United States Patent [19]

Sarath

[11] **Patent Number: 4,860,163**

[45] **Date of Patent: Aug. 22, 1989**

[54] **COMMUNICATION EQUIPMENT CABINET COOLING ARRANGEMENT**

[75] Inventor: **Alan Sarath,** Teaneck, N.J.

[73] Assignees: **American Telephone and Telegraph Company,** New York, N.Y.; **AT&T Bell Laboratories,** Murray Hill, N.J.

[21] Appl. No.: **229,076**

[22] Filed: **Aug. 5, 1988**

[51] **Int. Cl.**[4] **H05K 7/20**

[52] **U.S. Cl.** **361/384;** 361/391; 361/415

[58] **Field of Search** ..... 174/15 R, 16 R; 361/381, 383, 384, 390, 391; 165/104.33

[56] **References Cited**

U.S. PATENT DOCUMENTS

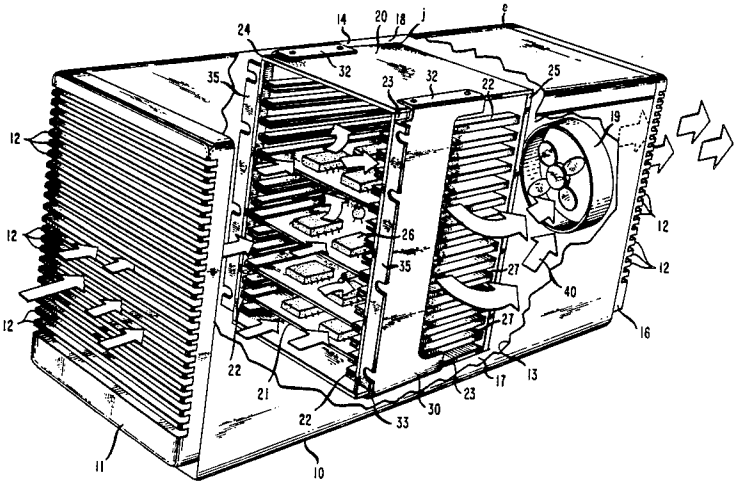
3,123,743	3/1964	Perlmutter	317/100
3,364,838	1/1968	Bradley	98/33
3,526,458	9/1970	Meyers et al.	355/45
3,889,487	6/1975	Frankfurt	62/99
3,967,874	6/1976	Calabro	361/384
4,006,388	2/1977	Bartholomew	317/100
4,106,076	8/1978	Miller et al.	361/394
4,261,519	4/1981	Ester	239/548
4,500,944	2/1985	Roberts et al.	361/384
4,672,509	6/1987	Speraw	361/384

Primary Examiner—A. D. Pellinen
Assistant Examiner—Gregory D. Thompson
Attorney, Agent, or Firm—Frederick B. Luludis

[57] **ABSTRACT**

In order to cool heat generating components mounted on circuit packs plugged into a backplane wiring board mounted in a compact cabinet, in which the backplane would normally prevent a stream of cooling gas entering the front of the cabinet from flowing evenly over the heat generating components, a flow control baffle is placed on each side of the backplane to direct cooling gas entering the cabinet to the rear of the circuit packs and then around the backplane to a plenum formed by the backplane and a rear surface of the cabinet where the gas is exhausted by a fan. The exhaust of the cooling gas by the fan causes the level of the cooling gas pressure in the plenum to decrease, thereby urging additional cooling gas to enter the cabinet through louvers formed in the front surface of the cabinet.

15 Claims, 3 Drawing Sheets



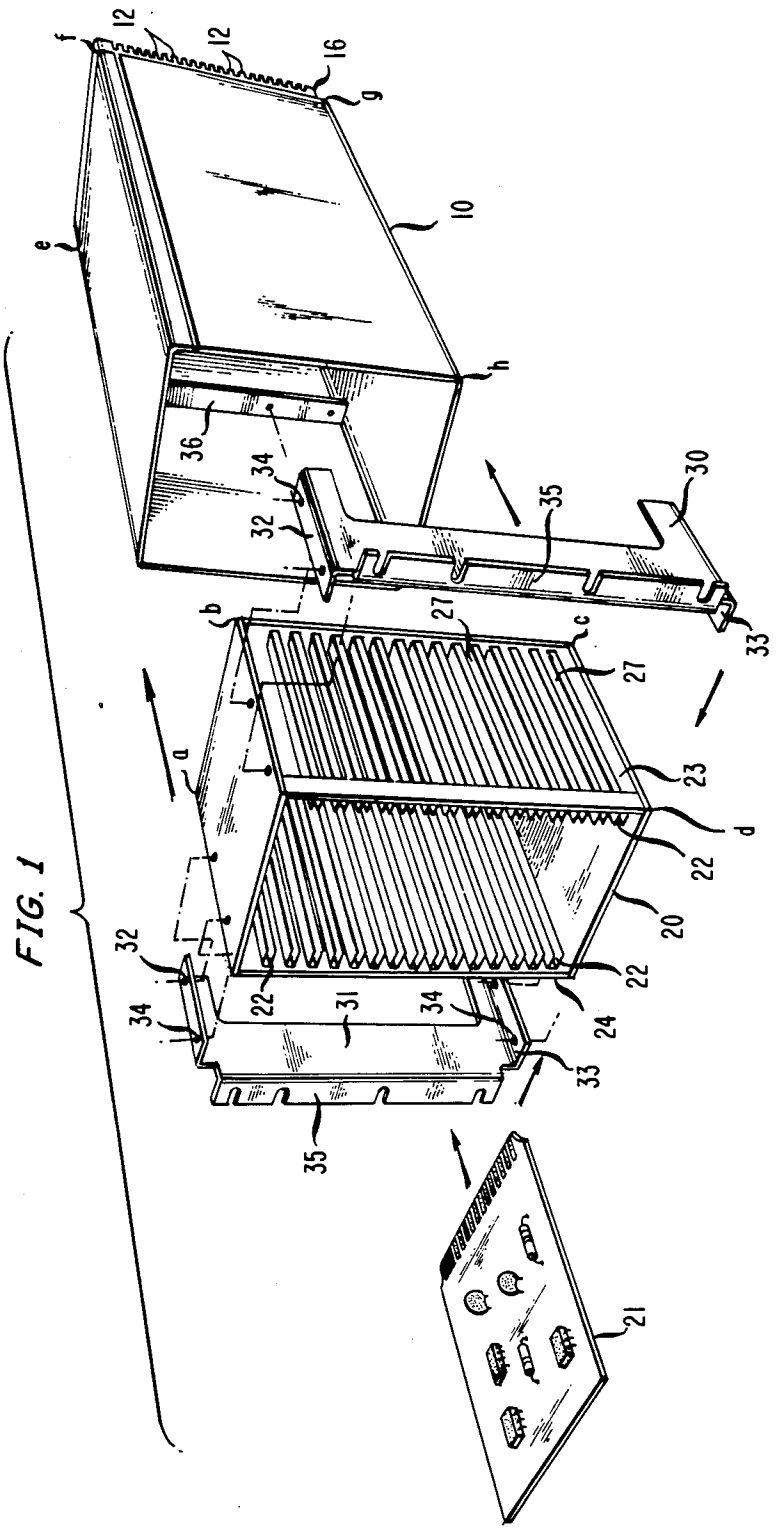


FIG. 1

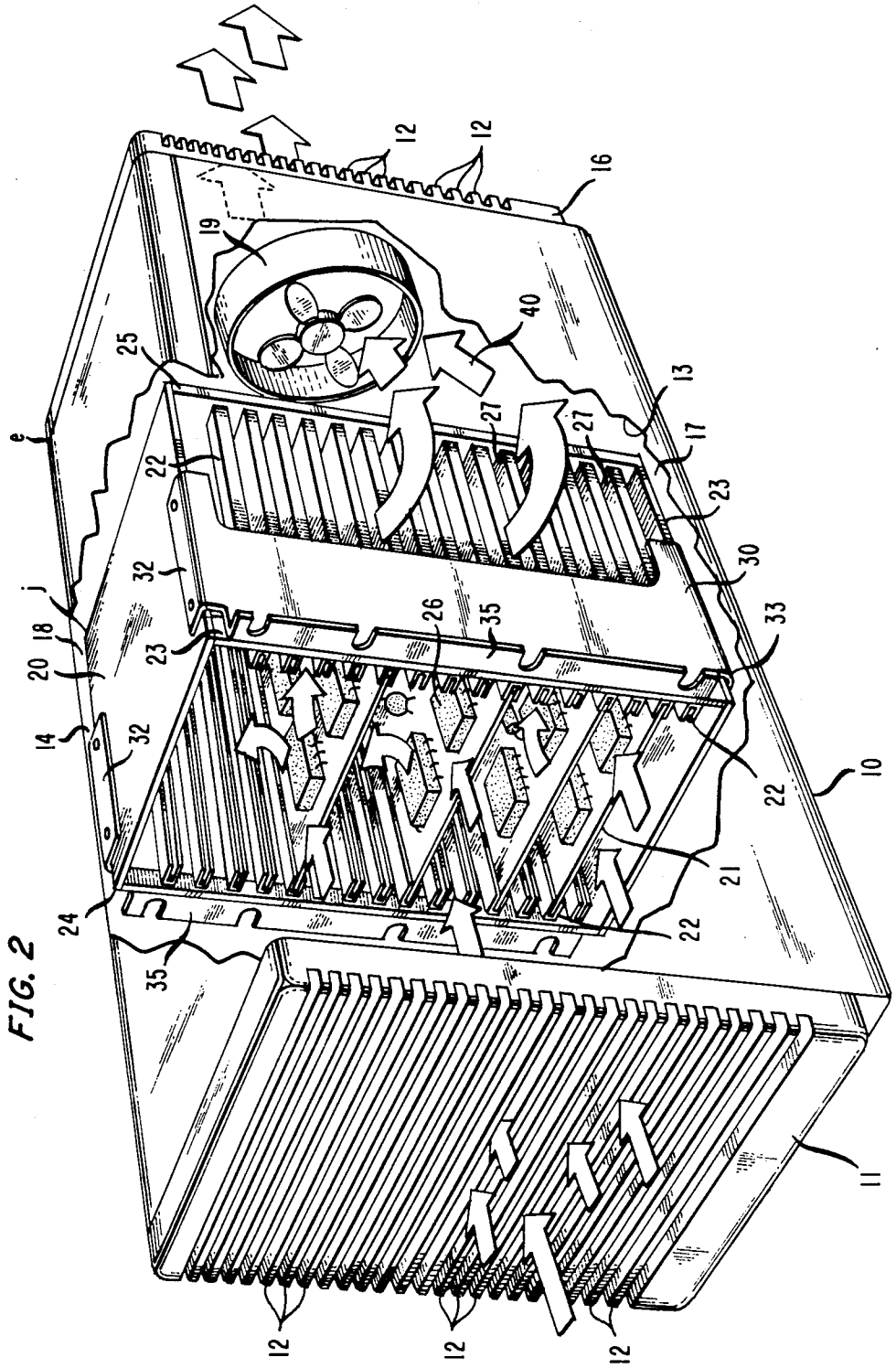


FIG. 2

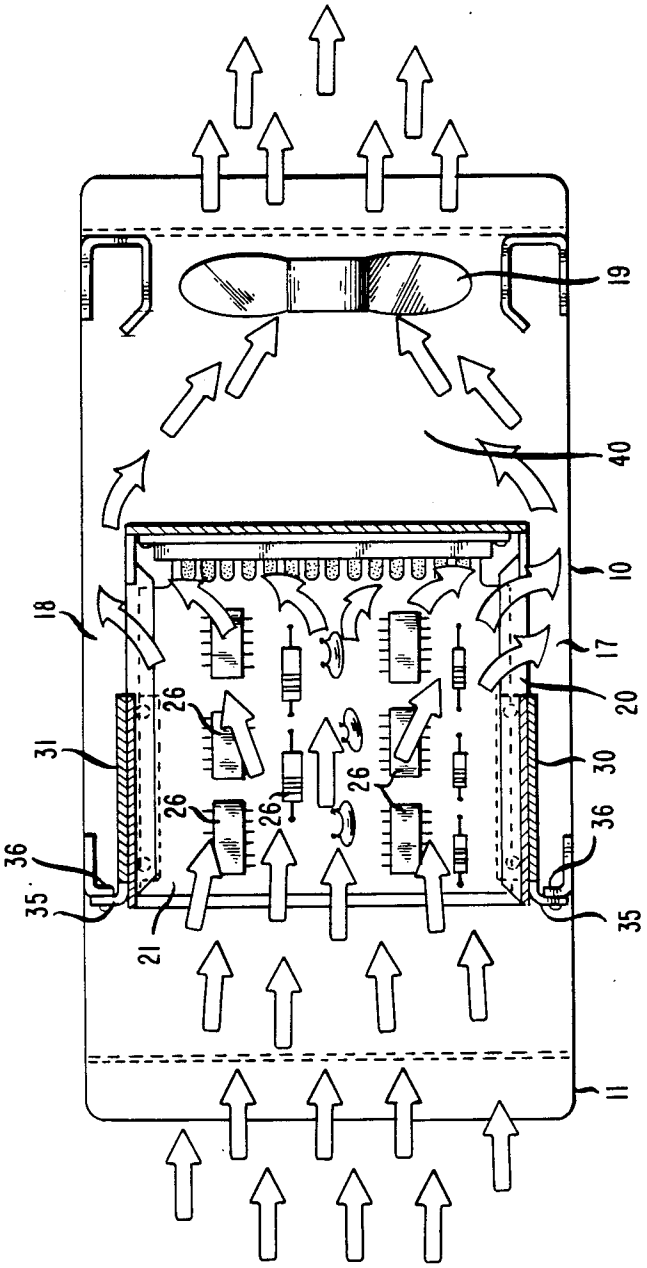


FIG. 3

COMMUNICATION EQUIPMENT CABINET COOLING ARRANGEMENT

TECHNICAL FIELD

The invention relates to an arrangement for cooling an electronic assembly of heat generating components mounted in an equipment cabinet.

BACKGROUND OF THE INVENTION

In conventional cooling arrangements, in which circuit packs are edge mounted in a circuit pack cage and plugged into a so-called backplane wiring board attached to the cage, a cooling gas enters the bottom of the cabinet, rises vertically and passes over the heat generating components mounted on the circuit packs and then exits via louvers formed in the top surface of the cabinet. The vertical flow of the cooling gas is augmented by a forced convection system, such as a blower fan placed at the bottom of the cabinet or just beneath the circuit packs. Although such cooling arrangements are adequate, they are still faulty in some notable respects. For exmaple, when a blower fan is placed in proximity to the circuit packs, the flow of the cooling gas forms a vortex, thereby causing uneven cooling of the heat generating components. In addition, when the circuit packs are of different lengths, pockets of cooling gas formed by face plates attached to one end of the longer circuit packs prevent the cooling gas from flowing evenly over components mounted at the front of the circuit packs.

Alternatively, the circuit pack cage could be rotated 90 degrees so that it is mounted vertically in the cabinet. The cooling gas could then enter one side of the cabinet, flow over the heat generating components and exit via the opposite side of the cabinet. However, such a cooling arrangement would be ineffective in the instance where it is contemplated that at least two such cabinets will be placed side-by-side, since one cabinet would exhaust heated cooling gas into the next adjacent cabinet. With the circuit pack cage so oriented, the cooling gas could be arranged, on the other hand, so that it enters the front surface of the cabinet, flows over the heat generating components and then exits via the rear surface of the cabinet. However, in this instance, the backplane would impede the flow of the cooling gas causing it to form a turbulence within the cabinet.

SUMMARY OF THE INVENTION

In order to cool heat generating components mounted on circuit packs plugged into a backplane wiring board attached to the rear surface of a circuit pack cage disposed in a compact cabinet, in which the backplane would normally prevent a stream of cooling gas entering the front of the cabinet from flowing evenly over the heat generating components, a flow control baffle is placed on each side of the circuit pack cage to direct cooling gas entering the front of the cabinet to the rear of the circuit packs and thence around the backplane to a plenum formed by the backplane and a rear surface of the cabinet where the gas is exhausted by convection. The convection is obtained using, for example, a blower fan. The exhaustion of the cooling gas causes the level of the cooling gas pressure in the plenum to decrease, thereby urging additional cooling gas to enter the cabinet through louvers formed in the front surface of the cabinet.

BRIEF DESCRIPTION OF THE DRAWING

The features and advantages of the instant invention will be fully appreciated by reference to the following detailed description, when read in light of the accompanying drawing in which:

FIG. **1** is an exploded, front perspective view of apparatus which is the subject of the present invention;

FIG. **2** is a cut-away, front perspective view of the apparatus shown in FIG. **1** assembled in accordance with the principles of the present invention; and

FIG. **3** is a cut-away top plan view of the apparatus depicted in FIG. **2**.

DETAILED DESCRIPTION

Referring now to FIG. **1**, there is shown flow control baffles **30** and **31** about to be attached to respective side surfaces **23** and **24** of circuit pack cage **20**. Specifically, the end portions of baffles **30** and **31** are bent perpendicular away from the main body thereof to form top and bottom flange members **32** and **33**. Baffles **30** and **31**, which are mirror images of each other, are attached to circuit pack cage **20** by passing threaded bolts (not shown) through holes **34** formed in top and bottom flange members **32** and **33**, respectively, and thence into corresponding holes (not shown) formed in the top and bottom surfaces of circuit pack cage **20**. Once baffles **30** and **31** are so attached they are secured to circuit pack cage **20** by threading a nut having interior threads formed therein onto each bolt.

In addition, the front end of each baffle **30** and **31** is bent perpendicular to the main body thereof in a direction opposite to that of flange members **32** and **33** to form a front flange **35**. Front flanges **35** attach to respective flanges **36** mounted in the interior of cabinet **10** to secure circuit pack cage **20** to the latter, as will be shown below.

Circuit pack cage **20**, which may be, for example, the 84 HP Sub-Rack available from BICC-VERO Electronics Inc. of Trumbull, CT., includes a plurality of circuit pack guides collectively designated **22** for receiving respective circuit packs, such as circuit pack **21**. The height and width of circuit pack cage **20** are illustratively 17.0 inches as measured from point "b" to point "c" and 10.5 inches as measured from point "a" to point "b", respectively. The depth of circuit pack cage **20** is illustratively 7.0 inches as measured from point "c" to point "d".

Circuit pack cage **10** also includes a so-called backplane wiring board (not shown in FIG. **1**) affixed to a rear surface of circuit pack cage **20**. The backplane wiring board could be, for example, the **J1** VME bus backplane also available from BICC-VERO Electronics Inc.

Communication equipment cabinet, or housing, **10** includes a front door **11** (not shown in FIG. **1**) and a rear door **16** each having a number of louvers **12** formed therein. Rear door **16** provides access to the back-plane wiring board when circuit pack cage **20** is mounted in cabinet **10**. The height and width of cabinet **10** are illustratively 27.3 inches as measured from point "f" to point "g" and 12.8 inches as measured from point "e" to point "f", respectively, thereby making the height and width of cabinet **10** respectively 10.3 inches and 2.3 inches greater than that of circuit pack cage **20**. The depth of cabinet **10**, which is shown slightly exaggerated in the FIGs., is illustratively 21.5 inches as measured from point "h" to point "g".

DOCKET ALARM

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts

Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research

With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips

Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS
Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS
Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS
Sync your system to PACER to automate legal marketing.