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Blaine

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[54] **AUXILIARY OPERATORS FOR SLIDE DAMPERS**

[75] Inventor: **John C. Blaine**, Ottawa, Ill.

[73] Assignee: **Libbey-Owens-Ford Company**, Toledo, Ohio

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[52] **U.S. Cl.** **432/54**; 137/309; 432/181

[51] **Int. Cl.**[2] **C21B 9/12**; F16K 11/00

[58] **Field of Search** ..... 432/17, 54, 161, 177, 180, 432/181, 185, 212, 222; 126/285 R, 285 A; 110/163; 137/309

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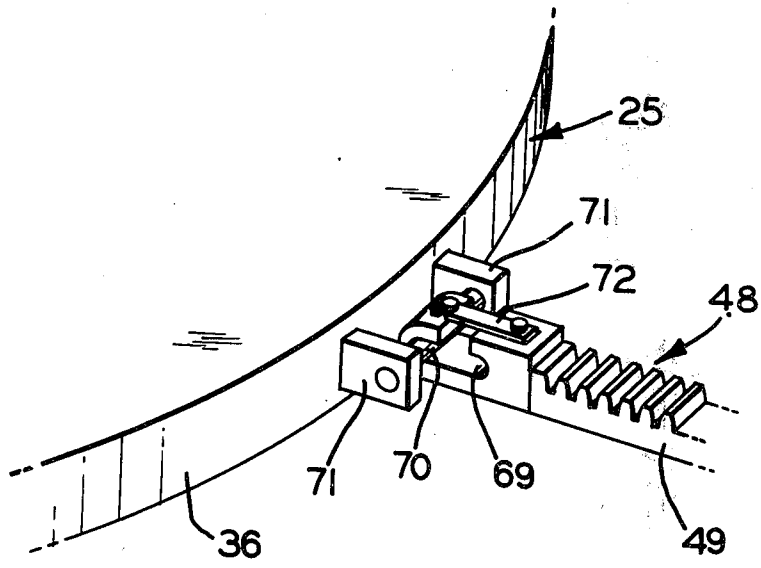
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Primary Examiner—John J. Camby
Assistant Examiner—Henry C. Yuen
Attorney, Agent, or Firm—Collins, Oberlin & Darr

[57] **ABSTRACT**

A manually operable auxiliary apparatus for moving a slide damper in an ejector stack having a reciprocating arm movable in a linear path. One end of the arm is detachably connected to an end of the slide damper for pushing or pulling the damper between open and closed positions. Movement of the reciprocating arm is provided by a force multiplying device whereby an operator can easily and conveniently manually move the damper between its open and closed positions when the primary operating means for moving the damper is inoperative.

2 Claims, 6 Drawing Figures



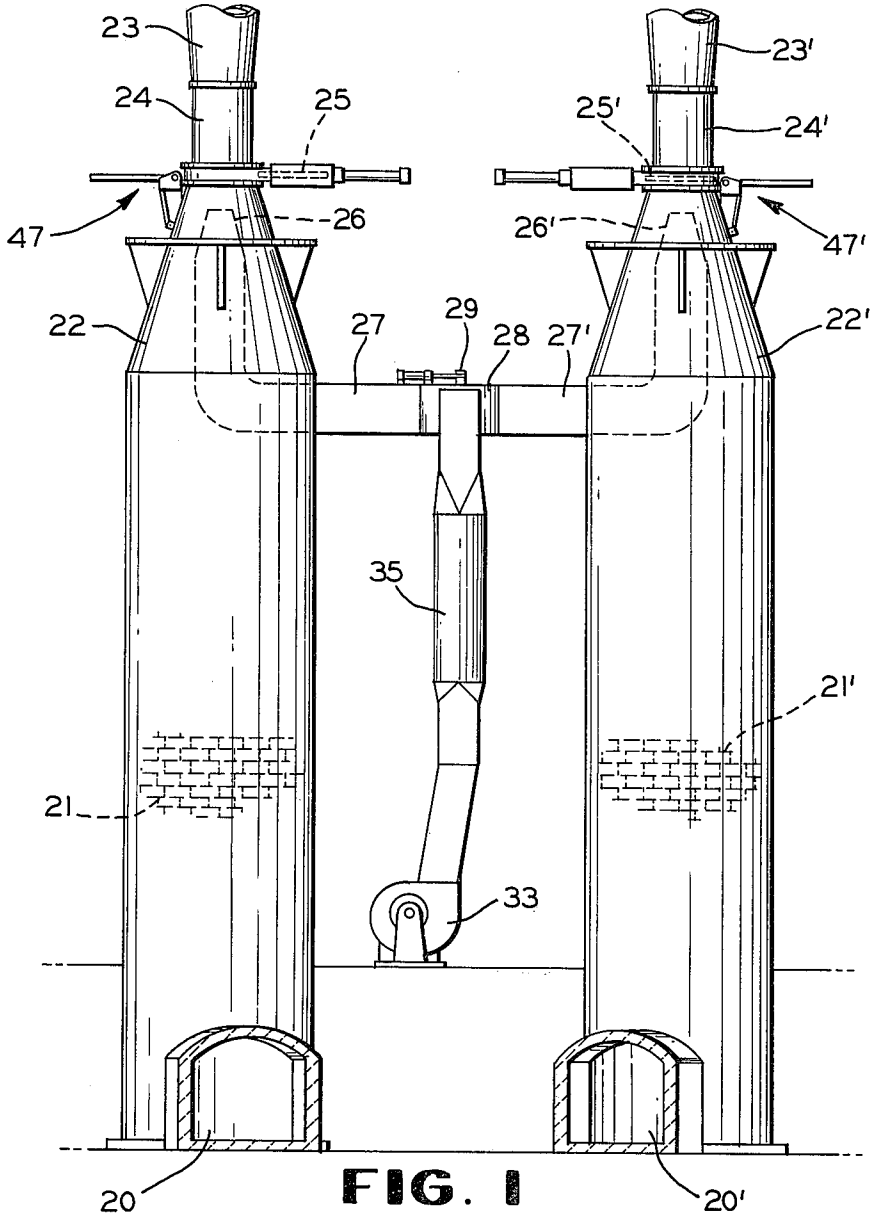

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FIG. 1

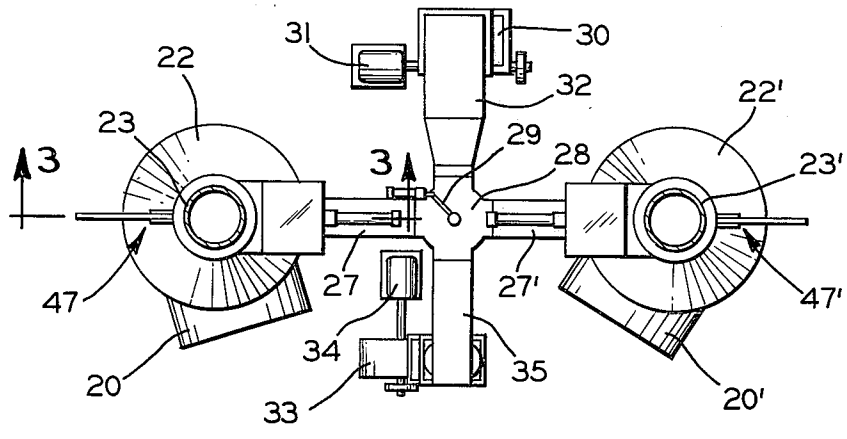

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FIG. 2

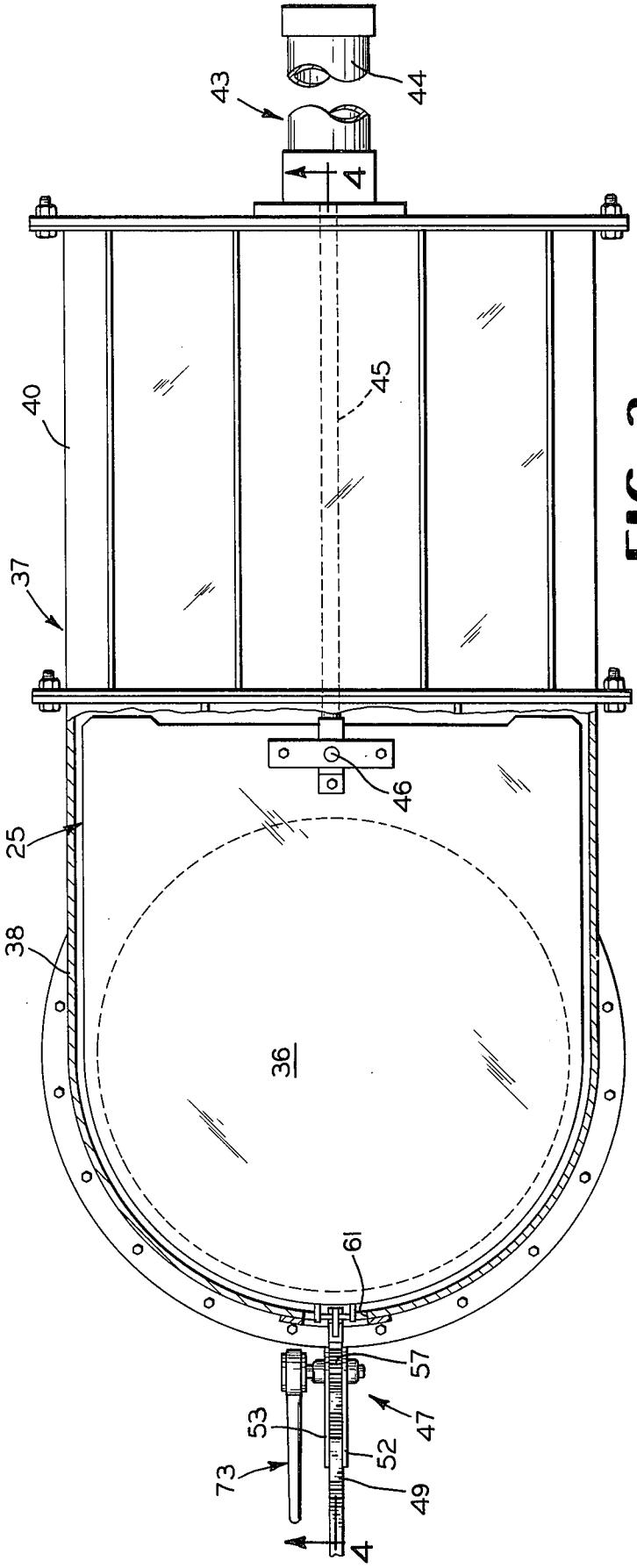

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FIG. 3

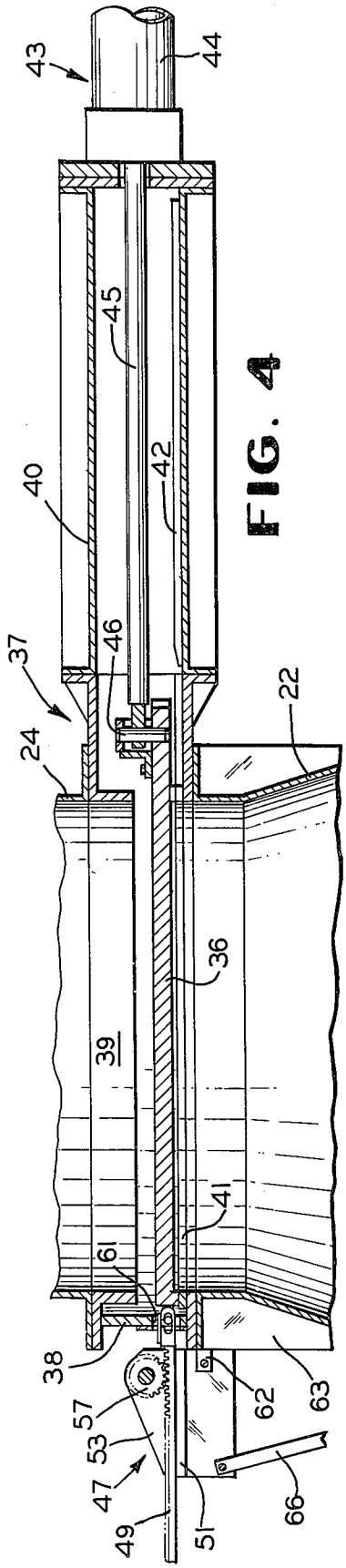

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FIG. 4

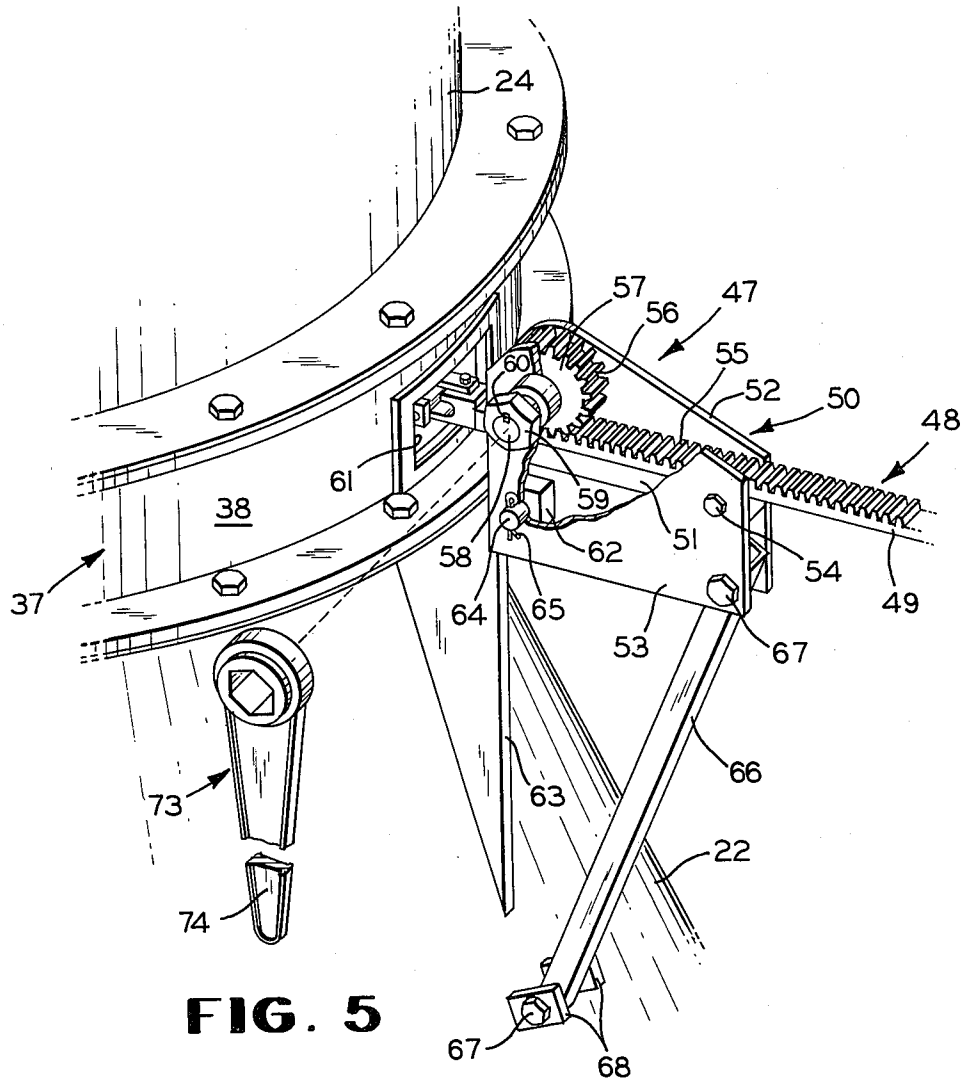

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FIG. 5

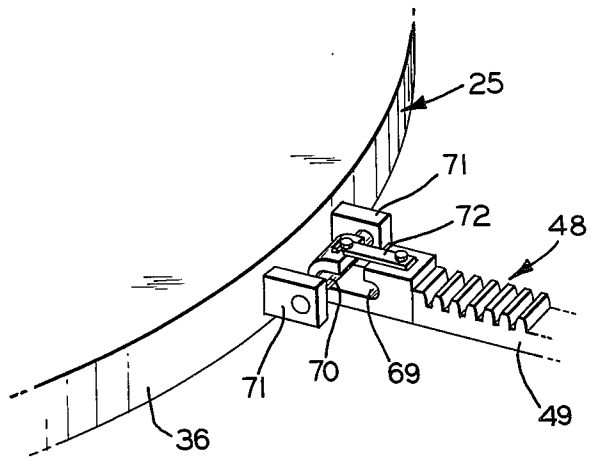

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FIG. 6

AUXILIARY OPERATORS FOR SLIDE DAMPERS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to furnace control apparatus and, more particularly, to auxiliary apparatus for controlling the flow of combustion air and hot waste gases to and from regenerative type furnaces.

2. Description of the Prior Art

As is well known, flat glass is produced in a continuous tank-type melting furnace wherein raw batch materials are continuously delivered to the charging end of the furnace, melted and refined as they move through the furnace, and then withdrawn from its delivery end as a continuous ribbon. In furnaces of this type, heat for melting the raw batch is introduced through ports arranged in a longitudinal series along each opposed longitudinal side wall, the ports leading to sources of supply of fuel and preheated air. The combustion air obtains its preheat from the hot waste gases which have previously passed through the checkerwork of the regenerators associated with the ports being fired. The two series of ports are alternately operated independently of each other so that first one series of ports is fired and the opposite series exhausts that hot waste gases. Then, at periodic intervals of about 20 to 30 minutes, the operating condition of the two series of ports is reversed, that is, the ports being fired serve as the exhaust ports and the ports exhausting the hot waste gases serve as the firing ports. Also, it should be noted that the average campaign of such a furnace is about five years.

One well known system for controlling the flow of combustion air and hot waste gases employs two ejector stacks wherein one of the stacks is connected to the regenerators associated with one series of ports and the other stack is connected to the regenerators associated with the other series of ports. Air is supplied under pressure to each ejector stack and means is provided whereby the supplied air may serve either as ejector air to withdraw hot waste gases from one series of ports through its regenerators, or as combustion air which will first flow inwardly through the other series of regenerators and its associated series of ports. The reversing mechanism employed in such a system comprises a reversing valve for directing combustion air to one stack and ejector air to the other stack, in combination with two dampers wherein one damper is associated with one ejector stack and the other damper is associated with the other ejector stack, which dampers alternately close and open the stacks to the atmosphere. The dampers associated with the ejector stacks are normally slide valves which, because of their size and weight, are conventionally operated by fluid power motors of the piston type.

As previously indicated, operation of these motors is frequent and, over extended periods of time, the extreme operating conditions imposed upon the power motors cause extensive wear of their seals and even breakdown of their component parts necessitating occasional repair or replacement. This creates a major problem in the continuous operation of the furnace as it is necessary for its proper operation to reverse the dampers.

SUMMARY OF THE INVENTION

Generally speaking, the periodic cycling of the furnace is continued when either or both of the fluid motors are disabled by providing each slide damper with an auxiliary operating apparatus. In accordance with this invention, the end of each slide damper opposite its connection with the fluid motor is provided with a horizontally extending bail for connection to a force multiplying device. The device comprises a rack and pinion mechanism mounted on and externally of the ejector stack by a bracket wherein the pinion is adapted to be rotated by a manually operable reversible ratchet type wrench for linear movement of the rack. One end of the rack is provided with a T-shaped slot for connection to the bail, and it may be provided with a latch for locking the bail within the slot.

OBJECTS AND ADVANTAGES

Accordingly, it is an object of this invention to provide a relatively simple and dependable auxiliary apparatus for manually operating a slide damper when its primary operation means is disabled.

Another object of this invention is to provide an auxiliary damper operating apparatus with a force multiplying device whereby one person can easily and conveniently move a large and heavy slide damper from one position to another.

Other objects and advantages will become more apparent during the course of the following description when taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, wherein like numerals are employed to designate like parts throughout the same:

FIG. **1** is a side elevational view of a forced draft system for a continuous tank melting furnace embodying this invention;

FIG. **2** is a top plan view of the system shown in FIG. **1**;

FIG. **3** is a cross sectional view, taken substantially along line **3—3** in FIG. **2**, of the slide damper in the ejector stack associated with this invention;

FIG. **4** is a top plan view of the slide damper shown in FIG. **3**;

FIG. **5** is an enlarged fragmentary perspective view of the auxiliary damper operating apparatus constructed in accordance with this invention; and

FIG. **6** is an enlarged fragmentary view of the detachable connection employed to connect the operating apparatus to the slide damper.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring particularly to FIGS. **1** and **2**, the primary regenerators (not shown) of a conventional continuous glass melting tank are adapted to be connected to tunnels **20** and **20'** associated with vertical secondary regenerators **21** and **21'**. The upper ends of the regenerators are connected to inlet chambers **22** and **22'** of two upright ejector stacks **23** and **23'**, respectively. These stacks are of venturi shape and are provided adjacent their throats **24** and **24'** with slidable dampers **25** and **25'**, respectively. Upwardly extending forced air emitting nozzles **26** and **26'** are mounted in the chambers **22** and **22'**. These nozzles are connected by horizontal ducts **27** and **27'** to a chamber **28** containing a revers-

ing valve 29 which alternately connects the ducts to a source of ejection air and a source of combustion air. An air fan 30, driven by a motor 31, delivers ejection air through a duct 32 to the chamber 28. Another air fan 33 driven by a motor 34, delivers combustion air through a duct 35 to the chamber 28.

In the apparatus thus far described, the combustion air fan 33 may be used to supply air inwardly through either of the secondary regenerators 21 or 21' to supply heated combustion air to the glass melting furnace in a known manner, while the ejector air fan supplies air for the withdrawal of hot waste gases outwardly through the other regenerator and the ejection of these gases to the atmosphere. Thus, with the damper 25 open, the damper 25' closed and the reversing valve 29 directing ejection air through the open ejector stack 23, combustion air will flow through the duct 27' into the inlet chamber 22' and thence downwardly through the secondary regenerator 21' which preheats the air being delivered to the primary regenerators of the glass melting furnace. At the same time the ejection air from the chamber 28 will flow through the duct 27 and thence upwardly through the venturi stack 23, drawing hot waste gases upwardly from the glass melting furnace through the secondary regenerator 21 which will be heated by the hot waste gases passing therethrough. When the flow of air through the furnace is to be reversed, the damper 25 will be closed, the damper 25' opened, and the reversing valve 29 moved to its other position. The combustion air will then flow downwardly through the secndary regenerator 21 while the ejection air will flow upwardly through the stack 23' and withdraw hot waste gases upwardly through the regenerator 21'. The fan 33 is suitably adjusted to supply air at the rate required for efficient combustion of the fuel firing the furnace, and the fan 30 is suitably adjusted to supply air at the rate required to maintain the pressure within the furnace at a desired value.

Since the slide dampers 25 and 25' and the operating mechanism are constructed of like parts, a description of one will serve as a description for the other. As indicated in FIG. 1 and clearly shown in FIG. 3, the slide damper 25 comprises a substantially flat plate member 36 movably contained in a housing 37 which connects the throat 24 of the ejector stack 23 to the top of the inlet chamber 22. The housing 37 comprises an open annular section 38 which provides a passageway 39 between the ejector stack 23 and the inlet chamber 22, and an enclosed casing section 40 for receiving the plate member 36 when it is moved to a position to open the passageway 39. The plate member 36 is configured to co-operate with the annular section 38 of the housing 37 to close the passageway 39 and is normally composed of cast iron to withstand the high operating temperatures required in the glass melting operation. The passageway is approximately five feet in diameter and thus, the plate member 36 is very large and heavy.

Referring now to FIGS. 3 and 4, the damper 25 is shown in its closed position. That is, the plate member 36 overlies the passageway 39 and shuts the inlet chamber 22 from the ejector stack 23. The plate member 36 is supported on a slideway 41 which surrounds the passageway 39 in the open annular section 38. The plate member 36 is slidably movable along the slideway 41 onto slideway 42 (only one shown) provided in the enclosed casing section 40 to open the passageway 39 for the flow of air therethrough. Since the plate member 36 is of large size and considerable weight, it is normally moved by a power cylinder such as a piston type fluid motor 43. The motor includes a cylinder 44 having a piston (not shown) therein connected to a piston rod 45, the end of the latter being connected by a pin 46 attached to one end of the plate member 36 in a conventional manner.

As previously indicated, the firing of such a furnace employed in the continuous glass making operation is reversed at periodic intervals of about 20 to 30 minutes and the average campaign of such a furnace is on the order of five years. Thus, it is apparent that the damper operating motor 43 is subjected to frequent and hard use over extended periods of time which occasionally results in its breakdown.

According to the invention, the slide damper 25 is provided with a manually operable operable auxiliary operating apparatus generally indicated by the numeral 47, so that one person can conveniently and easily move the slide damper between its open and closed positions when failure of the power motor 43 occurs. The apparatus 47 generally comprises a reciprocating means 48 such as an arm which is movable along a linear path by a force multiplying device such as a gear mechanism. The reciprocating arm is provided with means for detachably connecting it to the slide damper 36.

Referring now to FIG. 5, the reciprocating means 48 of the invention generally comprises a rack 49 supported within an open bracket 50 on a longitudinally extending slide bar 51. The open bracket 50 is provided with a pair of parallel vertical side plates 52 and 53 arranged in spaced apart relation by the slide bar 51 and secured together by bolts 54 (only one shown). The rack 49 extends along the slide bar 51 with its teeth 55 in mesh with the teeth 56 of a pinion gear 57. The pinion gear is fixedly attached to a shaft 58 rotatably mounted in the side plates 52 and 53. A hexagonally shaped member or nut 59 is keyed as at 60 to one end of the shaft 58 for a purpose which will be described hereinafter.

The rack 49 is supported in substantially the same horizontal plane that the plate member 36 lies in by mounting the bracket 50 on and adjacent to the top end of the inlet chamber 22 so that the rack may pass through an aperture 61 provided in the wall of the annular housing section 38 for connecting it to the internally located plate member 36. Thus, as best seen in FIGS. 3 and 5, the bracket 50 is externally mounted on the chamber 22 by a pivotal connection and a supporting leg. The pivotal connection may include an anchor leaf 62 fixedly secured to a rib 63 forming part of the inlet chamber 22, the side plates 52 and 53 of the bracket 50, and a headed pivot pin 64. As shown in FIG. 5, the leaf 62 projects between the side plates 52 and 53 and the pivot pin extends through co-operating apertures provided in the leaf and side plates and is keyed therein by a cotter pin 65. The supporting leg may comprise a leg member 66 which extends between the bracket 50 and the wall of the inlet chamber 22. Still referring to FIG. 5, one end of the leg 66 projects between the side plates 52 and 53 and is connected thereto by a bolt and nut indicated by the reference character 67. The other end of the leg 66 projects between a pair of upstanding plates 68 fixedly secured to the wall of the inlet chamber and is connected thereto by a similar bolt and nut 67. Thus, the entire device 47 may be removed when not in use so as to be out of the way, and quickly attached in case of an emergency.

Referring now to FIG. **6**, the end of the rack **49** is provided with an inverted T-shaped slot **69** for attachment to a bail pin **70** attached to the end of the plate member **36** by a pair of projecting members **71**. A pivotal latch **72** is provided across the open leg of the T-shaped slot **69** to detachably lock the bail pin **70** within the T-shaped slot. The connection between the rack **49** and the plate **36** may be made within the interior of the housing **37** by inserting the coupling end of the rack through the apertures **61**, engaging the slot **69** with the bail pin **70** and closing the pivotal latch **72**.

As indicated in FIG. **4** and shown in FIG. **5**, a reversible ratchet wrench **73** having a hexagonal socket for receiving the member **59** is provided for manually rotating the pinion gear **57** in either of its directions of rotation. The handle **74** of the wrench **73** is of such length that it provides a mechanical advantage to easily rotate the pinion gear **57** and pull or push the plate **36** between its open and closed positions, respectively.

It is to be understood that the form of the invention herewith shown and described, is to be taken as an illustrative embodiment only of the same, and that various changes in the shape, size and arrangement of the parts may be resorted to without departing from the spirit of the invention.

I claim:

1. In a reversing forced draft glass melting furnace of the type having a pair of regenerators adapted for periodic cycling, an ejector stack connected to each regenerator, an ejector nozzle mounted in each said stack, a reversing valve periodically and alternately communicating said nozzles with a source of combustion air and a source of ejection air, a slide damper associated with each said stack above each said nozzle to direct the flow of air in each said stack, a power means for automatically and periodically operating each said slide damper in conjunction with said reversing valve, the improvement comprising auxiliary operators for moving each said slide damper between open and closed positions and wherein each said auxiliary operator includes:

a. means for reciprocating its said slide damper between said open and closed positions in event of failure of said power means and comprising a movable rack;

b. means for mounting said reciprocating means on said ejector stack in substantially the same plane as said slide damper;

c. a manually operable force multiplying device operatively connected to said reciprocating means for imparting movement thereto; and

d. means for detachably connecting said reciprocating means to said slide damper, said detachable connecting means comprising a bail pin affixed to the end of said slide damper, and said rack being provided with a T-shaped slot for receiving said bail pin.

2. An auxiliary operator for manually moving a slide damper as claimed in claim **1**, including a latch connected to said rack for locking said bail pin within said T-shaped slot.

* * * * *