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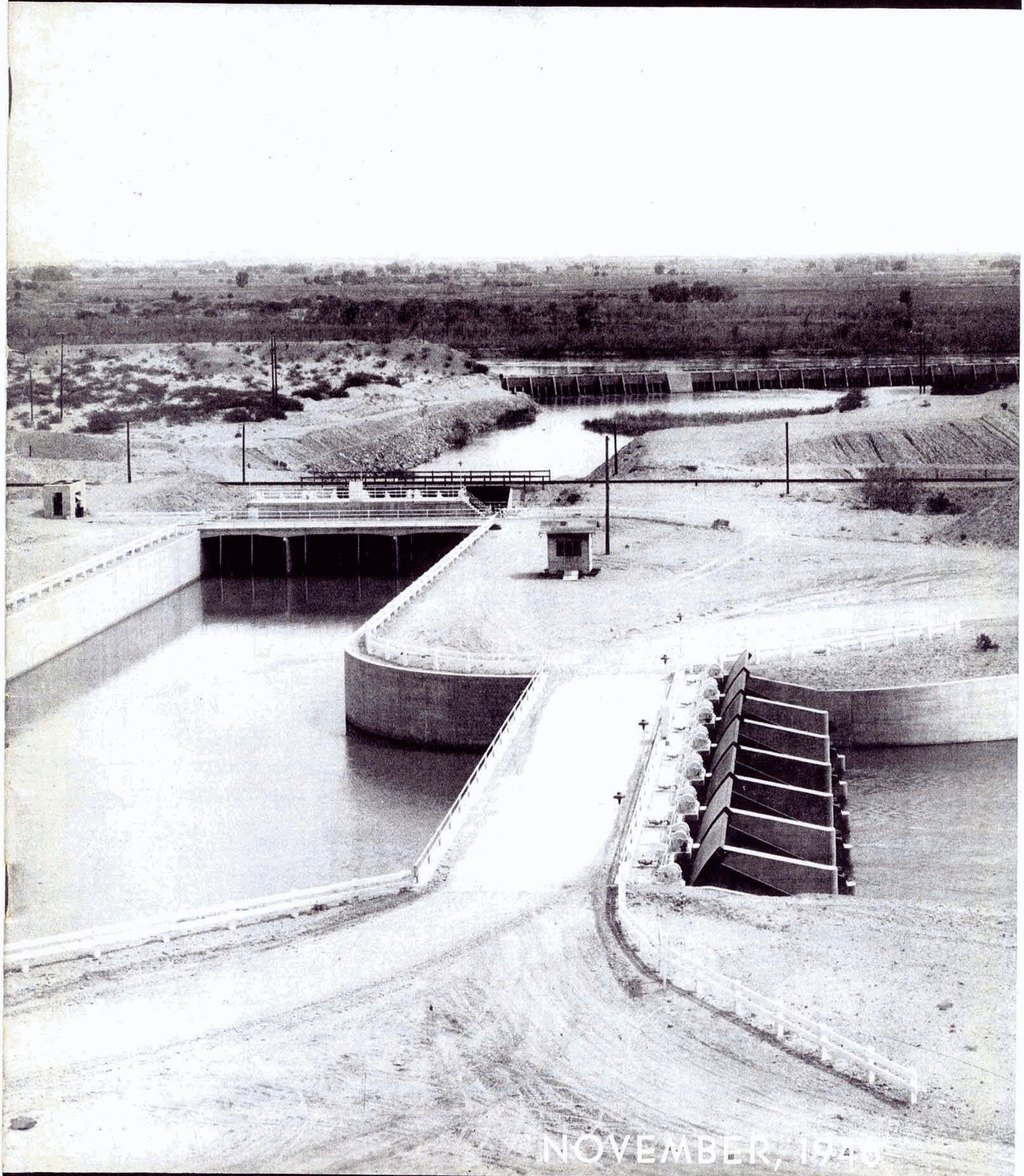

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COVER CAPTION:

Pilot Knob check and wasteway with Rockwood Heading in the background. This will eventually become the site of a power drop. A plant of 33,000 kilowatt capacity will be installed in the 55 foot drop.

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Monthly

The Truth Shall Make You Free

CONTENTS FOR NOVEMBER, 1946

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Imperial Valley Looks to the Future

By MUNSON W. DOWD

TODAY the world is food-conscious. As the population increases, the farming areas, their fertility, and their crops become more important. For the next few years, or perhaps longer, the United States is destined to play a large part in the feeding of the world. Its ability to do this will depend upon the development of many rich farming areas throughout the country. It is no exaggeration to say that the Imperial Valley of California is one of the most important of these, and since it is being further developed, the present article will show it will continue to play a larger part in the farming industry. This part will include not only the actual growing of crops, but the setting of an example for others in the solution of its complex problems and in its ultimate success.

CROPS

The Imperial Irrigation District which delivers water to more than 400,000 acres of normally farmed land in Imperial County, California, is the largest in the United States. The actual gross acreage under canals is 612,000 acres, with an additional 250,000 acres of land assigned for future development on the East and West Mesas. Irrigation of this quarter of a million acres will be possible because of the All-American Canal, which will be discussed later. Agriculture is the dominant industry in the Imperial Valley, with manufactures chiefly related to the processing and packaging of farm products. The chief advantage of the area, in addition to its abundant water supply from the Colorado River and its rich soil, is the warm climate which causes crops to develop early, permitting entry of the markets before competition. To take full advantage of this opportunity, the Valley has specialized in the raising of winter vegetables, early cantaloupes, tomatoes, and many other truck and field crops. Since only a minor portion of the land is in permanent crops, the agriculture is very flexible and able to follow any favorable marketing trends. In general, also, agriculture is highly commercialized and conducted on a large scale. The 1940 census showed that 30 per cent of the acreage was in farms of 1,000 acres or more, while only 16 per cent included farms of less than 100 acres. A regular pattern of crop rotation is followed, with alfalfa almost universally used to restore the productivity of the soil after the growing of truck, flax, and grains. The most successful general practice is to use the best land for truck crops about three years out of six or seven.

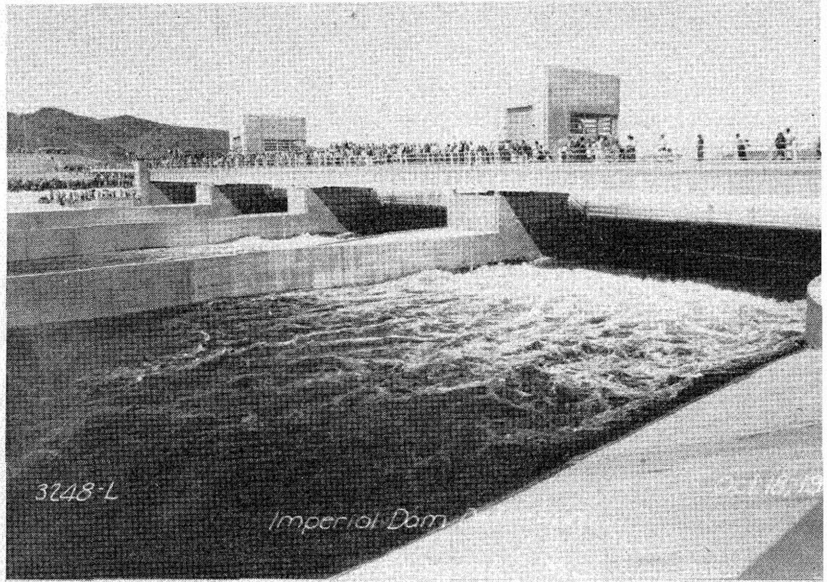
The crop values, including livestock, shipped out of the Valley varied from 41 million dollars in 1938 to a low of 19 million dollars in 1932 to a high of 64 million dollars in 1945, with the following general breakdown in 1945:

Crop	Value dollars (millions)	Crop	Value dollars (millions)
Cantaloupes and Honey Dews	7.5	Flax	4.5
Lettuce	9.2	Alfalfa	11.8
Peas	0.7	Sugar Beets	2.1
Carrots & Cabbage	6.0	Cattle, Sheep & Hogs	9.4
Tomatoes	1.4	Dairy Products	1.0

Plate 1. Rice field west of Imperial.

Plate 2. Imperial Dam dedication October 18, 1938. There is usually water flowing in all channels as it is here. The people on the dam are reflected on the roller gates.

Plate 3. Completed section of New Briar Canal from drop 5. This is a typical canal section.



Thus there is reason for the contention that the Imperial Valley can be reckoned a major factor in our food production. It grows roughly 25 cents of every hundred dollar's worth of crops raised in the United States.

Although a large portion of the products of the Imperial Valley is shipped to all parts of the United States by rail, a considerable amount is sold to the constantly growing markets of San Diego and Los Angeles. This proximity to major markets is also a very important factor in the success of the Valley.

LOCATION AND PHYSICAL CHARACTERISTICS

A prerequisite to the understanding of the Imperial Valley, its problems and their solution, is the realization of its location, physical characteristics, and attributes. The area that is now known as the Imperial Valley lies in the Southeastern corner of California, on the floor of what was once in the geologic past an arm of the Gulf of Lower California. About half of the Imperial Valley area, known as Mexicali Valley, is situated in Mexico. In past ages the Colorado river, in the process of building its delta as it flowed into the gulf, dammed off the upper end, which, when the water evaporated, became a deep inland valley, for the most part below sea level. From time to time the Colorado would overflow its banks and fill up this dry lake, forming a large inland body of water. Eventually, however, the water would disappear and leave the bed an open desert. It is estimated that the last of these lakes disappeared about 700 years ago. During these inundations, the Valley was packed to a great depth with fine silt laid down almost level but with a gentle slope to the north. These rich alluvial deposits, representing the top soil from about one-thirteenth of the United States, plus some coarser textured wind-transported material, constitute the present soils of the Imperial Valley.

Thus Nature set the stage in the Imperial Valley for great things; climate, fertile level land, and a convenient source of water was provided. Man had only to see the possibilities and develop them. Nature had, however, disguised her gifts. Before irrigation the Imperial Valley was an extremely dry, hot desert, very difficult to cross, with water holes few and far between.

HISTORY

When the Spanish explorers in the middle of the sixteenth century became the first white men to gaze upon the Imperial Valley and Colorado River, they dreamed not of the possibility of agricultural development but only of the fabled gold which lay to the north across its hot sands and along the banks of the Colorado in the legendary "Seven Cities of Cibola." A century and a half later when De Anza and Father Junipero Serra trudged wearily across the wasteland upon which grew only cactus and lizards, it was not their promised land but a necessary evil in the journey between Mexico and the Missions of California. In the days of the 49'ers, the Imperial Valley, then known as the Colorado Desert, lay on the trail from Fort Yuma to San Diego. The wagon trains did not tarry on that hot trail unless absolutely necessary. Many broken wagons and charred bones bear mute testimony that not all who started from Yuma reached their destination. These men filled with the gold fever, as were the early Spaniards, failed to note the richness of the soil, the flat and for the most part, cleared land, and the gradual slope from the Colorado River which made the desert ideal for something more substantial than the smoke dreams of gold. All men apparently were asleep to the facts which lay before their eyes; that is, all except one, Dr. O. M. Wozencraft, who is considered to be the real "father" of Imperial Valley. He alone did not curse the sand and the heat and the lack of water, as in him was born the idea of converting the desert by irrigation. Although Dr. Wozencraft dreamed of great things and saw the tremendous possibilities, his endeavors were drowned by the Civil War.

After Wozencraft's death in 1887, it was only a

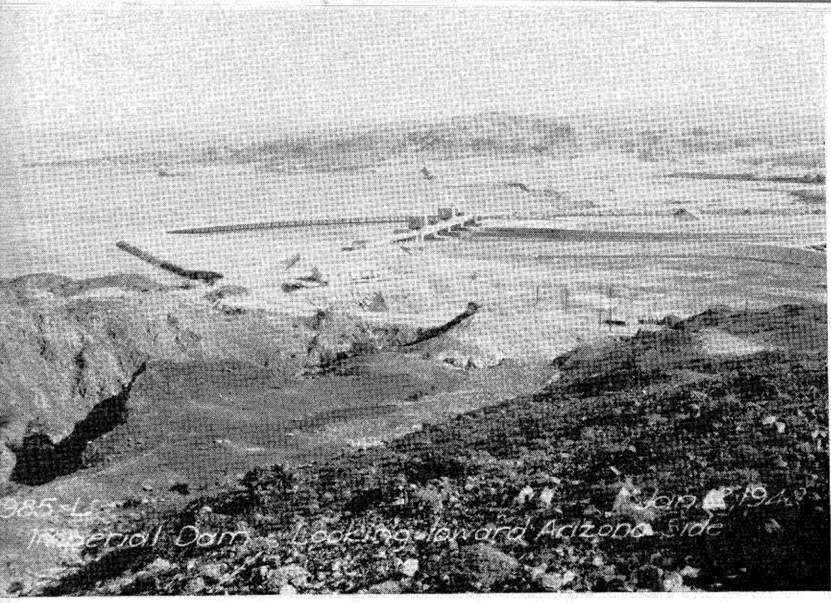


Plate 4. Imperial Dam, looking toward the Arizona side. Rockwood Heading is to the far right.

matter of a few years before a civil engineer, C. R. Rockwood, stumbled upon the fact that the large area could be irrigated from the Colorado River and with a visionary's enthusiasm began the battle to get water into the Colorado Desert. He conducted careful surveys in 1892-1893, in which he ran lines from a proposed headgate near Yuma, Arizona, down some old Colorado River overflow channels and into the Salton Sink in the vicinity of the station of Flowing Well on the Southern Pacific Railroad. He discovered that the canal would have to go through Mexico, since in the United States there was a natural barrier of high lands and sand hills between the river and the basin. Furthermore, the series of passages around the high lands which had been formed by the Colorado River through the centuries on its way to the Salton Sink provided a natural and economical diversion canal. When he attempted to obtain a right-of-way across the lands of Mexico for the canal, however, the trouble was started with that country which was to last for 30 years. To make possible the irrigation of the desert, the "California Development Company" was formed in 1896, with little capital but a wealth of hope. Rights were finally obtained from Mexico for the canal through its territory, and after a bitter financial struggle, water from the Colorado River was first delivered into the Imperial Valley in 1901.

This was not the end of the story, however; it was just the beginning. Many hardships and trials were to be endured before the Colorado River would be conquered and a measure of security attained for the people of the Imperial Valley. For the first few years after 1901, there were problems for the farmers in getting their land under cultivation and learning what crops would grow the best. They found that almost anything they tried was a success, since the soil was fertile and warm winters made for a long growing season. Through their efforts the cultivated area continued to increase until in the winter of 1903-1904 it had reached considerable proportions. So much so, that in this winter there was a serious water shortage when the riven went down and the headgate would not divert a requisite quantity of water. The cause of the lack of diversion capacity was the deposition of silt in the headgate and upper mile of the main canal. This was the Valley's first experience with the silt which in the following years would become a constantly increasing menace. Since the California Development Company had not necessary equipment to remove the silt, a plan was decided upon whereby the Colorado itself was to carry the silt from the main canal. About 15 miles down the canal, in Mexico, was a shallow lake into which the Colorado periodically overflowed. A waste gate was installed in the canal at an advantageous point on the shore of this lake. During the flood season, an extra-large quantity of water was to be diverted from the river and the excess subsequently wasted at this point. According to the theory, this large volume of water would sluice the silt deposit out of the upper channel, lowering it in preparation for the next drought season. The plan was carried out and the flood diverted through the headgate.

Although the large flow seemed at first to be behaving as planned, the benefits were only temporary, for, as the flow decreased, it became evident (in the summer of 1904) that the canal grade for the upper four miles had been raised to such an extent that no diversion could be made at even moderately low water. Although dredging equipment available was not sufficient to remove the deposit from the upper canal channel, it was capable of doing a smaller job. With the need for water becoming more urgent day by day as the river fell, the decision was reached, after much discussion, to make a new cut from the Colorado into the main canal at a point below the silt deposit at which only 3300 feet of easily removable river deposits separated the two channels. This new cut had to be made in Mexico, and thus the consent of the Mexican Government was necessary. However, since there was little time for waiting, the California Development Company, believing that an understanding had been reached, proceeded to make the cut and to send elaborate plans for a controlling gate to Mexico City. Since permission of the Mexican government was also necessary prior to the construction of any controlling structure, every effort was made to obtain early approval. Meanwhile, the Colorado took advantage of the unprotected channel.

With the new diversion in operation during the summer and winter of 1904-1905, there was ample water for irrigation of corps. However, as the winter waned, the wiser heads began to wonder what would happen when a flood came through the open cut. About that time, February, 1905, a series of unusually early floods arising in Gila River, a tributary, marked the Colorado's first efforts in a two-year battle which almost wrote a finis to the Imperial Valley and the high hopes of the inhabitants. Contrary to all precedent, three floods came down the river during the months of February and early March, 1905. The cut widened until a veritable torrent was being diverted from the river into the main canal. Since this tremendous inflow of water was far more than was required for irrigation purposes, the excess ran into the Salton Sink, which was originally dry, and began to fill it, forming what is now known as the Salton Sea. With haste born of necessity, a series of fruitless afforts was made to close the cut, which, in spite of all endeavors, grew larger. Through the summer of 1905 and the following winter and the summer of 1906 the gap widened until the entire flow of the Colorado was all but submerging the Imperial Valley. It was not until the following February, 1907, that the break was finally closed, after six expensive failures. The successful closure was made largely through the efforts and at the expense of the Southern Pacific Railroad. This company was vitally interested in the fate of the Imperial Valley because of the revenues it derived therefrom, and also because its tracks paralleling the Salton Sea were continually being flooded and had to be moved farther back as the water level rose.

IRRIGATION PROBLEMS

From the beginning, the Imperial Valley has had a multitude of irrigation problems to face, some of which have threatened the very life of the Valley itself, as did the flood which has already been discussed. Since the Imperial Irrigation District came into existence in 1911, it has attacked and solved most of the problems completely. Although it has achieved only a partial solution for the remainder, the future promises complete success. The following is a summary of the principal engineering problems which confronted the Imperial Irrigation District when it was formed:

1. Danger of flood from the Colorado.
2. Inadequate water supply in drought years.
3. High silt content in the water, which made necsary continual dredging of canals and raising of the levee from the intake to the Gulf of California.
4. Dependence on water supply which flowed through Mexico.
5. Alkali accumulation in the soil and high ground water table caused by lack of drainage.

Since the first four problems have been very nearly solved, they will be discussed first, along with their methods of solution.

As was mentioned in the brief history of the Valley, a drought followed by a flood was the cause of the first serious trouble other than that of a financial nature which the residents of the area encountered. Although the Colorado is one of the major rivers of the United States, draining about one-thirteenth of the land area, its flow is very unpredictable. The discharge at Yuma, Arizona, has varied from 200,000 cubic feet per second to a low of about 1,000 cubic feet per second. During the maximum flow the levees were hard put to keep the flood out of the Valley, and in drought times there was not enough water in the river to maintain livestock. Thus it was necessary in the past to keep constant watch along the river levees from the intake to the Gulf, maintaining a rock train and crew in preparation for a flash flood which could break through. The problem was further complicated by the fact that silt in the river continuously built up the channel grade at the lower end near the delta. To offset this action, levees had to be raised from time to time, at great expense. Equally as troublesome as the flood danger was periodic lack of water, which was made more critical by the agreement existing with Mexico in exchange for the right to deliver water to the Imperial Valley through that country. The Mexican lands were entitled to half of the available water, although the irrigated acreage was much smaller than that on the United States' side. In addition, the Imperial Irrigation District had to provide levee protection and irrigation facilities for the Mexican lands without cost. Thus, Mexico received half of the available water and paid only the cost of distributing it to the lands. In view of these international complications, the need for a main canal entirely in the United States was very apparent.

The Colorado River, in addition to being one of the chief rivers of the United States, is also one of the largest in volume of silt carried. It has been estimated that prior to the completion of Boulder Dam the Colorado deposited 137,000 acre feet of silt per year onto its delta at the head of the Gulf of Lower California. This silt continued to build up the delta and raise it higher and higher above the floor of the Imperial Valley. In addition, it deposited in the canals, so that the Irrigation District had to employ dredgers constantly for cleaning operations. The canal banks continued to grow in height, and as they did, the maintenance cost increased steadily. The burden of silt carried by the river was not only expensive in forcing the erection of the elaborate levee system in Mexico and in canal maintence, but also tended to seal the land, preventing proper penetration of water. Actual measurements of the amount

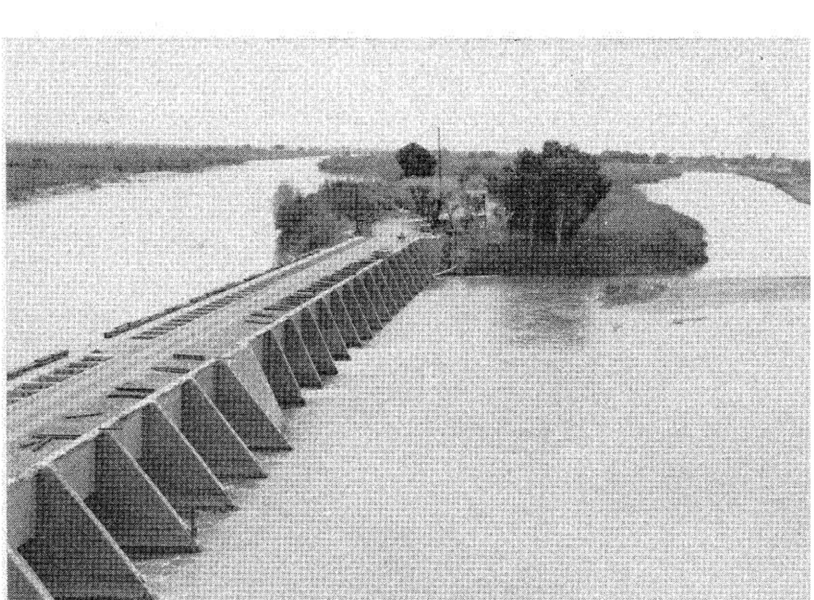


Plate 5. Rockwood Heading, showing the Colorado River to the left and the Alamo Canal to the right. Water is diverted to irrigated lands in Mexico. Formerly all Imperial Valley irrigation water passed through here.

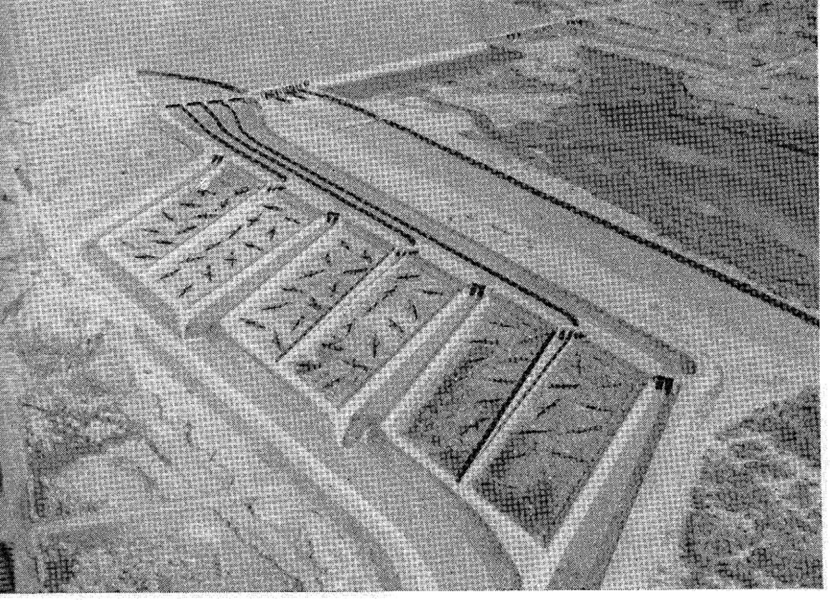


Plate 6. Imperial Dam and desilting works. The scrapers rotate constantly at a very low speed. The basins, usually full, are empty in this picture.

of silt carried in the canals indicated that the maximum reached as much as 30 per cent by volume, with an average of 15 per cent for an entire month. The annual cost of dredging the canals alone was $750,000.

The answer to the first two problems of flood and drought was obvious, namely, upstream storage. This came in 1935 with the completion of Boulder Dam. Boulder Dam is also proving a partial solution to the silt problem, since the dam is in a position to catch a large quantity (about 95 per cent of the Colorado's silt burden, and Lake Mead has a large enough capacity to retain the accumulation for an indefinite period of years. Also, conceivably, Boulder Dam aids in controlling the alkali menace, not by decreasing the total amount of salts in the water, but by portioning the percentage of dissolved chemicals throughout the year. This is important, since in the pre-storage days the salt content ran well below 600 p.p.m. during flood season, but in the period of low flow, the salts increased to as much as 2500 p.p.m., an amount which made the water undesirable for humans, animals, or irrigation purposes. Thus Boulder Dam serves the Imperial Valley in four important irrigation functions: water storage, flood control, silt storage, and equalization of dissolved salts. As an example of the degree to which the drought problem has been solved, it may be stated that Lake Mead stores enough water to supply downstream users for a period of four years without inflow.

Although Boulder Dam was the answer to several of the problems of the Imperial Valley, a major difficulty still remained, namely, the dependence on Mexico for water supply. This was taken care of by the All-American Canal, which was authorized as a part of the Boulder Dam Act in 1928. As discussed previously, the main canal from the river was originally routed through Mexico, (1) because the natural overflow channels of the Colorado were followed, and (2) because the digging of an All-American Canal at that time was entirely out of the question from a monetary standpoint. In addition insufficiency of engineering excavation equipment available at that time made the operation economically unfeasible if the money had been available, and there were many who felt that a cut through the sand hill barrier would not remain open but would be filled with the drifting sand. This latter point has proved to be entirely false since the completion of the All-American Canal, because no difficulty has been experienced with major movements of the sand hills, although the cut through this treacherous area in places is over 300 feet.

The All-American Canal has its diversion point at the Imperial Dam between California and Arizona, about 15 miles upstream from the town of Yuma, Arizona. It roughly parallels the Colorado to a point a mile north of the Mexican border. From here it turns to the west, remaining just inside of the international boundary until it reaches the Imperial Valley. Figure 6 is a photograph of the Imperial Dam, with the desilting works in the foreground. In the background are the Gila diversion works in Arizona. In the center of the Imperial Dam is the overflow section, adjacent to it is the wasteway, and at the near end, on the California side, is the gate structure, housing four diversion gates 75 feet long, for the channels pictured. Three of the four diversion channels lead to the desilting basins, which can be used or not, as desired. A fourth desilting basin may be installed in the remaining channel at a future date. The desilting basins were not used for the first few years of All-American Canal operation, since silt was deposited behind Imperial Dam. Since this structure is intended for diversion only, its silt storage capacity was soon exceeded with the result that it has been necessary to employ the desilting basins for over a year. Figure 2 is a photograph taken on October 18, 1938, when water was first diverted through the gates into the canal. Figure 7 shows the siphon structure which was necessary across New River Channel in the Valley itself. New River is a wasteway which drains into the Salton Sea. It was eroded during the 1906 flood, previously mentioned. The capacity of the canal is 15,000 cubic feet per second at its head, but through diversions and a waste-way-drop back into the Colorado its flow is decreased to 10,000 cubic feet per second when it enters Imperial Valley. The Irrigation District can now deliver water to Mexico at the border and does not encounter the international difficulties inherent in the former arrangement. The use of drops in the All-American Canal for power development will be discussed later under "Power Development."

In connection with the All-American Canal it is interesting to note in passing that some problems have now arisen because of lack of silt in canals. First, in some cases, canals have been widened in order to reduce the erosive effect of the clear water; and second, a rather serious moss condition has developed in canals and drains because of the relatively clear water. Moss could not grow in the formerly "silty" water.

Although Boulder Dam and the All-American Canal have eliminated most problems, one very pressing danger remains to be met. There is need for drainage both in order to lower the water table in numerous places and to remove the alkali accumulation which in the past has ruined many fertile acres.

The principal agricultural soils in the Valley are made up of alluvial deposits of fine-textured clays, silts, and sands which were laid down in the geologic past by the waters of the Colorado. There is also some land made up of coarser-textured wind transported material. Natural drainage of soils has been retarded by their relative imperviousness, insufficient surface slope, and lack of underground gravel beds. In many of the areas having inadequate drainage, the water table has come up to within six feet of the surface and alkali has accumulated in sufficient proportions to eliminate a part of the land as an efficient crop-producer. Thus large areas of the Imperial Valley in the past lay idle because of the alkali menace. Since it has been found that the high salt content of the Colorado (some 600 p.p.m.) does not increase the alkali content of the properly drained land, the Irrigation District has been carrying out an extensive drainage program. This program has been conducted actively for over 20 years. but the amount of work done per year has varied. For a few years during the depression, practically all efforts of this kind ceased, but with operations now in full swing, the District is nearing completion of ts program to provide a main outlet drain for every 160 acres of irrigated land. About 1200 miles of the projected drains are now completed, with about 100 remaining. Actual drainage of the farm lands is left to the individual owners who use either open cuts or tile drains. The variation in the types of soil has made any universal solution of the individual problem impossible. On the lighter soils, tile drains have proved very effective, with 500 miles in operation at the end of 1942 serving an area of 12,000 acres. Recent experiments indicate that tile works satisfactorily on some of the heavier soils, and pumping, which had not been thought feasible, has in a few special cases economically and practically justified itself.

Although the drainage problem is far from being solved, the adverse trend of conditions has been checked in that decline in some lands has been more than offset by improvements in others. This produces a hopeful picture, as compared with the situation in 1922, before the drainage program had been instituted and when a large acreage of formerly good land had gone out of production altogether.

A rather novel means has been found to reclaim some of the most alkalied and "tight" land in the Imperial Valley. That is by growing rice on it. The water standing on the land slowly goes into the ground, taking the soluble salts. A large quantity of water is required to dilute the salt so that the rice will live, but rice needs the water and the reclamation pays for itself, since the crop produced has a ready market. After the rice has been grown for two or three years, depending on how serious the original condition, another higher-return crop, such as flax, is put in for a year or two before rice production is again necessary. In this manner, much of the land previously considered hopelessly alkaline is being brought into fruitful production. Figure 1 is typical of a rice crop grown on this formerly "useless" soil.

POWER DEVELOPMENT

In addition to its original purpose of keeping the water for the Imperial Valley in the United States, the All-American Canal performs other services. First, it will make irrigable about 250,000 more acres on the East and West Mesas which were formerly above existing canals, and second, it provides a convenient source of electric power. The development of more land in the future is a straightforward proposition and therefore requires no additional explanation. Power development however is so interesting as to call for further discussion.

Since much of the territory traversed by the All-American Canal is covered with very light soil, and since the flow at times carries silt from the Colorado River, the canal grade was carefully designed to maintain the proper velocity of flow and prevent either scouring or deposition. It was thus necessary to construct a number of drops at points where changes in grade were essential. At four of these drops with an aggregate head of 126 feet the development of power is feasible. In anticipation of this development, the Imperial Irrigation District in 1936 installed a diesel plant at Brawley, California, one of the principal cities, and entered the power business. Since mutually satisfactory terms could not be reached with the California Electric Power Company, which was then operating in the area, the District commenced business in direct competition with the privately owned company in May, 1936. As the operation became more successful, the diesel plant was enlarged to take care of the constantly increasing

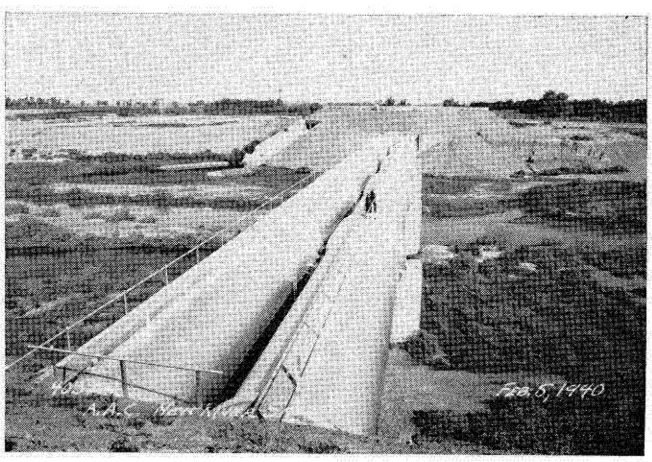


Plate 7. A.A.C. New River Siphon. The pipes are 15′ 6″ in diameter, and canal capacity at this point is 2600 second feet.

needs. The ultimate purpose of this plant, which now has an installed capacity of 12,000 kw, was to act as a source of standby and peak power loads after the units were installed at the All-American Canal sites. The first installations on the canal consisted of one unit in each of two drops. These would have an aggregate capacity of 14,400 kw, and they were ready for operation in 1940. This development represents a small portion of the total installed capacity of 91,500 kw which will be available and developed in the future. The number of customers on the District's lines increased steadily until in 1942 it obtained 62.4 per cent of the electric revenue of the Valley. In April, 1943, the District reached an agreement with the California Electric Company, covering purchase of the latter's properties in the Imperial and Coachella Valleys.

Since the firm capacity of the diesel standby plant in Brawley is only 9,000 kw, while none of the hydro power can be classified in this manner, the District needed an additional source of firm power to serve its territory with a 25,000 kw load. This was taken care of by a contract with the United State Bureau of Reclamation whereby the District secures 15,000 kw of firm capacity from Parker Dam. The District in return sells surplus power back into the Parker system. At the present time, plans are being completed for the installation of more hydro units at the existing power houses on the canal and for construction of a 20,000 kw steam plant at El Centro.

In addition to its primary purpose of providing electricity for the farms and homes of Imperial Valley, the power development on the All-American Canal serves another equally or perhaps more valuable service. It is the sale of power from these four drops which makes the All-American Canal financially feasible. In spite of the Imperial Valley's dire need for the canal, as has been pointed out, it is doubtful that the cost of the canal could have been carried by assessment on the lands. However, by development and utilization of these power possibilities, revenues are being provided which will, to a large extent, repay the cost of the canal.

PROSPECTS

With most of its irrigation problems either solved or definitely approaching solution the Imperial Valley *faces a period of almost assured prosperity.* To the advantages which Nature bestowed have been added the works of the farmers and engineers. The flood, drought, and silt problems are things of the past, and there will be fewer complicated international problems now that delivery of water is entirely within the United States. Large amounts of money will be saved the Irrigation District in maintenance of levees and canals in Mexico. This saving of money will extend to the United States side of the border because the absence of silt has made unnecessary the constant dredging of canals. Last, the All-American Canal, which is operating very successfully, will furnish electricity to the farms and cities of the Imperial and Coachella Valleys. Revenues from the sale of this electricity will be the principal source of funds with which the cost of all of the All-American Canal will be repaid.

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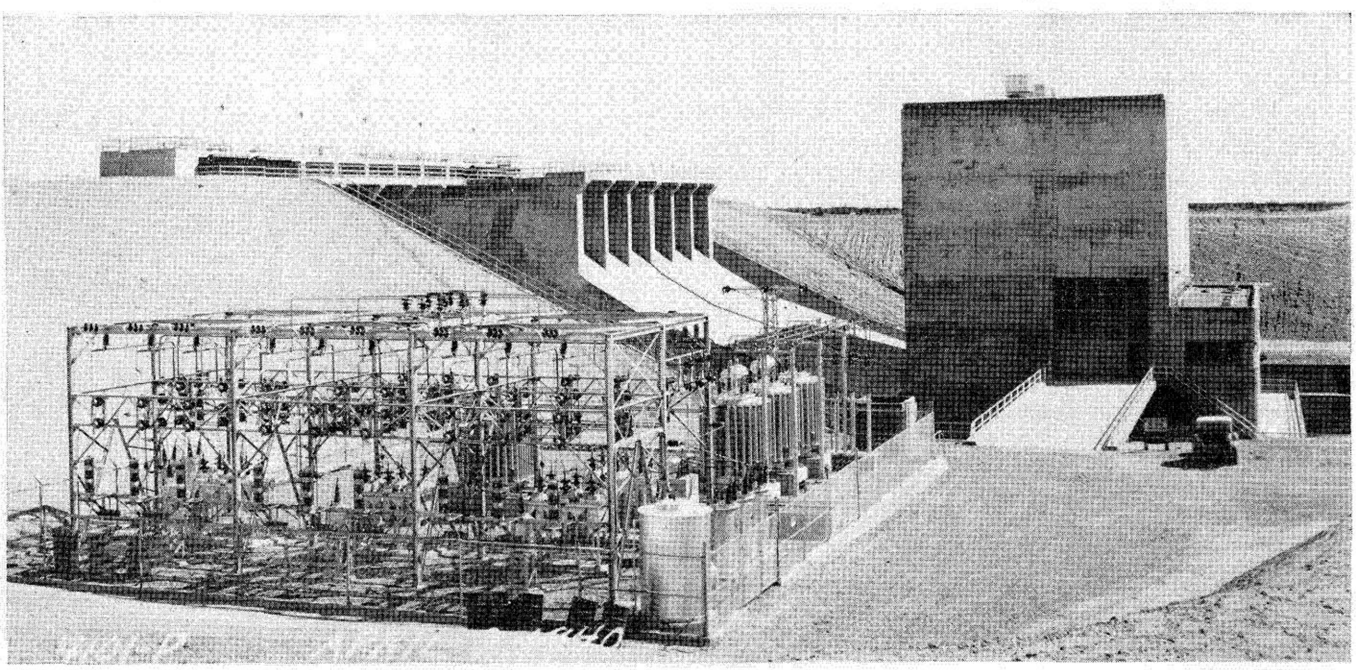

Plate 8. A.A.C. power drop 4. The turbine house is in the center of the gate structure. Spillways are on either side. Drop is 52 feet, giving 9600 kilowatts now, with a 19,200 kilowatt capacity planned eventually.

SOME ASPECTS OF ARMY ENGINEER OPERATIONS

By EDWARD C. KEACHIE

THE LABOR PRODUCTION PROBLEM AND ITS CONTROL

IN THE face of some dozen agencies dealing with labor during the war, the armed services established labor and production branches to work with their contractors. Why? The simple fact is that total war forces two basic changes in procurement.. The armed services do not, as in peace time, actually have a choice of able and unhampered suppliers from whom to choose, and there is no time in which to reschedule production with a second supplier if the first proves inadequate. The order must be given to (sometimes forced upon) the most promising* supplier, and he must then be contacted and often assisted to ensure that deliveries are made on time to meet the changing needs of battle. The mechanism of war production had in fact to be geared to this end by channeling men, materials and facilities under control procedures, for example, the Controlled Materials Plan; procuring agencies worked with the supplier to ensure the meeting of all requirements along the line to gain the final goal of output on schedule according to needs.

Thus in the labor field there were established manpower freezes and referral priorities which covered not only production but the construction of facilities for production. Special conditions for securing a certain few but vitally needed pay increases were made a regular part of War Labor Board procedure. The entire machinery for preventing and quickly terminating work stoppages was necessarily tied in with the procurement agency responsible for moving supplies to the troops. The basic expression of the armed services' functions in labor matters was to ensure production first and defer any argument or red tape. For example, the functions of established conciliation machinery were not superceded, but merely were helped to operate in an "at work" condition. The procurement agency was in position to do this for two basic reasons. First, it had the information and was in closest touch with operating conditions in the plant or on the construction job, thus nipped most troubles in the bud. Second, it had certain contract provisions to back it up so far as the contractor was concerned, besides the close touch and the prestige of its mission, and other factors tending to foster cooperation from unions, government agencies and other parties involved.

ORGANIZATION FOR PROCUREMENT

The Corps of Engineers in the Zone of the Interior, United States proper, operates† chiefly through some fifty-three Districts, supervised by six Divisions which are under the Chief of Engineers in Washington. District areas are primarily based upon physical considerations, such as rivers and harbors, the peacetime work of the Corps having dealt primarily with the work of the Engineer Department, mainly rivers and harbors. The Corps has also, since its inception in 1775, been responsible for fortifications. West Point originated as an engineer school, which it remained until 1866 when it became the U. S. Military Academy. In November, 1941, the Corps took over all military construction such as barracks, airports, and hospitals, from the office of the Constructing Quartermaster, together with the latter's personnel and facilities. During the early part of the war, procurement of engineer equipment and supplies for this country and for troops abroad was carried on by six special procurement districts reporting directly to the Chief of Engineers. This was similar to the procurement organization of the four so-called "technical services," i.e., Quartermaster, Medical, Signal, Chemical Warfare, Transportation, and other parts of Army Service Forces, Army Air Forces having an independent set-up. However, due to the unique organization and functions of the Corps of Engineers it was possible to consolidate activities to the end that districts procured material available in their own area, with certain exceptions made where necessary due to local conditions. For example, specialization by commodities was made in some cases, being favored by factors such as the extremely technical nature of the equipment, involving continuous development, e.g., pontoon bridges, water purification and storage equipment, and searchlights. Also, specialization was often best to tie in to the Controlled Materials Plan of the War Production Board or where there were a limited number of suppliers, as with tractors, motor graders and similar heavy earth moving equipment. For example, the Great Lakes Division at Chicago was responsible for buying this type of equipment for both Army and Navy, while barrage balloon winches were a specialty of the Pittsburgh District. Other factors were the parts problem and need for special crating or transportation arrangements. The Manhattan District atomic bomb project was given top priority by all, and their contracts, labor, and other needs were expedited in every way even by such seemingly remote Districts as San Francisco and Los Angeles.

On the west coast, partly due to the difficulty of contacting suppliers over such wide areas, the Districts were all engaged in procurement either directly or via the commodity organization, as agents for the order placing office. Chief burden fell on the San Francisco District which inherited the old west coast procurement office, and on Seattle, which procured for points north. After V E Day procurement was centralized in fewer Districts, San Francisco taking over much of that on the coast.

A notable example of commodity procurement was that for lumber, the engineers being responsible for securing lumber for the Army, Navy, and other governmental agencies. In 1944, a special organization was set up in the Corps to do this, called "C P A," which stood for central procuring agency. There were six regional offices, one being in Portland to handle the northwest pine and fir, and one in San Francisco for redwood and such fir and other woods

* Unfortunately this word "promising" was sometimes all too literally descriptive.

† As of autumn, 1945.

as are produced in the southwest, both production and shipment being handled by these offices. The latter office was originally a part of the San Francisco District and maintained its staff and location there, its labor problems being handled by the District.

SOME SPECIFIC LABOR PROBLEMS

Why, it has been asked, do men quit work during the crucial needs of war? Probably for the same reason as at any other time; the parties responsible believe they are not getting their due, and that all ends are in the long run best served by the temporary interruption. While of course tremendous pressures are some do occur. Stoppages from any cause are deplorbrought during war to greatly reduce stoppages, able but the important thing is to end them quickly and then profit by the lesson apparent in the situation if possible.

Some labor problems grew out of peculiar physical changes in otherwise normal processes. For example, because of a shortage in rolling stock, an agreement to load railroad cars to a percentage above normal capacity made it necessary to stack 94 pound sacks of cement ten and eleven high instead of eight or nine high as formerly. Nine was the normal load for the hand truck by which the sacks were transported from the conveyor at the car door to the body of the car. To place eleven on the truck meant difficulty in getting men able and willing to handle it, due to the weight and height of the load, while if fewer than a full stack were loaded, it was necessary to make an extra trip by armload or truck for the remainder. This meant extra men. Either way the critical problem of labor supply was aggravated, especially in view of the fact that the only men available for this type of work at relatively low pay were youths, old men, and transient service men. Variable factors, besides the extreme differences in men available, were the sizes of cars, condition of flooring, availability of conveyor extensions and other loading equipment, and attitudes of all concerned. Solution was a compromise which minimized rehandling by ensuring that most stacks were of hand truck height, and the securing of maximum ingenuity and cooperation from all concerned, once they realized that theirs was not an isolated "impossible" problem.

"Quickie" work stoppages often hit the headlines, some involving only the grievance of one man. Unjustified as these seem on the surface, there is frequently a much longer story behind them, which at least explains why they happen. One case involved a large manufacturer of equipment, where the men, allegedly with the consent of local union officials, walked off the job because an employee was transferred to the night shift against his wishes. Investigation showed that the man had been operating a certain machine for some seven months on the day shift, having been promoted from a simpler machine on which he had done satisfactory work, on the night shift. The probationary period on the present job was three months, therefore he had been considered a regular operator for at least four months. However, the company claimed that his spoilage was excessive, that he had been repeatedly warned about it, and that it was now necessary to demote him back to his old job on the night shift. The union claimed the man had not been previously told his work was unsatisfactory, and that his continuance beyond the probationary period was an admission by the company of his competency, and that to concede the point would mean giving up contract rights of long standing. To this the company replied that due to the shortage of competent help it was necessary sometimes to keep men on jobs for which they were not qualified, but that it was still their right to demote them when replacements were available. The union denied this, reiterating that if the work was satisfactory through the probationary period, the man must be retained unless "bumped" by a senior operator. The case was finally settled after a loss of 4,000 man days by giving the man a new probationary period of 60 days, with the company and union checking on all entries of spoilage.

This case, like so many, is analogous to an iceberg in that the greater and most significant part is below the surface, and its real character is belied by the merely apparent or obvious aspects. Here the underlying facts included the union's desire to reopen wage questions before the permitted contract date, in line with their hitherto successful technique of "jumping the gun" and confusing the management into ill-considered hasty action. The new manager, on the other hand, was attempting to correct what he felt to be loose conditions wherein the union had failed to comply with certain contract conditions. This was aggravated by the fact that the old management, under long existing labor scarcity conditions, had often winked at the union's violations or at most given only lip service to enforcement. Finally, the new manager was actually carrying the ball for a segment of local industry, and the union was correspondingly determined in its fight to control what it considered a key plant in the area, and also to keep the major competing labor union from gaining strength at its expense in this and other plants.

Personnel relations problems often assumed serious proportions under stress of war, and the majority of these were of course settled between the parties or through regular grievance procedures. Yet there were some where judicious assistance by the interested third party helped tip the scales toward harmony, if only by giving the parties a better opportunity for expression and perspective. Bucking crews were failing to report for work on new "shows" in a timber operation. Their stated grievances were that piece work earnings on those shows would be inadequate, that the particular location was hazardous, and that the timber wasn't being felled fast enough. Check showed that, in spite of all these difficulties, the men would return if a certain gang boss was removed from supervision of them. He had only recently been given this position by the woods boss, who felt that the man's abilities outweighed his admitted disadvantages of personality and habits. The woods boss was adamant as long as he felt that the men were questioning his authority. When all the facts were clear to all the parties, the man was restricted to his previous responsibilities, a new man acceptable to all was placed in charge of buckers, and operations resumed at the old rates and location.

Sometimes union regulations are nominally very restrictive as written in union by-laws or even in contracts, but in practice operate satisfactorily. Thus on a certain project to which there had been adverse pressure by certain outside interests, it was found very difficult to maintain operations effectively. Grievances arose over pay, quantities of work loads, travel expense, and certain forgotten clauses such as that requiring one man for each type of a certain unit. In this last instance, the units were started and stopped but twice a day, and required practically no other attention. Where before, a man handling other work readily handled two of the units, all at once it seemed necessary to have two more men to handle a unit apiece. Furthermore, the union was not in a position to supply the extra men, and no others seemed available. Yet, after all parties were fully informed, and the project was unquestionably under way, the difficulties melted away.

SPECIALIZED ITEMS AND PROCEDURES

Of particular interest to engineers are many of the specialized types of equipment procured. Some of these are either adaptable to peace or constitute new developments which can be used in their present form. For example, among the many forms of "quickie" shelter were portable barracks shipped knocked down in numbered crates. One type of these, developed not long prior to V E Day, uses aluminum panels for siding, keeping step with the changing availability of critical materals. Steel angle framing was selected as best meeting the needs of strength, size and production, while available plywood sections proved to meet the flooring requirements most readily. The barracks were of conventional rectangular shape, with a moderately pitched roof. In order to meet every reasonable shipping, storing, erection and occupancy need for troop housing, hospitals, and the divers other needs of the field, a scheme of standardized units was devised, limited to three types and designated A, B and C.* All consisted of complete sections of the standard barracks height, width of 20 feet, and a uniform length of eight feet. One section contained a window on each wall, while another contained a door on the side. The third section was the end section with windows. Thus, to make a standard 20 x 48 foot building, two of the end sections, one or more of the door sections, and three or fewer of the window sections were used. Any length was possible, on the 8 foot modulus. Mass methods in production, crating†, shipment, transportation, and erection were readily applicable and speedily demonstrated the peculiary suitability of the product in meeting the problems of the Pacific theatre.

Perhaps the most spectacular of the war created devices which applied construction tools to battle needs was the so called "tank-dozer," or armed bulldozer, technically known as a converted medium tank. This consisted of a medium tank equipped with removable dozer blade, special cargo space for explosives, and side doors. Its purpose was to cover or wreck enemy fortifications by direct action and to place men and explosives at the objectives under otherwise impossible fire conditions. It was possible, for example, to advance to a concrete wall or other structure, lay several hundred pounds of explosives, back away, and then remotely fire the charge. Under severe conditions the units were used in pairs with men slipping out the doors under the relative cover of the tanks on either side. Space was secured by removal of the main piece and its ammunition, but the revolving turret was retained as a base for rocket launchers. Rockets ideally filled fire needs during both the advance and the periods of maximum exposure. Machine guns were retained as needed.

This product was not made or supplied to the field in its final form, but only in the form of a "conversion kit" containing all necessary extra parts required. Nothing was wasted, and existing parts were re-used wherever possible. For example, the door openings were made by torch, and the resulting segment was at once reattached to the machine by hinges to form a door. This followed the "modification" principle of production economy used by the services, notably in aircraft. Thus the primary product is manufactured at capacity speed with a minimum of changes or variations which retard production. Late developments or special items are then incorporated after delivery to the services, at special centers, or even in the active theatres.

The tank dozer is also an example of rapid changes in procurement in line with lessons learned the hard way on the field of battle. Its genesis has been attributed to the dogged seabee dozer operator on a Pacific island, who, despairing of completing his allotted portion of airstrip on time in the face of withering pillbox fire, made the now historic moves which constitute a battle born invention. He raised the blade for protection and drove straight at the enemy until within a few feet, then literally "lowered the boom" on him and simply wrecked and filled the pillbox for later exhumation.

The services maintain special branches to ensure the most rapid translation possible of battle inventions or battle needs to new equipment and methods to ensure fulfillment of the mission. The Corps of Engineers has its section with headquarters in Washington. An interesting if somewhat homely example of the process by which the resources of the service are placed behind an idea was the development of space heaters. The origins of the oil drum heater may indeed be found in the ingenuity of an Alaskan engineer service G I, or it may go back further to civilian construction days and even the hoboes' "jungle." In any event, men were there and they were cold. Transportation was critical, and the luxuries, both of production and use, of peace type space heating were out of the question. But soon came amazing stories of novel ways to adapt oil drums to make heaters, often with urgent pleas for non-available parts like burners or valves. Out of the urgency, the new information, and the standard practice, there were evolved conversion units best suited to the needs, whether for oil or other fuels. These essentials were quickly put into production, and could be supplied in needed quantities, since the resulting simplicities of design enabled a minimum use of critical materials, production facilities, and cargo space.

CONCLUSION

Besides the accomplishments of the Corps in the field of procurement, there are of course the parallel accomplishments of war construction at home and overseas, of which space precludes mention here. "The Military Engineer," official publication of the Society of American Military Engineers, is suggested to the interested reader as being one of the best sources of information on operations and methods. One of the few bright spots of the war was the spontaneous cooperation and coordination in the field between personnel of all types of organizations working with the armed services, including industry, labor, governmental and other agencies.

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* Many of these buildings are now being used for emergency housing for veterans on college campuses.

† Each unit crated contained all parts necessary to erection plus special tools and full instructions. Even the crates were used in part for steps and other functional needs of the completed building. A complete treatise might well be written on the science and art of packaging, packing and crating as developed during the war. In 1942, due to use of inadequate domestic commercial methods, millions of dollars' worth of desperately needed materiel was lost to moisture, fungi, and physical violence, especially in the Pacific. By 1943 specifications were adequate, crating was a specialized industry, and such losses were negligible.

Reproduction of Prints, Drawings, and Paintings of Interest in the History of Science and Engineering

10. The First Hydrogen Balloon

By E. C. WATSON

JACQUES ALEXANDRE CÉSAR CHARLES (1746-1823), the French physicist who discovered the gas law which bears his name and who was the first to fill and to ascend in a hydrogen balloon, was born on November 12, 1746. It is appropriate to commemorate this centennial by reproducing CHARLES' portrait together with several of the many interesting contemporary prints which celebrated the success of his pioneer experiments in aerostatics.

The first public ascent of a large scale balloon took place at Annonay, France, on June 5, 1783. The balloon used was of the hot air type invented and constructed by the MONTGOLFIER brothers. The demonstration was so successful that the Académie des Sciences in Paris was stimulated to raise money for similar experiments and work with hydrogen was undertaken by CHARLES. The ascent of the first hydrogen balloon was described by BENJAMIN FRANKLIN in a letter to JOSEPH BANKS, President of the Royal Society in London, as follows:

Plate 1. Jacques Alexandre César Charles (1746-1823). (From a print publised by Berthoud, Paris).

Passy, Aug. 30, 1783

Sir,

On Wednesday the 27th instant, the new aerostatic experiment, invented by Messrs, Mongolfier of Annonay was repeated by Mr. Charles, Professor of Experimental Philosophy at Paris.

A hollow globe 12 feet diameter was formed of what is called in England oiled silk, here Taffetas **gommée,** the silk being impregnated with a solution of gum-elastic in lintseed oil, as is said. The parts were sewed together while wet with the gum, and some of it was afterwards passed over the seams, to render it as tight as possible.

It was afterwards filled with the inflammable air that is produced by pouring oil of vitriol upon filing of iron, when it was found to have a tendency upwards so strong as to be capable of lifting a weight of 39 pounds, exclusive of its own weight which was 25 lb. and the weight of the air contain'd.

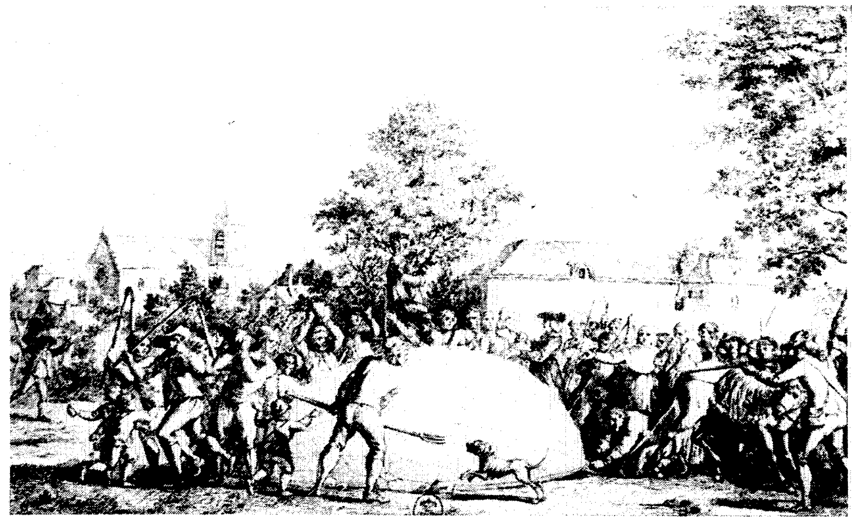
It was brought early in the morning to the **Champ de Mars**[1], a field in which reviews are sometimes made, lying between the Military School and the river. There it was held down by a cord, till 5 in the afternoon, when it was to be let loose. Care was taken before the hour to replace what portion had been lost of the inflammable air, or of its force, by injecting more.

It is supposed that not less than 50,000 people were assembled to see the experiment. The Champ de Mars being surrounded by multitudes, and vast numbers on the opposite side of the river.

At five o'clock notice was given to the spectators by the firing of two cannons, that the cord was about to be cut. And presently the globe was seen to rise, and that as fast as a body of 12 feet diameter with a force of only 39 pounds, could be suppos'd to move the resisting air out of its way. There was some wind, but not very strong. A little rain had wet it, so that it shone, and made an agreeable appearance. It diminished in apparent magnitude as it rose, till it enter'd the clouds, when it seem'd to me scarce bigger than an orange, and soon after became invisible, the clouds concealing it.

1. Where the Eiffel Tower now stands.

Plate 2. The landing of the first hydrogen balloon, August 27, 1783, in the village of Gonesse.
(From a contemporary French print).



The multitude separated, all well satisfied & much delighted with the success of the experiment, and amusing one another with discourses of the various uses it may possibly be apply'd to, among which many were very extravagant. But possibly it may pave the way to some discoveries in natural philosophy of which at present we have no conception.

A note secur'd from the weather had been affixed to the globe, signifying the time & place of its departure, and praying those who might happen to find it, to send an account of its state to certain persons at Paris. No news was heard of it till the next day, when information was received that it fell a little after 6 o'clock at Gonesse, a place about 4 leagues distance; and that it was rent open, and some say had ice on it. It is suppos'd to have burst by the elasticity of the contain'd air when no longer compress'd by so heavy an atmosphere.

One of 38 feet diameter is preparing by M. Mongolfier himself at the expence of the Academy, which is to go up in a few days, I am told it is constructed of linen & paper, and is to be filled with a different air, not yet made public, but cheaper than that produc'd by the oil of vitriol of which 200 Paris pints were consum'd in filling the other.

It is said that for some days after its being fill'd, the ball was found to lose an eighth part of its force of levity in 24 hours: Whether this was from imperfection in the tightness of the ball, or a change in the nature of the air, experiments may easily discover.

I thought it my duty, Sir, to send an early account of this extraordinary fact, to the Society which does me the honour to reckon me among its members; and I will endeavor to make it more perfect, as I receive farther information.

With great respect, I am, Sir

B. FRANKLIN

P.S.

I just now learn, that some observers say, the ball was 150 seconds in rising, from the cutting of the cord till hid in the clouds; that it's height was then about 500 toises[2], but, mov'd out of the perpendicular by the wind, it had made a slant so as to form a triangle, whose base on the earth was about 200 toises. It is said the country people who saw it fall were frightened, conceiv'd from its bounding a little when it touch'd the ground, that there was some living animal in it, and attack'd it with stones and knives, so that it was much mangled; but it is now brought to town & will be repaired.

The great one of M. Mongolfier, is to go up as is said, from Versailles, in about 8 or 10 days. It is not a globe but of different form, more convenient for penetrating the air. It contains 50,000 cubic feet, and is supposed to have a force of levity equal to 1500 pounds weight. A philosopher here, M. Pilatre de Rozier, has seriously apply'd to the Academy for leave to go up with it, in order to make some experiments. He was complimented on his zeal and courage for the promotion of science, but advis'd to wait till the management of these balls was made by experience more certain & safe. They say the filling of it in M. Mongolfier's way will not cost more than half a crown. One is talk'd of to be 110 feet diameter. Several gentlemen have ordered small ones to be made for their amusement; one has ordered four of 15 feet diameter each; I know not with what purpose, but such is the present enthusiasm for promoting & improving this discovery, that probably we shall soon make considerable progress in the art of constructing and using the machines:—

Among the pleasantries conversation produces on this subject, some suppose flying to be now invented, and that since men may be supported in the air, nothing is wanted but some light handy instruments to give and direct motion. Some think progressive motion on the earth may be advanc'd by it, and that a running footman or a horse slung and suspended under such a globe as to leave no more of weight pressing the earth with their feet, than perhaps 8 or 10 pounds, might with a fair wind run in a straight line across countries as fast as that wind, and over hedges, ditches, & even waters. It has been even fancied that in time people will keep such globes anchored in the air, to which by pullies they may draw up game to be preserved in the cook, & water to be frozen when ice is wanted. And that to get money, it will be contrived to give people an extensive view of the country, by running them upon an elbow chair a mile high for a guinea, etc., etc.[3]

The first human beings to ascend in a balloon were JEAN FRANCOIS PILATRE de ROZIER (1754-1785) and FRANCOIS LAURENT, MARQUIS D'ARLANDES (1742-1809)[4]. This ascent was made on November 21, 1783. Only 10 days later, on December 1, 1783, the second ascent and the first in a hydrogen filled balloon was made by CHARLES and one of the brothers ROBERT from the gardens of the Tuileries in Paris. The balloon, which was

2. About 3200 feet. A toise is 6.395 English feet.

3. This letter, which is preserved in the Library of the University of Pennsylvania, is reproduced in **The Ingenious Dr. Franklin**, by N. C. Goodman (Philadelphia, 1931).

4. See Am. Jour. Phys. 8 249 (1940).

Plate 3. The ascent of Charles and Robert from the Tuileries, December 1, 1783.
(From an engraving by de Launay after de Lorimer, published by Vachez in Paris).

constructed by the brothers ROBERT, was made of lutestring coated with gum elastic and had a diameter of 27 feet. The car was suspended from a hoop surrounding the middle of the balloon and fastened to a net which covered the upper hemisphere. After ascending to a height of about 200 feet and covering a distance of 27 miles in about two hours, CHARLES and ROBERT descended near the small town of Nesle, where ROBERT left the car and CHARLES reascended alone for a journey lasting a further 35 minutes during which he reached a height estimated at 2 miles. "The pair carried thermometers, barometers, and other 'philosophical instruments' for the observation of as many new natural phenomena as might possibly be discovered in these hitherto uncharted regions. The voyage was completely successful and marked by no unexpected incidents . . . Despite the elaborate collection of instruments, Professor Charles noted no new phenomena beyond the clearly predicted decrease in barometric pressure with height. He specifically noted only that the atmospheric temperature decreased so rapidly that in 10 minutes he passed 'from the warmth of spring to the cold of winter'."[5] It may be of interest to quote also BENJAMIN FRANKLIN'S report to JOSEPH BANKS upon this, the second aerial voyage made by man:

5. F. A. Magoun and E. Hodgins, **A History of Aircraft** (McGraw-Hill, 1931).

Passy, Dec. 1, 1783

Dear Sir:—

In mine of yesterday I promised to give you an account of Messrs. Charles & Robert's experiment, which was to have been made this day, and at which I intended to be present. Being a little indisposed, and the air cool, and the ground damp, I declined going into the garden of the Tuileries, where the balloon was placed, not knowing how long I might be obliged to wait there before it was ready to depart, and chose to stay in my carriage near the statue of Louis XV., from whence I could well see it rise, and have an extensive view of the region of air through which, as the wind sat, it was likely to pass. The morning was foggy, but about one o'clock the air became tolerably clear, to the great satisfaction of the spectators, who were infinite, notice having been given of the intended experiment several days before in the papers, so that all Paris was out, either about the Tuileries, on the quays and bridges, in the fields, the streets, at the windows, or on the tops of houses, besides the inhabitants of all the towns and villages of the environs. Never before was a philosophical experiment so magnificently attended. Some guns were fired to give notice that the departure of the balloon was near, and a small one was discharged, which went to an amazing height, there being but little wind to make it deviate from its perpendicular course, and at length the sight of it was lost. Means were used, I am told, to prevent the great balloon's rising so hight as might endanger its bursting. Several bags of sand were taken on board before the cord that held it down was cut, and the whole weight being then too much to be lifted, such a quantity was discharged as to permit its rising slowly. Thus it would sooner arrive at that region where it would be in equilibrio with the surrounding air, and by discharging more sand afterwards, it might go higher if desired. Between one and two o'clock, all eyes were gratified with seeing it rise majestically from among the trees, and ascend gradually above the buildings, a most beautiful spectacle. When it was about two hundred feet high, the brave adventurers held out and waved a little white pennant, on both sides of their car, to salute the spectators, who returned loud claps of applause. The wind was very little, so that the object though moving to the northward, continued long in view; and it was a great while before the admiring people began to disperse. The persons embarked were Mr. Charles, professor of experimental philosophy, and a zealous promoter of that science; and one of the Messieurs Robert, the very ingenious constructors of the machine. When it arrived at its height, which I suppose might be three or four hundred toises, it appeared to have only horizontal motion. I had a pocket-glass, with which I followed it, till I lost sight first of the men, then of the car, and when I last saw the balloon, it appeared no bigger than a walnut. I write this at seven in the evening. What became of them is not yet known here. I hope they descended by daylight so as to see and avoid falling among trees or on houses, and that the experiment was completed without any mischievous accident, which the novelty of it and the want of experience might well occasion. I am the more anxious for the event, because I am not well informed of the means provided for letting themselves down, and the loss of these very ingenious men would not only be a discouragement to the progress of the art, but be a sensible loss to science and society.

I shall enclose one of the tickets of admission, on which the globe was represented, as originally intended, but is altered by the pen to show its real state when it went off. When the tickets were engraved the car was to have hung to the neck of the globe as represented by a little drawing I have made in the corner.

I suppose it may have been an apprehension of danger in straining too much the balloon or tearing the silk, that induced the constructors to throw a net over it, fixed to a hoop which went around its middle, and to hang the car to that hoop.

Tuesday morning, December 2nd.—I am much relieved from my anxiety by hearing that the adventurers descended well near L'Isle Adam before sunset. This place is near seven leagues from Paris. Had the wind blown fresh they might have gone much farther.

If I receive any further particulars of importance, I shall communicate them hereafter.

With great esteem, I am, dear sir, your most obedient and most humble servant.

B. FRANKLIN.

P.S. **Tuesday evening.**—Since writing the above

I have received the printed paper and the manuscript containing some particulars of the experiment which I enclose. I hear further that the travellers had perfect command of their carriage, descending as they pleased by letting some of the inflammable air escape, and rising again by discharging some sand; that they descended over a field so low as to talk with the labourers in passing, and mounted again to pass a hill. The little balloon falling at Vincennes shows that mounting higher it met with a current of air in a contrary direction, an observation that may be of use to future aerial voyagers.[6]

Most of the features of modern balloons are due to CHARLES. Thus he was the first to use hydrogen successfully and he invented the valve at the top of the balloon as well as the method of suspending the car which are still generally used.

CHARLES attained great fame during his lifetime and many portraits of him exist. Plate 1 was made from a print published in Paris and reproduced by F. L. Bruel in his monumental **Histoire Aéronautique par les Monuments, Peints, Sculptés, Dessinés, et Gravés des Origines á 1830** (Paris, 1909). The vignette below the portrait-medallion depicts the enthusiastic scenes when CHARLES and ROBERT landed at Nesle, "where the **procés verbal** was signed by, among others, the Duc de Chartres and a 'Gentilhomme anglais,' Mr. Farrer, who rushed up to Charles on his arrival with the explanation, 'Moi, Charles, premier!' and was in such a state of excitement that he signed the **procés verbal** twice over in an almost illegible hand."[7]

Plate 2 reproduces a contemporary print showing the frightened citizens of Gonesse attacking the first hydrogen balloon after its descent in the town. The scene and the reaction of the peasants is graphically described in the following quotation given in H. TURNOR'S **Astra Castra** (London, 1865):

> For on first sight it is supposed by many to have come from another world; many fly; others, more sensible, think it a monstrous bird. After it has alighted, there is yet motion of it from the gas it still contains. A small crowd gains courage from numbers, and for an hour approaches by gradual steps, hoping meanwhile the monster will take flight. At length one bolder than the rest takes his gun, stalks carefully to within shot, fires, witnesses the monster shrink, gives a shout of

6. This letter is also reproduced in **The Ingenious Dr. Franklin,** by N. G. Goodman (Philadelphia, 1931).

7. W. Lockwood Marsh, **Aeronautical Prints and Drawings** (London, 1924).

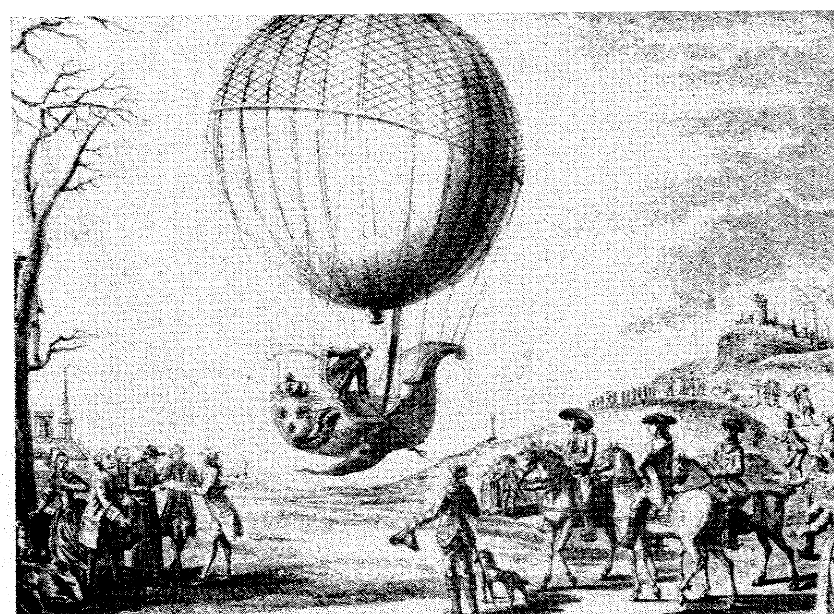


Plate 4. Charles re-ascending alone after landing at Nesle, December 1, 1783.
(From an engraving by Denis after Desrais, published in Paris by Bassett).

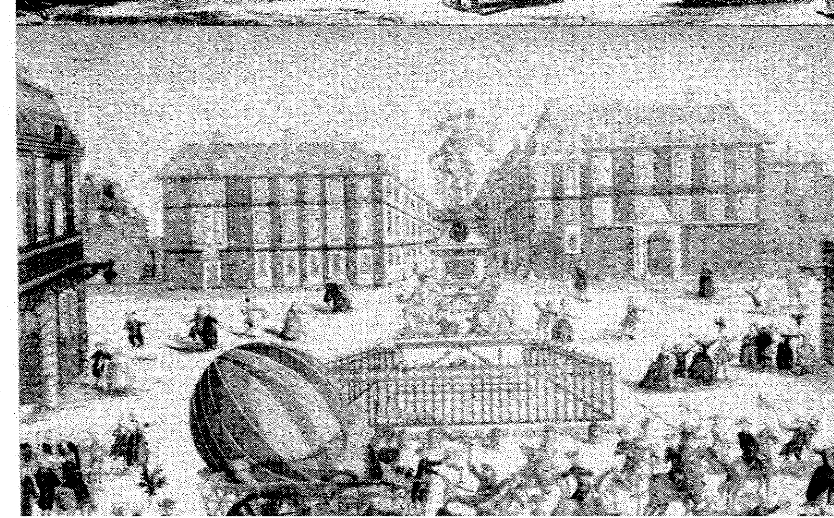


Plate 5. The return of the Charles and Robert balloon to Paris, December 2, 1783.
(From a color print published in Paris by Bassett).

triumph and the crowd rushes in with flails and pitchforks. One tears what he thinks to be the skin, and causes a poisonous stench; again all retire. Shame, no doubt, now urges them on, and they tie the cause of alarm to a horse's tail, who gallops across the country, tearing it to shreds.

German and English copies of this print were published at Augsberg, Germany, and by John Wallis of Ludgate Street, London, and French copies in Paris.

The ascent of CHARLES and ROBERT from the Tuileries on December 1, 1783, produced a great profusion of prints.[8] Selected for reproduction here (Plate 3) is one from the delightful series of de LAUNAY after de LORIMER, which was published by VACHEZ in both colored and uncolored states. These "are pehaps the best of all ballooning prints"[9] and several of them were used as illustration in FAUJAS de SAINT-FOND'S **description des experiences de la machine aerostatique** (Paris, 1783-4), which is "The chief contemporary authority for the details of the earlier ascents"[9]

Plate 4 shows CHARLES re-ascending alone after the signing of the **procés verbal** at Nesle and Plate 5 "is a highly imaginative picture of the triumphant return of the balloon to Paris the next day, showing it apparently still fully inflated with hydrogen and surrounded by flaming torches in dangerous proximity to the gas."[9]

8. The **Katalong der Historischen Abteilung der Ersten Internationalen Luftschiffahrts-Asstellung (ILA) zu Frankfurt a.M. 1909**, by L. Liebmann and G. Wahl (Frankfurt, 1912) lists more than 40 without exhausting the list.

9. W. Lockwood Marsh, **Aeronautical Prints and Drawings**, (London, 1924).

C. I. T. NEWS

LACEY OF CHEMICAL ENGINEERING NAMED DEAN OF GRADUATE SCHOOL

DR. William Noble Lacey, professor of chemical engineering was appointed Dean of the Graduate School in October. He succeeds Dr. Richard Chase Tolman, wartime vice-chairman of the N.D.R.C. Dr. Tolman resigned in order to devote more time to research and new duties as technical advisor to Bernard Baruch, United States representative on the United Nations Atomic Energy Commission.

Dr. Lacey has recently been designated as a recipient of the Anthony F. Lucas Gold Medal of the American Institute of Metallurgical Engineers for research on hydrocarbon behaviour. This award will be made in March 1947.

During the war Dr. Lacy was attached to the Eaton Canyon rocket project. He received his bachelor's degree at Stanford in 1911 and his master's and doctorate degrees at the University of California in 1913 and 1916. Before coming to the Institute in 1916, Dr. Lacey spent a year at M.I.T. as a research associate.

The graduate school deanship is not an honorary appointment. A great deal of work and responsibility will be added to Dr. Lacey's already crowded schedule. Recommendations for grants and other financial aids to graduate students are among the Dean's tasks. The great numerical expansion of the graduate school to 581 is instituting new problems.

A recently made curriculum change that Dr. Lacey must consider at close range is the addition last March of chemical engineering to the list of subjects in which the Ph.D. degree may be taken. Heretofore chemical engineering was offered as a minor subject in connection with the doctorate in chemistry or mechanical engineering.

The chemical engineering department is under the direction of Doctors Lacey and Sage. Chief research project now in progress is the American Petroleum Institute's hydrocarbon research now in its 20th year under Dr. Lacey's supervision. For the last nine years, Dr. Sage has co-sponsored this research.

The behaviour of hydrocarbon mixtures under conditions found in underground petroleum and natural gas reservoirs is being studied. Temperatures as high as 400 degrees Fahrenheit and pressures up to 10,000 pounds per square inch are possible with the department equipment. Dr. Lacey describes this work as physical chemistry research done under engineering conditions. Also in progress at the chemical engineering department is research in engineering thermodynamics.

BEAVER ELEVEN WINS TWO, LOSES TWO

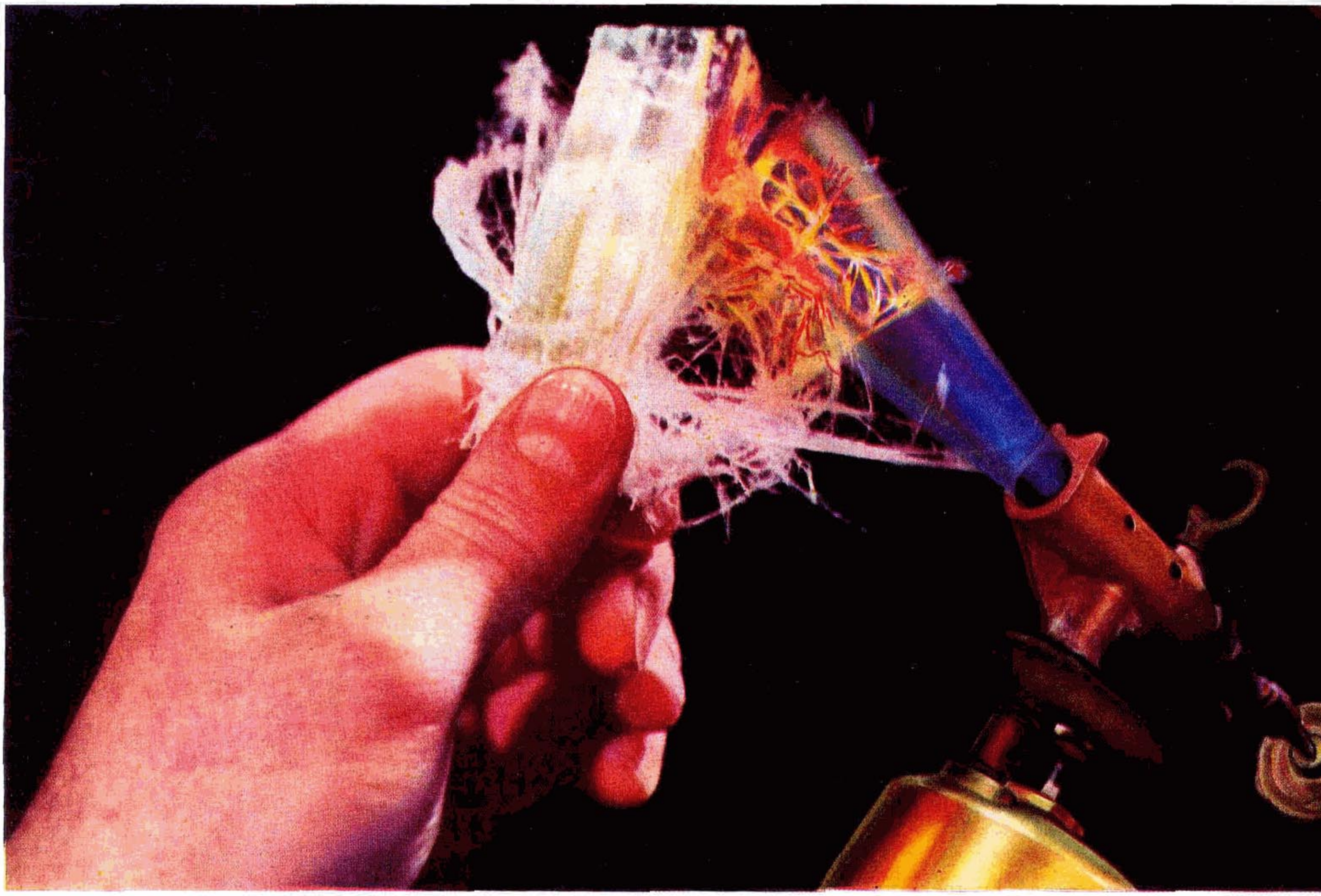
OFF to a good start this season, beating La Verne College 40-0 in a non-league opener, and swamping Occidental 21-7, the Beavers have since slowed down, bowing to Whittier, currently heading the league, 19-7, and also to Redlands, second in league standings, 21-6.

The victory over Oxy, not wholly unexpected after the La Verne encounter, showed the Beavers in control at the Rose Bowl. After an early Occidental touchdown, the Techmen scored in the first, second, and fourth quarters.

The game with Whittier saw the Poets handing the Caltech team their first loss of the season. Looking good, but not quite good enough, the Beavers lost their first half lead of 7-6 early in the third quarter, when Whittier drove 70 yards down the field to their second and deciding touchdown. Whittier's other score came late in the game when a Poet guard fell on a Beaver fumble over the end zone.

Redlands, fresh from a 6-6 tie with Pomona which was reckoned the weakest team in the league, gave the home team a very rough time in the Rose Bowl. The Bulldogs' wide-open playing clicked too frequently and gave them a 14 point lead in the first half. A Beaver drive in the third quarter produced six points, but the game was never in doubt.

On the basis of this last game, the Beavers will start the Pomona game November 16, as underdogs. However, Coaches Mason Anderson and Pete Mehringer will have the uninjured squad in shape to counter the Sagehens' standbys, the single wingback and short pass over the line with a passing attack, against which Pomona has produced only a weak defense this season.



ASBESTOS CANNOT CARBONIZE

...USED EXCLUSIVELY IN U. S. MOTORS

ASBESTOS is a fibrous rock that has not changed in character for ages. It is the only known natural fibre that is absolutely incombustible. Asbestos is the protecting element in U. S. Motor windings.

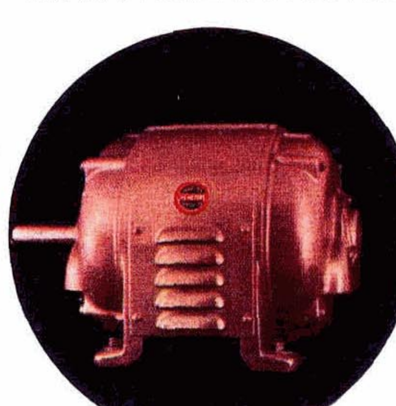
Life of a motor is proportional to the life of the insulation protecting the windings. If carbonization starts to progress, the insulation chemically and physically changes from an insulator to a conductor. Thus, destruction of the windings is threatened from failure of the very thing that was originally designed to protect them.

Materials commonly used for insulation include varnished cloth, oiled linen, paper, press-board, insulating varnish; but *all of these will carbonize.* Not one of them is fireproof. All of these, even the best, will deteriorate under the temperatures at which motors are often called to operate. Repair shops, busy rewinding motors, furnish proof of the continuous carbonization of motor windings.

Contrast such construction with the advanced U. S. Motor method of using Asbestos as the protecting element. While there is no way of protecting motors to guarantee perpetual life, the U. S. Asbestic Process of insulating windings infinitely increases motor life. Danger of breakdown is minimized.

Asbestos is the greatest of all pliable, heat-resisting materials *because it cannot carbonize.* (That's why asbestos is used in automobile brakes.) Being soft and flexible it is an insulation that can be folded and worked into the windings of U. S. Motors. Asbestos is a high heat conductor. It transmits heat away from the inside of the motor much faster than ordinary elements.

U.S. MOTORS
ASBESTOS-PROTECTED



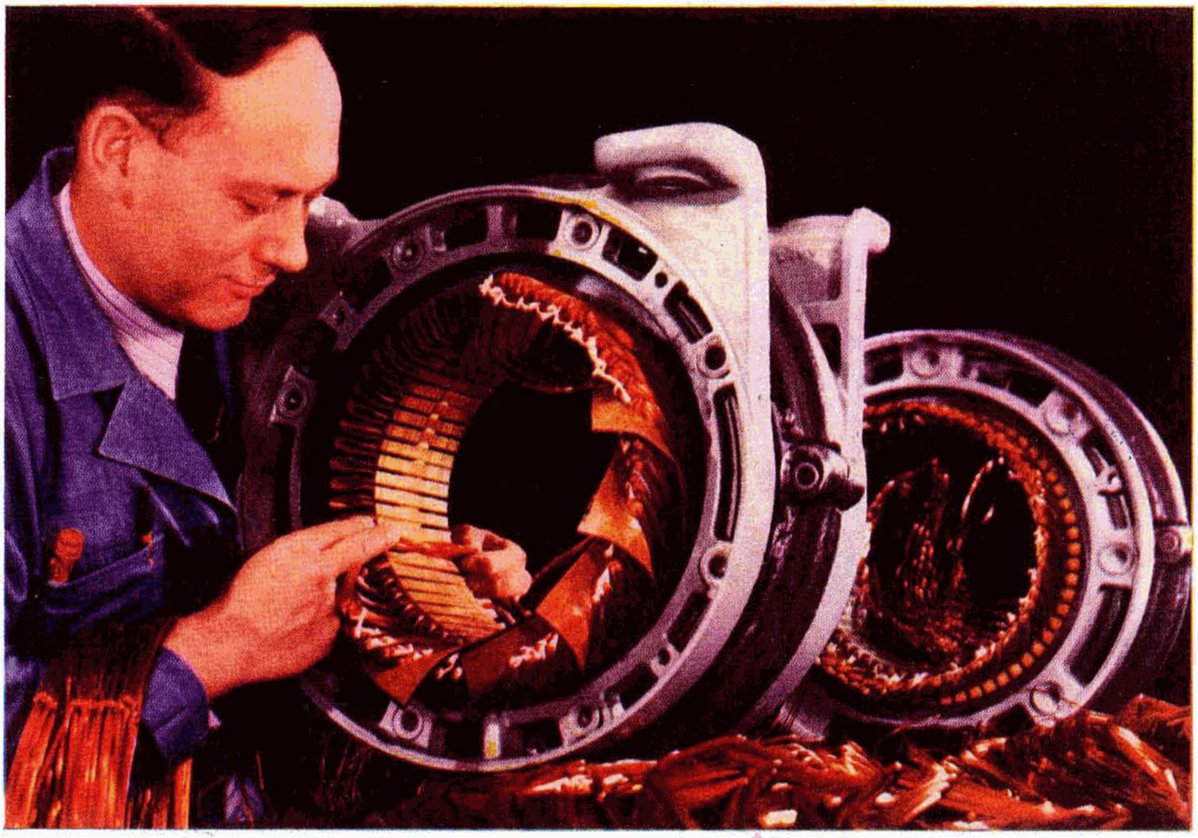
When asbestos insulation was developed by U. S. Motors there was no manufacturing plant in the country which offered the facilities for processing asbestos fibre suitable for U. S. Motors application. No manufacturer of ordinary insulation was equipped, either with machinery or knowledge, to make asbestic material of the kind required, so it was necessary for the U. S. organization to devise means for processing this material.

The pure asbestos is first treated to render it moisture-proof. Sheet asbestos is cut and molded to conform with the perimetrical shape of each stator slot. Die-cut shapes are made to fit between coils and between phase windings where coil ends are nested.

The impregnating compound, Asbestosite, is produced by reducing asbestos fibre rock to a very fine powder. This asbestos base is held in colloidal solution with high volatile diluents which are driven off after the compound permeates the windings.

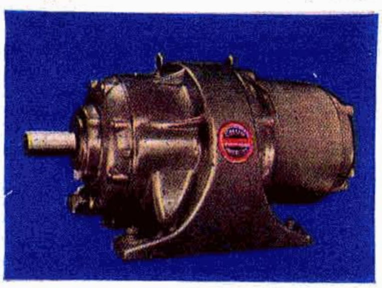
Through baking and particular curing means, the Asbestosite is hardened and forms a solid, intimately attached to and isolating every turn of windings.

Asbestos-protection is an exclusive U.S. Motors feature, pioneered, patented and perfected by U.S. engineers. It's the answer to long motor life. *Request Bulletin.*

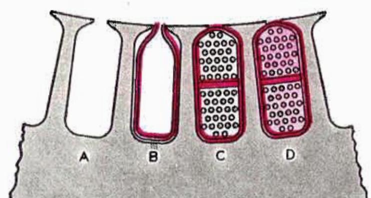


BUILDING ASBESTOS INTO U.S. MOTORS

The heart of a motor is its hottest spot. Asbestos is used in U. S. Motors to protect the windings against heat. Barrier walls of asbestos are inserted in each stator slot. Coil separators of asbestos plate-board are positioned to insulate and provide heat-proof walls between coils in each slot. The lips of the asbestos barrier between the wires and the steel are overlapped at the tooth tips. This forms a cell of sheet asbestos between the copper windings and the steel core. Then the stator is submerged in an impregnating tank of Asbestosite. The latter penetrates the windings and surrounds each wire with a coating of asbestos. An interrupted current is passed through the windings to gently vibrate and isolate each wire.

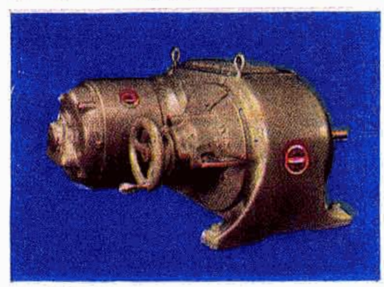


U. S. Horizontal Syncrogear Motor



U. S. ASBESTIC PROCESS

(A) Empty stator slot. (B) Formed cell of Asbestos. (C) Windings inserted. (D) Asbestosite (indicated in color) penetrates every interstice.



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UNICLOSED MOTORS . . . . *Horizontal and Vertical*
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ALUMNI NEWS

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The San Francisco Chapter meets weekly for lunch at the Fraternity Club, 345 Bush Street, on Mondays.

DUBRIDGE SPEAKS TO NEW YORK CHAPTER

RICHARD K. Pond '39 reports on the New York Chapter of the Alumni Association, of which he is secretary-treasurer:

". . . It was a real pleasure for us to announce our first meeting of the 1946-1947 season because we were able to commence a series of outstanding programs with a real special event.

"During one of New York's equinoctical storms (L.A. editors please note this expression), the New York Chapter had as their guest of honor for the evening, Dr. L. A. DuBridge, the new president of California Tech. Dr. DuBridge was in the city on official business for the American Physical Society, and was able to squeeze in three hours with the Alumni and ladies. Although it was Saturday night, September 21st, 37 guests and wives turned out at the Hotel Holley in Manhattan, to listen to the first official speech on the part of the new president.

"He explained fully the plan which was materializing for new staff, housing and association with other scientific institutes in Californa. He also enlarged upon a change in program from secret military projects to those of more general fundamental scientific interest.

"Incidentally it turned out to be Dr. DuBrige's birthday. His regime, which we trust will be as fruitful as Dr. Millkan's during the next 25 years, was properly inaugurated with blown candles on a 'Happy Birthday Cake.'

"At the same meeting the New York Alumni entertained Dr. Carl Anderson and Professor Robert Brode of the University of California. They were kind enough to discuss some of their plans and work on cosmic rays.

"It was one of the most successful, interesting, and entertaining evenings the Chapter has had for some time. Everyone felt particularly honored at having attended Dr. DuBridge's interesting talk; his first since he has taken active control of the Institute's affairs.

"President Evan Johnson proposed and received a vote of confidence to have at a future an unbiased speaker in the field of unionzation of professional engineers."

ALUMNI ASSSOCIATION HOLDS FIRST FALL MEETING

THE FIRST fall dinner meeting of the Southern California group of the Alumni Association was held October 22 at the Acme Brewery in Vernon. Director Harold M. Huston reports on its success:

"The vision of plenty of beer and good food for one dollar were powerful lures, and 200 thirsty and hungry Tech men wrote or phoned for reservations. But with the maximum number limited to 75, the affair was a sell-out within three days.

"The meeting was held in Acme's Sequoia Lodge, a rugged, one-story, gabled-roof building with that 'come-hither' look on the outside, and the interior just as convincing. Paul Bunyan must have built it. The ceiling is heavily beamed, the pillars of whole, hewn trees, and the side-walls massively knee-braced. Quite an unusual place, truly an oasis in the Vernon industrial desert, and an old haunt of our dignified Association president, Allen Laws, according to the Acme Brewery manager, Mr. Perry Hansen.

"An ideal engineer's night out, the meeting proved to be the kind we like best after a hard day. First, a prolonged stress-relieving, talking and soaking period before dinner. Then a good meal. And finally, a not-too-strenuous inspection trip. For this kind of therapeutic treatment Acme Brewery has an efficient, line-production layout, consisting of series-connected bar, dining room, and brewery, plus convenient auxiliary facilities.

"For most of those present the 'kiss of the hops' cast quite a spell, and they were somewhat reticent to eat when summoned. But dinner proved a worthwhile diversion. Designed and served by Acme's Mater D, Mr. A. D. (Tony) Ferrari, the repast started with some 'trick' celery hearts previously boiled, then given a delayed treatment with vinegar. (The Latin name for this escapes me.) Next came a teaser of thin-sliced smoked spring salmon, followed by the entre: roast veal previously marinated in sour cream, wine and vinegar, for 10 days under refrigeration. Truly à triumph in culinary chemistry.

"The inspection trip through the brewery was a sobering experience, intellectually and otherwise. The capacity of just this one brewery is 750,000 barrels a year, with expansion soon to a million and a half barrels. Considering the local population, it would seem that many of us are (fortunately) drinking less than our quota of beer. The inspection of the plant was thorough and enjoyable, but quite eventless except for one unfortunate incident. Some thoughtless engineer suggested that the sacred and traditional brewmaster be replaced by a small control lab and two young chemists. This man's name is withheld until next of kin are notified.

"During the usual belt-loosening lull after dinner, Allen Laws sandwiched in a little Association news and business, one item of which was the report that the recent increase in dues had been accompanied by an increase in membership, the net result of which is that we remain solvent and respectable, and need not draw on the loan proffered by the Institute and Board of Trustees. Program Chairman Fred Schell, who arranged the meeting, also spoke briefly, indicating that the evening was without cost to the Association, but that the dollar charge was largely absorbed by mailing, printing and reply costs. He also indicated that repeat performance was impossible this year. Maybe next year, huh?"

CALTECH-OXY ALUMNI MEETING

SOMETHING new has been added to the Caltech-Occidental rivalry! On October 23 at the Pasadena Athletic Club there was held a most interesting and enlightening luncheon meeting. Alumni of Caltech and Occidental, at the invitation of the alumni of Occidental, met to get the "low down" on who would win the traditional gridiron contest to be held the following Friday night.

The "classics" versus the "exact sciences" experiment produced everything except the final score. Introduced for statements, to be with or without predilection, was a galaxy of potentates including the Occidental College President, Dr. Coons, and the President-elect of Caltech, Dr. DuBridge. The friendly rivalry existing between the two schools was welcomed by both presidents. Opinions as to the outcome of the game (some of them pretty well hedged) were voiced by the respective athletic managers, by the student body presidents, by members of the football squads, and by representatives of the press.

The war of nerves was soothed by the Occidental Quartet, which presented three beautifully sung numbers, after which the real barrage was loosed. The Occidental coach, Ray Dennis, and Mason Anderson discussed the potentialities of their respective teams. The final concensus of opinion was that "the better team will win" with the Beavers a "mystery" team of neophytes and the Tigers a "bomb" with a lit fuse of unknown length.

There followed a showing of a selected short subject on "football thrills." The meeting was adjourned with everyone present being positive that a well worthwhile experiment had been consumated, a noble precedent established, and that a repeat performance was mandatory for next year.

FIFTY-FOUR MILLION DOLLAR OVERSTATEMENT

A proofreader's oversight in the October issue produced the optimistic statement that a $60,000,000 grant to the Institute from the Rockefeller Foundation was being used for the construction of the Mount Palomar Observatory and 200-inch telescope. Dr. DuBridge's office observes that the amount mentioned by C.I.T.'s new president was $6,000,000, a sufficient sum to assure completion of the greatest astronomical observatory in the word.

PERSONALS

1918

MILTON W. WELDON is president and general manager of the Porter Safety Brake Company.

1922

LINNÉ C. LARSON was recently relieved of active duty as major, Corps of Engineers, U. S. Army. He has been admitted as a partner in the firm of Taylor and Taylor, Consulting Engineers, in Los Angeles.

1927

M. MAXWELL BOWER, formerly Major Bower of the Army Signal Corps, recently visited this area in connection with a new cross-country cable installation by the American Tel. & Tel. Co. and the Bell Laboratories.

ALAN E. CAPON was recently appointed chief electrical engineer for the City of Burbank, Calif. He has responsible charge of electrical installations for a new steam electric generating plant as well as other responsible supervisory duties in the Public Service Department.

1928

LUTHER EASTMAN is working as assistant valuation engineer of the California Railroad Commission in Sacramento.

FRANK NOEL has been married 11 years and has a daughter 9 and a son aged 6. Frank is assistant highway engineer, Division of Highways at Stockton. At present on construction engineering, working on a four-lane highway north of Merced and on repair work through Atwater. He reports: "Post-war highway traffic is terrific."

1929

ALLEN W. DUNN commanded an Engineer G. S. Regiment and saw duty in England, France and Okinawa working on primary jobs and heavy construction such as airports, hospitals, railroads and water supplies. Allen is living in Arcadia and working at the Southern California Telephone Company in Los Angeles.

1931

GLENN J. CHAMBERLAIN came to Southern California because of the serious illness of his father, and has decided to stay—it looked so good to him and his family including three sons. Glenn has recently taken a job wth Bechtel Bros. McCone.

1932

WILLIAM R. BERGREN is back at Tech for reading and research prior to settling down again after being discharged from the Army where he served as a major in the Nutrition Branch of the Sanitary Corps.

JOHN L. COX is now employed at the Naval Ordnance Test Station in Pasadena.

KENNETH SWART is chief engineer at the Security Engineering Company at Whittier. Ken will be back east attending the A.P.I. convention in Chicago which takes place in November. He is hoping to see some of his Caltech friends who reside in the "Windy City."

WILLIAM SAYLOR is one of a triangular partnership (the other two being the above mentioned Cox and Swart) who recently completed a desert cabin near Victorville.

1934

RAY W. HASKINS is working as a market research specialist with the Carpenter Steel Company in Reading, Pennsylvania.

HAROLD B. JOHNSON visited the campus recently and tells he is still with the Inspection Department at Lockheed.

1935

ARTHUR E. ENGELDER is currently studying medicine and pathology at the Post-Graduate School of Medicine of Duke University. He recently was released from active duty with the Army where he was a major in the Medical Corps.

DR. H. S. RIBNER still likes to call himself a physicist after nearly six years at the Langley Laboratory of the National Advisory Committee for Aernonautics in Virginia. When R. T. (Sweepback) JONES recently transferred to NACA's Ames Lab. in California, Herb was upped to head of the Stability Analysis section. Herb claims he doesn't know anything about stability, so he's horning in on supersonic aerodynamics. He says he doesn't know aything about that either, but he insists that keeps him free of bias——. His concluding remark is that Hampton Roads area is a wonderful spot for ducks and ghost fleets, but he'll take a short beer.

1936

CHARLES W. BEST saw three years service in the Army as a master sergeant and his stations included Oahu, Okinawa and Korea. Charles took up his civilian life with a bang by getting married to a Minnesota girl, Miss Josephine E. Thomas and resuming his previous position with the J. H. Baxter Company in Long Beach.

HUGH F. COLVIN recently changed positions and is now general manager of the Southern California Heating Service Company with offices in Pasadena and Arcadia.

RAY A. JENSEN is residing in Hermosa Beach while awaiting the completion of a new home in West Los Angeles.

1937

CHARLES F. HADLEY is now in Tulsa, Oklahoma doing research for Stanolind Oil Company of Indiana. During the war he was research associate at Harvard University working on Counter-radar and also at Stanford for Sperry of New York. He was married in 1942 and has a one-year-old daughter.

R. BRUCE LOCKWOOD recently left the employ of Lockheed to engage in Consulting Geology in partnership with J. Gordon Cole with offices in Los Angeles. His home is in Burbank where he resides with wife and daughter Lynda, age two.

JOHN SELBERG and his wife, announce the arrival of John Ryan Selberg on September 29th, weighing in at nine pounds five and one-half ounces.

1938

THOMAS V. DAVIS was an engineer at the Atomic Bomb Project at Los Alamos. He is taking graduate work at Tech in Civil and Aeronautical Engineering and is resident associate at Blacker House.

CARL F. FRIEND has changed positions and is now employed at the Pacific Division of the Bendix Aviaton Corporation in North Hollywood.

1939

JOHN W. BLACK has just moved into his recently completed new home in Westwood. Johnny is employed at the Hughes Aircraft Company as a project engineer.

1940

RAYMOND C. BAIRD is with the Fluor Corporation and working in acoustical research in connection with industrial muffler desgn. He recently purchased a home in Westchester Heights and sings (professionally) as baritone soloist at the Westwood Community Methodist Church.

GERALD P. FOSTER and his wife are the proud parents of a little girl whom they named Shirley Ann. She was born on September 18.

WILLYS LEMM is employed as a mechanical engineer at the Pasadena branch of the Naval Ordance Testing Station.

1941

NEWELL PARTCH has recently joined the Johnson Company after serving two years in the United States Naval Reserve. Stationed at the David Taylor Model Basin, Washington, D. C., he was charged with the development of high-speed camera equipment and of acoustic counter-measures for use in prosubmarine warfare. He also had additional duty in the investigation of captured enemy equipment.

JOSEPH WEISS returned to work for Westinghouse Electric Corporation in their Los Angeles office, having transferred from their Pittsburgh plant where he was originally employed. His present assignment is panelboard specialist, advising the sales engneers.

1942

EDWARD BARTLETT is teaching assistant at Tech and a graduate student in mechanical engineering.

WARREN A. HALL was released from the Navy in September. His last station was at Quonset Point, Rhode Island, which he left on September 10 and drove across the country visiting various points of interest and arriving here October 12. Warren now lists auto and tire difficulties as sore subjects—he really had a time.

WILLIAM T. HOLSER spent the summer in southeast Alaska with the U. S. Geological Survey, surveying nonmetallic mineral deposits. He is now at Columbia University after having accepted a staff appointment of lecturer in Geology and is also studying for a Ph.D.

JOHN W. MILES has returned to California. He is now an Assistant Professor in the Engineering department of U.C.L.A. and also a consultant to Northrup Aircraft Inc. and North American Aviation Inc.

MERLE SMALLBERG is just out of the Marine Corps where he saw service in North China occupational forces for the past year. He is now working for Bendix Aviation in ths area.

LAWRENCE SMITH and wife Jean announce the birth of their second child in July. She has been named Laurene Ann.

GEORGE P. SUTTON is the proud father of Marilyn Jean born in September. George has been promoted to supervisor at North American Aviation Inc.

1943

EVERETT J. MACARTNEY was married in October to Miss Frances Peck of Honolulu. They will live in Los Angeles as Everett is working for the Southern California Gas Co.

RICHARD A. SUTTON has been discharged from the Navy and is now at C.I.T. doing graduate work in mechanical engineering. His wife is a Scottish girl whom Dick met and married while serving in Britain.

RALPH M. WILLITS has just returned from an extended vacation to the Northwest, seeing Seattle, Glacier National Park, Yellowstone, Grand Tetons, Bryce and Zion Parks. Ralph served as a radar officer on P. T. boats.

1944

WILLIS A. BUSSARD was married to the former Miss Jean Mount on the fifth of October at Longmeadow, Massachusetts. Willis is employed with Du-Pont at Martinsville, Virginia.

ILIF ROSS DANA JR. has accepted a position with the Haddock Construction Co.

FRANK B. CLENDENEN is awaiting transportation to Maui and the East Maui Irrigation Company in Hawaii to see about a position with them. Frank was recently released from the Navy where he had the rank of ensign.

FRED W. MORRIS JR. is teaching at the East Los Angeles Jr. College, instructing on a full time basis in college algebra, intermediate algebra, college physics and engineering drawing. He is also taking graduate work in education at Occidental.

ROBERT O. RANDALL was discharged from the Navy recently. While in service he was stationed in San Juan, Puerto Rico as communication watch Officer.

RAYMOND A. SAPLIS is with Okinawa Geological Survey.

DOYLE WILCOX married Miss Eunice Fuller in June. They are living in Pasadena as Doyle is an electronics research engineer for the Consolidated Engineering Corporation.

1945

GEORGE FENN is now with Northrop Aircraft working on control mechanisms.

LARRY HALL was an aviation cadet in the U.S.N.R. at the time of his release. He is now employed by the Consolidated Engineering Corp. as a research engineer.

DONALD M. LEINWEBER was with the Weather Reconnaissance Squadron of the Naval Reserve which flew the area and made aircraft reports before, after and during the bomb blast on "Baker Day". Donald has returned to his home in Lee's Summit, Missouri following his release from active duty.

BRUCE R. VERNIER has been employed at Douglas Aircraft Co.

THAYNE H. YOUNG is getting back to civilian life after seeing service in the Navy.

1946

PHIL H. BENTON was separated from the Navy and has obtaned a position in engineering on Southern California.

CLAUDE L. CARTER has moved to Santa Monica and was recently employed at Douglas Aircraft Company in the mechanical section of the engineering department.

TED DEHNKE is employed by the Dow Chemical Company in the plastics planning and engineering division at Midland, Michigan.

HENRY W. SCHROEDER is living at Fleming House on campus while taking graduate work in electrical engineering.

The Main Line

NOVEMBER, 1946

This is the month of Thanksgiving.

Viewing the confused state of America and the world, you may well ask, "What is there to be thankful for?"

This:

Just over a year ago America emerged victorious from the greatest war in history. At terrific cost her heroic sons and daughters, with their Allies, decisively defeated three dictatorial powers which threatened to enslave the world.

In spite of shortages of almost everything, America has just enjoyed the most bountiful harvest in her history.

In spite of strikes and other setbacks, American industry is producing consumer goods at a higher rate than ever before.

In spite of predictions that America's population would soon level off and begin to decline, more babies are being born than in any year before the war.

In spite of four exhausting years of war, Americans still enjoy by far the highest living standards of any people on earth.

In spite of many war-born Government regulations and restrictions which are still in effect, our fundamental liberties as guaranteed by the Constitution's Bill of Rights are secure:

I

Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof; or abridging the freedom of speech or of the press; or the right of the people peaceably to assemble and to petition the Government for a redress of grievances.

II

A well-regulated militia being necessary to the security of a free State, the right of the people to keep and bear arms shall not be infringed.

III

No soldier shall, in time of peace, be quartered in any house without the consent of the owner, nor in time of war but in a manner to be prescribed by law.

IV

The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no warrants shall issue but upon probable cause, supported by oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized.

V

No person shall be held to answer for a capital or other infamous crime unless on a presentment or indictment of a Grand Jury, except in cases arising in the land or naval forces, or in the militia, when in actual service, in time of war and public danger; nor shall any person be subject for the same offense to be twice put in jeopardy of life or limb; nor shall be compelled in any criminal case to be a witness against himself, nor be deprived of life, liberty, or property, without due process of law; nor shall private property be taken for public use without just compensation.

VI

In all criminal prosecutions, the accused shall enjoy the right to a speedy and public trial, by an impartial jury of the State and district wherein the crime shall have been committed, which districts shall have been previously ascertained by law, and to be informed of the nature and cause of the accusation; to be confronted with the witnesses against him; to have compulsory process for obtaining witnesses in his favor, and to have the assistance of counsel for his defense.

VII

In suits at common law, where the value in controversy shall exceed twenty dollars, the right of trial by jury shall be preserved, and no fact tried by a jury shall be otherwise reexamined in any court of the United States than according to the rules of the common law.

VIII

Excessive bail shall not be required, nor excessive fines imposed, nor cruel and unusual punishments inflicted.

IX

The enumeration in the Constitution of certain rights shall not be construed to deny or disparage others retained by the people.

X

The powers not delegated to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States respectively, or to the people.

These have not changed...

The whole world needs rest and relaxation.

Men and women who have been under tension for this long period are looking forward to a change of scene.

Though the process of reconversion to peace is not complete, the natural and unchanging scenes of our great West are as they always were—a balm to troubled spirits, a relief to hard-pressed minds.

The cathedral groves of giant Redwoods in California are as peaceful as when the breezes stirred their branches before Christ was born. The blue Pacific breakers throb on the white sands of Southern California with the same lulling music they had when Los Angeles was but a sleepy hamlet. The white-capped mountains of the Pacific Northwest are still majestic and serene.

We hope you will be able to get away soon from the ordinary and routine things of life, and see new things, enjoy new experiences.

We have greatly improved service for you. You can relax on the train.

S•P ***The friendly Southern Pacific***