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MAGNETIC DOOR LATCH

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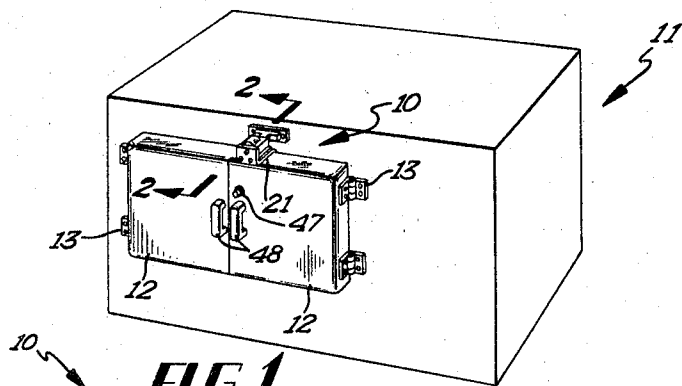


FIG 1

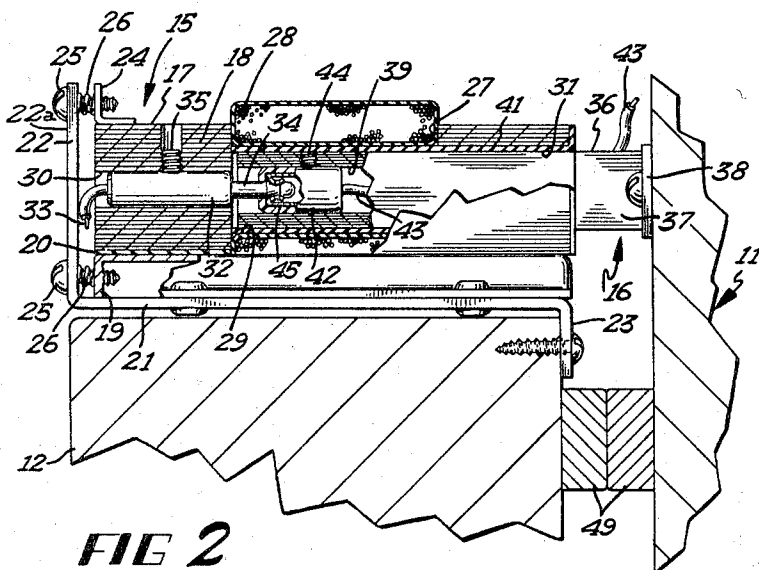


FIG 2

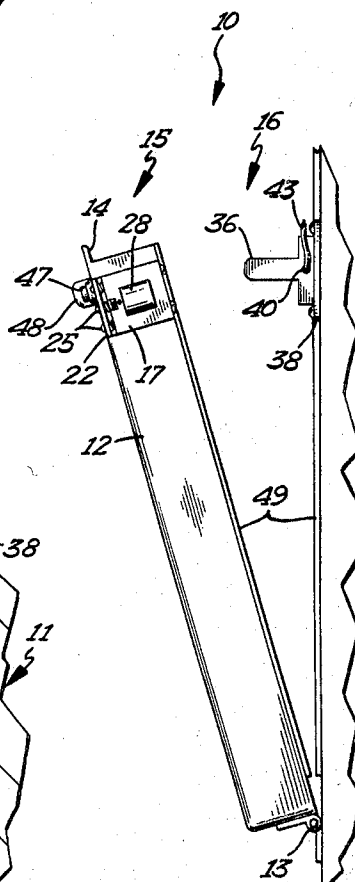


FIG 3

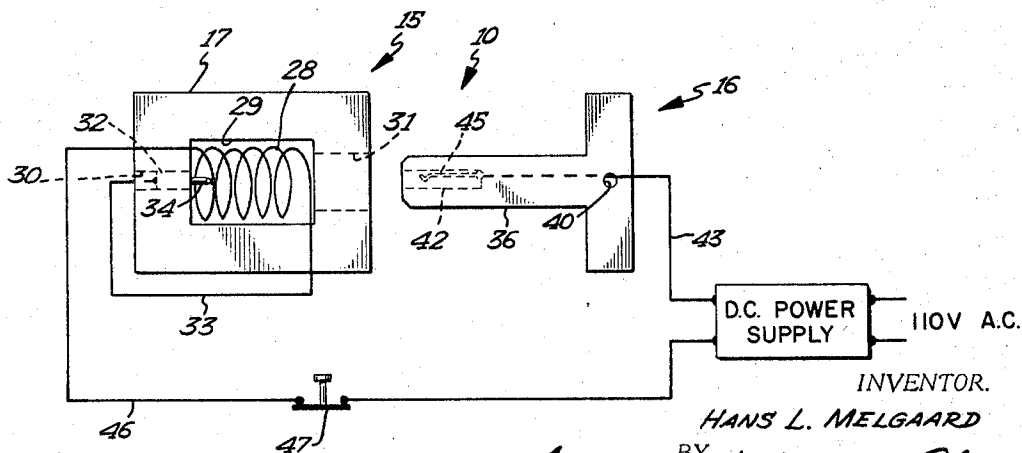


FIG 4

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MAGNETIC DOOR LATCH

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6 Claims

ABSTRACT OF THE DISCLOSURE

An electromagnetic door latch including an armature fixed to the door frame and a stator coil mounted on the door and surrounding the armature when the door is closed. A male connector on the stator and female connector on the armature mate when the door is closed thus completing the coil circuit, and energizing the coil. The energized coil attracts the armature and thus latches the door. A manual switch is provided for de-energizing the coil.

This invention relates to an electromagnetic latch device for use in latching and sealing a relatively large door of a chamber.

A general object of this invention is to provide an electromagnetic door latch, of simple and inexpensive construction, which is highly effective in releasably latching and sealing a large door of a cabinet, and is especially adaptable for use in conjunction with furnace doors and the like.

A more specific object of this invention is the provision of an electromagnetic door latch, including a pair of magnetic devices arranged and constructed so that the electromagnetic latch is automatically energized when the door is closed to exert a very strong pull to urge the door into latched sealed relation with respect to the door frame and thereby obviate the necessity of slamming the door in order to assure a tight seal. The latch is de-energized by a push button located adjacent the door handle so that little or no effort is required in opening the door, and since no mechanical means are used to interlock the door in closed relation, the latch provides a positive latching means which is also completely free for explosion relief.

These and other objects and advantages of this invention will more fully appear from the following description made in connection with the accompanying drawings wherein like reference characters refer to the same or similar parts throughout the several views, and in which:

FIG. 1 is a perspective view of a furnace utilizing the present magnetic latch device on the doors thereof;

FIG. 2 is a cross-sectional view on an enlarged scale taken approximately along line 2-2 of FIG. 1 and looking in the direction of the arrows;

FIG. 3 is a fragmentary plan view of a portion of the furnace illustrating the furnace door in an open condition; and

FIG. 4 is a diagrammatic illustration of the electromagnetic door latch circuit.

Referring now to the drawings, and more specifically to FIG. 1, it will be seen that one embodiment of the novel electromagnetic door latch 10 is incorporated on a furnace 11 for retaining the closure means thereof in closed sealed relation with respect to the access opening of the furnace. The furnace 10 may be of any suitable construction, and it will be seen that the access opening of the furnace is closed by a pair of substantially similar doors 12 which are mounted by hinge means 13 for swinging movement between open and close positions. It will be noted that one of the furnace doors 12 may be provided

with a lip 14 for overlying and holding the other furnace door thereof in the closed condition.

It is also pointed out that the latch 10 may be used with cabinet structures other than furnaces for latching and sealing the closures or doors of such cabinet structures in a closed relation. The latch 10, however, is found to be especially adaptable for furnace structures since the latch not only serves to maintain the furnace doors in closed sealed relation but is also operable to provide ease in opening the doors and permitting the doors to readily swing open from the closed position in the event of an explosion.

Referring now to FIGS. 2, 3 and 4, it will be seen that the electromagnetic latch 10 is comprised of a first magnetic device 15 and a second magnetic device 16, which are mounted on the door and door frame or furnace housing respectively. The first magnetic device 15 comprises a generally rectangular shape laminated stator 17 which is formed of a plurality of similar metallic laminations 18 formed of malleable iron. The laminated stator is provided with a lower mounting plate 19 formed of a suitable metallic material, but with a sheet 20 of insulating material interposed between the lowermost laminae 18 and the upper surface of the mounting plate 19. The mounting plate 19 has downturned annular flanges 19a which are provided with laterally extending flanges 21 that are provided with longitudinal slots therein to permit the passage of fastening elements such as rivets 19b therethrough. A generally L-shaped bracket 22 having a downturned rearward flange 23 is provided and the base plate 19 is mounted thereon. The rear flange 23 is secured to the upper edge of one of the doors 12 by suitable securing means such as screws or the like, so that the bracket with the first magnetic device 15 mounted thereon is positioned above the associated door 12, as best seen in FIGS. 1 and 2.

The laminated stator 17 is secured to the upturned flange 22a of the bracket 21 by means of a pair of L-shaped apertured mounting brackets 24 which are secured to the upper surface of the laminated stators 17. The front portion of the downturned flange 19a of the mounting plate 19 is also suitably apertured to receive a bolt therethrough. To this end, it will be noted that the apertured brackets 24 have threaded apertures therein to permit bolts 25 to pass therethrough. It will be noted that each bolt 25 has a small coil spring 26 positioned therearound and interposed between the upturned mounting bracket flange 22 and the brackets 24. A coil spring is also positioned around the lower bolt and is interposed between the front portion of the downturned flange 19a of the mounting plate 19 and the flange 22a. With this arrangement, the stator is capable of yielding movement relative to the bracket 21 in a fore-and-aft direction. It is pointed out that the slots in the base plate permit limited sliding movement between the plate and bracket 22.

The laminated stator 17 has a rectangular vertical opening 27 therethrough, as best seen in FIG. 2. The opening 27 accommodates a coil 28 of conventional construction, the coil having a central opening 29 therethrough. Referring again to FIG. 2, it will be seen that the laminated stator 17 also has an axial opening 30 centrally located in the front end thereof, which is disposed in coaxial alignment with the opening 29 through the coil 28. The rear end of the laminated stator 18 also has an axial opening 31 in the rear portion thereof which is disposed in coaxial alignment with the opening 29 in the coil 28 and the opening 30 in the front end of the laminated stator.

An insulated plug 32 is positioned within the opening 30 in the laminated stator 17 and this insulating plug has an electrical conductor 33 extending centrally therethrough. The electrical conductor is connected with a

male type plug contact 34 which projects axially and centrally into the opening 29 in the coil 28. A small set screw 35 may be used to snugly secure the insulated plug 32 into place within the opening 30 of the laminating stator 17. The electrical conductor 33 is connected to the windings of the coil 28 as best seen in the circuit diagram of FIG. 4.

The second magnetic device 16 includes a laminated armature 36 of generally T-shaped construction, which is comprised of a plurality of metallic laminae 37 formed of the same material such as malleable iron as the laminae of the laminated stator. The laminated armature 16 is provided with an attachment bracket plate 38 which is suitably apertured and which is secured to the front wall of the furnace 11 by suitable screws.

The laminated armature 36 which projects outwardly from the furnace 11 has an axially extending opening 39 therein which opens forwardly, and which communicates with an upwardly facing opening 40 in the rear portion of the armature. A sleeve 41 formed of an insulating material is positioned around the armature 36 as best seen in FIG. 2.

An insulating socket 42 with an electrical conductor 43 is positioned within the axial opening 39 adjacent the front end thereof and is secured therein by a suitable set screw 44. The plug 42 has a female type contact 45 which engages and mates with the male plug type contact 34 when the door is in the closed position. It will also be seen that when the door is closed, the laminated stator and coil will be positioned in surrounding relation with respect to the armature.

Referring now to FIG. 4, it will be seen that an electrical conductor 46 connects with the coil windings and is also connected to a source of electrical power. The electrical conductor 43 which connects with the female plug 42 is also connected to the source of electrical power to complete the electromagnetic circuit. A normally closed push button switch 47 has its contacts connected to the conductor 46 and it will be seen that when the push button is urged inwardly, the electromagnetic circuit will be opened and the electromagnet will be de-energized. The push button switch 47, as best seen in FIG. 1 is located adjacent the handles 48 of the doors 12 so that an operator may conveniently press the handle 48 on the associated door 12 and simultaneously push the push button switch to de-energize the electromagnetic circuit.

In use, the electromagnetic latch 10 will be energized when the door is in the closed condition, and will hold the door in sealed relation with respect to the front wall of the furnace. To open the door, the operator will grasp the handle 48 and simultaneously push or depress the push button switch 47, thereby opening the circuit and de-energizing the electromagnetic latch. The door may be easily pulled open by the operator since there is no mechanical interlocking elements.

Thereafter, when it is desirable to close the door the operator merely pushes the door 12 to the closed position, it being pointed out that the door 12 which does not have electromagnetic elements associated therewith will be, of course, closed firstly. As the door approaches the closed position, the male type plug contact 34 will engage the female type contact 45. This engagement will occur prior to the door being completely closed, thus energizing the first magnetic device which actually constitutes an electromagnet. The armature will be disposed within the coil of the electromagnet when the latter is energized, and will be influenced by the magnetic field generated by the electromagnet. The coil will actually function as a sucking coil in this arrangement, and since the armature is stationary or affixed to the furnace, the reaction of the armature in the magnetic field will produce the positive closing action so that the door will seal against the sealing elements 49 thereof which may be formed of suitable heat resistance material such as asbestos or the like.

With this arrangement, it will be noted that the operator is not required to slam the door to assure that the door is in sealed relation, since the electromagnetic latch is automatically energized prior to complete closing of the door. This electromagnetic latch actually exerts a very strong pull when energized and the pull or intensity of the magnetic field may be varied readily by varying the amount of current passed through the coil. The use of a push button located closely adjacent to the door handle for de-energizing the electromagnetic circuit provides a readily accessible means for facilitating opening of the door since an operator is required to use little effort to swing the door to the open position.

Since there are no mechanical interlocking elements in the electromagnetic latch, this particular latching arrangement provides freedom for explosion relief. The door will swing open in response to the force exerted by expanding gases during an explosion rather than being pulled from their hinge mountings as is the case with many mechanical latches. Since the current to the electromagnet may be readily varied, the desired force needed to open the doors even when the electromagnetic circuit is energized may be determined by selecting the amount of current necessary to produce the desired results.

From the foregoing description, it will be seen that I have provided a novel electromagnetic latch for latching a door of a cabinet or other structure in a predetermined position relative to the cabinet structure or door frame, prior to actual complete closing of the door. It will be noted from the preceding paragraphs that the novel electromagnetic latch while being automatically energized as the door approaches the closed position may also be readily energized by opening a normally closed switch which is conveniently located with respect to the door handle.

Thus, it will be seen that I have provided a novel electromagnetic latch for doors which is not only of simple and inexpensive construction, but one which functions in a more efficient manner than any heretofore known comparable device.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the various parts without departing from the scope of my invention.

What is claimed is:

1. Apparatus for latching a door in predetermined position relative to the door frame, comprising first and second cooperating magnetic devices to be mounted on the door and door frame, said first magnetic device including an electromagnet, said second magnetic device including a magnetic armature urged under influence of the magnetic field of the electromagnet to tend to move in a predetermined direction, and circuit means connected to said electromagnet to control the magnetic field thereof and including a manual switch to de-energize the electromagnet and also including a switching device responsive to movement of the door to supply current to the electromagnet.

2. The apparatus as defined in claim 1 wherein said first magnetic device includes an electrical connector part, and said second magnetic device includes a second electrical connector part cooperative with said first connector part to complete an electrical connection therethrough when said magnetic devices are moved into proximity with each other and defining said switching device.

3. The apparatus as defined in claim 1 wherein said first magnetic device includes the coil and a laminated stator around said coil.

4. A self-operating magnetic door latch for latching a door in predetermined position relative to a door frame, said magnetic door latch comprising a first magnetic device including a laminated stator, a coil supported by said laminated stator, a second magnetic device including an armature, said magnetic devices being movable relative to each

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other when the door associated with said magnetic latch, is closed so that said armature is positioned interiorly of said coil,

circuit means connected to said magnetic devices to control the magnetic field of the coil and including a switch device having parts cooperatively connected to said coil and armature and responsive to relative movement therebetween to effect a switching action to thereby energize the coil when the magnetic devices are moved towards each other,

and a manual switch to de-energize the electromagnet.

5. The magnetic door latch as defined in claim 4 wherein said stator is positioned around said coil and wherein said stator and coil are movable as a unit relative to said armature.

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6. The magnetic door latch as defined in claim 4 wherein said switch device comprises a male and female type plug elements.

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15 335—254; 317—123