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private banks. Its object was, as expected, to control the dispensation of credit and discourage the inflow of foreign funds into Switzerland. It worked well as long as interest rates abroad were high. Now that these rates are no longer so engaging money is tending to come back and can be found for investment purposes outside the banking circuit. For this reason, the imposition of a credit ceiling is no longer very efficient.

The efforts at taking fiscal action of the Government have been frustrated by the popular will and Berne is currently attempting to ensure closer co-operation with the Cantons, and hopes to obtain from them a correct financial behaviour.

Revaluation long overdue

Mr. Hay said that, although a change of parity of the franc could conceivably be considered as an economic tool, this had never been the case in the mind of the Federal Council. The revaluation of seven per cent of the Swiss franc performed on 9th May had been triggered by the unsettled world monetary climate but had anyway been long overdue. Mr. Hay said that Switzerland had been in surplus on current account for at least 12 years. For the last five or six years the Swiss franc had been pushing against its upper limit of fluctuation with respect to the dollar (the franc can fluctuate freely between 4.29 and 4.35 to the dollar before the Swiss National Bank intervenes) with the result that vast amounts of dollars had to be bought to support it. This situation was a clear pointer that the Swiss franc was undervalued. Mr. Hay said that revaluation didn't come at the best time, since Switzerland's trading position is now tending to deteriorate, but that it had to come. It eased for a while the pressure of foreign funds.

The latest measures by the Government was to halt building projects in certain cities and to enforce a new convention binding the banks to a blockage of inflowing foreign funds and a suppression of interest on foreign deposits. This made Swiss banks less attractive to foreign money from the point of view of yield. These directives had already been published when Mr. Nixon introduced his 10 per cent surcharge on all imports. But that same week, the Swiss National Bank had mopped up millions of dollars.

The death of the monetary system

With the declared inconvertibility of the dollar into gold, the international monetary system devised at Bretton Woods 25 years ago had practically come to an end. Mr. Hay, who implicitely condemned America for this failure, said that it had been a good system and that whatever new system will be introduced, it will not work unless each country abides by the rules.

Finally, he touched on the relevance of a wages policy in combatting inflation. He recalled that the Peace of Labour agreement of 1937 had secured a sane social climate in industry and prevented wage demands from being a primary factor in the rise in the cost of living. A wages policy, with statutory limits on wage increases, had never been officially considered so far. Switzerland had been far too liberal for such a possibility to be taken seriously. It had however been raised by the President of the Vorort, an employers' organisation, in a recent and controversial speech. This personality had demanded a statutory wage freeze, a price freeze and two to four hours more work a week everywhere. Needless to say, the trade unions were not pleased and his suggestions received little support.

Mr. Hay said that it was indeed too early to consider taking such extreme measures. Even if the Government were to consider such a possibility, it would have to consult the cantons and the organisations involved in the matter according to a traditional procedure. Then Parliament would have to give the go-ahead, which of course could still be frustrated by the negative outcome of an optional referendum.

Things move slowly sometimes in Switzerland and the country is, as yet, not properly geared to face the surprises of an unsettled world economy.

(PMB)

BRIEFING BY A THEORETICAL PHYSICIST

The Institute of Theoretical Physics of the "Eidgenossische Technische Hochschule" is an old and creaky building off the Hochstrasse, on the wooded and residential Zurichberg. It is an ideal retreat for the few mathematical dons who spend their life there, thinking and attempting to find the quantified solution to the secrets of the Universe. There we were fortunate in meeting Professor Klaus Hep, recognised by his co-researchers to be among the very top theoretical brains in Switzerland, and were briefed in the nature of his arcane research.

Professor Hep is a youngish man in his middle thirties. He was lounging from one of the stuffy rooms of his Institute along the linoed corridor to another when we met him. A simple man in sport shirt-sleeves and a friendly smile. A quick look at his forehead revealed that his cortical dimensions were quiet in the ordinary. He struck one by his simple and genial appearance. Who knows, his IQ may have been quite standard. We were standing in a room which had doubtless been the seed-bed of many ingenious theories — the kitchenette where the indispensible coffee cups were washed up and the biscuits stored.

To begin with, he explained that the Zurich theoretical group had specialised for many years in "*axiomatic quantum field theory*". What the dickens is that supposed to be? will ask 90 per cent of laymen confronted with this weird notion for the first time. Well, as far as I can gather from the hasty scribble of my note-pad, it is a branch of physics that seeks to unravel the innermost secrets of matter by starting from a minimal number of basic and logical principles.

But first, it is useful to make the distinction between the three terms *quanta, field and axiom.*

Quantum mechanics was discovered by the German physicist Max Planck in 1905. He made a break with classical mechanics by postulating that energy was chopped up into fundamental grains or "quanta", a hypothesis which worked wonderfully. The discontinuity of other observable physical quantities such as linear and angular momenta was later postulated with great success. Therefore, just as matter is made up of atoms, which are its smallest building blocks, all physical quantities are made up of elementary "quanta". At a later stage, physicists discovered that the *quantum* aspect of matter was just the dual facet of its *wave* nature. They developed the unifying mathematical framework, known as wave mechanics, during the 1930s. These were the heady days of theoretical physics.

A *field* is a portion of space with given physical properties, two examples being the gravitational field and the magnetic field. This notion was introduced in the new physics when researchers attempted to express the results of quantum mechanics (applicable to the infinitely small) and those of relativity (applicable to the infinitely large) in an all-embracing theory. They have been at this task for over 30 years and, as Professor Hep underlined, are nowhere near a final solution yet.

The notion of *axiom* is a little more involved. If I understand Professor Hep correctly, the general idea

is that nature must satisfy some basic rules, irrespective of any physical theory. Thus the principle of causality, which asserts that everything must have a cause, has to be accepted if any physics is going to be done at all. In the same way, the principle of relativistic invariance, which states that physical laws must be the same in every part of the universe, has also got to be admitted.

These fundamental requirements are expressed mathematically as axioms. The mathematical objects satisfying these axioms and adequate in describing the physical world are developed so that a complete lattice of mathematical relations can be deduced. These relations subtend the physical world and should be proved right when translated into physical terms. This would be the proof that nature behaves "logically".

To some extent axiomatic quantum field theory has yielded the results expected of it. To name some of the most important I must quote Professor Hep. They are the *PCT Theorem, the prediction of symmetries found in nature, the relation between spin and statistics, scattering coefficients and the analycity of amplitude diffusion.*

These results were however of a very general nature. When the theoretician attempted to apply the techniques of axiomatic quantum field theory in particular problems he ran into unsurmountable mathematical difficulties. The method was just not applicable to practical problems in the actual state of the mathematical art. The problem was not one of computation and computers were of no use at this stage. It lay in sheer mathematical complexity. "We're not really physicists anyway", said Professor Hep. "We're plain mathematicians. The development of actual mathematics comes as a reply to the challenge of physical problems.

"Owing to these mathematical obstacles", he continued, "we have temporarily moved away from axiomatic field theory to return to somewhat more empirical methods previously closed to us because of insufficient mathematical equipment. In brief, what we are trying to do now is to forget the axioms, and to play about with the equations of the system under study so as to make them satisfy certain constraints imposed by the physical conditions of the problem.

"The method is less general and less beautifully abstract but more promising in the present circumstances. Instead of starting with axioms to hopefully reach meaningful equations, we start with the equations and may eventually find the underlying axioms. All the physics we are now involved in must take account of an infinity of particles and of the nature of the interaction between each one of them.

"This is the crux of the *many body problem.* I am now trying to understand the mechanism of the *laser,* a device which produces a beam of perfectly coherent light and in which a multitude of atoms vibrate together. The phenomenon was explained by Einstein 50 years ago, long before the laser was invented. However, his simple theory failed to describe by what *exact* mechanism the electrons of billions of atoms could be brought into perfectly synchronous oscillations. This problem, and all those concerned with collective behaviour, require the most recent methods of theoretical physics and statistics".

At this point the atoms of my brain were buzzing collectively and I switched to another subject by asking Professor Hep how he worked.

"As far as I am concerned, I cannot engage in research in the same straightforward way as I might for a daily job such as polishing my shoes or making tea. The theoretical physicist is rather like an artist. To do something worthwhile he must be in the right mood. An artist cannot "force" a masterpiece unless he has some kind of inspiration. In the same way, I can't force my way through to the solution of a problem. Sure, I think of the problem for perhaps six hours a day and it is at the back of my mind for the rest of the time. But the solution comes of its own accord at the right time. You cannot give yourself a time limit for an answer.

"Intuition is of course most important. But it is a complex thing acquired with considerable experience. It is built on an awareness of physical analogies, of theoretical and experimental results. The most important requirement in this work is a solid mathematical background.

"Research implies a lot of reading and I have to keep abreast of things by poring over the literature. I don't read the proofs in detail but keep in my mind a clear picture of the arguments. It is often useful for me to derive the results on my own.

"My work is by no means all my life, it can't be. My family life, the discussions which I have at the Institute and my contacts with students are all essential to me. I couldn't just sit in a room with a pen and a piece of paper engrossed in research. Without my daily life and the teaching which I love I am sure that I would be totally unproductive".

Professor Hep must be a happy man. He knows the intellectual bliss of moving in a world of logic and abstraction but is still able to savour the more commonly shared pleasures of life. Into the bargain he is one of the youngest and most brilliant researchers in his field.

(PMB)

SNTO NEWS

An important sculpture exhibition in Basle

The "Kunsthalle" (Hall of Art) in Basle has a great surprise in store. From October 23 to November 28 it is showing an exhibition of iron sculptures by Robert Müller who lives in France. The Zurich City Council has decided to award to Robert Müller the art prize of Zurich for 1971. (This prize alternates with prizes for literature and music.) The considerable amount of prize money will, as usual, be handed over in a ceremony in the early part of winter. The City Council pays special tribute to this citizen of Zurich by mentioning that his work and extraordinary powers of expression have found recognition in the whole world and thus contributed to our country's reputation abroad. The exhibition in Basle will therefore not only be of regional importance but will radiate into many directions. Robert Müller, sculptor in metal, was born in Zurich on June 7, 1920. He first worked under the direction of Germaine Richier and Otto Bänninger and in 1945 started creating sculptures of his own, first at Morges on Lake Geneva, then in Genova (Italy) and from 1949 in Paris. A large Paris exhibition in 1954 paved his way for his success. Already in 1956 he received the prize for sculpture of the museum of Sao Paolo and further successes led to his participation in the bi-annual exhibition in Venice, Sao Paolo and Paris. He is regarded as one of the bst-known iron sculptors of our time, an important successor to Julio Gonzalez. Nature and fantasy blend in his sometimes surprising forms which may have humorous or tragic overtones, thus representing today's way of life. The exhibition in Basle will be an important event.

Swiss Dining Car Company at big highway crossing N1/N2

An "Agip" motel is being built—and will be under the management of the Swiss Dining Car Company—at the crossroads of National Highways N1 and N2 in the immediate vicinity of the Olten-Egerkingen exit, at a point where the planned Mittelgäu Express Road is supposed to join Highway 5. Due to the enormous density of traffic caused partly by international tourism and partly by Swiss and regional travel, the location of the motel may be considered unique. The new highway motel will be an ideal stopping place for motorised tourists and a convenient meeting place for businessmen. The distances from Berne and Zurich are about 37 miles or about 30-45 minutes