MAGNETO-HYDRODYNAMIC TECHNOLOGY

(By Hugo Tiismus, Doctor of Tech., Professor of the Tallinn Polytechnical Institute, USSR)

Smooth and precise control of smelt flows is required in many branches of the economy, because the conventional techniques of pumping such liquids by mechanical pumps do not fit. Most of the smelts are very aggressive and corrode any material with which they are in contact within a few hours. Besides, the working conditions of the servicing personnel are very arduous.

In Nature there are forces, however, which can set any smelt in motion without the use of electric-driven pumps. These forces emerge in the metal proper when influenced by the electro-magnetic field, *i.e.* they are a result of direct conversion of electric energy into mechanical. These forces can be made to move, mix and doze off the smelt by magnetohydrodynamic (MHD) machines.

Scientists of Estonia have made a large contribution to the theory of MHD-machines. Its founder was Professor Aleksander Voldek of the Tallinn Polytechnical Institute, who was also the father of a school of research into liquid-metal machines. His fundamental works have produced a great influence on the development of MHD-technology in the country and abroad. To this day their basic provisions attract the attention of many research institutes, higher educational establishments and production enterprises. For example, the Department of Electric Drives of the Tallinn Polytechnical Institute is doing important work on the theory and development of the automated MHD-drive (an MHD-pump activated by a power source and an automatic control system).

The MHD-drives have rendered it possible to pump smelts through pipelines and also to control the speed of the flow and pressure. This class of energy equipment has facilitated a wide use of new technological processes, at least, in four branches of the economy—nuclear power engineering, steel-making, casting and the chemical industry. Thus, an alloy of sodium and potassium alkaline metals, can be used as heat carriers in modern nuclear reactors. This is a better heat carrier than the other liquids. Besides, the alkaline metals are sufficiently light and have good electric conductivity. They are also used in MHD-units for heat transfer from power reactors.

New Devices

An MHD-drive is based on a machine which combines the properties of an electric unit and a hydraulic plant. This makes it highly controllable. The direct electromagnetic force effect enables the creation of fundamentally new devices for teeming liquid metals in steel-making. This old technique, however, has long-known drawbacks. The oxide film is thus destroyed and the liquid surface of the metal in the ladle becomes highly oxidised in contact with air. The use of an MHD-drive as the holding device fully rules out oxidisation and the burning out of liquid metal.

Besides, our studies of the theory of the MHD-drive are used in the solution of some tasks in the creation of high-speed overland cushioned transport, machine-tool manufacture and robot technology. Our laboratory has developed small-size linear motors for industrial robots which convey metal sheets for cutting by scissors. They are also used for turn-tables for X-raying welding seams of thin-walled metal cylinders, for rotary teeming plants and others. (*Soviet Features, Vol. XXIII, No. 14, January 24, 1984*)

MONITORING ENVIRONMENTAL POLLUTION IN THE UKRAINIAN SSR

When the biosphere undergoes a change due to natural causes, it is sure to return to its original state, or else the changes are so gradual that there is no apparent ecological stress. However, in many parts of the world the impact of human activities over the past few decades are comparable with natural changes lasting over hundreds of thousands of years, and here the consequences are substantial and usually detrimental to the environment. The USSR is a highly industrialised country with rapidly expanding urbanization and agriculture, so that the environment is coming under increasing pressure. This is particularly so in the Ukrainian Soviet Socialist Republic.

There is thus the need for a scientific appraisal of the effects of natural causes and human activities on the state of the biosphere, and special observations are made to detect anthropogenic changes against the background of natural changes. The fundamental

purposes are (a) to observe and assess the current state of the environment, and (b) to detect and forecast changes in this state. The information obtained is used to determine what preventive measures may be needed to avoid or minimize adverse changes and to optimize man's interactions with his environment.

Back in the 1950s there had been a standard program to analyse water samples for temperature, transparency, oxygen content, salts and suspended matter. Physical characteristics of sediment deposits in water bodies were also recorded. From 1968 the program was extended to include analysis for certain pollutants. By 1972 observations were being made at 142 sites on 28 rivers and reservoirs in the Ukrainian SSR.

Analysis of samples of air commenced in 1965 when a number of air pollution observation stations were set up in four large Ukrainian cities. By 1970 there were 38 stations in 13 different conurbations.

The Hydrometeorological Service was therefore well prepared to assume its added responsibility and, being in no way connected with the industries which create pollution, could be relied upon to make an objective evaluation of the state of the environment.

The chief thrusts of the State Service to Observe and Monitor Environmental Pollution are the following:

—To observe and monitor, according to standard physical, chemical and hydrological criteria, the level pollution in the air, soil and water (rivers, lakes, reservoirs and seas), with the object of assessing the degree of pollution and perceiving significant changes in concentrations;

—To observe changes in the environmental state caused by traces of toxic substances.

—To provide the industrial sectors concerned with regular uptodate reports on the level of air, soil and water pollution as well as forecasts of possible changes in pollution concentrations.

—To prepare and issue reference material on pollution, its transport and diffusion, as affected by industrial procedures and hydrometeorological conditions, taking into account protective measures already in force.

In the USSR, the maximum permissible concentrations (MPC) levels have been established for more than 500 substances in fresh and sea water destined for domestic use, cleaning or for fishing. Similarly, MPCs have been declared for 214 substances (and 32 combinations of substances) in the air. Several have also been set for pollutants in the soil. The MPC is conceived as being the level which is still favourable for a given organism rather than the maximum load it can survive.

In devising the program it was necessary to define priorities: for the monitoring of pollutants, and three categories were decided upon:

1. Substances emitted on a massive scale, because of their widespread effect (such as sulphur dioxide, nitrogen oxides and carbon monoxide in city air; petroleum products, phenols, detergents and certain metals in water; pesticides in soils);

2. Particularly toxic substances (with an extremely low MPC) in areas where their existence had been confirmed by observations.

3. Pollutants known to exist in emissions or discharges in a given region. (*WMO Bulletin, Vol. 33, No. 1, January 1984, p. 52*)

METEOROLOGICAL SERVICE AT SIERRA LEONE (AFRICA) UNDER UNITED NATIONS DEVELOPMENT PROGRAM/WMO

Following the recommendations drawn up during the preparatory assistance project, the new project proposed for organizing the Meteorological Service at Sierra Leone (Africa) was approved by UNDP in October 1982.

It is being carried out with the assistance of two experts, Mr. K. D. N. de Silva (Sri Lanka) and Mr. V. S. Ramachandra Rao (India). Meteorological equipment for new observing stations, as well as testing and telecommunication equipment, has been ordered. Candidates were selected for training abroad in agrometeorology and telecommunications. The antennas at the meteorological centre were improved, thus considerably enhancing data reception from neighbouring countries.

In addition, a site survey was undertaken by a radar consultant Mr. G. N. Rao (India), in September 1983 and recommendations were prepared for the installation of a weather radar purchased by the Government. (*WMO Bulletin, Vol. 33, No. 1, January 1984, p. 65*)