they produce new fissions and these in turn new fissions and so onward in geometrical progression, so that a whole massive piece of uranium might blow up in a sudden explosion of unparalleled fury touched off by so seemingly innocent an event as the entry of a single neutron?

This is perhaps the most important of the unsolved questions of physics. Let us begin by asking after a certain necessary though not sufficient condition. The fissions can not proceed in geometrical progression, the explosion of the whole mass can not occur, unless each fission results (on the average) in more than one free neutron to replace the one neutron which is consumed in producing it. Is this so? Well, the few people whose opinions are worth taking agree that it is. They do not agree well as to how many fresh neutrons there are over and above *one,* but they do agree that there is an excess.

With this as a basis, let us turn the question around. Why has not the great explosion happened as yet, since there are neutrons enough to achieve it?

One reason apparently is, that the fresh neutrons are moving with the wrong speeds when they are released. Fission is performed mainly by very slow neutrons, while the new-born ones are very rapid. But if the piece of uranium were very large, even the fresh neutrons would be slowed down by their repeated collisions with nuclei; and therefore those who are trying to make the explosion, or trying to approach it without quite making it, are heaping up great masses of uranium. If, however, the uranium is mixed with other elements—as in nature it always has been—the neutrons are liable to be captured and rendered harmless by the nuclei of these others. Therefore, the next step is to purify the uranium. This would be easy enough were it not that "purity" in this connection means something more stringent than even chemical purity. Within the last few weeks it has been proved that only one isotope of uranium is sensitive to slow neutrons, and this is a rare one—fortunately, I feel like saying. One must perform a process of isotope-separation in which the two isotopes differ in mass by less than two per cent., and one is more than a hundred times as abundant as the other. Probably this will take a long time in the doing. If and when it is done, shall we find that human artifice has succeeded in removing or relaxing the last brake provided by nature to impede the slide toward catastrophe? Perhaps not even then, for the rare isotope of uranium may have ways of its own for capturing neutrons and rendering them harmless before the most of them achieve fissions. Perhaps on the other hand the brakes are easier to relax than the foregoing words imply. Possibly they can be relaxed just a little without letting go altogether, and then there may be available a potent source of power. But at this point I depart from the traditional detachment of the scientist, and express the fervent hope that the mastery of this process, if ever to be achieved at all, will not be achieved until the world is ready to use it wisely.

SCIENTIFIC EVENTS

EXHIBITS IN THE GEOLOGICAL SCIENCES AT THE CALIFORNIA INSTITUTE OF TECHNOLOGY

Two interesting and important exhibits have recently been given on indefinite loan to the museum of the Division of the Geological Sciences of the California Institute of Technology in Pasadena.

The Kettleman North Dome Association has presented three large models, constructed by Martin Van Couvering, consulting petroleum engineer of Los Angeles. These models[1] served as a part of the exhibit of the defendants, the Kettleman North Dome Association, in one of the most important lawsuits ever tried in the state of California. The trial was concluded in 1938, and subsequently the models were on display at the Golden Gate Exposition of 1939.

One model (about 16 feet long and 6 feet high) shows, on a scale of 500 feet to the inch, all the wells in the Kettleman Hills field by means of steel pegs, on which the different formations encountered are distinctively colored. Another exhibit makes possible the correlation of the areal geologic map (on a scale of 1,000 feet to the inch) with a structural relief model. The third case (also on a scale of 1,000 feet to the inch) consists of a wooden relief model of the dome, in which by the removal of separable segments, subsurface structure can be revealed along various cross-sections.

The other exhibit has been made available by the Metropolitan Water District of Southern California, through F. E. Weymouth, general manager and chief engineer. This consists of three display cases containing some 175 specimens, principally rocks, but including minerals and fossils, assembled largely by L. H. Henderson, resident geologist for the district. Several of the diamond drill cores, taken in connection with the location of the San Jacinto tunnel,[2] are included in the exhibit. The collection constitutes a valuable record of the different lithologic types encountered in the drilling of the ninety-two miles of tunnels of the Metropolitan Water District's Colorado River aqueduct.

1 John H. Maxson, *Am. Asn. Petrol. Geol., Bull.* 24, 740–741, 1940.

2 L. H. Henderson, *Jour. Geol.,* 47: 314–324, 1939.