May 19, 1953 D. V. HAMMOND ET AL 2,638,892

FURNACE DAMPER CONTROL

Filed Dec. 22, 1947 5 Sheets-Sheet 1

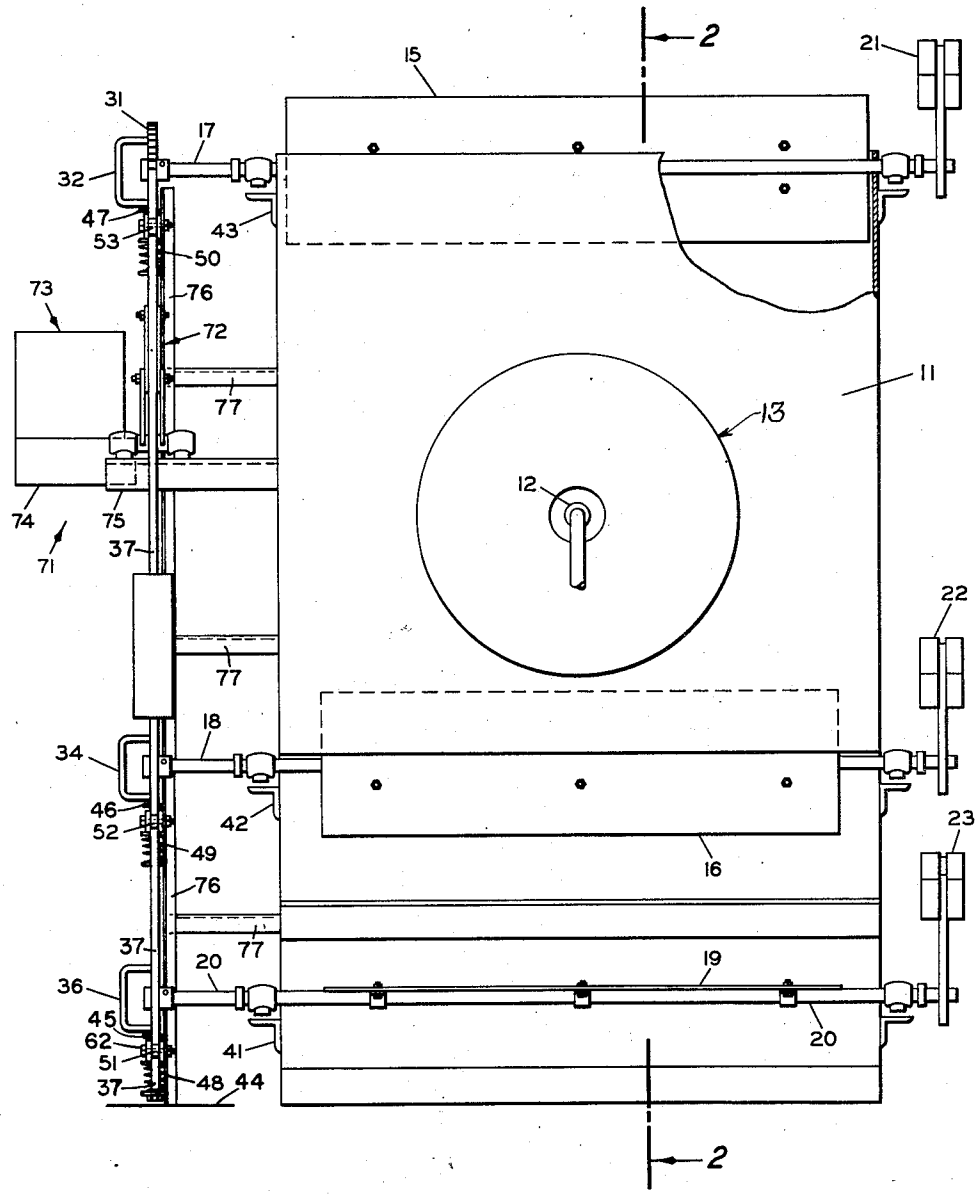


FIG. 1

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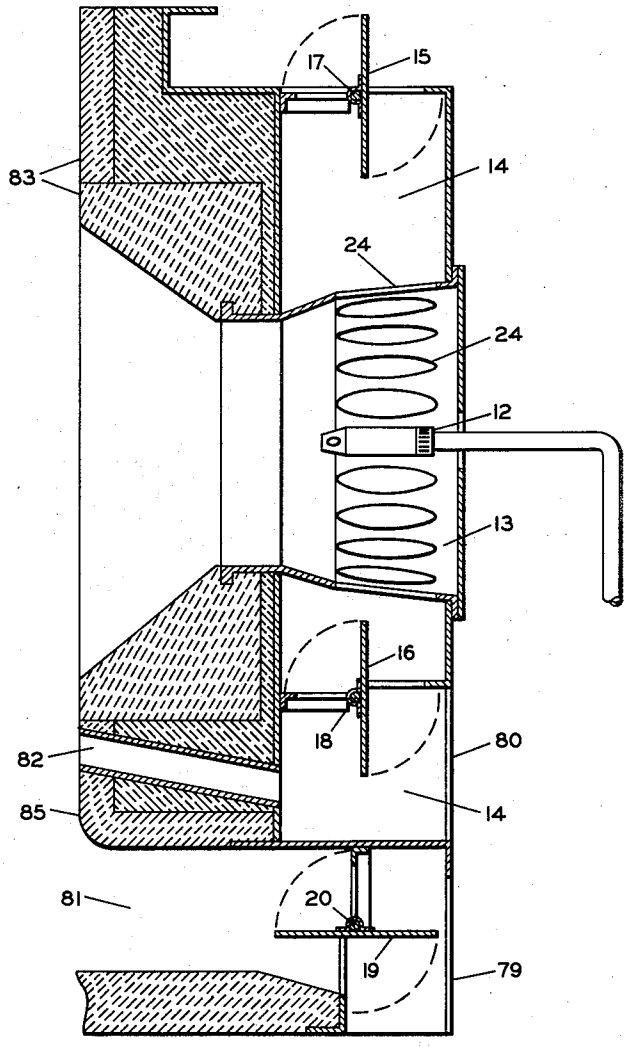


FIG. 2

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FURNACE DAMPER CONTROL

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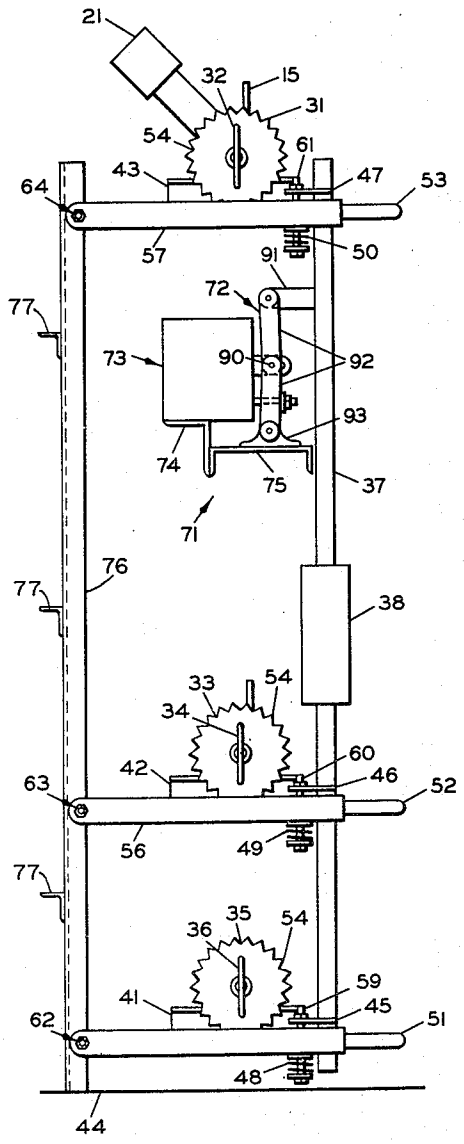


FIG. 3

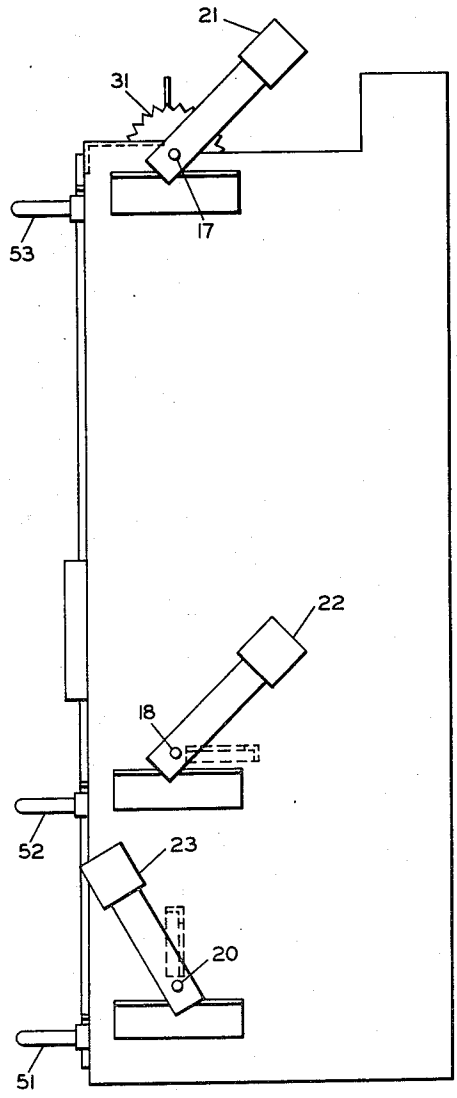


FIG. 4

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FURNACE DAMPER CONTROL

Filed Dec. 22, 1947 5 Sheets-Sheet 4

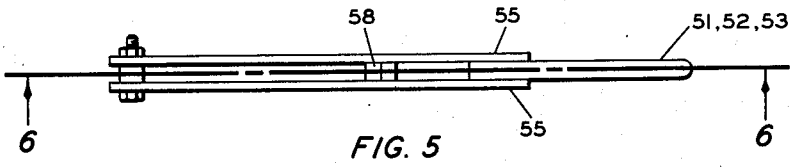


FIG. 5

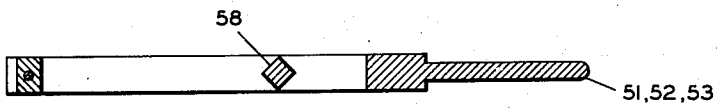


FIG. 6

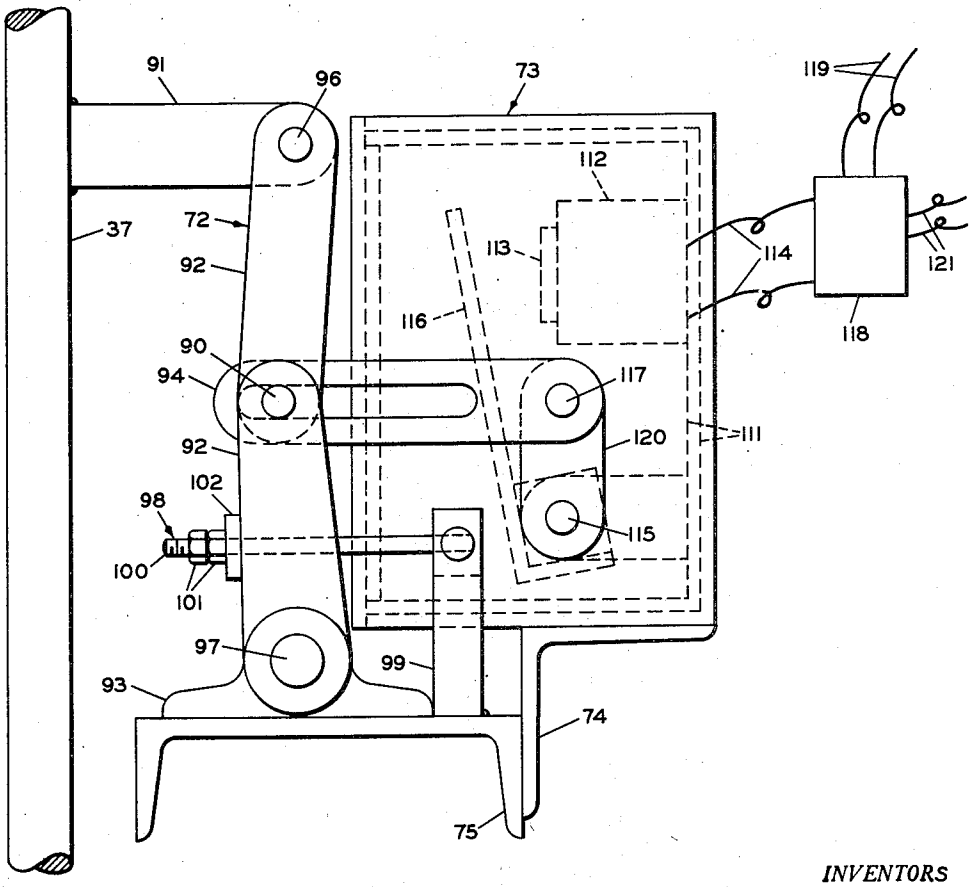


FIG. 7

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FURNACE DAMPER CONTROL

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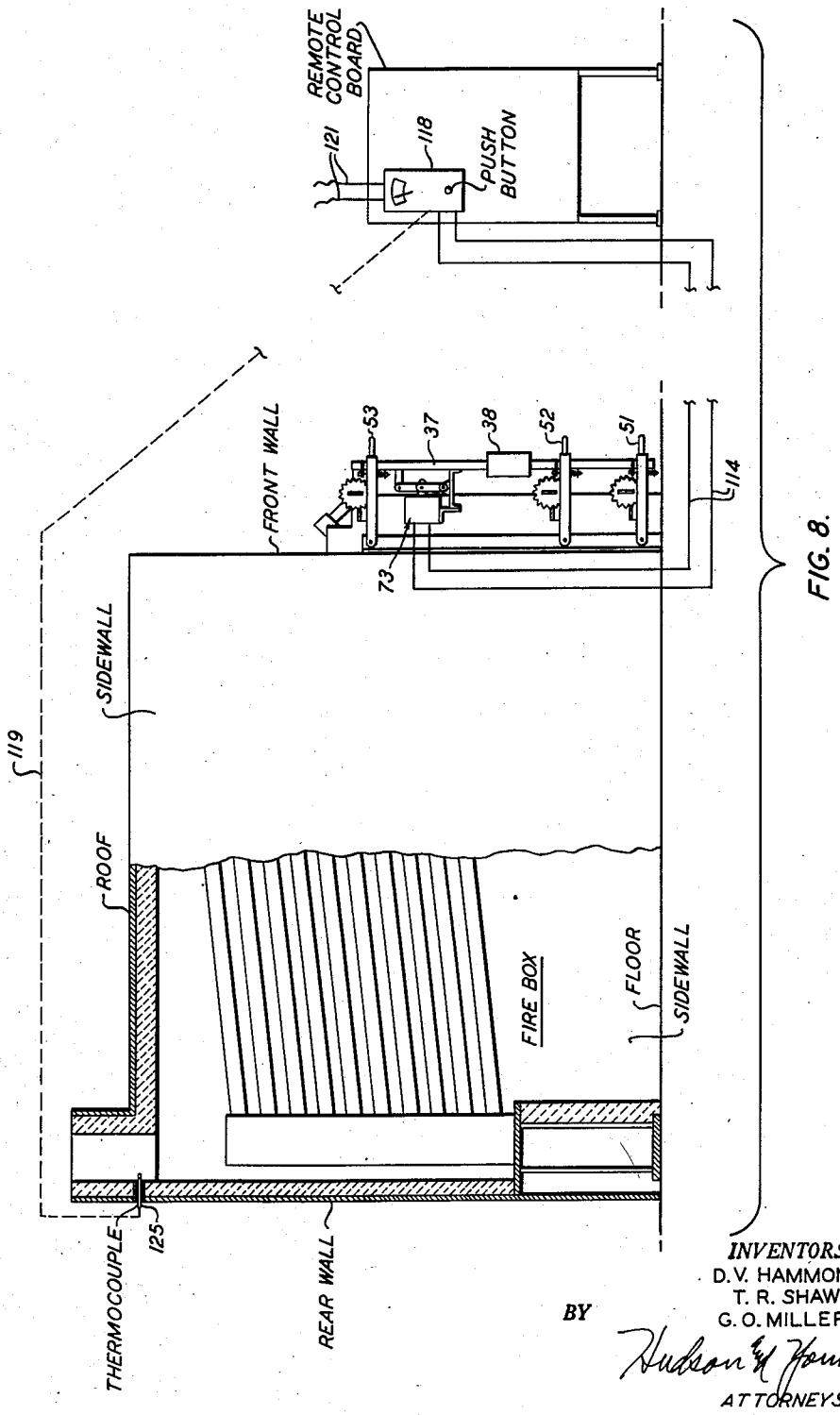


FIG. 8.

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Patented May 19, 1953 2,638,892

UNITED STATES PATENT OFFICE

2,638,892

FURNACE DAMPER CONTROL

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Application December 22, 1947, Serial No. 793,238

4 Claims. (Cl. 126—286)

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This invention relates to furnaces. In one of its more specific aspects it relates to furnace dampers and in a still more specific aspect it relates to a control mechanism for the operation of furnace dampers.

An object of our invention is to furnish a control mechanism for the operation of furnace dampers. Another object of our invention is to provide an apparatus for the closing of furnace dampers. Still another object of our invention is to provide an apparatus for the closing of furnace dampers, which apparatus may be operated from a point remote from the furnace. Still another object of our invention is to provide a safety closure means for closing of furnace dampers, which means may be responsive to excessive temperature within the furnace.

These and other objects will be realized upon reading the following disclosure and taken with the attached drawing, which respectively describes and illustrates a preferred embodiment of our invention.

In the drawing, Figure 1 represents diagrammatically the front elevation of a furnace burner and wind box equipped with the damper closure apparatus of our invention. Figure 2 is a section view of the furnace dampers and air ducts. Figure 3 is a side elevation of the damper closure means. Figure 4 is a side elevation of the damper closure means on the side of the wind box opposite the elevation of Figure 3. Figure 5 is a plan view of a release lever bar. Figure 6 is a longitudinal sectional view of the release lever bar of Figure 5. Figure 7 is an elevational view of the control box and toggle joint apparatus. Figure 8 is a side elevation, partly in section, of a furnace assembly showing sidewalls, roof, temperature indication means and remote damper control apparatus.

Referring to Figure 1, the wind box proper is composed of a front wall 11 in the center of which is a burner 12 positioned in a burner opening 13. The furnace front wall contains a wind box 14 which may best be seen in section in Figure 2. This wind box 14 is equipped with an upper damper 15 and a lower damper 16. The front wall is also equipped with a fire box damper 19. This latter damper controls air flowing through a duct 81 directly into the fire box of the furnace. A duct 82 permits the flow of a small quantity of air into the fire box of the furnace at all times.

The upper damper 15 is rigidly attached to a damper shaft 17 and the damper rotates around this shaft as a center. In like manner, the damper 16 is attached to a damper shaft 18

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around which the damper rotates. Also the damper 19 is attached to and rotates around a damper shaft 20. The damper 15 is intended to control the flow of air from the exterior of the furnace into the upper portion of the wind box 14. This damper extends across approximately the entire front wall of the wind box. The dampers 16 and 19 also extend across the entire front wall of the wind box, dampers 16 controlling the flow of air into the lower portion of the wind box 14 and damper 19 controlling the flow of air into the air duct 81. Air from the wind box 14 passes through a series of openings 24 into the area adjacent the burner for passage into the fire box.

On one end of the upper damper shaft 17 is rigidly attached a weight 21. This weight may be positioned on the shaft 17 at any desired angle from the horizontal. This weight is intended to close the damper 15 upon release of a holding mechanism on the other end of the damper shaft.

A damper weight 22 is attached to one end of the lower damper shaft 18. This weight is also adjustable with respect to the horizontal and is intended to rotate the damper shaft 18 to close the damper 16 upon release of mechanism at the opposite end of this shaft.

In a like manner, a damper weight 23 is attached to the same corresponding end of the fire box damper shaft 20. This weight also is adjustable with respect to horizontal and is intended to close the damper upon release of a holding mechanism on the opposite end of the shaft 20. The holding mechanism for the upper damper 15 may be seen in Figures 1 and 3. In Figures 1 and 3 a wheel 31 is rigidly attached to the end of the shaft 17. This wheel has a handle 32 attached thereto in such a manner that the wheel may be turned by hand, as in opening the upper damper 15. The shaft 18 also has attached to its end a wheel 33 with a handle 34. Shaft 20 has a similar wheel 35 with a handle 36.

Each of these wheels has some notches 54 cut into their peripheries in such a manner as to form teeth for meshing with a square bar 58 within the release lever assemblies 62, 63 and 64, one of which is shown in Figure 6. These levers are constructed of pairs of side bars 55, 56 and 57, between which is attached the handle members 51, 52 or 53, respectively, for the several release lever assemblies. A vertical support member, as an angle iron 76, is attached to the side of the windbox by brace members 77, and is intended to support the pivot ends of the hand lever assemblies 62, 63, and 64. By this means trip bar

37 can only move vertically upward and downward.

The lower release lever assembly is equipped with a compression spring 48 which surrounds a bolt 59. The bolt is supported by a plate member 45 which is attached to the lower portion of the trip bar 37. Upon pushing downward on the handle 51 the spring 48 is compressed and the square bar 58 becomes unmeshed with the notches 54 in the wheel 35 and the operator can then by grasping the handle 36 rotate the damper and shaft, 19 and 20, respectively, to any position desired. The weight 23 on the end of this damper shaft 20 is intended to be so positioned with respect to the shaft 20 that when the weight is approximately horizontal the damper 19 will be closed. Then upon rotation of the handle 36 in the proper direction the weight 23 is lifted and the damper 19 is opened to whatever extent is desired. When the damper 19 is in this opened position downward pressure is released from the handle 51 and the compression spring 48 raises the lever assembly 62 so that the square bar 58 meshes with a notch in the wheel 35 to hold the wheel 35 in position and the damper 19 open.

The lower wind box damper 16 may be positioned in like manner by pushing downward on the handle 52 which compresses the spring 49 and allows rotation of the hand wheel 33 and rotation of the damper 16. Downward pressure is then released from the handle 52 and the lever arm 63 raises to hold the wheel 33 in its position. The compression spring 49 is held in place by a bolt 60 and a plate member 46 which latter member is attached rigidly to the trip bar 37.

The upper wind box damper 15 may be adjusted in a manner similar to the other dampers by pushing downward on the handle 53 to compress spring 50. Wheel 31 is then adjusted to give the desired damper opening and then the pressure on the handle 53 is released to allow the lever assembly 64 to rise so that the square bar 58 meshes with a notch 54 in this wheel to hold the damper in its proper position. The compression spring 50 is held by a bolt 61 and a plate member 47, the latter being attached rigidly to the trip bar 37. The trip bar 37 carries a weight 38 as a means to make certain that upon operation of a control assembly 71, the trip bar will drop by gravity.

When the several dampers are in their respective operating positions, that is, partly or fully open, the lower end of the trip bar 37 is intended to be an inch or two above a base plate 44 positioned at the bottom line of the furnace and directly under the trip bar. With the trip bar raised the control assembly 71 is in the position as indicated in the drawing.

This control assembly 71 is composed of several parts, a control box 73 which contains a control apparatus and a toggle assembly 72. This toggle assembly is composed of two toggle members 92 held together by a shaft 90. The upper end of the upper toggle member 92 is pivoted to a bar 91 which in turn is rigidly attached to the trip bar 37. The lower end of the lower toggle member 92 is pivoted to a base member 93 which in turn rests upon a channel support member 75. One end of this channel support member 75 may be attached to the adjacent side of the wind box as a support. An angle support member 74 is attached to the channel support 75 in such a manner as to furnish a base upon which the control box 73 rests. The control box of course is rigidly attached to this angle support member 74.

The toggle apparatus and its operation may best be seen upon reference to Figure 7 of the drawing. As shown in Figure 3 and in Figure 7 the toggle member is so positioned that the trip bar 37 is an inch or two above the base plate 44. It will be noted that the toggle members 92 are out of line with respect to a straight line joining the pivot shafts 96 and 97. The lower toggle shaft 92 rests against a stop washer 102 which in turn is locked in place by lock nuts 101 on a bolt 100. This bolt stop assembly 98 is attached to a support member 99 which in turn is supported by the channel support member 75. The support member 99 may be attached to the channel by welding or other means as desired. The stop nut 102 is intended to act in preventing the lower toggle member 92 from resting too far off center to the left (Figure 7) so that upon a slight movement of a toggle arm member 94 to the right (in Figure 7) the two toggle members 92 will at their common point (shaft 90) move toward the center line connecting pivots 96 and 97 and beyond this center line toward the right. When the arm member 94 so operates the toggle members 92, the upper end of the upper toggle member 92, its shaft 96, the bar 91 and the trip bar 37 drops until the trip bar 37 rests on the base plate 44. When the trip bar 37 drops in this manner the plate members 45, 46, and 47 drop also and these of course lower the compression springs 48, 49 and 50 to permit dropping of the release levers 62, 63 and 64 to release the notched wheels 35, 33 and 31 thereby permitting the weights 23, 22 and 21 to drop and to close the several dampers.

To reset the trip bar toggle mechanism it is merely necessary to push the toggle arm member 94 and the shaft 90 (common point of the toggle members 92) to the left, as in Figure 7, to such an extent that the shaft or pin 90 is beyond "dead center" or in other words, until the shaft 90 is to the left of the center line joining shafts 96 and 97. This operation raises the trip bar off the base plate 44 an inch or two as previously stated. Each of the dampers must then be set in any desired open position manually as hereinbefore explained.

The angle iron members 41, 42 and 43 of Figures 1 and 3 are attached to the side wall of the wind box for the support of bearings through which the several damper shafts extend. The "weight" ends of the damper shafts are also positioned in bearings to facilitate rotation of the shafts.

The control box toggle assembly of Figure 7 consists of two main parts, the toggle assembly 72 and the control box 73. The control box 73 may be constructed of steel plate lined with heat insulating lining material 111. Within this box is a solenoid coil 112 containing a metal core 113. This solenoid 112, 113 is a conventional coil. An armature or arm 116 is pivoted around a shaft 115 in such a manner that upon closing the circuit in lead wires 114 the arm 116 will be drawn to the core 113 and held in that position until the circuit in wires 114 is broken. The shaft 115 around which the armature 116 rotates extends through the side wall of the box 73 and outside the box this shaft is rigidly fastened to a bar member 120. The other end of this bar member 120 is pivoted to one end of the toggle arm member 94 in such a manner that when the armature 116 rotates to the right and is held against the solenoid core 113 the toggle assembly is tripped to the right and the trip bar 37

falls, thereby permitting all three dampers of the wind box to close.

This solenoid may be operated or made responsive to any operation as desired, for example, as illustrated in Figure 7, the diagrammatically illustrated box 118 may be a conventional controller unit, with wires 119 leading to a thermocouple 125. The thermocouple may be installed at any desired location in the furnace fire box and this apparatus so operates that when the temperature in the fire box rises to a value above the maximum permissible fire box temperature the control apparatus 118 will operate to close the circuit 114 which will cause the core 113 of the solenoid to become magnetized. The core will then attract the arm 116 and the toggle joint will be tripped and the trip bar will be dropped to permit automatic closing of the dampers.

Then when the temperature in the fire box drops below the referred to maximum temperature the circuit 114 will be broken and the armature released from the core 113 but the toggle joint will not move to reset itself because of the heavy weight of the trip bar 37 and its weighting member 38. This operation must be done manually. The control box 118 receives current from a source not shown through power lines 121.

The lead wires 119 which have hereinbefore been mentioned as attached to a thermocouple positioned in a strategic location may be attached to a push button in the control house in which the furnace operator spends a portion of his time. With the push button apparatus, in case of a fire or other emergency, the operator may close the dampers of the furnace by merely pushing the button to close the circuit in lines 119 and in 114 which in turn will cause the rapid closing of the dampers.

Referring to Figure 2 this burner front wall assembly is actually the front wall of the furnace with the wind box and burner in place. The insulation material 83 is the front wall of the fire box while the exterior or right hand portion of this figure represents the outer surfaces of the front wall of the furnace and the furnace wind box. The upper damper permits the inflow of air from the atmosphere through the upper portion of this front wall through an opening made when the damper is open. The lower wind box damper 16 and air duct 82 receive atmospheric air through an opening 89 which extends horizontally across the entire front of the wind box. The air duct 81 receives its air when the damper 19 is open through a front wall opening 79 which opening starts substantially at the ground level and extends laterally across the entire front wall of the wind box.

We have found that the damper closure mechanism as herein disclosed operates very satisfactorily as a safety device for furnace operators in case of an emergency. The device further assists in minimizing furnace damage in case of a fire by rapidly permitting either automatic or manual closing of the furnace dampers.

Materials of construction of all of the apparatus parts may be selected from those commercially available and no special alloy steels nor special materials are required.

We have herein described a preferred embodiment of our invention but it will be obvious to those skilled in the art that the construction or operation of various apparatus parts may be varied and yet remain within the intended spirit and scope of our invention.

Having disclosed our invention, we claim:

1. A damper operating device comprising, in combination, a damper disposed in a gas carrying conduit and mounted on a shaft, said damper being nonrotatable with respect to said shaft, both ends of said shaft extending beyond the confines of said conduit, a weighted damper closing means at one end of said shaft and outside of said conduit for constantly biasing said damper toward a closed position, a sprocket wheel on the other end of said damper shaft, a hand lever pivoted at one end to a fixed support for vertical movement with respect to said sprocket wheel, a sprocket tooth attached to said hand lever in such a manner as to mesh between teeth of said sprocket wheel when the other end of said hand lever is in a raised position and to disengage from the teeth of said sprocket wheel when said other end of the lever is in a lowered position, a compression spring for biasing said other end of said hand lever toward said raised position, a vertically disposed weighted shaft, means for guiding said vertical shaft for vertical reciprocating movement only, means attached to said vertically disposed weighted shaft and engaging said lever to bias said compression spring upwardly in a compressed condition when said vertically disposed shaft is positioned at the upward end of its extent of longitudinal movement, and a toggle assembly for holding said vertically disposed shaft at the upper end of its extent of longitudinal movement, said toggle assembly comprising a first and lower fixed pivot, a first generally upright disposed toggle arm member rotatably fixed at its lower end to said first pivot, a second generally upright disposed toggle arm member pivoted at its lower end to the upper end of said first arm member at a second and generally horizontally movable pivot point, the upper end of said second toggle arm member being pivoted to said vertically disposed weighted shaft, aforesaid pivot points being disposed substantially in a straight line when said vertically disposed weighted shaft is at the upper end of its extent of longitudinal movement, stop means to prevent movement of said second pivot point in one horizontal direction from its substantially centered position, means to move said second pivot point from said centered position in the opposite horizontal direction whereupon said vertically disposed weighted shaft moves downward by force of gravity to release the bias of said compression spring to unmesh said sprocket tooth from said sprocket wheel and said damper will return to its closed position under the influence of its bias, and a manually operable means for rotating said damper shaft to open said damper against its bias.

2. A furnace assembly for heating material comprising, in combination, a fire box surrounded by side walls and a roof, a burner assembly disposed in one side wall, a furnace windbox surrounding said burner and communicating therewith for conducting air from the exterior of the furnace to the burner assembly, said windbox having an opening for admitting air thereto, a damper assembly extending into said windbox for controlling the flow of air comprising, in combination, a damper disposed in said windbox in controlling relation to said opening and mounted on a shaft, said damper being nonrotatable with respect to said shaft, both ends of said shaft extending beyond the confines of said windbox, a weighted damper closing means at one end of said shaft and outside of said windbox for constantly biasing said damper toward a closed posi-

tion, a sprocket wheel on the other end of said damper shaft, a hand lever pivoted at one end to a fixed support for vertical movement with respect to said sprocket wheel, a sprocket tooth attached to said hand lever in such a manner as to mesh between teeth of said sprocket wheel when the other end of said hand lever is in a raised position and to disengage from the teeth of said sprocket wheel when said other end of the lever is in a lowered position, a compression spring for biasing said other end of said hand lever toward said raised position, a vertically disposed weighted shaft, means for guiding said vertical shaft for vertical reciprocating movement only, means attached to said vertically disposed weighted shaft and engaging said lever to bias said compression spring upwardly in a compressed condition when said vertically disposed shaft is positioned at the upward end of its extent of longitudinal movement, and a toggle assembly for holding said vertically disposed shaft at the upper end of its extent of longitudinal movement, said toggle assembly comprising a first and lower fixed pivot, a first generally upright disposed toggle arm member rotatably fixed at its lower end to said first pivot, a second generally upright disposed toggle arm member pivoted at its lower end to the upper end of said first arm member at a second and generally horizontally movable pivot point, the upper end of said second toggle arm member being pivoted to said vertically disposed weighted shaft, aforesaid pivot points being disposed substantially in a straight line when said vertically disposed weighted shaft is at the upper end of its extent of longitudinal movement, stop means to prevent movement of

said second pivot point in one horizontal direction from its substantially centered position, means to move said second pivot point from said centered position in the opposite horizontal direction whereupon said vertically disposed weighted shaft moves downward by force of gravity to release the bias of said compression spring to unmesh said sprocket tooth from said sprocket wheel and said damper will return to its closed position under the influence of its bias, and a manually operable means for rotating said damper shaft to open said damper against its bias.

3. The furnace assembly of claim 2 wherein said means to move said second pivot point comprises an electrically operable means responsive to temperatures within the furnace.

4. The furnace assembly of claim 2 wherein said means to move said second pivot point comprises an electrically operable means operable from a point remote from said furnace.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
312,449	Dunn	Feb. 17, 1885
422,956	Malmborg	Mar. 11, 1890
1,048,659	Claus	Dec. 31, 1912
1,125,416	Watson	Jan. 19, 1915
1,352,255	Emerson	Sept. 7, 1920
1,627,013	Cowie	May 3, 1927
2,190,892	Swepston	Feb. 20, 1940
2,301,876	Hurlburt	Nov. 10, 1942
2,339,614	Breese	Jan. 18, 1944