

about 10 percent less bending than Einstein's does. The bending produces an apparent shift in the star's location. Optical observations have shown the bending exists but have not succeeded in measuring the amount to within the 10 percent accuracy necessary to distinguish between the theories.

The advent of radio and radar astronomy and artificial space probes have provided a number of new possibilities for increasing the accuracy of the measurements, but so far they have not succeeded in doing it.

At the Goldstone station of the Jet Propulsion Laboratory of California Institute of Technology, for example, observations were made of the quasar 3C-279 as the sun passed in front of it. At three centimeters wave length, reports JPL's Dr. Richard Sramek, there was an apparent change in position of 1.77 plus or minus 0.2 seconds, an estimated error slightly more than 10 percent. At 13 centimeters wave length, says Dr. Duane O. Mühleman, the apparent change comes to 1.82 seconds, again with a probable error around 10 percent.

**Results** at better than 10 percent accuracy are hoped for from both quasar observations by very long baseline interferometry, in which signals from widely separated telescopes are combined for high accuracy in determining position (SN: 11/8, p. 437), and from signals sent by Mariners 6 and 7 as they passed behind the sun during April and May (SN: 5/16, p. 481). But results from both of these experiments are still in the preliminary stage, say their respective spokesmen, the quasar group's Dr. I. I. Shapiro of the Massachusetts Institute of Technology and the Mariner group's Dr. J. D. Anderson of JPL.

One place where observation seems to favor Einstein is the so-called advance of perihelion: the gradual changes in the orientations of planetary orbits. For Mercury, Einstein predicts a motion of 43 more seconds per century than Newton did. Dr. Dicke's theory predicts about 10 percent less motion than Einstein's. Observation shows 42.3 seconds.

To make up the discrepancy between this prediction and the observation, Dr. Dicke suggests that the sun is slightly oblate and that the oblateness produces additional forces on Mercury.

Dr. Dicke has done observations in which he claims he sees the requisite oblateness (SN: 3/9, p. 229); others disagree. Dr. Shapiro and some colleagues studied 400,000 past measurements of the sun and came up with a figure for the oblateness that differs from Dr. Dicke's, but with such wide margin for error that, says Dr. Shapiro, "It does not exclude Dicke, but it does not give him much comfort." □

## MINE SAFETY

### Slowness in response

When the 1969 Federal Coal Mine Health and Safety Act was passed late last year (SN: 12/27, p. 592), it was hailed as the country's strongest coal mine legislation and the answer to a historic problem. But there is a difference between the passage of a law and the accomplishment of its purpose.

In the six months since its enactment, the law has become the focus of a rising tide of controversy: In parts of some mines there has been rigorous enforcement, in others none; some mine owners have rushed to comply with its regulation, while others have not, claiming they cannot meet them economically. And the act itself, instead of being hailed as an instrument of good, is being blamed for short coal supplies at a time when the nation faces a possible power crisis (SN: 6/6, p. 550).

The U. S. Bureau of Mines, charged with enforcing the act, contends that its job is rendered impossible by the lack of qualified inspectors. To do an adequate job, the bureau estimates that it needs 1,000 inspectors, five times the number on its rolls. It is training 100 more mine workers as inspectors, but the shortage and spotty enforcement are not expected to end until late 1971 at the earliest.

**Besides manpower**, the industry is citing equipment problems, which the bureau says put it in the position of enforcing the unenforceable. The act, for example, states that by this past March 30 all mine cars had to have automatic brakes. The problem is that automatic brakes have never been built for mine cars, says Henry P. Wheeler Jr., acting bureau director for health and safety, though they are being developed. Similarly, 20,000 to 25,000 methanometers, which detect methane, will be required by December 31. But they are in short supply. It will be March, says the bureau, before that number can be manufactured and distributed.

Similarly, at the end of this month, a limit of 3.0 milligrams of coal dust per cubic meter of air in a mine goes into effect. Many mines cannot now meet that limit, and the problem of getting enough equipment to the mine sites will create further delay. The mine owners contend that the six months they have had has been insufficient.

The bureau must still enforce the law, however. Some coal mine operators are already being cited for violations, and in April about 60 small mine owners from Virginia, Tennessee and Kentucky went into Federal Court and obtained a restraining order. The order prohibits the bureau from enforcing the law where circumstances prevent mine

owners from complying with it. Although the decision originally affected a tristate area, the bureau subsequently extended it to cover all mines.

"A year from now," says Wheeler, "the mines will be healthier and safer, but in this period of time, there is going to be this confusion and uncertainty."

At the same time, the Senate Committee on Interior and Insular Affairs last week delayed confirmation of Dr. J. Richard Lucas, head of the mining engineering department at Virginia Polytechnic Institute, as the replacement for ousted bureau director John F. O'Leary. Lucas is under attack for what critics believe is an unduly sympathetic attitude toward mine owners.

The House Subcommittee on Labor, on the basis of an ongoing investigation, places responsibility for the enforcement problem squarely with the bureau. The subcommittee finds the industry generally reluctant, but cites no specific foot-dragging.

To make sure none develops, Rep. Ken Hechler (D-W. Va.) and others oppose Dr. Lucas' appointment. "Lucas symbolizes the industry point of view, putting a low priority on the health and safety of coal miners as against coal production," charges Hechler. □

## PATENTS

### Signing the treaty

Lack of standardization has created turmoil in the area of international patents. Applications are bogged down by a multitude of forms, differing patent laws, separate filings for each country where a patent is sought and inadequate patent search facilities in many places. The result is massive backlogs, duplication of effort and unnecessary costs.

To overcome these problems, the United International Bureaus for the Protection of Intellectual Property (BIRPI) set out in 1966 to draw up a Patent Cooperation Treaty that would streamline patent application procedures. A year ago a final draft was drawn up (SN: 6/21/69, p. 596), and now delegates of 53 nations are meeting in Washington to put the final touches to the treaty.

**The conference** will end June 19, and what will come out of it will be a draft of a two-phase agreement that would permit an applicant to file one international application through the patent office of his home country. This obviates multiple filings in many different languages with different forms and extra fees. The subsequent search operations will be carried out in one of five centers in the United States, West Germany, Japan, the Soviet Union and The Netherlands.

According to this first phase of the treaty, the applicant then has 20 pro-