

[54] **DEVICE GENERATING AND DIRECTING A FLOW OF COMBUSTION SUPPORTING GASEOUS MEDIA**

3,785,302 1/1974 Davis 110/8

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[51] Int. Cl.² **F23G 7/00**

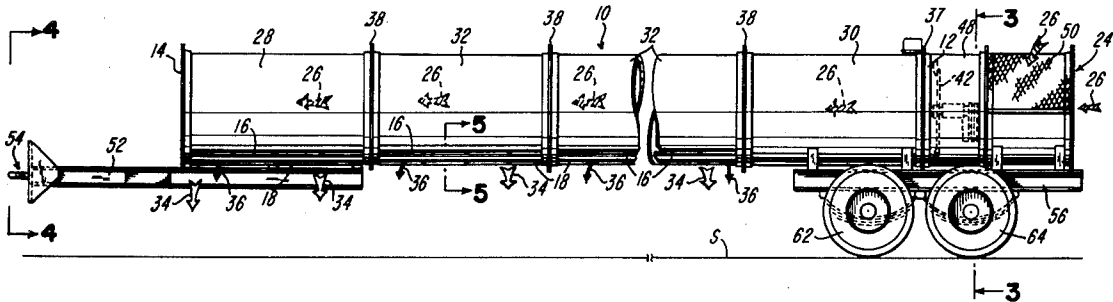
[58] Field of Search 110/19, 8 R, 18 R, 8 C, 110/18 C, 119

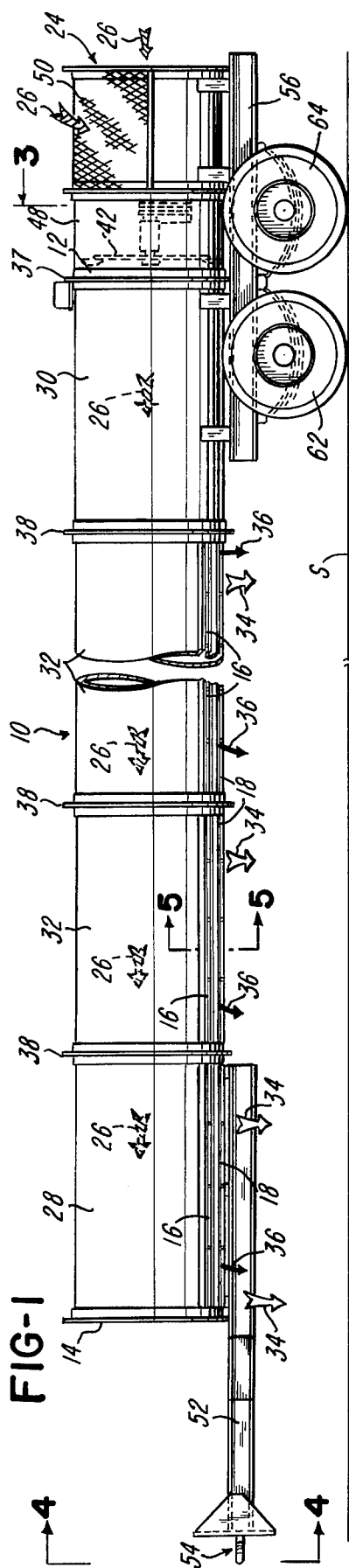
[56] **References Cited**
UNITED STATES PATENTS

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[57] **ABSTRACT**
The device of the present invention comprises an elongate, substantially cylindrical housing having an open end and a closed end, the housing including a pair of circumferentially spaced discharge means radially projecting therefrom and extending substantially the full length thereof. Means in communication with the open end of the housing introduces a flow of gaseous media into the interior thereof at a greater than atmospheric pressure, and generates a flow of gaseous media from said housing in a predetermined, controlled direction through each of said pair of discharge means.

15 Claims, 7 Drawing Figures





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FIG-4

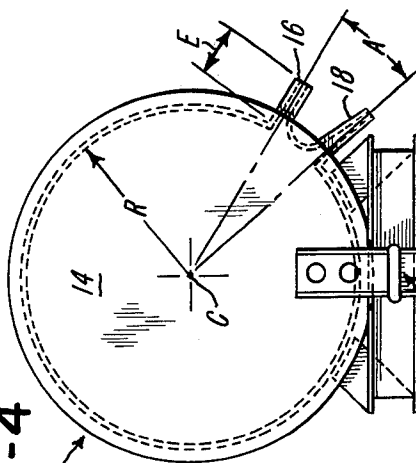


FIG-3

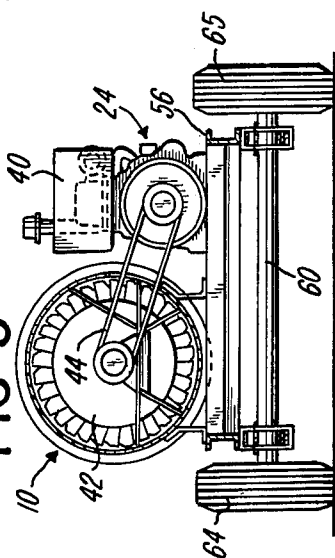


FIG-5

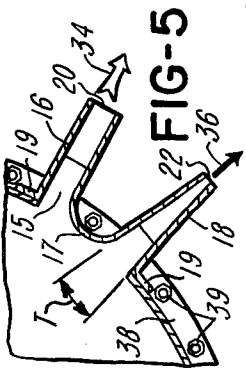
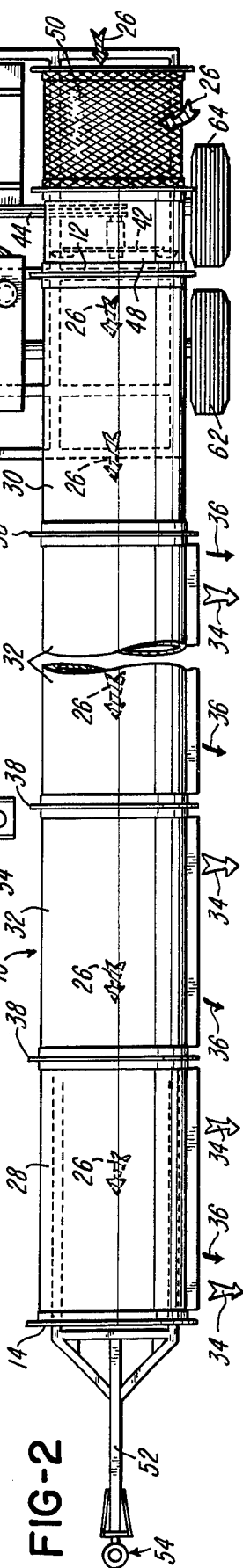
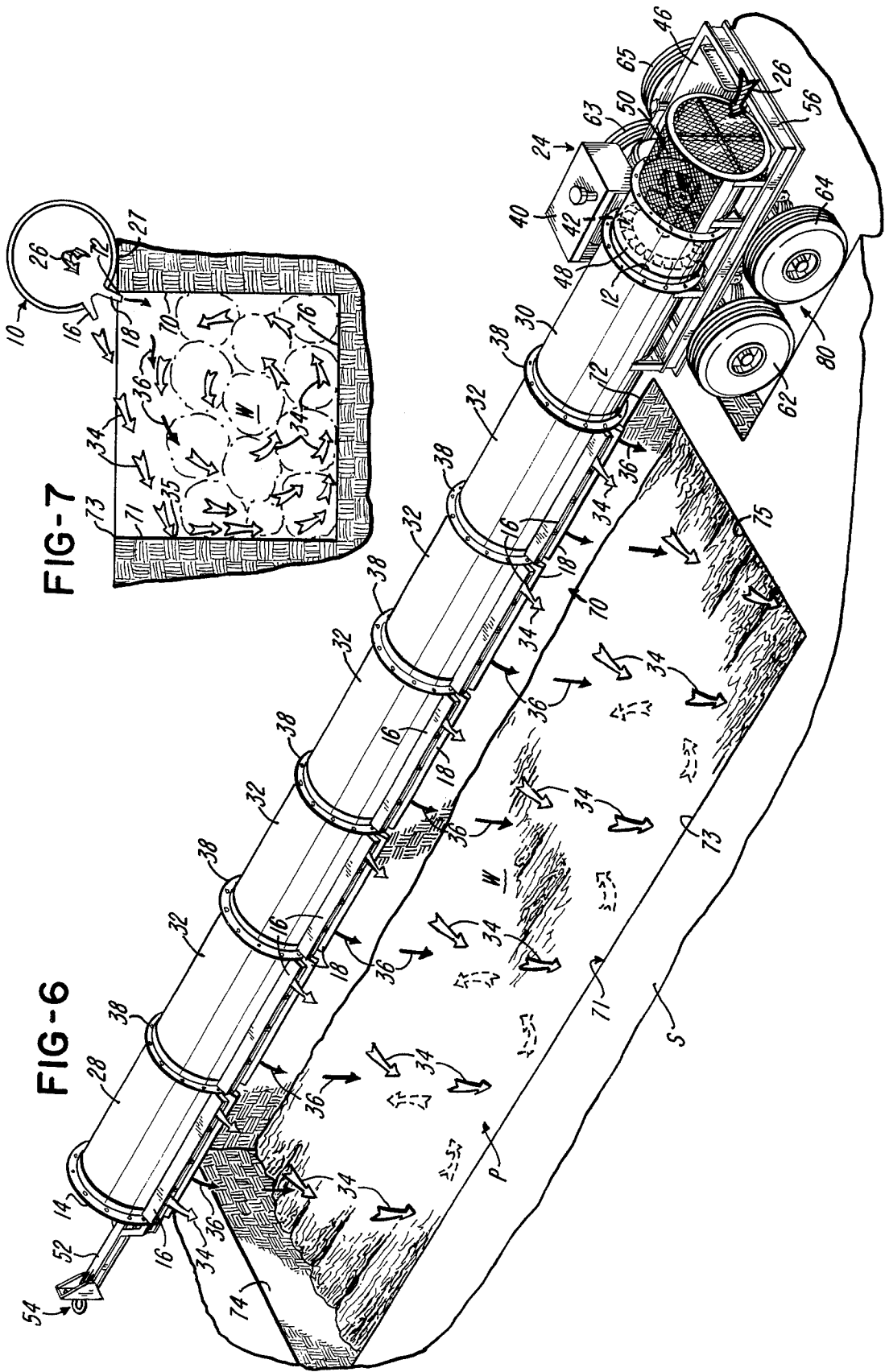


FIG-2





DEVICE GENERATING AND DIRECTING A FLOW OF COMBUSTION SUPPORTING GASEOUS MEDIA

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is directed to a portable device for generating and directing a flow of combustion supporting gaseous media into an open pit incinerator or the like from each of a pair of elongate nozzles disposed along the upper edge of one of the side walls of the pit. The flow of gaseous media from one nozzle is directed downward substantially along said one side wall whereas the flow of gaseous media from the other nozzle is directed across the top of the open pit and thence against and downwardly along the other side wall thereof. The flow of gaseous media from the last mentioned nozzle provides a continuously flowing gaseous curtain over the open top of the incinerator, which effectively precludes the emission of smoke, fly ash and the like into the atmosphere. Further, the nozzles are so constructed and arranged as to provide a continuous cyclical flow of combustion supporting gaseous media within the interior of the incinerator, thereby enhancing the ready and substantially complete and efficient combustion of the material contained therein.

2. Description of the Prior Art

It is known to generate a turbulent, cyclical flow of gaseous media such as air or the like in a walled incinerator or the like to enhance the combustion of waste material contained therein, as shown, for example, in U.S. Pat. Nos. 3,704,676 (FIG. 4) and 3,465,696 (FIG. 7). It is also known to direct the combustion supporting gaseous media into selected areas of the incinerator to effect a more efficient combustion process, as disclosed in U.S. Pat. No. 3,610,180 (FIG. 7). In fact, much thought and consideration has been directed to the design of devices which allegedly improve the degree and efficiency of the combustion process, as evidenced by the complex and complicated prior art constructions disclosed in, by way of example, U.S. Pat. Nos. 3,465,696; 3,561,377 and 3,610,180.

Each of these patents describe a complicated incinerator device including means for generating a flow of air or the like along predetermined paths in the interior of the incinerator to enhance the combustion of burnable waste materials. In general, the devices of the prior art each include an incinerator of specific design, integral with and part of the overall system, and an air flow device specifically adapted for use with said incinerator. Due to the complicated nature of these devices, permanent installation thereof is generally required and therefore, the waste materials must be transported to the incinerator.

The present invention comprises a portable device which is adapted for use in conjunction with an open pit which is thereby converted into an inexpensive, highly efficient incinerator. The device, being portable, is adapted to be moved from place to place with ease and economy, permitting transfer of the device to the location of waste material to be burned, in direct contradiction to the devices of the prior art.

The device of the present invention provides a continuously flowing curtain of gaseous media over the open top of an open pit with which it is associated, thereby precluding the emission of fly ash, smoke and

other objectionable products of combustion into the atmosphere.

SUMMARY OF THE INVENTION

The device of the present invention comprises an elongate, substantially cylindrical housing having a closed end and an open end and including a pair of circumferentially spaced nozzles, radially projecting therefrom and extending substantially the full length thereof, providing means for directing gaseous media discharged therethrough in predetermined directions relative to the side walls and contents of an open pit. Means in communication with the open end of said housing introduce gaseous media into the interior of the housing at greater than atmospheric pressure, for providing an adequate supply of gaseous media for discharge through each of said elongate nozzles.

The discharge means comprise a pair of elongate nozzles angularly displaced from one another about the circumference of the housing and projecting radially outward therefrom, wherein each of said nozzles directs the flow of gaseous media along a predetermined path.

The device of the present invention is particularly suited for generating and directing a flow of gaseous media into the interior of an open pit incinerator or the like, from the upper edge of side wall thereof, wherein one of said nozzles directs a flow of gaseous media downward substantially along said one side wall whereas the other of said nozzles directs a flow of gaseous media across the open top of the incinerator against and thence downward along the opposite side wall. The flow of gaseous media across the open top of the pit forms a gaseous curtain over the top of the incinerator, precluding the emission of smoke, fly ash and the like. Further, the device of the present invention generates a turbulent, cyclical flow of gaseous media within the interior of the incinerator, enhancing the combustion of materials contained therein.

The device being portable may be easily transported to the site of waste material, eliminating the need for hauling waste from construction sites and the like to an incinerator for the efficient disposal thereof.

It is, therefore, a primary object of the present invention to provide a device adapted for use in conjunction with an open pit incinerator for generating and directing a flow of combustion supporting gaseous media into the interior thereof.

It is another object of the invention to provide a device for generating a continuously flowing gaseous curtain over the open top of a pit to preclude emission of smoke, fly ash and other products of combustion from the interior thereof, and recycling same wholly within the pit to effect a more complete combustion thereof.

Other objects and features of the present invention will be readily apparent from the accompanying drawings and description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary side elevational view of the device of the present invention.

FIG. 2 is a top elevational view of FIG. 1.

FIG. 3 is a view taken at line 3—3 of FIG. 1.

FIG. 4 is a view taken at line 4—4 of FIG. 1.

FIG. 5 is a sectional view taken at line 5—5 of FIG. 1, enlarged for clarity of detail and understanding.

FIG. 6 is a perspective view illustrating the device of the present invention disposed adjacent the upper edge of the side wall of an open pit.

FIG. 7 is a diagrammatic illustration showing the flow pattern of the combustion supporting gaseous media from the nozzles of the device of the present invention relative to an open pit and its combustible contents.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In general, the device of the present invention comprises hollow, elongate, substantially cylindrical housing 10 having an open end 12 and a closed end 14; a pair of elongate discharge nozzles 16 and 18 extend from and throughout substantially the entire length of housing 10, as shown in FIGS. 1, 2 and 6. Suitable means, indicated generally by the numeral 24 are disposed in communication with open end 12 of the housing for introducing combustion supporting gaseous media such as, by way of example, ambient air 26 into the housing at greater than atmospheric pressure. In the preferred embodiment, housing 10 comprises a plurality of end-interconnected segments 28, 30 and 32 wherein the closed-end-adjacent segment 28 and the open-end-adjacent segment 30 are separated by one or more intermediate segments 32. Each adjacent pair of segments is coupled at 38 by suitable means such as fasteners 39 (see FIG. 5) to form the continuous, substantially fluid-tight, cylindrical housing 10 of the present invention.

Means 24 includes a cover 48, disposed in axial alignment with open-end-adjacent segment 30 of the housing to which it is coupled at 37 by suitable means such as fasteners 39 or the like. A fan 42 rotatably mounted within cover 48 in axial alignment with the housing is driven by an internal combustion engine 40 or the like, via belt drive 44, note FIG. 3. The numeral 46 designates a conventional fuel reservoir or tank for engine 40. A shroud 50 provides a protective screen for the air being drawn into fan 42. It should, of course, be understood that other means could be substituted for the fan apparatus illustrated herein without departing from the scope and spirit of the present invention.

In the preferred form, the device of the present invention is adapted to be trail mounted and therefore, may be transported to the material which is to be consumed, thereby eliminating the time and expense often required to haul quantities of waste materials from construction sites or the like. Extension 52 is secured to and extends longitudinally outward from the close-end-adjacent segment 28 and includes a suitable hitch 54 providing means for securing the device to a tractor or the like. Support frame 56 is secured to and depends from open-end-adjacent segment 30 of the housing and includes a pair of axles 58 and 60 for wheels 62-65.

As illustrated in FIGS. 6 and 7, the device of the present invention is particularly well suited for use in conjunction with open pit incinerator P or the like having a pair of opposite side walls 70, 71 and a pair of opposite end walls 74, 75. Preferably, the length of the pit, i.e. the distance between end walls 74 and 75, corresponds to the collective length of each of nozzles 16 and 18. As diagrammatically illustrated in FIG. 7, the lowermost portion 27 of housing 10 is disposed adjacent and where possible, in abutting relationship with surface S adjacent the top of the pit for minimizing the open space between housing 10 and upper edge 72 of

side wall 70. For this purpose a pit or cutout 80 is provided for wheels 62-65, when the device is operatively associated with the side wall of a pit shown. Specifically, it is desirable that the space between ground surface S and bottom 27 of the housing be kept at a practical minimum. The particular application will dictate the procedure to be followed in order that the discharge end of nozzle 18 is disposed at or preferably somewhat below surface S and in abutting relationship with side wall 70 at upper edge 72 thereof.

Once the device of the present invention has been properly disposed adjacent the upper side wall of a pit, as shown in FIGS. 6 and 7, waste material W within the pit is ignited and fan 42 is activated, introducing ambient air 26 into the housing to be exhausted into the pit through nozzles 16 and 18. In the preferred embodiment, a major portion of the flow such as, by way of example, 80 percent of the gaseous media from housing 10 occurs through upper elongate nozzle 16, as indicated by arrows 34 across the top or open mouth of the pit in a generally downward direction, impinging upon opposite side wall 71 as at 35 below the upper edge 73 thereof and above waste material W, after which it is directed in a substantially downward direction along wall 70 toward bottom wall 76 of the pit thence upwardly as illustrated. A lesser, or minor portion, such as, by way of example, 20 percent of the flow of gaseous media from housing 10 occurs through the lower elongate nozzle 18 as indicated by arrows 36 downwardly along pit wall 70 where it is intercepted by the upward flow of gases 34 from nozzle 16, generating a turbulent, cyclical flow pattern as illustrated in FIG. 7. Thus, the flow of gaseous media from nozzles 16 and 18 provides an effective air curtain over the top or open mouth of pit P precluding emission of smoke, fly ash and other products of combustion therefrom, while recycling same to effect a more complete combustion thereof, wherein the flow culminates in the cyclical, turbulent pattern illustrated in FIG. 7, enhancing the complete combustion of waste material W contained in the incinerator.

As illustrated in FIGS. 4 and 5, the inner ends of the adjacent walls of nozzles 16 and 18 are interconnected at radius 17, whereas the outer walls of the nozzles terminate in outturned mounting flanges or tabs 19. The nozzle assembly is adapted to be mounted to elongate opening 15 in the side wall of the housing by suitable means such as welding or the like.

The nozzles project radially outward from the central, longitudinal axis C of the housing and are angularly displaced from one another about the circumference thereof by angle A. It should be understood that the angle A is dependent upon the separation of flow required and therefore, in the present embodiment is dictated by the width of pit P, i.e., the distance between opposite side walls 70 and 71. Specifically, the angular displacement A between nozzles 16 and 18 is such that the flow of gaseous media discharged therefrom will essentially conform to the pattern of FIG. 7.

Nozzles 16 and 18 are each of a minimum length E which is sufficient to establish the desired flow of gaseous media, wherein discharge end 20 and 22 thereof direct the gaseous media along a predictable, predetermined path as illustrated, by way of example, in FIG. 7. Generally, it has been found that the length E should be equal to 30-50 percent of the radius R of housing 10. Further, in order to generate the flow pattern illus-

trated in FIG. 7, it is desirable that a major portion of the gaseous media be discharged through the uppermost nozzle 16 and the remaining, minor portion be discharged through lower nozzle 18 which is slightly tapered along its length as indicated by angle T to reduce the flow of gaseous media therethrough. Uniformly satisfactory results have been achieved where 75-85 percent of the gaseous media is discharged through nozzle 16 and 15-25 percent through nozzle 18. It should, of course, be understood that each of these factors will vary with the size of the open pit, P.

In order to further enhance the understanding of the present invention when used in conjunction with an open pit of the type illustrated in FIGS. 6 and 7, if it is assumed that the pit is 8-12 feet in width and 15-18 feet deep, and the pit would be filled with logs, debris and other solid waste material to a level approximately 5-6 feet below surface S, i.e. sufficiently beneath the open mouth of the pit to permit unrestricted flow of gaseous media from the nozzle 16 to a point 35 on side wall 71. While the pit may be of any reasonable size, it is preferably 25-40 feet in length.

Nozzle 18 projects outward from the housing at an angle approximately 20° from an axially extending vertical plane passing through housing 10, and uniformly satisfactory results are obtained in those instances in which the angular displacement A between nozzles 16 and 18 is 40°-60°.

Fan 42 should produce a steady gaseous flow of approximately 1,000 cubic feet per minute per foot of length of the housing. In practice, uniformly satisfactory results have been obtained with a fan apparatus generating approximately 35,000 cubic feet per minute (c.f.m.) for a housing 25 feet long, and 48,000 c.f.m. for a device having a housing 40 feet long.

Once the device has been properly positioned with respect to the upper side of an open pit as in FIG. 6 fuel oil or the like may be deposited on the contents of the pit to facilitate the initial combustion of said contents. Thereafter, the fan is progressively brought up to speed for providing a continuous supply of gaseous media for the housing. In practice, it has been found that use of the subject device in conjunction with a pit of the size described will, during an 8-hour period, permit the complete burning of a quantity of waste material equal to four times the capacity of the pit.

Uniformly satisfactory results have been obtained in those instances in which air is continuously supplied to the housing whereby to maintain from 8 inches to 12 inches static pressure therein. The maintenance of such air pressures in the housing will insure the continuous discharge of air from the two nozzles at the minimum rate of 1,000 c.f.m. per foot of nozzle, that is, housing length.

By way of summary, it will be noted that the uppermost elongate nozzle 16, through which from 75-85 percent of the air or gaseous media is discharged, is arranged in such a manner as to deliver an elongate, continuous stream of air across the width of the pit and which impinges against the opposite side wall at a location somewhat above the top of the combustible contents of the pit. This continuous stream of air functions as a moving curtain which effectively prevents the escape of smoke, fly ash and the like from the open, upper portion of the pit, while continuously supplying an excess of combustion-supporting air to the burning contents of the pit.

The lower elongate nozzle 18, through which from 15-25 percent of the air, or gaseous media is discharged, is arranged in such a manner relative to the upper side edge of the pit and the other elongate nozzle 16, as to deliver an elongate, continuous stream of air adjacent side wall 70 which effectively prevents the fire within the pit from flaming up along or adjacent said wall, while continuously supplying additional combustion-supporting air to the burning contents of the pit.

By providing the length of lower nozzle 18 so as to at least engage upper edge 72 of side wall 70 of the pit, a seal is provided which effectively prevents the accidental or unintentional escape or passage of flame or products of combustion under said nozzle and housing.

What is claimed is:

1. A device for generating and directing the discharge of two individual streams of combustion-supporting gaseous media into an open top combustion pit, comprising: an elongate, substantially cylindrical housing having an open end and a closed end; a pair of circumferentially spaced, elongate discharge nozzles projecting radially therefrom and directed toward the combustion pit at one side thereof; and means in communication with the open end of said housing for continuously introducing gaseous media into the interior thereof at pressure greater than atmospheric and for directing a first stream of gaseous media through one of said nozzles across the open top of the pit from one side thereof and thence downwardly along the other side of the pit, and for directing a second stream of gaseous media through the other of said nozzles adjacent said one side of the pit and downwardly along said one side of the pit.

2. A device as called for in claim 1, wherein the nozzles are so constructed and arranged that the individual streams of gaseous media discharged therefrom diverge at an angle of from 40° to 60°.

3. A device as called for in claim 1, wherein the length of one nozzle is such as to extend at least to the upper edge of the side wall of an elongate open pit along which the housing is disposed for discharging a first stream of gaseous media into said pit adjacent the aforesaid side wall, and wherein the other nozzle is disposed above and relative to the first mentioned nozzle for discharging a second stream of gaseous media across the pit and against the other side wall thereof.

4. A device as called for in claim 3, wherein is included means for effecting discharge of from 15% to 25% of the gaseous media in the first stream and from 75 to 85 percent of said media in the second stream.

5. A device as called for in claim 1, wherein the means for introducing gaseous media into the housing is adapted to maintain a static pressure therein of from 8 inches to 12 inches.

6. A device as called for in claim 1, wherein the means for introducing gaseous media into the housing is adapted to sustain a discharge rate of 1,000 c.f.m. of said media through said nozzles per foot of length of housing.

7. A device as called for in claim 1, wherein said housing and said means for introducing gaseous media therinto comprise a unitary, portable unit.

8. A device as called for in claim 7, wherein the means for introducing gaseous media into the interior of the housing and that end of the housing adjacent thereto are wheel mounted.

9. A device as called for in claim 8, wherein the other end of the housing includes a hitch.

10. A device as called for in claim 1, wherein said housing comprises a plurality of similar, end-connected segments each of which includes a pair of elongate discharge nozzles wherein the nozzles of each section are disposed in axial alignment. 5

11. A device as called for in claim 1, wherein the means for introducing gaseous media into the interior of the housing comprises a blower and means for driving it. 10

12. A device as called for in claim 3, wherein the length of the first mentioned nozzle is from 15-25 percent of the diameter of said housing.

13. The method of burning elongate combustible material such as, by way of example, tree trunks, brush, and the like, which comprises the steps of: 15

- a. digging a pit in the earth of sufficient width and length to accommodate a charge of elongate combustible material; 20

b. igniting the combustible material within the pit;
c. continuously introducing a first, elongate, stream of air from the upper edge of one side wall of the pit, across the width of the pit, at a location above the upper surface of the combustible material housed therein, to impinge against the surface of the other side wall and thence be deflected into the combustible material; and of

d. continuously introducing a second, elongate stream of air adjacent and downwardly along the first mentioned side of said pit, and into said combustible material.

14. A method as called for in claim 13, wherein the volume of air discharged in said second stream is from 15-25 percent of the total volume of air discharged from both of said streams. 15

15. A method as called for in claim 13, wherein the total quantity of air discharged through both streams approximates 1,000 c.f.m. per foot of length of said pit.

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