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H. A. FABER

2,164,394

COMPENSATING-DUCT SYSTEM

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Fig. 1.

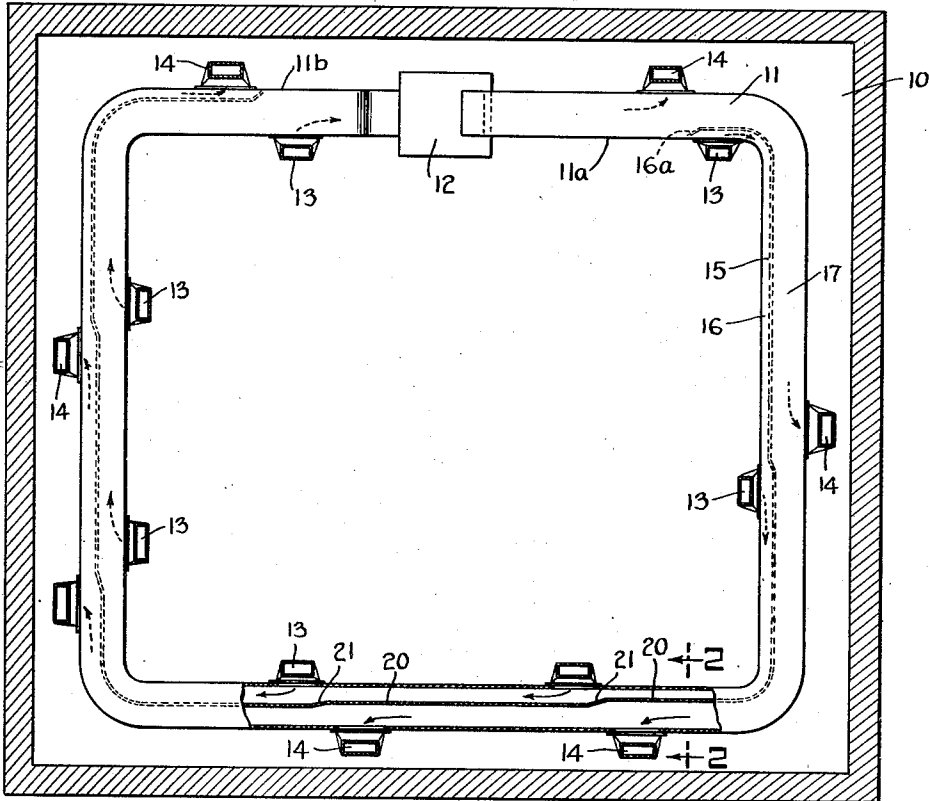


Fig. 3.

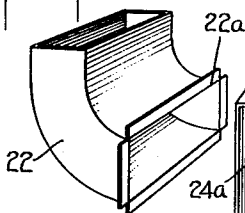


Fig. 2.

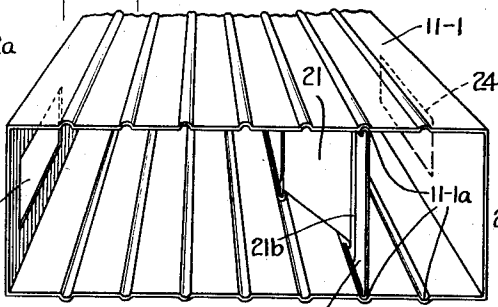


Fig. 4.

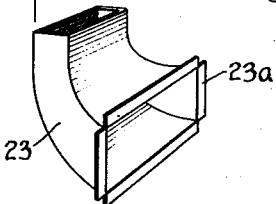
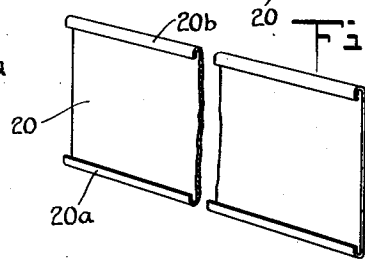
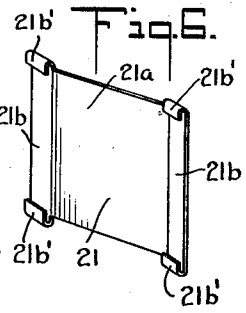


Fig. 6.



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COMPENSATING-DUCT SYSTEM

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10 Claims. (Cl. 98—33)

My invention relates to duct systems, and particularly to such systems wherein a main flow conduit provides for intake and discharge of fluid at spaced locations along its length.

5 An outstanding feature of the invention is the provision for compensation volumetrically, within the confines of the main flow conduit, for inflowing and outflowing fluid. Advantageously, the structure is so arranged that volumetric compensation for inflowing fluid automatically compensates volumetrically for outflowing fluid, thus affording substantially uniform velocity of flow, within the conduit, of inflowing and outflowing fluid.

15 A further feature of the invention is the provision of standard main flow conduit structures readily adaptable in compensating-flow-passage characteristics to the requirements of a variety of types of duct systems.

20 In attaining the advantageous features of my invention, I preferably provide a main flow conduit having a partition along its length dividing the conduit into an outflow passage and an inflow passage. The spacing of the partition from one wall of the conduit may increase in gradations toward the opposite wall of the conduit to provide inflow and outflow passages of sequentially changing voluminal capacity. Inflow ducts may communicate with the inflow passage at spaced locations along its length coordinating with the gradations thereof, and outflow ducts may communicate with the outflow passage at spaced locations along its length coordinating with the gradations thereof.

35 My invention assumes a particularly advantageous form when incorporated with air conditioning systems of the "loop" type wherein a main flow conduit of substantially uniform cross section extends around an endless path which is interrupted by an air conditioning unit, supplied for conditioning air, taken from various locations in the enclosure by ducts, and for projecting the conditioned air for distribution, through ducts, to various locations in the enclosure.

45 The inflow ducts for air to be conditioned are spaced apart around one peripheral wall of the main flow conduit, and the outflow ducts for the conditioned air are spaced apart around the opposite peripheral wall thereof. From an inflow wall location between the first air inflow duct and the air conditioning means, a partition extends outwardly to form a dead end, and then lengthwise with the conduit, providing a passage section of preferably a uniform cross section which is determined in extent by the voluminal

requirements of the air introduced by the one inflow duct. Adjacent the location of the second inflow duct, the spacing of the partition from the inflow-wall is increased an amount sufficient to compensate for the additional air introduced into the passage. At the succeeding locations of inflow ducts, the spacings of the partition from the inflow-wall successively increase to compensate for the air added by each succeeding inflow duct. The partition terminates against the outflow-wall of the main flow conduit at a location between the air conditioning means and the proximate outflow duct at the side thereof opposite to that at which the partition commences. Thus, by provision of a gradated inflow passage compensating for inflow of to-be-conditioned-air to the main flow conduit, a coextensive outflow passage, graduated to compensate for outflow of conditioned air from the main flow conduit, is had coincidentally.

The structural characteristics of the main flow conduit, the partition, and the connecting inflow and outflow ducts are such as to afford ready adaptability to a variety of specific installations and to adjustment thereafter in accord with changing requirements of such installations.

In the drawing which illustrates a preferred embodiment of the invention:—

Fig. 1 represents a sectional plan view of an enclosure equipped with a duct system pursuant to the invention; the main flow conduit of the duct system is illustrated in plan and partly in horizontal section.

Fig. 2 represents a perspective view of an enlarged fragment of the main flow conduit taken sectionally at the line 2—2, Fig. 1; duct couplings are omitted.

Fig. 3 is an enlarged detail view in perspective illustrating one type of duct coupling for association with the main flow conduit.

Fig. 4 is an enlarged detail view in perspective illustrating another type of duct coupling for association with the main flow conduit.

Fig. 5 is an enlarged detail view in perspective illustrating a lengthwise partition element for use with the main flow conduit, the intermediate portion of the partition element being broken out to conserve space; and

Fig. 6 is an enlarged detail view in perspective illustrating a crosswise partition element for association with lengthwise partition elements of Fig. 5.

The drawing illustrates the present invention applied specifically to air conditioning systems of the duct type.

Accordingly, the numeral 10, Fig. 1, indicates the walls of an enclosure representing a lower floor of a dwelling house, factory, etc., or a chamber in a building in which it is desirable to carry conditioned air to various locations and to return the used air for recirculation through an air conditioning unit.

In the present instance, a main flow conduit 11, of substantially uniform cross section throughout, follows an endless path from an interposed air conditioning unit 12 back thereto to form a "loop" system. The exact configuration of the path followed in a given instance will be determined by the requirements of the particular installation. In most installations the main flow conduit advantageously extends adjacent the outer walls of the enclosure to be air conditioned.

At spaced locations around the inner peripheral wall of the conduit 11, and communicating with its interior, are inflow ducts 13 their spacing with respect to one another being determined by the extent of air conditioning required. At spaced locations around the outer peripheral wall of the conduit 11, and communicating with its interior, are outflow ducts 14, their spacing being determined in general by the spacing of the inflow ducts, and their placement with respect to the conduit being correlated with the placement of the inflow ducts, i. e., in substantially opposing alignment therewith transversely of, but along the length of, the conduit.

Within the main flow conduit 11 a partition 15 divides the interior into an inflow passage 16 and an outflow passage 17. The spacing of the partition 15 from the walls of the conduit is graduated preferably in step formation along the greater part of the length of the conduit for compensating volumetrically for inflow and outflow of air to and from the conduit.

In providing the inflow and outflow passages 16 and 17, respectively, the partition 15 preferably commences against the inflow wall of the conduit, designated 11a, at a location between the first inflow duct 13 and the air conditioning unit 12, and extends generally transversely of the conduit a distance determining the spacing of the first section of the partition from the conduit walls. The commencement portion of the partition forms the dead end 16a for the passage 15. Thereafter, the partition continues lengthwise with the conduit, and substantially parallel with the walls thereof, to provide the first inflow passage gradation of a substantially uniform cross section throughout. Proximate the location of the next inflow duct 13, the partition 15 turns toward the outflow wall—designated 11b—of the conduit, and extends generally transversely of the conduit a distance which suitably enlarges the inflow passage to compensate for the additional volume of air supplied thereto by the stated next inflow duct 13. The partition 15 thereafter continues substantially parallel to the walls of the conduit to form the next gradation of the inflow passage. Proximate succeeding locations of inflow ducts, along the length of the conduit, the partition 15 turns and extends toward the outflow wall a suitable distance, thereafter continuing substantially parallel with the walls of the conduit, as aforescribed, for providing succeeding gradations of the inflow passage.

In this manner the partition 15 extends across the width of main flow conduit 11 in gradations along the length thereof, and ends against the outflow wall 11b of the conduit 11 at a location

between the last outflow duct 14 and the air conditioning means 12, at the side of the latter opposite to that at which the partition commences.

It will be readily noted that the partition 15, while providing for volumetric compensation of air flowing into the main flow conduit 11 through inflow ducts 13, coincidentally provides for compensation, volumetrically, of conditioned air flow from the main flow conduit 11 through outflow ducts 14, that portion of the conduit not comprehended by the inflow passage 16 forming the outflow passage 17.

The inflow ducts 13 lead to various locations throughout the building, or other suitable enclosure, and return used, spent air for recirculation through the main-flow-conduit 11, including passage through the air conditioning unit 12. Such air, discharged from air conditioning unit 12 in fully conditioned status, is distributed to various locations throughout the building, or other suitable enclosure, by the outflow ducts 14. Because of the compensating character of the inflow and outflow passages 16 and 17, respectively, air flow within the conduit will be substantially uniform in speed.

In rendering a so-called "standard" embodiment of the invention applicable to a variety of specific installations, structure capable of simple adaptation to each is provided.

Accordingly, the main flow conduit 11 is made up of section lengths of preferably sheet metal piping, advantageously of rectangular cross section. A fragmentary portion of one such piping section is illustrated in Fig. 2, being designated 11-1. Holding means are provided along the length of each piping section for receiving and retaining partition elements. In the present instance, the top and bottom walls of the piping section 11-1 are longitudinally corrugated, i. e. grooved in coordinating opposition, the individual corrugations or grooves 11-1a being closely spaced relative to the width of the piping.

Adapted for insertion between opposingly aligned grooves 11-1a of the top and bottom walls of the piping, are provided lengthwise partition elements 20, see particularly Fig. 5. Such elements are advantageously provided with rolled lengthwise edges, as at 20a and 20b, forming tongues for sliding coordination with any individual set of the stated opposingly aligned grooves 11-1a. Such partition elements 20 may be stocked by the distributor in various standard lengths determined by the needs of the various specific installations.

For use with the lengthwise partition elements 20, crosswise partition elements, similar to that designated 21 and illustrated in detail in Fig. 6, are provided. Each advantageously takes the form of a body portion 21a diagonally disposed between mutually parallel, but offset, end portions 21b, 21b'. Each of such end portions 21b, 21b' has opposing edges rolled in a manner similar to the rolled edges 20a and 20b of a lengthwise partition element 20, forming tongues 21b', 21b' for sliding coordination with any individual set of opposingly aligned grooves 11-1a of the piping section 11-1.

The crosswise partition elements 21 are utilized to effect the increase and decrease of passages formed by the lengthwise partition elements 20. They are interposed between serially related lengthwise partition elements 20, as clearly illustrated in Fig. 2, to provide continuity of partition extension at locations of change of passage

gradation. They may be formed for spanning the distance between two adjacent grooves 11-1a, as illustrated, or may be formed for spanning the distance between two grooves 11-1a which are separated by one or more similar grooves. Individual crosswise partitions varying in form, accordingly, provide different degrees of offset for the end portions 21b, 21b of the respective crosswise partitions; this, of course, being determined by the degree of diagonalness of the respective body portions 21a. A variety of standard forms of the crosswise partition elements may be stocked by the distributor to suit the needs of the various specific installations.

In adapting the piping sections 11-1 for connection with inflow and outflow ducts, duct couplings may be utilized. Such duct couplings are preferably of the "adaptor" type having one end of standard configuration and dimension, see the duct couplings illustrated in Figs. 3 and 4, designated 22 and 23 respectively, and the other end of configuration and dimension adapted for connection with a particular type of outflow duct. In this case, potential openings may be supplied at spaced intervals along the length of the lateral walls of each piping section 11-1, these being advantageously of the "knock-out" type indicated at 24, and configured and dimensioned for registry with the standard end openings of the duct couplings.

When it is desired to connect an outflow or inflow duct to the piping section, it is only necessary to suitably "knockout" the potential opening 24, resulting in an opening, as at 24a, with which the standard sized ends, see 22a and 23a, of duct couplings 22 and 23, respectively coincide.

A variety of types of "adaptor" duct couplings may be stocked by the distributor for adapting the piping sections 11-1 to the needs of a variety of differently configured and dimensioned inflow and outflow ducts.

While this invention has been illustrated and described with respect to a specific embodiment thereof, it is to be distinctly understood that changes may be made freely without departing from the generic aspects of the invention as defined herein and set forth in the following claims.

I claim:

1. In a duct system, a conduit of substantially uniform cross-section throughout; inlet ducts spaced apart along one of the walls of the conduit; outlet ducts spaced apart along an opposite wall of the conduit; and a partition extending lengthwise in the conduit between the said two walls thereof, the spacing of said partition from the first named wall increasing along the length thereof, and the spacing of said partition from the last named wall decreasing along the length thereof, thus providing within the confines of the conduit, flow passages which compensate volumetrically for flow into and flow out of the conduit along its length.

2. In a duct system, structure as recited in claim 1 wherein the spacing of the inlet ducts and the spacing of the outlet ducts along the length of the conduit substantially register, and wherein the spacing of the partition from the stated walls of the conduit is substantially uniform for substantially the distance between adjacent inlet ducts and between adjacent outlet ducts.

3. In a duct system, structure as recited in claim 1 wherein opposite interior faces of the conduit are provided with mutually parallel partition-holding-means closely spaced relative to the

width of the conduit and parallel with the length thereof, and wherein the partition is removable and replaceable and comprises a plurality of lengthwise partition elements coordinating, respectively and sequentially, with the said partition-holding means, and comprises further crosswise partition elements joining the ends of sequentially related lengthwise partition elements.

4. In a duct system, structure as recited in claim 1 wherein opposite interior faces of the conduit are provided with mutually parallel grooves closely spaced relative to the width of the conduit and parallel with the length thereof, and wherein the partition is removable and replaceable and comprises a plurality of lengthwise partition elements formed with tongue edges coordinating, respectively and sequentially, with the said grooves, and comprises, further, crosswise partition elements joining the ends of sequentially related lengthwise partition elements, the said crosswise partition elements being formed with mutually parallel end portions angularly related to a body portion, each of the said end portions having opposite tongue edges fitting into oppositely aligned grooves of the conduit in alignment with the said lengthwise partition elements, and the said body portion spanning the distance between the particular side-by-side grooves concerned.

5. A duct system comprising conduit means describing an endless path; outlets spaced apart along the length of one wall of the conduit means; inlets spaced apart along the length of an opposite wall of the conduit means; and partition means dividing the conduit means longitudinally into an outflow section and an inflow section, said partition means commencing at one of said walls of the conduit means and increasing in spacing therefrom substantially around the extent of the conduit means and terminating at the other said wall of the conduit means.

6. In a duct system, a conduit extending around an endless path; partition means within said conduit extending lengthwise therewith substantially around its path, said partition means commencing against one wall of the conduit, crossing the conduit in steps along its length, and terminating against an opposite wall of the conduit short of overlapping its said commencement, to divide the conduit into a passage increasing in width in step formation from each of its dead ends to the width of the conduit; means interposed between the said dead ends of the passage in the conduit for promoting circulation through the duct system; inlet ducts spaced apart around an outer wall of a portion of the passage from one dead end to the maximum width thereof and leading into the passage adjacent step locations thereof; and outlet ducts spaced apart around an outer wall of a portion of the passage from the other dead end to the maximum width thereof and leading from the passage, adjacent step locations thereof.

7. In a conduit providing for differential volumetric flow therethrough, independent flow passages defined within the confines of said conduit, said flow passages extending substantially side-by-side lengthwise of the conduit and being graded along their lengths to compensate for known changes of volume of material flowing therethrough, the gradations of one flow passage coincidentally providing similar but opposite gradations in another of the flow pas-

sages, and imperforate wall means separating said flow passages.

8. Conduit structure as recited in claim 7 wherein means for the inflow of material are spaced apart along the length of the stated one flow passage and means for the outflow of material are substantially correspondingly spaced apart along the length of the stated other flow passage.

9. In a conduit providing for differential volumetric flow therethrough, an intermediate imperforate wall extending lengthwise of the conduit to define independent flow passages, means for the inflow of material spaced apart at intervals along the length of one of said flow passages, and means for the outflow of material spaced apart at intervals along the length of the other of said flow passages, said intermediate wall being arranged such that it sequentially in-

creases the effective flow capacity of said one flow passage adjacent sequential means for the inflow of material and coincidentally sequentially decreases the effective flow capacity of said other flow passage adjacent sequential means for the outflow of material.

10. For use in a duct system, a conduit, knock-out opening means spaced apart along one longitudinal portion of the conduit, knock-out opening means spaced apart along another longitudinal portion of the conduit to approximately correspond with the placement of the first named knock-out opening means, and means interposed between the said two longitudinal portions of the conduit for receiving partition means in variant placement depending upon which of said knock-out opening means are utilized.

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