

will seemingly be transformed into a rocket ship, and, as the trip is made, the moon will be seen growing larger and larger. Arriving there, visitors will disembark, and see the earth hanging in the sky above the lunar mountains. It will change in phase, as the moon does as seen from the earth. Then, at new

earth, the sun will pass behind our planet. The moon will be illuminated with a strange red glow, from a ring of ruddy light around the earth.

After a three-week period on the moon, compressed into 45 minutes, the voyagers will be safely returned to earth.

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## NAVIGATION

## Navy's Chronometer Shortage Not Serious; Radio Helps

**S**HORTAGE of chronometers—accurate marine timekeepers—which has led the U. S. Navy to reduce the number on battleships from the usual three to two, is not as serious as it might have been at the time of the last war.

Radio time signals in recent years have increased both in accuracy and number to such an extent that a navigator could now operate satisfactorily with no timepiece but a dollar watch. Twenty times a day, on a number of different frequencies, signals are broadcast from the powerful Navy radio stations at Arlington, Virginia, Mare Island, California, and other locations. Thus, even a relatively poor clock or watch can be checked frequently and its error determined.

These time signals originate here at the Naval Observatory, whose superintendent, Capt. J. F. Hellweg, invented the transmitting clock which has made possible such accurate time signals, usually precise to within a hundredth of a second or less. This clock can be very rapidly checked and set by comparison with the standard clocks, kept in an underground vault at constant temperature and pressure. The actual transmission is controlled by a vibrating quartz crystal, similar to those used to keep radio stations operating on the proper wave lengths. Similar clocks, adjusted by the signals from Arlington, are used at distant stations.

Though many chronometers have been imported from England, Switzerland and Germany, good ones are also made in the United States. There are many in private hands, and, if the shortage became serious, these could doubtless be obtained by the government.

The chronometer is needed to find a ship's longitude. Latitude can be found by observing with a sextant the sun's height when it has its greatest altitude—that is, at "high noon." But to get the longitude, the navigator must find his

local time, and compare this with the time at some fixed point, usually Greenwich, the British national observatory. If he is west of Greenwich, his time is earlier, if east, it is later. The difference tells him the distance he is east or west.

Chronometers carry Greenwich time, and the local time can be found by astronomical observations in one of several ways. Most ships in the past have carried three chronometers. If there were only one, it might stop. With two, an awkward situation might arise if they differed, for no one could tell which was correct. But with three there is greater safety, for not more than one is likely to be seriously in error at a time.

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## TECHNOLOGY

## Technical School Merger Announced in Chicago

**A** NEW technical school, the Illinois Institute of Technology, has been formed in Chicago by the consolidation of the Armour Institute of Technology and Lewis Institute, each with nearly a half century behind it. With a total of about 7000 students in day and evening classes, the new Institute will be one of the country's largest.

In order to perpetuate the old names, the Illinois Institute of Technology will have three departments: Armour College of Engineering, Lewis Institute of Arts and Sciences, and Armour Research Foundation. Henry T. Heald, Armour president for the past two years, is president of the new school.

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Fifty thousand airplanes, which the United States is called on to produce for defense, are about 2,000 more than this country has built in all the years since the Wright brothers' experiments.

## ASTRONOMY

## Saturn-Jupiter Triple Pass To Begin on August 15

**B**EGINNING of a rare and complicated set of steps in the dance of the planets, during which Jupiter will pass Saturn three times in six months, will occur on Aug. 15. The last time such a maneuver was seen was in 1682 and 1683.

Astronomers call this a "triple conjunction." It is an effect of the motion of the earth around the sun, at a speed of 18.5 miles per second. Jupiter, farther out from the sun, travels more slowly, only eight miles per second, while Saturn plods along at about six miles per second. Once a year, as we overtake these planets, they seem to go backwards, or "retrograde," in the same way that a slow freight train seems to be going backwards when you pass it in a fast express.

At the present time, both Jupiter and Saturn, which rise soon after midnight, are traveling in their direct motion, from west to east. Now Jupiter, brighter of the pair, is to the west, but on Aug. 15, at 8:00 a.m., Eastern Standard Time, he will pass his fainter brother. They will be separated by about two and a half times the apparent diameter of the full moon.

On Aug. 27, as the earth catches up to Jupiter, he will seem to stop, after that will retrograde, moving to the west. On Sept. 4, Saturn likewise will stop, and turn back. Then, on Oct. 11, Jupiter will again pass Saturn.

By Dec. 31, we shall have moved far enough along that Jupiter will again seem to stand still, and then start moving east once more. After Jan. 10, Saturn will resume his direct motion. On Feb. 20 the third, and final, conjunction of the series will take place. In the fall of 1941, the two planets will again move to the west, but this time Jupiter will not reach Saturn.

About 19 years from now, Jupiter will again pass Saturn, but then only once. While the planets will retrograde at that time, as they do every year, this backward motion will not occur at the right time to cause a triple conjunction.

A very famous triple conjunction occurred in the years 7 and 6 B.C., about the time of the birth of Christ. It has been suggested that this was one of the strange happenings in the sky observed by the Wise Men, which have come down to us as the "Star of Bethlehem."

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