

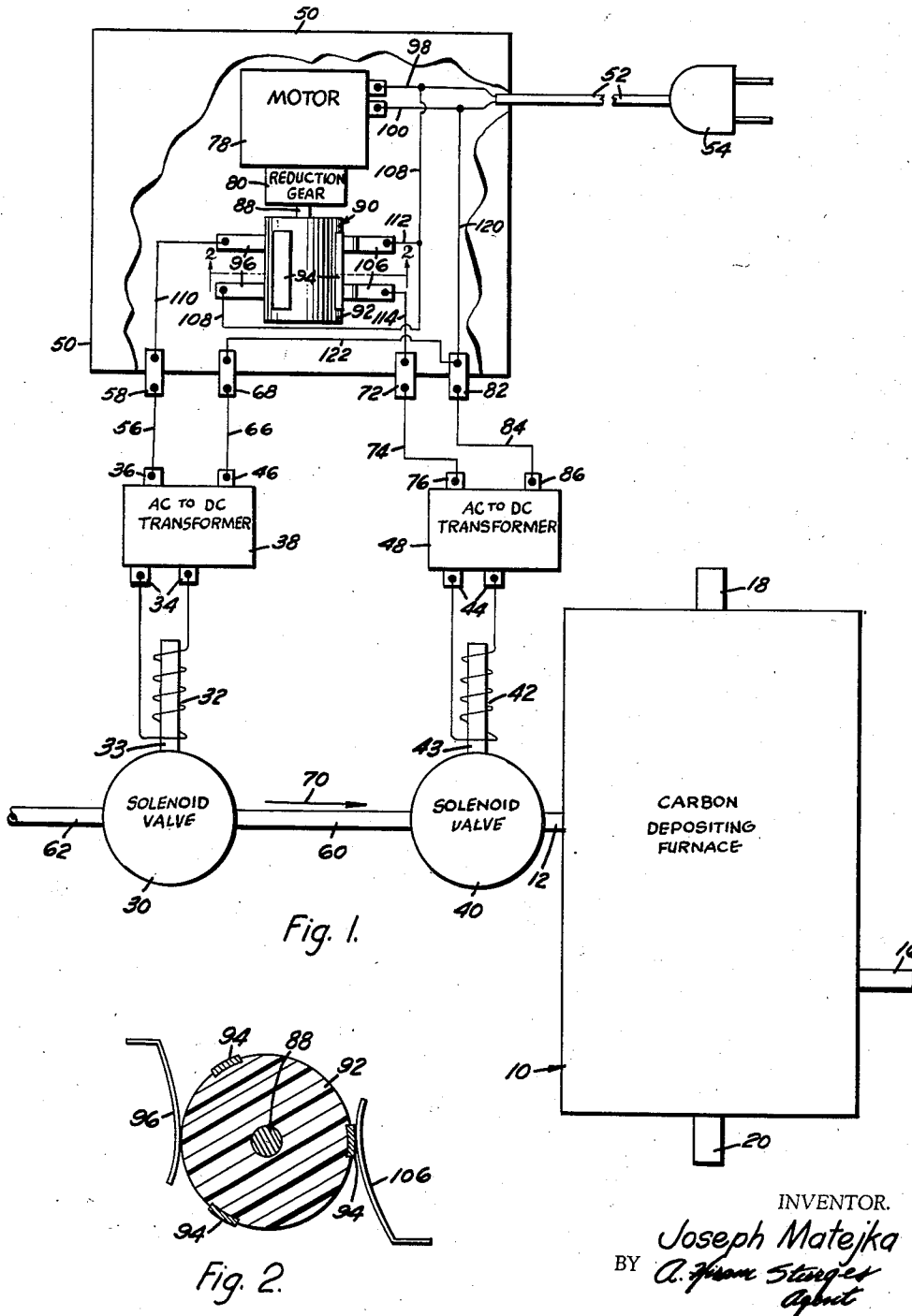
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GAS FLOW CONTROL SYSTEM

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GAS FLOW CONTROL SYSTEM

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This invention relates to gas flow control and more particularly it is an object of this invention to provide a gas flow control system capable of accurately metering such small quantities of the gas flow that they could not be metered by commercial flow meters.

While there are many other uses, it is a particular object of this invention to provide a gas flow control system suitable for controlling the flow of gas into furnaces of the type used for depositing a thin carbon film on ceramic bodies for the manufacture of electrical resistors for use in electronic circuits of all types. In such furnaces it is especially desirable to feed the gas at a constant rate of speed as the cracking of the hydro-carbon gases in the furnace cause a depositing of carbon on the ceramic bodies of the resistors which must be of an accurately controlled thickness for the proper functioning of the electronic circuits in which the resistors are used.

In the operation of such furnaces the rate of speed of ceramic resistor blanks through the furnace can control the amount of carbon deposited on each blank while the rate of flow of the gas into the furnace is held constant. However, if it were not possible to hold the rate of flow of gas into the furnace constant, the resulting resistors would be of varying and inconsistent resistivity and would be unsuitable for most electronic circuits, as would also be the case if an ordinary flow meter were used.

Therefore it is a further object of the invention to provide a gas flow control of novel construction in combination with a carbon depositing furnace specifically, although it will be understood that the gas flow control has many other uses as well.

Yet another object of the invention is to provide a gas flow control which functions by the opening and closing of two spaced valves disposed in a line connected to the gas supply source, the valves disposed in series, the operation being such that first one valve opens and closes and then later the other valve opens and closes, both at regularly timed intervals, whereby gas disposed in the space between the valves, flows forwardly in a pulsation, the valves being controlled by any suitable time-control means.

Other and further objects and advantages of the present invention will be apparent from the following detailed description, drawing and claims, the scope of the invention not being limited to the drawing itself as the drawing is only for the purpose of illustrating a way in which the principles of this invention can be applied.

Other embodiments of the invention utilizing the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention and the purview of the appended claims.

In the drawings:

Figure 1 is a schematic showing of the gas flow system of this invention and is shown as used in combination with a carbon-depositing furnace, the latter being one

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example of a use to which the gas flow control system can be put.

Figure 2 is a cross-sectional view taken along the line 2—2 of Figure 1.

The two wires 98 and 100 of the cord 52 are each connected to a respective terminal 102 or 104 of the motor 78.

One of the brushes 96 is connected to the cord wire 98 by a lead 103. The other one of the brushes 96 is connected by a lead 110 to the timer terminal 58.

One of the brushes 106 is connected to the lead 108 by a wire 112 and the opposite one of the brushes 106 is connected by a lead 114 to the timer terminal 72. Another lead 120 connects the cord wire 100 to the timer terminal 82 and the timer terminals 82 and 68 are connected by a wire 122.

As thus described, it will be seen that the motor 78 drives the cylinder 92 through the reduction gear unit 80 and as the cylinder revolves, the conductor strips 94 will be brought into contact with one then the other of the pairs of brushes 96 or 106 whereby a circuit is completed to first one then the other of the solenoids 32 and 42 permitting sequential opening and closing of the valves 30 and 40.

It will be understood that the electrical regulating means just described is only one method of controlling the solenoid valves and any suitable electrical timing mechanism may be employed and still be within the scope of this invention and the appended claims.

A carbon-depositing furnace is generally designated at 10, and has a gas intake 12 and a gas exhaust 16. The furnace 10 also has ports 18 and 20 for entrance and exit of the ceramic blanks which form the base or body portion of electrical resistors. The carbon depositing furnace 10 is of type more completely described in the applicant's earlier patent, No. 2,695,922, issued November 30, 1954, and titled Carbon Depositing Furnace.

In accordance with this invention, two valves 30 and 40 are provided, each valve being automatically controlled by suitable means, such as, for example, solenoids 32 and 42, respectively, controlling the valve stems 33 and 43, respectively.

The coils of the solenoids 32 and 42 are each connected to terminals 34 and 44 on the D. C. side of respective A. C.-D. C. transformers 38 and 48.

The transformer 38 has two further terminals 36 and 46 on the A. C. side which are connected by leads 56 and 66 to one set of terminals 58 and 68 of an electrical timer generally indicated by the numeral 50.

The timer 50 has another set of terminals 72 and 82 which are connected by leads 74 and 84 to respective terminals 76 and 86 on the A. C. side of the transformer 48.

The electrical timer 50 is connected by a cord 52 and plug 54 to a suitable source of electrical power.

The timer 50 includes a motor 78, a reduction gear unit 80 mounted thereon, a shaft 88 extending outwardly from the reduction gear unit 88 upon which is mounted a drum switch assembly generally indicated by the numeral 90.

The drum switch assembly 90 comprises an elongated cylinder 92, of plastic or other suitable non-conductive material, fixed to and rotatable with the shaft 88.

Elongated conductor strips 94 are disposed longitudinally of the cylinder 92 in spaced apart positions about the periphery thereof and are embedded or otherwise secured in the surface of the cylinder 92.

Two pairs of spaced apart brushes 96 and 106 are provided and positioned one pair on each side of the cylinder adjacent thereto. The brushes 96 and 106 are arranged whereby each is in frictional contact with the surface of the cylinder 92.

The gas line 60 extends between the valves 30 and 40 and another gas line 62 connects the valve 30, which shall hereafter be called the first valve 30, to a suitable source of gas under constantly uniform pressure, not shown. The gas from the source of supply flows in the direction of the arrows 70 to the lines 62, 60 and through the line 12 which is also a gas intake line for the furnace 10.

In operation, it will be seen that this automatic valve control means which has been, for example, illustrated by the solenoids 32 and 42 and by the electrical regulator 50, is set for the successive opening and closing first of the valve 30 and then of the valve 40 and then the flow of gas through the line composed of the parts 62, 60 and 12 is regulated with great precision.

In the operation, the valve 30 is first opened and closed at a time when the valve 40 is closed. This permits the line 60 between the valves to become filled with gas at the pressure of the gas entering the valve 30. Then the valve 40 is opened and closed at a time when the valve 30 is closed. This permits the gas in the line 60, which is under pressure, to escape to a large extent through the valve 40 and into the furnace 10. Then the valve 30 opens and closes again while the valve 40 remains closed and this sequence is repeated continually to form a continuously operating automatic gas flow control system of a type especially desirable in the control of flow of gas in such small quantities as not to be accurately controlled by other types of control meters.

It will be seen that the gas lines 12, 60 and 62 together form a gas conveying means and that the valve 30 and the valve 40 respectively form first and second controllable means for blocking and unblocking the flow of gas through the gas conveying means at first and second points, namely at the valves 30 and 40.

In this sense the time 50 and the solenoids 32 and 42 together form a control means adapted to be connected to a source of power and so constructed as to regularly and successively actuate the first and second controllable means 30 and 40 for the opening and closing of first one, then the other of the first and second controllable means 30 and 40 at a known time interval therebetween whereby the gas conveying means is never open at both the first and second points, namely at the valve 30 and at the valve 40, at the same time.

From the foregoing description, it is thought to be obvious that a carbon-depositing furnace valve constructed in accordance with my invention is particularly well adapted for use, by reason of the convenience and facility with which it may be assembled and operated, and it will also be obvious that my invention is susceptible of some change and modification without departing from the principles and spirit thereof, and for this reason I do not wish to be understood as limiting myself to the precise arrangement and formation of the several parts herein shown in carrying out my invention in practice, except as claimed.

I claim:

1. In combination with a hydro-carbon gas cracking

and carbon depositing furnace of the type used in manufacture of electrical resistors, a system for causing small quantities of gas to flow into said furnace at a regulated rate comprising: a pair of solenoid valves, an electrical timer connected to said valves and causing said valves to operate successively first one then the other at a known time interval between the operation of said valves whereby said valves are never both open at the same time, a first of said valves being attached by suitable gas conveying means to a source of gas, pressure of said source of gas being greater than atmospheric, a second suitable gas conveying means attaching the first solenoid valve to a second solenoid valve, said second suitable conveying means having a specified volume between said valves when both of said valves are closed, and a third suitable gas conveying means attaching the said second solenoid valve to said carbon-cracking-and-depositing furnace, said time interval being sufficient to allow said second gas conveying means to fill with gas to capacity under these conditions.

2. In combination with a hydro-carbon gas cracking and carbon depositing furnace of the type used in manufacture of electrical resistors, a system for causing small quantities of gas to flow into said furnace at a regulated rate comprising: a gas conveying means connected at one end to said furnace and adapted to be connected at its other end to a source of gas under a pressure greater than atmospheric, a first controllable means for blocking and unblocking flow of gas through said gas conveying means at a first point, a second controllable means for blocking and unblocking flow of gas through said gas conveying means at a second point, a control means adapted to be connected to a source of power, said control means being so constructed as to regularly and successively actuate said first and second controllable means for the opening and closing of first one then the other at a known time interval therebetween without necessity for constant manipulation whereby the gas conveying means is never open at both said first and said second points at the same time.

3. The combination of claim 2 in which said control means includes an electrical timer.

4. The combination of claim 2 in which said control means includes solenoids connected to and controlling each valve and an electrical timer controllably connected to said solenoids.

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