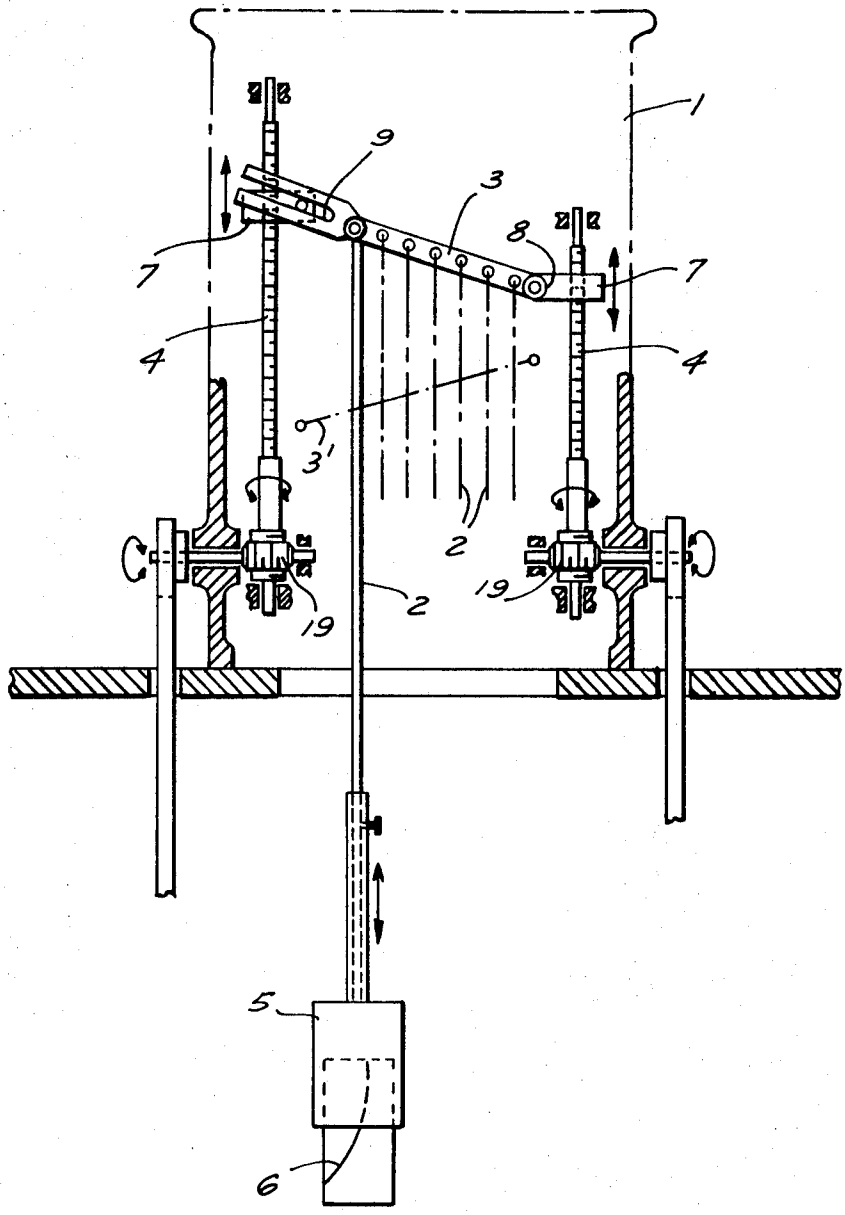
Nov. 2, 1971 J. J. MARTIN 3,616,704

APPARATUS FOR REGULATING THE ADMISSION OF COMBUSTION AIR TO BURNER GRATES HAVING INDIVIDUAL COMBUSTION ZONES

Filed Oct. 23, 1969 3 Sheets-Sheet 1

FIG. 1




INVENTOR
JOHANNES JOSEF MARTIN

BY Michael I. Stiker

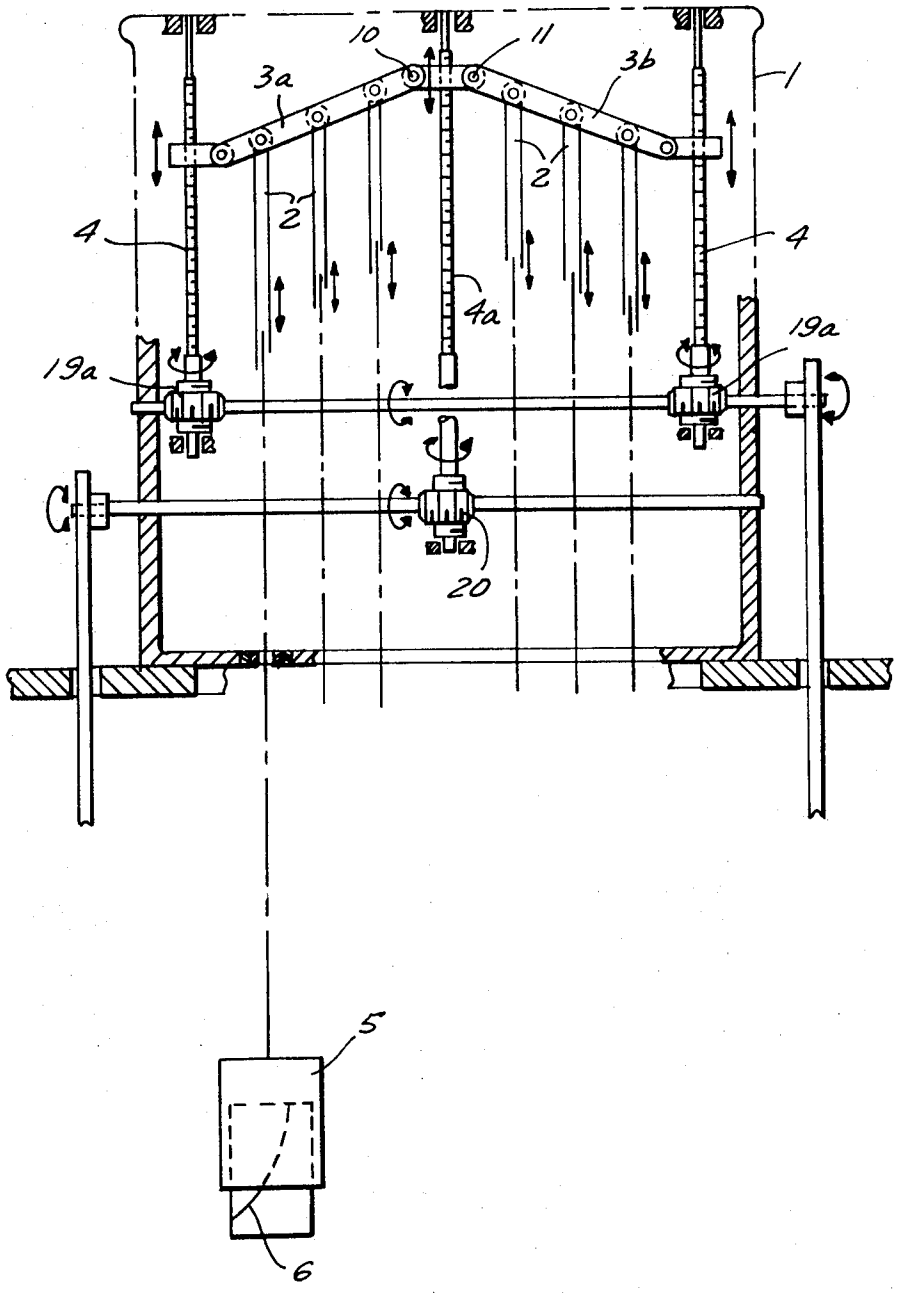
ATTORNEY

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Filed Oct. 23, 1969 3 Sheets-Sheet 2

FIG. 2



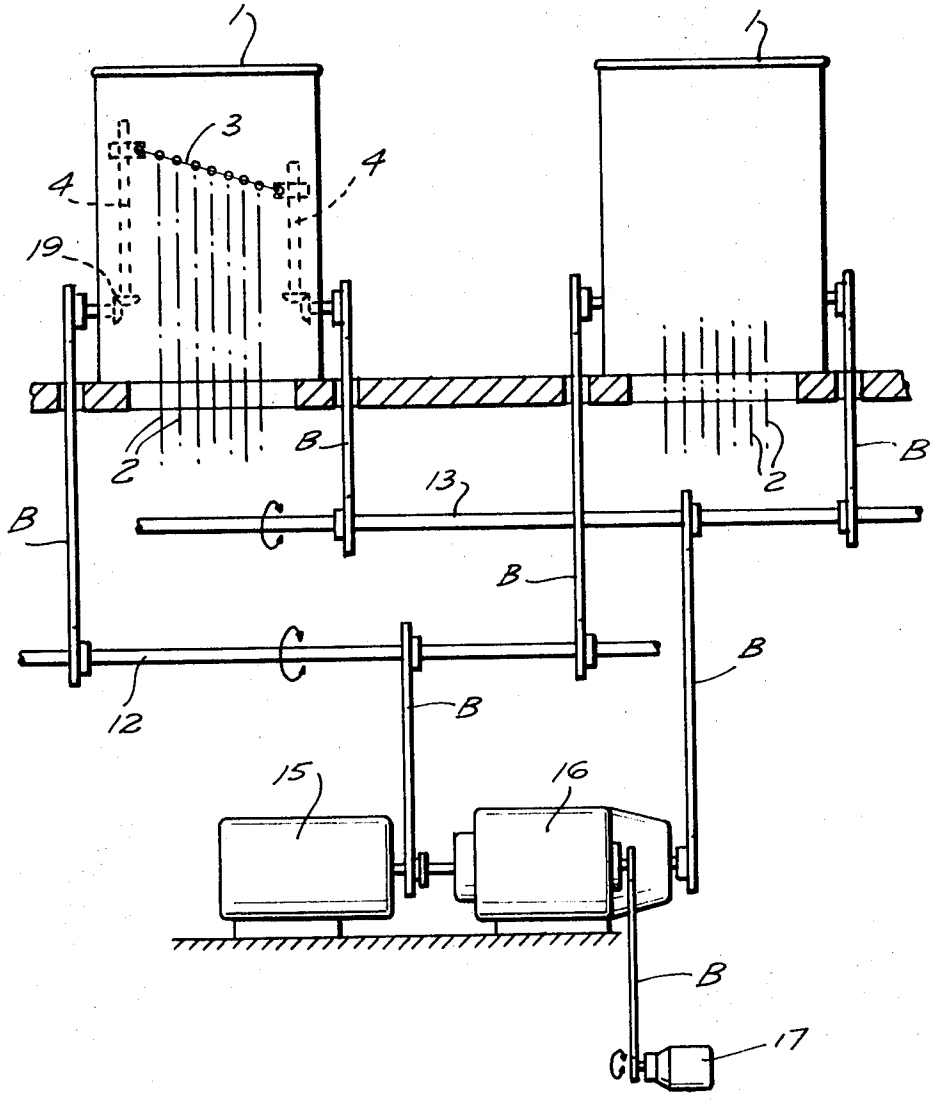

INVENTOR
JOHANNES JOSEF MARTIN

BY Michael J. McGee

ATTORNEY

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Filed Oct. 23, 1969 3 Sheets-Sheet 3

FIG. 3




INVENTOR
JOHANNES JOSEF MARTIN
BY
ATTORNEY

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3,616,704

# APPARATUS FOR REGULATING THE ADMISSION OF COMBUSTION AIR TO BURNER GRATES HAVING INDIVIDUAL COMBUSTION ZONES

Johannes Josef Martin, 248 Leopoldstrasse,
Munich 23, Germany

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U.S. Cl. 74—89.15 7 Claims

## ABSTRACT OF THE DISCLOSURE

A plurality of at least substantially parallel control rods are each shiftable a predetermined maximum distance in opposite directions between end positions in which each rod closes and fully opens, respectively, an air admission port communicating with one of the combustion zones of the grate. A linking member extends transversely to the aforementioned directions and is connected with the control rods. Shifting means effects shifting of the linking member in the aforementioned directions in a sense effecting shifting of the respective control rods through different distances between their end positions.

## BACKGROUND OF THE INVENTION

The present invention relates generally to burner constructions, and more particularly to an apparatus for regulating the admission of combustion air to burner grates in burner constructions having individual combustion zones.

The combusion air is supplied to burner grates from below. The control of air admission to the individual burner zones or combustion zones of the burner grate is effected by control rods cooperating with suitable valves, sliders or the like, and all of these control rods are operated simultaneously and in identical manner, meaning that they are all moved through identical distances when any movement at all occurs. The apertures through which air can then pass to the individual combustion zones of the grate, and which are controlled with respect to their exposed cross-sectional area by the control rods, are delimited according to the formula obtained by considering distance of movement of the control rods, and characteristic line of the air throughflow. Details concerning this formula and the prior-art construction may be found in German Patent No. 919,188. This prior-art construction makes it possible to accommodate to a certain extent the air supplied to each individual combustion zone to the air requirements for each zone which vary per time unit. However, it has been found that if the heat value of the matter being burned on the grate, particularly refuse and industrial trash, fluctuates strongly, it is necessary for most efficient and economical operation of the burner to assure as constant as possible a development of heat from the burning matter over any given period of time and without manual controls, independently of any degree of load, that is to assure this not only if the burner operates at full capacity or near full capacity, but even if it operates for instance at or near half capacity.

It is well known that the individual combustion zones of grates in large burners contribute diversely to the heat development, even if they are of identical dimensions. Thus, in burners which use a pre-drying stage for the matter to be burned, the pre-drying zone itself contributes only very little to the development of heat because the newly introduced moist mass of burnable refuse will not react readily with the oxygen in the air. The subsequently following zone in which the refuse begins to burn through, contributes a significantly greater amount of heat and the further following zone in which the refuse is fully combusted contributes a very large and under certain circumstances even the largest amount of heat. In the following zones wherein the refuse burns off and wherein the slag burns out, the contribution of heat is again correspondingly lower because of the only small residual quantities of combustibile material.



It follows that the combustion zones wherein the combustion activity is most significant, will also contribute to a most rapid change in the quantity of heat liberated in these zones when the supply of combustion air to them is varied. Therefore, the present invention has as its aim to compensate for a momentary lag in heat supply, or to compensate for a momentary excess of heat supply, not by generally changing the pressure or quantity of combustion air supplied to the entire grate but rather to effect such variations selectively in dependence upon the particular combustion zones.

## SUMMARY OF THE INVENTION

It is accordingly, an object of the present invention to overcome the aforementioned disadvantages of the prior art.

A more particular object of the present invention is to provide an apparatus of the type under discussion which permits selective variation of the supply of combustion air to different combustion zones of the grate of a large burner.

In pursuance of the above objects, and others which will become apparent hereafter, one feature of the invention resides in an apparatus for regulating the admission of combustion air to burner grates having individual combustion zones. This apparatus comprises, briefly stated, a plurality of at least substantially parallel control rods each of which is shiftable a predetermined maximum distance in opposite directions between end positions in which it respectively closes and fully opens an air admission port communicating with one of the combustion zones. A linking member extends transversely to these directions and is connected with the control rods. Shifting means is provided for shifting the linking member in these directions in a sense effecting shifting of the respective control rods through different distances between the aforementioned end positions.

By resorting to the present invention the uniformity of heat liberated is greatly increased even if the combustion value of the material being combusted varies greatly, and thereby the economic use of refuse and other matter of varying combustibility, is significantly enhanced.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

## BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a vertical section, somewhat diagrammatically shown, through an apparatus according to the present invention;

FIG. 2 is a view similar to FIG. 1 but showing a further embodiment of the invention; and

FIG. 3 is a somewhat schematic illustration of a drive arrangement for use in conjunction with apparatus such as shown in FIGS. 1 and 2.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

Discussing now the drawing in detail, and firstly FIG. 1 thereof, it will be seen that reference numeral 1 identifies a housing which in the illustrated embodiment contains

the rod-like screw-threaded spindles 4. These spindles are in mesh with the internally tapped ends 7 of a linking member or adjustment yoke 3 to which there are secured in articulate manner control rods 2 corresponding in number to the number of combustion zones to which air is to be supplied from below. In the illustrated embodiment it is assumed that there are seven such combustion zones and accordingly there are seven such control rods only one of which is shown in full lines whereas the others are suggested in chain lines.

Each of the control rods 2 extend to a throughflow aperture for combustion air which is delimited by a curved line 6 corresponding to the displacement distance-through-flow-characteristic line of the respective combustion zone in the manner disclosed in the aforementioned German patent. When the control rods 2 are moved longitudinally, they shift the sliders 5 (only one shown) to thereby vary the unobstructed cross-sectional area of the respective aperture and permit the precisely regulated and necessary quantity of air to move to the combustion zone which is controlled by the respective aperture. Of course, the present invention is suitable for use with other embodiments wherein the aforementioned principle is not used, that is wherein the displacement distance-throughflow-characteristic line principle plays no role.

It will be seen in the drawing that the yoke 3 is so configurated that the drive via the driven spindles 4, and thereby the shifting of the control rods 2, takes place in such a manner that the control rods 2 associated with the more sensitive combustion zones—for instance the middle two of a total of six such combustion zones—will move through greater distances than the control rods associated with the other combustion zones, and possibly also move at greater speed. This is suggested at reference numeral 4*a* in FIG. 2. Where the combustion grates are such that the heat supply is already very good in the first and second zone, and decreases successively in the following zone, the adjustment advantageously takes place beginning with the first control rod as shown in FIG. 1. For kinematic reasons the yoke 3 must be inclined to a greater or lesser degree because of the difference in the distances through which the different control rods are to be moved. Of course, it is possible to have the yoke assume the position shown by the chain line 3′ in FIG. 1, instead of the full line position illustrated. In any case, the constant change of the relative position of adjacent ones of the control rods when regulating effects are to be obtained, assures that even when abrupt and significant changes in the air supply to the sensitive combustion zones occur, no undesired results are obtained in the remaining zones. Thus, the blowing-out of beginning combustion at the initial combustion zone—which occurs frequently in prior-art constructions—is avoided when the supply of combustion air rapidly is increased. Conversely, the danger of slag flow in the terminal combustion zones at low melting point of the slag-forming matter is avoided.

In the embodiment illustrated in FIG. 1 one of the ends 7 of the yoke 3 is provided with an articulated joint 8, and the other is provided with an elongated slot 9 cooperating with the illustrated pin, in order to provide the necessary freedom for the respectively required inclined position of the yoke 3. The connection between the yoke 3 and the tapped ends 7, which are of course discrete members, can also be reversed, that is the joint 8 can be provided at the side opposite from the one illustrated in FIG. 1, and the slot 9 provided at the side which in FIG. 1 is shown to have the joint 8. A further and non-illustrated embodiment provides for the yoke to consist of two telescopically connected elements which each have an articulated joint 8 at their respective ends.

The embodiment illustrated in FIG. 2 provides for a particularly rapid change of air supply to the middle combustion zones. For this purpose the yoke is subdivided into two or several sections, here two sections 3*a* and 3*b*, which



are connected by joints 10 and 11 and which are guided in the region of these joints by a middle spindle 4*a* which is driven as before. If it is necessary that the interior of the housing 1 be air-tightly closed from the ambient space, then sealing sleeves may be provided through which the control rods 2 extend as shown in FIG. 2.

The embodiment in FIG. 3 shows how the spindles 4 of each unit incorporated in a housing 1 can respectively be adjusted via separate drives 12 and 13. In other words, the spindles associated with the sensitive zones may be driven by one drive and those with the less sensitive zones may be driven by another drive. This may be advantageous, for instance, if after temporary significant displacement of the yoke 3 the speed of return of the yoke 3 to its normal position is desired to be regulatable. The drive of the shafts 12 and 13 may for instance take place via a motor 15 and a variable gear drive 16, the latter being associated with a control motor 17. The various elements are connected for motion transmission by the belts B. The rotary shaft 12 transmits its rotary motion via the associated belt B to the schematically illustrated drive 19 of the spindle 4, this drive 19 being shown in form of cooperating bevel gears. The shaft 13 transmits motion via its associated belts B to the other spindle 4 of the respective unit 1, but the shaft 13 is driven at a different rotational speed than the shaft 12. Referring back to FIG. 2, it is pointed out that the spindle 4*a* may for instance be driven by the shaft 12 via the drive 20, whereas the spindles 4 may each be driven at identical speed via the drive 19*a* and the shaft 13. Of course, other possibilities exist but this will illustrate how a differential in the movement of the respective rods 2 can be obtained.

It is emphasized that other drive means may also be provided for driving the spindles 4, 4*a*.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of constructions differing from the types described above.

While the invention has been illustrated and described as embodied in a control apparatus for combustion air in furnaces, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

I claim:

1. Apparatus for regulating the admission of combustion air to burner grates having individual combustion zones, comprising a plurality of air admission ports each communicating with one of said combustion zones; a plurality of at least substantially parallel control rods each composed of at least two telescoped sections to be length-adjustable and each being shiftable in opposite directions between end positions in which it respectively opens and closes one of said air admission ports; a linking member extending transversely to said directions and being connected with said control rods remote from said air admission ports; and shifting means for shifting said linking member in said direction in a sense effecting shifting of said control rods through different distances between said end positions.

2. Apparatus for regulating the admission of combustion air to burner grates having individual combustion zones, comprising a plurality of air admission ports each communicating with one of said combustion zones; a plurality of at least substantially parallel control rods each shiftable in opposite directions between end positions in which it respectively opens and closes one of said air admission ports; a linking member comprising at least two sections extending transversely of said directions and being connected with said control rods remote from said air admission ports, and connecting means articulately connecting said sections with one another; and shifting means for shifting said linking member in said directions in a sense effecting shifting of said control rods through different distances between said end positions.

3. Apparatus as defined in claim 2; and further comprising at least one nut means provided on said linking member in the region of said connecting means, and at least one threaded spindle cooperating with said nut means and said shifting means and extending in said directions.

4. Apparatus for regulating the admission of combustion air to burner grates having individual combustion zones, comprising a plurality of air admission ports each communicating with one of said combustion zones; a plurality of port closure elements each associated with one of said air admission ports; a plurality of at leats substantially parallel control rods each having one end portion and another end portion connected with one of said port closure elements, said control rods being shiftable in opposite directions between end positions in which the associated port closure elements respectively open and close said air admission ports; a linking member extending transversely to said directions and having opposite ends, said linking member being connected with said one end portion of said control rods; and shifting means for shifting said linking member, said shifting means comprising discrete first and second motion-transmitting means each of which is associated with one of said ends of said linking members for shifting the latter in said directions so as to be adapted to adjust the position of the closure elements relative to the air admission ports to different extents or, if desired, in unison and to identical extents.



5. Apparatus as defined in claim 4, further comprising guide means guiding said linking member at said opposite ends for said shifting movement.

6. Apparatus as defined in claim 5, said motion-transmitting means comprising screw spindles extending in said directions, and said guide means comprising nut means provided at said opposite ends.

7. Apparatus as defined in claim 6, said shifting means comprising drive means associated with said spindles for rotating the same independently of one another at differential speeds and in mutually opposite directions of rotation.

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WILLIAM F. O'DEA, Primary Examiner

W. S. RATLIFF, JR., Assistant Examiner

U.S. Cl. X.R.

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