Food Preservatives and their Action.

UNDER modern conditions of civilisation, the question of supplying food to large numbers of people who live at a distance from the actual areas of production, has assumed an importance which can scarcely be overestimated. The problem has been attacked along two lines: first, by means of quicker and more efficient transport; secondly, by the introduction of preserved foods, including under this term both those which are sterilised by heat and also those preserved by exposure to low temperatures. Owing to the loss or partial destruction of certain accessory food factors during the process of preservation, it is essential that fresh food, especially vegetables and fruit, should be available for general use, and this is largely ensured by means of efficient transport between producer and consumer. On the other hand, certain articles of diet, especially meats, which must be transported long distances, must undergo some treatment to keep them in a condition fit for human consumption, and there is no doubt that the most suitable method to employ is one which ensures sterility and its maintenance during transport: thus the meat, after *efficient* sterilisation by heat, may be tinned and kept sealed from the air, or it may be chilled or frozen, the low temperature preventing any microbic or similar growth.

Unfortunately, simple chilling of meat at a temperature just below freezing point will not prevent deterioration on a long voyage: freezing at a temperature of 10° F. is, however, successful, but the meat does not compare so favourably with fresh meat. It has, therefore, been suggested that the process of chilling might be supplemented by the addition of a chemical preservative or antiseptic when meat has to be conveyed long distances before consumption. The substance which has been used commercially to a small extent in this connexion has been formaldehyde, and the question at once arises as to the effect of this substance upon the human economy. In the Interim Report of the Food Preservatives Committee,[1] recently published, the use of formaldehyde as a food preservative is considered, both from a general point of view and also with particular reference to the carriage of chilled beef. The Committee is unanimous in condemning its use, both with regard to its effects on the consumer himself and also from the fact that it can be used to conceal incipient decomposition, without, of course, thereby rendering the food fit for human consumption.

Formaldehyde acts as an antiseptic since it is a powerful protoplasmic poison: its action is, however, not specific for micro-organisms only, but it also reacts with human tissues, combining with the proteins: thus its excretion is slow and so its action is probably cumulative. When ingested it irritates the mucous membranes with which it comes in contact, and after prolonged use may cause inflammation of the liver and kidneys. It also combines with the proteins of foods, thus rendering them less digestible. In spite of these drawbacks, its use might perhaps have been thought less objectionable in the case of chilled meat, where the carcasses, after being placed in the refrigerating chamber, are exposed for a short time only to the action of the formaldehyde in the form of vapour; the air in the chamber is circulated by fans, and after about half an hour the vapour is removed by a current of fresh air.

In these circumstances it might have been supposed that any organisms on the surface of the carcasses would be killed and the meat remain fresh at a temperature just below the freezing point. Apart from the fact that the process is uncertain in its action owing to the uneven distribution of the vapour in the chamber, its success also seems to depend on the cleanliness with which the meat is handled before it is put into the chamber. These considerations tell against the method, and when it is also found that traces of formaldehyde may be present in the meat at more than one inch from the surface, it is seen that the consumer may take into his system quantities of the poison which cannot fail, in the long run at any rate, to be injurious.

The Committee concludes, therefore, that formaldehyde should be banned as a food preservative in all cases. This conclusion may be applied also to the use of formaldehyde as an antiseptic in disease. For external application it has its use, but internally any effect it may have upon micro-organisms is counteracted by its simultaneous deleterious actions upon the tissues of the body.

[1] Interim Report of the Food Preservatives Committee on the Treatment of Chilled Beef and other Foods with Formaldehyde. (Ministry of Health.) H.M. Stationery Office. 1924. Price 2*d*.

The Free Atmosphere in India.[1]

THE Memoirs before us are by Mr. J. H. Field, who has succeeded Sir Gilbert Walker at Simla, and by Dr. W. A. Harwood. They are of particular interest from the fact that both authors have been connected with upper-air work in England almost from its first conception.

In the introduction, Mr. Field discusses the methods and instruments that were used, many of which were designed by him especially for the purpose; and he is to be congratulated on the success that has been attained.

Owing to the climate of India the ordinary rubber balloons could not be used, on account of the difficulty of storage, and gutta-percha balloons, made up as required, were substituted for them. Mr. Field describes his semi-graphical methods of working up theodolite observations quickly, and gives some very useful formulæ showing the final error in terms of the errors of observation. He finds that too much trust may easily be placed in the two-theodolite method, and gives an example in which the four angular measurements are perfectly consistent among themselves and yet the height of the balloon is in error by 50 per cent. He adopted the tail method for general use.

The results of some very useful experiments are given, showing the extent of the errors which may occur owing to the heating by solar radiation of the recording instruments, and also by the inevitable lag of the thermograph. The conclusion reached is that the resulting error is small up to a height of six kilometres, and this is confirmed by the good agreement of the mean values obtained by night and by day. Above 10 kilometres the error is increased by the unfortunate necessity in having to use gutta-percha balloons, the rising velocity of which falls off as their highest point is reached; but up to 12 kilometres it does not seem likely that the error exceeds two or three degrees.

Mr. Field has done a most useful piece of work,

[1] "Memoirs of the Indian Meteorological Department." Vol. xxiv., Parts v., vi., vii., and viii.

and his memoir should be read and carefully studied by every one similarly engaged: to such it will give many valuable hints.

In Part vi. Dr. Harwood discusses the observations made with kites and registering-balloons over India and the Arabian Sea. He gives first a summary of the results obtained by Field by means of kites, and then deals with the registering-balloon ascents made in India, chiefly at Agra, during the years 1914–18. In all 237 were sent up, 156 instruments were returned, and 152 of these gave usable records, a result which reflects great credit on Mr. Field and his Indian assistants. The figures were handed to Dr. Harwood, on his return from war service in 1918, to be worked up.

Dr. Harwood has taken every care to ensure accuracy, and being well acquainted with the many possible sources of error, has only used such ascents as may be reasonably supposed to be free from error, especially from the effects of solar radiation, a precaution needful in view of the slow rise of gutta-percha balloons. He gives particulars of the temperature, humidity, and pressure at various heights in the three Indian seasons—the cool, the hot, and in the monsoon—and also annual means for the density. He carries his tables up to 12 kilometres, and it is only to be regretted that the stratosphere was not reached, and that at least the results from Agra are not published in full detail.

It is not possible to comment on the many interesting points discussed, but the following may be mentioned. The mean annual lapse rate comes out as identical up to 9 kilometres with that of nearly all other stations; so also the daily temperature variation in India, as elsewhere, is confined to the first one or two kilometres. The excessive heat of the hot season is found to be confined to the bottom layer; higher up the monsoon season is the hottest. The high correlation between pressure and temperature so noticeable in Europe is absent in India, perhaps because the short period variations of pressure are too small.

Comment is made on the figures for the equator given by the reviewer in the M.O. Geophysical Memoir, No. 13, and the absence of information as to their source. These figures were formed from the smoothed mean values derived from the few data available at that time. Further observations on the equator are necessary to show whether Van Bemmelen's excellent set of results from Batavia, most of which have been published since then, fairly represent the general equatorial conditions.

Parts vii. and viii. discuss the motion of the free air over India as it is observed by means of clouds and pilot balloons. The year is divided into three seasons, and three separate heights are taken: the height of low clouds, 2 kilometres; of middle clouds, 5 kilometres; and of high clouds, 9 kilometres. These are the heights assigned to the different clouds in the International Cloud Atlas, and Dr. Harwood accepts them as correct for India. Many tables are given showing the direction of the wind and the percentage frequencies for each direction at each height for 15 stations distributed over the Peninsula; in some cases separate values for each month are given. It is noted that cloud observations necessarily refer to cloudy weather and that pilot-balloon observations will refer chiefly to clear weather, and there is some evidence that there is a systematic difference between the two, but it does not seem to be large enough seriously to prejudice the results of using them as equivalent. The figures will be of great interest to any one who is endeavouring to elucidate the cause of the monsoons.

In Part viii. the relation of the monsoons to the general circulation of the atmosphere is dealt with, and the similarity of the north-east monsoon to the circulation over the North Atlantic is discussed. Dr. Harwood finds a very noticeable coincidence between the track of storms and depressions, as shown in the Climatological Atlas of India and in the Meteorological Atlas of the Indian Seas, and the monthly mean directions of the upper winds at the cirrus level. If this be more than a coincidence, and it seems to be so, it has an important bearing on the formation and propagation of cyclones, and shows that their source must be sought for in the upper winds rather than in the surface conditions.

The four Memoirs form a very valuable contribution, not to Indian meteorology only, but also to meteorology in general. W. H. DINES.

The Royal Photographic Society's Annual Exhibition.

THE Royal Photographic Society's Exhibition was opened on Monday, September 15, and will remain open until October 25, with free admission, at 35 Russell Square. The Scientific and Technical Section is probably the largest and in a general sense the most interesting that the Society has ever been able to arrange. Among the astronomical exhibits are photographs of nebulæ made at the Mount Wilson Observatory by the 60-inch and the 100-inch reflecting telescopes, illustrating Dr. Edwin Hubble's proposed general classification of nebulæ, and a frame that shows the different degrees of elongation of elliptical nebulæ. Dr. William J. S. Lockyer, director of the Norman Lockyer Observatory, Sidmouth, sends some striking photographs of star spectra, and what is, with little doubt, the most successful photograph of a meteor that has ever been secured. Various forms of clouds and their changes are illustrated by several contributors, and geological work by one exhibit from the National Geographic Society of Washington. Closely allied to this are several "survey and record" photographs from the United States and Canada, a very notable one being a photograph, by Dr. W. H. Wright of the Lick Observatory, of the Sierra Nevada Mountains in the neighbourhood of the Yosemite Valley, taken from the Observatory on Mount Hamilton. The details shown range in distance up to 135 miles, and several comparative details are indicated which clearly demonstrate the effect of the curvature of the earth in depressing the more distant as compared with the nearer hills.

Among the stereoscopic slides, the set of 50 by Mr. Herbert G. Ponting which illustrate China and Japan, and include the manners, customs, and occupations of the people, are specially notable. The new Section of Cinematography has twenty excellent exhibits by three authors. Press photography, commercial stage photography, lantern slides, colour photographs of many kinds, natural history photographs, radiographs (including the C.D.X. dental X-ray apparatus of Messrs. Watson and Sons, and a series of 18 dental radiographs), photographs transmitted by wireless, and so on, are all shown in their latest and most perfect forms.

Photomicrography in the service of technology and scientific investigation is exceptionally well illustrated. The Research Laboratory of the Eastman Kodak Co. shows the fibres, and their characteristics, that are contained in photographic paper pulp, and illustrate a new method of distinguishing rag and bleached wood pulp, presumably by differential staining and photographing through suitable colour screens. Mr. W. S. Gerecke, of the U.S. Rubber Co., has sent a long series that refer to