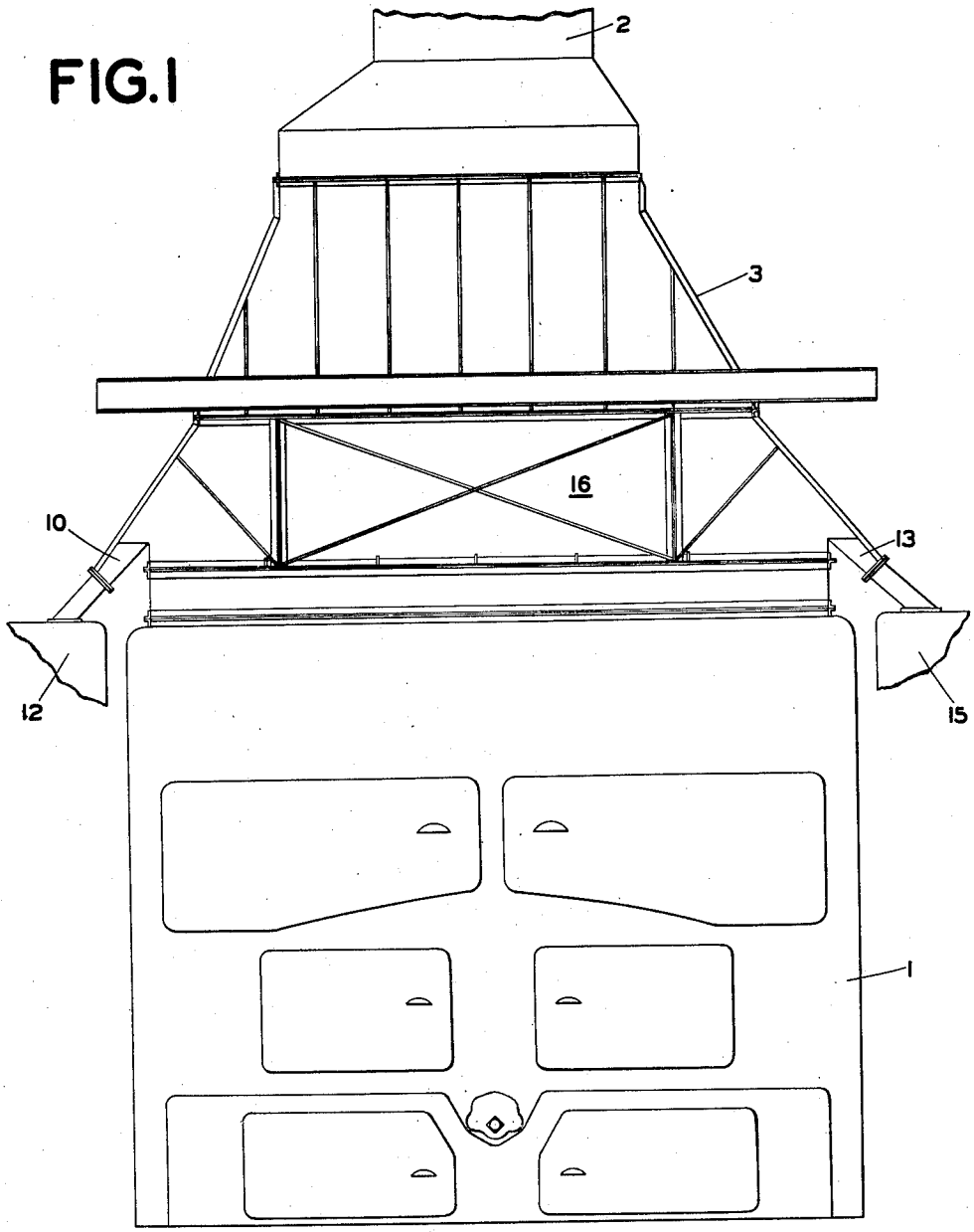
Dec. 6, 1949 H. O. DANZ 2,490,116

SEPARATOR OR COLLECTOR

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FIG.1



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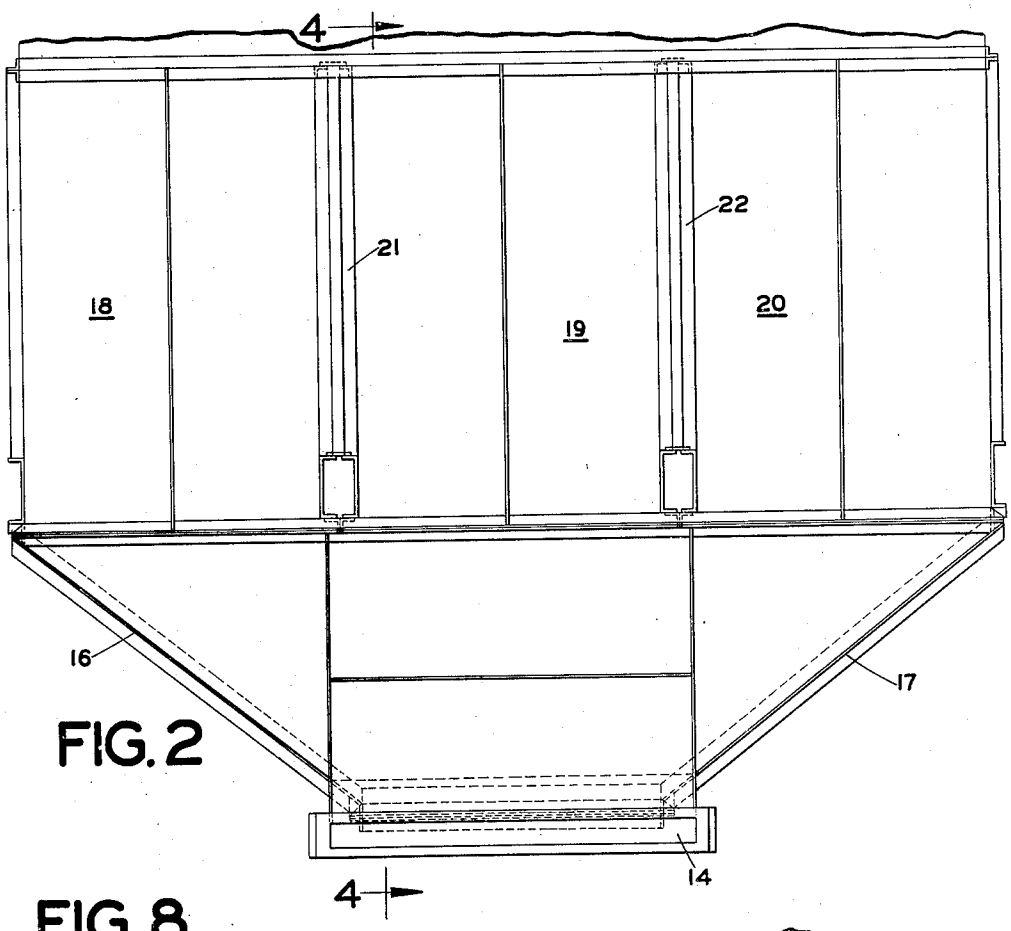
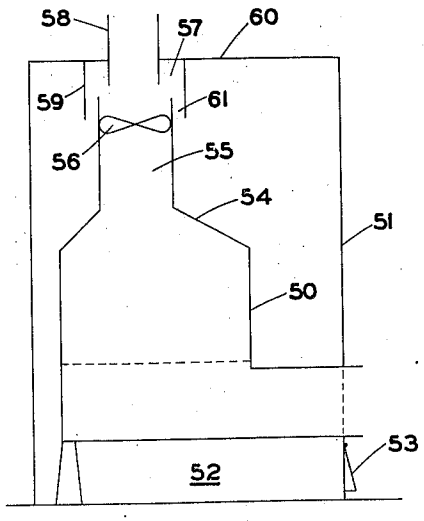


FIG. 2

FIG. 8



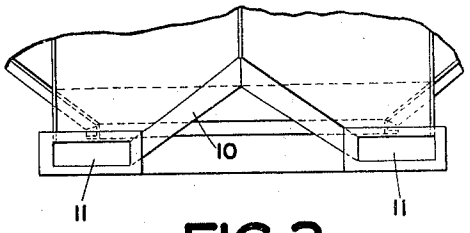


FIG. 3

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FIG. 4

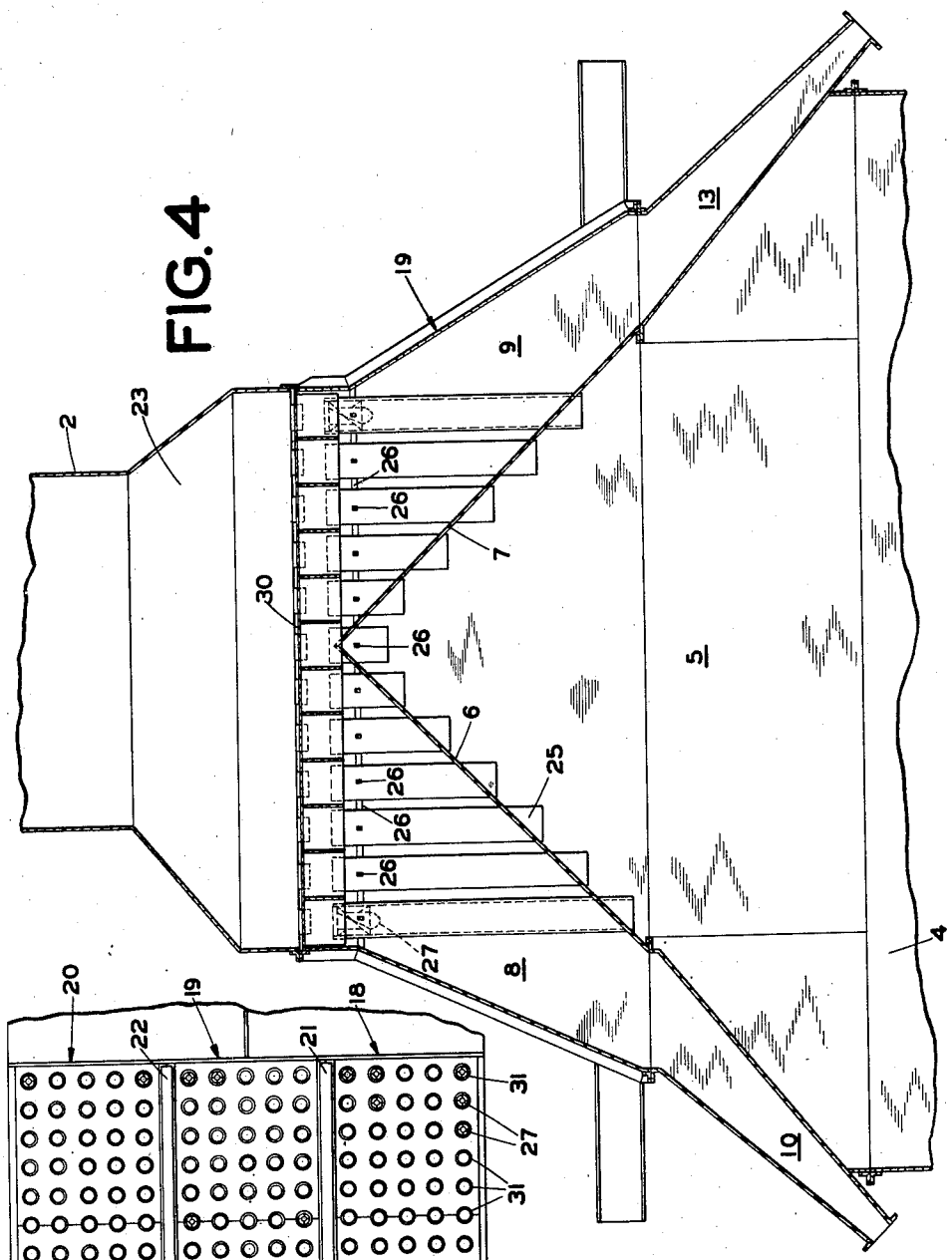


FIG. 5

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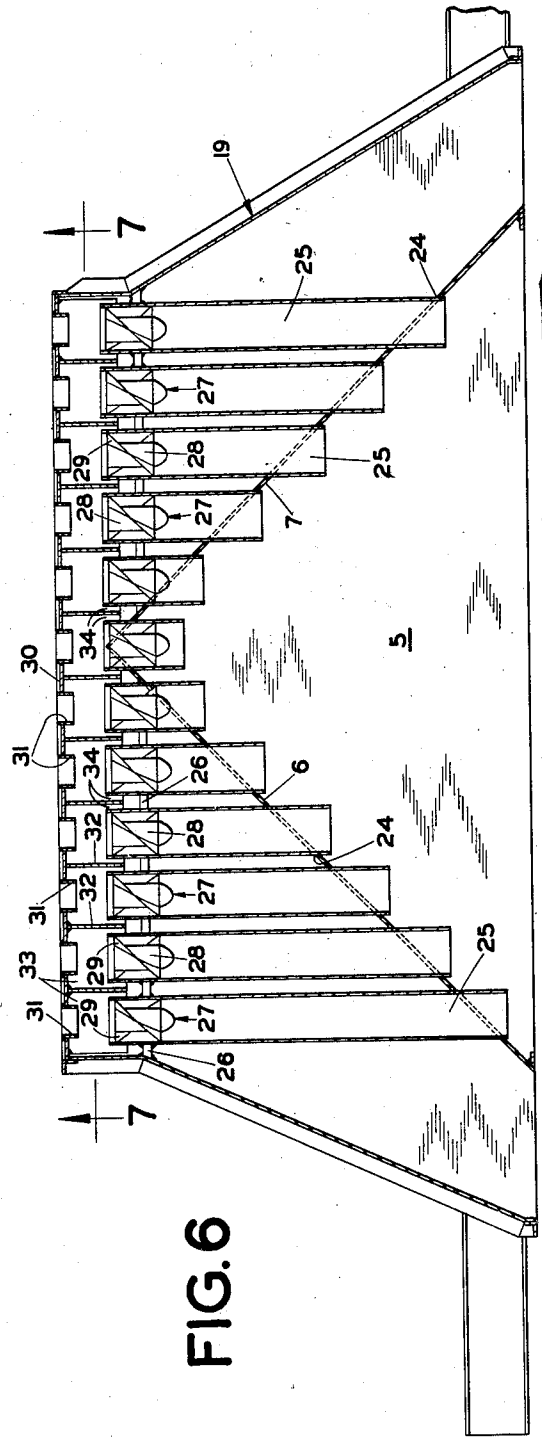


FIG.6

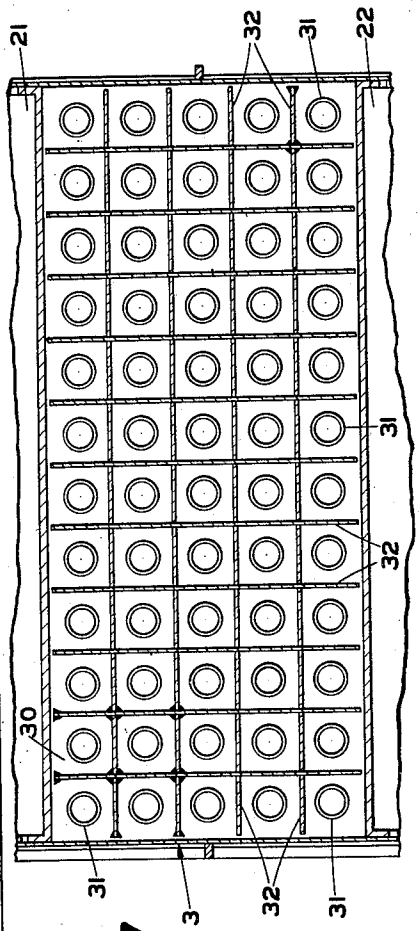


FIG.7

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2,490,116

UNITED STATES PATENT OFFICE

2,490,116

SEPARATOR OR COLLECTOR

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Application January 8, 1947, Serial No. 720,908

7 Claims. (Cl. 183—80)

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This invention relates to new and useful improvements in apparatus for separating foreign particles from a gaseous stream in which they are carried.

An object of the invention is to provide an efficient apparatus of simple and rugged construction.

Another object is to provide a separator which is particularly adapted for cooperation with the boiler or heating apparatus of a power plant, for example.

Another object is to provide an apparatus for collecting the foreign particles carried in the gaseous stream and removing them therefrom.

The invention consists in the cooperative arrangement and combination of parts to be more fully described hereinafter and the novelty of which will be particularly pointed out and distinctly claimed.

In the accompanying drawings, to be taken as a part of this specification, there are fully and clearly illustrated several preferred embodiments of the invention, in which drawings:

Figure 1 is a view in front elevation of a power unit such as an industrial boiler having intercalated in the stack a separator or cinder collector,

Fig. 2 is a detail side elevation, looking from right to left of Fig. 1, of the cinder collector.

Fig. 3 is a detail side elevation, looking from left to right of Fig. 1, of the cinder collector,

Fig. 4 is a view in section on the line 4—4 of Fig. 2, but showing a portion of the boiler and of the stack,

Fig. 5 is a plan view of the interior of the collector with an outlet plate or tube sheet removed,

Fig. 6 is a view in vertical section through the collector, generally similar to that of Fig. 4,

Fig. 7 is a detailed view in section on the line 7—7 of Fig. 6 and looking in the direction of the arrows, and

Fig. 8 is a diagrammatic view of a separator or collector showing the invention.

Referring to the drawings by characters of reference, the numeral 1 indicates generally a boiler or furnace such as might be employed in industrial power apparatus and which has a chimney stack or outlet flue 2 for the producing of combustion. The stack includes a portion 3 intercalated between the chimney and the boiler 1, this portion being a casing of generally truncated triangular form in front elevation as seen in Fig 1 and of generally rectangular form in plan view as seen in Fig. 5. The boiler flue outlet 4, see Fig. 4, discharges upwardly into the casing into a

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space 5 having upwardly inclined converging walls 6, 7 forming the roof of the chamber 5 and separating the chamber 5 from laterally positioned cinder collecting chambers 8, 9. It will be apparent that the upper wall or roof of the chamber 5 might be formed by a single inclined wall or that there might be more than two walls converging upwardly and joined at their marginal side edges. The collecting chamber 8 discharges downward through a chute or duct 10 which may be divided as seen in Fig. 3 and have two outlets 11 which feed into a closed hopper 12, a portion only of which is shown. The chamber 9 likewise discharges through a chute or duct 13 which feeds through an outlet 14, see Fig. 4, into a closed bin or hopper 15, a part only of which is shown. It may be noted that the lower portion of the casing 3 has upward diverging front and rear walls 16, 17 to accommodate the enlarged cross section of the upper casing portion containing the chambers 8 and 9.

The casing 3 is made up of a plurality of identical upper sections or portions 18, 19 and 20 each of which contains the inclined roof walls 6, 7 and a pair of spaced collecting chambers similar to the chambers 8 and 9, these sections being separated from each other by partition walls 21, 22 extending vertically from side to side of the boiler 1. These sections 18, 19 and 20 discharge into a hood or the like 23 which is tapered to join the chimey stack 2. The sections 18, 19 and 20 being similar to each other a description of one will suffice for all.

The walls 6 and 7 each have a plurality of equispaced elliptical apertures 24 therethrough which are rows at right angles to each other. Extending downward through each of the apertures 24 and sealed therein there is a tube or conduit 25 extending vertically upward and each of which terminates slightly below the walls 6 and 7 and within the chamber 5. The upper ends of the tube 25 terminate in a substantially common horizontal plane so that the tubes 25 are of varying lengths, decreasing toward the center line of the chamber 5. The upper ends of the tubes 25 are rigidly supported by a grill work or grid formed by bars 26 extending radially from and joining the tubes to each other and to the side walls of the casing 3. These bars may be secured in position by welding or the like. In the upper outlet end portion of each of the tubes 25 there is a gas rotating means or spinner 27 which serves to direct the outlet flue gases into a predetermined annular path. Each spinner has a central cylindrical body portion 28 concentric with its re-

spective tube 25 and which supports spiral vanes 29 which cause the rotation of the gas stream so that the particles of foreign material such as cinders in the flue gases are impelled laterally or radially outward toward the side walls of the tubes 25.

The casing 5 has a top wall 30 having a plurality of apertures therethrough alined one with each of the tubes 25 and each containing a conduit or tube member 31 which projects downward but terminates short of and in spaced relation above its alined tube or conduit 25. The tubes 31 are each of smaller flow area or diameter than the tubes 25 and these tubes each have their geometrical individual elements positioned substantially parallel to each other so that the walls of the tubes 31 and 25 are parallel to each other. Each of the tubes or conduits 31 is separated from the other by shield or partition members 32 in the form of a grid, see Fig. 7, which are welded or otherwise rigidly secured to the underface of the top wall or plate 30. These shield members 32 extend downward below the outlet ends of the tubes 25 and provide a pocket or recess 33 around each of the tubes 31. The shield members 32 are also spaced laterally from the tubes 25 as at 34 to provide a down flow space for discharge of the cinders or foreign particles carried in the outlet flue gases. It may be noted that in a practical commercial installation, solely for purposes of illustration, with a casing section as 19 having horizontal dimensions of say 5 x 11 feet, the conduits 25 might have an internal diameter of substantially 8 inches and the conduits 31 an internal diameter of about 6 inches, the spinner cylinder 28 being of about 4½ inches diameter.

In the operation of this separator or collector it will be apparent that an induced draft fan may be employed for combustion air or flue gas exhaust and also when the furnace or boiler is under natural or forced draft that the flue gases containing particles of foreign material such as the cinders will discharge upward into the chamber 5. The main gas stream in the chamber 5 will be split into branch gas streams flowing upwardly through the tubes 25 from below the walls 6 and 7. These gas streams will be directed into predetermined annular paths by the central cylindrical portions 28 of the deflecting members 27 and this annular stream will be caused to whirl or rotate by the spinner blades or fins 29. In addition to the conduits 31 being of less diameter than the conduits 25 and such that the cylindrical portions 27 cause the annular stream to discharge into the pockets or cells 33 and not directly into the conduits 31, there is also the lateral or radial discharge of the cinder particles toward the side walls of the conduits 25 so that these particles discharging from the tubes 25 will be prevented from direct flow through the top plate or wall apertures by the depending portions of the conduits 31. The foreign particles or cinders collecting in the pockets 33 will be thrown out of the air stream and will fall by gravity through the annular channels or passageways 34 which surround the upper ends of the tubes 25 and will deposit on the upper inclined faces of the walls 6 and 7, thence flowing by gravity down the wall surfaces and through the duct members 10 and 13 into the collecting bins or hoppers 12 and 15. The cleaned gases will discharge upward through the conduits 31 into the hood 23 and thence flow to atmosphere through the chimney stack.

It is also contemplated that the walls 6, 7 might converge downward so as to form a V-shaped trough which would be accomplished by mere transposition of the portion of the collector of the vertical plane of the wall 7 to a position at the left of the portion of the vertical plane of the wall 6 as viewed in Fig. 6.

Referring to Fig. 8, it is a diagrammatic illustration of the above described separator in somewhat different form or arrangement of parts. Here the boiler or furnace is designated 50 and is contained within a housing or casing 51 of which the lower portion 52 forms a bin or collecting chamber having a clean-out door 53. The upper wall 54 of the combustion chamber of the furnace has an outward and downward inclined surface so that the cinders or foreign particles falling thereupon will flow therefrom into the bin 52. The furnace 50 has a combustion gas outlet flue or conduit 55 opening upwardly from the combustion chamber through the wall 54. The conduit 55 contains a gas rotating means or spinner 56 positioned substantially in the outlet end portion of the conduit 55 and which throws or whirls the discharging gases into a predetermined annular path. The spinner 56 also causes the foreign cinder particles to discharge radially or laterally into the outer annular portion of the discharging gas stream such that these particles will be directed into the annular recess or pocket 57 formed between the conduit or tube 58 and the cylindrical shield member 59. The conduit 58 projects upward through and is sealed in the top casing wall 60 and leads to or forms part of the usual chimney stack. The shield member 59 which is sealed to and descends from the inner surface of the top wall 60 extends downward around the conduit 55 in spaced relation thereto to provide an annular flow passageway 61 for the discharge of the cinder particles into the bin 52.

The operation of this form of the invention will be apparent from the foregoing description of this Fig. 8 taken in connection with the foregoing description of the invention as shown in Figs. 1 to 7 inclusive.

What is claimed and is desired to be secured by Letters Patent of the United States is:

1. Apparatus for separating particles of material from a gaseous stream in which they are carried, comprising a casing defining a chimney stack portion, upward converging inclined walls separating said casing internally into an inlet chamber and laterally spaced particle collecting chambers, a plurality of closely adjacent vertical conduits extending through said walls and terminating at their lower ends adjacent said walls and at their upper ends substantially in a horizontal plane, grid bar means extending across said casing and rigidly supporting the upper ends of said conduits, spinner members, one spinner member being positioned in the outlet end portion of each conduit, a top wall on said casing, a plurality of outlet conduits extending through and sealed in said top wall, said outlet conduits being alined one with each of said first-named conduits and terminating at their inlet ends above said first-named conduits, and vertically positioned wall members extending downward from said top wall and terminating above said inclined walls, said vertical wall members being laterally spaced from and surrounding said first-named and said second-named conduits to provide a separating chamber around each of said outlet conduits and a downflow passageway around each of said first-named conduits.

2. In an apparatus for separating particles of material from a gaseous stream in which they are carried, a casing, a plurality of upright conduits within said casing and supported in spaced relation to each other, a wall having apertures receiving and fitting said conduits and dividing said casing into an inlet chamber and a particle collecting chamber surrounding said conduits, a top wall structure having partition members forming cells surrounding and spaced from the outlet ends of said conduits to provide downflow passageways, said partition members separating said conduit outlet ends from each other, an outlet tube within each cell and opening through an aperture in said top wall structure, said outlet tubes having their inlet ends terminating in spaced vertical relation to the outlet ends of said conduits and being alined with and of less diameter than said conduits, said wall structure separating said collecting chamber from a clean gas outlet chamber into which said outlet tubes open, and means to direct the gaseous stream particles from each conduit into an annular flow pattern discharging into each cell around its outlet tube.

3. In an apparatus of the character described, an open ended casing having a plurality of transverse partition members separating said casing into an inlet chamber for a particle laden gaseous stream, into a clean gas outlet chamber and into an intermediate particle collecting chamber, said partition members being positioned such that one partition member separates said intermediate chamber from said inlet chamber and another partition member separates said outlet chamber from said intermediate chamber, said one partition member being inclined for gravity flow therealong of the collected particles, a plurality of conduits sealed in and having their inlet ends opening through and terminating substantially at said one partition member and terminating at their outlet ends in a substantially common plane adjacent said other partition member, a grid structure extending across said casing and rigidly supporting and spacing from each other the outlet end portions of certain of said conduits, intersecting partition members extending from said other partition member and forming cells surrounding and spaced from the outlet end portions of said conduits to provide downflow passageways, said other partition member having apertures therethrough, alined one with each of said conduits, tubular outlet members sealed one in each of said apertures and extending into its cell and each having its inlet end terminating in spaced vertical relation to the outlet end of its cooperating conduit, and means to direct a particle laden gaseous stream leaving each conduit into the cell space surrounding its outlet member.

4. Apparatus for separating particles of material from a gaseous stream in which they are carried, comprising a casing having a transverse wall separating said casing into a lower inlet chamber and an upper particle collecting chamber, a plurality of upright conduits in said collecting chamber and extending through said wall, means in the outlet end portion of each of said conduits and operable to direct certain particles of the stream-carried material laterally outward from the upper end of each conduit, a top wall on said casing and having outlet apertures therethrough alined one with each conduit, a plurality of tubular members extending downward from said top wall and registering one with each of said apertures and having their inlet ends of less diameter than and terminating above said conduits, partition means extending downward from said top wall and forming around each of said tubular members a separating chamber, said partition means terminating below the outlet ends of said conduits and above said first-named wall and providing around each of said conduits a downflow passageway for the separated particles.

5. Apparatus for separating particles of material from a gaseous stream in which they are carried, comprising a casing having a transverse wall separating said casing into a lower inlet chamber and an upper particle collecting chamber, a plurality of upright conduits in said collecting chamber and extending through said wall, means in the outlet end portion of each of said conduits and operable to direct certain particles of the stream-carried material laterally outward from the upper end of each conduit, a top wall on said casing and having outlet apertures therethrough alined one with each conduit, a plurality of tubular members extending downward from said top wall and registering one with each of said apertures and having their inlet ends of less diameter than and terminating above said conduits, partition means extending downward from said top wall and forming around each of said tubular members a separating chamber, said partition means terminating below the outlet ends of said conduits and above said first-named wall and providing around each of said conduits a downflow passageway for the separated particles, said transverse wall being inclined at such a steep angle that the particles will flow therealong by gravity.

6. Apparatus for separating particles of material from a gaseous stream in which they are carried, comprising a casing having a transverse wall separating said casing into a lower inlet chamber and an upper particle collecting chamber, a plurality of upright conduits in said collecting chamber and extending through said wall, means in the outlet end portion of each of said conduits and operable to direct certain particles of the stream-carried material laterally outward from the upper end of each conduit, a top wall on said casing and having outlet apertures therethrough alined one with each conduit, a plurality of tubular members extending downward from said top wall and registering one with each of said apertures and having their inlet ends of less diameter than and terminating above said conduits, partition means extending downward from said top wall and forming around each of said tubular members a separating chamber, said partition means terminating below the outlet ends of said conduits and above said first-named wall and providing around each of said conduits a downflow passageway for the separated particles, said transverse wall being inclined at such a steep angle that the particles will flow therealong by gravity, and means closing said collecting chamber against gas flow therethrough.

7. Apparatus for separating particles of material from a gaseous stream in which they are carried, comprising a casing having a transverse wall separating said casing into a lower inlet chamber and an upper particle collecting chamber, a plurality of upright conduits in said collecting chamber and opening through said wall and having their inlet ends communicating directly with said inlet chamber, a plurality of

elongated cylindrical deflecting members positioned one in the upper outlet end of each of said conduits and providing an annular passageway therearound, stream rotating means in each of said passageways, a top wall on said casing and having outlet apertures therethrough alined one with each conduit, a plurality of tubular members extending downward from said top wall and registering one with each of said apertures and having their inlet ends of less diameter than and terminating above said conduits, partition means extending downward from said top wall and forming around each of said tubular members a separating chamber, said partition means terminating below the outlet ends of said conduits and above said first-named wall and providing around each of said conduits a downflow passageway for the separated particles.

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