Feb. 23, 1965 A. KINKEAD ETAL 3,170,544

PREFABRICATED METAL CHIMNEY

Filed March 1, 1962 2 Sheets-Sheet 1

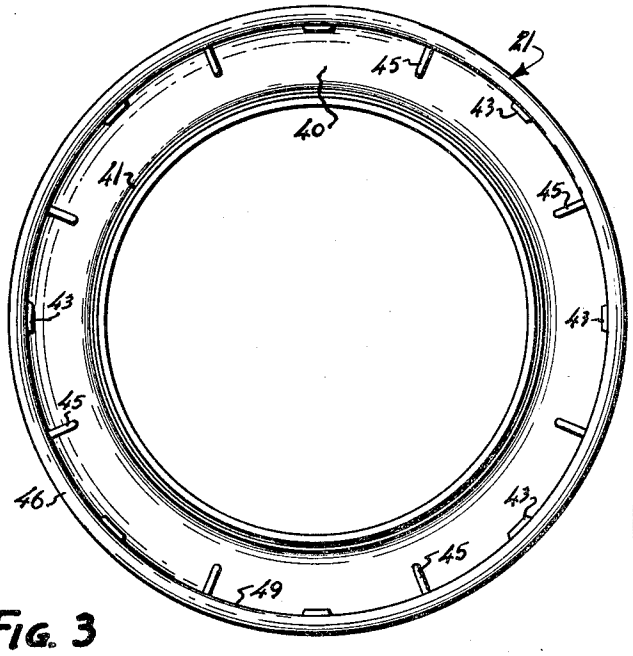


FIG. 3

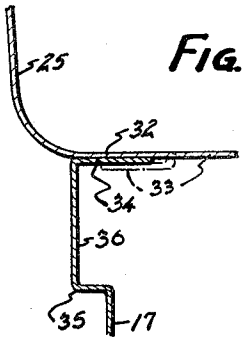


FIG. 8

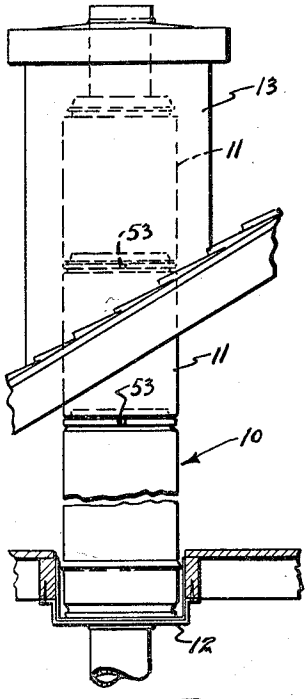
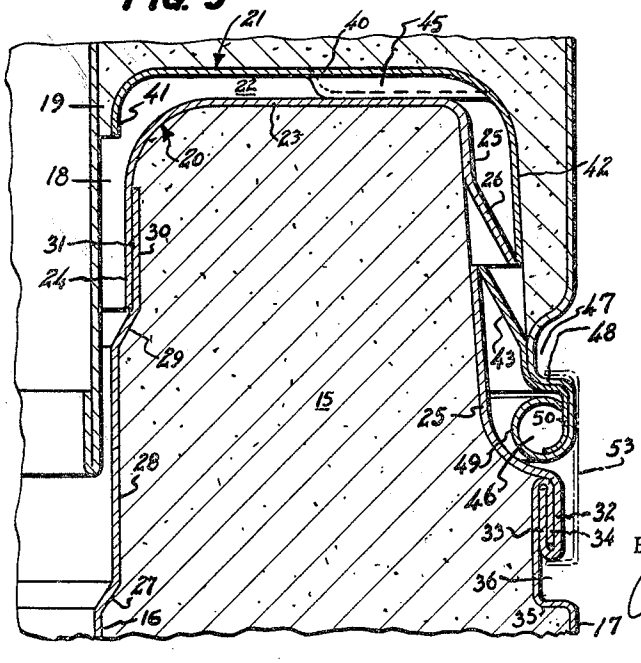


FIG. 1

FIG. 5



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Feb. 23, 1965 A. KINKEAD ETAL 3,170,544

PREFABRICATED METAL CHIMNEY

Filed March 1, 1962 2 Sheets-Sheet 2

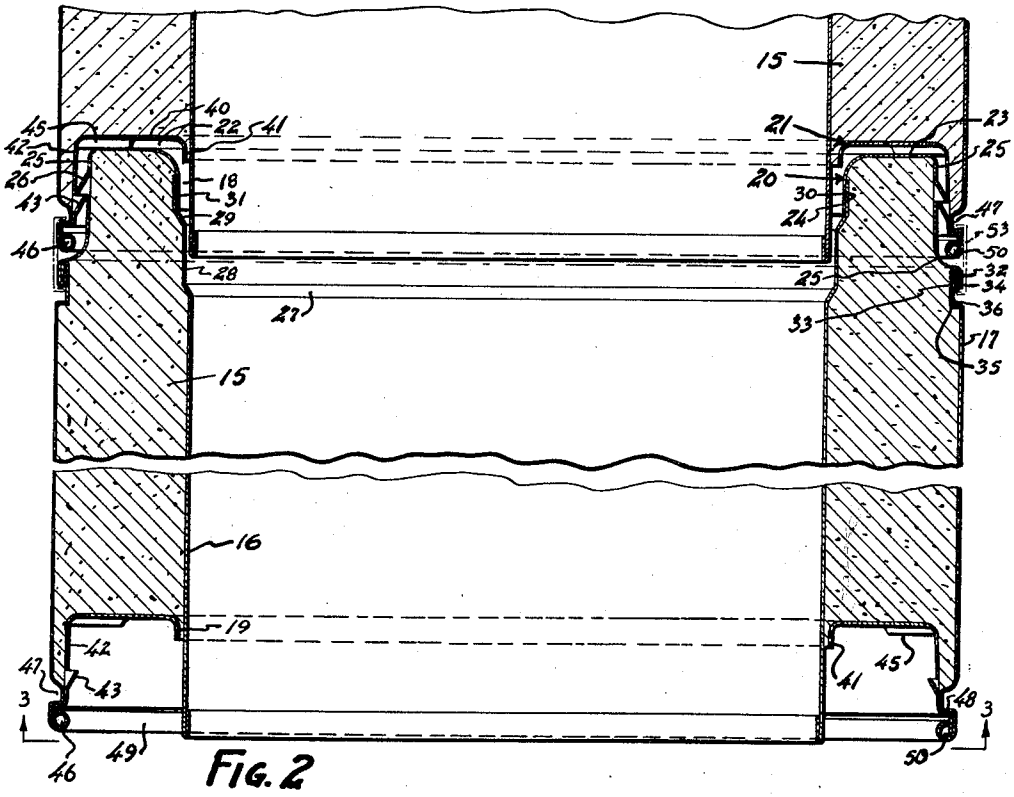


FIG. 2

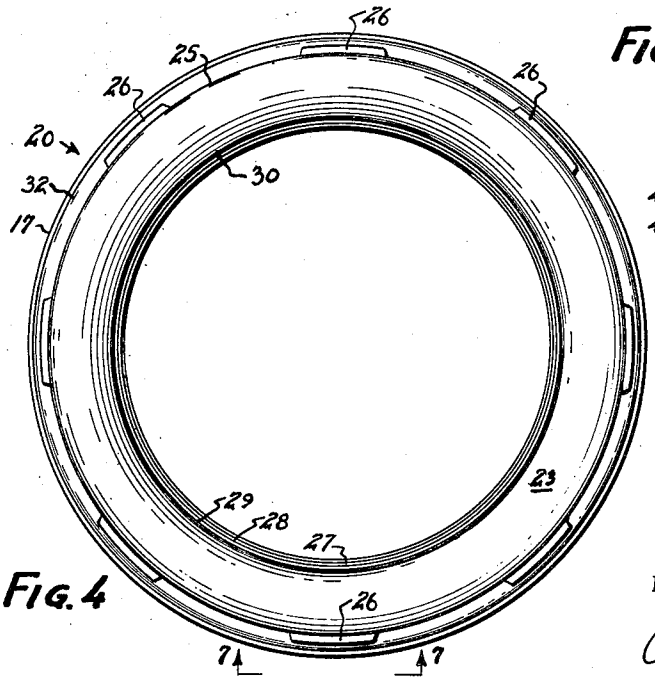


FIG. 4

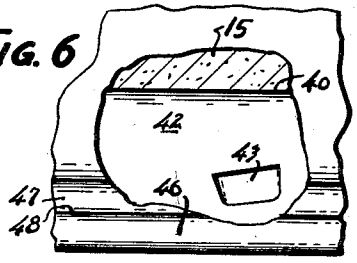


FIG. 6

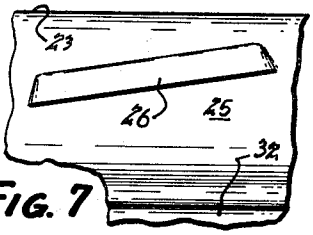


FIG. 7

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PREFABRICATED METAL CHIMNEY

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8 Claims. (Cl. 189—27)

This invention relates to improvements in prefabricated metal chimneys of the type that can be manufactured in separate sections and later connected together on the job site.

Prefabricated metal chimneys offer certain inherent advantages, one important advantage being that they can be used with all types of fuel and with all types of fuel burning home appliances. In general, such metal chimneys are double walled structures prefabricated in separate sections having a male and a female coupler end so that they are connectable to other sections of a similar construction to form the completed chimney of the desired size at a particular location. They thus eliminate the need for the old conventional masonry type chimneys that are not only time-consuming and expensive to construct, but also inefficient in their operation.

A primary object of the present invention is to provide an improved prefabricated metal chimney construction that overcomes some of the structural and operational problems of prior art chimney devices and which provides increased performance characterisitcs.

One serious problem with prefabricated metal chimneys prior to the present invention was that of compensating for the expansion of the inner wall member which normally attains a much higher temperature than the outer wall member to which it is attached. In chimney designs heretofore utilized the inner wall was restricted at both ends by its connection to the outer wall so when the inner wall expanded due to its higher temperature it caused a distortion of the male and female coupling members at the ends of the chimney section. This distortion reduced the annular air passages between adjoining sections which are important in eliminating the transfer of heat axially along the chimney and in dissipating heat therefrom. Also, in prior art double-walled metal chimney constructions, the expansion of the inner wall created the familiar and annoying "oil can" expansion noises that are usually characteristic of heated sheet metal conduits. The present invention eliminates this effect and solves the entire inner wall expansion problem by means of a novel arrangement of elements wherein the inner wall is well supported but free to move relative to the outer wall so that its expansion does not affect the male and female couplers.

Another important factor in this novel construction is that, although the inner wall is free to expand at one end the overall double wall construction is unusually strong and the end couplers include means for retaining compacted insulation materials between the inner and outer walls.

Another object of the invention is to provide an improved coupling construction for prefabricated metal chimney sections that will enable the sections to be connected together without jamming them in a cocked or misaligned position relative to each other. The present invention eliminates the problems of the screw-type connection heretofore used and provides instead a novel coupling construction that enables the prefabricated metal pipe sections to be joined together in perfect alignment by an axial movement only of the pipe sections. Also, means are provided to assure a uniform annular space between adjoining sections and a novel locking means provides a positive snap-on lock between sections as they are moved together axially. Yet, the sections can be

disassembled easily, if desired by a relatively small rotational movement between the sections.

Another advantage of the novel double walled chimney construction afforded by the present invention is that it provides for the escape of moisture from within the space between the inner wall and the outer wall. Without this feature any moisture vapor that might be trapped in the insulation material between the inner and outer wall members could not otherwise be released.

Still another object of the present invention is to provide a novel prefabricated metal chimney construction that enables the space between the inner and outer walls of the chimney section to be conveniently filled with insulating material. This is an important factor because in order for the insulation material to be effective it must be compacted under a substantial pressure. Thus, at least one coupler end must be able to withstand increased stresses during the filling process while the other coupler end must be readily installable and strong in order to retain the insulation material after it has been inserted.

Other objects, advantages and features of the present invention will become apparent from the following description presented in accordance with 35 USC 112.

In the drawings:

FIG. 1 is a view in elevation of a prefabricated chimney embodying the principles of the present invention as it appears in a typical installation;

FIG. 2 is an enlarged view in elevation and in section showing a connected pair of chimney sections according to the invention;

FIG. 3 is a slightly reduced bottom end view of the chimney section of FIG. 2, taken along the line 3—3 and showing the female end of a chimney section according to the invention;

FIG. 4 is a slightly reduced top plan view of the male end of a chimney section shown in FIG. 2;

FIG. 5 is a greatly enlarged fragmentary view in section showing in detail the male and female couplers of two connected chimney sections of the present invention;

FIG. 6 is an enlarged fragmentary view in elevation showing a portion of a female coupler and a locking tab;

FIG. 7 is an enlarged fragmentary view in elevation showing a portion of a male coupler and one of its locking tabs;

FIG. 8 is a fragmentary view in section showing the male coupler before being bent to form the joint with the outer wall member as shown in FIG. 5.

In the drawings, FIG. 1 shows a typical installation for a prefabricated chimney 10 comprised of a plurality of connected chimney pipe sections 11, embodying the principles of the invention. The sections 11 are constructed in a novel manner so that they can be conveniently and rapidly joined together to constitute the main height of the chimney. The base of the chimney 10 may be supported by a suitable chimney-support bucket assembly 12, and at its upper end, the chimney 10 may be equipped with a prefabricated housing 13. Such a housing is described in detail in our application Serial No. 98,928, filed March 28, 1961. The bucket assembly 12 and the housing 13 are shown as being typical accessories for prefabricated metal chimneys but neither is intended to limit the scope of the present invention.

The prefabricated chimney sections 11 have a novel double wall construction providing an annular space 14 for retaining a high temperature insulating fill 15. Insulating material such as a mineral fiber like rock wool can be used and it must be packed tightly to prevent any draft through the space 14. A novel and particularly effective insulation material for use in prefabrication metal chimneys is described in co-pending application Serial No. 229,790 filed November 8, 1962.

Each prefabricated chimney section 11 has an inner tube or pipe 16 usually made from relatively thin-gauged stainless steel (Underwriter's Laboratories, Inc. specifies that the minimum thickness here being 0.012 inch), and an outer tube or pipe 17, usually made of thicker galvanized steel, preferably 24 gauge. In a typical instance, the inner diameter of the inner pipe 16, which is the flue passage, is 10 inches and the outer diameter of the outer pipe 17 is 14 inches. The annular space 14 which is filled with the insulating material 15 is thus approximately two inches thick.

At the top of each chimney section 11 is a male coupler 18 and at the bottom of each section is a female coupler 19. The main element forming the male coupler 18 is an annular metal cup 20, and a similar cup 21 is the main element of the female coupler 19. As FIG. 2 shows, the cup 21 is substantially wider and deeper than the cup 20, and when two adjacent sections 11 are coupled together an annular air space 22 is formed between the cups 20 and 21.

As shown in detail in FIG. 5, the male cup 20 has a top plate portion 23, an inner rim 24, and a tapered but nearly cylindrical outer connecting wall 25. A plurality of circumferentially spaced apart tabs 26 extend outwardly, e.g. 30°, and adjoining chimney sections 11 together. Though the ends of the tabs 26 lie essentially in a plane that passes through the outer wall 25 perpendicular to the pipe axis, they are also preferably inclined slightly (e.g. 10°) on the wall 25 in line with a right hand helix pattern.

The inner pipe 16 is stepped out at a shoulder 27 (see FIG. 5) to provide a wider-diameter portion 28 that is wider by an amount somewhat greater than the thickness of the inner pipe 16. The portion 28 leads to another outstepped shoulder 29 forming an outer end portion 30 which fits the inner rim 24 of the male cup 20. The inner rim 24 of the male cup member 20 is rigidly attached to the outer end portion 30 of the inner wall 16 by means of a series of spot welds 31 or rivet fastenings spaced apart circumferentially along the inner rim 24.

Before installation (see FIG. 8) the male cup 20 has a flat radial flange 32 and the outer rim portion 33 of this flange 32 is curled over during manufacture of the section 11 to join it to the outer wall 17 by means of a Pittsburgh joint 34. The outer wall 17 extends downward from the inside of the joint 34 for a short distance and then extends radially outward at a shoulder 35 thereby forming an annular slot 36 just below the joint 34. It is apparent, therefore, that the male cup 20 is rigidly attached to both the inner pipe 16 and the outer pipe 17.

The female cup 21 has a central annular plate portion 40, a down turned inner rim 41, and a downwardly extending outer rim 42. The outer rim 42 is tapered slightly, though nearly cylindrical, and has a plurality of circumferentially spaced tab members 43 that are similar to and which cooperate with the tabs 26 on the male coupler 18 to lock the couplers 18 and 19 together. The tab members 43 extend inwardly and upwardly from the outer rim 42 and, as shown in FIGS. 6 and 7, they are substantially shorter in length than the tab members 26. Also, the tabs 43 lie in a plane perpendicular to the axis of the section 11, and they are preferably inclined in a helix pattern similar to that of the tabs 26. As shown in FIG. 5, when the male coupler 18 is axially seated in the female coupler 19, the tabs 26 of the male coupler overlap and extend above the tabs 43 of the female coupler. To provide a means for limiting the amount of insertion of the male coupler 18, in the female coupler 19, a series of radially extending depressions 45 are formed and spaced apart circumferentially in an annular plate portion 40 of the female cup 21. The depressions 45 are of equal depth and they serve to maintain the uniform annular space 22 between each pair of adjacent sections 11 that is essential to the dissipation of heat from the chimney 10.

The outer rim of the female cup 21 is connected to the lower end of the outer pipe 17 by a curled end connection 46. Near its lower end the outer pipe 17 extends inwardly to form an annular groove 47 and directly below the groove 47 it extends outwardly to form a shoulder 48. Then it curls inwardly to form a curled back end portion 49. The lower end portion 50 of the outer rim 42 of the female cup 21 is formed to lie adjacent to and inside the annular shoulder 48 and the curled back end portion 49, thereby securing the female cup 21 to the outer wall 17 at this curled back joint 46.

The inner rim 41 of the female cup 21 is not connected to the inner wall 16 but terminates closely adjacent to it, thereby closing the annular space 14 at the lower female coupler end 19 of the section 11 and retaining the insulation material 15. A clearance 51 is maintained between the inner rim 41 and the inner wall 16 so that it is free to move axially during expansion and contraction. As shown in FIG. 5, when the inner wall 16 expands, it is free to move axially along the outstepped portion 28 above the shoulder 27 of an adjoining chimney section 11 so that a smooth uniform diameter of the chimney 10 can be maintained at the joints between sections.

The aforesaid novel arrangement of elements forming the pipe sections 11 solves important problems and provides several advantages over double walled chimney structures heretofore devised. The inner wall 16 being free at one end can expand and contract without affecting the male or female couplers 18 and 19. Calculations indicate that expansion of about ⅛ inch per lineal foot is needed to allow for axial expansion of the inner pipe. With its lower end free to expand in this manner there is no tendency for the inner wall 16 to push upward against the male cup 20. This free floating arrangement for the inner pipe wall eliminates any distortion of the chimney 10 at its end couplers 18 or 19 or any need for the coupling joint to flex during heating. The end couplers can thus be made stronger and more rigid. Moreover, by this novel arrangement, which allows the inner wall 16 to move freely during expansion, the present invention also eliminates the familiar noisy "oil can effects" that heretofore plagued prefabricated metal chimneys.

Another important feature of the present invention is the coupling action provided by the outwardly circumferentially spaced tabs 26 on the male coupler 20 which cooperate with inwardly and upwardly extending tabs 43 on the female coupler 21 to lock adjoining pipe sections 11 together. The tabs 26 on the male coupler 21 may be formed easily by providing circumferentially spaced apart U-shaped cuts in the outer wall 25 which are then bent outwardly. As formed, the tabs 26 are thus resiliently yieldable. When a pair of adjoining pipe sections 11 are connected, the male coupler 18 is merely moved axially into the female coupler 19 until the male cup 20 abuts against the circumferentially spaced apart depressions or blisters 45 on the inside of the female cup 21. At this point, the outwardly and inwardly extending tabs 26 and 43 of the male and female couplers 18 and 19 barely overlap (see FIG. 5). If the tabs 26 and 43 are axially aligned when the two pipe sections 11 are engaged, they will initially bear against each other and yield inwardly as the sections are moved together, and as the top plate 23 of the male cup 20 engages the spacing blisters 45, they will then snap into the overlapping locked position. If the tabs 26 and 43 do not happen to be aligned when the sections are axially moved together, a small twist of the adjoining section after the male coupler 18 is fully inserted, of not more than 45 degrees will move them into the overlapping locking position shown in FIG. 5.

Although, it is generally not required for most installations of the chimney 10, in some instances an additional strengthening means may be provided by a band 53 having a channel shaped cross section may be extended around each joint. The flanges of the band extend into the

groove 47 above the curled end connection 46 of the female coupler 19 and into the groove 36 below the joint 34 on the male coupler 18 on adjoining sections 11. The ends of the band 53 are then drawn together in the well known manner by a bolt and nut connected through a pair of end flanges. Such an extra strengthening means would be desirable where the chimney is to be suspended, thus receiving more support from above than below.

When the chimney sections 11 are connected, their outer walls shed moisture and no water can flow from outside into the inner pipe 16 or even get in between the couplers 18 and 19. The snugness of the inner pipe section 16 in the section 11 assures retention of all the flue gases inside the pipe 16.

The locking tabs 26 and 43 are not large enough to allow any of the installation material 15 to escape from the space 14 between the inner and outer pipe sections 16 and 17, and actually they provide a ventilating means for releasing any moisture trapped in the insulation material.

From the foregoing, it is apparent that the present invention comprises a highly improved prefabricated chimney structure that provides new and unobvious results both in versatility and performance.

To those skilled in the art to which this invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the spirit and scope of the invention. The disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

We claim:

1. A prefabricated double walled chimney section adapted to be coupled to a similar section to form a chimney column, said section comprising:

(*a*) an inner pipe;
(*b*) an outer pipe;
(*c*) insulation between said pipes;
(*d*) a male coupler on the upper end, and a female coupler on the lower end of said section, said couplers comprising
(*e*) annular radial plates with inner and outer generally axially extending flanges connected to said inner and outer pipes for retaining the spacing between them;
(*f*) said inner and outer flanges of said male coupler being rigidly connected to the upper ends of said inner and outer pipes, respectively;
(*g*) said outer pipe being rigidly connected to said female coupler outer flange at its lower end, and said inner pipe extending closely adjacent near its lower end to said female coupler inner flange and being movable relative thereto, said inner pipes of succeeding sections extending down into the inner pipe of the next lower section and below said plate;
(*h*) means for spacing said plates of adjacent couplers apart by a predetermined amount to provide a fixed annular air spaced between adjoining sections;
(*i*) and means on said male and female couplers for axially locking said section to an adjoining like section.

2. The device as described in claim 1 wherein said means for spacing said plates apart comprises a plurality of circumferentially spaced apart depressions in said radial plate of said female coupler.

3. The device as described in claim 2 wherein said means for locking said sections together comprises a plurality of circumferentially spaced apart tabs extending downwardly and outwardly from said outer flange of said male coupler, and a plurality of tabs extending inwardly and upwardly from the outer flange of said female coupler, said tabs being resiliently yieldable when engaged during the axial connection of adjacent pipe sections and are so spaced axially on said couplers so that they can snap back into an overlapping locking position when said male coupler is abutted against said depression in an adjoining like chimney section.

4. The device as described in claim 3 wherein said tabs are inclined a predetermined amount with a plane perpendicular to the axis of said chimney section.

5. The device as described in claim 4 wherein said tabs are aligned along helical path with respect to the axis of said section and wherein said tabs on said male coupler are longer than the tabs on said female coupler.

6. A prefabricated double walled chimney section adapted to be coupled to a similar section to form a chimney column, said section comprising:

(*a*) an inner pipe;
(*b*) an outer pipe;
(*c*) insulation between said pipes;
(*d*) a male coupler on the upper end, and a female coupler on the lower end of said section, said couplers comprising
(*e*) annular radial plates with inner and outer generally axially extending flanges connected to said inner and outer pipes for retaining the spacing between them;
(*f*) said inner flange of said male coupler overlapping and rigidly fastened to an outstepped upper end portion of said inner pipe and said outer flange of said male coupler being rigidly connected by means of a Pittsburgh joint to the upper end of said outer pipes, respectively;
(*g*) said outer pipe being rigidly connected by means of a curled around joint to said outer flange of said female coupler at its lower end, and said inner pipe extending closely adjacent near its lower end to and movable relative said inner flange of said female coupler, said inner pipes of succeeding sections extending down into the inner pipe of the next lower section and below said plate;
(*h*) means on said radial plates for spacing the plates of adjacent couplers apart to provide a fixed annular air space between adjoining sections;
(*i*) and means on said male and female couplers for axially locking said adjoining sections together.

7. The device as described in claim 6 wherein said means for spacing the adjacent plates of adjoining sections apart comprises a plurality of circumferentially spaced apart depressions in said radial plate of said female coupler.

8. The device as described in claim 6 wherein said means for locking said sections together comprises a plurality of circumferentially spaced apart tabs extending downwardly and outwardly from said outer flange of said male coupler, and a plurality of tabs extending inwardly and upwardly from the outer flange of said female coupler, said tabs being resiliently yieldable when engaged during the axial connection of adjacent pipe sections and are so spaced axially on said couplers so that they can snap back into an overlapping locking position when said male coupler is abutted against said depression in an adjoining like chimney section.

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