

in voltage and current. This means that only 100 μ V. is available across a shunt for the measurement of current at 100 per cent level. At the same time a resolution and repeatability of 0.1 per cent of amplitude (and 0.1° of phase angle at amplitude levels greater than 10 per cent) has been aimed at, with an absolute accuracy of 1 per cent and 1° at the base frequency. Such stringent requirements call for a bridge method of measurement.

For voltage measurement a voltage derived from the network is compared in a transformer with an internal reference signal. The latter is derived from a three-phase master oscillator through a mag-slip phase shifter and a potentiometer amplitude adjuster. The same oscillator energizes the network through phase shifters and potentiometers in active units representing generators. The difference of the two signals is derived from the transformer and provides the input to a servo-system which adjusts the shafts of the reference phase shifter and potentiometer until the reference signal becomes equal in phase and magnitude to the unknown voltage and the error signal disappears. The phase and magnitude of the network voltage (referred to a phase of the master oscillator) are then indicated on dials ganged with the shafts of the reference phase shifter and potentiometer. The current bridge is identical except for a difference in the operating level.

The shafts of both bridges drive the elements of a small analogue computer, also servo-operated, which indicates the products $P = VI \cos \phi$ and $Q = VI \sin \phi$. Here ϕ is the direct phase angle between the voltage V and current I measured, and hence P and Q represent the active and reactive volt-amperes.

Although the equipment is for use primarily in the service of the electrical industry, it is intended that so far as possible its versatility and flexibility shall be made available for the solution of problems within its range irrespective of their origin.

FAMILY PLANNING

IN an article on family planning*, Dr. Philip M. Bloom discusses the principles of family spacing which have been commonly accepted by most civilized communities. Besides accounts of the 'safe' period and the more usual methods of contraception like the condom and cervical cap, Bloom discusses investigations now being made into the development of oral contraceptives. At present, research is along four lines. In the first place an anti-fertility substance, phosphorylated hesperidin, is being investigated. It is thought that the sperm liberates an enzyme, hyaluronidase, which acts on the capsule of the newly-discharged ovum in such a way as to allow penetration and fertilization by the sperm. Phosphorylated hesperidin is a non-toxic inhibitor of hyaluronidase; an American worker has administered it orally to three hundred couples in an attempt to control fertility. He claims much success but corroboration is needed.

Secondly, an anti-fertility factor of an entirely different nature is that contained in the plant, *Lithospermum ruderalis*. It is likely that it either inhibits the secretion of the pituitary gonadotrophic hormone or neutralizes it. Dried extracts of *Lithospermum* used on laboratory animals of both sexes have reduced fertility; nothing is really known of

its effects on human beings. In England, a gromwell (*Lithospermum officinale*) has been found to contain this anti-fertility factor, and properly prepared extracts are non-toxic. They permit the possibility of trials in human volunteers. A third line of research is that of finding substances such as anti-vitamins or anti-hormones which will prevent development of the ovum or curtail its ability to embed itself in the endometrial lining of the uterus. Fourthly, there is the possibility of active immunization. An antigen which would produce immune bodies in the female capable of preventing either fertilization or nidation offers interesting speculation. Langer in New York has used such an antigen in female mice. With extracts of human umbilical cord given in three weekly injections, he found that female mice brought into contact with fertile males following a wait of three weeks showed delays in producing young in about 80 per cent of cases. Further, some of these substances may act as early abortifacients and would not be readily accepted by large sections of society. Others, by interfering with ovulation, would produce irregularities in menstrual cycles which may cause considerable emotional upsets in women. A great deal of further research work has to be done before an easy oral contraceptive is discovered and accepted; but it is probable that at some future time such a substance will be found.

SALMON MIGRATION AND THE ENVIRONMENT

By PROF. A. G. HUNTSMAN

Fisheries Research Board of Canada and University of Toronto

WHAT fish do of themselves is simple enough; but where they go is greatly complicated by environment and weather. This is a general conclusion from twenty years investigation of salmon and other fishes with the view of their management. Where they go is basically important in management and needs to be predicted.

Where salmon go may, as is most natural for us, be considered psychologically in the belief that they go where they will, and they are free to go anywhere in the water. Or it may be considered physiologically in the belief that their internal processes determine where they go, and physiology has now the highest repute among zoologists. But, to follow either of these courses is to reckon without one's host. The host in this case is the environment. Claude Bernard concluded that living is the continuous adjustment of internal conditions to external: "Ce n'est point par une lutte contre les conditions cosmiques que l'organisme se développe et se maintient; c'est, tout au contraire, par une adaptation, un accord avec celles-ci". This means that the environment sets the pace, that it determines living.

If we can rid ourselves of preconceived ideas, there is no mystery in salmon migration. It is easy to see that the anadromous salmon is carried downstream and swims back up, and that the katadromous eel swims upstream and is carried back down. It is also easy to see that fish are carried downstream when they wander and do not resist the current sufficiently by heading and swimming upstream, and also that, when wandering vigorously, they head and swim

* *Health Education Journal*, 12, No. 2; April 1954.