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[54] **CONTROL SYSTEM FOR BAG FILTERS**
4 Claims, 1 Drawing Fig.

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[50] **Field of Search** 55/272, 273, 283, 302, 286, 341, 274

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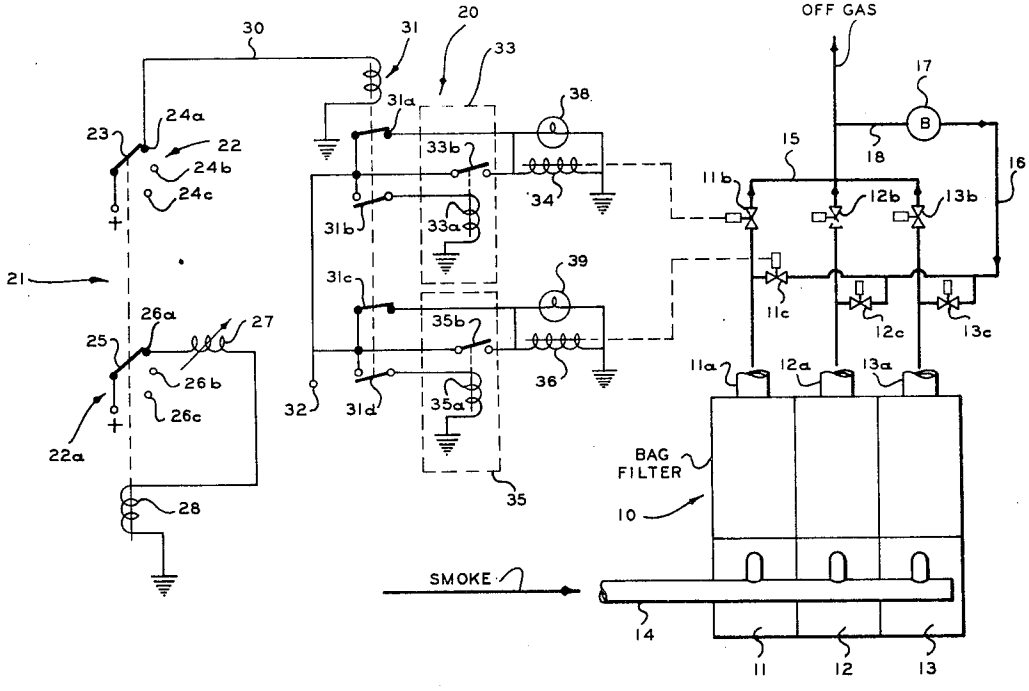
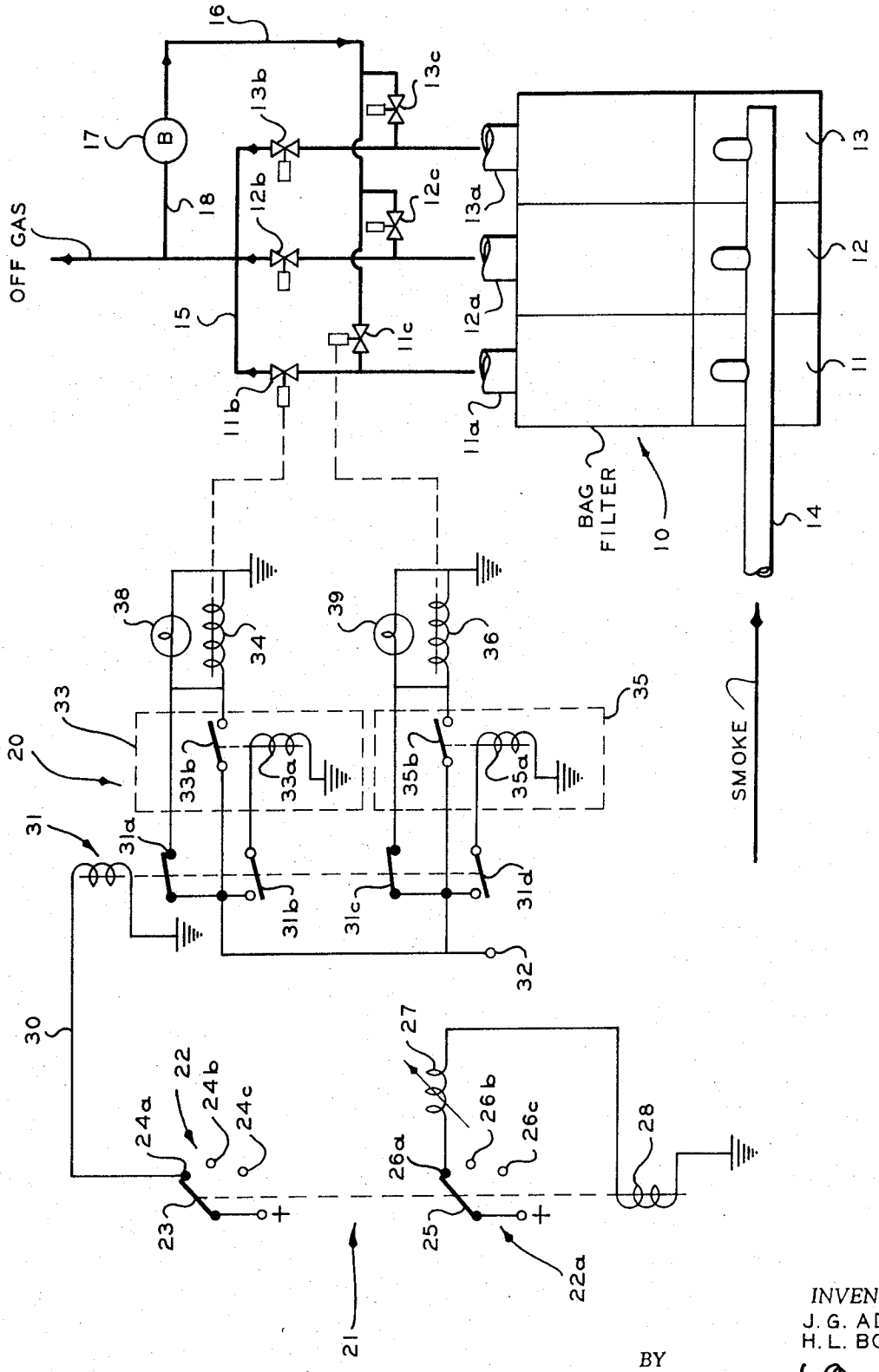
ABSTRACT: A bag filter system has an off gas conduit communicating with each compartment. Each conduit includes a valve controlling the discharge of off gas and a valve regulating the introduction of repressuring gas to its associated compartment. The valves are sequentially controlled to close the off gas conduit of each compartment for a predetermined period and admit repressuring gas for a predetermined shorter period.





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CONTROL SYSTEM FOR BAG FILTERS

BACKGROUND OF THE INVENTION

This invention relates to a control system for a bag filter.

Bag filters are divided into a plurality of separate compartments each containing one or a multiplicity of filter bags. A smoke is introduced into the bag filter. The particulate matter in the smoke is retained in the bags while the filtered gas, referred to as off gas, passes through separate conduits to a collection header. It is desirable in such a system to periodically repressure the bags in the individual compartments. To this end, a control valve in the off gas conduit is closed and a repressuring gas, usually obtained from the off gas header, is pumped or blown into the compartment. This repressuring operation is advantageously carried out sequentially in the respective compartments so that filtering of the smoke continues, except for the compartment where repressuring is taking place.

BRIEF DESCRIPTION OF THE INVENTION

We have found that the repressuring cycles for the different compartments are most advantageously of different lengths. We attribute this to different conditions of the bags in each compartment and dissimilar piping arrangements for passing the repressuring gas to the individual compartments. Heretofore, it has been necessary to shut down the entire bag filter operation in order to adjust these time periods.

In order to overcome this problem, and to provide complete flexibility in the repressuring of the compartments, we have provided a control system. This includes timing means for each compartment which is actuatable to close a control valve in the conduit leading to the smoke header for a predetermined period, and simultaneously open a pressuring valve to admit gas to the compartment for a shorter predetermined period. The system further includes a control switch which is operable to sequentially energize the timing means of the respective compartments.

The cycle length of the timing means and control switch can be individually adjusted according to our invention to provide complete flexibility in control of the length of the repressuring cycle, the period during which the off gas control valve is actuated during that interval, and the length of time that the repressuring gas is admitted to the compartment. Hence, the repressuring cycles can be adjusted as desired during normal operation of the bag filter without requiring shutdown, and this desirable end is accomplished with a minimum amount of standard, readily available and economical circuit components.

DETAILED DESCRIPTION OF THE INVENTION

Various other objects, advantages and features of our invention will become apparent from the following detailed description taken in conjunction with the accompanying drawing, in which:

The FIGURE is a schematic view of a bag filter utilizing the control system of our invention.

Referring now to the FIGURE, a bag filter **10** is provided with a multiplicity of compartments, three of which are indicated by reference numerals **11**, **12** and **13**. Each compartment contains one or a multiplicity of porous bags, not shown, arranged to filter particulate material from a smoke which is admitted to the individual compartment through a header **14**. Various conventional parts of the bag filter system, such as a conveyor for removing the discharged particulate material, bag shaker, and the like, are not shown since they form no part of the present invention.

In the compartments **11**, **12**, **13**, the filtered gas, herein referred to as off gas, is discharged through conduits **11***a*, **12***a* and **13***a*, respectively, to an off gas header **15**. The conduits are provided, respectively, with control valves **11***b*, **12***b*, and **13***b* which can be closed to interrupt the flow of off gas from the individual compartments.

The conduits are further provided, respectively, with repressuring valves **11***c*, **12***c*, and **13***c* disposed between the filter compartments and the control valves. The valves **11***c*, **12***c* and **13***c* control the flow of repressuring gas to the respective compartments from a repressuring gas header **16** which is fed by a blower **17**. Preferably but not necessarily, the repressuring gas is the off gas from the bag filter and, accordingly, in the embodiment shown, the inlet of the blower **17** is connected to the off gas header **15** by a conduit **18**. The repressuring gas can, if desired, be fed directly to the compartments **11**, **12** and **13** instead of through the conduits **11***a*, **12***a* and **13***a*.

It will be understood that the individual compartments **11**, **12** and **13** are sequentially repressured. Considering the compartment **11**, for example, the control valve **11***b* is closed and the repressuring valve **11***c* is opened at the beginning of the cycle whereupon the repressuring gas is introduced into the compartment. After a predetermined period, the repressuring valve **11***c* is closed and thereafter the control valve **11***b* is opened to permit resumption of normal operation of the bag filter compartment. Then immediately or after a timed period, the repressuring cycle is initiated in another compartment, for example, the compartment **12** and thereafter sequentially in the rest of the compartments of the bag filter. As will become apparent hereafter, the length of the period during which the valve **11***b* is closed, the length of the period during which valve **11***c* is opened, and the interval, if any, between the sequential repressuring cycles can be varied at will by utilizing the control system of our invention.

A separate control unit **20** is provided for each compartment and these control units are all controlled by a single control switch **21**. Only the control unit for the compartment **11** will be described in detail, and it will be understood that similar control units are provided for each of the other compartments of the bag filter, for example, the compartments **12** and **13**.

In the example shown, the control unit **21** consists of a two-gang multiple-position step switch. One gang **22** has a contactor **23** connected to one terminal of a current source and contacts **24***a*, **24***b* and **24***c*, one for each compartment of the bag filter. The other terminal of the current source is represented by ground. The second gang **22***a* of the switch **21** similarly has a contactor **25** and contact points **26***a*, **26***b* and **26***c*. The contact points **26** are connected, respectively, through variable time delay relays, one of which is denoted by reference numeral **27**, to one terminal of a motor magnet **28**, the other terminal of which is grounded. When the motor magnet **28** is actuated the contactors **23**, **25** advance one point, Subsequent actuations of the magnet move the contactors stepwise until the last contact point is reached, whereupon the contactors return to the first contact points **24***a* and **26***a*, respectively. Thus, the control switch is sequentially operable by the motor magnet **28** and the length of dwell on each contact point can be individually regulated by adjustment of the time delay relays.

The control unit **20** which operates the repressuring valve **11***c* and control valve **11***b* of the bag filter compartment **11** will now be described in detail, this unit being actuated when the contactor **23** dwells on the contact point **24***a* and the contactor **25** dwells on the contact point **26***a*. It will be understood that a similar control unit is provided for each of the other bag filter compartments, these being actuated when the contactor **23** dwells, for example, upon the contact points **24***c*, **26***c*.

The contact point **24***a* is connected to ground through the coil of a multiple contact relay **31**. This relay has a normally closed set **31***a* of contact points, one of which is attached to a power supply terminal **32** and the other of which is connected to ground through a solenoid **34** actuating the control valve **11***b*. A timer **33** has a coil **33***a* which is connected in circuit with ground, the current source **32** and a normally open set **31***b* of contacts of the relay **31**. The timer **33** also has a normally open contact set **33***b* connected in parallel with the contacts **31***a*.

The relay 31 additionally has a set 31*c* of normally closed contacts, one of which is connected to the terminal 32 and the other of which is connected to ground through a solenoid coil 36 controlling the repressuring valve 11*c*. The timer 35 has a coil 35*a*, one terminal of which is grounded and the other terminal of which is connected through a normally open set 31*d* of contacts of the relay 31 to the terminal 32. The timer 35 also has a set 35*b* of normally open contacts connected in parallel with the contacts 31*c*. Indicator lights 38 and 39 are connected in parallel with the respective solenoids 34 and 36.

OPERATION

At the start of the repressuring cycle for the compartment 11, the contactor 23 moves to contact point 24*a*, thus energizing the relay 31. Prior to such actuation of the relay 31, the solenoid coil 34 was energized by current supplied through the contact set 31*a* to maintain the valve 11*b* in open position. Upon actuation of the relay, the circuit to the solenoid 34 is broken by opening of the contact set 31*a*, thus closing the control valve 11*b* and the off gas conduit 11*a*. At this time, operation of the timer 33 is initiated by closure of the contacts 31*b*.

Similarly, prior to movement of the contactor 23 to the contact point 24*a*, solenoid 36 was energized through the contact set 31*c*, thus maintaining the repressuring valve 11*c* in closed position. Upon operation of the relay 31, the circuit to the solenoid 36 is broken by opening of the contacts 31*c* and the repressuring valve 11*c*, accordingly, moves to open position, thus admitting repressuring gas to the compartment 11. At the same time, operation of the timer 35 is initiated by closure of the contacts 31*d*.

After a first predetermined period, the timer 35 closes the contact points 35*b* thereby energizing the solenoid 36, closing valve 11*c* and interrupting the flow of repressuring gas to the compartment 11. Thereafter, at the end of a second predetermined period, the timer 33 closes the contact points 33*b*, thus energizing the solenoid 34. This causes the valve 11*b* to open and reestablishes flow of gas through the compartment 11 to the off gas header 15. Either immediately or a predetermined period thereafter, the time delay relay 27 allows energizing of the motor magnet 28, thus moving the contactors 23 and 25 to the respective contact points 24*b* and 26*b*. Thereupon, the relay 31 is deenergized, current is supplied to the valve solenoids through the contact sets 31*a*, 31*c*, and the timers 33, 35 are reset. The described energization of the step switch 21 initiates a repressuring cycle, similar to that previously described in detail, for the compartment 12. As the step switch moves to its subsequent contact points, repressuring cycles are initiated and completed sequentially for the remaining compartments of the bag filter. When the cycle for the last compartment is completed, the contactors 23, 25 return to the respective contact points 24*a*, 26*a* and a new sequence of repressuring steps is initiated.

It will be evident that the length of the repressuring cycles, and the length of the actuation periods of the control valves and repressuring valves can be varied at will by adjusting the timers 33, 35 and the time delay relays 27. It will be apparent, therefore, that we have achieved the objectives of our invention in providing a completely flexible control system for regulating repressuring of individual compartments of a bag filter, and such adjustments can be carried out without shutting down the bag filter operation.

Other variations and modifications of this invention will be apparent to those skilled in the art without departing from the spirit and scope of the invention.

We claim:

1. In a bag filter system wherein a smoke is filtered through bags in a plurality of compartments, each having a conduit for the discharge of off gas, a control valve in each conduit, a repressuring valve connected to introduce repressuring gas to each compartment, and means for feeding gas through said repressuring valves; a control unit for each compartment including timing means actuable to close the control valve of the associated compartment for a first predetermined period and to open the repressuring valve of the associated compartment for a second predetermined period shorter than said first predetermined period, and a control switch sequentially operable to energize said control units by actuating the timing means thereof;

wherein the control switch is a two-gang step switch having a motor magnet, one gang having a set of contact points connected through respective time delay relays to said motor magnet, and the second gang having contact points connected in circuits to initiate actuation of the respective control units.

2. The system of claim 1 including an off gas header connected to said conduits, and wherein said feeding means includes a blower having its inlet connected to said off gas header.

3. The system of claim 2 wherein said valves are solenoid valves, and each control unit includes a relay, a first timer, and a second timer, each timer having a coil, one solenoid valve being connected in circuit with a normally open contact set of the first timer and a normally closed contact set of said relay, the coil of said first timer being connected in circuit with a normally open contact of said relay, and the other solenoid valve is connected in circuit with a normally open contact set of said second timer and a normally closed contact set of said relay, the coil of said second timer being connected in circuit with a normally open contact set of said relay, the coil of each relay being connected in circuit with a power source, a contact point and the contactor of the second gang of said step switch.

4. In a bag filter system wherein a smoke is filtered through bags in a plurality of compartments, each having a conduit for the discharge of off gas, a control valve at each conduit, a repressuring valve connected to introduce repressuring to each compartment, and means for feeding gas through said repressuring valves; a control unit for each compartment including timing means actuatable to close the control valve of the associated compartment for a first predetermined period and to open the repressuring valve of the associated compartment for a second predetermined period shorter than said first predetermined period, and a control switch sequentially operable to energize said control units by actuating the timing means thereof;

wherein said valves are solenoid valves and each control unit includes relay means, a first timer and a second timer, each timer having a coil, one solenoid valve being connected in circuit with a normally open contact set of the first timer and a normally closed contact set of said relay means, the coil of said first timer being connected in circuit with a normally open contact of said relay means, and the other solenoid valve is connected in circuit with a normally open contact set of said second timer and a normally closed contact set of said relay means, the coil of said second timer being connected in circuit with a normally open contact set of said relay means, the actuating circuit of each relay means being connected in circuit with a power source and said control switch.

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