ASTRONOMY

Leap Year

This Month the Addition of a Day to Adjust the Calendar Calls Attention to Its Imperfections

By JAMES STOKLEY

JUST as we seldom pay attention to a part of our body until an ache or a pain calls it to our attention, so do we take our calendar for granted most of the time. But during next month, February in a leap year, we have to make the adjustment that reminds us that even the best calendar is not all that could be desired. As a matter of fact, a calendar perfectly accurate is impossible because it has to measure two different units which are of such a size that one cannot be expressed as an exact multiple or fraction of the other.

In most of our systems of measure—length, area, money, etc., — the units are arbitrarily chosen so that a smaller one goes evenly into those that are larger. Thus, there are twelve inches in a foot, a hundred cents in a dollar. But in measuring time we have two natural units. One is the time the earth requires to turn on its axis, the day. The other is the time that the earth requires to make one of its complete circuits around the sun, the year.

The number of days in a year is approximately 365¼. Expressed more precisely, the number is 365.24219, but even this is not exact. No matter how many numbers we write after the decimal point, the ratio can never be expressed absolutely — the mathematician says that the year and the day are incommensurable.

The Month

Even this is not all, for there is another natural unit, the month, which is based upon the time between successive appearances of the moon at the same phase, and this length of time is not commensurable with either the day or the year.

The older calendars were mostly based on the moon, as among the Hebrews and the ancient Romans. However, it was inconvenient to have the same month occurring at various times in different seasons of the year, and so the Romans would occasionally add an intercalary month, an extra one, to bring the months and the seasons into step once more. But this was left in the hands of officials to whom graft was not unknown, and it was a fruitful source. For instance, if a magistrate had been elected for a certain period, he could extend his term for a time by the device of adding a month at the right moment.

Julius Caesar reformed this, upon the advice of the astronomer Sosigines. He ignored the moon completely and assumed that the length of the year was 365¼ days. So he introduced the idea of the leap year. Ordinary years were to be of 365 days, so that after four years, the extra quarter of a day in each would amount to a full one, and then the year's length would be 366 days.

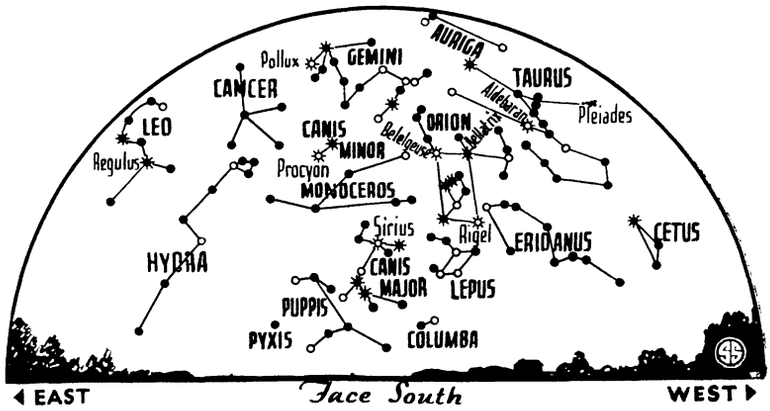
Not Accurate

But this was not entirely accurate, although it worked for a long time. The slight amount that the year is shorter than the period Caesar adopted amounts in the course of a thousand years to nearly eight days. By the year 1582 the error was about 13 days, and then Pope Gregory XIII introduced a new reform. Like Caesar, he also called in astronomical aid, in the person of one Clavius. He brought it back, not to the time of Caesar, but to the way it was in the year 325, the date of the Council of Nicaea, which had, among other matters, decided on the means of calculating the date of Easter. To do this ten days were dropped completely, and to prevent the calendar getting out of step soon again, he decreed that thereafter a year beginning a century should be a leap year only if it were divisible by 400, while ordinary years should, as before, be leap years if they were divisible by four. Thus, in four centuries there are a hundred leap years according to the Julian calendar, but only 97 by the Gregorian. This reduced the error so that not until some three thousand years have passed will it be in error as much as a day.

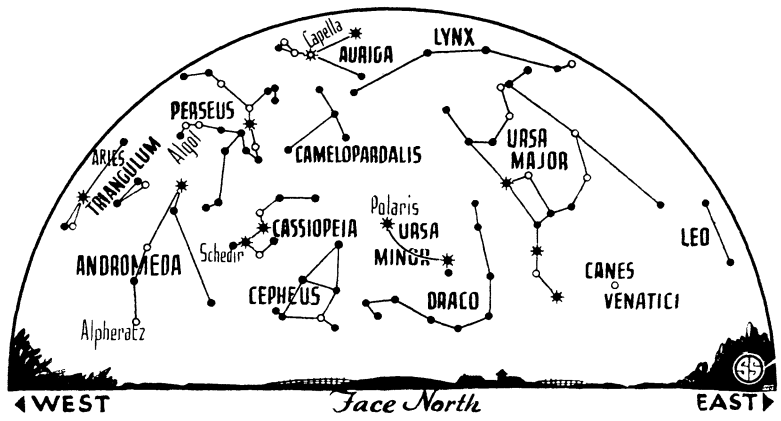
Next Reform

Probably the next reform that will be made in the calendar will be to make every year the same, so that the 25th of December, for example, will always come on Wednesday. There have been two suggestions by which this might be done. One is to have a year of thirteen months instead of twelve, each exactly four weeks, or twenty-eight days, in length. Thirteen times twenty-eight, however, is 364, one day less than an ordinary year and two less than a leap year. Therefore, it is proposed that the year should begin with a "Year Day," which would not belong to any month or week. A second such day would be inserted in the calendar every fourth year, at the beginning of summer, and called "leap day," so that this would take care of the leap year.

☼ ✱ ○ • SYMBOLS FOR STARS IN ORDER OF BRIGHTNESS



DOGS GREAT AND SMALL



GUIDING STAR

The mariner's guide, the ever faithful North Star, will serve as an aid to you also, in locating the constellations of the northern heavens.

Another proposed calendar revision is the so-called "World Calendar," of twelve months, with the four quarters of the year equal, 91 days to each. The first month of each quarter, that is, January, April, July and October, would start on Sunday, and have 31 days. The second months of each quarter, February, May, August, and November, would start on Wednesdays and have 30 days, while the remaining months would each begin on Friday and have 30 days. Here also, a "year day" would be used between the last day of December and the first of January, as well as a "leap day" every fourth year, which would come between June 30 and July 1.

Start on Sunday

It has been suggested that 1939 would be a good year to start calendar revision because it begins on a Sunday. But because of the inertia in changing an institution so long established as our present calendar, it hardly seems likely that the necessary agreement of many different nations could be obtained so soon. Possibly by 1950, when the year again begins on Sunday, the change may be possible.

Astronomers are relatively unconcerned about calendar change because they have solved the problem of calendar irregularities by following the practice of giving every day its own serial number and using that in their records and computations. This number is called the Julian day. Feb. 1, 1936 has the Julian number of 2,428,195.

As winter draws nearer to its close, during the month of February, the constellation of Leo, the lion, appears in the eastern sky. The brightest star is Regulus, in the beast's shoulder. This star is also a part of a group called the Sickle, and marks the end of the handle, which is directed towards the south. The blade curves up and then southwards, and the stars that form it are the same as the ones that indicate the head of the lion. Below, and farther north, is a triangle of stars which represent the rest of the lion. Denebola, at the lowest corner of the triangle, is the end of his tail.

Great Dipper

In the northeast is the Great Dipper, the handle hanging downwards, part of Ursa Major, the great bear. The two stars at the top of the bowl are the Pointers, which show the direction of Polaris, the pole star, itself at the end of the handle of the little dipper.

But the most brilliant of all the stars visible at any time of year in the nighttime sky is directly south at the time for which the maps are prepared. This is ten p. m. Eastern Standard Time at the beginning of February, nine o'clock on the fifteenth, and eight on the twenty-ninth. The star is Sirius, the dog star, part of Canis Major, the great dog. It is bright because it is close, as no other star ordinarily seen from the United States is closer. Its distance is more than eight light years, for it is so far away that the light from it takes more than eight years to reach the earth, though travelling every minute about eleven million miles.

The other celestial dog, Canis Minor, is higher in the sky, and to the left, containing the bright star Procyon. To the right of Sirius is the great warrior, Orion, which can be recognized easily from the three stars in a row that are supposed to form his belt. The ruddy star above these is Betelgeuse, in one of his shoulders, while a little to the west is Bellatrix that marks the other shoulder. Below the belt is Rigel, in one of his legs, while the fainter star, Saiph, to the left, is in the other.

Overhead Capella

Still higher than Orion, almost directly overhead, is Capella, part of Auriga, the charioteer. A short distance to the east of the zenith is Pollux, the brighter of the twins, Gemini, Castor being his brother. To the right of Orion one can see the bull, Taurus, in which a V-shaped group of stars, the Hyades, outline his face. Among these is Aldebaran, distinctly red in color, which is the eye. A short distance farther to the right, in the bull's shoulder, are the Pleiades, the "seven sisters" of mythology, of which six can ordinarily be seen with the naked eye. Many more are revealed with the aid of a telescope, or even a pair of opera glasses.

Over in the northwestern sky is a constellation shaped like the letter W on one side. This is Cassiopeia, a queen of ancient Ethiopia, according to the mythological account. Her daughter, Andromeda, is marked by the constellation next to the south.

During February no planets are in a position where they may be seen well during the evening, though a glimpse may be obtained of Mars in the west soon after sunset. Mercury is now a morning star, and rises longest before the sun about the 26th, when one may be able to see it in the morning twilight. Jupiter and Venus may also be seen in the early morning hours, Jupiter rising first. The moon in February is full on the 7th, at last quarter on the 15th, new on the 22d and at first quarter on the 28th. Apogee, the time when it is farthest from the earth, occurs on the 11th, with a distance of 252,000 miles, while perigee, when it is closest, comes on the 17th. Then only 223,250 miles will separate us.

Moon's Phases

The moon is full on February 7 at 1:19 a. m. E. S. T., at last quarter on February 15 at 10:45 a. m., new moon on February 22 at 1:42 p. m., and at first quarter on February 29 at 11:28 p. m.

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"A fully developed swordfish is probably the fastest swimming creature in the world," says a writer in Natural History.