Jan. 14, 1941. W. A. STEIGER ET AL 2,228,418

HEAT GENERATOR

Filed March 19, 1938 3 Sheets-Sheet 1

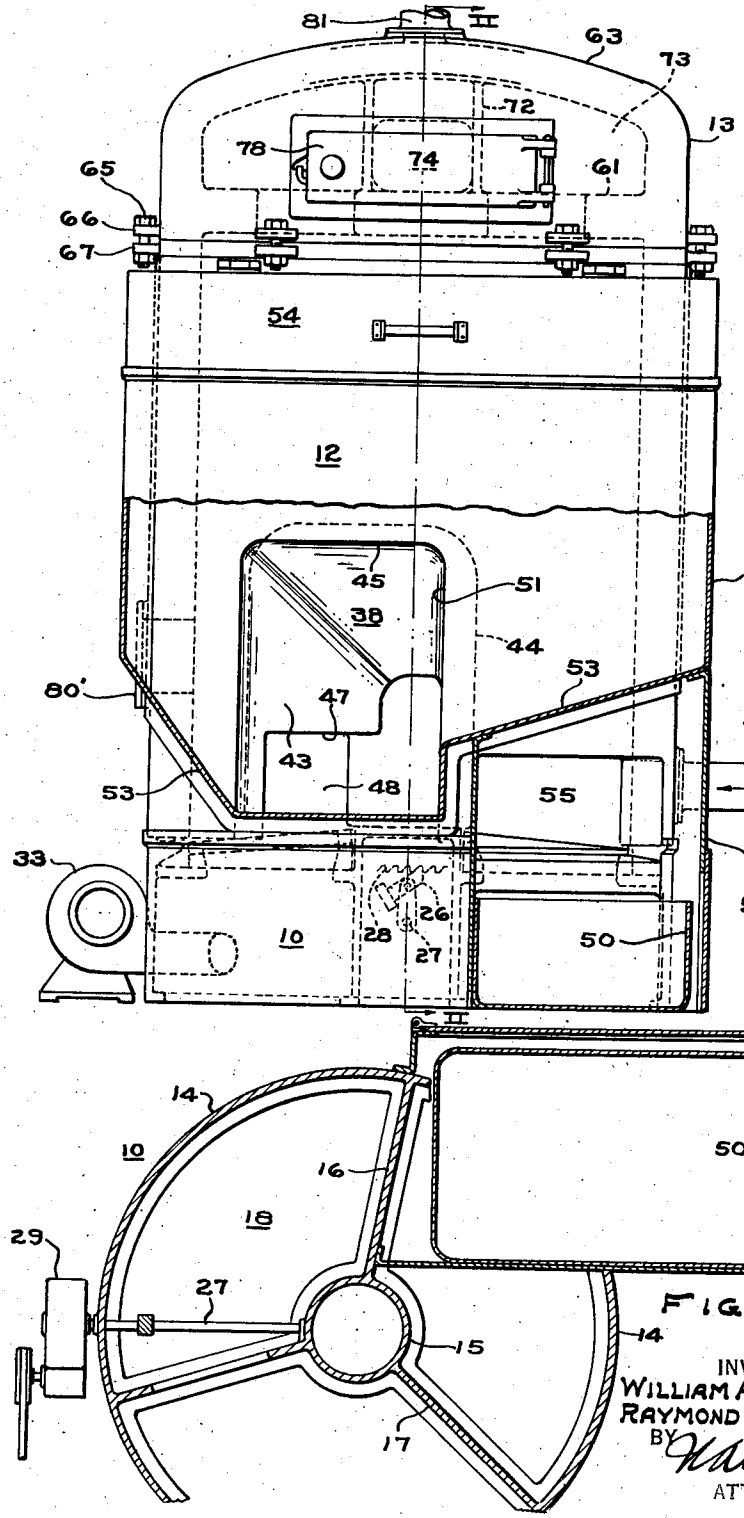


FIG. 1.

FIG. 5.

INVENTORS
WILLIAM A. STEIGER
RAYMOND J. RIDGE
BY
ATTORNEY

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HEAT GENERATOR

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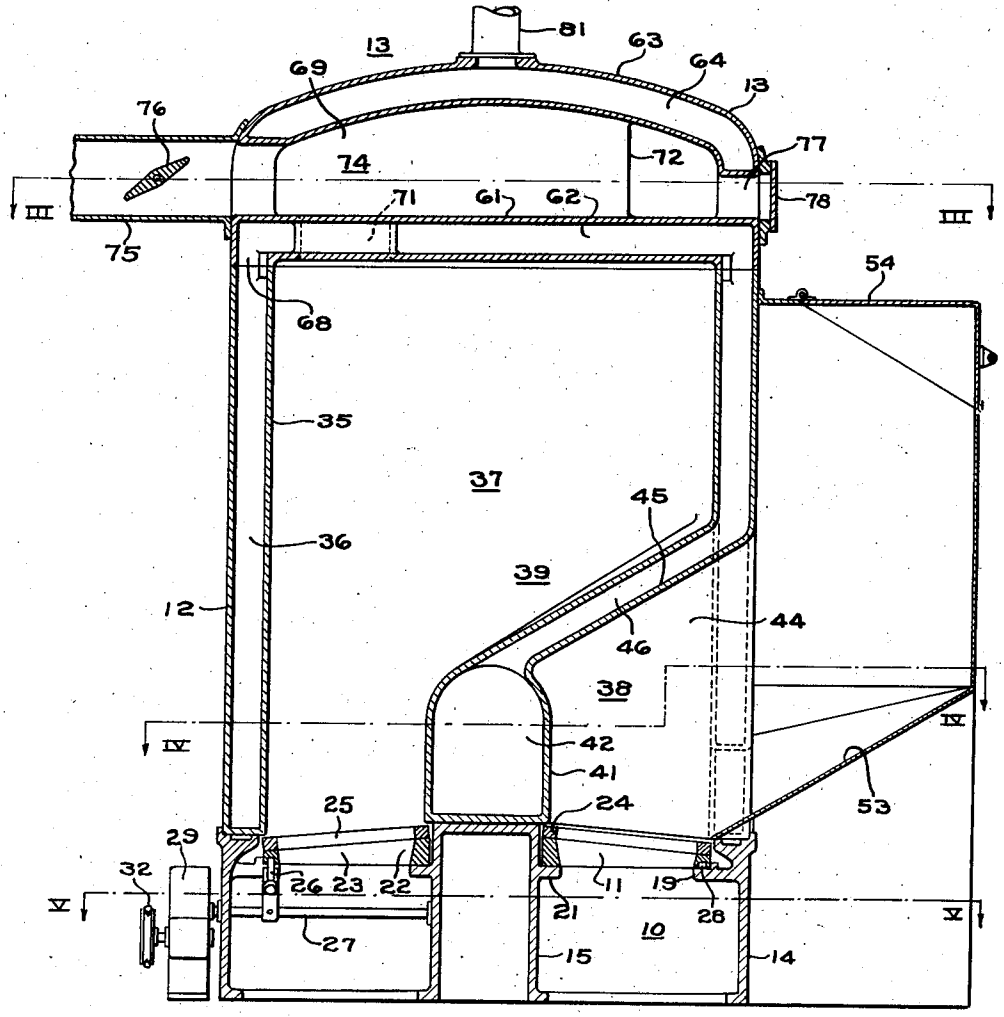


FIG. 2.

WITNESSES:

E. H. Lutz

M. V. Duffy

INVENTORS

WILLIAM A. STEIGER,

RAYMOND J. RIDGE.

BY H. A. Steiger

ATTORNEY

Jan. 14, 1941. W. A. STEIGER ET AL 2,228,418

HEAT GENERATOR

Filed March 19, 1938 3 Sheets-Sheet 3

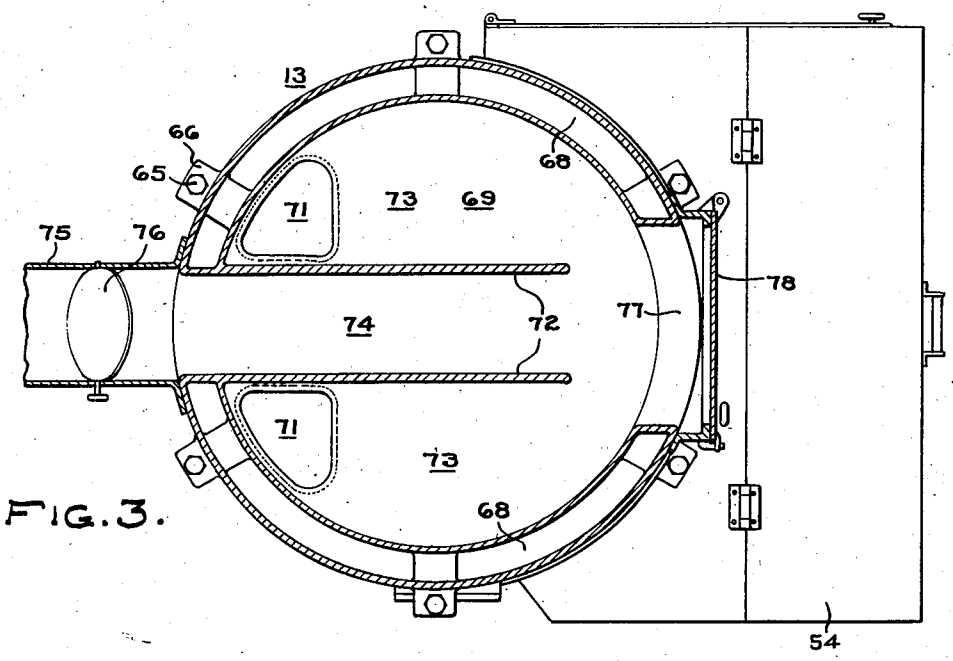
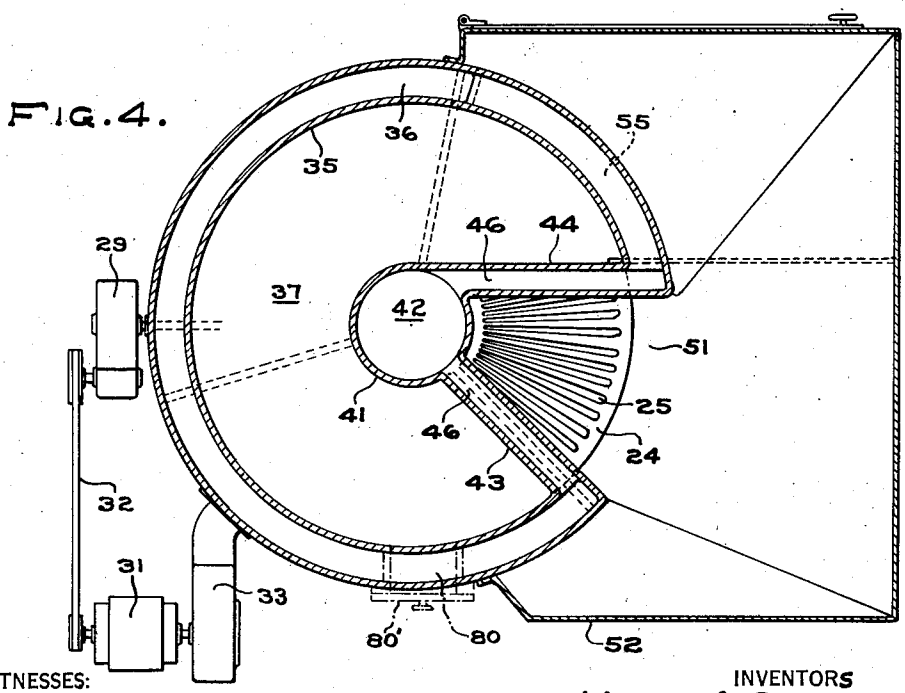


FIG. 3.

FIG. 4.



WITNESSES:
E. H. Lutz.
M. V. Duffy.

INVENTORS
WILLIAM A. STEIGER,
RAYMOND J. RIDGE.
BY
ATTORNEY

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UNITED STATES PATENT OFFICE

2,228,418

HEAT GENERATOR

William A. Steiger, Highland Park, and Raymond J. Ridge, Lansdowne, Pa., assignors to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application March 19, 1938, Serial No. 196,868

4 Claims. (Cl. 122—30)

Our invention relates to heat generating apparatus and more particularly to mechanically fired boilers for domestic heating purposes and has for an object to provide improved apparatus of this kind.

A further object of the invention is to provide an improved stoker-fired boiler that is inexpensive to construct and which may be operated for relatively long periods without attention.

A further object of the invention is to provide an improved heat generator of the type set forth which may be readily serviced by the operator.

A still further object is to provide a boiler structure adapted for use with a rotary grate stoker and having a relatively large amount of heat transfer surface.

These and other objects are effected by our invention as will be apparent from the following description and claims taken in connection with the accompanying drawings, forming a part of this application, in which:

Fig. 1 is a front view of a stoker boiler unit constructed in accordance with the invention;

Fig. 2 is a vertical section taken along the line II—II of Fig. 1;

Figs. 3 and 4 are sectional views taken along the lines III—III and IV—IV of Fig. 2, respectively; and,

Fig. 5 is a partial sectional view taken through the base along the line V—V.

Reference will now be had to the drawings wherein we have disclosed a domestic type hot water or steam heater constructed in accordance with our invention. The structure includes a base 10 in which a circular grate 11 is rotatably mounted, a boiler 12 and a head 13 carried by the latter.

The base 10 includes an outer wall 14, an inner column 15 and radially extending walls 16 and 17 connecting the same and defining a windbox 18 within the base 10. An inwardly extending flange 19 is formed within the outer wall 14 and rotatably supports the grate structure 11. The inner side of the grate 11 is supported by a flange 21 formed on the center column 15. The grate structure 11 is formed as an annulus and includes a suitable frame 22 rotatably carried by the flanges 19 and 21 and provided with relatively large openings 23 for the passage of air therethrough. Suitable grate bars or segments 24 are seated upon the frame 22 and are provided with a plurality of openings 25 for the passage of air, said openings being relatively small for preventing the passage of ash to the windbox.

Rotation of the grate structure 11 is effected by a pawl 26 oscillated by a shaft 27 and engageable with an annular series of ratchet teeth 28 formed on the under surface of the grate frame 22. The shaft 27 may be oscillated by a speed reducing mechanism 29 that is driven by an electric motor 31, preferably by means of a belt 32. A blower 33 may be driven by the motor 31 for supplying air for combustion to the windbox 18. Suitable seals (not shown) may be provided at the top of the windbox walls 16 and 17 where they engage the grate frame 22 for confining the supply of air to the portion of the grate above the windbox 18. The stoker apparatus described heretofore and the windbox seals are shown in the patent of R. A. Foresman, No. 2,043,994, dated June 16, 1936. The stoker which we have described defines one type that may be employed in our improved heat generator but it will be understood that other forms of rotary grate stokers are equally suitable.

In accordance with our invention, the fluid heater or boiler structure 10 includes a substantially cylindrical wall 35 having a fluid space 36 formed therein. The wall 35 defines a space above the grate that is divided into a combustion chamber 37 and a fuel space or pocket 38 by means of a wall structure, generally indicated at 39, and extending inwardly from the outer wall 35. Accordingly, the combustion chamber 37 is disposed above a segment of the grate 11 and the fuel pocket 38 above a second segment thereof.

The inwardly extending wall structure 39 includes a center member or drum 41 having a fluid space 42 formed therein, and side walls 43 and 44 and a top wall 45 defining the fuel pocket 38 and connecting the drum 41 to the outer wall 35. The fuel pocket walls 43, 44 and 45 include respective fluid spaces 46 that communicate with the fluid spaces 36 and 42. The wall 43 of the fuel pocket 38 has its bottom portion 47 spaced above grate as best shown in Fig. 1, for defining a fuel passage or orifice 48 through which the fuel bed passes to the combustion chamber 37 as the grate is rotated; the thickness of the bed of fuel being determined by the height of the opening 48. Further reference to the feeding of fuel to the fuel pocket 38 and combustion chamber 37 will be made hereinafter. The wall 44 of the fuel pocket 38 is preferably disposed at a tangent to the inner periphery of the grate and terminates at its lower end adjacent the grate for a purpose to be referred to hereinafter.

An opening 51 is defined in the outer wall where it is joined to the fuel pocket wall mem-

bers 43, 44 and 45 and a fuel magazine 52 is disposed exteriorly of the wall 35 and encloses the opening 51. The fuel magazine 52 includes bottom wall members 53 that incline toward the opening 51 for facilitating the delivery of fuel thereto. The fuel magazine 52 may extend outwardly from the wall 35 at the front and to the side of the opening 51 so that a copious quantity of fuel may be stored and operation of the apparatus over a long period of time is effected without the attention of the operator. An access door 54 is provided for the magazine 52 adjacent its top.

Removal of ash from the grate 11 is effected by the wall 44 which moves the ash radially of the grate 11 and through an opening 55 formed in the outer wall 35 as best shown in Figs. 1 and 4. As the grate rotates, the ash carried thereon engages the wall 44 and is moved outwardly toward and through the opening 55. A refuse container 50 shown in Figs. 1 and 5 is disposed beneath the opening 55 for receiving the discharged ash, and is preferably enclosed in a housing 56 having an access door 57. The housing 56 may extend from the bottom of the magazine 52 to the floor and is substantially dust-tight.

The boiler head structure 13 is best shown in Figs. 1, 2 and 3 and includes a horizontal wall 61 enclosing a fluid space 62 and a top wall 63 which may be dome-shaped as shown. The latter wall encloses a fluid space 64 communicating with the space 62. The head 13 is secured to the boiler 12 by means of suitable bolts 65, which engage lugs 66 and 67 formed on the head and boiler structures, respectively. Openings 68 best shown in Figs. 2 and 3 are provided in the bottom wall 61 and effect communication between the fluid spaces 62 and 36 of the head and boiler respectively. The recited wall members of the head 13 enclose a space 69 for products of combustion, which space is connected with the combustion chamber 37 by means of relatively large openings 71 formed in the horizontal wall 61 of the head. Baffles 72 are preferably formed integrally in the head structure 13 and provide a tortuous passage for the hot gases passing through the space 69. The baffles 72 divide the space 69 into gas passages 73 and 74, as best shown in Fig. 3.

A flue 75 is connected to the rear portion of the passage 74 for conducting gas therefrom and may be provided with an adjustable damper 76, as shown. In order to provide for the removal of dust or fly ash from the wall 61, we provide a clean out opening 77 in the front of the head structure which opening is closed by a door 78.

An opening 80 is provided in the outer wall 35 adjacent the fuel admission end of the combustion chamber 37. This opening provides access to the combustion chamber for starting the fire and inspection of the same. A suitable door 80' is provided for the opening 80.

Water to be heated enters the boiler space 35 adjacent the bottom thereof through a conduit 79 and the heated water or steam is removed from the head space 64 by means of a conduit 81. The conduits 79 and 81 may be connected to suitable radiators (not shown) forming elements of a conventional heating system.

Operation

It will be assumed that the magazine and fuel pocket are filled with fuel and that the motor 31 is energized. A bed of fuel is carried by the grate 11 from the pocket 38 to the combustion chamber 37, the depth of the fuel bed being determined by the height of the opening 48 and is substantially constant. Combustion is initiated adjacent the wall 43 and is progressively effected as the bed moves around toward the wall 44. Combustion is completed in advance of the wall 44 so that only ash remains on the grate 11 where it passes beneath the wall 44. The ash is deflected radially and outwardly of the grate and through the opening 55. The ash drops into the container 50 which, when filled, is removed from the housing 56.

The hot products of combustion pass upwardly in the combustion chamber 37 and contact the outer wall 35, the walls 43, 44, and 45 of the fuel pocket and the bottom wall 61 of the head 13. All of these walls are subjected to radiant heat and convection heat. After passing through the openings 71, the hot gases pass forwardly through the passages 73 and thence rearwardly through the passage 74 to the flue 75, and are cooled by the walls of the head prior to entering the flue.

The formation of the boiler structure 12 with a substantially complete cylindrical wall and the water cooled fuel pocket structure formed in the combustion chamber provides a large amount of heat transfer surface between the heated gases in the combustion chamber and the fluid being heated. These walls are subjected to the radiant heat of the fire and are swept by the hot gases rising therefrom. The bottom wall 61 of the head 13 covers the combustion chamber and is also subjected to radiant heat and convection currents. This structure provides a relatively large amount of heat transfer surface for a stoker of the rotary type and fed with fuel in the manner described.

It will be apparent that the boiler and fuel pocket structure may be readily and inexpensively manufactured as a unit, preferably by casting. Our improved boiler structure may be applied readily to known types of stoker apparatus and to conventional head structures which renders it flexible in its application to various forms of these elements.

While we have shown our invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are imposed by the prior art or as are specifically set forth in the appended claims.

What we claim is:

1. In a fluid heating structure for a rotatable annular grate, the combination of an outer jacketed wall disposed above the periphery of the grate and enclosing a combustion chamber, said wall having an opening for fuel formed in the bottom portion thereof adjacent the grate, a housing having jacketed walls joined adjacent the center of the grate and connected to the bottom portion of the outer wall peripherally of said opening for defining a fuel pocket above a segment of the grate and communicating with said opening, the jacketed walls of the housing being closely spaced with respect to the grate for working clearance, said housing being spaced below the top of said outer wall so that a portion of the combustion chamber extends above the housing and a magazine for fuel disposed on the exterior of the outer wall for feeding fuel gravitationally through said opening to the grate; said housing

having a portion thereof spaced above the grate for defining a fuel discharge orifice through which fuel is carried to the combustion chamber by the grate during rotation of the latter.

2. In a heat generator, the combination of a rotatable circular grate, an outer wall having a space therein for fluid to be heated disposed adjacent the outer periphery of the grate, said wall having circumferentially spaced fuel admission and ash discharge openings formed therein adjacent the grate, means including a wall extending inwardly from a bottom portion of the outer wall for defining a fuel pocket above a segment of the grate in communication with the fuel admission opening and a combustion chamber above a second segment of the grate and communicating with the ash discharge opening, said combustion chamber extending at least in part above the inwardly extending wall and the fuel pocket, said inwardly extending wall having a first portion thereof terminating adjacent the upper surface of the grate for deflecting ash therefrom through the ash discharge opening and a second portion spaced above the grate for defining a fuel orifice through which fuel is carried from said pocket to the combustion chamber as the grate is rotated and a magazine for fuel disposed exteriorly of said outer wall for the gravitational feeding of fuel through said fuel admission opening to the fuel pocket.

3. In a heat generator, the combination of a rotatable grate, an outer wall extending upwardly from adjacent the periphery of the grate and having a fuel admission and an ash discharge opening formed in the bottom portion thereof, a plurality of wall members extending inwardly from the perimeter of the fuel admission opening and connected adjacent the center of the grate for defining a fuel pocket and a combustion chamber above respective segments of the grate, and at least a portion of the combustion chamber extending above the fuel pocket, said fuel admission and ash discharge openings being in communication with the fuel pocket and the combustion chamber, respectively, one of said inwardly extending wall members having its lower end disposed adjacent the grate for deflecting refuse from the grate and through the ash discharge opening and another of the wall members having its lower end spaced above the grate for defining an orifice through which fuel is passed from the fuel pocket to the combustion chamber as the grate is rotated, said wall members having spaces formed therein for fluid to be heated and a magazine for fuel disposed on the outer side of said outer wall and enclosing said fuel admission opening.

4. In a heat generator, the combination of a rotatable grate, an outer wall having a fluid space therein and defining a combustion chamber above the grate, a wall structure extending inwardly from a bottom portion of the outer wall for defining a pocket for fuel above a segment of the grate and beneath a portion of the combustion chamber, said inwardly extending wall structure having a first portion thereof disposed adjacent the grate for deflecting ash radially therefrom and a second portion spaced above the grate for defining an orifice through which fuel is passed from said fuel pocket to the combustion chamber, said outer wall having first and second circumferentially spaced openings therein adjacent the grate for respectively admitting fuel to the fuel pocket and discharging ash deflected by said wall structure, a magazine for fuel disposed exteriorly of the outer wall for the gravitational feeding of fuel through said first opening to the fuel pocket, a head carried by the outer wall and having a gas passage communicating with the combustion chamber and a fluid space connected to the fluid space of the outer walls and means for conveying gases from the passage in the head.

WILLIAM A. STEIGER.
RAYMOND J. RIDGE.