United States Patent

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[54] ATMOSPHERE CONTROL ARRANGEMENT FOR MACHINERY

6 Claims, 2 Drawing Figs.

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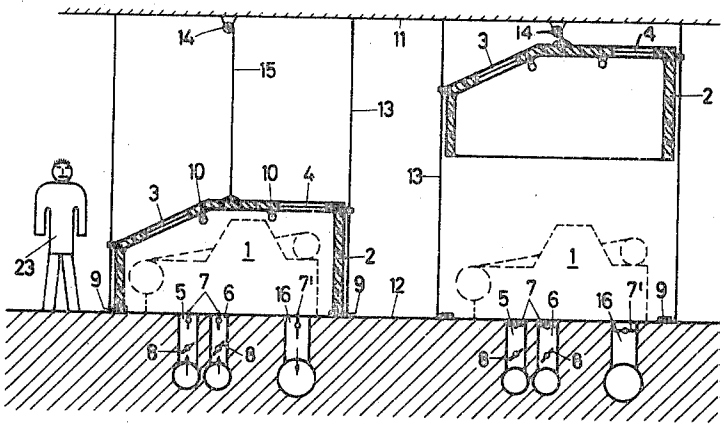
ABSTRACT: The automatic weaving looms of a textile plant are individually enveloped by hoods of acoustical insulation material suspended from hoists and sealingly engaging the floor about the associated machines. Air at controlled temperature and humidity is supplied to the interior of each hood and exhausted from that interior through a system of manifold pipes having orifices in the floor under each hood, and valves in the orifices which open automatically as the hood descends into the operative position and close when the hood is lifted.



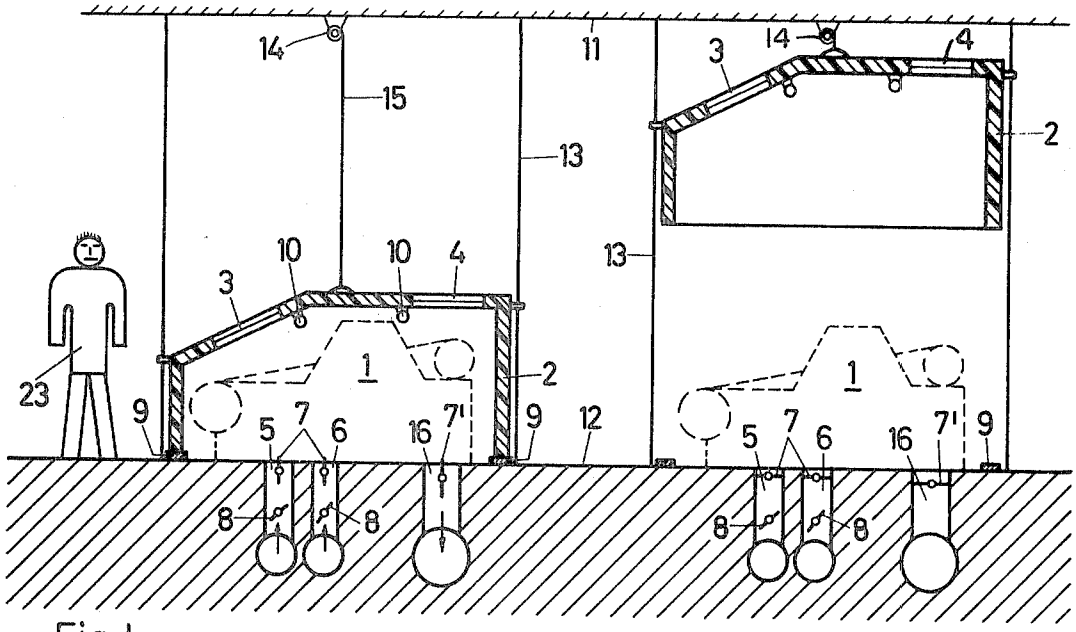
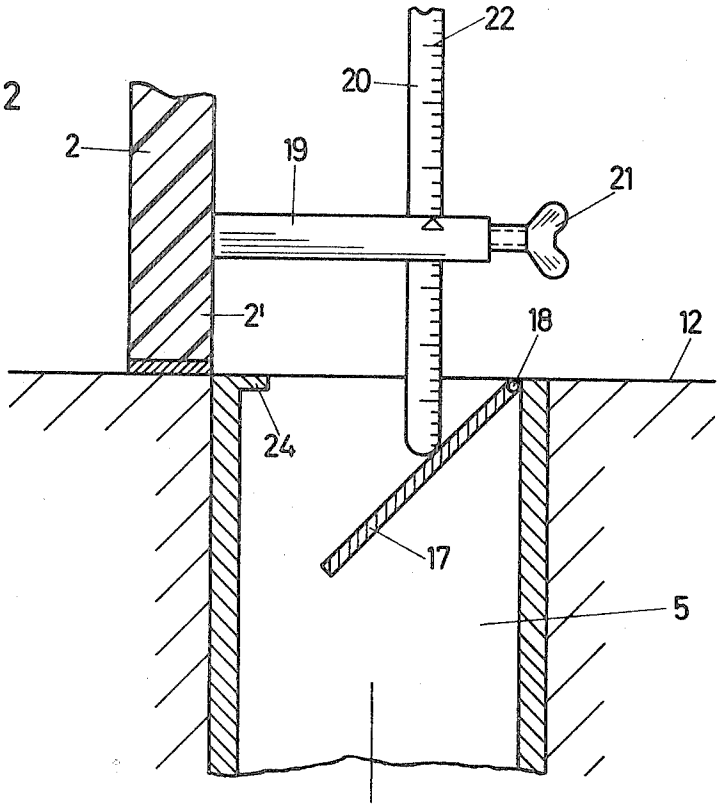


Fig. 1

Fig. 2



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ATMOSPHERE CONTROL ARRANGEMENT FOR MACHINERY

BACKGROUND OF THE INVENTION

This invention relates to controlled environments, and particularly to an arrangement for providing atmosphere control for machinery requiring specific temperature and/or humidity for operating at highest efficiency.

The problem attacked by the instant invention will be described hereinafter with specific reference to textile machinery. It is well known that textile fibers, with rare exceptions, change their mechanical properties with ambient temperature and humidity. Yarns and fabrics of closely predictable mechanical properties can be made only in controlled atmospheres, and many textile machines, such as knitting machines and weaving looms operate at highest efficiency and with a minimum of downtime only in a narrow range of temperatures and relative humidities with each type of fiber.

It is common practice, therefore, to install looms and knitting machines in sheds sealed from the ambient atmosphere and connected to heating, refrigeration, and humidifying equipment to maintain the desired atmosphere. If the temperature of the sealed space differs much from that of the outer atmosphere, the air must be circulated in the enclosed area at a rate adequate for maintaining a uniform temperature. Yet, air circulation cannot exceed a linear velocity of about 0.6 to 0.7 meters per second to avoid inconvenience to the operators and maintenance personnel enclosed with the machinery. At air velocities bearable to the personnel, conventional air-conditioning equipment is ineffective in carrying dust and other solid contaminants from the work area to a filter.

It is the object of the invention to provide a controlled atmosphere which may be selected at will for optimum machine operation without causing inconvenience or even health damage to personnel supervising the machinery. It is an additional object of the invention to protect the personnel against inconvenience which may be caused by the machines themselves, such as noise and dust.

SUMMARY OF THE INVENTION

With these objects and others in view, as will hereinafter become apparent, the invention provides each machine with a downwardly open hood dimensioned to receive the machine therein, the hood having an annular rim about the downwardly directed opening thereof. Means are provided for moving the hood toward and away from an operative position in which the rim sealingly engages the floor on which the machine is supported. The atmosphere in the hood is maintained at a temperature of 15° to 50° C. by a source of air at that temperature and a supply conduit which connects the source to the interior of the hood in the operative position of the latter. An exhaust conduit leads outwardly of the hood interior.

Other features and many of the attendant advantages of this invention will readily become apparent from the following detailed description of a preferred embodiment when considered in connection with the appended drawing.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

FIG. 1 shows a textile factory equipped with atmosphere control equipment of this invention in elevational section; and

FIG. 2 shows a modified valve arrangement for use in the apparatus of FIG. 1 in a corresponding view, but on a larger scale.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawing in detail, and initially to FIG. 1, there is shown only as much of a weaving mill as is necessary for an understanding of the invention. Only two of the many looms 1 of the mill are shown together with the roof or ceiling 11 and floor 12 of an enclosing shed which may have windows (not shown) and be open to the ambient atmosphere.

The looms 1, when operating, are enclosed in individual hoods 2 which are downwardly open boxes of nonmetallic acoustical insulation material such as asbestos fiber composition panels assembled on a light metal frame, not itself shown, and practically impermeable to air. Apertures in each hood 2 are provided with sliding or otherwise movable, transparent windows 3,4 which normally seal the apertures, but may be opened to permit an operator's intervention in the mainly automatic operation of the enclosed loom without removing the hood 2.

The desired atmospheric conditions are maintained in the interior of each hood 2 by an air-conditioning system including sources of cooled and humidified air, conventional in themselves, and not shown, and distributing manifolds embedded in the floor 12. The nonillustrated part of the system includes a heat exchanger arrangement in which air is cooled or heated to the desired temperature, normally not lower than 15° C. nor higher than 50° C., and dried to a relative humidity of well below 50 percent. One or more pumps force the cooled or heated air through two humidifiers which automatically mix the air with water droplets or steam to raise the relative humidity to 50 percent in one airstream and 90 percent in the other stream. The two streams enter respective manifolds which communicate with the interior of each operating hood 2 through supply conduits 5 and 6 respectively, the illustration of the air supply system being limited substantially to these conduits.

Each conduit is equipped with a shutoff valve 7 and a control valve 8 essentially consisting each of a pivotally mounted flap. The flaps of the shutoff valves 7 are operated by solenoids (not shown) and are spring or gravity biased toward the open position. The flaps of the control valves 8 are set by hand by means of nonillustrated handwheels connected to the control flaps by chains and sprockets. A resilient, annular pad 9 conforming to the shape of the rim about the open bottom side of each hood 2 is arranged on the floor 12 and conceals one or more normally open microswitches (not shown) in the supply circuit of the solenoids which operate the valves 7. The valves 7 are normally closed, and are opened by the associated solenoids when the latter are energized by the microswitches in the pad 9, the switches being closed by the weight of the hood 2 resting on the pad 9.

To permit an operator 23 to inspect a loom 1 while it is enveloped by its hood 2, lamps 10 are mounted on the inside of each hood 2, and are supplied with electric current through conductors embedded in a hoisting cable 15, as is conventional in elevators. The cable depends from an electrically operated hoist 14 mounted on the ceiling 11 and is attached to the hood 2 above the center of gravity of the latter. The hood 2 is guided during its vertical movement by cables 13 tensioned between the floor 12 and the ceiling 11 and running through eyes fastened on the hood 2.

Air is withdrawn from the interior of the hood 2 in its operative position through an exhaust manifold system 16 embedded in the floor 12 and having an orifice under each hood. A valve 7′ in the orifice is normally closed, but is opened by a nonillustrated solenoid when the hood 2 descending on the pad 9 closes a nonillustrated microswitch in the current supply circuit of the solenoid which operates the valve 7′. The rate at which air is exhausted from the hood 2 (by weight) is preferably slightly smaller than the combined rate at which air is supplied to the hood through the conduits 5 and 6 so as to maintain in the hood 2 a pressure slightly higher than that of the ambient atmosphere and to maintain outward flow of air from the hood through the practically unavoidable leaks of the wall enveloping each loom 1.

The relative humidity in each hood 2 can be set to an optimum value by operating the valves 8. The mixture of air at 50 and 90 percent relative humidity may be controlled to achieve any humidity value between these limits, a wider range of humidity settings can be achieved by supplying air

even closer to 100 percent relative humidity and air drier than corresponds to 50 percent RH. It is well established, however, that a relative humidity near 65 percent is most advantageous for the weaving of many textile fibers, and it is preferred that the drier air be supplied at a relative humidity not substantially higher than 50 percent, nor substantially lower.

The dual valves in the air supply conduits 5,6 may be replaced by a single-valve flap 17 mounted in the orifice of each air supply conduit in the manner illustrated in FIG. 2 with reference to the conduit 5. The flap 17 is attached by one edge to a hinge 18 equipped with a nonillustrated torsion spring that tends to swing the flap upwardly or clockwise, as seen in FIG. 2, into sealing engagement with an inner flange 24 at the orifice of the conduit 15.

The rim portion 2' of the hood 2 carries a bracket 19 which projects horizontally into the interior of the hood and slidably receives a vertical rod 20 provided with a longitudinal scale of indicia 22. The rod may be secured on the bracket 19 in a selected position by a winged screw 21, and shifted in the direction of hood movement for adjusting the extent to which the valve flap 17 is displaced from the closed position when the hood 2 reaches its operative position. The arrangement illustrated in FIG. 2 is equally applicable to the second air supply conduit 6 and to the exhaust conduit 16 in an obvious manner, and may be employed for automatically maintaining a desired relative humidity and a desired overpressure which may be set according to readings on the scales 22.

As compared to an air-conditioning system supplying an entire weaving shed with air of controlled temperature and humidity, the individual atmosphere control hoods of the invention have numerous advantages. The humidity of the atmosphere in which each loom operates may be individually controlled as may be needed for weaving different textile fibers. The rate of airflow through each hood may be high enough not only to maintain perfectly uniform atmospheric conditions for every part of the machine, but high enough to sweep lint and dust effectively from the working area, and much higher than could be tolerated by operating personnel. The latter are protected by the hoods against the operating noise of the looms, yet can inspect the looms through the windows 3,4 and may push the windows aside for brief routine operations without significantly upsetting the atmosphere in the hood. It is another important advantage of this invention that the first cost and the operating cost of an air-conditioning system of the invention are much lower than the corresponding costs of a conventional installation, and even more substantial savings result from the simpler construction of the factory building.

The illustrated manifold system may readily be modified to supply air to individual hoods not only at different humidities, but also at different temperatures so that the operating temperature may be varied to suit the yarn being woven. It has been found advantageous to operate looms at temperatures up to 50° C. which are not readily tolerated by operating personnel and from which the personnel is protected by the hoods 2 which insulate not only against noise, but also against heat.

While the invention has been described with reference to textile machinery, more specifically weaving looms, individual air-conditioning hoods have obvious advantages with other machinery capable of substantially automatic operation such as grinders and other metalworking machines. It should be understood, therefore, that the invention may be practiced otherwise than as specifically disclosed.

What is claimed is:

1. In an arrangement for operating a machine under controlled atmospheric conditions, the machine being supported on a floor and capable of substantially automatic operation, in combination:

a. a downwardly open hood essentially consisting of acoustical insulating material and dimensioned to receive said machine therein, said hood having an annular rim about the downwardly directed opening thereof;

b. hoist means for moving said hood in a vertical direction toward and away from an operative position in which said rim sealingly engages said floor; and

c. atmosphere control means for maintaining in said hood an atmosphere of air at a temperature of 15° to 50° C., a relative humidity of a least 50 percent, and a pressure higher than that of the ambient atmosphere, said atmosphere control means including

1. a source of air at said temperature, humidity, and pressure,

2. a supply conduit connecting said source to the interior of said hood in the operative position of the same,

3. an exhaust conduit leading outward of said interior,

4. a valve in each of said conduits, and

5. valve-operating means responsive to movement of said hood for opening and closing said valves when the hood moves toward and away from said operating position thereof.

2. In arrangement as set forth in claim 1, at least one of said valves being biased toward the closed position, and said valve-operating means including an abutment member positioned for engagement with said one valve when said hood approaches said operative position and for displacing the engaged valve toward the open position.

3. In an arrangement as set forth in claim 2, mounting means for securing said abutment member to said hood in each of a plurality of positions offset relative to each other in the direction of hood movement toward the operative position, and for thereby varying the displacement of said one valve toward said open position.

4. In an arrangement as set forth in claim 1, said source of air being effective in supplying air of a relative humidity close to 100 percent at said temperature, the atmosphere control means further comprising another source of air at said temperature and at a relative humidity of not substantially more than 50 percent, and another supply conduit connecting said other source to said interior in the operative position of said hood.

5. In an arrangement as set forth in claim 4, said conduits being located in said floor and having upwardly directed orifices in the same.

6. In an arrangement as set forth in claim 1, a light source mounted on said hood in said interior of the same, said hood being formed with an aperture, and a window movable relative to said hood toward and away from a position in which said window seals said aperture.

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