

incident X-radiation, and hence it can occur in either direction, *viz.*, further excitation or a de-excitation. The dynamic reflections arising in either way would appear superposed in the finally observed result, and the net consequence to be theoretically expected would be an increase in the intensity of the reflection with rising temperature, besides subsidiary effects such as increase in diffuseness. The magnitude of the increase of intensity would depend on the frequencies of the eigenvibrations which are effective in giving the observed reflection, and the proportionate increase would be the smaller, the higher the frequency or frequencies under consideration. *Per contra*, the intensity would diminish when the temperature is lowered, but since the quantum-mechanical excitation would persist in every case, the reflection would not disappear even at the lowest temperatures but would on the other hand persist. The intensity at low temperatures would be relatively the largest in the case where the eigenvibrations involved would have relatively the highest frequencies. There is no reason to expect any notable dependance of

the magnitude of the temperature variation on the setting of the crystal at which the dynamic X-ray reflections are recorded.

7. DEPENDENCE ON CRYSTAL STRUCTURE

It will be evident from what has been stated above that the pattern of dynamic X-ray reflections by a crystal would be largely determined by the number and nature of its eigenvibrations and their frequencies, and also on the manner in which these eigenvibrations influence the structure amplitudes of the various crystal planes. Each individual case would have to be considered on its merits as in the case of static X-ray reflections, but general considerations regarding the nature of the oscillations possible in ionic, molecular or layer lattices would enable us to predict or at least understand the general nature of the dynamic X-ray patterns to be expected in these respective cases. But it would take us beyond the scope of the present article to enter into these details.

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EDITORIAL NOTE

SCIENTIFIC FILMS

THE influence of Science and its technological applications on the social structure of modern civilisation is becoming increasingly apparent. Science is ever in the process of modifying the relations of man to his natural environment and between social groups of human beings. It is clear that scientific research and knowledge offer man the alternatives between improving and degrading social life: they can help or obstruct solution of social problems.

In democratic countries the choice of the alternatives largely depends, not so much on the few men at the laboratory bench, but on the large majority who elect their ruling representatives. And it is a truism that the more enlightened and responsible the electorate, the greater the calibre of the administrators and higher the efficiency of administration. Therefore, the essential prerequisite for a true and successful democracy is a liberal education which includes a certain basic knowledge of science that enables the farmer and the factory hand, the trader and the consumer appreciate advances in applied and technological branches.

In free India, where there is yet enormous scope for application of available information and technological processes, science has a conspicuous role to play before she could come on a par with the Western world. We have to look

to science to unfold a new era of sustained economic prosperity, to prevent or eliminate disease, to strengthen the defences of the country and guarantee a permanent peace. The broad attainment of these goals demands a well-informed public. Science must be intelligently and accurately explained to the layman so that he may understand its possible contributions and also its limitations in reference to problems of human welfare and that he may actively help and participate in its applications. Towards this end every available means should be mobilised by the state and the public in order that the level of knowledge of the producer might be raised to the highest.

While simple and lucid expositions of scientific subjects and their application to industry and agriculture are growing popular, they are not within effective reach of the unlettered man in India. He could nonetheless be approached through visual education. Even for literates this system has come to be recognised as the most telling and rapid means of enlightenment on a wide variety of subjects. In many countries, Educational Films have become a common and much-appreciated method of broadcasting the progress in science and technology. In Britain itself there are more than thirty Scientific Film Societies, and in America almost every college and university has its Film unit.

The method of learning through films owes its ubiquitous popularity to the fact that man

always thinks in terms of pictures. It is, therefore, far easier for him to comprehend in terms of his "natural language". And it should be admitted that the alphabet is only the second best, and lacks the direct appeal that pictorial presentation offers.

Advances in cinematography promise, further, a potent tool in the understanding of natural phenomena, like plant growth, fertilisation, bird flight, animal movements and certain metabolic process of plants and animals. High speed and micro-motion techniques, through expansion or abridgement of the time factor, have opened up new fields of investigation in fundamental and applied aspects of science. It is thus possible to analyse and get a better insight into the process of germination, flowering, the spread of the flame and the combustion of gases in internal-combustion engines, and stresses in jet turbines blades and other phenomena which cannot be otherwise understood. In industry, time and motion study of factory hands and of technical processes have invariably led to improvements resulting in reduced fatigue to the worker, increased efficiency and larger production.

The utility of films, in education, indeed, holds endless possibilities. In our country, where adult education can contribute so much to agricultural and industrial production, films on mechanised agriculture, soil fertility, plant nutrition, role of trace elements in crop production, application and utility of artificial manures and compost, village sanitation and personal hygiene, and presentation to the factory worker the industry in full perspective and his place in the production of the final commodity will

go a long way in reducing the acute shortage of food and manufactured goods in the country.

The formation of the Scientific Film Society in Bangalore is a step in the right direction for achieving the above-mentioned objectives. The Society has, among its aims and objects, the promotion of interest in scientific films and investigation of the means of application of these for the benefit of human welfare in India, rendering technical assistance to scientists to produce their own films relating to their own researches and to maintain a film library for the use of scientists and the public. The availability of a reasonably cheap film projector and a continuous stream of scientific films within easy reach should make "Home movies" almost as popular as the gramophone and the radio.

That need and scope for such a Society is fully appreciated by our statesmen is seen by the hearty support offered by the Prime Minister of Mysore when he inaugurated the Society. The Ministers both at the Centre and in the Provinces have frequently made it clear that they are alive to the possibilities of the medium of visual (and auditory) education. It should be possible for the Ministry of Education at the Centre to begin with a new section for the production and propaganda of scientific and education films under the guidance of experts. In the meanwhile it is open to the scientists and the public to establish active branches of the Scientific Film Society in every City and help further the cause of Science and Industry in India. And we are confident that this movement will receive the munificent support of the various governments in the country and the co-operation of similar organisations abroad.

CONTACT RECTIFIER FOR LOW-VOLTAGE HEAVY CURRENTS

AT a time when further development of electrical conversion machinery was considered to have come almost to a standstill, the development of a contact rectifier by Siemens Schuckert, after years of research and operating experience, has focussed the attention of engineers on this new equipment. The American Institute of Electrical Engineers in their summer meeting last year, considered it worth while to discuss this new equipment and examine the possibility of its being used in Electrochemical industries in place of the now well established Mercury Arc Rectifier, especially for low voltage heavy current work.

The new equipment consists of a contact mechanism synchronously driven and adjusted to make metallic contact between the A.C. source and the D.C. load at proper time intervals, i.e., when the particular phase of the A.C. system is capable of delivering energy in the desired direction. These contacts are actuated by a shaft carrying different eccentrics. A feature of this rectifier is the use of saluable reactors with what is termed as "elastic excitation" to obtain good commutation and regulation.

The contact rectifier is a very interesting

development, and the advantages claimed make it particularly suitable for use in electrochemical industry. Overall efficiencies of 97 to 98 per cent, including transformers, have been reported for low voltage operation. Small space requirements, low maintenance costs, absence of auxiliary equipment are some of the distinct advantages mentioned. Reliability of operation is claimed from the operating experience at Hannover. It is stated that during three years of continuous operation the short circuit safety device acted only twice. The contact life was about two months per set of contacts.

From the data available at present, it can be stated that the contact rectifier, with slight improvements in design and further operating experience, might soon make a strong claim for itself in the field of low voltage heavy current operation.

Further information about this rectifier can be gleaned from the following references:

- (1) *British Intelligence Objectives Sub-Committee Report*, No. 408. (H.M. Stationary Office, London.)
- (2) Otto Jenson: *A Mechanical Rectifier Trans. of the Electrochemical Society*, 1946.