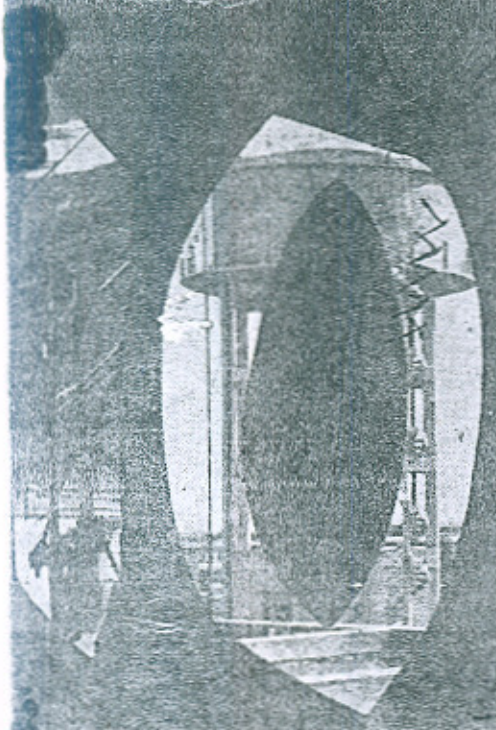
ENGINEERING NEWS



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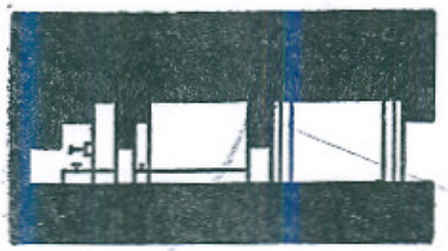
QUARTERLY JOURNAL OF THE WEST PAKISTAN ENGINEERING CONGRESS

AEG

Electrical Plant and Equipment of all Kinds

Erection
Manufacture
Design



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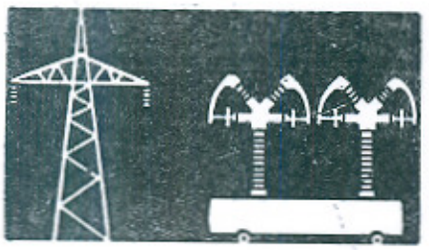

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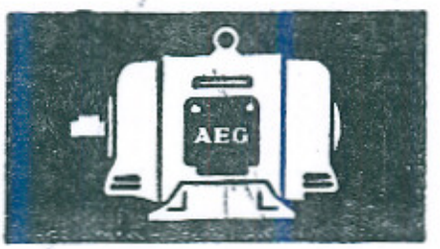

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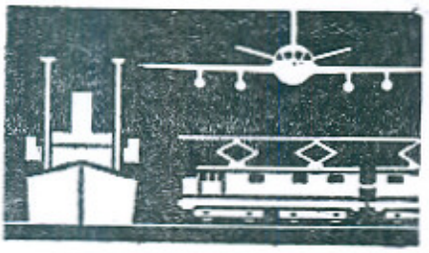
Industrial Plant



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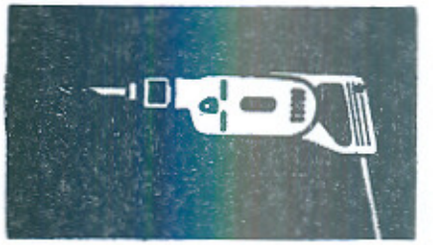
Marine Engineering
Airfield Equipment



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In this issue

From the small

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...to the large

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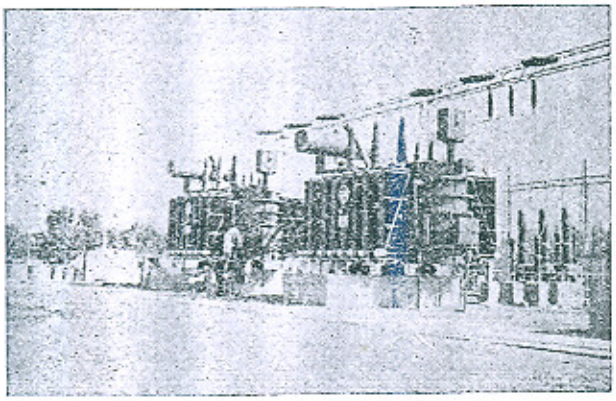

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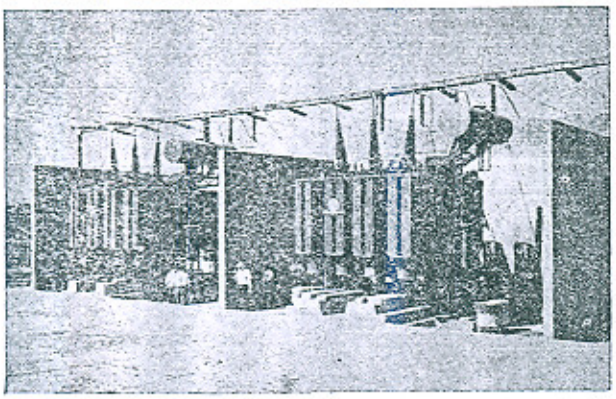

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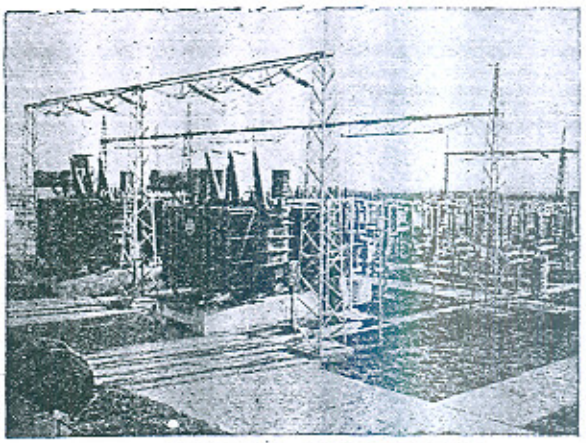

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TEN YEARS OF SERVICE

Ten years ago, *Engineering News* was founded as an organ of the West Pakistan Engineering Congress. It was dedicated to "the best traditions of the engineering profession" and to the "dissemination of professional knowledge". Over the past decade we have endeavoured to serve these ideals in our humble way.

In the history of men, ten years may be a brief period, but not so in the domain of modern technology. The sum total of engineering knowledge is known to the doubling every ten years. Today, we have twice as much to communicate as we had when the first issue went into print. We, therefore, look at this juncture in the history of *Engineering News*, as important enough to warrant some retrospection and introspection.

In retrospect, we have a feeling of satisfaction and a sense of accomplishment. *Engineering News* has been bringing to you a constant stream of information covering all branches of engineering; technical articles; important engineering news; book-reviews; abstracts of technical papers and views on the state of the profession in Pakistan. As an additional service to our readers, we are publishing a 10-year index to the *Engineering News* in this issue. A mailing address card is also attached in the issue to facilitate the despatch of the magazine to the reader. We believe that we have been of use to all of you and more so to those who are located at out-of-the-way places. For being able to publish *Engineering News*, we are grateful to our contributors, who took their precious time and leisure hours to write for us, and heartily thank them all. But we have our regrets too. The general response to our appeal, made in the first issue, "Knowledge should traverse from mind to mind" has been poor.

The Congress was established in 1912. Till 1956, when *Engineering News* was founded as a quarterly, its only publications were the annual proceedings. A year later,

in 1957, annual symposia were added. Since then, despite the spiralling up of the developmental activity, engineering knowledge and our membership, we have not been able to increase the number or frequency of the Congress publications. The reasons for this impasse are not far to seek.

Engineers, the world over, suffer from a shyness of taking to pen. "Deeds, not words", seems to be their motto. In Pakistan, this shyness has already cost us a great deal in withholding important information from the profession and in keeping the public uninformed about our professional achievements. To exhort our members to write, we borrow the following line from Bacon : "Every man is a debtor to his profession". And one way of meeting your debt is to share your experience and findings with others.

Another difficulty in enhancing the publication activity of the Congress is that of finances. *Engineering News* has been financially deficit all along, because the full membership of the Congress (1200 in all) does not care to pay its dues. The annual subscription of the *News* is too meagre to meet the ever-increasing cost of production. Engineering magazines, in general, thrive on advertisements. We have not been able to exploit this source of income mainly because our readers, who could help us so much in getting these advertisements, have not been alive to this problem.

On this tenth anniversary of *Engineering News*, our feeling of accomplishment is therefore tarnished by the regret that we have not been able to make it into a monthly magazine. Lack of textual matter and finances have been our bottleneck. While we renew our dedication to serve our ideals of the best traditions and dissemination of knowledge, we also hope that with your increased support we will be able to present an improved *Engineering News* to you in the ensuing year of its publication.

West Pakistan Engineering Congress: The Council

INTRODUCING THIS YEAR COUNCIL

This year the general body of the Engineering Congress elected Mr. A. M. Akhoond, Chief Engineer, West Pakistan Railways as its 49th President. Five Vice-Presidents were also elected. The sixth Vice-President is the past President. We are giving below brief biographical sketches of the President and Vice-Presidents.

The President

MR. A. M. AKHUND, Chief Engineer, Pakistan Western Railways, Lahore was elected the 49th President of the Engineering Congress for the year 1965-66.

Mr. Akhoond was born in 1914 and joined the Indian Railway Service of Engineers in 1938. An Engineer of varied experience, with a keen interest in bridges, his first promotion as Executive Engineer, Bridges came in 1944. In 1946 he was appointed as an Engineer-in-charge of Surveys before taking over as an Executive Engineer-General, in the Railway Headquarters. From 1952 he has been actively taking decisions about improvement in the Engineering Section of Pakistan Western Railways. He worked as Deputy Chief Engineer Bridges and as Director, Civil Engineering before taking over as Chief Engineer in 1961. He is still holding this post.

His interest in bridges took him to United Kingdom and U.S.A. to finalize the drawings and specifications of the new Rohri Channel Bridge near Sukkur.

As President of the Congress Mr. Akhoond is busy in arranging for the Headquarters of the Congress. We hope his efforts will bear fruit.

The Vice-Presidents

MR SARWAR JAN KHAN, Chief Engineer, Peshawar Region, has over 32 years of Government service. After obtaining his degree in Civil Engineering from Sheffield University, he joined the N.W.F.P. Public Works Department in 1933. He was promoted as an Executive Engineer in 1940, Superintending Engineer in 1948, Deputy Chief Engineer in 1954 and as an Additional Chief Engineer in 1958. During his long

engineering service, he constructed the New Michni Canal, Pehur Canal. Siran and other Canals. The Kheshki Lift Irrigation Scheme, Peshawar Cantonment Lift Irrigation Scheme and Warsak High Level Canals were constructed under his supervision. He was also responsible for the alignment, design and implementation of the Joe Sheikh Link Channel. The Dera Ismail Khan Tubewell Scheme was also completed under his charge. In his earlier career, he was also in charge of Buildings and Roads construction in the Province. The important works included the Construction of Mardan Degree College and the Medical College of the Peshawar University. He also constructed Dir Gujar Lari Pass Road, Ghora Gali Lora Road and Shiwaki Shakardara Road. His professional Duties included major Development shemes like Warsak and Kurram Garhi Project. Mr. Sarwar Jan is known for his keen interest in the affairs of the Congress. It is hoped that the Council will benefit from his experience.

Mr. Ahmad Hassan

MR. AHMAD HASSAN, Vice President of the Council, is another senior and experienced Engineer with a background of over 35 years of Engineering performance. His earlier service was devoted to the P. W. D. of Bahawalpur Government where he joined after obtaining his degree in Civil Engineering in 1930 from Durham University. He was promoted as Executive Engineer in 1938, and Superintending Engineer in 1948. Most of his service was for the Bahawalpur Government where he was responsible for many development schemes. These included Canal, Roads, Hospitals, Colleges, Public Schools, a Model Town and a Jamiá Masjid. During the war he was on deputation with Government of India and constructed the National Highway from Panjnad to Reti. For two years from 1952 to 1954, he was a member of Pakistan Delegation to Washington in connection with the water dispute with India. Before coming over to the Irrigation Department of West Pakistan in October 1957 as Additional Chief Engineer Operations he was Chief Engineer P. W. D. and Secretary to Government Public Works Department in the Bahawalpur State. He is at present performing the important functions of Chief Engineer and Adviser Irrigation to the Agricultural Development Corporation since April 1962, controlling the irrigation systems of Ghulam Mohammad Barrage, Guddu Barrage and the Thal Doab.

An experienced Engineer with a varied background, Mr. Hassan is taking keen interest in the activities of the Congress.

Mr. Syed Hamid

The Waterlogging and Land Reclamation problem of Pakistan brings to one's mind the foremost Engineer of the country deeply connected with the problem, Mr. Syed Hamid, Chief Engineer, Groundwater and Reclamation Division, Wapda. His first connection with this problem arose when he was appointed Under-Secretary and Officer on Special Duty, Waterlogging and

Land Reclamation Investigation in the Punjab Irrigation Department. This work took him to USA, on a study tour in 1951. On return he followed this subject, as Superintending Engineer, Rasul Hydro-electric power station which was constructed for energising the tubewells used as an anti-waterlogging and salinity control measure. To procure tubewell equipments, he visited Australia in 1953 and on his return he was made the Project Director, Groundwater Development Organization, in 1954. This background helped him tremendo sly as Project Director, Groundwater and Reclamation in Wapda, which post he held, from 1958, till he became Chief-Engineer in the same Division, in 1962. Before taking over his special assignment on Waterlogging and Land Reclamation he had 14 years' experience of the working of the Irrigation Canals. He joined the Irrigation Department in 1937 and worked in various capacities in Revenue Division, Canal Headworks, Inundation Canals, etc. His last assignment was on the construction of Bhakra Dam, before he took over as Under-Secretary to the Government.

In connection with his assignment as Chief Engineer of Groundwater and Reclamation Divisions, Wapda, he visited Yugoslavia in 1960 and Russia in 1963. He is internationally known for his work and responsibilities towards the solution of one of the most complicated problems faced by the country.

He was recently elected a Member of Pakistan National Committee to represent Pakistan in the International Commission on Irrigation & Drainage to be held in India in February 1960. He was the Director of F.A.O. Symposium on Water-logging and Salinity in 1964 and a year earlier in 1963, he conducted the West Pakistan Jubilee Symposium on the same subject.

The Council has the benefit of his vast experience in this specialised branch of Engineering.

Mr. M. A. Wahid

Mr. M. A. Wahid is Chief Engineer, Building and Roads Department. He has 25 years of service in this department. During this long period, he has gained considerable experience in the construction and maintenance of Buildings, Roads, Sanitary, Electrical and Mechanical Engineering works. Mr. Wahid originally joined the Irrigation Department in 1937 and was associated with the Haveli Canal Project. In 1940 he was transferred to the Building and Roads Department, where he worked as an Under-Secretary in 1944 and was promoted as a Superintending Engineer in 1948. Mr. Wahid was promoted as Deputy Chief Engineer in 1959 and an Additional Deputy Chief Engineer in 1960. He has attended Pakistan Administrative Staff College. He was also a member of the mission on Highways and Bridges sent to Canada in 1961. Mr. Wahid is at present the Chief Engineer, Central Region. Before taking over this position, he was the Director-General, Housing and Settlement Agency and Chief Engineer, Highway Nucleus. He brings with him the experience of the Buildings and Roads Engineering for the Council and will be of considerable help in handling the affairs of the Executive Committee.

Mr. Irshad Hussain

Mr. Irshad Hussain is an experienced Engineer who has become a Director of an engineering firm. Mr. Irshad graduated in Civil Engineering from the Panjab University in 1945. He holds a Master's Degree from Harvard University in the U. S. A. On his return from America in 1949 he worked as an Executive Engineer, Lahore, Public Health Division and later on as a Research Officer, Buildings and Roads Research Department. In 1954 he was on deputation in United Kingdom with the Department of Scientific and Industrial Research, England. As a Research Officer, he presented three papers to the Engineering Congress. His subjects of investigations were connected with water disposal works, and environmental comforts in residential buildings.

He resigned from the Government Service in 1957 and joined Packages Limited as General Manager. He was both in charge of the construction and administration. He has been working as General Adviser to Industries affiliated with the Wazir Ali group. Currently Packages Limited are putting up a Paper-board Factory at a cost of rupees six crores. He has been placed as Director of the Packages Limited.

He is a keen Civil Engineer who has worked persistently for the promotion of West Pakistan Engineering Congress. He has been always connected with this organization. The Congress has all along enjoyed the hospitality of Packages Limited through his courtesy.

In 1964-65 he was a Vice-President of the American Society of Civil Engineers, West Pakistan Chapter. He is also a Fellow of American Society of Civil Engineers.

Public Image of Engineer

By

KHALID MAHMOOD*

In this article Mr. Khalid Mahmood has discussed the present anomalous situation of the Engineering profession "dedicated to the service of mankind and responsible for harnessing the forces of nature to the well-being of human race". He has put forth many suggestions adoption of which can lead to a better public image of the profession.

The professional morale of engineers in Pakistan is currently (1965) at a low ebb. Frustration and gloom hang heavy on the minds of builders of this developing country and complaints of lack of recognition, relegation to secondary position and a generally sceptical atmosphere are prevalent; not without justification. This anomalous situation, in which those 'dedicated to the service of mankind" and "responsible for harnessing the forces of nature to the well-being of human race" find themselves, has many facets. Introspection will yield many faults with the men of the profession. Yet all the blame for the current situation cannot be laid at the door of the engineer.

Engineering, as a profession, has some inherent characteristics which do not lend it to automatic public appreciation. Other noble professions: medicine, law, education, have more personal, individualistic and instantaneous relationship with their beneficiaries. Engineering benefit communities or at least large groups of people (over large periods of time even generations) who may see no obvious connection between their everyday life and the accomplishment of engineer. Another reason is that whereas other noble professions generally follow establishment of human habitats, engineering largely precedes it. It requires conscious effort for the public to realise that the developed environments, which they take for granted, are the results of sweating and untiring effort of one or more generation of engineers. Another set-back to engineering, as a profession, is that it cannot hide its mistakes. A cracked wall will continue to present a glaring evidence of the buried foundation failure. A comparison can be made with medicine as in the adage, "Doctors bury their mistakes; engineers can't". The purpose in recounting these differences, however, is not to absolve the

*Hydraulic Officer, Irrigation Research Institute, Lahore.

engineer from the need to improve his technical skill, professional attitude or ethical behaviour but to stress one field of endeavour, which the profession can legitimately exploit to improve its public image, and which it has so far persistently neglected. This is the field of public education about the role of engineer. Unless the public is told about the aims and objects of this noble profession, about its achievements and its potentialities, it is not possible to expect any recognition from them. While we are planning to reorientate our professional outlook in view of changing administrative and economic patterns of planning and executing engineering projects, it may be useful to make an effort in this direction too. The responsibility for the "selling" of the engineers' role to the public lies both with the individual members of the profession and the engineering societies. This can be fulfilled by the following steps:

(i) Role played by the engineers in the past

The past achievement of the engineers should be brought out and explained. The idea being not the ancestor-worship, which can lull us to sleep, nor aggrandisement of living personalities, but the education of general public about the dismal picture, our surroundings and our lives would have had but for the work of engineers. Specifically, large projects in the sectors of water, water power, communication and building engineering should be described with emphasis on the pioneering spirit of the profession and the "before-and-after" conditions.

(ii) Role of Engineers at the present

The day to day maintenance of our public facilities may not seem glamorous to those who use them. Often the importance of these utilities is realised in their absence, but then, with a feeling of disgust rather than that of appreciation. Similarly, the impact of engineering on the present goes on developing day after day, almost imperceptibly, without the public ever realising it unless some one can put his finger on it and explain it. The role played by the engineer, in the maintenance and operation of the common facilities and the continuous stream of development that goes on unnoticed and unsung, should be explained to the public.

(iii) Problems of Present and Future

Pakistan is beset with many problems in the field of its natural resources. The agricultural economy is suffering from the double menace of waterlogging and salinity, which is throwing about 1 acre per minute out of cultivation. The congested roads are taking heavy toll of human lives at about one thousand persons per year. Inadequate potable water supply and sewerage is causing untold misery and loss of millions of man hours. Ninety per cent of our houses go dark after sunset because there is not enough electrical power. Poverty, need, ignorance, disease and hunger loom large over a vast section of the country, because there is not enough water, sanitation, electricity, and means of communication. Some attention has been focussed in recent years on problems like the waterlogging and salinity but many others have not even been enunciated. Is it not for the engineering profession to take control of his domain and state the problems as they exist, to the public? The profession can thus better visualise its own role and explain it to the public, who will

better appreciate the status of the engineer. And then there are the problems of future: Problems of our irrigated agriculture, some of which we are already feeling, and others, which have only cast their shadows—Deterioration of river channels, consequent upon the increased withdrawals and the replacement plan—Sediment exclusion which will become more difficult with every additional cusec diverted for irrigation—Disposal of sediment, when removed by silt clearance and dredge basins—Worsening of flood problem as river beds rise and channel capacities deteriorate. Similarly problems of stream and air pollution as urbanisation and industrialisation expand. And think of the need for housing, water supply, sewerage, roads, railways and power for the future. This list is by no means exhaustive, nor all these problems have been entirely neglected. In some cases, projections have been made to forecast the hazards and anticipate the requirements, in others, vague anticipations have been made. Most of these are however waiting for some non-technical administrator, to bring them to light.

The government departments and semi-autonomous bodies are respectively controlling different sections of our engineering responsibilities. A survey of our present needs and future requirements will perhaps need their active co-operation, but the task cannot be entirely left to these agencies. It is only in the engineering societies, far from the red-tape, the congestive atmosphere of departmental rules and the seniority complexes, that engineers can form themselves into working groups and survey the problems of present and future. This task of planning is neither simple nor susceptible to engineering analysis by simple engineering principles. The needs of today are to be fulfilled in the light of our gross economic potential and the problems of tomorrow cannot be projected without hazards. In the rapidly changing modern day world, anticipations of future requirements become more of an art. It is here that the private consulting engineer is more suited for the job, than the government agencies. The technical societies, should do what they can in delineating respective fields and their broad statements and urge the government to pass on the problems to private consultants, for preparing master plans. A proper exposition of the problems of present and future and the plans for their solution will awaken the public to its own needs and to the role of the engineer.

(iv) Current Projects

But for a few engineering organisations, there is no publicity of the projects being planned, executed or completed. Even when the public is told, it is more in a maze of technicalities—and these technicalities are so dear to the engineers. What is needed is the publicising of the socio-economic impact of these projects. After all, the engineering projects are not executed *per se*. A bridge is not built because an engineer happened to conceive a marvellous design. It is there to fulfil some socio-economic need of the locale. Similarly river training is not the result of the whims of some engineers to see a river flow along a better course for aesthetic reasons alone. Same is true of water supply, railways, reclamation, sanitary, building, power, roads, dams, canals, drains, and all the other fields of engineering endeavour. The need is to understand the impact of these

projects on the society, from their very inception and then explain it to the public. This is the only language they can understand. The responsibility in this case is squarely on the individual engineer but the engineering societies can do much in imparting this outlook to the engineer, through a broadening of the scope of university education, short in-training courses and engineering academies.

(v) Achievements of Research

A static profession gives the picture of a dying man. It is only a dynamic attitude, of a constant effort to learn and improve that can impress public mind. Though there is a pressing need for us to crystallise our research needs and to reorientate the attitude of the general engineer towards adoption of better techniques and newer theoretical knowledge, yet the achievements in this field are not being emphasised. While we have to accomplish these goals within, we have also to publicise the achievements of our research effort and their utility, so as to portray the dynamic side of the profession. Here, the research organisations can play a leading role.

(vi) Reorientation of Engineer's Outlook

Despite all that may be publicised about the achievement of engineer in the uplift of the society, the public image of the profession can be no better than the sum total of the impressions given by its individual members. A major portion of the "Ugly" image, which the engineer has, is the result of follies of individual members of the profession, often magnified many times over. The accusation of unethical practices, wastage of public funds on ill-conceived and sparsely investigated projects and of unprofessional attitude, is more exaggerated than factual, but the engineer cannot be entirely absolved of it. The need is, for the individual engineer, to consider himself the unofficial ambassador of his profession and act accordingly. The Engineering Congress is drawing up a "Code of Ethics" for the engineers. This code, when enforced, will give a guiding light to the profession about the do's and don'ts. But a good code of ethics does not automatically guarantee a good ethical behaviour. The ultimate onus for adopting professionalism as a way of his life will be on the individual engineer. The enforcement of the code should be a responsibility of the technical societies and they will have a grim responsibility in it. They will have to watch their steps lest this power of sitting in judgement corrupt them and lead to witch hunting. Exemplary conduct by the leaders of the profession will undoubtedly be more effective than precept. Nevertheless the formation and enforcement of the code will improve the image of the engineer.

The suggestions made, for improving the public image of the engineer, in the previous paragraphs are not easy of achievement nor can they promise a quick return. The age-old negligence will need some time for rectification. The task is also arduous, and who does not have his hands full of his technical and administrative problems. But in the interest of our profession and the future generations of our profession (to whom we owe the responsibility of leaving better working conditions than have been our lot) and above all, in the interest of our nation, we need to make a start as soon as we can. A frustrated engineering profession is a parasite on our natural resources, eating away our development

potential from within. The previous record of our technical societies shows that in the face of challenge, they have always shown zeal and energy to fulfil any task. A cooperative effort by these societies can accomplish this task too. It is possible for the various societies and the Congress to maintain their individual entity and yet cooperate at the top level by forming a joint council, which can direct and supervise the effort in this direction. Committees can be made to fulfil the assignment dealing with specific expository objectives in their respective fields. Exposition of the role and accomplishment of engineer can also be effectively achieved by engineering exhibitions open to public at the time of annual sessions of the societies. These exhibitions can be made peeping windows into the impact of the engineer on the society. The Congress and other technical societies can strengthen their public relation sections. The engineering agencies can be convinced the need of a better effort in this direction. Cooperation between the technical universities and the Congress can bring about introduction of economics, ethics and sociology oriented courses in the universities and in the arrangement of short training courses for the engineers in these subjects. An academy of engineers is the crying need of the day, which, if fulfilled, can be used to impart a more synthesised and broader outlook to the engineer.

Parallel to our efforts in setting our house in order, there is a need for a better exposition of the role, accomplishments and potentiality of the engineers to the public and to the Government. Out of this exposition, will come a better public image and recognition and respect will follow. Are we prepared to make this effort?

Some Measures to Promote Scientific Education and Research for National Development

By
Dr. MUSHTAQ AHMAD

The President of Pakistan invited a number of top scientists of Pakistan to discuss the promotion of scientific research in the country. The scientists met at Swat for 4 days and discussed among themselves the problems of promotion of Scientific Educatian and Research in Pakistan. There were many contributions, which will be printed by the division of scientific research. We reproduce here the contribution of Dr. Mushtaq Ahmad, Director, Irrigation Research who pointed out some of the measures which are essential for this aspect of our National Development.

The potential in appraising, exploiting and conserving the national resources of a country depends on its capacity to use science and technology in service of the nation. Pakistan as a developing country is undertaking huge Development Projects in the field of industry, agriculture, utilisation of water and power resources, reclamation of waterlogged and saline lands, development of mineral resources and improving means of communications such as waterways, railways, highways and airways, and host of other projects. If the nation has to catch up with more advanced countries in reasonable time then all these developments have to be made in the life time of one or at the most two generations. It is not impossible. Already countries like Japan and Russia have shown that it can be done as fast as that but for this development we need a very large number of Scientists, Engineers and Technicians. I may point out at the very outset that by Scientific education, I mean education in all disciplines of Science and Engineering and I definitely include education of technicians in its scope. This I have done with a purpose, as I think no country trying to bring an industrial and economic revolution can do so unless it has qualified Scientists to investigate and develop new means of utilisation of national resources and indigenous materials ; the Engineers to plan, construct and operate the projects or the plants ; and technicians to give a physical shape to the Engineers' blueprints.

Evaluation of the requirements of Scientific Education for the National Development

Let us evaluate the national requirements of scientific education keeping in view the development projects of the country.

The main questions to be looked into are :

1. What are the requirements of Scientists, Engineers and Technicians for the needs of a developing country like ours ?

2. Are we producing adequate number of Scientists, Engineers and Technicians for carrying out the programme of national development ?

3. Are we producing men of the right quality and calibre who can shoulder the responsibility.

4, If there are short-falls in any of the above objectives, what are the main defects and what broad measures are needed to remove the defects and to make scientific education more attractive ?

Quantitative evaluation of Scientific Education for national development

Recently Unesco carried out an investigation to determine an index of scientific and technical potential of a country. Prof. Kovda fixed a number of criteria, one of which was the number of Scientists and Engineers produced by a country per million of the population. It was found that the more developed countries have 500 to 4000 Scientists per million of the population and judging from the experience of the most developed industrial countries, the number of Engineers was estimated to be 5 to 10 times as great. Taking an average of 1000 Scientists as immediate target per million for a less developed country like ours we would need 50,000 Scientists and about a minimum of 2,50,000 Engineers in West Pakistan alone. If we roughly take the ratio of 1 Scientist to 5 Engineers to 100 Technicians we need about 5 million Technicians. Against this what is the condition today in West Pakistan?

All the universities in West Pakistan put together do not produce more than 4000 Science Graduates in a year and not more than 500 M. Scs. in all the subjects. (Let us forget the quality for the present). The production of Engineering Graduates in West Pakistan is not more than 500 per year. If we assume that we have already 2000 qualified Scientists and 20,000 Engineers, which is an optimistic estimate, then at the present rate of production we need 100 years to reach the target set for Engineers and 240 years for getting the required number of Scientists. As far as the arrangement for the training of Technicians is concerned it was hardly considered necessary in the past. During the British rule no attempt was made to set up anything like British national or higher national certificate in Technology. Not a single Polytechnique was set up and only very few Technical Schools were opened, while in their own country they have 300 Colleges of Technology, training 30,000 Technicians a year. In our country the Scientific Commission realised the need and now in the Second and Third five-year plans we have planned to open Technical Schools and Polytechniques so that 7000 Technicians may be produced in a year. Thus by conventional proposed technical education for Technicians we can perhaps get half the number in 350 years.

Obviously there is a great gap to be filled and we must increase the facilities at least 4 times if we have to achieve the targets.

Some one can question that I am suggesting a production of so many Scientists, Engineers and Technicians. How can they find employment? I would answer in the words of Dr. Lenianihan quoted from one of the addresses of Prof. Abdus Salam: "If there is no industry in Scotland, there is no need of Technical Colleges; and the Scientists, the Technologists and the Technicians are the main products of educational system not of the industrial system, in which they hope to work. A coherent demand for technical education facilities will not rise from an assortment of industries, but the existence of technical trained people will facilitate the growth of new industries." Following the above argument we must plan to produce the Scientists the Engineers and Technicians in required numbers in foreseeable future without fear of unemployment. If the men have skills and a will to work they will create work for themselves.

The qualitative evaluation of scientific education

As far as the quality of Scientists, Engineers and Technicians is concerned, it is definitely unsatisfactory, for if it were not so we may not have to send so many students abroad for higher training and get an army of experts in all fields from abroad.

Before one can go into the cause of the low quality products of our Scientific education, let us see what are the main defects in the products of present-day scientific education. To my mind these are :

(*i*) In our present scientific education system we have more of cramming and less of appreciation and understanding of the Scientific Phenomena.

(*ii*) There is a definite lack of development of power of observation and use of scientific methods of measurement in the Scientists we produce.

(*iii*) There is a definite lack of development of power of logical scientific reasoning, the spirit of investigation and a keen desire to probe into the unknown realm.

(*iv*) The average Scientist or an Engineer abhors manual labour. He dislikes to do a manual job himself. There is no sense of dignity of labour. There is no urge to make manual work less laborious and more dignified.

(*v*) In the Science and Engineering Graduates and Technicians the development of sense of accuracy is lacking to a great extent.

(*vi*) Adequate mathematical background to enable them to pursue in advanced stage the different subjects is not provided.

(*vii*) There is more of indoctrination, more of bookish knowledge and less of experimentation and opportunity of learning by doing a thing.

Having seen that our scientific education system for creating the Scientists, the Engineers and Technicians is deficient in number and in quality, obviously to meet the demands of rapid national development we must plan to produce more Scientists, Engineers and Technicians and definitely of better quality than we are doing at present. For this, more young talented boys have to be attracted towards Science and Technology and more facilities for scientific and technical education in all fields have to be provided. I will give only a few basic suggestions and broad outlines to

achieve the above objectives. A few of the suggestions require a change in the mental attitude of the nation towards science and technology. Some are the concern of the Government or men in power, others are the concern of the Teachers, the Scientists and the students. The measures are:

(1) Create a place of respect for the Scientific and Technological Professions in Society

In the present society in our country the respect is associated with authority, wealth, or power to do harm or good, and unfortunately the Scientist or the Technologist possesses neither of these qualities. No doubt the great Scientists adopt science for its appeal to the unknown and inherent interest in revealing the secrets of nature, but a young boy planning his future career is generally influenced by the hard facts of life he sees around him. Thus many young brilliant men are repulsed from science and technology because they see that opportunities of reaching the high salaried positions are very few in comparison to administrative posts to which, unfortunately, authority and prestige are also attached. A comparison of technological service in the higher salaried ranks with the best administrative service in the country given below will clear the present position :—

Pay Scale above	Cumulative percentage of cadre	
Rs.	Technical	Administrative
3500	Nil	21
3000	3	23
2000	9	25
1000	12	59
500	41	86
400	47	100
300	100	—

The conditions as they are and so long as they exist, science and technology will always be relegated to a secondary position. Action in this matter is needed by the Government and by the Universities to make Science and Technology a desirable career not only intellectually but also materially. So long as it is not done we shall continue to employ foreign experts at very high cost because we refuse to treat our own men of equivalent merit squarely. No wonder most of our Scientists, Engineers and Technicians prefer to work abroad. In the interest of the national development there must be an awakening in the Scientists and Technicians themselves who should create public opinion for improving the position of men of Science and Technology in life, for only then the nation's youth can be attracted towards science and technology.

(2) Create a respectable position in Society by dint of hard devoted work

Material gains apart, if the Teacher and the Technologist is not getting proper respect in Society we must admit that the fault is not wholly that of the Adminstration. We have to see if the Scientists or the Technologists are creating through hard, selfless and devoted work a place of respect for themselves and their profession of which they can feel proud. The British Scientists have created a reputation and position of respect in Society which is not found in many countries. One of the best British honours is becoming the Fellow of the Royal Society. The Prof. and Teacher is respected for his hard selfless work. No doubt the disparity in emoluments is not as great as in our country, but I am sure if the Scientist and the Technologist get back the pride of performance and skill, the respect in

Society will be regained and with it will come the material gains too. Which should come first I cannot say ; but once Science and Technology establishes position of respect in Society there will be no dearth of Scientists, Technicians and Skills.

(3) Create an appeal for Science and Technology among the youngsters

Science and Technology holds an inherent interest for youth. An environment where children and young people can nourish this interest by reading popular factual articles or even Science fiction should be created. If the young mind is to be influenced at an early stage, all literature should be in our own national language. It is of paramount interest, that some Journals and Periodicals may switch over from 100% poetry and fiction to keep a fair balance between literature, art, science-fiction and technological achievements. If this cannot be done then pure scientific and technological journals in national language with popular appeal to children and young men should be brought out.

(4) Create conditions by which boys at all the ages may be trained in Science and Technology.

We must create conditions so that at all stages the right type of men may get opportunity of training in Science and Technology. At an early stage the right type of boys should be drawn towards science and technology according to their aptitudes. The very outlook of education should be changed at earlier stages because now the emphasis should be for producing Technicians, Engineers and Scientists rather than a large number of clerks for running the administration. For this, half of the existing schools should be given either technical or agricultural bias and at least half of new schools to be opened should be technical high schools with strong technical or agricultural bias. There must be ample recognised and organised facilities for adults, for men in service, in factories, in farms, to add to their technical qualifications and skills not only in big towns but all over the country. In fact all factories must be forced by law to open technical training centres where in-service training for increasing the skills should be given, or all industries should be taxed to defray the cost of training technicians. Only then we can create technicians in required numbers.

(5) Need of a National Scientific language

The existence or lack of national scientific language is a factor which can determine the success or failure of the scientific and technical education on a mass scale. No nation can plan an extensive system of science or technical education in a language in which the Students do not think. The purpose of scientific education is to train men who can think for themselves and can then translate their ideas into words, deeds or physical shape. As we can never dissociate thinking from words, any teaching done in a foreign language is bound to create more science parrots than real thinkers. No nation has made real progress in science and technology on a mass scale which has foreign language as medium of instruction. Russia, Japan and China are notable examples. The sooner we adopt the national language as the medium of technical and scientific education the better it is for science and technology.

(6) **Create facilities for training Science Teachers, Professors in Science and Technology for all stages from school to post-Graduate University stage in our own country**

We as a developing nation with the clear objective of producing larger number of Scientists, Engineers and Technicians must plan well ahead of future needs. For this we need a planned project for the education and training of Science Teachers, University Profes-ors for Science and Technology as far as possible in our own country. Creation of good, devoted Teachers who can create a lasting interest in a subject in their pupils is the surest way of furthering the cause of scientific and technological education. It is impossible that all the Teachers in Science and Technology we ultimately need can or should be trained in foreign countries. We must collect in our own country the best of Scientists and Teachers for advanced research and teaching in different fields such as Mathematics, Physics, Chemistry, Medicine, Engineering and various other Applied Sciences and start high grade Post-Graduate and Doctoral work in our own Laboratories. It is not within the means of each University of this Region to specialise in each of the above subjects. What we should aim at is that different Universities should pick out subjects of their specialisation, and collect not one but scores of top class men in that subject. Let there be men of Science in one discipline at least at one place in the country where they can understand each other, discuss with each other and create a climate of research. One or two men in a subject at an Institution cannot set the chain reaction. Let each University excel in a few selected subjects for higher learning and research and the problem will be solved in not a distant future in creating opportunities of higher learning and research in our own country.

(7) **Improve Technical Skills in the country for sustenance of Science and Technology**

In no country the achievement of a Scientist or an Engineer can be above the level of the craftsmanship of the technicians in the country. The usefulness of Scientists and Engineers will be limited unless the nation has the skilled craftsmen to translate the ideas of Scientists or Engineers in material form. Their work will always be hampered by the lack of facilities to produce or repair the required instruments or machines. In all the development projects whether these be in the fields of Industry, Agriculture or utilisation of national resources, the end-products or manufactured goods which are the real national wealth, come as a result of the skills of the Technicians.

Epoxy Resin Compound for repair of Set Concrete

Jointing new concrete to old concrete surfaces has always been a problem. During recent years a new resinous chemical compound has come in the market. It provides an effective bond between different structural materials, such as metals, cement, wood and many others besides. Epoxy Resins have an entirely new bonding mechanism and have excellent bonding properties. This material has not yet been tried by our engineers. This article has been prepared to acquaint the engineers in West Pakistan with some properties of this useful binder.

The first description of epoxy resin appears to have been published by a Norwegian, Lindeman, in 1891. However, commercial distribution of epoxy resins has only recently been developed. Epoxy resins as presently manufactured are available in a wide range of consistencies ranging from a virtual solid to liquids of relatively low viscosity. Those of higher viscosity have higher molecular weights. The colour ranges from straw to amber.

Epoxy adhesives are available in one package and two package systems. One package adhesives contain a latent curing agent which is activated by heating the joint. Usually, such adhesives are stable for a year or more at room temperature, but some require storage under refrigeration.

Two-package systems usually comprise resin and curing agents which are mixed just before use. They are stable for an indefinite time at room temperatures before being mixed. Once mixed in a predetermined ratio, a chemical reaction begins which converts the system from a liquid to a tough plastic solid in a relatively short time at ambient temperatures. Like all chemical reactions, heat hastens this process. Thus, the epoxy compound sets faster on a hot day than on a cold one. For all practical purposes, once the system hardens, it will not melt, flow, flush or bleed. The resulting adhesive has low shrinkage and, when used properly, the strength of the epoxy bond will usually exceed the strength of the material being jointed.

Curing Agents

The curing agents mostly used are primary and tertiary amines or aliphatic polyamines. Organic acids and anhydrides are also used as curing agents. Sometimes a plasticizer is usually included in the commercial epoxy system. Polysulphide

liquid polymers are a common plasticizer. The flexibilizers impart increased impact resistance to the cured system and improve performance at low temperatures. Sometimes in order to increase the bulk and reduce the cost, a filler material is also added. Coal tar products, clay, asbestos, silica, mica, aluminium oxide are some of the fillers. These slow down the curing action and increase 'pot life' *i.e.*, the time during which the material will harden. In order to control the setting time some resinous modifiers are also used.

Properties of epoxy compounds

These compounds have high specific adhesion to metals, glass and ceramics. Generally cured epoxy resin is seven times stronger than cured phenolic resin. They possess high impact, tensile and compressive strengths. The compressive strength of epoxy concrete is 10,000 lb/sq. in and tensile strength is about 1500 lb/sq. inch. When solidifying they do not release water or any other condensation products. It is thus possible to connect two metals without an addition of any pressure. In concrete they attain a bond stress of about 1200 lb/sq. inch. Epoxies are highly resistant to acids, alkalies, salts and solvents. There is no effect of temperature, heat or electric current on these. They do not show any shrinkage. It has been found that they can set within a few hours.

Use of epoxy compounds

Whenever an old set concrete is to be repaired the portion to be repaired is cleared of the dead concrete. Its surface is cleaned and a thin coating of the Epoxy adhesive is given and then the new concrete is placed over it. This system makes a very strong bond. It has often been demonstrated that a cracked beam when repaired by an Epoxy resin and loaded again to crushing will not break at the point of repair. In fact the bond made by this material is five times stronger than the ordinary concrete. The material can be used to increase the bond between the concrete and embeded reinforcing bars. Coating Iron bars with this material increases the bond between the concrete and the reinforcement. Fracture which sometimes occurs in the reinforced external corner of slab can be repaired by the use of this material. It is possible to integrally use this material in mortar. It is necessary that the concrete should have a dry surface. A dry fine sand can be used in the mortar in the ratio of 1 to 7 by weight. When a big area is to be repaired both the coarse and fine aggregates can be used and in that case, the ratio of Epoxy binder to aggregate can be 1 to 8. Recently this very material has been used in binding of glass fibres. At present tubewell strainers now being used by Wapda have glass fibres bonded by epoxy resin. They will form a non-corrosive material.

Use of the material

It is important that the surface to which an epoxy adhesive is applied is thoroughly cleaned. Oil stains should be removed by sand plasting. Sometimes acid cleaning is also attempted. Such surface should be carefully washed and dried before giving a thin (up to about 1 millimeter thick) coat of the material. It may be noted that usual epoxy adhesives are too viscous to be applied by spraying. If spraying is to be adopted, an addition of aromatic compound such as xylene is necessary. In that case it will be necessary to wait until complete

evaporation of the solvent takes place. For this reason spray application is not recommended except under the control of trained personnel. It may be noted that once hardening of the stuff has started, it is impossible to remove the material except by mechanical means.

Cost of epoxy compound

Epoxy compounds are expensive. They also possess a useful life many times longer than the other materials. Their quick curing property makes them exceptionally suitable for emergency repairs.

Handling precautions

Many uncured epoxy compounds are toxic. The hardener (particularly amines) and diluents are primarily responsible for this, but the resins also are toxic to a degree. If the workmen take proper precautions, they can handle toxic epoxies safely. Otherwise, they are likely to suffer from skin rashes, severe itching, eye irritations and respiratory ailments. The toxicity of epoxies can be cumulative.

The degree of protection needed by men in handling epoxy compounds varies with the epoxy and the application. A man trowelling an epoxy mortar on concrete blocks for a decorative wall may need nothing more than a pair of plastic or rubber gloves. A man using an epoxy as a spray should wear a complete bad weather outfit of boots, pants, coat, hat and gloves. In addition, he should use an approved respirator and should cover any exposed skin with a protective cream.

Epoxies, particularly those containing solvents, should never be used without adequate ventilation. Confined fumes and solvent vapours can seriously irritate the eyes, lungs and respiratory tract after long exposure. They also pose a fire and explosion hazard. If a man does get epoxy on his skin, he should wash it off immediately with soap, water and a scrubbing brush. 1.

Under no circumstances should the epoxy be removed from the skin by using a solvent. Many epoxy solvents are irritants in themselves, and a thin solution will cover a greater area and penetrate deeper into the pores. 2. 3

Clothing soiled with epoxies should not be reworn unless carefully cleaned.

Epoxy adhesives and binders should not be confused with other compounds such as polyvinyl acetates polyesters, neoprene emulsions, which can function as adhesives, binders, or modifiers of portland cement paste and under certain conditions can develop strengths that are adequate for the work in hand. None, however, appears to possess fully the useful characteristics of properly formulated epoxy systems which include the ability to establish strong and permanent bonds to both fresh and hardened concrete; the ability to cure and harden in contact with moist concrete; negligible volume change on curing; the retention of cured strength in the presence of water, and outstanding resistance to weather and chemical agents.

In a paper by Welch C. B. Carmichael, Civil Engineering and Public Review of June, 1962, has reported results of detailed investigations on Epoxy concrete, to determine its crushing and tensile strength, shrinkage, thermal properties etc. During recent years several papers on the use of this material have appeared. The references of these papers are as follows.

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TUNNEL PAINTED WITH EPOXY FOR 30 CENTS PER Sq. Ft.

The Massachusetts Turnpike Authority is trying now on a 1,900 ft-long vehicular tunnel, which passes beneath buildings in Boston's new $100-million Prudential centre. To obtain a light reflectile finish, the tunnel has been coated with a smooth, glossy epoxy. A special yellow colour was used, which minimizes the appearance of dirt.

Installation cost of the epoxy coating was approximately 20 per cent of what tile would have amounted to on this project. The comparison of in-place costs for both material shows less than 30 cents per sq ft for a two coat epoxy application, compared to an estimated $1.50 to 2.00 per sq for tile. Maintenance costs for epoxy are also estimated to be a small fraction of what would be required for tile surface.

The coating selected for the tunnel is Sika's Colma Protective Coating, which is resistant to chemical attack. After application, the coating forms a flexible skin that tenaciously adheres to concrete and other construction materials. When future maintenance is required, a single coat of epoxy can easily be rolled on, as this material will bond to itself without sandblasting. Recoating can be accomplished with a minimum of interruption to traffic.

The two component epoxy was mixed, just before use, with a paddle powered by a ½ in, electric drill. One or two men mixed the epoxy, and other in the 10 man crew rolled it into the roof and 18 ft. high walls. The second coat was applied from 24 to 36 hours later, covering any possible pin holes. Long handled roller were used, although either spray guns or brushes were applicable.

When ambient temperature fell to 50 deg. F., portable oil fired heaters were used the tunnel openings to retain the heat. The contractor estimated that work could have been completed in six weeks without interruption from other trades. The actual time extended over a four-month period.

*Reproduced from *Civil Engineering*, ASCE, New York, December, 1965.

Cheap Use of Solar Energy*

Brace Research Institute, attached to McGill University Canada, Faculty of Engineering, has recently issued five pamphlets on the Cheap Use of Solar and Wind Energy. A simple method to construct a Solar Still, a Solar Steam Cooker and Solar Water Heater and method to use Solar Energy for heating Swimming Pool are put forth. A method to construct a Cheap Wind Machine for pumping water is also given. In this article abstracts from these five leaflets are issued for the information of the readers.

How to make a Solar Still

The availability of modern engineering materials makes it possible to construct a solar distillation equipment of a large size at a relatively low cost, in any sunny area where good drinking water costs more than (US.) $5.00 per 1,000 gallons, solar distillation is certainly worth consideration.

The description given below represents one of many possible designs of solar distillation equipment. It has the advantage of being suitable for units producing anywhere from 1 gallon to 1,000 gallons per day, and will operate for a long period in isolated locations without attention. No auxiliary power source is needed other than means for feeding water into the unit, and no site levelling is necessary.

Description of Solar Still

Fig. 1 shows a cross-sectional view through a solar still that incorporates a black plastic water tray and a transparent plastic cover, galvanized steel guttering and concrete or brick side and end walls. The width is chosen to suit the width of the transparent plastic cover material, usually available in rolls 6 ft. wide. The length can be anything from a few feet to hundreds of feet.

Depth of Water

The depth of water that is evaporated each day is about 1/8 inch, so that the maximum dasirable depth in the evaporating tray is one inch.

The Transparent Cover

The most suitable material for the transparent cover is a thin polyvinyfluoride film that is sold under the trade name of "Tedlar". It is produced by DuPont Company, U.S.A. It has been noticed that this material can last for 5 to 10 years.

*Reservoir Evaporation Control—A Review by RUSSELL G. DRESSLER, reprinted from Solar Energy Society Sun At Work, Fourth Quarter, 1965

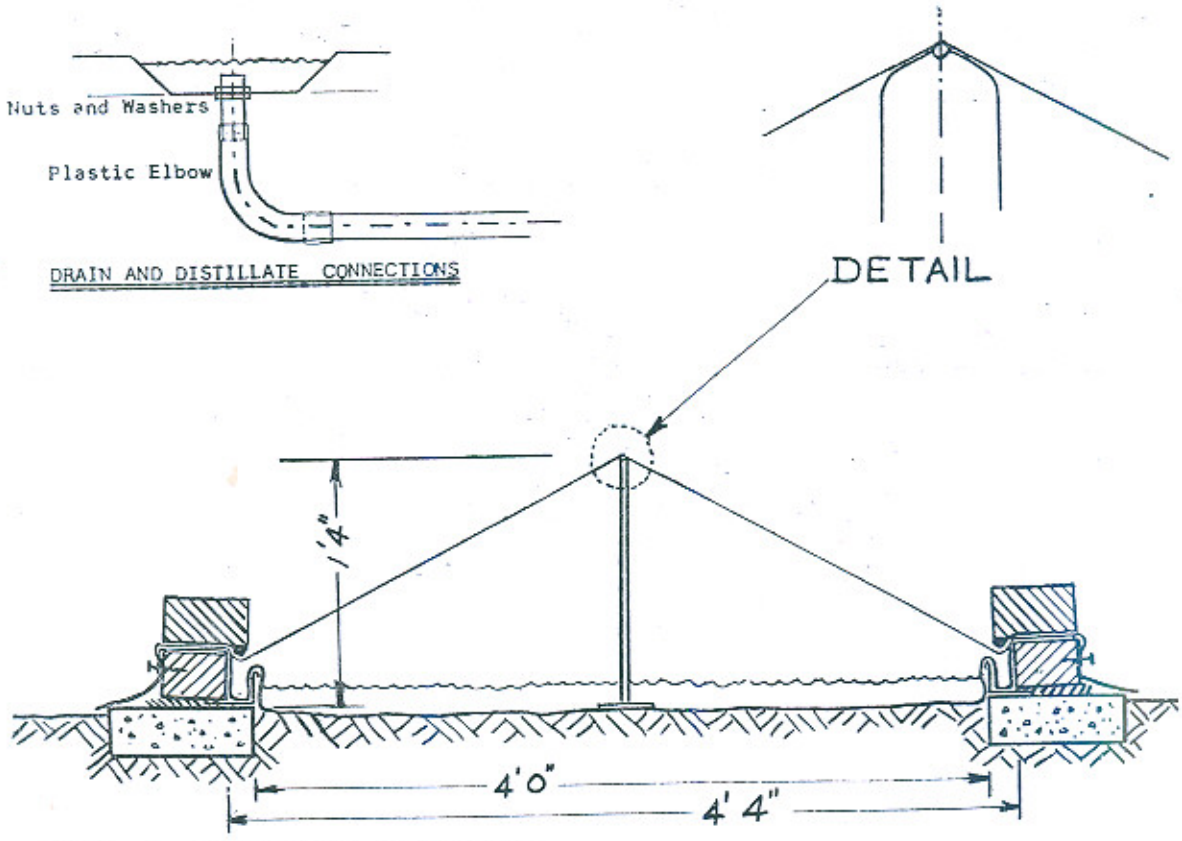

FIG. No. 1. CROSS SECTION OF SOLAR STILL

A bad quality water containing salts is used in the Tray. The water which will be available from the still will be distilled water. It can easily be used even for car batteries. This technique is being adopted in many islands along the Greek Coast and other places where fresh water is not available. Recently in Western Australia, 4500 sq. ft. still have been installed. In an article by J. A. Appleyard on Solar Research in the University of Western Australia published in Sun At Work, a publication of Solar Energy Society in its 4th Quarter 1965, detail of its construction is put forth. The still has been constructed in collaboration with the Division of Mechanical Engineering of C.S.I.R.O., Melbourne. The plant is operating since 1964 and produces an average of 330 gallons of distillate daily during the summer months. It has been found that glass is more efficient than plastic film. The cost of a 400 sq. ft. still has been estimated by McGill University at 480 dollars.

A Solar Water Heater

In the leaflet details of using solar energy for heating water for domestic or agricultural use is explained. The water heater can provide from 30 to 40 gallons of hot water per day at a temperature of 130 to 140°F. The detail of the construction of solar water heater is shown in Fig. 1 in which A is the absorber which receives the sunrays and heats the water. B is the absorber casing which uses absorbers and the installing material. C is the hot

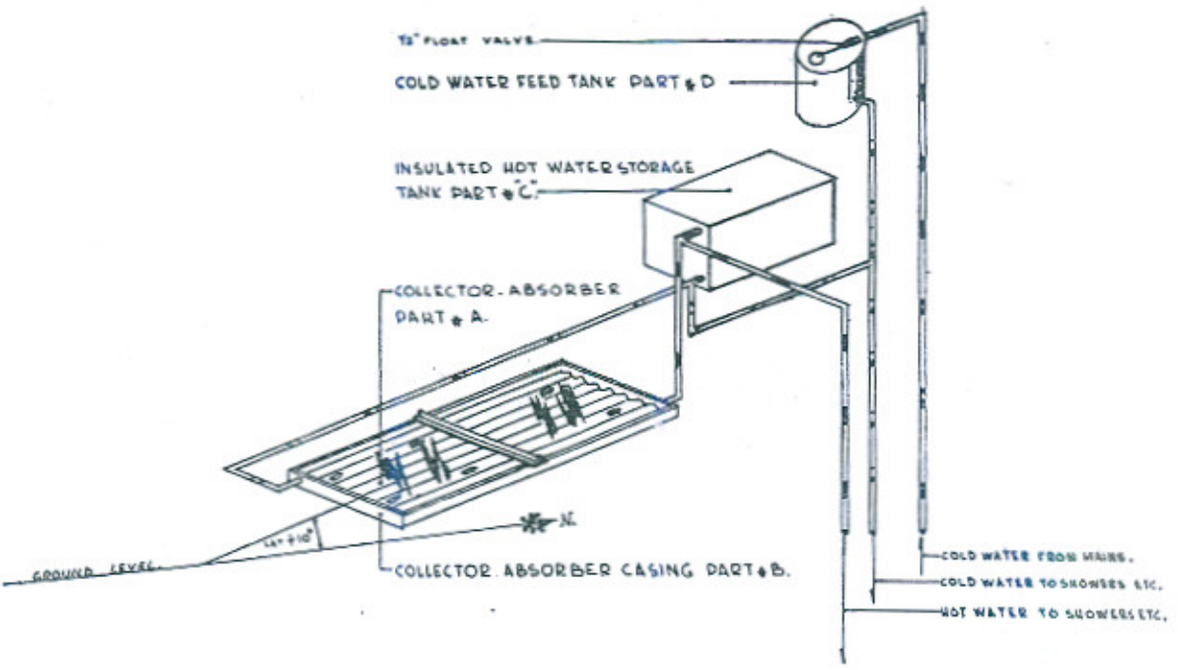

Fig. 1.

water storage drum and D is the cold water feed tank. The actual construction of the heater is shown in Fig. 2. The water storage tank can be made out of old oil drum. The absorber is made of corrugated galvanized Iron Sheet of 22 gauge. The working is explained in Fig. 2. A complete detail of the construction of each component is given in the pamphlet issued by the Organization.

Construction of a Cheap Wind Machine for Pumping water

This pamphlet describes the construction of a Wind Machine Operating at the wind speed range from 8 to 12 miles per hour, and the water level is not more than 10 to

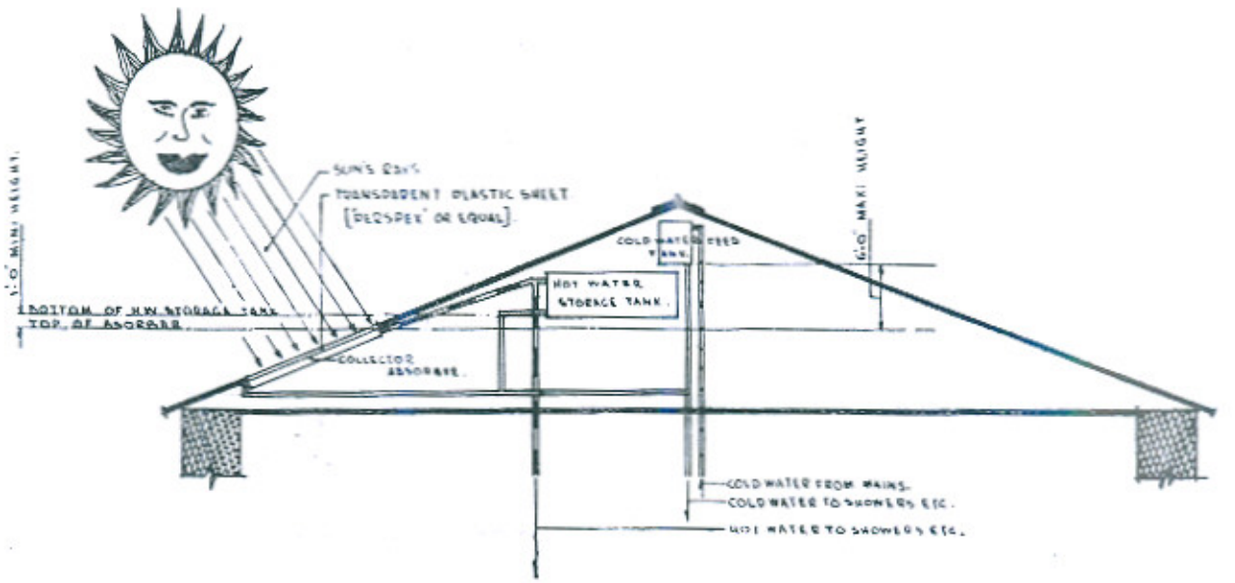

Fig. 2.

15 ft. below ground. It is based upon the design of a Finnish engineer Mr. S. J. Savonius. The whole system consists of a rotor, a drive and the pump. The design of the rotor is explained in Fig. 1. It consists of

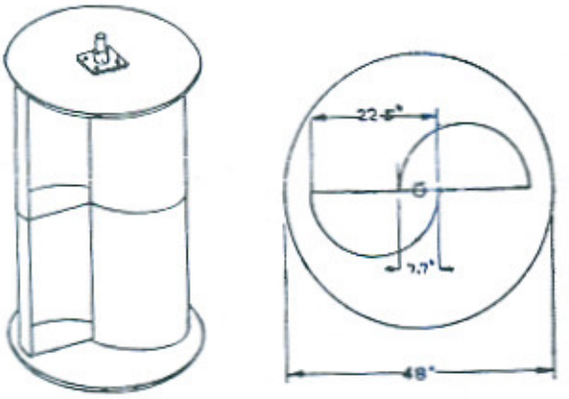

Fig. 1.

two number of 45 gallons oil drums, bisected lengthwise and welded together. These are mounted on plywood. The rotor fitted on a frame is shown in Fig. 2. The power generated by the rotor is communicated by an excentric connected rod to a bell crank. It works the pumping rod which is attached to a pumping set working on the press of a rubber dye - frame. The system of communicating the power by Excentric Drive Assembly is shown in Fig. 2 and the communication of this power to the pumping set is explained in Fig. 10. The cost of such a system has been worked out to be 51

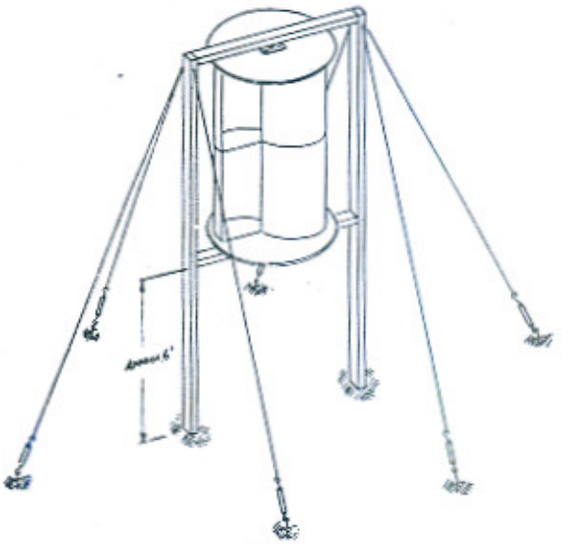

Fig. 2.

U.S. dollars. In the pamphlet detail is given for selecting the diameter and structure of a pump and its output can also be worked out. This type of pumping machine can be made conveniently in areas of West Pakistan where the wind speed during the summer season ranges from 8 to 10 miles per hour.

International Conference held recently—XIth I.A.H.R. Conference

The International Association for Hydraulic Research held its XIth meeting in Leningrad from 7 to 11 September, 1965.

The members of the Congress can obtain free set of Proceedings which are available in six volumes on condition that they pay in advance the cost of forwarding (U.S. $5 by surface mail and U.S. $15 by air). It may be noted that from 1st January 1965 annual subscription of individual member has been raised to U.S. $7.

International Organization for Standardization

International Organization for standardization held its first meeting of its technical committee on 2-4 June, 1965. The subject was Measurement of Liquid Flow in Open Channels. The standards were fixed for the following measurements.

WG1—Measurement of liquid flow in open channels by velocity area methods.

WG2—Measurement of liquid flow in open channels by notches, weirs and flumes.

WG3—Glossary of terms used in connection with the measurement of liquid flow in open channels.

WG4—Measurement of liquid flow in open channels by dilution method.

WG5—Flow measuring instruments and equipment.

WC6—Sediment flow.

Coming Scientific Conference

Twelfth IAHR Congress

Colorado State University has invited IAHR Congress to hold its 12th Session in 1967 in Fort Collins Colorado, U.S.A. The subjects for the technical sessions and the seminars of the Congress are yet to be fixed.

Second Latin-American Congress of Hydraulics

The Regional Committee of I.A.H.R. will hold its Second Latin-American Congress of Hydraulics in Caracas, Venezuela from 11 to 16 July, 1966. The subjects to be discussed will be:—

(*a*) River hydraulics

(*b*) Maritime hydraulics

(*c*) Fundamental hydraulics

(*d*) Hydraulic structures

(*e*) Teaching hydraulics

Symposium on Pumps

A syposium on pumps in power stations will be organized in Germany at Brunswick from September 7-9, 1966. Those interested may contact the Secretary of the I.A.H.R. Symposium, Fachgruppe Energietechnik, Postfach 10250, Dusseldorf 10, Germany.

Conference on Coastal Engineering

The Tenth International Conference on Coastal Engineering is to be held in Tokyo from 7-10 September, 1966. Further information may be had from Secretary Coastal Engineering Research Council care of American Society of Civil Engineers.

Sixth Congress on Irrigation and Drainage

The sixth Congress on the subject noted above will be held in New Delhi, 4—14 January, 1966. The four questions will be discussed. Question No. 19, Reclamation of saline lands under irrigation, will be dealt by Sayyid Hamid of Pakistan as a General Reporter.

World Power Conference; 15th Sectional Meeting

The Japanese National Committees of the World Power Conference will hold 15th Sectional Meeting of the Conference in Tokyo, October 16—20, 1966. Communications and enquiries concerning the Tokyo Conference may be addressed to Japanese National Committee, World Power Conference, c/o Japan Power Association, Daido Building, 1-46, Shiba Minamisakuma-cho, Mina-to-ku, Tokyo, Japan.

A New Book on Hyderaulic Research

A new book of 11 chapters dealing excessively with hydraulic research has been produced in Czech language. It discusses all aspects of hydraulic research. At the end of the book there are Russian and English summaries. The authors, J. CABELIKA and P. NOVAK proposed to publish 2 more volumes on the subject. The second volume will give results of measurement on prototype and the third will deal with the investigation of hydraulic problems with the aid of analogies and differential with particular reference to research on movement of water in permeable soil.

Science and Industry

The third volume of *Science and Industry* Journal No. 4 1965 has issued three articles of interest to the engineers. Khwaja Azeemuddin has discussed the Gumti River and its Problems. This article is produced in *Engineering News* as well.

P. Simons and W. J. Armstrong has given a New Method of Soil Stabilisation.

The Feasibility of Sewage Disposal in West Pakistan by Sewage Stabilisation Lagoons is discussed by Mr. Mohammad Nawaz Tariq.

Institute of Engineers, Pakistan, held its 12th Convention at Lahore. The Institute is holding its 12th Convention in Lahore in the month of March 1966. This will be the first Convention being held in this city of West Pakistan. It will be occasion for a meeting of East and West Pakistan Engineers. There will be thirteen papers on different subjects which will be discussed.

It is hoped that the President of Pakistan will honour the convention and will lay the Foundation stone of the Institute Building at Lahore. The site for the Centre has been selected in Gulberg III close to the American Mission Hospital.

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Book Reviews and New Books

The development of Groundwater resources with special reference to deltaic areas

New York, United Nations, 1963, 244 p., $3.00. (Water resources series No. 24.)

This is based upon the Symposium held in Bangkok from 24 April to 8 May, 1962. It was organized by ECAFE and Unesco.

* * *

The design of open water courses

Wageningen (Netherlands), International Institute for Land Reclamation and Improvement, P.O. Box 45, 1964, 80 p. (Bulletin No. 7).

A code of practice for the design of open watercourses and ancillary structures.

* * *

Annotated bibliography on reclamation and improvement of saline and alkali soils (1957-1964)

Compiled by L. F. Abell and W. J. Gelderman. Wageningen (Netherlands), International Institute for Land Reclamation and Improvement, P.O. Box 45, 1964, 59 p., $3.00 (Bibliography No. 4).

A reference book for practical method of reclamation.

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Advances in hydroscience

Edited by Ven Te Chow, Vol. I. New York and London, Academic Press, 1964, 442 pp.

* * *

Le Sahara; geologie, resources minerals

By RAYMOND FURON. 2nd ed. Paris, Payot, 106 boulevard Saint-Germain, 1964, 316 pp., 30 fig., 30 F. (Biblioteque Scientifique Series).

* * *

Program for advancing desalting technology,

Washington, D.C. Department of the Interior, 1964, 35 pp.

* * *

World prospects for natural resources: some projections of demand and indicators of supply to the year 2000

By JOSEPH L. FISHER and NEAL POTTER. Baltimore, Md. (U.S.A.). The Johns Hopkins Press, 1964, 80 p., $1.50.

* * *

Geochronology in Canada (ed. F. Fitz Osborne)

Royal Society of Canada Special Publication No. 8, University of Toronto Press, 1964. Published in the U.K. by Oxford University Press, 156 pp. 48*s*.

This is a book of Geology. It will interest Geologist. The book is excellently produced and well illustrated.

* * *

The World Register of Dams (4 volumes)

Published by the International Commission on Large Dams of the World Power Conference, 11, rue de Teheran, Paris 8 eme. Price $40, including postage (obtainable through National Committees of I.C.O.L.D.)

The World Register of Dams has been prepared by a sub-committee of the International Commission on Large Dams under the chairmanship of Mr. J. Guthrie Brown. It contains tabulated details of some 10,000 dams either completed by the end of 1962 or currently under construction in the 48 countries that were members of I.C.O.L.D.

NEWS & NOTES

Potassium Permanganate Capsule Method for Rapid Estimation of Cement in Mortar and Concrete

M/s. G. F. Zafar, Irshad Ahmad and Mohd Shafique of the Irrigation Research Institute, have put forth an improved chemical technique to determine the contents of cement in a set specimen of mortar or concrete. There are several methods, both physical and chemical which have been used for the estimation of cement content in a mortar. The important ones are the Conductometric Method, Adsorption Method, Rebound Method and the Chemical Analysis Method. The method described in the paper is an improvement on the Potassium Permanganate technique. The calcium oxide content of cement is assumed equal to 63%. Its chemical equivalence of potassium permanganate is 71.7 gms. Thus 1.0% of cement will contain 0.0063 gm. of calcium oxide equivalent to 0.0071 gm. of potassium permanganate. Several glass capsules are filled with potassium permanganate corresponding to different known percentages of cement content.

The procedure to estimate the cement content followed is that 1 gm. of finely powdered sample is treated with 10 to 15 ml. of HCl for about 5 minutes. The solution is filtered and washed. The filtrate is treated with ammonium hydroxide. The precipitate of Alloxide and Ferricoxide are formed. The solution is filtered again. To the filtrate a saturated solution of Ammonium Oxalate is added. The precipitate is filtered and washed. It is then dissolved in sulphuric acid. To this solution capsules containing known percentage of potassium permanganate are added and the solution is shaken. The addition of capsules is stopped when the pink colour appears. Only 0.0010 gm. pot. permanganate is sufficient to impart a distinct pink colour to 200 ml. of water. The percentage of cement is estimated by counting the number of capsules of potassium permanganate added. It was found that this method gave fairly accurate result with the economical use of the solution.

International hydrological decade: The Co-ordinating Council holds first meeting

From May 24 to June 3, 1965 the first session of co-ordinating council of the decades was held in Paris with 21 members of the council present. This included Pakistan also. A review of the progress of the Inter-govermental meetings of experts was held. Seventy-eight member states had formed National Committee. The Council examined the project presented by

the member States. The World Hydrological Organization and the International Association of Scientific Hydrology had planned a symposium on the design of hydrological net works. It was held in Quebec City, Canada from 15—22 June, 1965. It was decided that the next council meeting would discuss the implications of the symposium. The Council also discussed Research Projects relating to hydrological cycle and the world water balance ; regimes of surface and groundwater; problems of floods and evaluation of flood characteristics; stream channel; erosion and sediment transport; influence of human activity on hydrological regimes and tropical research on specific aspects of hydrology. The council approved nearly 40 Research Projects within this context. Other subjects discussed by the council on which decisions were taken related to the exchange of information, training of Hydrologists and Regional cooperation.

First International Symposium on Ecosystems

A symposium, first of its kind, was held in Copenhagen with the cooperation of the Unesco and Danish National Commission. More than 120 specialists from twenty-eight countries attended the symposium. A large number of papers were presented on this special subject by experts on micrometeorology, plant physiology and soil science. They discussed subjects like formation and production of photosynthesis in plants organism, estimation of respiration of trees, effects of carbon dioxide on productivity and many other similar subjects. The proceedings will be published by Unesco in its Natural Resources Research Series.

The need for international Co-operation in Soil Science, by V. A. Kovda

The joint F.A.O./Unesco project for the publication of a soil map of the world was discussed at the Eighth International Congress of Soil Science held in Bucharest from 31 August to 9 September 1964. Two sessions were devoted to the project. At the first session the General Assembly heard an account of the project, its history, recent progress and some of the technical results achieved. During the second session, which was held within the framework of Commission V, the draft soil maps of the different continents were presented and the document on "Preliminary definitions legend and correlation table for the soil map of the world was discussed. The results of the project were favourably received by the Congress. Both the General Assembly and Commission V passed resolutions commending the work which had been carried out and urged its continuation toward a successful completion.

Professors Kovda who is well known in this country for his contributions to the problem of waterlogging and salinity, delivered a detailed address at this meeting. Professor Kovda in his address gave the history of the project, its need and the present method of work with regard to the preparation of a soil map of the world. The International Organization is helping in the preparation of the soil map and has put forth standards with regards to the choice of scale; methods of work; coordination at the regional and continental level; preparation of International museum of soil standards and nomenclature. Soil legend for the world soil may have been distributed. A summary of the up to date progress of the project is also contained in the address of Dr. Kovda.

Mounting Plate Glass in Sides of FIumes and Tanks

By
ELTON F. DALY*

A common problem is that of Mounting Glass Plates in the wall's of flumes and tanks and sealing them to prevent leakage. In this article some details are given to effectively install glass plate on the sides of the flumes. This method has been developed in the Hydraulic Laboratory of the California Institute of the Technology. The details of the method to mount the glass plate is given in this article.

The vertical section through a lower edge of the flume in Fig. 1 shows the method of mounting and scaling the glass. The Z-shaped support permits the glass to extend below the bottom plate of the flume, so that the seal does not block the line of the sight at the bottom of the flume. The rigid structure shown is important to the success of this method of mounting the glass. It minimizes deflections and movement between the glass and the structure, thus reducing stresses in the glass and movement in the seals.

First phase-mounting

The glass is first set in place on a piece of neoprene strip lying in the bottom of the Z-shape formed from 3/16 in steel plate, which has been welded to the standard rolled structural channel.

The neoprene strip serves to support the glass by a fairly uniform pressure and avoids overstressing it. The glass panel is then positioned in the channel by using small wooden wedges inserted on each side at the bottom and by wedging on the outside and clamping at the top. By the use of wedges the glass panel can be positioned to any degree of accuracy required.

In this flume, the panels were set with the aid of a piano wire stretched from one end of the structure to the other. When the glass was finally positioned, spaces were left between the glass and the steel structure. Experience indicates that these spaces should be not less than 3/16 inches or even ¼ inches in width. In the present case the spaces were only 1/8 inches wide and were found to be too narrow. Because such a small width was allowed, it was necessary to align the steel structure of the flume much more precisely than would otherwise have been necessary, thus adding to the cost without improving the end result.

The space on the outside or dry side of the glass is filled with body putty, a

*Laboratory and Shop Supervisor, W. M. Keck, Laboratory of Hydraulics and Water Resources, California Institute of Technology, Pasadena, Calif. (Reproduced from Civil Enginering, DSCE ; June 1965, p. 74).

material commonly used in the repair of automobile bodies and which is available from many different manufacturers. It can best be described as a two part system composed of a Putty like material that remains soft and pliable until the second part, or catalyst, is added. This causes the putty to polymerize and become hard with very good adhesion. The amount of time to work the material, or the "pot life" after the two parts have been mixed, varies from 20 min to over an hour, depending on temperature and the amount of catalyst used. This is a convenient material because it can be applied easily with an ordinary putty knife.

Since this material has very good adhesion, the glass should be waxed where it comes in contact with the putty to reduce adhesion and facilitate removal of the glass panel when necessary. Any good paste wax of the kind normally used to polish automobiles will do. Care should be taken not to get wax on any surface except that which is to be in contact with the putty.

The glass is thus fully supported laterally by the body putty on the outside and by wood wedges and clamps on the inside. This completes the first phase of the mounting procedure.

Second phase-sealing

The second phase, or sealing operation, is done in the space on the inside or wet side of the glass panel. The depth of the inner and outer spaces can vary but in this case a depth of $1\frac{1}{4}$ inch was used. This was a good depth for supporting the outside but deeper than needed to make a good seal. To reduce the amount of sealant needed, the lower part of the space was filled with a polyethylene rope material to within 3/8 inch of the finished flume floor or bottom, as shown in Fig. 1. This rope was 3/8 inch square and was squeezed into the inner space with a thick-bladed putty knife so as to provide base for the sealant.

The sealant used is a silicone-rubber material available at most industrial paint

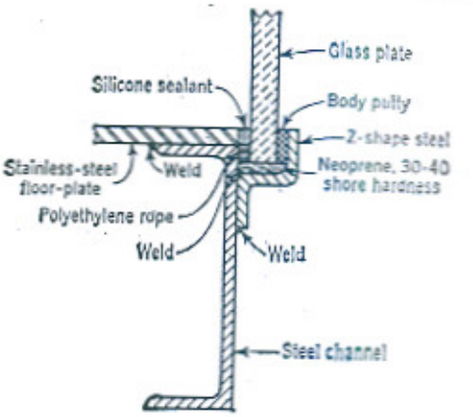


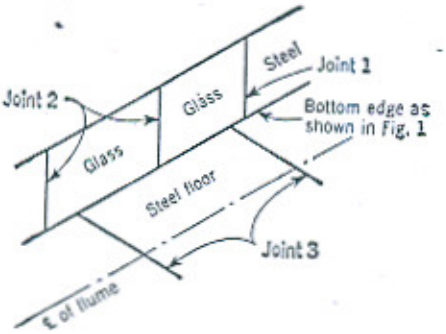
FIG. 1. Joint between glass and steel at lower edge of flume at California Institute of Technology.

supply houses and is used commonly to seal steel sash. It comes in polyethylene throw-away containers to fit ordinary hand-calking guns or it can be applied by power (air) operated guns. When it comes out of the tube it is similar to toothpaste in appearance. It air cures in several hours and is completely cured in 24 hours.

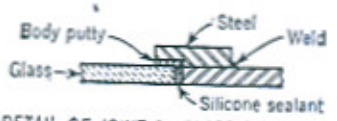
On some surfaces this sealant requires a primer to insure good adhesion. The primer is easily applied with a brush as it has the clearness of water and the same consistency. In the present flume it was necessary for the surface of the seal to be smooth and flush with the steel bottom. To achieve this a strip of masking tape was put on both sides of the area to be sealed and a putty knife was drawn along the joint to remove all excess sealant, thus leaving a smooth flat surface. The masking tape was removed while the sealant was still soft. Care should be used in putting

it away from the joint so as not to roughen the surface. Since the silicone sealant shrinks slightly when it sets, a slight excess of material must be added if an absolutely flat surface is required.

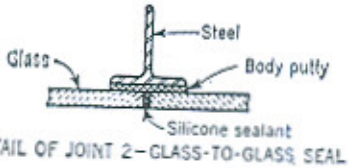
Other joints used on the flume are shown in Fig. 2 (a). A vertical joint, glass to steel, is made as shown in Fig. 2 (b). A joint of glass to glass is made by having a section of steel T or I-shape supporting both ends of the glass panels, Fig. 2 (c). In both these joints the body putty is used to fill the outer space and the sealing is again done from the inside with the silicone sealant. The ends of the panels are spaced approximately $\frac{1}{4}$ inches apart, leaving a space for the seal that will be $\frac{1}{4}$ inches wide and equal in depth to the thickness of the glass panels. A steel-to-steel but joint is also easily made as shown in Fig. 2 (d). This joint was made with the sealant in preference to but welding in order to avoid the distortion of the bottom resulting from welding.



(a) TYPICAL FLOOR AND WALL JOINTS OF FLUME



(b) DETAIL OF JOINT 1—GLASS-TO-STEEL SEAL



(c) DETAIL OF JOINT 2—GLASS-TO-GLASS SEAL

(d) DETAIL OF JOINT 3—STEEL-TO-STEEL SEAL

FIG. 2. Joint details for mounting glass plates in walls of flumes and tanks.

Principles summarized

The principles of making successful seals on glass windows may be summarized as follows :—

Glass should not be in contact with steel, and the mounting compounds should be flexible enough to allow a slight deflection of the steel structure without overstressing the glass.

Two different kinds of material are required ; one for structural support (on the outisde), and one for sealing (on the inside).

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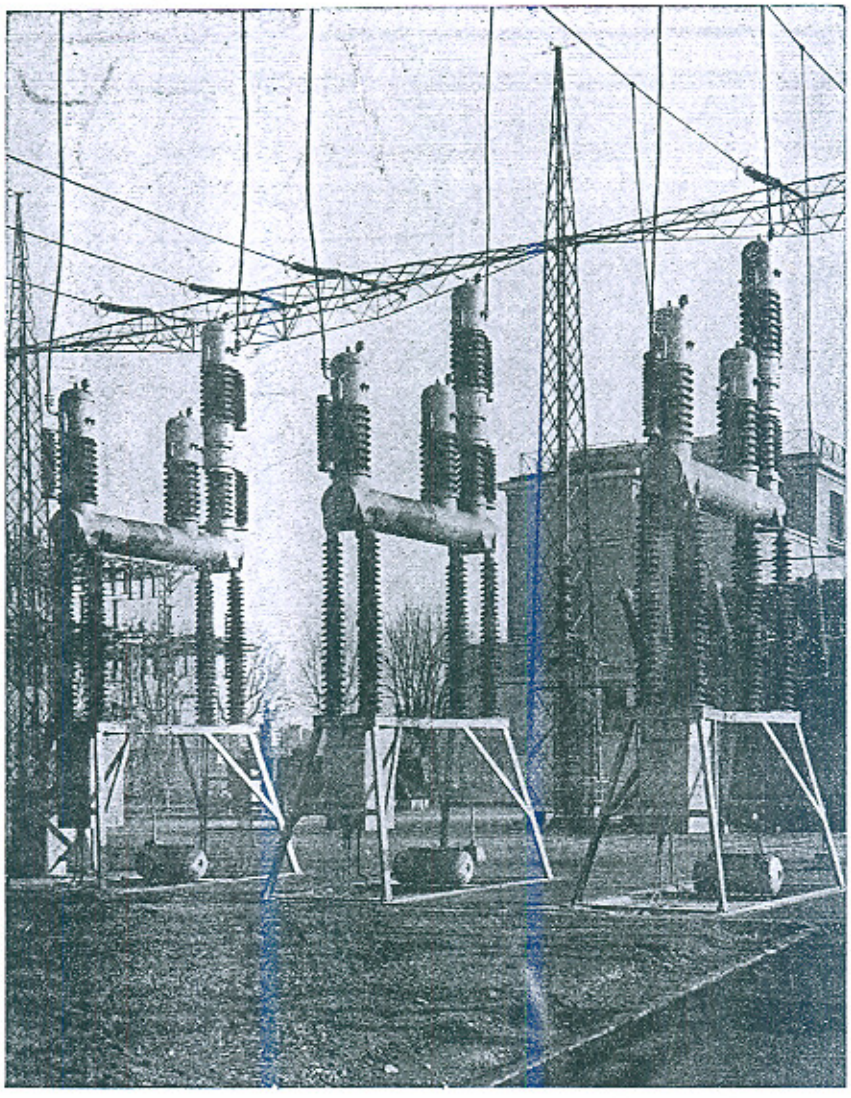

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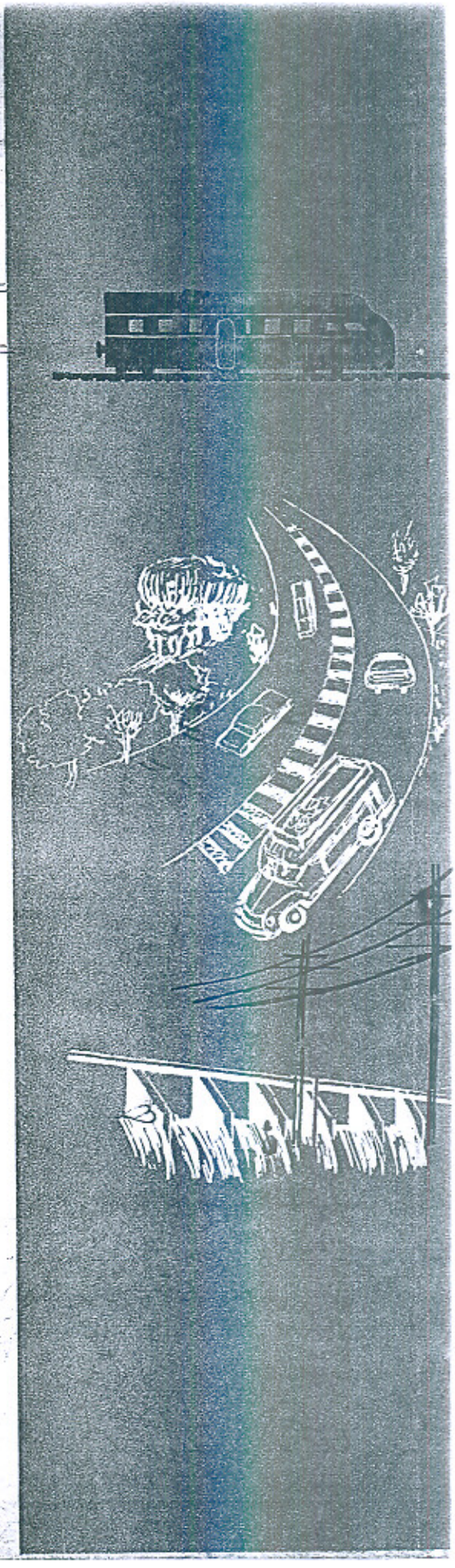

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