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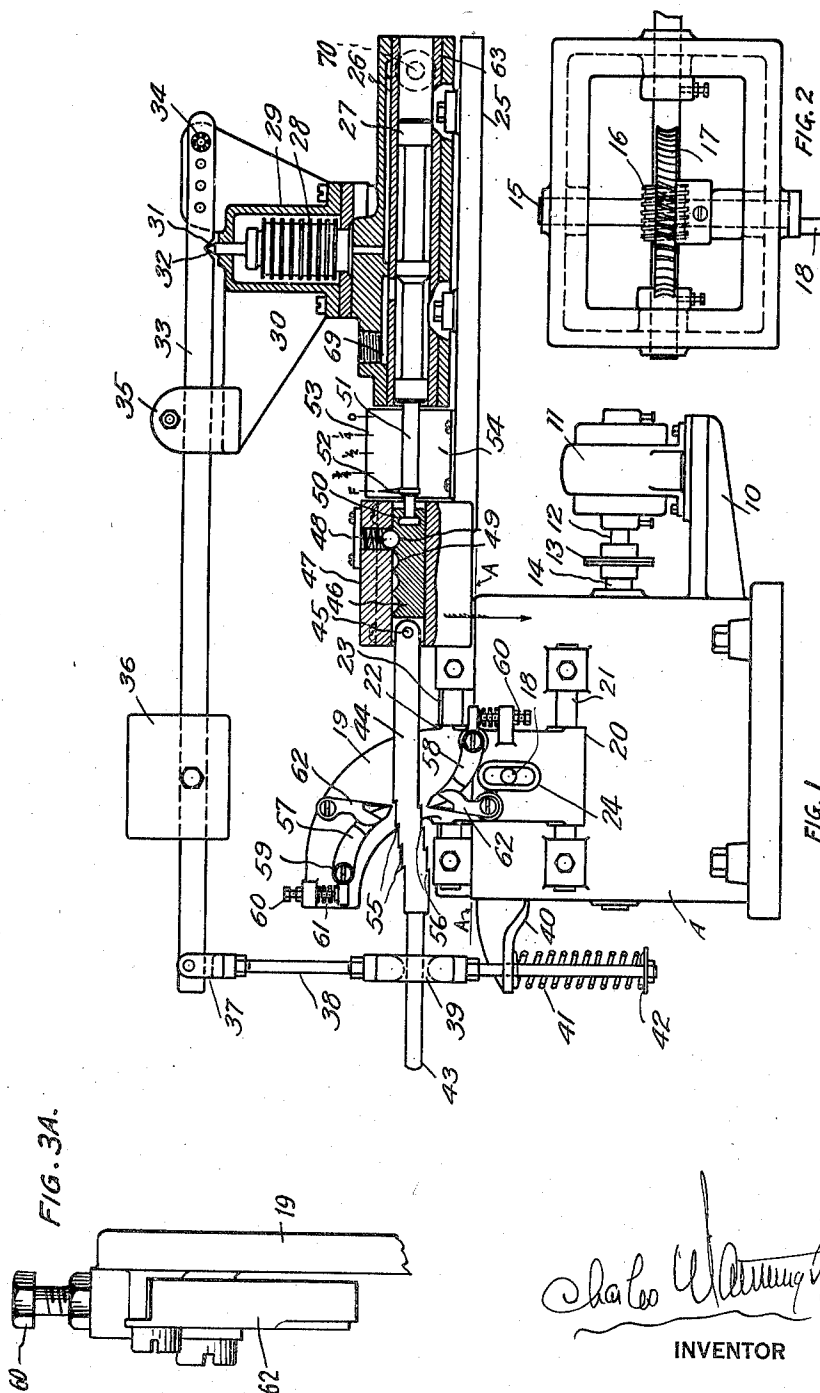
C. WAINWRIGHT

2,116,456

AIR GOVERNOR

Filed March 25, 1936

3 Sheets-Sheet 1



Charles Wainwright
INVENTOR

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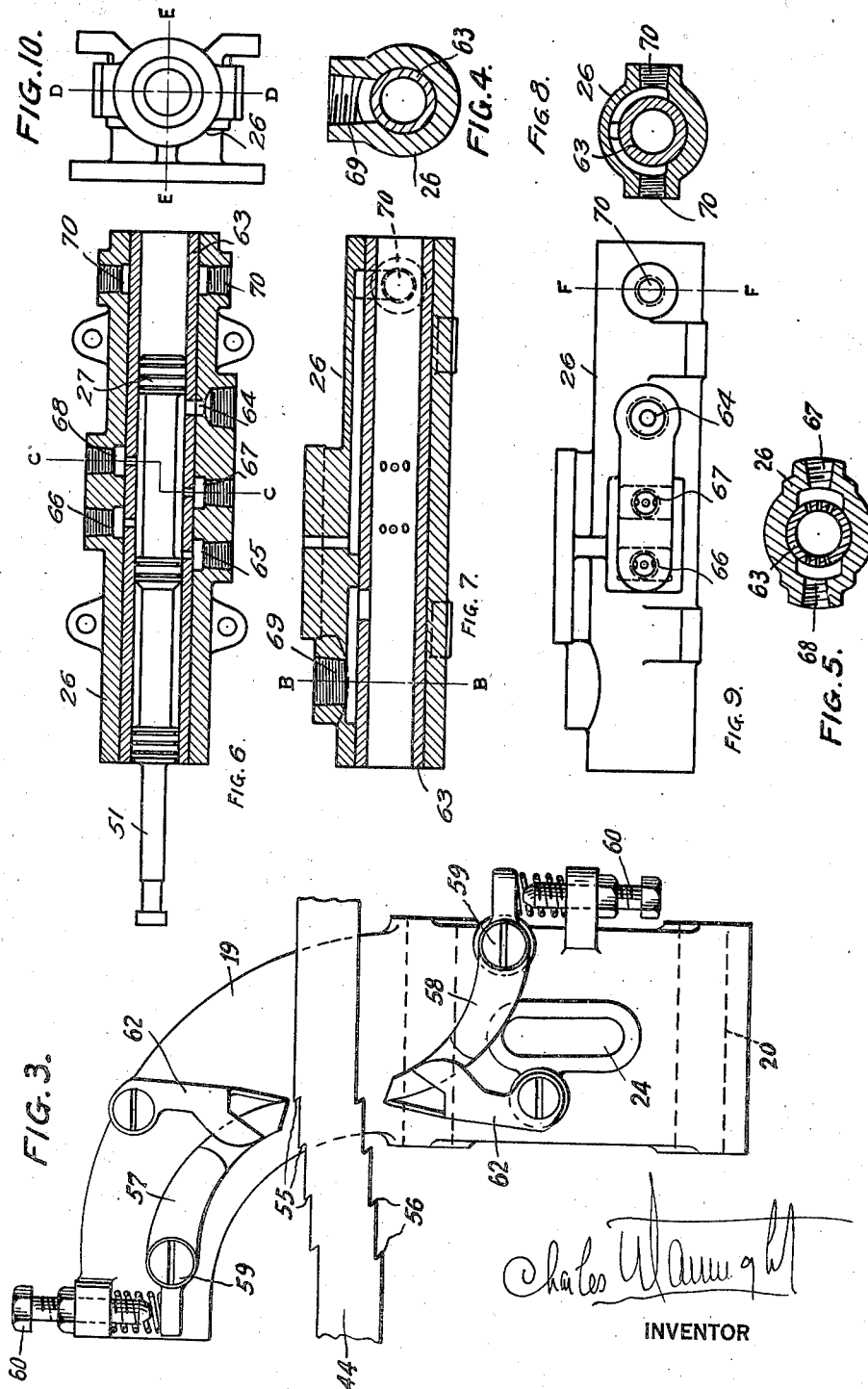
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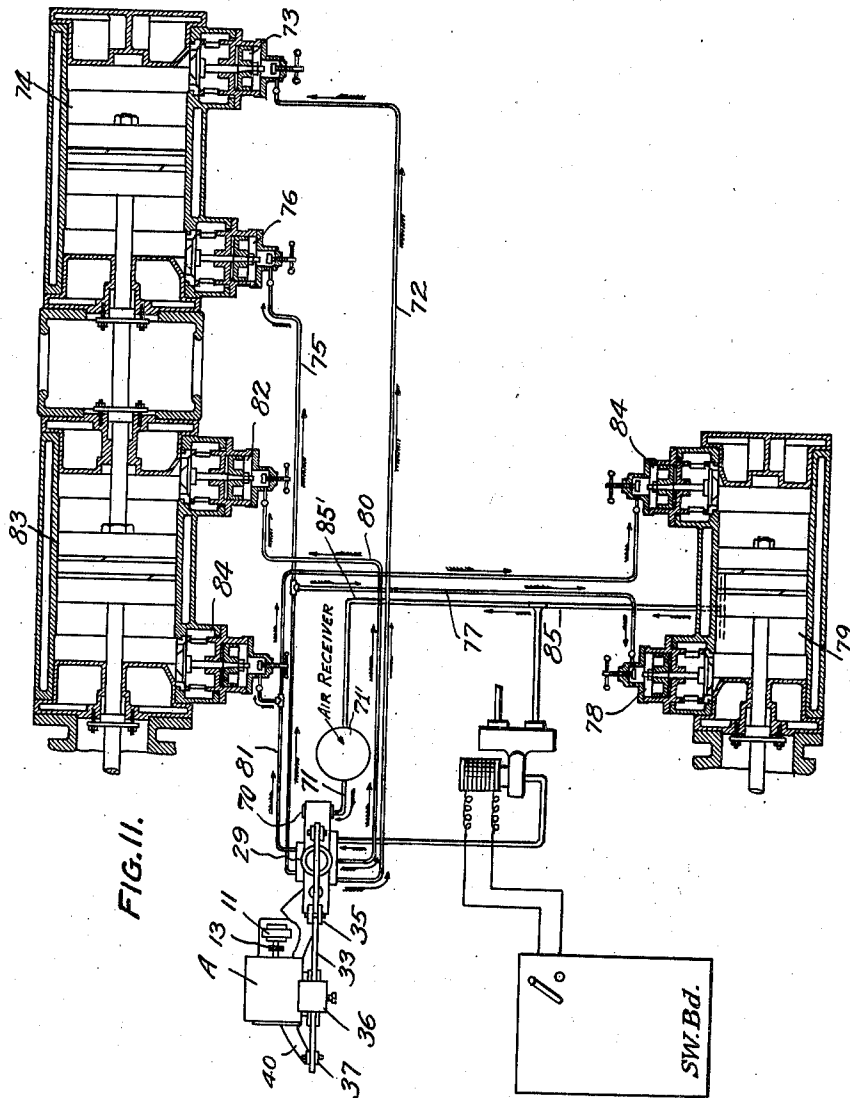
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Charles Wainwright

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UNITED STATES PATENT OFFICE

2,116,456

AIR GOVERNOR

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Application March 25, 1936, Serial No. 70,902

1 Claim. (Cl. 230—25)

The invention relates to governor mechanism and more especially to governors for air and gas compressors.

The primary object of the invention is the provision of a governor of this character, wherein the same when equipped with an air or gas compressor will enable through sequence of steps the unloading and loading of such compressor, the governor being of novel construction and automatic in its working.

Another object of the invention is the provision of a governor of this character, wherein a drop in pressure of a compressor in the complete cycle of unloading and loading can be varied at the will of an operator and thus in this manner the compressor can be rendered inoperative or restored to normal working condition for delivering maximum output.

A further object of the invention is the provision of a governor of this character, wherein the compressor is constantly under the control of the governor so that unloading thereof can be effected in steps and likewise loading thereof had.

A still further object of the invention is the provision of a governor of this character, which is simple in its construction, thoroughly reliable and effective in its operation, automatic in the working thereof, strong, durable, easy of adjustment, and inexpensive to manufacture and install.

With these and other objects in view, the invention consists in the features of construction, combination and arrangement of parts as will be hereinafter more fully described, illustrated in the accompanying drawings, which disclose the preferred embodiment of the invention and pointed out in the claim hereunto appended.

In the accompanying drawings:

Figure 1 is an elevation partly in section of the governor mechanism constructed in accordance with the invention.

Figure 2 is a sectional view looking from the line A—A in Figure 1 showing a part thereof in plan.

Figure 3 is an enlarged side elevation of the bracket of the governor for the step action of the same.

Figure 3A is an enlarged end elevation of the upper portion of the bracket of the governor.

Figure 4 is a sectional view on the line B—B of Figure 7.

Figure 5 is a sectional view on the line C—C of Figure 6.

Figure 6 is a sectional view on the line D—D of Figure 10.

Figure 7 is a sectional view on the line E—E of Figure 10.

Figure 8 is a sectional view on the line F—F of Figure 9.

Figure 9 is a side elevation of a structure shown in Figure 7.

Figure 10 is an end elevation thereof.

Figure 11 is a top plan view partly in section of the governor and a three-cylinder, two-stage air compressor in association with each other.

Similar reference characters indicate corresponding parts throughout the several views in the drawings.

Referring to the drawings in detail, A designates generally a housing having at one end a shelf or support 10 which may be integral or separate therefrom and upon which is mounted an electric motor 11, its driving shaft 12 through a coupling 13 having connection with a power shaft 14 which is journaled in the housing A and extends therethrough. This power shaft 14 is operatively connected with a crank shaft 15 through the medium of reducing gears 16 and 17, respectively, the shaft 15 being at right angles to the shaft 14 and is journaled in the housing A with one end carrying a crank 18 without said housing.

At one side of the housing is a feed bracket 19 which is in the form of a curved arm and is slidably sleeved at 20 on a lower guide 21 and at 22 on an upper guide 23, respectively, for horizontal shifting motion. The bracket is formed with an elongated slot 24 in which fits the crank 18 so that this crank will effect the shifting of said bracket 19 on the operation of the motor 11.

At the upper portion or top of the housing A is a bed or table 25 carrying a cylinder 26 in which works a piston valve 27, the cylinder being provided with suitable ports and ducts. On the top of the cylinder 26 is arranged a bellows 28 confined within a shell 29 built upon a support 30. The bellows 28 operates a fulcrum pin 31 constituting a part thereof and suitably fitting in a seat 32 provided in a vertically movable arm 33 adjustably pivoted at 34 to the support 30 and extended through a limit yoke 35 which is also on the support 30 and carries an adjustable weight 36. The yoke 35 is a limit stop to the swing of the arm 33. The arm 33 at the end remote from the pivot 34 has pivoted thereto a hanger 37 from which depends a rod 38 equipped with a bearing 39 and this rod is slidable through a guide 40 carried by the housing A while operating against the guide is a coiled spring 41 surrounding the said rod 38 and seated at 42 thereon. The

bearing 39 embraces an extension 43 of a feed rack 44 which is pivoted at 45 to a cross head slide 46 within a guide block 47 constituting a part of the bed 25. The block 47 has arranged therein a ball spring tensioned friction latch 48 for engagement in a series of seats 49 in the slide 46.

The slide 46 through coupling 50 with a stem 51 has connection with the piston valve 27. The stem 51 carries a pointer or indicator finger 52 coacting with a scale 53 on a scale plate 54 carried by the bed 25 between the cylinder 26 and the block 47 for full visibility.

The rack 44 has the upper and lower series of stepped feed teeth 55 and 56, respectively, for alternate engagement by reversely acting upper and lower feed dogs 57 and 58, respectively, which are pivoted at 59 upon the feed bracket 19 and have coacting therewith adjustable limit stops 60, and tensioning springs 61, respectively. The feed dogs 57 and 58 are interfitted with limit stops in the form of pawls 62 which act counter to the stops 60 and function to have the feed dogs 57 and 58 positively engage with the step teeth on the rack 44 and eliminate the riding of these dogs over such teeth in their attack on the said teeth for the positive locking engagement of such dogs alternatively in their order.

The piston valve 27 may be built for two or more step regulations in the working of the governor and its cylinder 26 has an internal bushing 63 throughout the length of the latter, the piston valve being adapted to work within this bushing and at the port 64 is connected a compressed air supply which is usually the receiver of the air or gas compressor while at the port 65 is connected one of the unloading valves of a cylinder of the compressor while the ports 66, 67 and 68 are likewise connected to the unloading valves of other cylinders of the compressor and the port 69 is connected to the atmosphere or intake to the compressor. There is provided the ports 70 in the cylinder 26 and either of these is for connection 71 with the air receiver 71' of the compressor, the port 70 not connected being suitably plugged. The several ports 70 are arranged for convenience in the hook-up of the air receiver of the compressor according to location of the latter. The ports 65, 66, 67, and 68 are spaced in conformity with the disposition of the teeth 55 and 56 on the rack 44 and consistent with the travel of the crank 18 on the shaft 15. Now when the piston valve 27 is moved a distance of one tooth in one direction the port 65 is shut off from the port 64 while the port 69 will be brought into communication with the said port 65 and the lead 72 from the port 65 allows the compressor valve 73 to operate for unloading of the compressor cylinder 74 with which it is associated and on further movement of the valve 27 in the same direction for the extent of a single tooth of the rack 44 the port 66 is shut off from the port 64 and communication of this port 66 is had with the port 69 so that the lead 75 to the said port 66 permits the unloading valve 76 associated with the cylinder 74 to operate for a second step of the unloading of the compressor, the lead 75 being fitted with a branch 77 which extends to the valve 78 for a compressor cylinder 79 which is the high pressure cylinder of the compressor. Similarly the ports 67 and 68 are brought into communication with the port 69 and these ports have the leads 80 and 81 connected with the valves 82 of the compressor cylinder 83 and the valves 84, respectively, one

being for the cylinder 79 and the other for the cylinder 83 for further unloading in sequence of these compressor cylinders for the complete unloading of said compressor. It has been stated that the cylinder 79 is the high pressure cylinder while the cylinders 74 and 83 are the low pressure cylinders of the compressor.

The receiver 71' is connected to the discharge of the high pressure cylinder 79 and this connection 85' is diagrammatically indicated as a line connected with line 85. The line 85 which is connected with the high pressure cylinder 79 at the discharge side thereof in connection with the port 64 in the cylinder 26 has fitted therein a three-way cock 86 and this cock may be operated electrically through the circuit of an automatic electric starting apparatus on the switch board 87 for the motor driving the compressor so that said cock will be actuated at the time of the starting of the motor for a complete unloading of the compressor until the motor will have been brought to the proper speed to have the compressor within control of the governor. In starting the compressor with compressed air in the receiver 71' if the cock 86 is turned to the proper position the source of compressed air to the governor is cut off and all compressed air in unloading valves 73, 76, 78, 82, and 84 on the cylinders 74 and 79 will be vented to the atmosphere thereby making the compressor completely inoperative as to delivery of compressed air or in other words the said compressor will be completely unloaded.

In the operation of the governor the compressed air from the receiver 71' through connection 71 enters the port 70 and thence flows into the bellows 28 which balances the arm 33 as opposed to the combined force of the weight 36 and the spring 41. This opposed force is regulated to suit the terminal air pressure of the compressor. If the terminal air pressure increases the arm 33 moves upward causing the lifting of the rack 44 in that direction so that the dog 57 and pawl 62 will engage with a tooth 55 of the rack 44 and movement of the bracket 19 causes the valve 27 to be moved a definite distance for cutting off the port 65 from the source of supply of compressed air which is conveyed to the unloading valve 73 of the cylinder 74 and thereby exhausting this compressed air through the port 69 to the atmosphere which causes the said valve 73 to be inoperative and thereby cutting off one-fourth of the capacity of the compressor. If the terminal air pressure still increases after this reduction in capacity, a similar occurrence takes place and the valve 27 moves another definite distance and thereby causing the unloading valves 76 and 78 to go into action and thereby cutting off another quarter of the capacity of the compressor. Under this the compressor unit is one-half unloaded. If the terminal air pressure still increases a similar action takes place and the valve 27 again moves a definite distance for controlling the unloading valve 82 and thus cutting off another one-fourth of the capacity of the unit. Now if the terminal air pressure still increases the valve 27 again moves another definite distance and thereby makes inoperative the unloading valves 78 and 84 and at this time cutting off another one-fourth of the capacity of the compressor so that the compressor will be completely unloaded and cannot deliver compressed air. When the terminal air pressure of the compressor unit begins to fall a reversal of operation just previously described takes place. That

is to say, the arm 33 drops causing the rack 44 to come into engagement with the dog 58 and pawl 62 coacting therewith whereby through a step by step movement of this rack 44 the valve 27 correspondingly moves and in sequence all of the unloading valves are closed whereupon the compressor is delivering its complete output of compressed air. Thus the governor will control the output of a compressor step by step by the rising and falling of its predetermined terminal air pressure.

The governor is automatic in its working when the motor 11 is operating and the drop in pressure in the complete cycle in loading and unloading can be varied at the will of an operator. Each step of unloading of the compressor follows in a definite sequence and these steps are controllable by the teeth 55 and 56 of the rack 44 coacting through dogs 57 and 58 and the movement of the bracket 19 operated from the motor 11.

What is claimed is:

The combination with a fluid compressor, including a plurality of cylinders each having a bypass valve, of a governor for effecting the loading and unloading of said compressor bypass valves in a sequence of steps, including a reciprocable member movable in steps in accordance with the steps of the sequence of the loading or unloading of the compressor, a continuously operated reciprocating member adapted to engage said reciprocable member and move it a step at a time in either the loading or unloading sequence, and pressure controlled operating means for effecting the engagement between said reciprocable member and said continuously operated reciprocating member or disengagement thereof in accordance with the pressure of fluid compressed by the compressor.

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