Europe for example, without mutual interference, and explained that, although the number of possible frequencies available might be infinite, the useful range is not. He said that the service range of transmission might be said to be proportional to its wavelength, so that very high frequency transmissions have a very small reliable service area. If the band width occupied by a transmission could be reduced, the number of channels could be increased in the same proportion. Examples of narrow band transmissions cited included single sideband, suppressed carrier (for wired transmissions) and restricted modulation frequencies, and he mentioned an American invention by which an intelligible modulation range of 200–3,000 c./s. can be transformed at the transmitter to a range of from zero to a few hundred cycles a second, thus reducing the sideband frequency width to be accommodated, and providing further channels in a given range of carrier frequencies; the signal is re-transformed at the receiver. Captain Eckersley still believes, in spite of theories to the contrary, that sidebands were real.

Dealing with wired broadcasting, Captain Eckersley expressed the view that this system would provide a solution to ether congestion, and envisaged a future when perhaps even a special cable would be laid to every house, not only in Great Britain, but also in every country of the world, linking continents as far apart as Europe and America, although he realizes the present difficulties of operating a submarine cable of such dimensions. The number of channels available in a wired system would be infinite, and in this, together with the American invention described, he sees in the future a solution of our broadcasting problems.

Development of Fuel Research

ON March 26 Dr. E. W. Smith, director-general of gas supply, Board of Trade, addressed the Fuel Luncheon Club of London, choosing as his subject the question: "What do we want?" By "We" he meant the British community as a whole and not the interests of some particular industry or individual. He suggested that fuel, heat and power supply is more important than any other future concern of the Government, even than agriculture. Unrestricted competition, he said, should be abolished. The utilization of coal has led to our growth of industry and population, but the advantages so gained cannot continue indefinitely, and possibly not for long. To raise coal and sell it abroad at a loss is folly. To do the same with competitive fuels at home is equally foolish.

The Board of Trade has brought into one control coal, gas, electricity and oil, but if a Ministry of Fuel were established it should do more than regulate these. It should be a highly competent body, independent of vested interests, capable of advising, with long views, on the whole fuel policy of the nation. Fuel is becoming dearer and the mere stimulation of coal consumption is wrong. Allocation of fuel for domestic and industrial use should be made according to what has been determined as the best for a given purpose. This calls for a development of research on a great scale, greater than any hitherto known in Great Britain. Fuel research should no longer be distributed among many competitive research organizations, but co-ordinated in one comprehensive scheme with directors of the specialized branches. It should then be done with the most ample and best-equipped facilities for experiment.

Statistical Theory of Accident Proneness

THE scientific investigation of industrial accidents may be regarded as commencing in 1919 with the publication of a report by Prof. Major Greenwood and H. M. Woods for the Industrial Health Research Board, then known as the Industrial Fatigue Research Board, the data in which indicated that the hypothesis that persons were different in their liability to accidents from the start gave the best fit to the observed distributions. The mathematical considerations underlying these theoretical distributions were examined by Prof. Greenwood and Mr. Udny Yule in a paper published in the *Journal of the Royal Statistical Society* in 1920. A further paper on theory and observation in the investigation of accident causation by E. G. Chambers and G. Udny Yule has now appeared in the supplement to the same *Journal* (7, 89–109; 1941). In this, Mr. Yule gives a note on the statistical theory of accidents with special reference to the time factor, application of which to accident data leads to the conclusion that a lengthy period of experience is necessary for an individual proneness to accidents to manifest itself fully. Accident proneness may be regarded as a latent disposition needing certain circumstances to reveal it, rather than as an active function which is constantly in operation. Individual differences in accident proneness may, therefore, play their part chiefly in the earlier period of exposure to risk, their importance diminishing as the period of exposure increases. The maximum benefit gained by selective tests for proneness is, therefore, likely to accrue when the tests are applied to new entrants into risky occupations. The chief contributors towards accident rate might thus be found and eliminated during their most vulnerable periods. This conclusion is supported by the observed fact that selective tests are of much less value when applied to experienced workers than they are when given to new entrants.

To the discussion on this paper Dr. J. L. Irwin contributed an analysis of variance leading also to the conclusion that the most likely explanation of the differences between drivers is a difference in individual proneness to accidents, and Prof. Greenwood, commenting on the fact that Mr. Chambers had shown that a necessary condition for accepting the proneness hypothesis as a complete explanation of the fact is not fulfilled, agreed with his suggested explanation that the rate changes with time and pointed out that the study of Royal Air Force accidents might be of value here, since the high standard of selection probably eliminated the pathologically prone.

Fluorescent Light Sources

IN a paper before the Illuminating Engineering Society on April 14, Mr. J. N. Aldington pointed out that two types of fluorescent lamp have been developed within the last decade, both of which employ the mercury vapour discharge as the source of primary radiation. In the first type, envisaged so long ago as 1900 by P. Cooper Hewitt, a high-pressure mercury arc operates with a high luminous efficiency, and fluorescent coatings on the outer bulb containing the arc tube produce colour modulation of the emitted light. Ultra-violet and violet radiation of a wavelength above about 3,000 A. is absorbed by suitable inorganic sulphides and is re-emitted in the visible region to supplement the dominant mercury light. The change in overall efficiency brought about by

this energy transformation is negligible, but the effect on the colour-rendering properties of the emitted light is appreciable and useful. The second type of fluorescent light source is exemplified in the 80 watt MCF/U lamp, which was put on the market in March 1940, and is being used extensively for industrial lighting. A fluorescent powder layer coated on the inside surface of the tube containing a low-pressure mercury discharge tube is so vigorously excited by the resonance radiation from mercury that it produces about ten times the light given by an uncoated tube of similar size. The light is white and has colour-rendering properties sufficiently close to those of daylight for most industrial applications. The fluorescent layer is a mixture of inorganic powders which if used separately would give blue, yellow and red light and they are most efficiently activated by radiation of wave-length 2,537 A.

As the 80-watt lamp was designed primarily for industrial lighting to meet the demands of war-time conditions, the major applications in Great Britain have been in industry. Much experience has, however, been gained in the United States, where in the last three years fluorescent lamps have been introduced into practically every lighting field. It is found that the low surface brightness of approximately 0·5 candle per sq. cm. in the case of the 80-watt lamp and the large size of the source render it of great value for producing illumination conditions which can be made to approach daylight interior lighting. Shadows are softened and in a well-designed installation the illumination of vertical planes can be made effectively. In most cases stroboscopic effects are of little importance, the phosphorescence of certain of the powders used in the lamp construction assisting in bridging the gap between the cyclic changes in light output. The psychological effect of apparently cool light has proved advantageous in certain industries, and the freedom from glare in a well-designed installation is a noteworthy feature.

A Projected Canal System for England

IN a booklet entitled "The Projected Grand Contour Canal" (Birmingham: Cotterell and Co., 2*s*.), Mr. J. F. Pownall describes his ideas of a waterway linking together the main ports of England and accessible to coasting vessels up to 1,500 tons displacement, as well as canal barges. He points out that in the main watersheds of England, the lowest cols are at approximately 300 ft. As a result, he plans this canal to follow as near as possible the 310 ft. contour, which would obviate canal locks, with their delay and cost of upkeep, and necessitate only a few tunnels. Already some two hundred miles of existing canals lie at about 300 ft.; others are at lower levels. These might be linked by lifts, which have the advantage over locks in that they do not lose water in operation.

The main canal and its chief branches would be 864 miles long and would be 100 ft. wide at the water level, 17 ft. deep, with a clear headway under bridges of 80 ft. From London the Lea navigation would be used and improved as far as Hertford, where the new canal would begin with a lift. Thence it would pass through Bletchley, Rugby, Lichfield and Market Drayton to Manchester, with branches to Birmingham, the Trent and Wrexham. Through Lancashire it would pass by Clitheroe and Skipton, with a branch to Bradford and the Aire and Calder navigation, and thence along the eastern flank of the Pennines to Richmond and Newcastle, with a branch to Hartlepool. In the south, branches would reach Bristol and Southampton. At or near all the great ports, lifts would operate to and from the 310 ft. level. Sixty per cent of industrial England would thus be served at a cost which Mr. Pownall estimates at a halfpenny per ton mile. Other features of the suggested canal would be its service as a 'water grid' and as a line for gas, oil and other pipes which could be laid on its bed.

Wood Pigeon Nest Census

AN ecological survey of the wood pigeon's breeding habitats in Great Britain is being organized by the Edward Grey Institute, Museum Road, Oxford, as part of the British Trust for Ornithology's investigation into the biology of this species. The basis of the survey is a punch card, one being used for each occupied nest. The card is printed with a simple system of habitat classification; types of wood are illustrated by stating the name of the chief tree, shrub and flower. The finder also gives details of the position and contents of the nest, completing the hatching and fledging records if there are opportunities of returning to the nest. A punch card may be used at any time when a nest is found, but the maximum information is obtained from a census of any area of known acreage. If possible the census is repeated each month, cards being made out for nests not previously discovered and fresh information added to the old ones. The scheme is therefore flexible, allowing contributions from either an individual with only a few minutes to spare, or from members of a team; it also allows scope for organization within the team, encouraging those with specialized knowledge, such as a botanist, photographer, 'surveyor', and so on. For those proposing to organize a team census a pamphlet "How to Organise a Wood Pigeon Nest Census" is available from the Institute.

As the most active members of the Trust are now serving with the Forces a special appeal is being made to schools and youth organizations to help with the census. Several biology teachers are now using pigeons in dissection classes, and are studying crop contents, checking their identifications with observations in the field. A leaflet "Directions for Biologists" is available for anyone willing to undertake the examination of pigeons.

Lodgewood Telegraph Poles

C. H. AMADON, in an article on this subject (*Bell Lab. Rec.*, 20, No. 6, Feb., 1942), refers first to initial experiments made to preserve pine poles by creosoting, and secondly describes the method finally adopted. In the latter the poles are placed in closed cylinders and compressed air is admitted for about half an hour until the pressure rises to about 85 lb. per sq. in. Some of this air enters the cells of the wood. Hot creosote is then pumped in until the cylinder is full, pressure being maintained at 85 lb. per sq. in. during this period. More hot creosote is next pumped in until the pressure rises to about 135 lb. per sq. in. During this period of nearly three hours the creosote is taken up by the wood and fills its cells. At the end of this pumping period, air pressure is released and a vacuum is created under which the entrapped air brings to the surface most of the excess creosote, which drips off and is pumped out of the cylinder. The vacuum is broken after about an hour and live steam at a pressure of 20 lb. per sq. in. and a temperature of 260° F. is admitted