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[45] Patented **Aug. 24, 1971**

3,052,176	9/1962	Anderson.....	98/33
3,402,654	9/1968	Berst	98/33
3,415,178	12/1968	Ball	98/33

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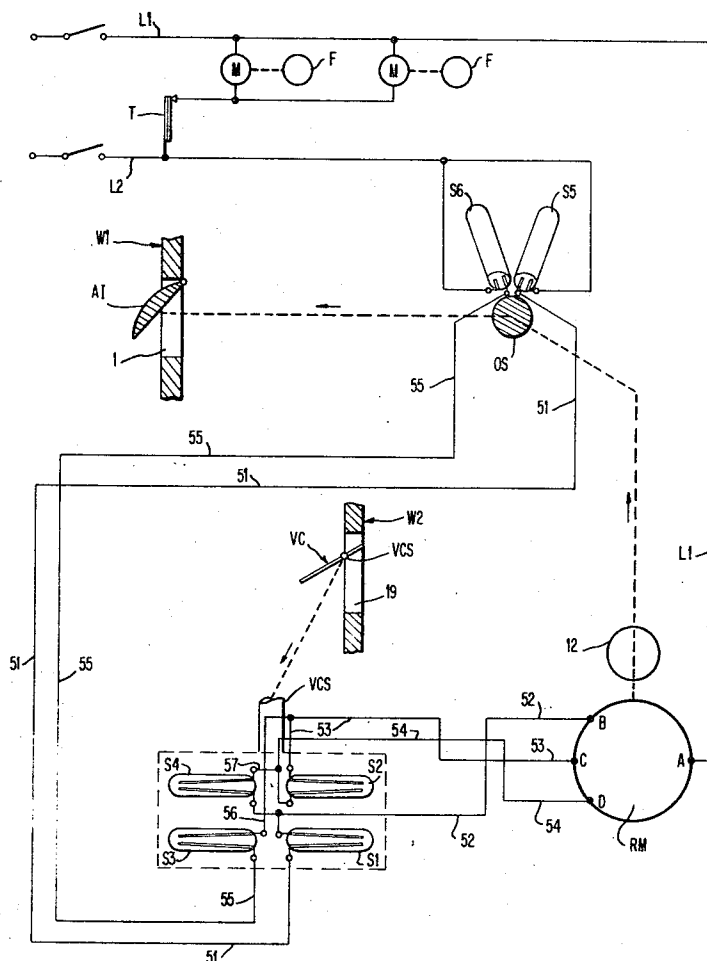
**[54] APPARATUS FOR MAINTAINING A DESIRED
VACUUM WITHIN AN ENCLOSURE
16 Claims, 11 Drawing Figs.**

[52]	U.S. Cl.....	98/32, 98/33, 98/37, 98/39, 98/95
[51]	Int. Cl.....	F24f 13/00
[50]	Field of Search.....	98/32, 33, 95, 37, 39

[56] **References Cited**
UNITED STATES PATENTS

2,316,237	4/1943	Grunert.....	98/39
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ABSTRACT: The vacuum within an enclosure from which air is exhausted for, e.g. ventilation, is maintained at a desired degree by controlling the effective size or area of an air inlet opening in one wall of the enclosure in dependence upon the degree of vacuum in a region adjacent to a different wall of the enclosure, preferably a wall opposite that having the air inlet opening. By way of example, the invention is disclosed as used for maintaining that degree of vacuum in a poultry house believed to be most conducive to feed conversion and growth of poultry.



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3 Sheets-Sheet 1

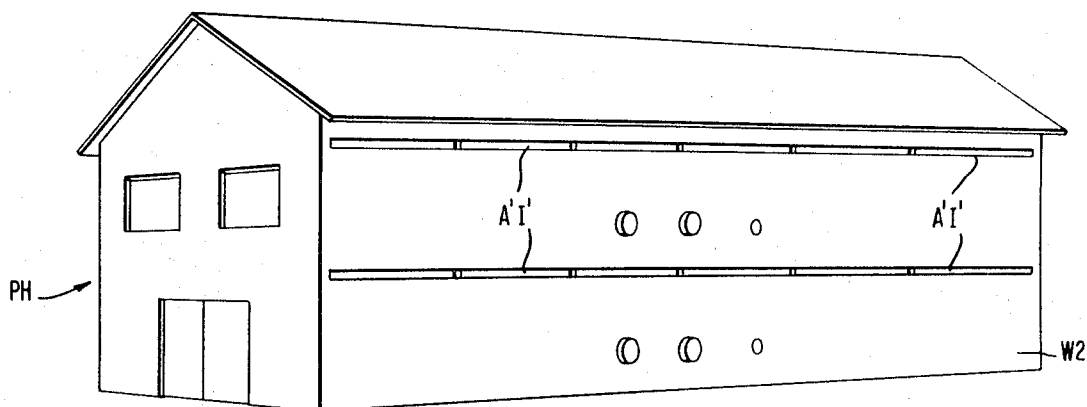


FIG. 1

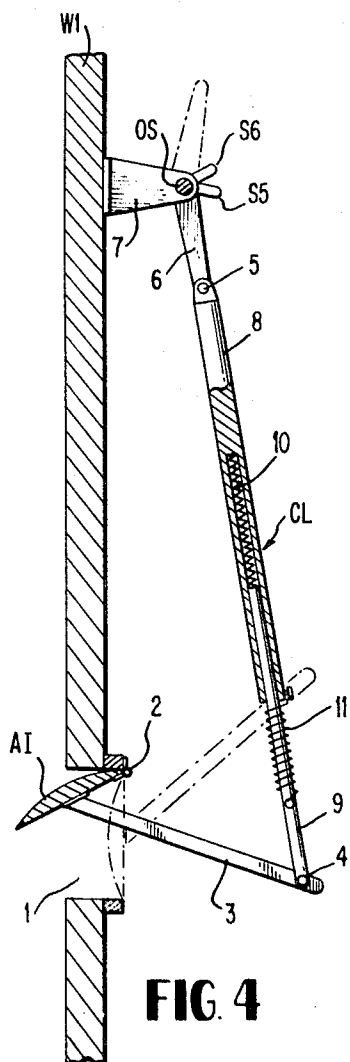


FIG. 4

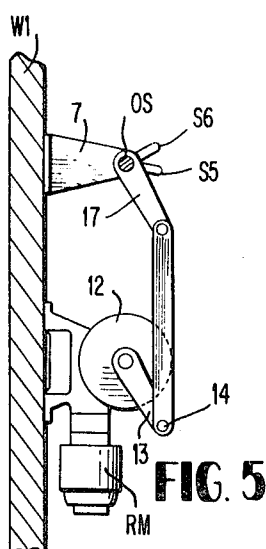


FIG. 5

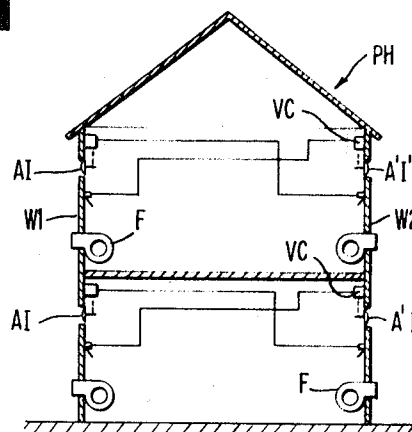


FIG. 2

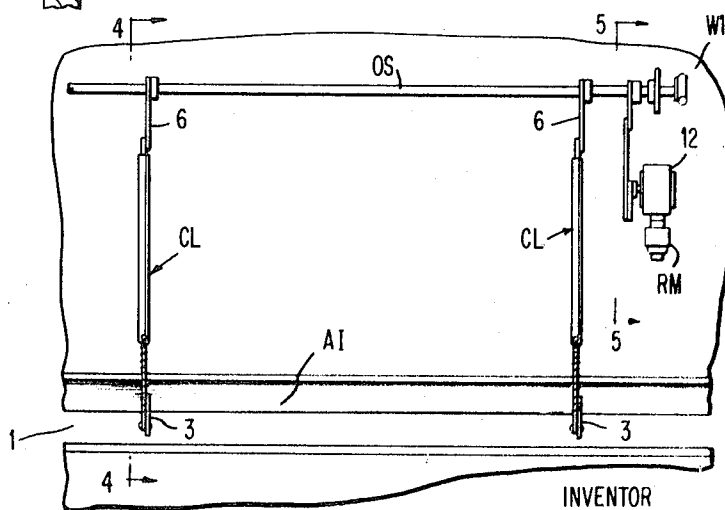


FIG. 3

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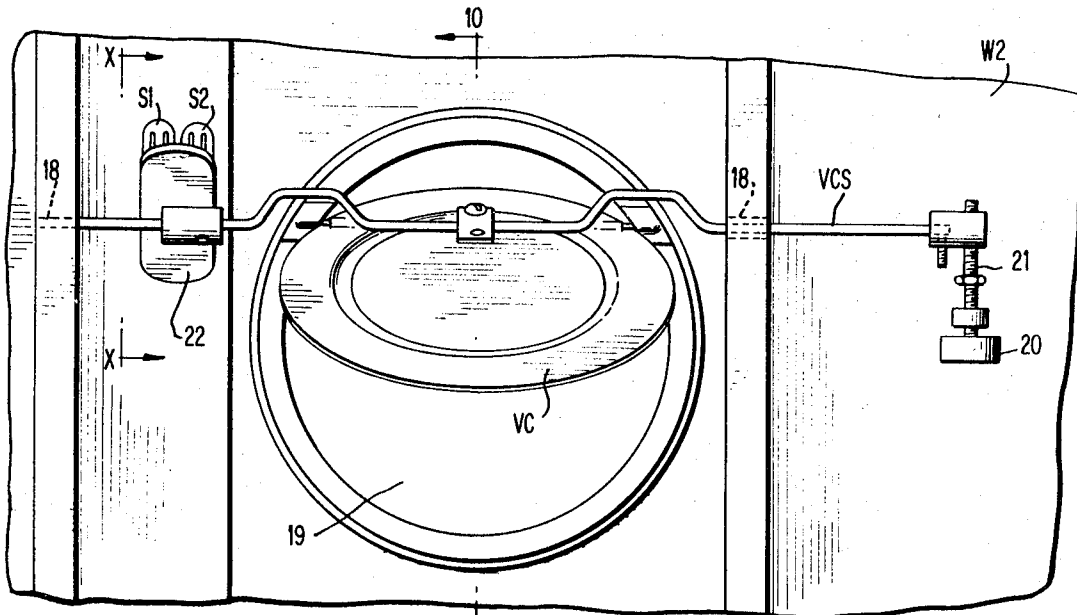


FIG. 6

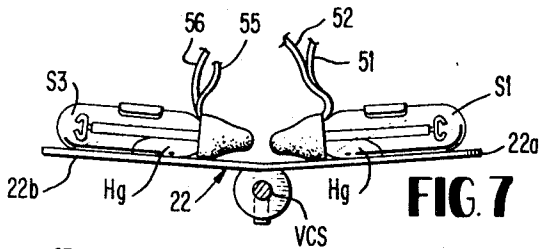


FIG. 7

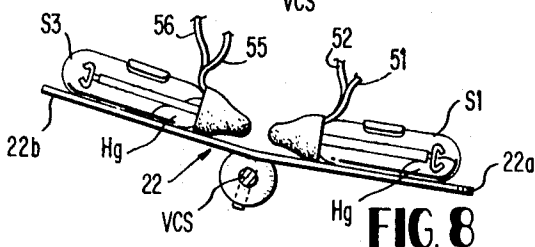


FIG. 8

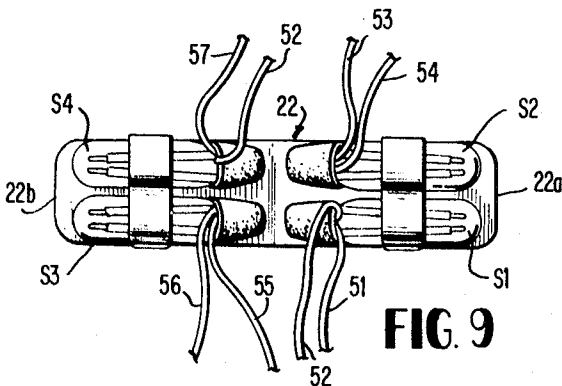


FIG. 9

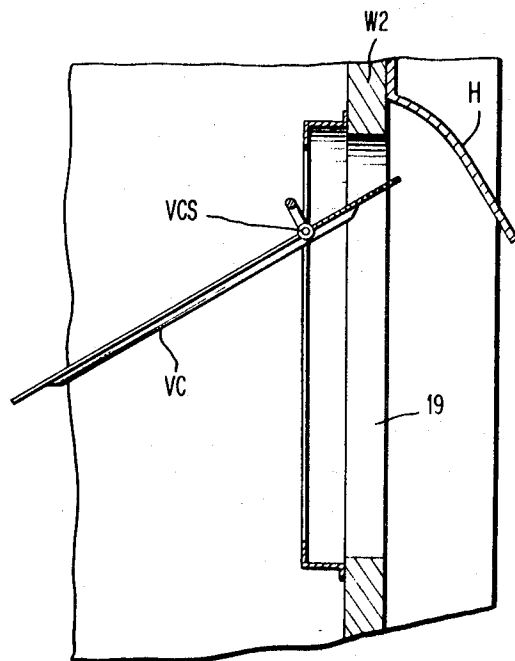


FIG. 10

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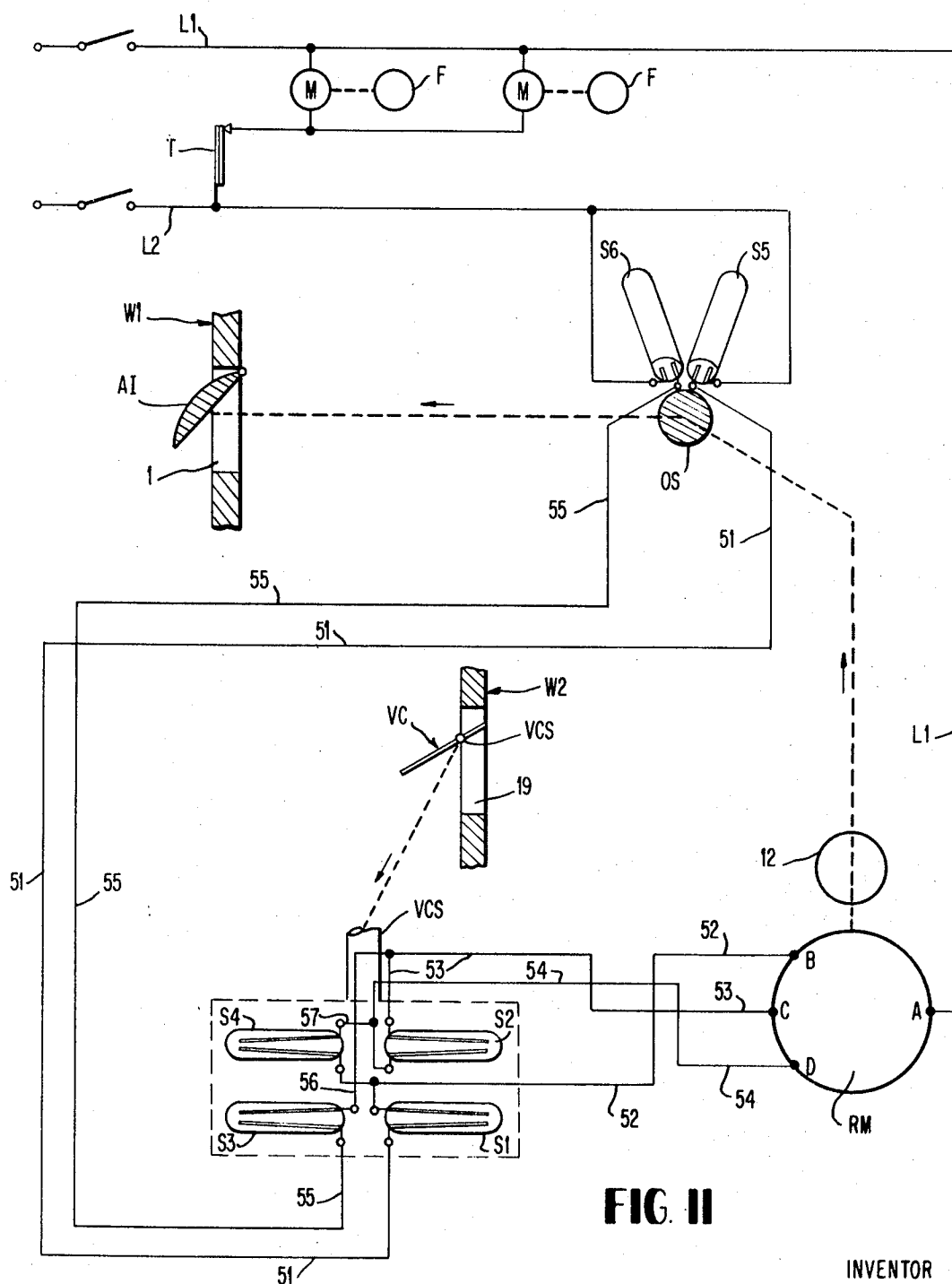


FIG. 11

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APPARATUS FOR MAINTAINING A DESIRED VACUUM WITHIN AN ENCLOSURE

SUMMARY OF INVENTION

It is known that for some purposes it is desirable to maintain a closely regulated degree of vacuum, i.e. negative pressure, with an enclosure. Thus, in the raising of poultry, particularly on a commercial scale, poultry, e.g. chicken, are raised in poultry houses ventilated by fans which exhaust air from the enclosure and thus draw air into the enclosure through wall openings, thereby creating a vacuum within the enclosure. Poultry growers have learned that efficient feed conversion and hence growth of poultry raised in such an enclosure are importantly affected by the vacuum within the enclosure, a vacuum of about one-eighth inch water gauge being the optimum, or close to it. The conventional way of attempting to maintain a desired vacuum has been to vary the effective area of the ventilating air inlet openings manually according to the observed vacuum within the enclosure. Thus, if the observed vacuum is too high, the effective area of the inlet openings is increased, whereas if the observed vacuum is too low, the effective air inlet opening area is reduced. Effecting such control manually has left much to be desired because of the amount of attention required with consequent expense, and because of the practical impossibility of maintaining the required vacuum constantly and accurately, particularly when maintaining the required condition is complicated by variables such as winds changing in velocity and direction, and atmospheric conditions in general.

An object of the present invention is to provide an apparatus which largely overcomes the difficulties encountered in previously known systems of maintaining a desired vacuum within an enclosure, the invention providing for controlling the effective area of an air inlet opening in one wall of an enclosure in accordance with the vacuum condition in a remote part of the enclosure.

Another object of the invention is to provide an apparatus of the class referred to in which the vacuum condition is sensed in a region adjacent one wall of the enclosure, and the sensed value is utilized to vary the effective area of an air inlet opening in an opposed wall of the enclosure.

A further object of the invention is to provide improved apparatus for automatically maintaining a desired degree of vacuum within an enclosure, such as a poultry house.

Other objects of the invention will become apparent from a reading of the following description, the appended claims, and the accompanying drawings, in which:

FIG. 1 is a perspective view of a two-story live poultry house including an installation of equipment embodying the invention;

FIG. 2 is a vertical section of the poultry house showing ventilating fans in elevation, and showing schematically the relationship between air intake closures on both of two opposed sides of the building and respectively cooperating vacuum responsive control devices on opposite sides of the building;

FIG. 3 is a fragmentary elevation of air intake closure mechanism as viewed from inside the building, drawn on an enlarged scale;

FIG. 4 is a fragmentary section on the line 4—4 of FIG. 3;

FIG. 5 is a fragmentary section on the line 5—5 of FIG. 3;

FIG. 6 is an enlarged scale elevation of a vacuum responsive control device;

FIG. 7 is a section on the line X—X of FIG. 6, showing an assembly of mercury switches mounted on a shaft included in the vacuum control device, the switch assembly being movable to three positions, and being shown in this figure in a neutral position in which all of the switches are in circuit breaking, i.e. open positions;

FIG. 8 is a view similar to FIG. 7, but showing the switch assembly tipped in one direction to close certain of the switches while the others remain open;

FIG. 9 is a detailed plan view of the switch assembly shown in FIGS. 6-8;

FIG. 10 is a vertical sectional view on the line 10—10 of FIG. 6 of a portion of the building wall opposite the wall shown in FIGS. 3-5, FIG. 10 illustrating parts of a vacuum responsive control device; and

FIG. 11 is a schematic wiring diagram showing a switching circuit and connections for controlling the operation of a reversible motor which closes or opens an air intake closure, according to the required correction of the vacuum condition within the poultry house.

In the illustrative embodiment of the invention, the apparatus for controlling the degree of vacuum is shown in connection with a poultry house PH comprising, inter alia, spaced opposed sidewalls W1 and W2. Exhaust fans F driven by motors M are mounted in each of the walls W1 and W2. Each wall W1 and W2 is formed in each story with an air inlet opening 1, the inflow of air through which is controlled by an air intake closure, there being closures AI in the wall W1 and closures A'I in the wall W2. As described hereinafter, the closure AI in the wall W1 is opened or closed by reversible drive means under the control of a device located on the side of the wall W2 which senses a function of the vacuum in the region adjacent the wall W2 and controls the operation of the reversible motor. Conversely, the closure A'I controlling the air intake opening in the wall W2 is operated according to the vacuum condition existing in the region inside of the wall W1. Thus, there are two separate but similar systems, each comprising an air inlet closure member in one wall which is controlled in its opening and closing movements in accordance with the vacuum in the region adjacent the opposite wall. Because of the similarity of the two systems, a detailed description of the system including the air intake control closure AI in the wall W1 will suffice.

As shown in FIGS. 3 and 4, a portion of the wall W1, for example the first story portion, is formed with an elongated air intake opening 1 the inflow of air through which is controlled by a plurality of aligned air intake closures AI functioning together as one. Each closure AI is pivoted at 2 and is provided with two fixed arms 3 which are pivoted respectively at 4 to cushion links generally designated CL, the upper ends of which are pivoted at 5 to cranks 6 on an operating shaft OS mounted to rock in a bracket 7 fixed to the wall W1.

As is apparent from FIG. 4, clockwise rocking of the shaft OS will rock the closure AI toward its open position. If there should be an obstruction in the opening 1 or if the pivot 2 should freeze, the cushion link CL will permit continued rocking of the crank 6 after blockage of the closure member AI so as to prevent damaging any of the parts. Conversely, if free closing movement of the closure AI should be prevented during counterclockwise rocking of the operating shaft OS, the link CL will yield to prevent damage. To these ends, the cushion link is constructed to be yieldable longitudinally both in the compressing and in the extending direction when subjected to a load greater than that which it normally transmits in opening and closing the member AI. In the form shown, the cushion link CL comprises an outer telescopic section 8, an inner telescopic section 9, a compression spring 10 between the housed end of the inner section 9 and the root of the bore in the outer section 8, and a tension spring 11 having its ends connected respectively to the lower end of the outer section 8 and a lower end part of the inner section 9. It is apparent that the cushion link CL will transmit normal operating force in both directions and will yield in either direction if subjected to greater than normal force.

Reversible drive means, in the form shown including a reversible motor RM, is provided for rocking the operating shaft OS in selected directions according to whether correction of the vacuum condition in the enclosure requires opening or closing of the closure AI. The drive means further includes a reduction gear 12 which is shown as being incorporated in a unit construction with the reversible motor RM. The power takeoff from the reduction gear 12 is transmitted through a crank 13 pivoted at 14 to a link 15 which in turn is pivoted at 16 to a crank 17 fast with the operating shaft OS. Driving of the motor in one direction under the control of

means to be described later will rock the crank 13 clockwise so as to rock the shaft OS clockwise, whereas driving the motor in the opposite direction will rock the crank 13 and the shaft OS counterclockwise. Rocking of the shaft OS is, of course, transmitted through the crank 6, the cushion links CL and the arms 3 to the closure AI.

While any suitable reversible motor and reduction gear equipment may be used, the motor and reduction gear used in the equipment illustrated in the drawings is a reversible four-terminal AC Dayton Gearhead Motor assembly from Dayton Electric Mfg. Co. of Chicago, Ill., having a speed reduction ratio of approximately 2,400:1 which permits a small motor to be used for moving the closure AI slowly as is very important in obtaining delicate and accurate variation of the vacuum conditions in the enclosure. Excellent results are obtained with this equipment which provides an output speed of about one revolution per four minutes of operation.

The motor RM which operates the closure AI in the wall W1 is controlled in accordance with the vacuum condition in the region adjacent the opposite wall W2, as previously set forth. Components of the control mechanism are illustrated structurally in FIGS. 6-10, and are indicated schematically in the circuit diagram FIG. 11 to be explained in detail hereinafter.

Referring to FIGS. 6-10, a vacuum control member VC, somewhat in the nature of an induction opened damper, is fixed to a vacuum control shaft VCS which is rockably mounted in bearings 18 which position the member VCS adjacent to a control air flow opening 19 in the wall W2. The member VC is fixed to the shaft VCS above the center of gravity of the member VC so that the weight of this member tends to rock it counterclockwise from the open position shown in FIG. 10 toward a position in which it would close the opening 19. Vacuum within the enclosure in the region adjacent the wall W2 will cause control air to flow in through the opening 19 so as to urge the control member VC clockwise toward a position as shown in FIG. 10 or some other partially opened position. The degree of vacuum required to move the vacuum control member VC by overcoming its weight may be varied by a counterweight 20 carried by an arm 21 offset from the axis of the rock shaft VCS, the counterweight 20 being adjustable along the arm 21.

If the vacuum within the enclosure is higher than the desired predetermined vacuum, control air will flow at a relatively high velocity through the control air flow passage 19 in the wall W2, thereby swinging the vacuum control member VC inwardly, that is clockwise as viewed in FIGS. 10 and 11. Vice versa, too low a vacuum in the enclosure will be accompanied by less air velocity through the passage 19 so that the vacuum control member VC will swing counterclockwise toward closed position as viewed in FIGS. 10 and 11. The sensed velocity of the control air flowing in through the passage 19 is a function of the vacuum in the region adjacent to the wall W2. As will be explained in detail later, clockwise swinging of the member VC effects opening movement of the closure AI with consequent reduction in vacuum within the enclosure, whereas counterclockwise swinging of the member VC effects closing movement of the closure AI with consequent increase in vacuum within the enclosure.

Electrical switch components operated by rocking of the vacuum control member VC are illustrated structurally in FIGS. 6-9. A mounting plate 22 is secured to the vacuum control shaft VCS and has its two ends 22a and 22b slightly inclined upwardly and outwardly from the center of the plate 22 which is directly above the shaft VCS as shown in FIG. 7. Two mercury switches S1 and S2 are carried by the plate end part 22a, and two mercury switches S3 and S4 are carried by the other end part 22b. Each of the switches S1-S4 has its internal contacts at the outer end of the associated switch tube remote from the shaft VCS. When the switch assembly is in the position shown in FIG. 7, the mercury globules Hg of each switch are in the inner or lower ends of the switch tubes so as not to bridge the switch contacts, all switches S1-S4 thereby being open when the assembly is positioned as shown in FIG. 7

FIG. 8 shows the switch assembly tipped clockwise from the FIG. 7 position so that the mercury globules Hg in the switches S1 and S2 have run down to the outer ends of the tubes to bridge the contacts and close the switches S1 and S2. In the FIG. 8 position, the switches S3 and S4 are still open.

Now, if the switch assembly S1-S4 is tipped counterclockwise from the position shown in FIG. 7, the switches S3 and S4 will be positioned so that their outer ends are lower than their inner ends, and the mercury globules will run down the switch tubes to close the switches S3 and S4. It is important to note that the relative inclinations of the switches S1 and S2 on the plate part 22a and the switches S3 and S4 on the plate part 22b are such that when the switch assembly is tipped counterclockwise from its FIG. 8 position, the mercury globules Hg in the switches S1 and S2 will move away from their associated contacts; but the globules in the switches S3 and S4 will not move into contact bridging positions until the assembly has been rocked counterclockwise beyond the neutral position shown in FIG. 7. In other words, when the assembly is rocked counterclockwise from the FIG. 8 position, it must go to the neutral position shown in FIG. 7 before further rocking will close the switches S3 and S4.

Irrespective of the protection against damage provided by the cushion links CL as explained above, it is desirable so to control the reversible motor RM as to deactivate it when the air intake closure AI has been moved to either a position unnecessarily close to its opening limit position or unnecessarily close to its closing limit position. For this purpose, two mercury switches S5 and S6 are mounted on the operating shaft OS as shown in FIGS. 4, 5 and 11. As is apparent from FIG. 11, the internal contacts of the switches S5 and S6 are in the inner ends of the switch tubes adjacent to the operating shaft OS so that when the switches S5 and S6 are positioned as shown in FIG. 11, which corresponds to a normal operating position of the air inlet closure AI, the switches S5 and S6 will be positioned relatively to each other in the nature of the legs of a "V" and both will be closed by the mercury globules bridging the internal contacts. In the normal position of the operating shaft OS, each switch S5 and S6 is inclined at about 70° to the horizontal. FIGS. 4 and 5 show the switches S5 and S6 in the positions occupied as a result of overdriving of the air inlet closure AI, the switch S5 being inclined below the horizontal so as to be in circuit breaking open condition.

OPERATION

The schematic view in FIG. 11 shows the electrical circuits and switches for regulating the rate of flow of intake or ventilating air drawn into the enclosure by the fans F. The air intake rate is regulated by the air intake closure member AI mounted in the air intake opening 1 in one wall W1 of the enclosure. The closure member AI is moved to different positions under the control of the vacuum control member VC mounted in the path of control air flowing through the passage 19 in the wall W2 of the enclosure opposed to, that is on the opposite side of the building from, the wall W1.

When temperature conditions within the enclosure call for drawing ventilating air into the enclosure through the opening in the wall W1, the thermostat T is closed so as to connect the fan F motor M across the power supply lines L1 and L2. Assuming that the desired vacuum is present within the enclosure and that the air intake closure member AI is in the partially open position shown in FIG. 11, the vacuum control member VC will be held in the position shown in FIG. 11 by air flowing inwardly through the associated opening 19 in the wall W2. The overdrive control switches S5 and S6 are in the positions shown in FIG. 11 so as both to be closed, and the vacuum control switch assembly S1, S2, S3 and S4 is in a neutral position as shown in FIG. 7 in which the mercury globule in each of these switches is at a position in the switch tube such that the switch contacts are not bridged by mercury, i.e. the switches are open. As long as the desired degree of vacuum exists in the enclosure, the reversible motor RM which operates the air intake closure member AI will not be

energized, and all of the control elements will remain in the positions shown in FIG. 11. The contacts in the overdrive control switches S5 and S6, being at the inner ends of the switch tubes adjacent to the operating shaft OS, the mercury globules in these switches normally bridge the contacts so as to close the switches S5 and S6.

If, due to change in some condition, the vacuum within the enclosure becomes too great, that is more vacuum than the desired predetermined optimum vacuum, correction of the vacuum is effected by moving the air intake member AI clockwise to a more open position. This is effected as a result of the clockwise rocking of the vacuum control member VC and its shaft VCS caused by increased velocity of control air flow through the opening 19 in the wall W2 resulting from the higher than desired vacuum within the enclosure. The clockwise rocking of the vacuum control shaft VCS will rock the mercury switch assembly S1, S2, S3 and S4 clockwise to the position shown in FIG. 8 so as to lower the outer ends of the switches S1 and S2 to an extent sufficient to cause the mercury globules in these switches to run down the switch tubes and bridge the contacts in the switches S1 and S2. With the switches S1 and S2 closed in that manner, the reversible motor RM will be energized to operate in one direction so as to rock the operating shaft OS clockwise, which in turn will rock the air intake control member AI clockwise toward a more open position. Under these conditions the motor terminal A is permanently connected to the supply line L1, and the supply line L2 is connected to the motor terminal B via the closed mercury switch S5, a conductor 51, the closed mercury switch S1 and a conductor 52 leading to the motor terminal B. At the same time, the motor terminal C is connected to the motor terminal D via a conductor 53, the closed switch S2 and a conductor 54. Thus, under these conditions, the motor terminal A is connected to the line L1, the motor terminal B is connected to the line L2, and the motor terminal C is connected to the motor terminal D. With the motor so connected, it will run in a direction to rock the operating shaft OS clockwise, which in turn will rock the air intake closure AI clockwise to a more open position, thus reducing the resistance to flow of intake air and reducing the vacuum within the enclosure.

When the air intake closure AI has been opened sufficiently, the vacuum in the enclosure decreases and the velocity of control air flow through the passage 19 in the wall W2 also decreases. The vacuum control member VC then rocks counterclockwise until the switch assembly S1, S2, S3, S4 on the vacuum control shaft VCS is also rocked counterclockwise to such a position that the mercury globules in the switches S1 and S2 move away from their associated contacts, opening the switches S1 and S2. With these switches opened, the motor RM is deenergized so that the air intake closure AI will remain in the position establishing the desired vacuum within the enclosure. When the switch assembly S1, S2, S3, S4 has been tipped just sufficiently to open the switches S1 and S2 for stopping the motor, the switches S3 and S4 will not have been tipped sufficiently to cause the mercury globules to move to the outer ends of the switch tubes. Consequently, the switches S3 and S4 will not be closed when the switches S1 and S2 are just opened.

Under an unusual condition brought about by wind or some unpredictable factor, the vacuum within the enclosure may remain greater than desired despite the opening of the air inlet control AI. With the vacuum remaining too great, the motor RM would continue to run so as to operate the shaft OS clockwise to an overdriving extent which would bring the air intake closure AI to its limit of clockwise rocking, as determined by its structure. If the motor RM should continue to run under these conditions, the air intake closure would encounter resistance to its movement which might cause damage to the driving mechanism. Such overdriving is prevented by opening of the normally closed switch S5 when the operating shaft OS has continued its clockwise rocking until the switch S5 is tipped to an inclined position below the horizontal, causing

the mercury globule in the switch S5 to move away from the contacts in the inner end of the switch tube, thereby opening the switch S5. Since the switch S5 is in circuit with the motor RM when the latter is operating to open the air intake closure AI, opening of the switch S5 by overdriving of the operating shaft OS will stop the motor and prevent excessive overdrive. It should be pointed out that any abnormal clockwise rocking of the operating shaft OS will not open the switch S6 even though it does open the switch S5.

Now assuming that the vacuum within the enclosure becomes lower than the desired vacuum, the apparatus operates to move the air intake closure AI counterclockwise toward its closed position, thus restricting the air inflow through the opening in the wall W1 and increasing the vacuum within the enclosure. With low vacuum in the enclosure, the velocity of air flow through the vacuum control air passage 19 in the wall W2 will be decreased so that the vacuum control member VC and its shaft VCS will rock counterclockwise and tip the mercury switch assembly S1, S2, S3, S4 counterclockwise. This will close the mercury switches S3 and S4, and energize the motor RM in a manner to cause it to run reversely, that is in a direction to drive the air intake closure AI counterclockwise toward a more closed position. With the switches S3 and S4 closed, the line L1 is connected to the motor terminal A, as before. The line L2 is connected to the motor terminal C via the normally closed overdrive control switch S6, a conductor 55, the switch S3, a conductor 56, and the conductor 53. The motor terminal B will be connected to the motor terminal D via the conductor 52, the switch S4, a conductor 57, and the conductor 54. Thus, the motor terminal A is connected to the line L1, the motor terminal C is connected to the line L2, and the motor terminal B is connected to the motor terminal D with the result that the motor RM operates reversely so as to drive the operating shaft OS counterclockwise and move the air intake closure AI toward closed position.

When the desired higher vacuum has been established in the enclosure, the vacuum control member VC and associated shaft VCS rock back, i.e. clockwise, so as to rock the switch assembly S1, S2, S3, S4 and tip the switches S3 and S4 to inclined positions causing their mercury globules to move away from their contacts, whereby the switches S3 and S4 are opened, the switches S1 and S2 remain open, and the motor RM is stopped.

If conditions should create a tendency for overdriving of the air intake closure AI during its closing movement, the counterclockwise rocking of the operating shaft OS will open the switch S6 and thus open the circuit to the motor terminal C and cause the motor to stop.

When no overdrive conditions exist, as is normal, both switches S5 and S6 remain closed at all times, and the controlling of the motor is effected entirely by the switch assembly S1, S2, S3, S4 which is tipped by rocking of the vacuum responsive control member VC.

The system described above has been found to provide very close controlling of the vacuum in a poultry house. A vacuum or negative pressure of one-eighth inch water gauge has been found by poultry raisers to be conducive to most efficient feed conversion and hence growth. The disclosed equipment may readily be set to maintain the desired vacuum by adjusting the position of the counterweight 20 on the arm 21, thus varying the tendency of the vacuum control member VC to close the control air passage 19 by gravity against the kinetic opening force of the control air flow.

While under most conditions better control of the vacuum within the enclosure may be obtained by providing inlet openings in two walls and associated control means mounted at the sides of the enclosure remote from the respective openings, advantages of the invention may nevertheless be achieved by providing an inlet opening in one wall only with its control means mounted at a side of the enclosure remote from that wall. In installations including an inlet opening 1 in one wall only, it is desirable to provide its associated control air flow opening 19 with a hood H as shown partially in FIG. 10 to reduce wind interference with operation of the control.

The apparatus and method of operation described are representative of the presently preferred practicing of the invention, but it is intended that the disclosure be illustrative rather than definitive, the invention being defined in the claims.

I claim:

1. Apparatus for controlling the degree of vacuum within an enclosure having two spaced opposed walls and means for withdrawing air from within the enclosure, said apparatus comprising means defining an air inlet opening in one of said two walls; a closure mounted for opening and closing movements cooperatively with respect to said inlet opening; reversible drive means operatively connected to said closure for moving the latter respectively toward open and closed positions; and control means connected to said drive means and being mounted at the side of said enclosure remote from said one of said walls and being responsive to vacuum within said enclosure for causing operation of said drive means to move said closure toward closed position when the vacuum in said enclosure in the region of said control means is less than a predetermined vacuum, and to move said closure toward open position when the vacuum in said enclosure in the region of said control means is greater than said predetermined vacuum.

2. Apparatus according to claim 1 in which said control means is mounted on the other of said two spaced opposed walls.

3. Apparatus according to claim 1 in which said drive means comprises a reversible electric motor and said control means comprises a switching circuit for reversing said motor.

4. Apparatus according to claim 3 in which said switching circuit comprises switch means movable to three positions in dependence upon the vacuum in said region, namely: a first position for causing said motor to drive said closure toward closed position when the vacuum in said region is less than said predetermined vacuum; a second position for deactivating said motor when the vacuum in said region is the desired predetermined vacuum; and a third position for causing said motor to drive said closure toward open position when the vacuum in said region is greater than said predetermined vacuum.

5. Apparatus according to claim 1 in which said control means comprises means defining a control air flow passage in the other of said two spaced opposed enclosure walls; a member movably mounted in the path of air flowing through said passage from outside said enclosure to the interior thereof and being movable by said control airflow in amounts varying according to the velocity of said control airflow; electrical means for controlling the operation of said reversible drive means; and switch means operated by the aforesaid movements of said member for operating said electrical means to: (1) cause operation of said drive means to move said closure toward closed position when the vacuum in said region is less than said predetermined vacuum, (2) to deactivate said drive means when the vacuum in said region is said predetermined vacuum, and (3) to cause operation of said drive means to move said closure toward open position when the vacuum in said region is greater than said predetermined vacuum.

6. Apparatus according to claim 5 in which said drive means comprises a reversible electric motor, and in which said electrical means comprises an electrical circuit including said motor and switch means movable by the movements of said member for reversing the motor electrical connections.

7. Apparatus according to claim 6 including a rock shaft on which said member is mounted; reversing switch means mounted on and being rockable with said rock shaft; and means connecting said switch means in circuit with said motor, whereby said motor is driven selectively in one direction or the other or is deactivated according to the position to which said member, said rock shaft and said switch means are rocked by air flowing through said control airflow passage.

8. Apparatus according to claim 7 including a counterweight mounted on said rock shaft and being adjustable for varying the amount of movement of said member caused by the velocity air flowing through said control air flow passage.

9. Apparatus according to claim 7 in which said reversing switch means comprises an assembly of mercury switches mounted on said rock shaft at such inclinations to the horizontal that when said member is in a neutral position which it occupies when the vacuum in said region is said predetermined vacuum the mercury globules in said switches do not close the respective switch contacts and said motor is thereby deactivated, the switch mercury globules being movable by gravity in response to rocking of said member, said rock shaft and said switches to one side or the other of said neutral position for causing operation of said motor in selected directions.

10. Apparatus according to claim 1 in which the connections between said reversible drive means and said closure comprise a cushioning-force-transmitting element which is yieldable in the event of continued operation of said reversible drive means when continued movement of said closure is prevented.

11. Apparatus according to claim 10 in which said cushioning-force-transmitting element comprises a telescopic link having two link components; and spring means connecting said components for transmitting normal operating force from one component to the other and vice versa according to whether closure opening or closure closing force is being transmitted, said spring means being yieldable under the influence of greater than normal operating force so as to prevent damage in the event said reversible drive means continues to operate when continued movement of said closure is prevented.

12. Apparatus according to claim 1 including means responsive to movement of said closure toward its open and closed positions respectively for deactivating said reversible drive means when said closure attains predetermined positions respectively in its opening and closing movements.

13. Apparatus according to claim 1 in which said closure is mounted to rock in its opening and closing movements, further in which said reversible drive means comprises an electric motor, said apparatus further comprising normally closed electrical switch means in circuit with said motor and being mounted and connected to said closure and being operable in response to rocking of said closure for deenergizing said circuit when said closure attains predetermined positions in its opening and closing movements.

14. Apparatus according to claim 13 including a rock shaft on which said closure is mounted for movements to its open and closed positions, said switch means comprising mercury switch means mounted on said rock shaft to be rockable in unison with said closure.

15. Apparatus according to claim 1 in which said enclosure is a live poultry house.

16. Apparatus according to claim 1 in which there is another air inlet opening in the other of said two walls; another closure mounted for opening and closing movements cooperatively with respect to said other air inlet opening; another reversible drive means operatively connected to said other closure for moving the latter respectively toward open and closed positions; and another control means connected to said other drive means, being mounted at the side of said enclosure remote from said other of said two walls and being responsive to vacuum within said enclosure for causing operation of said other drive means to move said other closure toward closed position when the vacuum in said enclosure in the region of said other control means is less than a predetermined vacuum, and to move said other closure toward open position when the vacuum in said enclosure in the region of said other control means is greater than said predetermined vacuum.