divided into 6 groups and given the food containing the chemicals in concentrations as indicated in Table 1. The rats were weighed weekly. After 4 weeks they were sacrificed by guillotine, and blood analyses were performed by the usual clinical methods.

Table 1 summarizes the results. Cobalt produced the usual increase in red blood cells, hemoglobin, and hematocrit. The animals fed 0.2% and 1% EDTA along with the cobalt showed some diminution of the cobalt effect. There were no essential differences in the blood counts of those animals given 5% EDTA, with or without cobalt, and the controls. The rats in all the groups appeared normal in all outward respects during the course of the experiment and suffered no loss of weight. No gross pathological conditions were discernible at autopsy.

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Device for Stirring Liquids under Reduced Pressure in the Absence of Air and Mercury[1]

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In the course of investigations concerned with liquid solutions that had to be thoroughly stirred in the absence of foreign gas, particularly air and mercury, we have made several improvements in an apparatus designed by L. J. Heidt (*1*) for this purpose, especially for the study of photochemical reactions produced by the irradiation of such solutions in a stationary reaction vessel. Heidt's description is very brief and is not accompanied by a sketch or any details of construction, since it is given incidental to some other work. The improved model is sketched in Fig. 1. The device operates by rotating in air a strong magnet, which turns an iron rotor inside a vacuum chamber made of brass.

Among the improvements is the construction of the vacuum chamber in such a way that there is easy access to the parts within it, especially the bearings, which need to be cleaned and lubricated frequently. Access to these parts is obtained by disengaging the joint marked *A* in the sketch.

Another improvement is the provision for adjustment of the force between the magnet and the rotor so that this force can be kept small enough not to break the glass stirrer when it becomes stuck in the reaction vessel. This adjustment is made by means of the screw so marked at the top of the sketch of the vacuum stirring head.

[1] The work on this device was assisted by a grant-in-aid from the Charles F. Kettering Foundation as part of its integrated program of research on the photosynthesis problem.

A third improvement is the use of commercial-turned cone-thrust ball bearings instead of conical steel pins riding in brass; the latter often gave rise to great changes in the speed of stirring, because it was practically impossible to lubricate them adequately when they were operated continuously for several days. The ball bearings can be lubricated satisfactorily with Apiezon M vacuum stopcock grease.

Most of the device is constructed of brass, but the shaft driving the magnet is made of cold rolled steel, and the shaft attached to the rotor and the chuck at-

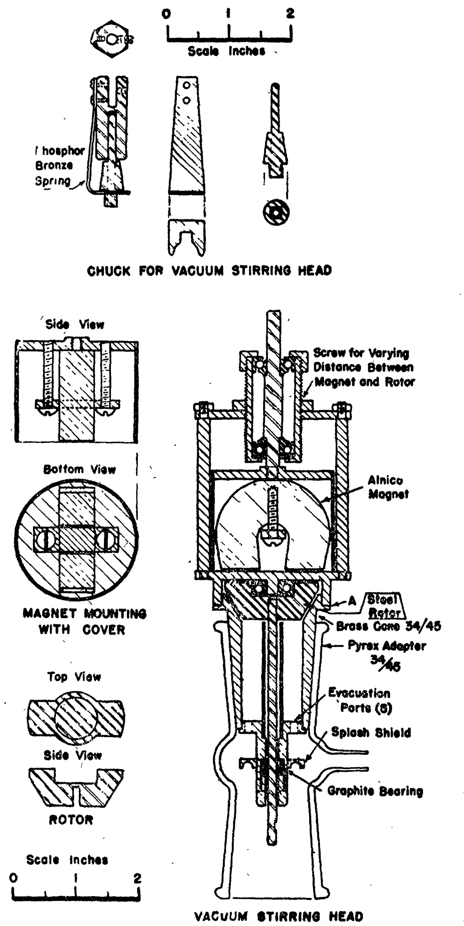

FIG. 1.

tached to this shaft are made of stainless steel. The shaft of the glass stirrer is held in the chuck by de Khotinsky or Sauereisen Insulate cement when the reaction mixture is made up of water or an organic solvent, respectively. The thrust-type ball bearings are Nice No. 702, 11/16 in. OD, and accommodate a 3/16-in. shaft.

The magnet is surrounded by a brass shield, primarily for safety. The flat top on the magnet was ground there to facilitate mounting. The plate holding the screw for adjusting the position of the magnet is held in place by three equally spaced posts, only two of which are shown in Fig. 1. Other details of construction are apparent from the sketch. The device may be supported conveniently by a ring clamp, which grasps the cylindrical section of the vacuum stirring head immediately above *A*.

The joint marked *A* in Fig. 1 was made vacuum-tight by applying a thin layer of de Khotinsky cement to the shoulder at *A* while the male part of the joint was disengaged from the female part and heated gently to 140° C. The former was then screwed into place, and the parts around *A* were warmed until the cement also wet the female part. The parts were screwed together tightly while hot and allowed to cool slowly to room temperature.

The vacuum chamber and the standard taper adapter were snugly fitted together by lapping them with silicon carbide, grit No. 600, after which all traces of abrasive were removed by scrupulous cleaning. This joint was lubricated with Apiezon M grease in the usual manner and held together by a steel leash under tension. No trouble has been encountered in obtaining a vacuum, but the first degassing of the device occasionally requires more than a day before a vacuum of 10^{-4} mm Hg can be held overnight.

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Comments and Communications

Geology *Is* in the Elementary Schools

DORSEY HAGER'S plea for the teaching of geology in the grade schools (SCIENCE, **114**, 19 [1951]) reflects the concern of one who has undoubtedly experienced, enjoyed, and profited from both the formal and informal study of the earth sciences. There is no question that children of grade school age would also profit from more firsthand experiences with rocks, minerals, and physiographic forms. However, the approach suggested by Hager, involving new courses, simple geological texts, and the teaching of "geology as the Mother of Sciences, not as one of the natural sciences," is open to question.

It is becoming axiomatic that children, not subjects, are the concern of the grade schools. The past generation has seen a marked trend away from isolated subject courses of all types. Newer curricula based on findings in the fields of psychology and child development have taken their place. Grade school teachers would be loath to see geology introduced as a separate subject, despite the intrinsic value of the earth sciences, which they have long recognized.

The actual situation is not nearly as "outrageous" as Hager claims. In the opinion of the writer, it is hopeful and promising, although there is ample room for improvement. The scope and standards of elementary education do vary widely in different parts of the country. Localities may be found where science education is meager or absent. For the country as a whole, however, science education in the grade schools is constantly increasing, and materials from the fields of geology are included at nearly every grade level in the schools where science is taught. Even a casual survey of the textbooks used in elementary science will show much material from the field of geology. Land forms, soil, erosion, rocks and minerals, ore deposits, glaciation, mountain building, stratigraphy, fossils, weather, and climate are some of the topics included in ways that are appropriate to the age level and interests of the child.

The textbook series used in the elementary grades includes material on all the topics Hager uses as illustrations: erosion, building materials, rock identification, mineral fuels, metals, fossils, and the solar and stellar systems. When astronomy is included with geology, as Hager recommends, the space allotted in the textbooks reaches major proportions. As expected, the material is more advanced in the intermediate and upper grades than in the primary grades. Analyses of textbook content (Michals, B. E. *Science Education*, **34**, 248 [1950]) indicate the detailed distribution from grade to grade. In addition to textbooks, the elementary schools make considerable use of popularly written scientific books. A number of writers, especially Carroll Fenton and Lilian Strack, have produced excellent books packed full of geologic data which children use and enjoy. There is ample evidence from books and from state and local courses of study that the earth sciences are not neglected in the elementary schools.

A problem which Hager does not mention, and which is of greater concern to those working in science education, comes from the fact that science teaching in the elementary grades is relatively new. Because of this, classroom teachers who have had very little, or no training whatever, are trying to do the best they can with this subject. Teacher training institutions have only begun to prepare teachers for this work. Their efforts so far are limited. For this reason, teachers all over the country need and are anxious to have the kind of help that people like Hager and others, trained in the earth sciences, can offer. Why don't these geologists let local school boards, principals, and teachers know of their interest in science education? Let them indicate some specific ways they can help teachers—e.g., with field trips, specimens, demonstrations, or lectures. This could be a practical first step toward the goals set forth in Hager's communication.

There is no doubt, as Hager indicates, that the earth sciences are much more vital than some college texts