

[54] **NON-POLLUTING CHIMNEY**
 [76] Inventor: **Jacques Claude Michel Piot**, 171,
 Rue Join-Lambert, 76
 Bois-Guillaume, France

[22] Filed: **Jan. 28, 1972**
 [21] Appl. No.: **221,630**

[30] **Foreign Application Priority Data**
 Jan. 28, 1971 France 7103842
 [52] **U.S. Cl.**..... **98/58, 110/184, 138/149,**
 138/155
 [51] **Int. Cl.**..... **E04h 12/28**
 [58] **Field of Search**..... 98/58, 59, 60;
 110/184; 138/149, 150, 155

[56] **References Cited**
UNITED STATES PATENTS
 3,233,699 2/1966 Plummer..... 138/149 X

2,451,145	10/1948	Baker et al.	138/149
2,906,317	9/1959	Keyes.....	138/149 X
2,936,792	5/1960	MacCracken et al.	138/150 X
3,330,233	7/1967	Clements	110/184
2,342,058	2/1944	Morris	98/58 X

Primary Examiner—William F. O'Dea
Assistant Examiner—Peter D. Ferguson
Attorney—John C. Holman et al.

[57] **ABSTRACT**
 A non-polluting chimney comprising a flue for the products to be discharged, a covering of heat-insulating material surrounding the flue and a casing of plastics material surrounding the covering.

A specific embodiment comprises superposed chimney sections whose outer casings have end flanges which are clamped together, the corresponding flue sections being suspended from the casings.

11 Claims, 9 Drawing Figures

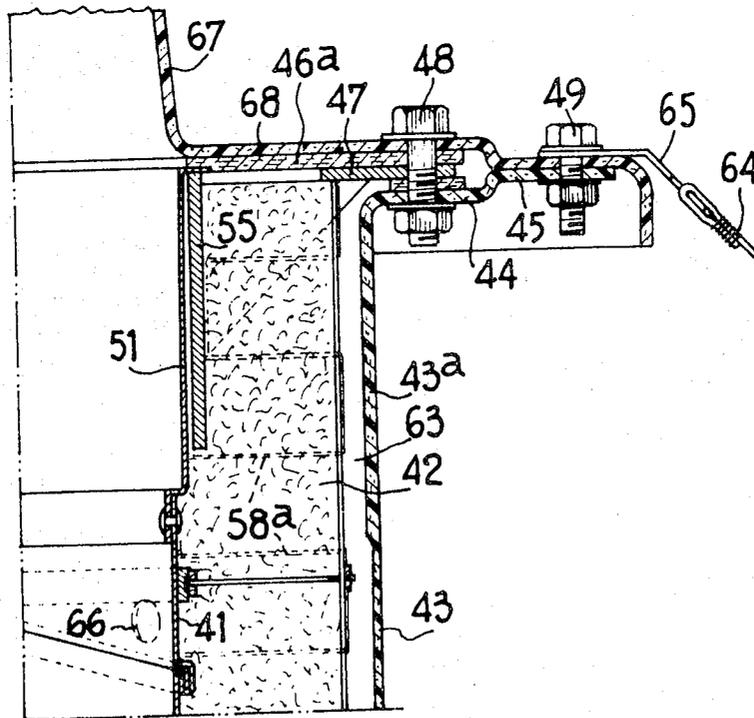


FIG. 1

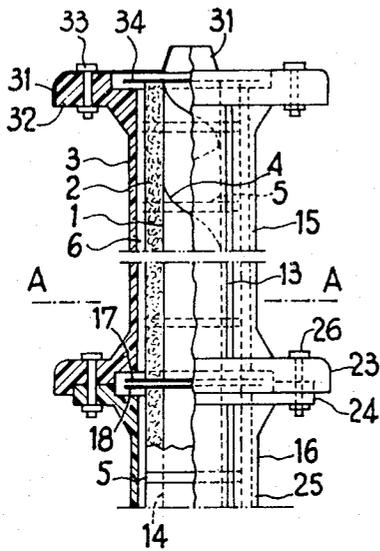


FIG. 3

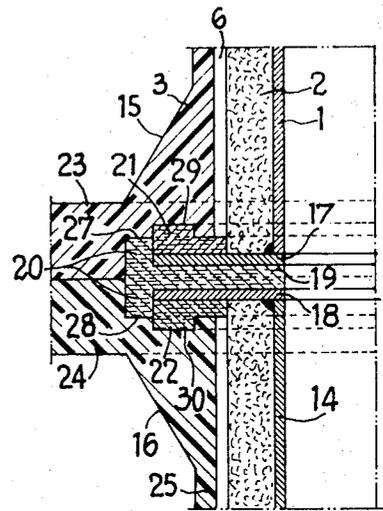


FIG. 2

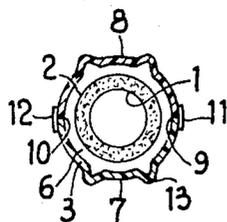


FIG. 4

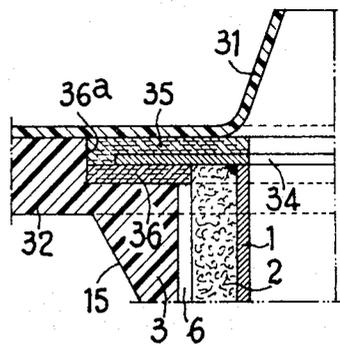
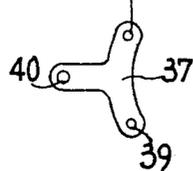
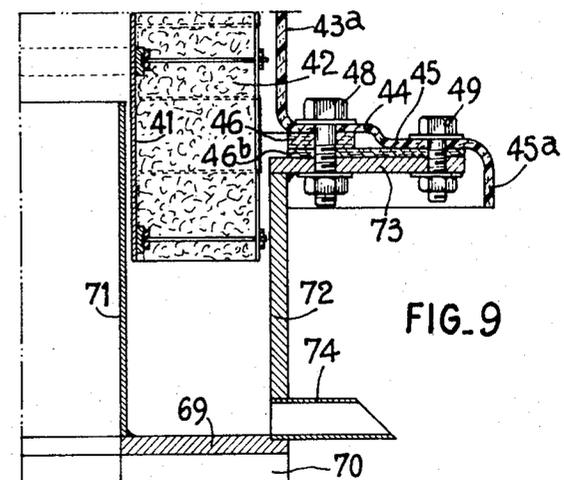
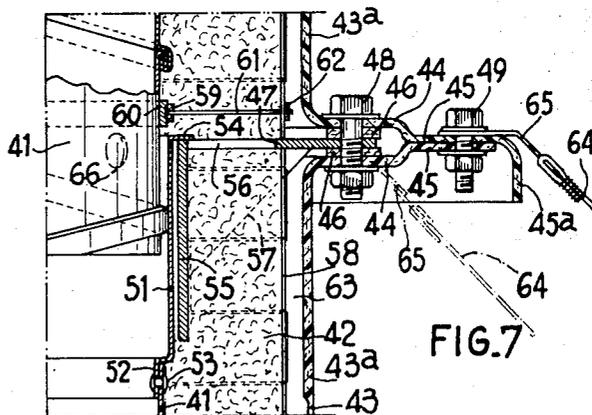
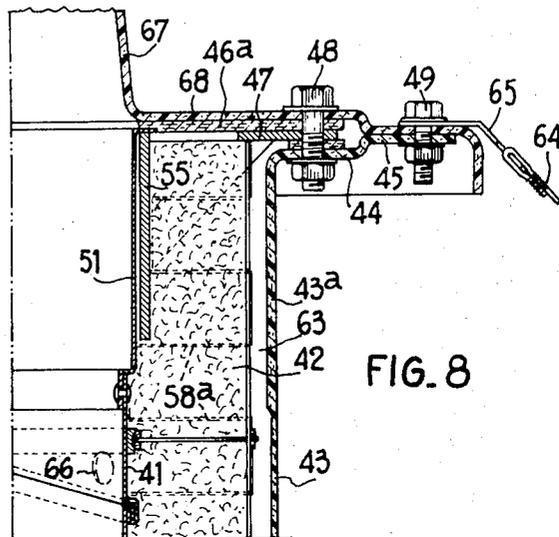
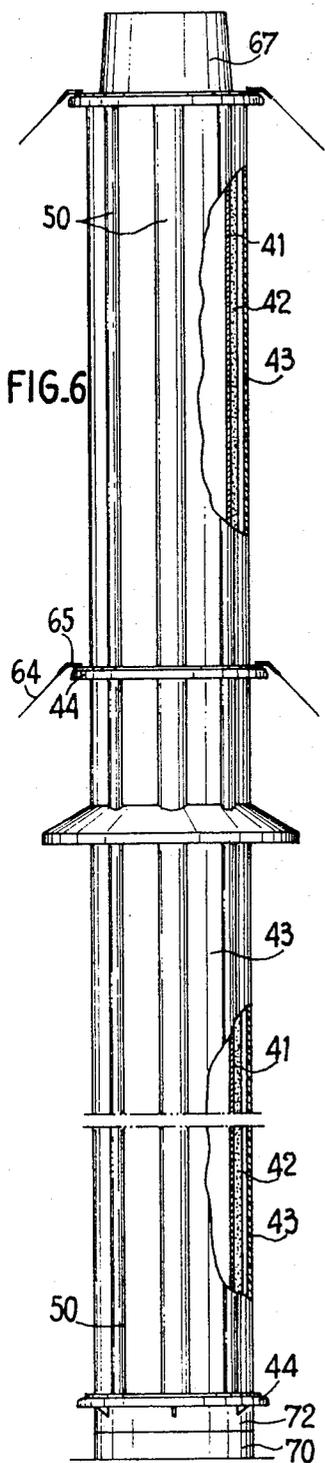


FIG. 5





NON-POLLUTING CHIMNEY

The present invention relates to a non-polluting chimney, that is a chimney which discharges products of combustion at sufficient height, temperature and velocity to avoid noticeably polluting the surrounding atmosphere.

The obtainment of a sufficiently high discharge velocity in the upper part of a chimney depends on maintaining a relatively high temperature of the product being discharged. This relatively high temperature is moreover beneficial since it prevents the production of corrosive products and smoky charcoal. The maintenance of such a temperature requires heat-insulating the chimney so as to avoid an excessive cooling of the product discharged. For this purpose, chimneys have been constructed having a discharge flue which is surrounded by a sleeve of aluminium whose inner surface reflects back onto the flue the heat given off by the latter and thus achieves an efficient heat insulation. However, these chimneys of aluminium are relatively weak and finally become oxidized both externally and internally. Consequently, their reflecting power diminishes and this has for result to reduce the heat insulating effect, increase the heat losses in the chimney and produce an undesirable drop in the temperature of the products discharged.

An object of the present invention is to overcome these drawbacks and provide an improved non-polluting chimney whereby it is possible to satisfy the various requirements of the art in an improved manner.

The invention provides a non-polluting chimney comprising a flue for the products to be discharged, a covering of heat-insulating material surrounding the flue, and a casing of plastics material surrounding the covering.

In a particular embodiment of the invention, the chimney comprises a plurality of superposed sections each of which comprises a heat-insulated flue section and a casing section provided at both ends with assembly flanges and each flue section has a collar at each of its ends, the adjacent flanges of two successive casing sections defining recesses which receive the adjacent collars of the corresponding two flue sections.

In another embodiment of the invention, the chimney comprises a plurality of superposed sections each of which has a heat-insulated flue section and a casing section having at both ends assembly flanges, each flue section being suspended from the upper flange of the corresponding casing section. Thus, when the temperature of the products to be discharged is very high, for example 300°-350°C in the case of products of combustion and with a flue of stainless steel or aluminium, the expansion allowed by such an assembly may be very considerable without resulting in stresses that adversely affect the correct performance of the chimney over a period of time.

Further features and advantages of the invention will be apparent from the ensuing description with reference to the accompanying drawings.

In the drawings:

FIG. 1 is a partial half-sectional and half-elevational view of a chimney according to a first embodiment of the invention;

FIG. 2 is a sectional view taken on line A—A of FIG. 1;

FIG. 3 is a sectional view of the assembly of two sections of the chimney;

FIG. 4 is a vertical sectional view of the assembly of the crowning of the chimney shown in FIG. 1;

FIG. 5 is a plan view of a fastener for the guying of the chimney;

FIG. 6 is an elevational view, with parts cut away, of a chimney according to a second embodiment of the invention, and

FIGS. 7, 8 and 9 are partial diametral sectional views on an enlarged scale of three parts of the chimney shown in FIG. 6 respectively corresponding to the assembly of two chimney sections, the assembly of the crowning with the upper chimney section and the assembly of the lower chimney section with the associated installation.

The non-polluting chimney shown in FIGS. 1-5, comprises a flue 1 for discharging the products of combustion, a covering 2 of heat-insulating material surrounding the flue 1 and a casing 3 of plastics material surrounding the covering 2. The flue 1 is of a material resisting the heat and corrosive attack of the products of combustion to be discharged. This flue may be of metal, in particular steel or stainless steel. In order to compensate the effects of expansions due to heat, the flue 1 may be provided with folded portions in the form of bellows, but it is more advantageous to employ a flue constructed in the known manner by the rolling and seaming of a band of metal in the form of a helix 4, the seaming allowing absorption of the expansions consequent to the heating of the flue 1. If desired, the flue may have a helical reinforcing groove parallel to the helix 4.

Although other heat-insulating means may be employed, the heat-insulating covering 2 is preferably composed of rock wool. The covering is held on the flue 1 by bindings 5 or metal netting.

An annular space 6 is formed between the outer face of the covering 2 and the inner face of the casing 3. The latter is preferably of self-extinguishing stratified polyester and coloured throughout its thickness. The casing 3 can be constructed by the assembly about the covering 2 of two semi-shells 7 and 8 which are welded together by the supply of plastics material at 9 and 10, lap joints 11 and 12 being adhered to these welds. If need be, for the purpose of for example dismantling the chimney, these welds are broken to separate the two semi-shells 7 and 8 which may be re-assembled by a further welding. Longitudinal ribs 13 stiffen the casing 3.

Except as concerns short chimneys, the chimneys according to the invention are constructed by the assembly of a plurality of sections each of which comprises a heat-insulated flue surrounded by a casing of plastics material.

In order to preclude heat losses which would have for effect to reduce the temperature of the products of combustion and render these products corrosive or harmful, not only the flues of these sections are heat-insulated, as explained hereinbefore, but the connection of the flue of one chimney section to the flue of the chimney section immediately above or below is arranged in such manner as to avoid a thermal connection or bridge between the two flues or between these flues and the atmosphere surrounding the chimney. For this purpose, the flues 1, 14 of the superposed chimney sections 15, 16 terminate respectively in identical collars or flanges 17, 18 which are in facing relation. These collars may be welded to the flues. A heat-

insulating seal or gasket 19 is interposed between these collars to prevent any direct contact between the flues 1, 14 or between their collars 17, 18. In the conventional case of circular cylindrical flues, the collars 17, 18 and the seal 19 are in the form of circular rings and a double flange 20 on the seal 19 enables the collars, and consequently the corresponding flues, to be mutually centered. On the side opposed to the seal 19, each collar 17 or 18 receives an annular heat-insulating seal or gasket 21 or 22, each seal being in two semi-circular parts. The seals 19, 21 and 22 may be of an asbestos material.

One chimney section is fixed to a superposed section by means of flanges integral with the casings of the sections, these flanges being held assembled by bolting. The assembly of these flanges ensures the assembly of the aforementioned collars and seals and the connection of the corresponding flues. Thus, the casing 3 of chimney section 15 forms a flange 23 which is fitted on the flange 24 integral with the casing 25 of the chimney section 16. Bolt means 26 assemble the flanges 23 and 24. Each flange 23 or 24 defines a recess 27 or 28 receiving respectively the collar 17 and seal 21 of the section 15 and the collar 18 and seal 22 of the section 16. Annular grooves 29 and 30 serve to center the seals 21 and 22 with respect to the flanges 23 and 24. With the seal 19 in position between the two collars 17 and 18, the tightening of the bolt means 26 clamps the seals 19, 21 and 22 against the collars 16 and 17 and consequently holds these collars assembled and interconnects the corresponding flues 1 and 14.

The extent of the upper flange such as 23 of an assembly of flanges covers or overlaps the lower flange such as 24. This covering or overlapping precludes infiltrations of water between the flanges.

According to the invention, the crowning of the chimney comprises a member 31 of epoxy glass which fits on the upper flange 32 of the upper chimney section 15. The member 31 defines a convergent portion which accelerates the discharge of the products. This member 31 is fixed by bolt means 33 the tightening of which maintains the upper end collar 34 of the flue 1 in position by the clamping of heat-insulating seals 35 and 36 between the member 31 and a recess 36a in the flange 32.

Curved members 37 having apertures 38 and 39 adapted to be engaged on the bolt means such as 26 enable the chimney to be guyed, the corresponding guy being attached at 40.

By way of a modification, in order to compensate possible differences in length, one of the collars carried by a flue section can be fixed to a sleeve which is slidably mounted on the flue and provided with a seal affording a fluidtight sliding assembly.

The collars may also be provided with preferably heat-insulating bosses and apertures receiving these bosses so as to center the facing collars, such as 17 and 18.

The chimney described hereinbefore affords, in addition to other advantages, the advantage of being light and very easily erected. It may be completely dismantled and has an attractive external appearance. No servicing or maintenance of its outer part is required.

The chimney illustrated in FIGS. 6 to 9 comprises an inner flue through which the products to be discharged flow, a covering of heat-insulating material surrounding the flue and a casing of plastics material surrounding

this covering. It comprises a plurality of superposed sections each of which comprises a flue section 41, a heat-insulating material covering section 42 and a casing section 43.

Each casing section 43 is constituted by a cylindrical tube which has at each end, moulded in one piece therewith (which increases its stiffness), an annular assembly flange 44 having an annular peripheral portion 45 parallel to the rest of the flange but axially offset relative thereto in the direction of the neighbouring chimney section. This tube has in its upper and lower end parts 43a an increased wall thickness equal to the thickness of the flanges so as to reinforce the casing assembly region. Each casing section bears against the lower casing section by the direct contact between the annular peripheral portions 45 of their flanges and by the bearing of the remaining parts 44 of these flanges against each other through two annular asbestos seals or gasket 46 between which is interposed a thick metal ring 47 the function of which will be explained hereinafter. Two rows of bolt means 48 and 49 respectively hold the assembly together in the region of the seals 46 and in the region of the peripheral portions 45. The peripheral portion 45 of the lower flange of each casing section has a cylindrical depending flange portion 45a which covers the peripheral portion 45 of the upper flange of the underlying casing section. Outer ribs 50 are provided along generatrices of the casing so as to stiffen the latter.

Each flue 41 consists of a metal band which is wound in the form of a helix and interlocked or seamed externally so as to constitute a cylindrical conduit which is suspended from a cylindrical socket or tube 51 of stainless steel having in its lower part a stepped portion 52 on which the section 41 is fitted and secured by rivets 53 and in its upper part a formed-over outer flange 54. The flange 54 of the socket 51 bears on the upper edge of a cylindrical sleeve 55 of mild steel which has a slightly greater inside diameter and is connected in its upper part to the metal ring 47 by a plurality of radial arms 56 which are in a number which varies with the diameter of the chimney and are reinforced by metal gussets 57 which bear against the sleeve 55. The length of each flue section is such that the lower part of the flue section extends into the support socket 51 of the flue section located thereunder to the extent of about one half of the length of the socket 51. The flue is for example constructed from stainless steel when the products to be discharged are products of the combustion of fuel oil since these products contain a notable amount of SO₂, or from aluminium when the products are the products of combustion of gas, these products containing a notable amount of H₂O.

As concerns the corresponding heat-insulating covering section 42 composed for example of rock wool, it has the shape of a cylindrical ring which is supported externally by a galvanized netting 58 which is closed upon itself and clamped to the heat-insulating covering section by steel wires 58a. The netting 58 is also fixed at various places along its length to the flue section by cylindrical bands of sheet material 59 which surround, with interposition of an asbestos insulation 60, the flue section and carry steel pins 61 which extend through the heat insulation covering and are combined with retaining plates 62 behind the netting 58. Internally, the heat-insulating covering is in contact with the flue 41 throughout its surface.

Thus, the various flue sections are fitted together by socket connections and this avoids the provision of a seal and moreover allows in the socket an axial expansion which is as large as could possibly occur. Further, radial expansions are allowed by a sufficient clearance between the socket 51 and the associated support sleeve 55. The flue sections are therefore assembled with no welding which would tend to set up stresses and the assembly is fully floating.

Further, each flue section and the heat-insulating covering section fixed thereto are entirely and solely supported by the corresponding casing section 43. This renders the whole of the chimney self-supporting by its casing of plastics material so that no servicing or maintenance is required. The casing is preferably of stratified polyester reinforced with fibre glass so as to possess the required strength and stiffness. It is preferably formed in a mould having a mirror-polished surface so as to possess perfectly smooth surfaces.

The action of the bolt means 48 and 49 results, in respect of the inner row of bolt means 48, in an excellent stability of the metal ring 47 clamped between the two flanges which thus constitutes in itself a very strong reinforced flange, and, in respect of the outer row of bolt means 49, in a good seal against entry of rain water, this seal being still further enhanced by the existence of the formed-over peripheral portion 45a on the upper flange.

The heat exchanges are reduced to a minimum since a large empty space 63 is provided between the heat-insulating covering 42 and the outer casing 43 so that the chimney has two insulating layers of which one is constituted by the heat-insulating covering 42 and the other by the air in the space 63. The asbestos seals 46 preclude transmission of heat in the region of the suspension of the flue sections and the creation of cold regions.

The space 63 moreover ensures that the expansion of the flue 41 has no effect on the outer casing and this reduces the number of adjustments required for the guying of the chimney. This guying is achieved by means of guy cables 64 fixed to plates 65 which are mounted on the flanges 44 either above and held fast by the bolt means 49, or below and held fast by the bolt means 48.

The described structure of the chimney enables the exhaust noises, resulting for example from the transmission of the noises of combustion, to be eliminated without loss of pressure in the products to be discharged. This elimination of noises is still further facilitated by the possible provision of apertures 66 in the wall of the flue sections 41, except possibly the lower section in which when the products to be discharged are gases, these gases expand whereas in the following sections they are already less hot.

The perfect heat insulation of the chimney imparts to the products to be discharged a particularly high upward velocity which creates throughout the height of the chimney a depression in the gas flue 41 of the order of -3 to -15 mm of water; thus, owing to this permanent depression, no escape of product to the exterior is possible. Even an accidental increase in pressure, for example caused by the installation at the upstream end of the chimney, could not result in an escape of product since the outer casing 43 is strictly fluidtight in the region of the assembly of the flanges, owing to the perfectly smooth surface condition of these flanges which

are produced by a moulding operation, as mentioned hereinbefore.

The surface condition of the gas flue precludes attachment of soot and renders chimney sweeping unnecessary. The assembly of the sections of the chimney by means of floating socket connections allows an extremely easy erection in addition to freedom of expansion.

The chimney has a very high resistance to corrosion and high temperatures.

However, the essential advantage afforded by the structure described resulting from an excellent heat insulation is, as in the case of the first embodiment described, the avoidance of formation of smoky charcoal which is constituted by a complex of carbon and nascent H_2SO_4 and is in the form of black fluff which oxidizes the metal surfaces onto which it falls.

The nature of the gas flue (for example stainless steel or aluminum) and the perfect heat insulation enable the chimney to withstand gas temperatures of the order of 500°C.

The assembly of the crowning of the chimney with the upper section and the assembly of the lower section with the chimney support are achieved with slight modifications in the assembly of the chimney section with each other.

The assembly of the crowning member 67, which is composed of epoxy resin reinforced with fibre glass, has a centre portion having a convergent shape so as to accelerate the flow of the discharged products and a wide flange 68 around the centre portion which has on its periphery the same shape as the flange 44 of the casing sections, the fixing being achieved in the same manner by means of two rows of bolt means 48 and 49 and with interposition of asbestos rings except that the ring 46a located above the ring 47 supporting the upper flue section is much larger so as to overlap entirely this ring, the connecting arms of the ring 47 and the formed-over outer flange of the flue section.

The lower section of the chimney bears against a connecting member constituted by an annular base 69 which is fixed on the support 70 for the chimney (for example smoke-box of a boiler, base of metal or masonry, flue or raised portion) which carries two cylindrical sleeves 71 and 72 of which the first fits with a slight clearance inside the lower flue section and the second surrounds the heat-insulating covering and the corresponding netting and carries in its upper part a steel annular flange 73 on which the lower flange of the lower casing section bears, these two flanges being assembled by two rows of bolt means 48 and 49 in the same manner as the other flanges but with the interposition of a similar seal 46 and another annular seal of asbestos 46b which extends radially to the formed-over peripheral portion 45a of the casing.

As in the entrance of the chimney the pressure is usually neutral or is a few millimetres, the arrangement of the flue 41 outside the sleeve 71 precludes the passage of gases into the rock wool which would deteriorate the latter. This arrangement also facilitates directing the rain water which may flow along the interior of the flue in the direction of the annular space between the two sleeves and an outer drain pipe 74.

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

1. A non-polluting chimney comprising a plurality of superposed sections, each section comprising in combi-

nation a flue section for the products to be discharged, a covering section of heat-insulating material surrounding the flue section, a casing section of plastics material surrounding the covering section, each casing section having an upper flange adjacent the upper end of the casing section and a lower flange adjacent the lower end of the casing section for assembling the chimney sections to each other, means for interconnecting the flanges of adjacent casing sections, and means for suspending each flue section from the upper flange of the corresponding casing section.

2. A chimney as claimed in claim 1, wherein in respect of two successive chimney sections, the lower flange of the upper casing section has a depending flange portion which surrounds the upper flange of the lower casing section.

3. A chimney as claimed in claim 1, comprising means securing each heat-insulating covering section to the corresponding flue section, an empty space being defined between said heat-insulating covering section and the corresponding casing section.

4. A chimney as claimed in claim 1, further comprising a base structure having an outer sleeve, an inner sleeve from which the products to be discharged issue, a flange integral with the outer sleeve, and means for securing the casing section of the lowermost of said chimney sections to the flange integral with said outer sleeve,

said inner sleeve upwardly extending into, and being in close proximity to, the flue section of said lowermost chimney section.

5. A non-polluting chimney comprising a plurality of superposed sections, each section comprising in combination a flue section for the products to be discharged, a covering section of heat-insulating material surrounding the flue section, a casing section of plastics material surrounding the covering section, each casing section having an upper flange adjacent the upper end of the casing section and a lower flange adjacent the lower

end of the casing section for assembling the chimney sections to each other, means for interconnecting the flanges of adjacent casing sections, and means for suspending each flue section from the upper flange of the corresponding casing section, said means comprising a structure in fixed relation to said upper flange and a collar in fixed relation to said flue section and bearing on said structure.

6. A chimney as claimed in claim 5, wherein said structure comprises an inner cylindrical sleeve, an outer ring in fixed relation to said upper flange, and radially-extending arms interconnecting the inner cylindrical sleeve and outer ring.

7. A chimney as claimed in claim 5, wherein said structure has a portion which is interposed between said upper flange and the lower flange of the casing section located thereabove, clamping means clamping said structure portion between said upper and lower flanges.

8. A chimney as claimed in claim 7, comprising seals of heat-insulating material interposed between said portion of said structure and the flanges between which said portion is clamped.

9. A chimney as claimed in claim 5, comprising a cylindrical socket having an upper end portion integral with said collar and a lower end portion in fixed relation to the flue section.

10. A chimney as claimed in claim 9, wherein in respect of two successive chimney sections, the upper flue section is in fitting relation to the socket of the lower flue section.

11. A non-polluting chimney comprising a flue for the products to be discharged, a covering of heat-insulating material surrounding the flue and a casing of plastics material surrounding the covering, the casing being composed of stratified polyester reinforced with fibre glass and being self-extinguishable.

* * * * *

40

45

50

55

60

65