

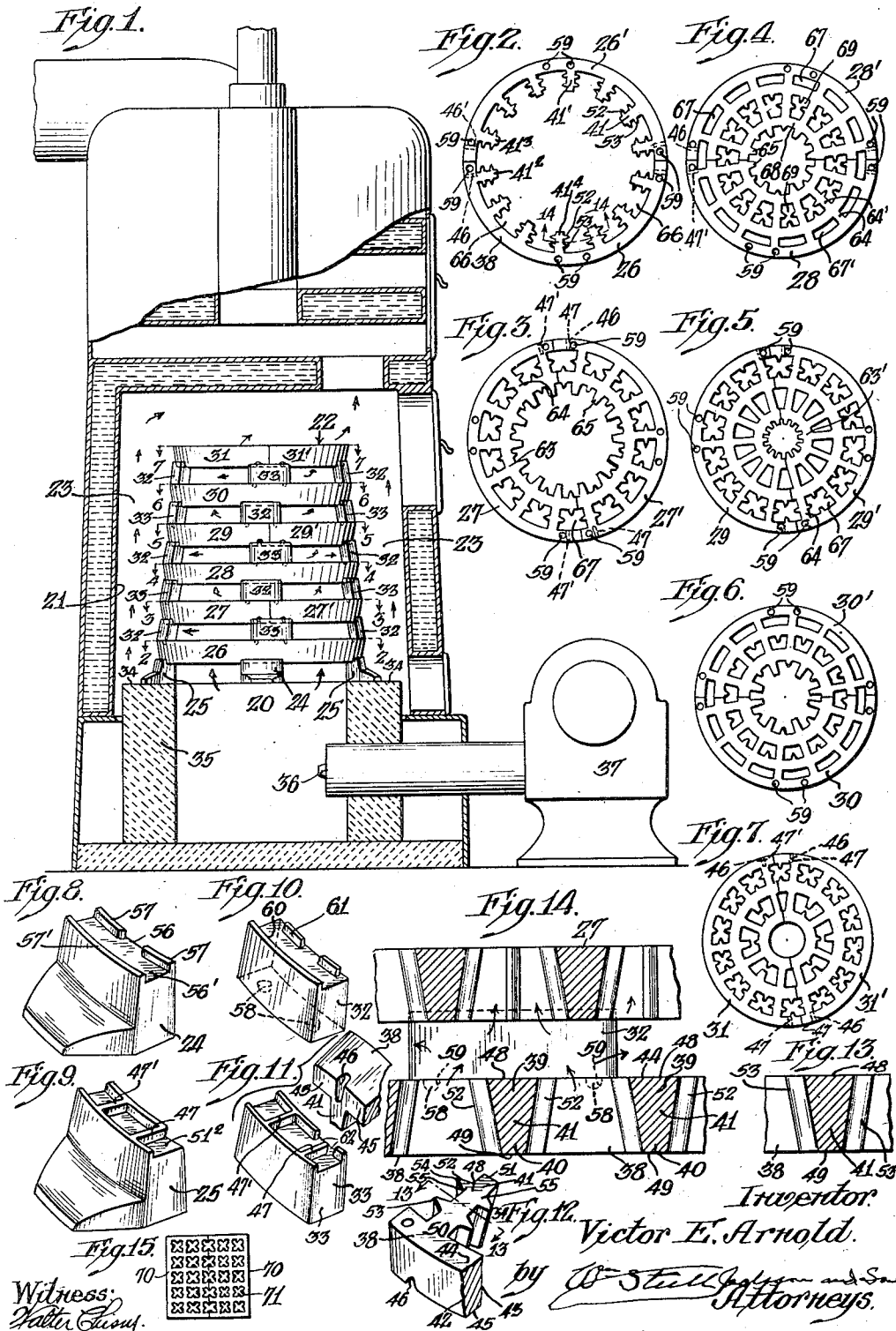
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FUEL ECONOMIZER

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FUEL ECONOMIZER

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5 Claims. (Cl. 110-97)

My invention relates to furnace insert material by which is conserved the heat from intermittent operation of an oil burning or gas burning flame.

One of the purposes of the invention is to build up a conical structure spaced from the inner furnace wall, using super-imposed grate-like disc baffles and spacers, the passages in each baffle being in line with metal of the baffle above, successively.

A further purpose is to provide a composite conical grate-like baffle structure within the combustion chamber of the furnace in which oil or gas fuel is used and which is spaced one baffle above another and separated from the side walls of the combustion chamber, the cone converging from the bottom upwardly.

A further purpose is to build up a conical pile of grate-like disc material comprising successive baffles spaced from the inside of the combustion chamber, and from each other, and having the baffle ribs or other solid structure of each disc in line with passages within the disc next below.

A further purpose is to form a heat receiving and conserving element within a furnace being converted from a coal burning to oil or gas burning construction which is divided into half sections in order that it may be possible to get the sections in with a minimum of difficulty.

Further purposes will appear in the specifications and in the claims.

Figure 1 is a side elevation partly broken away to show the construction of a furnace embodying the invention.

Figures 2, 3, 4, 5, 6 and 7 are top plan views of the various discs seen in Figure 1.

Figures 8, 9, 10 and 11 are perspective views showing spacing blocks intended to support successive grate-like heat distributing and receiving discs. Figure 11 includes also an inverted view of a cooperating part.

Figure 12 is a fragmentary section of a portion of the ring in Figure 1.

Figure 13 is a section taken upon line 13-13 in Figure 12, except that it shows a single grate bar only.

Figure 14 is a fragmentary schematic view corresponding to a section of Figure 2 taken upon line 14-14, but showing two baffles.

Figure 15 is top plan view of a modification, corresponding to the form shown in Figure 7.

In the drawing similar numerals indicate like parts.

It is common to replace a coal-supporting grate by brick or other structure upon which the nozzle of an oil or gas burning heater bears in the inter-

mittent operation of a furnace, and these substitute constructions take a variety of different forms.

The present invention builds up a heat conserving unit forming an economizer and using for the purpose a plurality of baffle discs arranged one over another, spaced by heat conserving blocks. The discs are preferably in tapered form, the metal parts being upwardly flared and the spaces between presenting, near the circumference, openings in one disc in line with baffle ribs in the next adjoining disc. The unit so composed is spaced from the wall of the furnace chamber so as to allow flow of products of combustion not only through the unit vertically, with lateral diversion of the products of combustion from space to space as the products pass up through the unit, but also to envelope the unit in hot products of combustion located between the unit and the inner furnace wall.

In the structure shown the furnace fire box is shown at 20, limited interiorly by walls 21 from which the unit heat-conserving structure 22 is spaced to provide an upwardly flared annular space 23 surrounding the unit and giving passage to the hot products of combustion which flow outwardly from between the baffle discs.

Obviously the number of baffle discs may be varied greatly and the relations between them may be modified so long as they come within the range of characteristics which identify my invention.

In the structure shown six discs appear, with spacing blocks between. These discs are made up each of at least two parts, in the views approximating halves, capable of insertion separately during the building up of a unit and resting as a unit upon feet 24 and 25.

Beginning with the bottom, the two parts of these respective discs have been given the numbers 26, 26'; 27, 27'; 28, 28'; 29, 29'; 30, 30'; and 31, 31'. The blocks by which they are separated are numbered respectively 32 and 33. They do more than merely support various disc-like baffles in a unit resting as a unit upon the top 34 of furnace wall 35 as each in turn holds also against sliding movement.

The several discs progressively reduce in open space within the sizes, that is, in the total cross section of open space within the interior of the discs, and correspondingly increase from the bottom upwardly progressively in the proportion of metal in each disc, notwithstanding that each upper disc is smaller in diameter than the next lower disc.

The metal of the discs is preferably of the same character as is in furnace grates and the discs perform a function somewhat similar to furnace grates. There are some differences, that they do not support fuel, and whereas the furnace grate is cooled as much as possible to perform its function without reducing the heat of the fire, the present baffle discs are intended to heat to a relatively high temperature, just beneath that temperature at which the discs will warp or buckle, it being the intention that the discs themselves may take up heat during each operation of the burner 36 and mixing and distributing motor unit 37.

Assuming without restricting, that the sections of the respective discs are half sections and describing the lowermost of the sections first, I will next describe the disc shown in Figure 2.

In Figure 2 two half sections are shown together as completing the lowermost disc. They comprise half sections 26 and 26' meeting at their ends and held together, in part at least by co-operating ribs or pins engaging with the upper surfaces of the feet and the under surfaces of the blocks next above. The lower disc comprises circumferentially extending rim portions 38, which are tapered in cross section so as to have their larger cross sections in the upper part at 39 and their smaller sections in the lower part at 40, and inwardly extending prongs 41. The outer and inner limiting lateral ring (disc) surfaces 42 and 43 are both sloped downwardly, converging toward the bottom and terminating in upper rim surfaces 44 and lower rim surfaces 45.

The lower rim surfaces 45 near the ends of the half sections are transversely grooved at 46 to receive generally upwardly extending tie strips 47, upon the supporting spacers, here the upper faces of the feet of Figure 9.

The prongs 41 of this lowermost disc form approximately radial inwardly extending ribs of spoke-like character which however do not extend to the center, not even to hubs, and are intended for heat storing and distributing purposes. They are preferably of approximately the same annular thickness and approximately the same in vertical depth as the rim portions of the discs and connect rigidly with these rim portions. As a result they appear somewhat as shortened spokes connecting with the rim in each case but not with any interior structure common to the different prongs or ribs.

In the illustration the prongs are tapered in vertical cross sections perpendicular to the radial lengths of the prongs so as to be wider circumferentially at their upper faces 48 than at their lower faces 49, and are also tapered in their radial extent so as to be wider at their outer ends 50 next the rim than at their inner ends 51. The taper from the bottom flaring upwardly causes the prongs to take up heat from the hot products of combustion more rapidly than would straight untapered spoke-like prongs.

Each of these spoke-like prongs carries fins, shown at 52 and 53 which in the illustration are transversely triangular and have their edges 54 away from the broader bases 55 which join the spoke-like prong supports upon which they are carried. On the other hand, in the illustration the bases of these fins follow the tapered faces, and the prongs in their entireties slope downwardly and inwardly. The fins themselves are not tapered and thus are of the same size from base to face at one end as at the other.

Any desired number of prongs may be carried

by the lower section. In the illustration each of the half sections carries seven prongs which are equally spaced from each other but those at the ends are not equally spaced from the ends of the section. The prong nearer the end of each section cooperates as a rib with the upper surface of one of the feet where there is a space 56 between inner flanges 57.

The separating and spacing blocks are of two general shapes, one for the feet below the lowermost disc, seen in Figures 8 and 9, and the other to support one disc from another disc, seen in Figures 10 and 11. In each of the shapes there are two general types, the one type as regards the upper surfaces by which support is given to an intermediate portion of the length of a disc (Figures 8 and 10) and the other by which support is given by the same foot or block to adjacent ends of different discs, (Figures 9 and 11) and at the same time hold the adjacent ends together.

Figures 10 and 11 represent the second shape of blocks used. The feet in Figures 8 and 9 rest upon flat surfaces and thus require no ties below the feet but with the blocks of Figures 10 and 11 it is desirable to anchor the blocks to the next rims beneath them as by dowels 58 for holes 59.

The difference between the upper surface of the block in Figure 10 (as distinguishing from that of Figure 11) is due to adaptation to different positions of use. The blocks of Figures 8 and 10 type preferably support the half baffles at positions in the middle of each half, whereas the type of Figures 9 and 11 are intended to support the two halves of each baffle at the points of opposite diametral sides where the ends of each half meet the ends of the other half.

The foot of Figure 8 rests on any suitable surface such as wall 35. Upon its upper surface within space 56' rests the lower rim surface 45 of approximately the middle of one of the half sections. Space 56' lies between outer flange 57' and inner flange 57. At one of the prongs, such as 41', the lower part of the prong close to the rim rests upon the upper foot surface within space 56 between the inner flange portions 57.

The outer and inner flanges prevent relative radial movement between the lower disc, and the adjacent end walls of the inner flange parts engage the prong and prevent relative movement of the parts in a direction along the length of the rim.

The foot shown in Figure 9 operates similarly to that shown in Figure 8 except that the adjacent ends of two baffle disc halves engage its upper surface and are held together by it. The groove 46 from one half baffle rests over tie strip 47 at the same time that the lower part of a prong 41² and rim rests upon the space 56² inside a projecting end of the outer flange. The groove 46' of the other half rests over the tie strip 47' and the adjacent prong 41³ is far enough beyond the block so that it does not require accommodation by cutting away the opposite end of the inner flange.

The block of Figure 10 is comparable with the foot of Figure 8 with some differences, however. It lacks a foot extension and instead secures the bottom of the block in position by pins 58 inter-fitting with holes 59 in the next disc below. If more nearly exact correspondence of the outer and inner curvatures 60, 61 of the block with the curvatures of the adjacent baffles be required than can be secured by making all the blocks of the same curvature different blocks can be used

between different pairs of discs. The outer flange 57 in each block corresponds generally with the outer flange in Figure 8 and the inner flange members 57 correspond approximately with the inner flange members in Figure 8. Rim and prong sections near the middle of the disc halves rest upon the space between the outer and inner flanges and where the inner flanges are parted to permit passage of a prong.

The form of Figure 11 corresponds approximately with that of Figure 9, space being provided between outer and inner flanges as in Figure 9 with tie strips 47 and 47' with which the walls of grooves 46 cooperate. The space at 62 is divided partly on one side and partly on the other side of the tie strip 47. Pins appear on the lower part of this block corresponding with the pins which appear on the lower part of Figure 10, and for the same purpose. For convenience in securing circulation of hot combustion products the blocks used in different tiers of the unit may be staggered so that adjacent blocks are out of vertical line.

The disc baffles progressively decrease in outside diameter and increase in the metal provided as compared with the area of the spaces between metal parts. This will appear very clearly in the difference between Figures 2 and 3. In Figure 3 what have been mere prongs in Figure 2 are connected with a ring 63 by what become effective as spokes 64 and a function generally corresponding to that of the prong in Figure 2 is effected by projections 65. In arranging these baffles one over another, it is the intention to have each space in the lower baffle in part at least in line with metal above so that it will be necessary for the hot products of combustion to divide and travel laterally between baffles. For example, what is a space 66 in the baffle of Figure 2 lies below a spoke 64 and the space 67 in Figure 3 lies in part at least over the prong 41⁴.

Carrying out the same idea as compared with Figure 3, the baffle in Figure 4 is provided with an additional ring, 68 and the spaces 67' and 69 are provided by the several rings and by spokes 64, 64'. Projections 65' appear here also.

In Figure 5 the spaces in the outer part of the baffle are shown as corresponding generally with spaces 67. The spokes are of the 64 type and the inner ring 63' becomes effective more nearly as a hub than as a ring but carries interior projections as in case of the other figures.

In Figure 6 the fifth baffle in the unit as shown is split up into rings of the order generally of those in Figure 4 and the spaces are quite small. This is still more noticeable in the form of Figure 7.

Though there are many advantages in a circular form of disc baffle, the baffle can be cast in other forms where it is desirable to have the furnace of different interior cross section, for example such as square. In order to emphasize this fact Figure 15 is included to show a single baffle out of a group of baffles having square baffle cross section. The baffle of Figure 15 could, of course, be located at any of various heights in the stack. Because of the close grouping of the metal parts of the baffle and the relatively small size of the openings provided in the particular structure of Figure 15 it would be well or perhaps best suited for use as a top baffle of the stack. The form of opening used closely allies this specific baffle to that shown in Figure 7; but it will be noted that the individual openings are of the same character from one side to the other in this Figure 15 form. The baffle of Figure 15 is split as is indi-

cated at 70 and the contours of the openings are identified as 71. All of the baffles are intended to be split.

When baffles have been built up into piles forming an upwardly and inwardly tapering unit the hot products of combustion travel upwardly through and between the baffles and, along the path are diverted into the annular space 23 where, coming in contact with the inner wall they are effective to heat the water—or the air in an air furnace—on the opposite side of this wall. In the meantime after each intermittent application of the flame they are heated through to a high temperature and retain the heat to reflect and refract heat to the inner furnace walls until they have cooled to normal temperature.

It will be evident that the heat resisting and retaining material of which the baffles are constructed is not subject to any of the forces tending mechanically to deteriorate the baffle and will therefore last a long time.

It will be evident that the outward and upward slope of the outer circumference of each baffle tends to divert the hot products of combustion which merge from between the baffles and to direct them toward the inner wall of the furnace chamber.

The division of the baffles into two or more annular sections facilitates introduction of the baffles into an existing furnace and stacking them therein.

It will be evident that the effectiveness of the baffles depends upon volume of metal in each baffle and the provision of sufficiently large spaces between the metal portions to permit adequate flow of hot products of combustion.

Though the total transverse area of the baffles progressively reduce in upper baffles as compared with lower baffles the proportion of metal baffles as compared with the spaces progressively increase upwardly, securing a maximum amount of heat transfer from the hot products of combustion in the upper part of the pile or stack.

In view of my invention and disclosure variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art, to obtain all or part of the benefits of my invention without copying the structure shown, and I, therefore, claim all such in so far as they fall within the reasonable spirit and scope of my invention.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A heat conserving unit for use in a furnace to receive and distribute heat from hot products of combustion intermittently applied, comprising a plurality of annular metal baffle rings, one above another and of upwardly reducing outer diameter, each baffle being made up of circumferentially separable parts, the cross section of the metal parts flaring upwardly and the passages within each baffle ring converging upwardly, and supports between the baffles interlocking with adjacent baffle parts to hold the parts against sidewise movement.

2. In a furnace heat retaining unit, a stack of radially divided annular flared baffles comprising outer rings flared upwardly both inside and outside the rings and intermediate connecting metal supports spacing the baffles from each other and holding the sections of the individual baffles against separation laterally where the divided baffles join.

3. In a furnace heat retaining unit, a stack

of metal disc baffles of progressively smaller diameters from the bottom upwardly, the baffles having open centers and the cross sections of the open centers in the baffles progressively reducing from the bottom upwardly at a rate of reduction greater than the rate of reduction of the diameters of the baffles.

4. In a furnace heat retaining unit, a tapered stack of metal baffles having rims and a plurality of spacers for said baffles resting each upon the rim of the baffle below and engaging to prevent lateral movement between them and having flanges cooperating with the rims above the

spacers to prevent lateral movement both in a radial direction and in a perimetrical direction.

5. In a furnace heat retaining unit, a pair of metal baffles of ring type having interior radially extending ribs, spacers supporting one baffle above the other baffle, the spacers having pins below to engage with openings in the lower baffle and having outer and inner flanges above to engage with the rim of the upper baffle and the inner flanges being split to engage with the radially extending ribs of the upper baffle.

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