

## Transistors Making Transition From Lab to Commercial Use

By WAYNE OLIVER  
NEW YORK (AP) — A revolution called the transistor is beginning to move out of the laboratory into commercial use, and soon may appear in many of the electronic products you buy.

First announced as a lab development nearly five years ago as a device performing the functions of a vacuum tube, the transistor in the past few weeks has been incorporated in new lightweight hearing aids that go for months without battery changes.

The military services are taking a large percentage of the limited output of transistors for a field, that result in more compact, more rugged, more reliable equipment.

Next civilian use probably will be in portable radios that can be made much smaller than present models, and will operate many times as long before needing a change of batteries. Wrist watch and cigarette pack sets may become practical realities rather than laboratory novelties.

Later transistors will find their way into regular home radio sets, TV sets in which they can replace all tubes except the picture tube, battery operated record players, electronic computers only a fraction the size of the present monsters, and perhaps new types of devices that have not been practical up to now.

But — the more cautious in the industry say that mass production of the transistor still has not been licked and that until the problem is solved, its use will remain limited. The output, nevertheless is many fold what it was a year ago and is running into thousands a day.

The transistor is a radical departure from the conventional tube that amplifies through use of heated filaments in a vacuum. The transistor uses a microscopic speck of the rare metal germanium for amplification.

There are two basic types of transistors. One is the point contact type in which the pointed ends of two very thin wires press against the speck of germanium. The other is the junction type consisting of a piece of germanium treated so it forms an electrical sandwich of three layers — positive in the middle and negative in top and bottom layers — with a wire connected to each layer.

Each has advantages and disadvantages compared with the other

so they probably will find different uses.

While the transistor never is expected to replace the vacuum tube in all its uses, it can do many of the things a vacuum tube can do, and some of them better.

Some of its advantages include: It averages about one-fiftieth the size of the vacuum tube; it uses only a tiny fraction as much current; it will withstand much greater shock; it lasts almost indefinitely.

The transistor was announced in 1948 by Bell Telephone Laboratories, research subsidiary of the American Telephone and Telegraph Co. Since then, 38 other companies have been licensed to make transistors under Bell patents.

Raytheon Manufacturing Co. recently reported it was supplying transistors to 15 manufacturers of hearing aids, and several hearing aids that use transistors have been put on the market.

Radio Corp. of America a few weeks ago gave a demonstration of transistors that included tubeless radio sets, a battery-operated television set with no tubes except the picture tube, and a battery operated photograph record player.

Transistors have been put to use in the Bell system in equipment at Englewood, N.J., that enables the customer to dial his own long distance numbers. Both transistors and companion light-sensitive devices called phototransistors will be installed before summer in equipment for automatically locating available circuits on long distance calls.

Military uses of transistors are cloaked in security restrictions but are known to be numerous.

Ultimately, transistors are expected to be relatively cheap but the limited quantities now on the market cost four to five times as much as vacuum tubes designed for similar purposes.

Although germanium, which makes transistors work, costs more than gold and only a little less than platinum, that isn't what causes the expense.

It's the difficulty in processing the germanium to the required degree of purity and the tedious job of making the transistor. The amount of germanium needed for each one is so tiny that the cost is only a negligible part of that of the transistor.

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