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Summaries of Addresses of the General President and Presidents of Sections

PRESIDENTIAL ADDRESS

General President: D. N. WADIA, ESQ., M.A., B.SC., F.G.S., F.R.G.S., F.R.A.S.B.

MINERALS' SHARE IN THE WAR

IN his General Presidential Address to the Thirtieth Session of the Indian Science Congress which met in Calcutta last January, Mr. D. N. Wadia deals with the question of "Minerals' Share in the War", in the course of which he observes:

"It is no exaggeration to say that half of the later wars of history have been directly or indirectly motivated through the desire of gaining access to stores of strategic mineral products, ores, fuels, salts, alloy metals and essential industrial minerals.

"The international mineral situation during pre-war years was in a chaotic state. While the United Nations were in a state of 'vacuous unwareness' about it, the Axis powers grabbed as much of the indispensable munitions minerals as they wanted and the war has been waged by them on the stores of hoarded minerals and metals.

"Only the adoption of a wise and justly planned international mineral policy framed by an International Directorate can preserve peace and goodwill amongst countries unequally endowed by Nature with mineral wealth. No country in the world, however well-supplied it be, is self-sufficient in mineral requirements, nor is any so situated that it can regard its mineral resources as purely domestic or national. Embargoes, tariffs, patent rights and transport controls imposed for political reasons do not offer a solution, but by hindering free movement of minerals become powerful contributive factors in precipitating world wars. Unequal geographical distribution of minerals being an unalterable fact, planned international economy should devise means not only to eliminate this cause of inter-country friction but to increase the interdependence of nations on each other for their vital trades and industrial needs and so make minerals a rallying point for international co-operation and goodwill."

Talking about the Social Obligations and Relations of Science in India, Mr. Wadia writes:

"The impact of science on the Indian masses has come in the form of a rather rude intrusion of machines and mechanics into the essentially simple rural economy of the country and it is not surprising that this meeting has not been a particularly happy one. It has disturbed the economic structure and created, if not some aversion, an indifference to the cult of science in the popular mind. But we all know that science is not all mechanics nor are its practical uses to man the greatest thing about science. The greatest thing about science is the scientific method—the most effective thing man has for discovering truth and the ways of Nature. It can bring solid benefits by releasing life from stagnation and the bonds of ignorance wherever these prevail, whether in cities or in the countryside, among the labouring masses or among the governing class. The awakening to the social obligations of science is of recent date and even in Europe and America, this aspect of the cultivation of science was for long not realised and left to sporadic individual efforts. With this awakening, a twofold problem faces science all over the world to-day—to press the newest discoveries and inventions of applied science into the service of agriculture, manufactories, hospitals, homes and schools and alongside with it to so control the impact of these on his private life that his mechanised work-a-day life may not be totally divested of all higher spiritual values. Our future national life and its material well-being largely depend on a wholesome balance being maintained between these two—the impulse to harness science to increase physical comforts of life and a restraining desire to preserve the old world spiritual calm and simplicity of living."

In the concluding part of his Address, Mr. Wadia outlines a scheme for a proposed Academy of Social Science for India to promote "peace among nations and intellectual freedom in order that Science may continue to advance and spread more abundantly its benefits to all mankind". According to Mr. Wadia:

"The proposed Academy should be a body of high academic standing and professional knowledge, which can take up long-range problems of social well-being of the people of India which the older Societies and Associations established along familiar but too general lines in some cases and rather over-specialised lines in others, cannot deal with without suspicion of religious or political bias. Socio-medical and political subjects, human relations, anthropology, political science, vital statistics, social biology, population problems, sociological research in particular bearing on various Indian communities are the subjects on which such an Academy can work in collaboration with the Indian Science Congress and half a dozen other institutions already existing in the country for some of the above-named specific objects. It can be a living organ in the body politic of India for voicing the collective opinion and focussing the specialised points of view of numerous isolated working bodies on the one problem how to promote the well-being of the common man."

PHYSICS

President: Dr. H. J. Bhabha, F.R.S.

RECENT ADVANCES IN THE THEORY OF FUNDAMENTAL PARTICLES

SCIENTIFIC activity began with the recording of facts of observation. This was followed by generalisations or laws based empirically on the record of such facts. Newton, by enunciating his laws of dynamics and gravitation, introduced a *new approach* to physical theory. He showed clearly that the ideas which are to be regarded as *fundamental* for the understanding of nature are certain *abstract concepts and postulates* on the basis of which certain results could be derived mathematically and compared with the facts of observation. This position was accepted because it was the only way to obtain a unified scheme for the observed regularities of nature. On the basis of such postulates, a physical theory is built up. If a newly discovered fact does not fit in with the theory, it necessitates a revision of the postulates leading to a more general theory from which the results of the older theory would follow as approximations. An example of this type of change is the theory of relativity.

The principle of relativity imposes restrictions on any physical theory that can be built up. So does the quantum theory. On the basis of the latter, Heisenberg showed that it is impossible to determine the position and momentum of a particle *simultaneously* with *unlimited accuracy*. Consequently the attempt to calculate the *exact* trajectory of a particle in space-time is abandoned. Instead, we now calculate the *probability* of a particle being in a given region of space at a given time. Consequently, the problem of mechanics at present is one of calculating a set of functions called *wave functions* from which physical properties associated with a particle can be derived. The possible wave equations from which such functions can be calculated and which satisfy the limitations imposed by the principle of relativity and the quantum theory have been given by Dirac. Pauli and Fierz. They can be shewn to describe elementary particles with integral and half integral spins. One important result of combining the relativity and quantum theories is the realisation that a one-body problem is impossible in relativistic quantum mechanics. The theory gives solutions which correspond to the particle being in states of negative kinetic energy. These solutions cannot be ruled out because transitions are possible between such negative states and positive states. Dirac overcame this difficulty by saying that all such states are normally occupied. Consequently there will be infinite and uniform distribution of charge which will produce no field. It is possible, sometimes, for a particle in a negative energy state to jump into a positive energy state. The empty negative energy state or "hole" becomes observable as a particle of the same mass but opposite charge. This corresponds to a positron in the case of the electron. The theory thus predicts the existence of the positron and the possible creation of positron-electron pairs. It is, therefore, clear that a one-body problem is impossible in relativistic quantum mechanics. These results have been verified experimentally by Anderson and by Blackett. Further developments have shewn that a physical theory of particles of half integral spin is impossible unless they satisfy the Fermi-Dirac statistics. Similarly a theory of particles with integral spin is impossible unless they satisfy the Bose-Einstein statistics.

One serious limitation of the quantum theory in its present form is that it leads to divergent results in higher approximations. This was first noticed in the interaction of electrons with radiation and it was believed that it was connected with the fact that the charge of the electron was assumed to be concentrated in a point. The work of Dirac, Pryce and Bhabha has shewn that this view is false. Dirac and Pryce have worked out a complete *classical* relativistic theory of a point electron moving in an electromagnetic field by taking into account the effects of radiation reaction on the motion of the electron exactly. Bhabha has extended the theory to spinning particles having a dipole interaction with the electromagnetic field. He has also shewn that an equally successful relativistic classical theory can be made for charged and spinning particles moving in meson fields. In all these theories, the mass of the particle is looked upon as an arbitrary mechanical constant which has nothing to do with the field the particle creates. Although the quantum theory in its present form treats the fundamental particles as points, no way of removing the infinites in an unambiguous and relativistically invariant way has been found.

GEOLOGY AND GEOGRAPHY

President: Dr. J. A. Dunn

SUGGESTIONS FOR THE FUTURE DEVELOPMENT OF INDIA'S MINERAL RESOURCES

IN his Presidential Address to the Section of Geology and Geography, Dr. J. A. Dunn of the Geological Survey of India offers certain valuable suggestions for the future development of Indian mineral resources, based on his knowledge and experience during more than twenty years of scientific work done in this country continuously in connection with the mineral industry; and has specially dealt with the future actual development of the mineral resources in India. After pointing out that the two statements commonly made with regard to India's mineral position, *viz.*, (1) that India is poor in mineral resources and (2) that such mineral resources as are available here have not been developed as fully as they should have been, are both mistaken, Dr. Dunn proceeds to point out that India's mineral industry has been far from negligible and has been a valuable asset to the country. Reviewing the actual geographical distribution of minerals in the country, he shows how the different parts of India are inter-dependent and that, therefore, a co-ordinated mineral policy applied to the whole

. unit is desirable. Talking of the
: the mineral industry, he points
may include both the development
eral deposits and the creation of
ies from minerals already mined,
; to discuss in detail the possible
expansion with reference to about
more commonly occurring minerals
value found in India. Dealing
reral lines along which enquiries
ued with a view to the ultimate
the mineral industry, Dr. Dunn
The stimulation of prospecting
ordinated with methods of pros-
mineral deposits must be closely
gically to obtain the maximum
ources available, methods of min-
improved, and also methods of
ilst the extended use of minerals
must receive constant attention."
he refers to the various ways in
ite can assist the mineral industry,
ıt the great and urgent need for
ı "Minerals and Metals Research
ıis country, including a "Fuel Re-
ɔn", to undertake investigations
ts of the mineral industry—parti-
a view to improve methods of
e cost of treatment, and further
pplication of certain minerals into
than those in which they are
From a wider point of view,
: in framing a mineral policy, each
be not merely "national" but also
l" in its outlook, and we must
lves as the trustees for the world
erals within our territory which
general needs".

BOTANY

sident: DR. K. BISWAS

.TIC AND TAXONOMICAL ES ON THE FLORA OF NDIA AND BURMA

ly reviewing the Systematic and
cal researches in India and
swas has given a detailed exposi-
ecological and phytogeographical
ts of the different regions of the
special reference to endemism.
the flora of Tibet is discussed in
ve manner. Hooker's Theory of
India, according to the author,
derable alteration in the light of
atic and taxonomical researches.
d that a detailed survey of the
; likely to result in reducing the
of the country. There is a great
gical work based on systematic
cal studies which has a very
on many problems of practical
'inally a plea is made for more
a-work in the several Univer-
itutions on the subjects of eco-
matic botany on certain definite
ould promote our knowledge of
tematics".

ZOOLOGY AND ENTOMOLOGY

President: DR. B. CHOPRA

PRAWN FISHERIES OF INDIA

NEXT to agriculture and perhaps animal husbandry, fishing is the biggest industry of our country. Prawns and crabs form very important part of our fisheries. The fisheries provide employment and means of sustenance to lakhs of people all over India and their total annual yield runs into enormous figures. The marine prawn of very great commercial importance in India is *Penæus carinatus* Dana which is fished extensively along the Sind and Bombay coasts, in the back-waters of Malabar and all along the Eastern coast. There are a few other species of prawns of commercial value scattered all over the country. The most important fresh-water prawn is *Palæmon carcinus* Fabr. A single specimen may weigh well over a pound.

Prawn fishing is practised on a large scale in Bengal, Orissa, Madras, Travancore, Bombay and Sind. In Travancore prawn is extensively cultivated alternately with paddy in paddy-fields. Large quantities are consumed fresh and sent inland packed between layers of ice. Prawns are also sun-dried or smoked or boiled and sun-dried. These or very similar methods are prevalent almost all over India.

Great advances in prawn industry have been made in South Africa, Norway, California and other countries. In India it is in a very backward state. At present we know very little about the habits and life-history of the commercial species of prawns. The existing methods of fishing, preservation, transportation and marketing are very poor. The resources for the development of prawn industry are immense in this country. If the industry is properly organised on firm scientific and technological basis, it is certain to have a great future.

ANTHROPOLOGY AND ARCHÆOLOGY

President: DR. N. P. CHAKRAVARTI

EPIGRAPHY AND ANTHROPOLOGY

AFTER paying a tribute to the departed anthropologists, Rai Bahadur Sarat Chandra Roy, Rai Bahadur Ramaprasad Chanda, Sir Flinders Petrie, Sir Arthur Evans, Monsieur Joseph Hackin and Sir J. G. Frazer, Dr. Chakravarti has reviewed the outstanding features of the work of the Archæological Department of the Government of India during the last year.

In the Sabarmati valley in Gujarat materials have been collected which are likely to throw some interesting light on the history of the Paleolithic, Neolithic and Iron Ages of India. A systematic excavation at Ahichchhatra, the capital of the ancient Panchala country, during the last two seasons, revealed the existence of five layers, virgin soil being reached 77 feet below datum. From the top, the first two layers belong to about the ninth and tenth centuries A.D., yielding Gadhaiya coins of Vigraha and Adi-Varaha types. The third stratum yielded an official Gupta sealing and evidently belonged to the Gupta period. The fourth stratum was of the later Kushan period. The fifth which yielded coins of the Panchala type belonged to the Kushan period if not to the Sunga period. This ancient city was enclosed on all sides by massive ramparts of mud encased later in bricks with a network of bastions. Two large temples were found rising up in diminishing tiers, with a pradakshina-patha in each tier. These were two of the nine Deva temples found by Yuan Chwang. A number of terra-cotta figurines have been found in the place including the Mother Goddess, Mahishasuramardhini, etc.

Sir Auriel Stein explored the banks of the dry bed of the Ghaggar (or the Vedic Sarasvati) and discovered a large number of new sites dating from the chalcolithic times to the Kushan period. The more eastern of these sites date from the Kushan period while the more western at Derawar and Sandhanwala with their black-on-red and other painted pottery are connected with Mohenjo Daro culture. These researches have a direct bearing on the problem of desiccation in Asia.

Proceeding to his main theme of the connection of epigraphy with anthropology, Dr. Chakravarti summarised the history of writing as explained by Edward Clodd (*Story of the Alphabet*) though the Memonic, Pictorial, Ideographic and later stages and opined that epigraphy was invaluable for the study of anthropology, since epigraphs record authentically much valuable information about ethnic tribes, their customs and sociological culture; Asoka's inscriptions mention the Kamboja, Gandharas, Rathikas, Bhojas and Pitinikas. Associated with the Yavanas were the Scythian Sakas, the Kshaharatas and the Kushans, the last of whom according to Sten Konow belong to the stock *Homo alpinus* from Chinese Turkistan and are undoubtedly Iranian. Samudra Gupta's Allahabad inscription mentions a number of autonomous tribes such as the Malavas, Arjunayanas, Yaudheyas, Madrakas, Abhiras, Prarjunas, Sanakanikas, Kakas and Kharaparikaras. Other inscriptions mention the Hunas, the Bhils, the Gonds and even the Todas. The inscriptions serve the study of social anthropology by giving the traditional origin of many ruling families and by suggesting the foreign elements among the people of the country who were absorbed into Hindu society and also the matrimonial relations of indigenous and foreign ruling families. Light is thrown also on the development of the castes, of the gotras, of the matrimonial problems, etc.

Concluding Dr. Chakravarti hoped that the value of inscriptions in the study of anthropological problems would not be lost sight of by future scholars.

M. H. Krishna.

MEDICAL AND VETERINARY SCIENCES

President: Dr. F. C. Minett

INFLUENCE OF CLIMATE ON THE INCIDENE OF DISEASE

Dr. Minett advocates a much closer liaison between Medical and Veterinary Workers in India as joint discussions and better collaboration between them, on the lines obtaining in Europe and America, would be of immense benefit to both professions. He next deals at length with the subject-matter of his paper "The Influence of Climate on the Incidence of Disease". This is a rather new field of investigation especially with reference to the domestic animals in India. Dr. Minett has been collecting all available and, as far as possible, authoritative information from the Provinces and also from the Indian States with regard to the incidence and spread of the several epizootics in the different seasons. Considering that India is a Continent where seasonal conditions vary considerably in the several parts of this country it is, indeed, a very difficult and a very long problem which only one of Dr. Minett's ability and experience could explore and elucidate. But the results of his investigations will have far-reaching and immense value in the prevention and control of epizootics. An accurate knowledge of the direct and what is equally important, the indirect influences, through changes in soil and fodder grasses by the seasonal variations, on the host and on the parasite and on the "Carriers" would be of utmost significance and we will be looking forward to Dr. Minett's valuable findings in this direction.

S. D. A.

AGRICULTURAL SCIENCES

President: Rao Bahadur Y. Ramachandra Rao

THE NEED OF PLANNING ON AN ALL-INDIA BASIS IN CERTAIN ASPECTS OF AGRICULTURAL ENTOMOLOGY

Insect pests in the Indian Peninsula can generally be classified as, firstly, those that are known to appear year by year on certain crops at particular seasons, mostly confined to particular localities and secondly, those, that have a considerable degree of mobility and that are capable of migrating long distances from the points of their origin. The Provincial Entomologists are well able to study and devise appropriate methods of dealing with the first group of pests; as regards the second group, as in the case of the Desert Locust, for example, an all-India agency is necessary to collect information on the movements of the pest from all likely breeding places, and circulate a warning to the provinces likely to be affected. While, such an agency is already functioning in respect of the Desert Locust, none has yet come into existence to deal with two other Indian locusts of potential danger, namely, the Bombay Locust and the Migratory Locust. Moreover, sufficient information about the breeding grounds, and areas of distribution and migration of these locusts has not been available; nor has any knowledge of the factors that are likely to favour the mass multiplication and swarming propensity of these locusts been gained so far.

Besides locusts, other insects like the paddy Army worm in South India, and cutworm in Bihar, are pests that migrate and spread over considerable areas during certain years. The Deccan grasshoppers invading contiguous areas in four different political territories is a problem by itself requiring extensive studies by a central body operating in all the territories as a single unit.

The case of the great locust infestation of South India in 1878 is extremely interesting. Severe infestation had occurred over the whole of the Carnatic and Mysore and part of the Deccan. Though it is true that the invasion was an abnormal development, due to unusual drought condition in 1876, it would show that there is nowhere a real immunity in South India. If the centres of outbreak are situated in the grass areas of the hill ranges, there is every likelihood of a recurrence of locust outbreak if conditions should become favourable.

Old records of about sixty years ago, regarding the locust invasion of 1878 recovered from Government offices, have given very valuable information about the migratory locust.

The vital need would appear to be a well-thought-out plan of research, on an all-India basis, by a central body of agricultural scientists, including entomologists, who should tackle such problems as cannot obviously be worked by a provincial agency. Such problems may include investigation on pests capable of migrating from one province to another, like the Bombay locust, the Deccan grasshopper and the Army and cutworms, and also research in matters of fundamental importance. In addition, the results of work undertaken by provincial authorities that remain unpublished for long periods for want of facilities and opportunities, should be collected periodically and examined by a central agency, for preventing overlapping in research and also for the purpose of pooling of available knowledge useful to the whole of India. The recommendations of this body could later be considered by the Imperial Council of Agricultural Research for sanction of funds, for publishing useful records and making them available all over India. It is with the help of central organisations that much of very necessary and important investigation about certain insect pests of potential danger to large tracts in India, can be conducted and later, effective measures of control adopted in time.

PHYSIOLOGY

President: PROF. B. NARAYANA

THE GROWTH OF PHYSIOLOGY AS AN EXPERIMENTAL SCIENCE

PROF. B. NARAYANA has traced the growth of physiology as such and has presented before us not only the researches done in the past but also those that have been done in recent years. He has gone back to the earliest days when physiology as such was not known. Since physiology is intimately associated with anatomy, medicine and surgery, it is only natural that he has referred to these in the course of his address.

Tracing from the days of Hippocrates the author passes on to the post-Hippocratic period when two notable schools of medicine were founded in Alexandria, one by Herophilus of Chalcidan (300 B.C.) and the other by Erasistratus (260 B.C.). He then passes from the third century B.C. to the second century A.D., when Galen flourished. In Galen, the ideas of Hippocratic writers were maintained but were given a Galenic stamp.

The birth of modern science of anatomy and physiology began from the time of Andreas Vaselius who was born on the new year's night 1514-15. Vaselius' attitude was that observations and not authority were standards to be followed. He laid the foundation of experimental methods so securely that his students and disciples never appealed to him as an authority but for judgment to what could be seen and demonstrated. His book *The Fabric of the Human Anatomy*, published in 1543, was the beginning of not only of modern anatomy but of modern physiology as well. Later on in the hand of Henry anatomy took a new shape and became physiology. From this time onwards physiology was inseparably associated with anatomy and physiological explanation was acceptable only if it was anatomically possible.

Coming to the nineteenth century, physiologists like Johannes Muller, Helmholtz and Ludwig in Germany and Claude Burnard in France had considerable influence on the growth of physiology in Europe. The influence of Claude Burnard on the development of physiology as an experimental science was considerable.

It is unfortunate that physiology was not so highly developed at the time as an experimental science in Great Britain as on the continent. It was not until 1836 that Sharpey exerted his influence on the spread of physiology as an experimental science in Great Britain. Later on he induced Michael Foster to take up the study of practical physiology and to him physiology owes a deep gratitude as he took active part in founding the British Physiological Society in 1886. Gradually many centres of physiological research in Great Britain were established.

Having given a brief review of the work done by various physiologists at different centres the author discusses more fully one of the important subjects in which work has been done in recent years and further work is in progress.—"The Physiology of the Pulmonary and Bronchial Vascular System". Recent work on the subject shows that the reactions of the various parts of the pulmonary vascular bed to nervous and chemical influences are not always similar and that any given response of the lung as a whole must be considered as the resultant of a number of reactions in different parts. Recently the relationship of physiology to surgery has also been recognized and it has been realised that physiology must take the help of surgery to solve many of its intricate problems and that surgery cannot make any real advance unless it goes hand in hand with physiology.

In conclusion it has been pointed out that ways and means must be found whereby this experimental science can grow as rapidly in this country as in others. An atmosphere of research should be created in all the physiological laboratories. It will also be of very great value if attached to a department of physiology, a purely research department, called the Department of Experimental Medicine be created.

ENGINEERING AND METALLURGY

President: N. V. Modak, B.E., M.I.C.E., M.I.E. (India), F.R.San.I., J.P.

THE THEORY AND PRACTICE OF SEWAGE PURIFICATION, WITH PARTICULAR REFERENCE TO WORKS AT DADAR, BOMBAY

BOMBAY is the first city in India to operate sewage purification works under skilled technical and scientific supervision with requisite laboratory control. Mr. Modak presents in this address, after a brief review of the modern trends in sewage disposal practice, a number of data and statistics collected at the Dadar plant, so that they may prove useful to engineers and chemists engaged in similar works in India.

The most marked trend in modernisation is the mechanisation of the treatment plant. Though economic considerations play an important part in the selection of apparatus or otherwise, plants installed in the midst of residential areas should be provided with mechanical appliances as they are helpful in minimising nuisance from smell when the various daily operations required for the efficient performance of the plant as a whole are carried out.

The next trend is in regard to pre-treatment of sewage prior to its entry into the preliminary sedimentation tanks. Pre-treatment has been developed on two lines, pre-aeration and flocculation. Pre-aeration is helpful in keeping the sewage fresh, and in the separation of grease. Flocculation is practised either with submerged paddles, having a peripheral speed of 1·5 to 1·7 f.p.s. or by blowing 0·05 to 0·2 cu.f. of air per gallon of sewage treated. Paddles give better results than compressed air. Flocculation with paddles is also adopted in the case of chemical precipitation tanks to secure thorough mixing of chemicals. Chemical precipitation is being revived, the sedimentation tanks being used for the purpose during the hot months when the sewage is very strong.

The Activated Sludge process has now passed the experimental stage and has become the most prominent mode of treatment. It can safely be relied upon to produce stable and sparkling effluents both for large and small installations, provided, skilled and scientific supervision can be afforded for its scientific operation. The process is, however, "very sensitive" and gets easily upset by factors like septicity, variations in quantity and strength of raw sewage, and the relatively large proportions of industrial wastes. Aeration is carried out with either diffused air or surface aeration, *i.e.*, mechanical agitation. The diffused air method is economical for plants of greater capacity than 4 m.g.d., while for smaller capacities the choice must be based on considerations of local conditions, and variations in flow and characteristics of sewage.

In Great Britain a number of activated sludge plants have been introduced between the existing sedimentation tanks, and the biological filters. Here the activated sludge process is employed to remove only the colloidal matter from sewage, *i.e.*, it is worked up to the clarification stage, and the filters, being more suited for the nitrification of dissolved organic matter, complete the nitrification stage.

It was thought that with the advent of the activated sludge process, the biological filters would not be considered for new installations. But as more experience was gained in the working of activated sludge process, and in particular about its sensitiveness, the troubles above mentioned were noticed, and people had to take recourse to biological filters which could withstand sudden variations in the strength and volume of sewage treated. The main drawbacks of this, however, are its large space requirement, aerial nuisance from smell and fly nuisance. These are now overcome by suitable means such as enclosing the filters and provision of forced draft aeration. Pilot plants have given such satisfactory results that this plant has a bright future, as it is cheap both in initial cost and operation cost, than the activated sludge process. Experimental work is, however, in progress to achieve further modifications of the filter such as stage filtration. There is no doubt that the old biological filter with suitable modifications will considerably influence the technique of sewage purification in the near future. An enclosed filter using forced draft aeration is in operation at Dadar from April 1941.

Sludge disposal is practised either by land treatment of sludge or burying or lagooning or drying in the open on beds. The first requires large space and has, therefore, fallen to the background, whereas the latter ones create nuisance. Pressing is adopted in many places and vacuum filters are used in several others, the dried sludge being sold as a fertiliser. Digestion of sludge in separate tanks called "digesters" is in practice, superseding the older methods. The gas obtained from digestion is used for power and fuel purposes. A single stage "digestion tank" is in operation at Dadar for five years. This is the first of its kind in India. Sixty thousand c.ft. per day of a gas of calorific value 600-650 B.T.U. per c.ft., are collected and while 25 per cent. of this is already being used for cooking and heating purposes in the K.E.M. Hospital, methods for utilisation of the remainder are being vigorously developed.

The sewage purification plant at Dadar is designed and operated for producing an effluent conforming to the standards laid down by the Rivers Pollution Board, England, for "combined" sewage. It was intended to extend this plant from 4 to 8 m.g.d., but due to conditions created by the war the work on the extension had to be deferred and the plant has, therefore, been overloaded. The total flow reaching the plant is about 10 m.g.d., out of which 5 m.g.d. are treated in the activated sludge plant, about 0·75 m.g.d. in the enclosed filter, and the remainder is bypassed after preliminary settlement into the open storm water drain close by. Full details of data and operation of the several units comprising the plant are presented and discussed.

S. K. L. Narayana.

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