

and Britain, early January is a more realistic target. One suspected case of Hong Kong flu in Birmingham was confirmed before Christmas but, as there were reported cases earlier this year with no ensuing epidemic, that is not necessarily the start of a large outbreak.

Also questionable is the instruction to doctors to immunize—at least in the first instance—only those people who are at special risk. From the medical point of view, of course, healthy individuals should be able to survive an attack of flu without too much discomfort. But what of the economic aspect, which the spokesman at the Department of Social Security said was entirely a matter for the Department of Employment and Productivity to consider? British industry is hardly in a position to face a temporary shut-down. Although it would now be impossible to immunize the whole British population, there appears to be a strong case for providing industrial medical centres with enough vaccine to protect employees. In any case, it is naive to imagine that vaccine is going to be administered completely in accordance with instructions. Dr Sydney Greaves, secretary of the Medical Practitioners' Union, is reported to have said that at least one local authority has taken the bulk of its vaccine supplies for its own staff, and that some doctors are complaining that commercial firms are supplying individuals not in great need of vaccine, with the result that priority patients are having to do without.

POLLUTION

Controlling the Motor Car

from a Correspondent

A SYMPOSIUM was held at the London headquarters of the Institution of Mechanical Engineers on November 25 and 26 under the joint sponsorship of the British Technical Council of the Motor and Petroleum Industries (BTC), the Institute of Petroleum and the Automobile Division of the Institution of Mechanical Engineers.

The chairman of the organizing committee, Mr L. Martland from Ford Motor Co., started the proceedings by describing the Californian and American pollution regulations. The continued export of cars with engines of less than 140 cubic inches capacity, he said, was helped by the action of the BTC and others in securing higher permitted levels after demonstrating to the US Federal authorities the increased technical effort needed on the smaller car.

Mr W. T. Oliver (Ford Motor Co., Basildon) described how his company was meeting the American regulations by air injection into the exhaust ports; stainless steel tubes were used and positioned to deliver the air close to the exhaust valve heads. Back firing in the exhaust caused by pressure changes during deceleration was avoided by using a valve to divert the air supply. Mr D. L. Sutton (Rover Co.) showed the influence of air/fuel mixture, ignition timing, engine speed and load. He described work on a valve fitted to the carburettor throttle plate to secure improved combustion on overrun. Gas traces and results from tests on treated vehicles were produced showing compliance with the regulations.

Mr G. L. Lawrence (Zenith Carburettor Co.) outlined some of the advantages of the air valve type carburet-

tor, and Mr E. W. Downing (Joseph Lucas Ltd) described the application of petrol injection to high performance cars. He pointed out the difficulties of securing low hydrocarbon and carbon monoxide levels on engines with large valve overlaps because the high exhaust gas content in the cylinders slows down combustion and limits the burnable range of mixtures.

Mr B. L. H. Bishop (Smiths Industries, Witney) reviewed the various crankcase emission regulations both in the United States and in Europe, and described various control systems to recirculate these gases into the induction system of the engine. It is well known, he said, that 85 per cent of the blow-by past the pistons into the crankcase of petrol engines is derived from the carburetted air/fuel mixture. The remainder—usually about 15 per cent—is exhaust gas. Hydrocarbon emission from the crankcase is therefore high and, ignoring evaporative losses from the fuel system, can account for some 25 per cent of the total discharge of hydrocarbons from an untreated engine.

Messrs B. V. Harris and H. I. Fuller (Esso Petroleum Co.) described the evaporative loss control device (ELCD) developed by Esso, which uses activated charcoal to trap hydrocarbon vapours from the fuel tank and carburettor, and then releases them to the engine at defined intervals of operation.

Mr B. W. Millington (Ricardo and Co., Engineers (1927), Ltd) reviewed recent work on the study of soot formation in the exhaust, and explained that X-ray spectroscopy showed it to have a graphite structure with hexagonal basic carbon units linked into platelets giving a crystallite about $21 \times 13 \text{ \AA}$ in size. Mr A. E. Dodd (MIRA) and Mr J. Spiers (Perkins Engine Co.) reviewed various smoke meters for assessing diesel exhaust and pointed out their various shortcomings. The relationship between density measurements and subjective appearance to non-technical observers of vehicle emissions from the exhaust pipe confirmed that, for steady speed full load conditions, the subjective reaction was related to carbon concentration and rate of discharge by the formula $C\sqrt{G}=K$, where C is solids concentration (g/m^3); G is the rate of discharge (litre/s) simply calculated for 100 per cent volumetric efficiency; and K is a constant representing a particular degree of acceptability.

Details of experiments with a barium compound diesel fuel additive for suppressing smoke were given by Mr B. E. Knight and Mr C. H. T. Wang (CAV, Ltd). Films of combustion with and without the additive were shown by the authors and illustrated the earlier disappearance of the luminous flame when the smoke suppressant was used. Results from engine tests showed that 0.5 per cent of additive in the diesel fuel reduced the weight of carbon by some 50 per cent; carbon monoxide and carbon dioxide were slightly increased and hydrocarbon content in the soot was reduced. Aspiration of the additive in petrol with the intake air has a smaller effect on smoke.

AMERICAN RESEARCH

Gloomy Forecast

It will come as no surprise that for the second year in succession a marked drop is forecast in the growth of expenditure on research and development in the United States. The prediction, prepared by Dr W. Halder Fisher and Mr L. Lederman, economists at the

Battelle Memorial Institute in Columbus, Ohio, paints the gloomy picture of a growth rate in research and development actually lagging behind the anticipated inflation in the cost of performing scientific work.

The estimate for 1969 of \$25,900 million exceeds the figure for 1968 by \$900 million or 3.6 per cent. This compares with increases of 5 per cent from 1967 to 1968 and 7.1 per cent from 1966 to 1967, and is, according to the Battelle Institute, easily the slowest rate of growth for any year since figures were first compiled in 1953. Current rates of inflation in research and development are estimated at between 5 and 8 per cent.

The Battelle report offers little cheer to those who look to the end of the Vietnam conflict for a reversal of this sad trend. The momentum of the drive for social action programmes directed against poverty, crime and unemployment is thought likely to dominate the demands for those funds which would become available after a cease fire, and the sums involved are not expected to be large in the immediate future anyway.

The Federal Government is expected to foot about 60 per cent of the research and development bill for 1969, with industry bearing 35 per cent and the colleges and universities 3.6 per cent. The declining growth rate of Federal expenditure in this field is reflected in the reduction of an average compound growth rate of 9 per cent during the past ten years to one of about 6 per cent for the past four years. The Battelle economists expected that the next ten years would see growth rates of between 4 and 8 per cent, although the value of this forecast must clearly be diluted by the many implied assumptions.

It is an interesting feature of the present structure of American research and development that although the Federal Government is the dominant source of funds, about 70 per cent of all research and development work is carried out by industry. The share of the cost of industrial research and development actually borne by industry is expected to rise from 44 per cent in 1964 to 50 per cent in 1969, which is said to reflect the increased awareness of businessmen of the relevance of research to increased corporate growth.

EDUCATION

Physics at Sydney

Few physics departments can be as assiduously watched over as the School of Physics at the University of Sydney, which is cared for by an association with the unwieldy title of Science Foundation for Physics within the University of Sydney, sensibly abbreviated to Science Foundation. Set up nearly fifteen years ago, at the start of the university boom in Australia, which has seen the number of Australian universities more than doubled since 1945, the Science Foundation is an association of public and private organizations to promote the work of the School of Physics and to encourage scientific education in Australia generally. It is the brainchild of Professor Harry Messel, head of the school of physics.

The proudest feather in the cap of the Science Foundation is its International Science School for high school students, which is to become an annual event in August and September at the University of Sydney. Previous schools have been mainly for Australian school-children, but this year Britain and Japan each sent

five students and the United States was able to send ten. Professor Messel hopes to extend the international scope of the school in future. He should have no difficulty in attracting students, although money is a problem. Past lecturers include Professors G. Gamow, T. Gold, H. Bondi, R. N. Bracewell, R. Hanbury Brown and J. D. Watson.

TRANSPORT

Cheaper in Bulk

NEXT summer, the first full-blooded attempt to make a hovercraft service work effectively across the English Channel will be undertaken by Hoverlloyd, a company backed by the Swedish shipping firm of Swedish Lloyd and the Swedish America Line. Hoverlloyd announced this week its timetable for 1969, and it sounded very much more professional than British Rail's attempt to run a service in the summer of 1968 with only one hovercraft. The British Rail service, like many pioneer ventures, ran into a multitude of snags, but the experience was valuable. More than 400 modifications have been made to the design of the hovercraft, and Hoverlloyd is confident that it can run a reliable service. It has invested more than £5 million in the venture, which is designed to make all other methods of crossing the Channel (including the tunnel) look hopelessly out of date.

The company will be operating two Mountbatten hovercraft—better known as the SRN 4—between Ramsgate and Calais. On the Ramsgate side, the terminal has been built at Pegwell Bay (after a long wrangle over planning permission), and the terminal at Calais has been built by the Calais Chamber of Commerce. The route will take the hovercraft across the notorious Goodwin Sands, some parts of which dry out at low tide, and within half a mile of the North Eastern Victory, an American ship wrecked on the Goodwins in 1947. In bad weather, the plan is to use the Goodwins to provide a measure of shelter for the hovercraft. The company believes that weather conditions will be suitable for operation whenever the wind is no more than force 7 on the Beaufort scale, which is a near gale. Throughout the year this means that the service should be able to operate 94 per cent of the time; in the busy summer season, 99 per cent reliability should be achieved.

The trip will take 40 minutes, and the turn-round time at each end will take only 20 min. This gives the hovercraft an astonishingly large carrying capacity—indeed, according to Hoverlloyd's estimates, the entire channel passenger traffic could be handled by eight hovercraft. With the two hovercraft, Hoverlloyd will have the capacity to carry 25 per cent of the passenger traffic and 17 per cent of the car traffic across the Channel, although if it achieved one-third of this in the first year it would probably be delighted.

The fare structure is designed to even out two factors which would otherwise reduce the efficiency of the operation. One of these is the fact that people have strong preferences about when they travel; as well as the peak in the summer months, there is also great variation during the day. Hoverlloyd has therefore established a two-level fare structure designed to encourage people to travel at off-peak hours. The other factor is the odd characteristics of the SRN 4; although it can carry 250 passengers, it can take only 30 cars.