

ing of tools. Prof. Wolfgang La Baume, of the Danzig Museum of Natural History and Prehistory, after a careful study of pierced stone axes, hammers, hoes and other tools of the New Stone Age, has built of wood, sinew and other primitive materials a drill press that duplicates their technique quite exactly.

The apparatus is crude but efficient. A Y-forked tree limb driven into the ground supports a stout wooden cross beam weighted at its other end with a stone and free to move up and down between a pair of straight sticks that act as guides. In the middle of the cross beam a shallow hole or socket acts as a bearing for a smaller vertical stick, at the lower end of which is fitted a piece of bone or hardwood that serves as the drill itself. This vertical stick is free to twirl in its socket, and is set in motion by a bowstring, after the manner of the "fire-drill" familiar to all Boy Scouts. The drill is armed with an angular bit of flint, which can eat its way through a piece of bone, wood, or other material with surprising ease, says Prof. La Baume.

For making holes in stone, a procedure surprisingly reminiscent of the most modern metallurgy is used. Modern workers in very hard metals, that defy steel drills, can bore and cut them by

using abrasives such as diamond dust, emery and carborundum, on the face of a tool of softer material. So also did the Neolithic machinists, when they wanted to make a hole in a flint ax-head. They used a blunt-ended wooden drill, or the shaft of a deer leg-bone, to twist and twirl on top of a little wet sand.

Prof. La Baume, using this method on his reconstructed Neolithic drill-press, can bore clean holes through very hard stones in very short time and with surprisingly little wear on the bone or wooden tool. The solid wooden rod gives him a clear bore-hole, the hollow bone makes an annular cut and takes out a core. New Stone Age tools, discarded before completion because something went amiss, show both types of boring.

The Danzig archaeologist has also reconstructed a stone-cutting tool employing the same principle to slice straight grooves into flat pieces of hard rock, making "blanks" similar to those from which Neolithic men began shaping their polished stone implements.

Apparently the skilled artificers of medieval Nuremberg, and the craftsmen of the mighty modern works of Essen, can point back to at least ten thousand years of ancestor-machinists.

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ASTRONOMY

Nebulae Emptier Than Air; Metals Are Frigid Vapor

THE SPACE between the nebulae is a million times bigger than the space occupied by the nebulae. Yet one might say space is crowded with nebulae compared with the sparseness with which the stars are contained in the nebulae.

This is one of the astronomical facts recently presented by Dr. J. A. Anderson of the Mt. Wilson Observatory in a popular discussion held under the auspices of the Astronomical Society of the Pacific.

The average distance between stars in a nebula like our own galaxy, the milky way, is millions of times bigger than the diameters of the stars. This means that the nebula is a thousand billion billion times as big as the sum of all the stars in it. And there may be some hundreds of billions of stars in one nebula.

Thus a nebula is emptier than ordi-

nary air. If the molecules in a thimbleful of air were strung together side by side the string would go thirty times around the earth. If a similar string of stars were made it would extend only one-seventh across the nebula.

Between the stars there are gas molecules thinly dispersed. Even metals at the low temperatures of interstellar space exist as vapor because the molecules do not meet each other often enough to form solid matter at once. There is also a large amount of dust, as indicated by great clouds which hide all stars behind them. Dust is a hundred million times as opaque as gas.

So much starlight has been emitted since the beginning of the universe that its mass would be equivalent to a hundred galaxies. And there may be a hundred times as much in the form of cosmic radiation.

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AERONAUTICS-METEOROLOGY

Lightning Not Dangerous To Aircraft in Flight

LIGHTNING is not dangerous to aircraft in flight.

This is the conclusion of a group of authorities on meteorological and electrical conditions who, as subcommittee of the National Advisory Committee for Aeronautics, reported results of a thorough investigation made since the wreck of the airship *Akron*.

An airship inflated with inflammable hydrogen is no more liable to damage from lightning than one inflated with non-inflammable helium, provided it is properly "caged" with electrically conducting metal framework, the scientists found. Their report states that in the airship the protection is greater the closer the meshes of the metallic framework, the wire bracing, and the wire netting enclosing the gas bags, and particularly the more highly electrically conducting the surface of the outer envelope.

A number of reports of damage by lightning to airplanes were reviewed. It was generally agreed that, "It is possible, without serious complication, to render an airplane practically immune to serious danger either to the airplane or to the occupants."

Though neither airplanes nor airships are in serious danger from lightning, both must make every effort to avoid thunderstorms, the scientists cautioned. The extremely violent and turbulent winds of thunderstorms, rather than the lightning, are the cause of destruction, it was pointed out.

This study of "Hazards to Aircraft Due to Electrical Phenomena" was made at the request of the Navy Department. Members of the subcommittee, appointed by Dr. Joseph S. Ames, president of Johns Hopkins University and chairman of the National Advisory Committee, were: Dr. Charles F. Marvin, Weather Bureau, chairman; Dr. L. J. Briggs, Bureau of Standards; Commander Garland Fulton (C.C.), U.S.N.; Dr. W. J. Humphreys, Weather Bureau; Dr. J. C. Hunsaker, Massachusetts Institute of Technology; Dr. F. B. Silsbee, Bureau of Standards; Prof. John B. Whitehead, Johns Hopkins University; Dr. G. W. Lewis, National Advisory Committee for Aeronautics (ex officio). They were assisted by Dr. M. F. Peters of the Bureau of Standards.

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