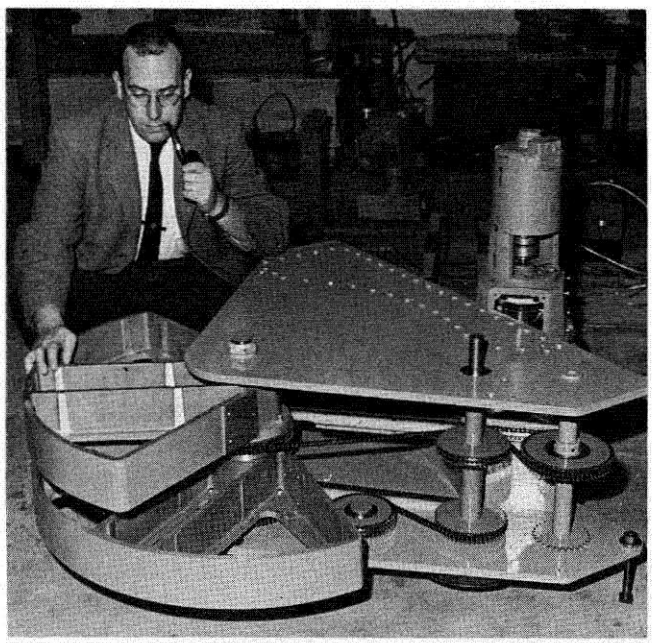
Earthquakes to Order

Because nature only comes up with the genuine article at rare intervals, Caltech engineers have now designed a machine that will manufacture earthquakes on demand. When it is placed in a building, this instrument can shake and crack the structure with all the violence of a natural quake. And by cracking some real buildings under controlled conditions, the Caltech engineers hope to produce information that will lead to practical, economical designs for buildings, dams and bridges that can withstand earthquakes without damage.

Because of the wide demand for this information in countries where earthquakes are prevalent, scientists from Japan, India, Argentina and Chile are cooperating on this research in the Caltech earthquake engineering laboratories. The work is under the direction of George W. Housner, professor of civil engineering and applied mechanics; and Donald E. Hudson, professor of mechanical engineering. The project is sponsored by the Earthquake Engineering Research Institute, a nationwide non-profit agency composed of engineers and scientists and headed by Dr. Housner, under a contract with the California State Department of Architecture.



Thomas K. Caughey, associate professor of applied mechanics, and the new earthquake-making machine.

The CSDA's chief concern is with public school buildings. Many school buildings in California do not conform to earthquake codes, though they are still in use because school building programs haven't caught up with the population growth.

The shake-making machine is small compared with the formidable quake it can produce. It is compact enough to carry through doorways – with help. It weighs about 500 pounds, including its 1½-horsepower motor. The shaking is produced by a pair of 20-inch swing boxes that counter-rotate unbalanced amounts of lead weights horizontally. Up to 400 pounds of the weights can be packed into each box. The boxes swing between heavy triangular steel plates, 46 inches long by 26 inches on the shorter two sides. The 15-inch-high assembly is bolted to the floor.

Varying the quakes

The ability to vary the weights in the boxes and to regulate the speed of the rotations between four and five hundred revolutions per minute makes it possible to produce quakes of varying magnitudes. The direction of the shaking is also controlled. The machines can be used singly or in teams on each floor of a building to produce motions in various phase relations.

Present plans call for constructing four of the machines, which were designed by Dino Morelli, associate professor of mechanical engineering. Thomas K. Caughey, associate professor of applied mechanics, devised the electrical design.

Drs. Hudson and Housner are now looking for a building in which to give the device a shakedown test. The ideal situation for testing the machine and for producing earthquake engineering data would be the erection of a test building about 20 feet square and 40 to 50 feet high. Such a structure would require only a steel framework and floor slabs.

Additional work is planned on other buildings, such as commercial structures or warehouses scheduled to be torn down on freeway clearance projects.

With data produced by the vibrator, and by some 100 small seismographs that are being installed in Los Angeles and San Francisco, Drs. Hudson and Housner hope to develop quake-resistant designs for structures, and to help produce sound building codes in areas subject to earthquakes.