressure of 70 lbs., the cutting-out point would be about 45 lbs. per square inch, and the cutting-in point about 55–60 lbs. per square inch.

If required for other purposes, the cutting-in and cutting-out pressures can, of course, be arranged as desired.

INSTALLATION and MAINTENANCE This is identical with the E.S.16 Governor as described on page 6.

ELECTRIC COMPRESSOR GOVERNOR TYPE E.S.16

(for Double Circuits)

This type has been constructed specially for use with air compressors driven by multi-phase A.C. motors.

This governor controls two phases, breaking or making their circuits as the air pressure rises above, or falls below, the predetermined limits to which the governor is set.

CONSTRUCTION The apparatus is the same as in the E.S.16 Governor for single circuits, described on page 3, except that the contact fingers are duplicated and the switch spider is arranged for two separate circuits.

OPERATION The operation of this governor is as described on page 4, except that contact carriers 3 are each arranged to carry two contact fingers 2, while switch spider 13 carries two separate contacts 1.

Thus when the piston 12 is moved upwards, both circuits are broken, and, when moved downwards, both are made, simultaneously in each case.

REGULATION and ADJUSTMENT See page 5.

INSTALLATION and MAINTENANCE See page 6.

CONTROL GOVERNOR TYPE E.S.16 C.

(for Double Circuits)

This has been designed for use in cases where two separate circuits are to be broken when the air pressure falls below a predetermined value.

Such cases occur in the interlocking of the air brake with the regenerative or rheostatic brake.

CONSTRUCTION and OPERATION

This apparatus, also, is identical with the E.S.16 Governor described on page 3, except that the contact fingers are duplicated and are of the same design as in the E.S.16 C Governor, illustrated on page 7, which make contact when the spider is in its upper position. The operation is, therefore, identical with that described on page 4, except that both circuits are broken when spider 1 and piston 12 are in their lower positions.

As with the E.S.16 C Governor, no pneumatic blow-out is available when the contacts are broken.

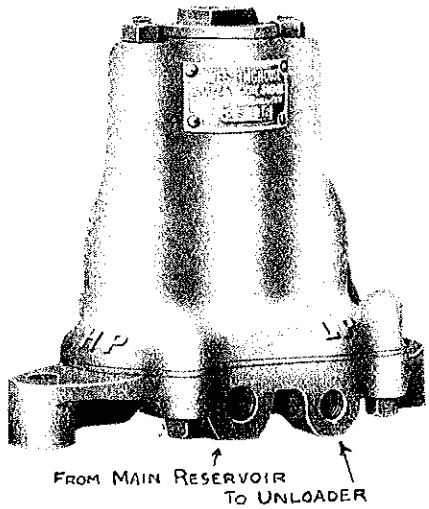
REGULATION and ADJUSTMENT

This is the same as that described on page 5, except that the cutting-in and cutting-out pressures are usually of different values to those given on that page, to suit the particular purpose for which the governor is used.

INSTALLATION and MAINTENANCE

See page 6.

COMPRESSOR GOVERNOR TYPE N.S.16



In certain cases of compressors driven electrically, and most cases of those driven mechanically, such as from the live engine shaft of an internal combustion engine, it is often impossible and generally undesirable continually to start and stop the source of power.

To avoid this an unloader or a clutch is installed with the compressor, together with a pressure governor.

This governor is operated as usual by the rise and fall of pressure in the main reservoir, but instead of controlling the making and breaking of a switch, it governs the operation of the clutch or the unloader.

CONSTRUCTION This apparatus is the same as the pneumatic portion only of the E.S.16 Governor, that is to say, the electrical portion with the operating piston is omitted.

As in governors described in foregoing pages, the apparatus is in two distinct parts, one being the operating mechanism, the other being the pipe bracket, so that the mechanism can be removed for examination without breaking any pipe joints.

OPERATION This governor operates in the same way as that described on page 4 so far as the regulating mechanism is concerned, which is the part shown on the right-hand side of the illustration on page 4.

Instead, however, of chambers N and K being connected to chamber J underneath the switch piston 12, they are connected through a port to the boss which leads to the unloading device.

In addition, chamber S is also connected to this port, so that when air pressure has built up in the unloader it causes valve 8 to reseat.

REGULATION and ADJUSTMENT This is as described on page 5, except that the pressures are often varied to suit different conditions.

INSTALLATION and MAINTENANCE See page 6.

Printed in Great Britain by HARRISON & SONS, LTD., 44-47, St. Martin's Lane, W.C.2.