

pneumatic principle can be applied also to measure the specific gravity of liquids of variable density by two standpipes connected to a differential pressure indicator or recorder. In a list recently issued, Messrs. Negretti and Zambra, who have wide experience in the manufacture of instruments of these types among many others, have supplemented the

illustrations with accessory schedules and diagrams showing how the several models are employed and connected under different conditions of service. More than a catalogue, it is thus a handbook for the reference of those responsible for the selection and installation of level measuring instruments.

## THE PUBLIC HEALTH IN WAR-TIME\*

**I**N every war of which we have records the wastage from disease has outnumbered many times the losses from killed and wounded. Figures from the War of 1914-18 support this statement, as well as the experience of the Walcheren expedition and the Crimean campaign.

Military and civil authorities are both interested in the maintenance of the public health in war-time. Military and civilian health authorities successfully co-operated in this respect during the War of 1914-18, and similar arrangements have been made in the present war.

While indirect war consequences, such as alterations in diet, excess of work and worry and the pandemic of influenza (1918-19), contributed to increased rates of mortality among civilians in the War of 1914-18, the record of civil public health was good on the whole. The population increased and the infant mortality rate was lowered. It must be remembered that that War saw the beginnings of those personal health services which have done so much to improve the health of the community; for example, the School Medical Service (1907), the Insurance Medical Service (1912), the Tuberculosis, Maternity and Child Welfare and Venereal Disease Services. It is a harder task in the present War to maintain the health services at the high level they have reached. In addition, unprecedented demands have been made on the national health services. The central health authority has become a more important arm of defence, and has had to organize an emergency medical service, in

itself a stupendous task, and an evacuation scheme for school children, expectant mothers young children and other priority classes of the population.

An account of the emergency medical service and of the medical problems of the evacuation scheme was also given.

Certain criticisms of the evacuation scheme were discussed. It was emphasized that the Public Health and School Medical Services should not be blamed for departures from the normal standards of cleanliness and conduct found in certain of the evacuees. The root cause of these conditions lies in the home. They mean that slum clearance has not yet gone far enough, that low standards of living still persist, and that the lessons taught in the school and clinic sometimes fail to reach the older generation.

It was suggested that the policy of preparing for casualties and of evacuation may have played no inconsiderable part in the present freedom of Great Britain from enemy air raids.

Reference was made to certain diseases—deficiency diseases, tuberculosis, venereal diseases, influenza, infectious diseases, cerebrospinal fever—which are the objects of special concern in this War. The civilian arm has yet to receive its baptism of fire. If that stern ordeal comes, it will endeavour to keep the flag of national health flying in the storm of war as zealously as it did in the sunshine of peace.

\* Substance of a Chadwick Public Lecture delivered on February 20 by Sir Arthur MacNalty, K.C.B., Chief Medical Officer of the Ministry of Health.

## HAULAGE PRECAUTIONS IN MINES

**O**F the deaths caused by haulage accidents in mines, the fact that over a period of eight years nearly 25 per cent were due to runaway tubs is sufficiently serious to indicate this as a subject demanding inquiry. One of the lines of research undertaken in this connexion was to determine the relative degree of effectiveness of the different types of backstay which are used as one means of arresting potential runaways. The backstay, which is known by several local names, is a strong steel bar which trails along the rail track at the rear of the string of tubs, its function being to dig into the track if the frain tends to run back. Frequently its action is ineffective, and this led to one line of research being directed by the Department of Mines towards ascertaining the chief causes of the failures and the ways and means of preventing them by improving

the design of this simple safeguard. The results of this investigation have now been published under the title "Backstays for use in Mines" (Safety in Mines Research Board Paper No. 103. H.M. Stationery Office. 1s. net), which describes all the steps taken and results obtained and makes available to the coal mining industry the conclusions reached.

Representative types of backstays having been obtained from several coalfields, these were examined for variations in design. They were classified in four groups, the classification mainly depending on the method of attachment to the tub. In other respects very marked differences were noted; length varied from 23 to 42 inches and weight from 9½ to 72 lb. They were subjected to a number of tests under conditions simulating those which might actually



occur when tubs are on an incline, such as allowing tubs to run back for some feet before the stay is free to operate, or being bumped into by a runaway. The results of the several tests are recorded in relation to the four different groups of the original classification. From these it was possible to draw conclusions as to a suitable mode of attachment, safe limits of length, weight and cross-section and general construction. It is interesting to note that the ideal length is about that of the longest stay examined and its weight should be about 40 lb.

The metallurgical and mechanical tests of the

materials used in the sample stays showed that they have usually been made of soft steel and therefore have been relatively weak and easily bent. The report recommends that high quality steel should be used, preferably 1.5 per cent manganese steel as previously suggested for colliery haulage drawgear.

In addition to the details of the investigation, the paper gives the analysis of the problem in relation to different numbers of tubs on various inclines. The formulæ published should be of considerable assistance in checking the sizes required under any given conditions.

## TRANSVERSE DISTRIBUTION OF HORMONES IN PLANTS

By E. D. BRAIN

“THE relation between various types of hormone distribution is the internal regulating mechanism of a plant.” This conception underlies the theory of the transverse reactions of plants which Georg Borgström discusses in a recent publication<sup>1</sup>. He emphasizes the physiological importance of transverse hormone distribution in relation to polar transport. Starting from the discovery that treatment with ethylene upset the normal transport of auxins and caused a transverse flow out of the phloem into the surrounding tissue with consequent swelling of the cells, Borgström studied various natural conditions which produced similar effects. He found that light of short wave-lengths, high humidity, high and low temperature, action of specific chemical substances, mechanical stimulation of the phloem and the age of the plant organ were factors which influenced the direction of auxin distribution, by diverting the normal polar stream into transverse channels with resulting reaction in the plant. Among these “transverse reactions” of the plant he classes tropistic growth responses, the light-growth reaction, secondary growth, root formation, root contraction, water transport, fruit development and leaf fall. He also discusses various other physiological and morphological problems in the light of his theory and suggests that the transverse distribution of hormones is responsible for various ecological types; the strength of the reaction being governed by the extent to which normal growth is upset by the transverse effect.

It is impossible to discuss here the numerous applications of the transverse theory, but I propose to deal with Borgström's interpretation of the mechanisms of photo- and geotropism, which is in some way illustrated by my own work on geotropism<sup>2</sup>. According to Borgström, light induces lateral hormone transport which increases the transverse growth of cells of the cortex and retards their elongation on the light side of the stem. Histological studies by various workers have endorsed this, and Borgström's measurements for cells of the cortex in *Pisum* stems and *Lupinus* and *Helianthus* hypocotyls, when submitted to unilateral illumination, show marked increase in width and decrease in length on the illuminated side. A transverse growth effect is therefore included in the mechanism of phototropic curvature. What has been termed as increased sensitivity in the dark can

also be explained as the normal elongation proceeding without interference from transverse light effects. A study of geotropically curved stems shows increased width of cells on the lower side, accompanied by elongation due to the accumulated auxin from the transverse effect of gravity. In the root the same distribution takes place but, since auxin inhibits growth, the lower side is retarded and positive curvature results. In my investigations on the growth of plants for prolonged periods on a klinostat, I have found histological changes which indicate the resultant of processes which would normally produce curvature. In hypocotyls of *Lupinus albus*, marked increase in the radial walls of the cortical cells was noted, and in radicles, cells of the cortex were much shorter in longitudinal section but only slightly smaller in transverse section. It appears as if radial extension is the predominant factor in negative curvature of the stem, whereas in roots the inhibition is more in the longitudinal direction. Reaction of shoots and roots is different and it seems doubtful if the transverse effect can be so complete an explanation of positive geotropism as Borgström suggests.

Besides seedlings, flowers and leaves of *Narcissus pseudo-narcissus* and fronds of *Asplenium bulbiferum* were grown on the klinostat. In *Narcissus* flowers no bend in the receptacle occurs on the klinostat but, at the stage when the bud bends normally, changes occur in the outer layer of cells. The difference in length of the dorsal and ventral halves of curved flower stalks has been explained by Zollikofer<sup>3</sup> as being due to the unequal elastic pressure of the two halves, as a result of unequal growth hormone distribution. On the klinostat the normally unequal distribution would be equalized and alteration in the elastic pressure might result, causing the tangential stretching of cells which are compressed when bending occurs normally. It is significant that these changes coincide with a maximum development of statoliths in the receptacle, which points to the possibility of some link between the statolith apparatus and the bending mechanism.

In *Narcissus* leaves the epidermal cells are shorter and there is a greater number of stomates on both the inner and outer surfaces of the leaves grown on the klinostat. The cells of the cortex of *Asplenium bulbiferum* fronds are much wider radially