

## METEOROLOGY

# High Atmosphere Warms

A complex chain reaction, initiated by the southward movement of very cold air, has been identified as the cause of the "explosive" warming of the stratosphere.

➤ AN "EXPLOSIVE" warming of the high atmosphere has been discovered through study of weather information radioed earthward from high-flying balloons.

No direct connection between this high-level warming and ground weather has been established, but weathermen suspect there is one. When such a connection is established, more accurate predictions of long-range weather can be made.

Sidney Teweles of the Weather Bureau's office of meteorological research and his associates have been studying the known examples of sudden warming in the usually inert stratosphere. One occurred on Jan. 24 of this year and, by coincidence only, on Jan. 24, 1957. The latter warming amounted to as much as 31 degrees Fahrenheit in only 12 hours.

In the Arctic, a total warming of 115 degrees, from 114 below to one degree above zero, was observed in less than two weeks in 1957, beginning Jan. 24.

Several other instances of rapid warming of the upper stratosphere have been reported in recent years, but none was as thoroughly recorded as the 1957 one. Although radiation from the sun was at first believed to be the cause, most weathermen now agree the causes are earth-bound and in some ways like those responsible for our daily weather changes.

The explanation for the explosive warming in 1957 given by Mr. Teweles is based on recent work by his chief, Dr. Harry Wexler, and others. It involves a complex chain reaction, set off by southward movement of extremely cold air, produced near the North Pole during the long darkness of the Arctic night.

During autumn months, the increasing weight of the steadily cooling air mass was balanced by the centrifugal force generated by a surrounding belt of winds that slowly strengthened to jet stream intensity.

When the temperature difference across this Arctic stratospheric jet stream reached a critical value, the planetary flow pattern became unstable. Then the crests and troughs in the invisible air stream expanded rapidly into two loops reaching far south of the Arctic circle, one over North America and the other over Siberia. In the loops, the strong current did not have the balance it possessed at higher latitudes.

Areas of sinking and rising motion appeared within the current to produce strong temperature changes because, in the atmosphere, descending air results in heating by compression and rising air results in cooling by expansion.

The observed warming can be explained by these vertical motions, Mr. Teweles' study showed. Within a day and a half, air of the upper stratosphere made a sloping

descent of 15,000 feet while moving through the southern portion of the loop along a 4,000-mile path leading into the center of warmest air.

The exceptional intensity of warming of the air current in the Newfoundland area resulted from the excessive centrifugal force associated with the great speed of the current. Layer by layer, this stratospheric jet stream shifted southward. To fill the gap on the stream's northern side, air from higher layers sank and was heated.

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## TECHNOLOGY

## Printer Types Faster Than Woman Can Talk

➤ AN AUTOMATIC PRINTER that can type out a full newspaper page in eight minutes has been developed.

It punches coded holes in 7/8-inch paper tape, as it types at the rate of 750 words per minute. This is ten times the speed of standard teletype equipment, and is five times faster than normal conversation.

Operating on the principle of the old-time stock ticker, the device has no ordinary typing keys. A wheel rimmed with letters spins at 3,750 revolutions per minute, hesitating momentarily when the proper letter comes into position. At this precise instant, a small hammer slaps the paper against the wheel.

The new machine, as yet unnamed, is the first in a family of high-speed teletypewriter units for use in combat, and was exhibited at the Armed Forces Communications and Electronics Association meeting in Washington.

Mounted on a jeep or truck as part of a combat communications center, the printer can relay high-priority messages to widely dispersed points. The tape, spewing from the machine at seven and a half inches per second, can be fed into automatic transmission equipment that, by means of the tape's punched coded holes, will relay messages exactly as received.

Not only is such relay five times faster than voice communication, but considerably more accurate, leaving a permanent printed record of the transmission for future reference.

The printer-puncher is designed to operate in conjunction with a mobile combat computer still under development, feeding the computer battle information for evaluation faster than humanly possible.

An average secretary can type at the rate of 60 words per minute; the world's record stands at 149 words per minute for a full hour of continuous typing; the machine prints and punches at 750 words per minute.

The high-speed mechanical typist was developed by Kleinschmidt Laboratories, Inc., a subsidiary of Smith-Corona, for the U. S. Army Signal Corps.

Science News Letter, June 14, 1958



*COMBAT TYPER—A soldier inspects a message from the super-speed teletypewriter device developed for the U. S. Army Signal Research and Development Laboratory, Fort Monmouth, N. J. Mounted on a radio-equipped jeep, the device is tested as part of a unified mobile communications center.*

## ASTRONOMY

## Top Star Rank: Groups Of Galaxy Clusters

➤ A TOP RANK in the hierarchy of stars is suggested by Dr. George C. Abell, assistant astronomy professor at the University of California at Los Angeles.

At the bottom rung of the hierarchy are the stars, of which the sun is one among countless billions. The stars combine into galaxies, of which our Milky Way galaxy is a fairly typical example. These, in turn, form into clusters of galaxies.

Until recently the clusters of galaxies were considered the largest astronomical unit, Dr. Abell said. He made his observations during the National Geographic Society-Palomar Observatory Sky Survey, using the powerful 48-inch Schmidt telescope at the Mt. Palomar Observatory.

Dr. Abell observed that the galaxy clusters themselves tend to combine into groups, known scientifically as second-order clusters and averaging some hundred million light years across and billions of light years away. A light year is the distance covered in one year by light, travelling at 186,000 miles per second.

Other astronomers question the existence of the groups of galaxy clusters. More detailed counts of galaxies and their distribution in space are now underway to settle the question.

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