

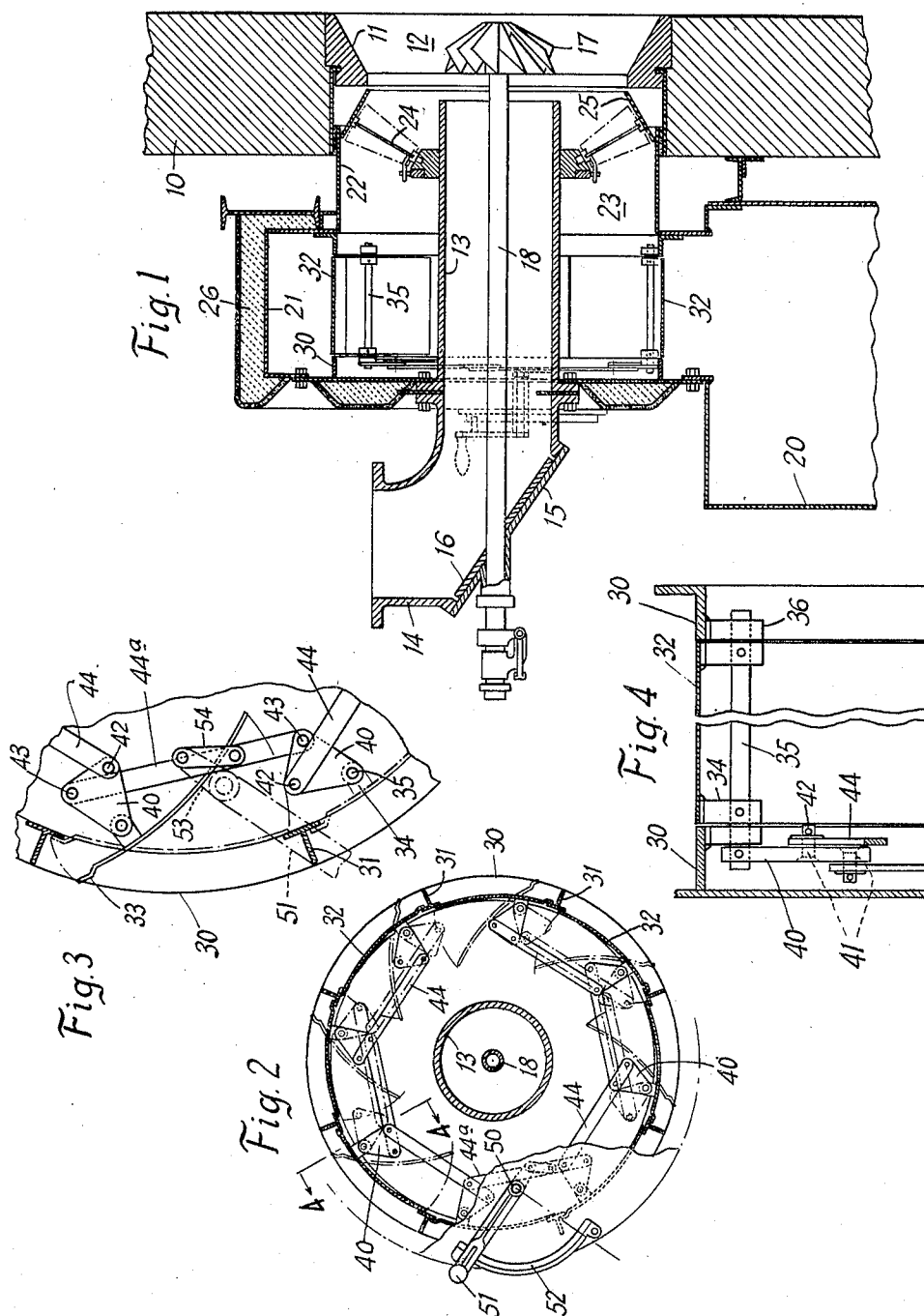
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AIR REGISTER FOR FUEL BURNERS

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AIR REGISTER FOR FUEL BURNERS

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6 Claims. (Cl. 110-104)

The present invention relates to the construction and operation of fuel burners, and more particularly, to the construction of fuel burner air registers and the operating mechanism thereof.

The main object of the invention is the provision of an improved air register construction which is characterized by its simplicity and low cost of construction, ease of operation, uniformity of control of the register doors, and adaption for use in fuel burner registers of relatively large size.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawing and descriptive matter in which I have illustrated and described a preferred embodiment of my invention.

Of the drawing:

Fig. 1 is a sectional elevation of a pulverized fuel burner having an air register constructed in accordance with the invention;

Fig. 2 is an outer end view partly in section of the construction shown in Fig. 1;

Fig. 3 is an enlarged view of a portion of Fig. 2 showing the air doors in an open position; and

Fig. 4 is a section taken on the line 4-4 of Fig. 2.

As shown in Fig. 1, a vertical furnace wall 10 has an opening therein in which is positioned a Venturi-shaped refractory block 11 defining the inner or discharge end of a burner port 12. A fuel pipe 13 having a horizontally arranged discharge end is positioned coaxially of the port 12. As shown, the outer end of the pipe is formed by an elbow 14 adapted to be connected to a suitable source of pulverized fuel and primary air. The lower side of the elbow is closed by a cover 15 having an inner wear plate 16. A bladed impeller 17 is positioned in the burner port slightly beyond the discharge end of the pipe 13 and arranged for coaxial adjustment by a supporting rod 18 mounted in the burner pipe. With the parts described in operation a stream of finely divided solid fuel and carrier air passes through the burner pipe 13 and is dispersed by the impeller 17 into the furnace.

The secondary air supply provisions for the fuel burner comprise a duct 20 connected to a suitable source of air under pressure and opening to a casing 21 surrounding and spaced from the burner pipe. A circular extension 22 connects the

casing to the burner port and defines an annular air passage 23 around the discharge end of the burner pipe. A circular series of obliquely positioned segmental secondary air vanes 24 are arranged in the passage 23 between the burner pipe and a frusto-conical ring 25 forming a flaring extension of the outer end of the refractory member 11. The vanes are arranged for angular adjustment, as indicated in broken lines, about their obliquely arranged axes by a suitable operating mechanism to control the quantity, velocity and direction of the secondary air passing therebetween. The casing 21 is covered over most of its exposed surface by insulation 26.

The passage of air from the duct 20 to the annular passage 23 is controlled by an air register having a pair of circular frame members 30 connected by T-shaped cross bars 31. The register is arranged in the casing 21 to form the outer end of the annular passage 23. The circumferential space between adjacent cross bars 31 forms an air inlet port which is closed by a corresponding rectangular curved air door or damper 32, the opposite ends of each door being arranged to contact with the cross members to fully close the corresponding opening. For this purpose, one end of each door has a slightly offset section 33 for fitting over the outer side of the cross bar. Each door is provided at an intermediate point on its inner side with a pair of depending ears 34 pinned to a shaft 35, which is rotatably mounted in supports 36 carried by the frame ring members 30. On turning the shaft 35, the corresponding air door 32 will be swung open, as illustrated in Fig. 3.

In accordance with my invention the air doors 32 are operated by a mechanism which insures uniform pivotal movement of all of the doors with only a relatively small force required to actuate the air door assembly in either the opening or closing movement. In view of the offset position of each door shaft relative to the door, the air pressure in the casing 21 will aid the opening movement and oppose the closing movement. As shown in Figs. 3 and 4 particularly, on the end of each shaft 35 is rigidly secured an isosceles triangular plate member 40. Each plate 40 has a pair of symmetrically arranged openings 41 adjacent the base thereof and equally spaced from the axis of the corresponding shaft 35. Stud 42, 43 are mounted in the openings 41 and project at opposite sides of the plate to form pivots at opposite sides thereof. The studs 42 project at one side of the plates, while all of the studs 43 project at the other side. As shown in Fig. 3, the studs

42, 43 of alternate plates are transposed as to the holes 41 occupied thereby.

A tie bar or link 44 extends between and pivotally connects each pair of adjacent plates 40, except the pair diametrically opposite the operating lever hereinafter described. As shown in Figs. 2 and 3, the tie bar connecting one pair of plates 40 is pivotally mounted on the stud 43 of both plates, whereas the tie bars connecting these plates to the other adjacent plates are mounted on the pivot studs 42 thereof. The relative arrangement of the shafts 35, plates 40, studs 42, 43 and tie bars 44 described provides a linkage connection between adjacent air doors forming in effect a jointed parallelogram, the short sides of which are the parallel lever arms between the corresponding studs on and the shaft connections of the plates 40. Each plate 40 thus is in effect a bell crank lever, the arms of which are symmetrically arranged. As shown in the drawing, the lever arms of each bell crank lever are angularly spaced at an angle corresponding to that subtended by the chord extending between adjacent pivot axes 35. In operation, all of the tie bars are moved radially and parallel to their original positions. The described arrangement of the tie bars and stud pivots provides a more effective leverage on the air door shafts and minimizes the power requirements for actuating the assembly. By arranging alternate tie bars on opposite sides of the bell crank members 40, no interference occurs therebetween. A uniform angular movement of each bell crank member 40 and the corresponding air door 32 can thus be effected.

As shown in Figs. 2 and 3 an operating shaft 50, actuated by a handle 51 moving across a quadrant 52, is mounted in the outer side of the casing 21 at a point intermediate two of the bell crank members 40. The shaft 50 carries a crank arm 53 to which a short link 54 is pivotally connected. The opposite end of the link 54 is pivotally connected to an intermediate point on the middle tie bar 44^a of the series. The handle 51 may be secured in any position relative to the quadrant 52 by a suitable spring-pressed lock mechanism.

When the fuel burner is to be put in operation the air register operating handle 51 is moved from its closed position, shown in Fig. 2, towards the opposite end of the quadrant 52 to similarly move all of the air doors from the closed position shown in full lines towards the open position shown in broken lines in Fig. 2. The air register construction described is particularly adapted for large size air registers, the specific construction illustrated being that used in an air register of 42 inches diameter. Eight air doors are employed, four at each side circumferentially of the operating shaft. With the particular form of interconnection between the air doors, all of the doors can be uniformly moved in the same angular direction relative to the circumference of the air register. In this manner the air door position can be used not only to control the quantity and velocity of the secondary air passing through the annular passage 23, but also to create a swirling movement of the entering air in a counter-clockwise direction, as shown in Fig. 2. The air register construction is particularly useful where the air entering the duct 20 has previously passed through a regenerative type air heater, as deposition of dust in the door operating mechanism has little or no effect on the ease of operation, in contrast to the operating troubles encountered with air door operating mechanisms of the gear and circular rack type under such

conditions. The mechanism is also advantageous in that only the usual manufacturing clearances are required in the pivotally connected parts, all lost motion being otherwise eliminated. The air register is adapted for use with gas and liquid fuel burners, as well as the pulverized fuel burner illustrated, and may be used with burners operating with an induced draft arrangement.

While in accordance with the provisions of the statutes I have illustrated and described herein the best form of the invention now known to me, those skilled in the art will understand that changes may be made in the form of the apparatus disclosed without departing from the spirit of the invention covered by my claims, and that certain features of my invention may sometimes be used to advantage without a corresponding use of other features.

I claim:

1. A fuel burner air register comprising an annular frame having air ports in the circumference thereof, pivoted doors controlling said ports, and means for simultaneously and uniformly moving said doors including bell crank members arranged to actuate corresponding doors, tie bars pivotally connecting circumferentially adjacent bell crank members, adjacent tie bars being connected in angularly overlapping relation to spaced pivots on opposite sides of the same bell crank member and equi-distant radially from the pivot point of said bell crank member, and an operating lever for moving one of said tie bars.

2. A fuel burner air register comprising an annular frame having air ports in the circumference thereof, pivoted doors controlling said ports, and means for simultaneously and uniformly moving said doors including bell crank members arranged to actuate corresponding doors, tie bars pivotally connecting circumferentially adjacent bell crank members, adjacent tie bars being connected in angularly overlapping relation to spaced pivots on opposite sides of the same bell crank member and equi-distant radially from the pivot point of said bell crank member and arranged to form in effect a jointed parallelogram between the pivot points of circumferentially adjacent doors, and an operating lever arranged to move one of said tie bars.

3. An air register comprising an annular frame having air ports in the circumference thereof, pivoted doors controlling said ports, and means for simultaneously and uniformly moving said doors comprising means forming a pair of angularly spaced lever arms for moving each door, tie bars pivotally connecting the lever arms of circumferentially adjacent doors, and each pair of lever arms being spaced at an angle corresponding to the angle subtended by the chord extending between the pivot axes of circumferentially adjacent doors.

4. A fuel burner air register comprising an annular frame having air ports in the circumference thereof, pivoted doors controlling said ports, and means for simultaneously and uniformly moving said doors comprising means forming a pair of angularly spaced lever arms for moving each door, tie bars pivotally connecting the lever arms of circumferentially adjacent doors, each tie bar and its lever arm connections being arranged relative to the corresponding door pivot axes to provide a perpendicular position of said tie bar relative to its lever arm connections at its point of midtravel, and an operating lever for moving one of said tie bars.

5. An air register comprising an annular frame

having air ports in the circumference thereof, pivoted doors controlling said ports, and means for simultaneously and uniformly moving said doors comprising means forming a pair of angularly spaced lever arms for moving each door, tie bars pivotally connecting the lever arms of circumferentially adjacent doors, adjacent tie bars being connected in angularly overlapping relation with each pair of angularly spaced lever arms on the corresponding door pivot axis, and an operating lever for moving one of said tie bars.

6. A fuel burner air register comprising an annular frame having air ports in the circumference thereof, pivoted doors controlling said ports, and

means for simultaneously and uniformly moving said doors comprising means forming a pair of angularly spaced lever arms for moving each door, tie bars pivotally connecting the lever arms of circumferentially adjacent doors, adjacent tie bars being connected in angularly overlapping relation with each pair of angularly spaced lever arms and the tie bars and lever arm connections being arranged relative to the corresponding door pivot axes to insure a perpendicular position of each tie bar relative to its lever arm connections at its point of midtravel, and an operating lever for moving one of said tie bars.

RALPH M. HARDGROVE.

CERTIFICATE OF CORRECTION.

Patent No. 2,329,468.

September 14, 1943.

RALPH M. HARDGROVE.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 68, claim 4, beginning with "each" strike out all to and including the word "midtravel" in line 73, and insert instead the following -

--each pair of lever arms being spaced at an angle corresponding to the angle subtended by the chord extending between the pivot axes of circumferentially adjacent doors --;

and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 6th day of June, A. D. 1944.

Leslie Frazer

(Seal)

Acting Commissioner of Patents.