

- (4) Arranging the exhaust and portions of the blading so as to expand the steam efficiently to the highest vacuum obtainable in the condenser.

Considering these proposals in the order given above, it will be evident, on theoretical grounds, that the necessity to heat the feed water, in other words, to reheat the water of condensation before conversion at constant temperature into steam, is the defect of the Rankine cycle; because it involves heat reception at temperature below the maximum.

Since the steam in the course of its expansion through the turbine is all the time falling in temperature, it is clear that this defect could be overcome if the heating of the feed could be accomplished by transfer of heat from the steam at corresponding stages of equal temperature, or, in other words, by a regenerative process. With the addition of such a process, the cycle would be

thermodynamically reversible, and under such conditions, the efficiency of the Rankine cycle for saturated steam would be brought up to that of the Carnot cycle. In practice a close approximation to this regenerative process can be obtained by the employment of a sufficient number of feed-water heaters in cascade supplied with steam tapped off from suitable stages of the turbine.<sup>1</sup> The steam which thus transfers its heat to the feed heater is first of all made to do some work by expansion in the turbine down to the temperature at which it is required for withdrawal to the corresponding heaters, and since a certain amount of heat is required for the feed

water in any case, the work obtained from this tapped-off steam is obtained merely at the expense of additional heat equal to the work done by it, in other words, this additional heat is utilized at nearly 100 per cent. efficiency. Expressed in another way, the utilization of some of the heat of the steam to pre-heat the feed water reduces the amount of heat that has to be taken in by the boiler and also that rejected to the condenser.

<sup>1</sup>Feed heating in a single stage by partly expanded steam is a well-known expedient. It was proposed by James Weir in 1876 and by Normand in 1899; and feed heating in progressive stages was proposed by Ferranti in 1906.

Science News Letter, June 27, 1931

SEISMOLOGY

# Automatic Seismograph Works Only When Quake Starts It

**H**OW SEISMOGRAPH instruments of a new type, cheaply constructed and starting automatically to register only when an earthquake rocks the actual spot where they are standing, are

being planted at various points in California to "trap" earthquakes when they happen, was told before the meeting of the Seismological Society of America in Pasadena last week by Prof. R. R. Martel of the California Institute of Technology. Prof. Martel read a report from Capt. N. H. Heck of the U. S. Coast and Geodetic Survey, who has immediate charge of the work.

Although earthquakes have engaged the attention of scientific men for many years and delicate instruments have been devised to detect them at a distance and tell how far away and how violent they are, strangely enough there has not been until the present time any instrument that could make a record of an earthquake occurring in the immediate neighborhood. They are so delicately built that a strong earthquake directly under them would wreck them. The new instruments are more ruggedly built, record only relatively large earth movements near by, and turn themselves on automatically when a quake begins.

The distribution of these instruments has been undertaken by the Federal government largely as a practical aid to engineers and architects in designing and placing buildings so as to avoid earthquake damage as far as possible. California was not chosen as the first area to be investigated by means of the new instruments because it is the most probable scene of great earthquakes, Captain Heck said.

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