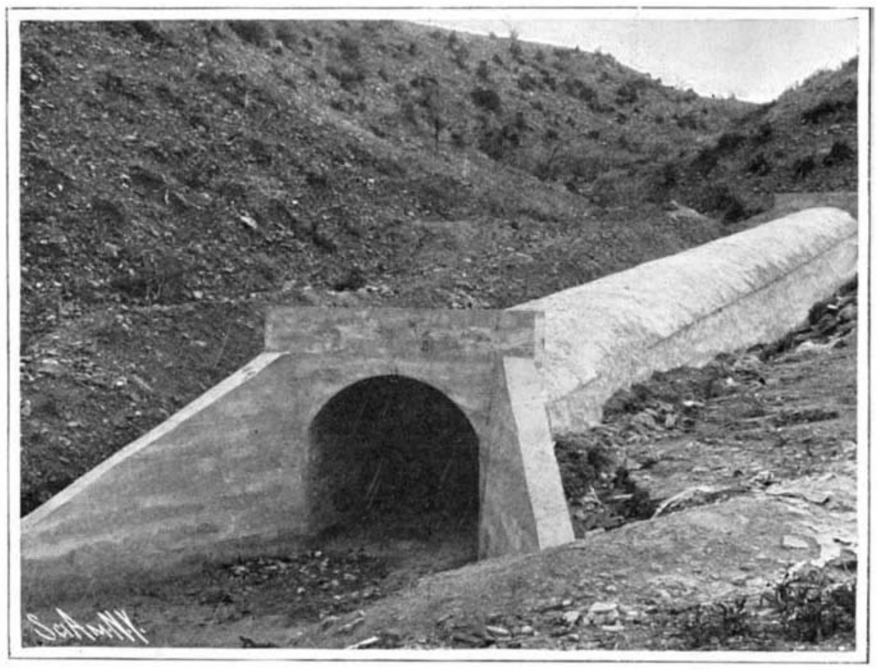
THE ROOSEVELT IRRIGATION DAM IN ARIZONA.

Of the fund of $25,000,000 at present available for irrigation projects in this country under supervision of the government engineers, $3,000,000 have been appropriated for a system which will probably be the most extensive of its kind. This is commonly known by two titles—the Tonto reservoir and the Roosevelt dam. The latter title has been appropriately given in recognition of the encouragement which President Roosevelt has shown toward the reclamation of our arid territory.

The Tonto reservoir, which will be fed by the stream of this name and the Salt River, will serve to irrigate what is known as the valley of the Salt River, which in its natural state is one of the most barren sections of America, being practically a desert, except where it is now watered by the few systems in existence, taking water from the Salt River. It is located largely in Maricopa County, Arizona. The dam itself will be erected in Gila County, about 65 miles northeast of Phœnix. At this point a natural site is afforded by a cañon formation. Here the gorge is but 200 feet wide at the base, expanding to 400 feet in width at the top of the cliffs. By the construction of a barrier of the dimensions proposed, a reservoir will be formed, about 18 miles in length and averaging 4 miles in width. While this area is less than that of some of the storage reservoirs already completed in this country, it will contain sufficient water to flood 1,300,000 acres to an average depth of one foot—far exceeding the largest Nile reservoir in the volume of water retained.

The dam from foundation to crest will be at least 250 feet in height, and will range in thickness from 165 feet at the bottom to 16 feet at the top, or be wide enough to provide a highway for vehicles, which is included in the plans. The maximum depth of water in the reservoir will be nearly 200 feet. The dam will, of course, rest upon a bed of solid rock, and a large amount of excavation will be necessary in order to obtain such a foundation.

The great magnitude of the work accounts for the fact that although operations were begun upon the project over a year ago, as yet only the preliminary details have been carried out. As the photographs show, these are of no little importance in themselves. Owing to the character of the country, it was necessary to construct a series of highways, in order to haul machinery and other supplies to the site of the dam from the nearest railway point. Road-building operations have covered nearly 100 miles alone, some of the highways being cut through bluffs ranging from 50 to 75 feet in height. The highway system includes one around the edge of the basin, in order that all parts of the reservoir may be accessible for inspection and repairs, if needed. The immense amount of rock cutting, the quantity of cement needed, also the elaborate concrete work, rendered necessary the construction of a large cement mill, several concrete mixing plants at various points, as well as smaller industries, which have created a village in the vicinity of the dam site, this community also being called Roosevelt. An odd feature of Roosevelt is that it is situated on the bottom of the proposed reservoir, and will pass out of existence as soon as the dam is completed. Owing to the difficulty in securing fuel and the expense of installing steam power, the engineers decided to utilize hydraulic and electric power, and a portion of the preliminary work has been the construction of a power canal, which is nearly 20 miles in length. It will generate sufficient current to operate all of the mechanism and that needed for illuminating the cement mill and other plants, and, if necessary, will furnish light for night work upon the dam itself. It is intended to employ electric motors in driving rock drills and other excavating machinery, also for the aerial cableways, and for the tramways, which will be employed in transferring material from the quarries and other points to the dam. The power canal has been constructed for permanent service. In completing it several tunnels were driven through the mountains, and several elaborate culverts were built. The latter have been constructed of concrete, while, in some cases, the tunnels have been lined with the same material. Concrete also has been used for the bottom and sides, in excavations where the earth formation is so soft that it is liable to be eroded by the action of the water. Another conduit three miles long has been built for supplying the town with water for drinking and other domestic purposes, as no natural supply is available in this vicinity. It may be needless to say that the auxiliary work includes a telephone system, by which communication is had with Phœnix.

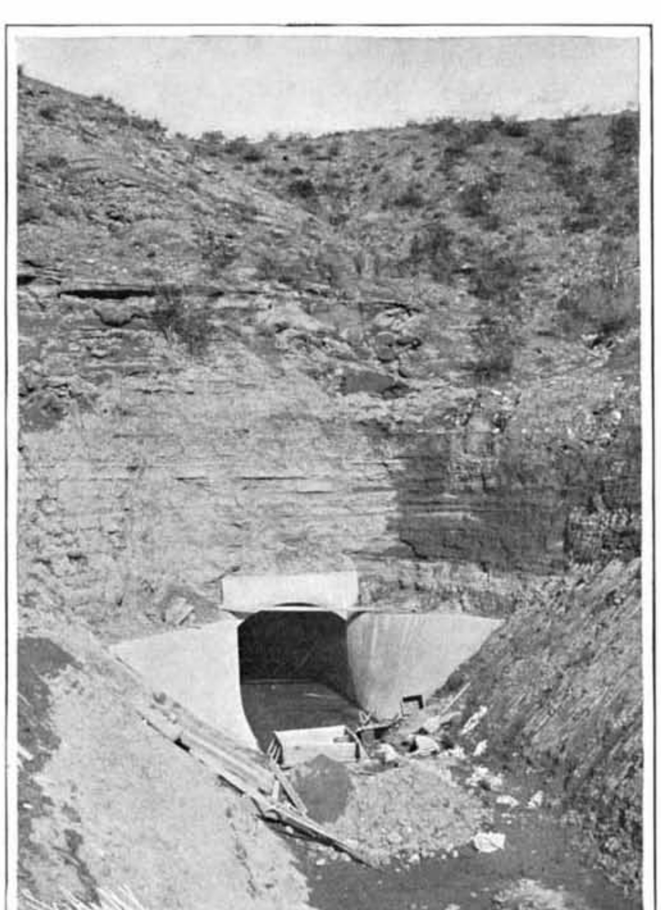


Large Culvert on Power Canal, Showing Substantial Character of the Concrete Work.

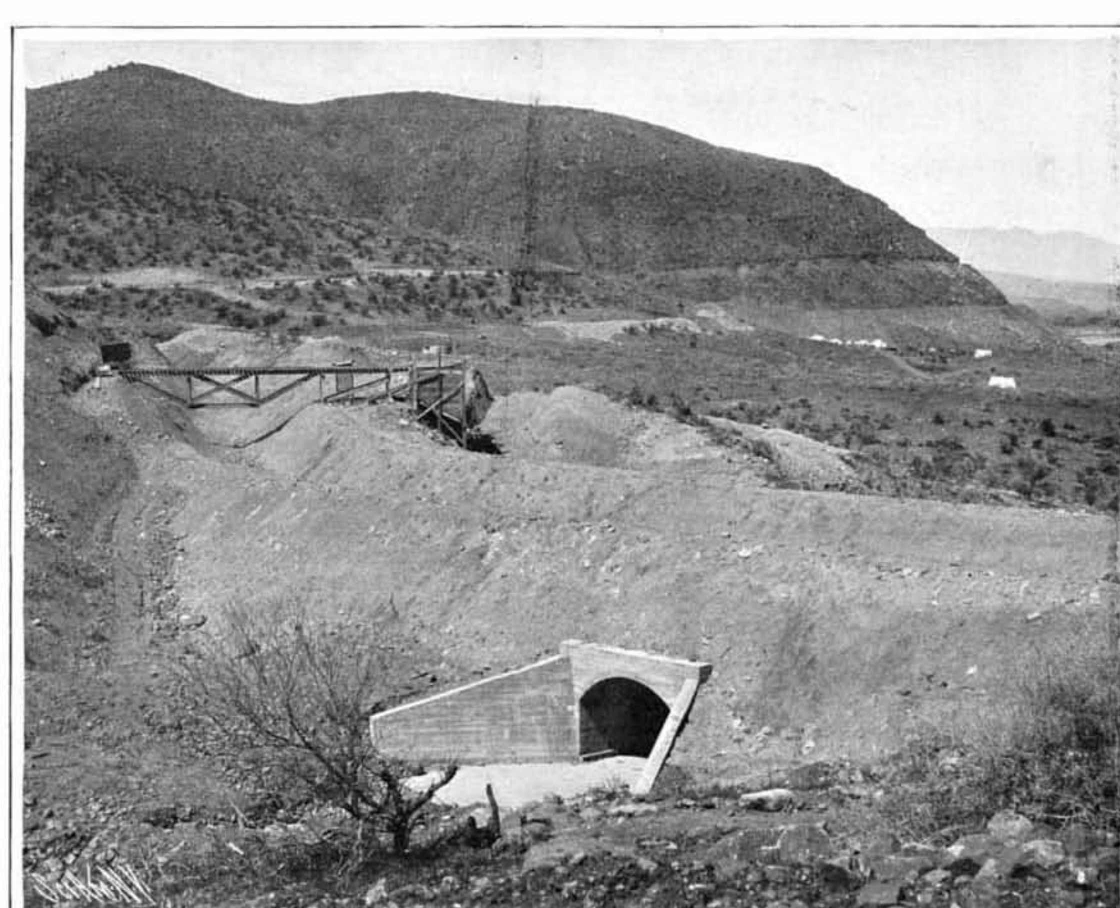
The operations extend into the mountains known as the Sierra Anchas, from which the necessary timber for false work and lumber for the buildings have been secured. Here a large sawmill has been erected. Fortunately a deposit suitable for the base of Portland cement has been discovered, about seven miles from the site of the dam, which is large enough to supply all of the raw material needed. It has been connected with Roosevelt by a tramway. Other auxiliary industries are lime kilns and brick kilns. Thus nearly all of the materials for the dam are being secured or manufactured in its vicinity. Thus far, over $500,000 has been expended in preliminary work, and within the next year it is expected that a considerable portion of the dam itself will be completed.

As already stated, the Salt River basin is now partly reclaimed for cultivation, but the irrigation systems are so inadequate that only about 75,000 acres can be served by the volume of water available during the entire year. The total area which will be reached by the new reservoir ranges between 250,000 acres and 275,000 acres, more than the entire area at present irrigated in the State. Measurements taken of the flow of water in the Tonto River itself, show that it is ample to supply this area without the possibility of failure. The result of the irrigation will undoubtedly be to make this desolate section of the United States one of the most fertile in the world, for the results which have already been obtained in grain growing and fruit and vegetable culture show that only water is needed to produce regular harvests. At present the yield of live stock and alfalfa alone is over $1,500,000 in value annually, from the comparatively small acreage which is cultivated; but fruits and vegetables native to the tropical and temperate zones, as well as corn, wheat, cotton, and other staples grow so abundantly, that in some instances three and four crops are gathered in a year.

On the Berlin-Dresden wireless telegraph line a working periodicity of 900,000 has been adopted. From the station at Oberschönlweide good readable messages have been sent not only to Dresden, 110 miles, but also to the lighthouse station at Fehmern, in Holstein, 166 miles northwest, and Carlscrona, in Sweden, 281 miles north. At Dresden during the night hours signals have been read that originated at the Marconi station at Poldhu, a distance of 764 miles. The wave length of the undulations from the latter station has been determined to be about 2,000 meters, or 1¼ miles.



Concrete-Lined Tunnel on the Power Canal.



Section of the Canal Built to Furnish Power in the Construction of the Roosevelt Dam.

THE GREAT ROOSEVELT IRRIGATION DAM IN ARIZONA.

The Temperature of Subways.

Before the opening of city subway lines employing electric traction, it was supposed that the temperature of the tunnels would be in all respects like that of cellars—not so cold as the exterior in winter, not so warm in summer. The analogy of the two cases seemed to be complete. But this was a delusion, for experience shows us that it is always warmer in the tunnel than at the exterior, even in summer. The causes that create the thermic condition of cellars and subways are well known. The temperature of any point of the earth depends normally upon two factors: the solar heat diffusing itself from the periphery of the earth toward the lower regions of the terrestrial crust, and the central heat of the globe diffusing itself in a contrary direction.

Now, the variations of temperature due to the sun become insensible at quite a slight depth (bordering on 33 feet in the majority of climates) on account of the trifling conductivity of the rocks for heat. At such level the temperature is absolutely constant during the entire year, and the figure that it reaches is exactly the mean temperature of the place. At a lower level the terrestrial strata have a higher temperature due to heating by the central caloric, and we know that the geothermic degree, that is to say, the vertical distance to which it is necessary to descend in order to find an elevation of 1 deg. C., has the mean value of from 98 to 107 feet; but the temperature, here again, is constant for a determinate depth. Thus the cellars of the observatory of Paris, which are 92 feet deep, preserve an absolutely constant temperature of 10.8 deg. C.

As the cellars of our dwellings do not usually descend to 32 feet, they are not entirely protected from the thermic variations due to the sun; yet such variations are attenuated and always occur therein a little later on than those of the surface.

As for the Metropolitan of Paris, the tunnel, contrary to what occurs in our cellars, possesses in summer a temperature greater by three or four degrees than that of the exterior. In the new subway of New York the variation in the same direction is sensibly 6 deg. F., that is to say, 3.3 deg. C.

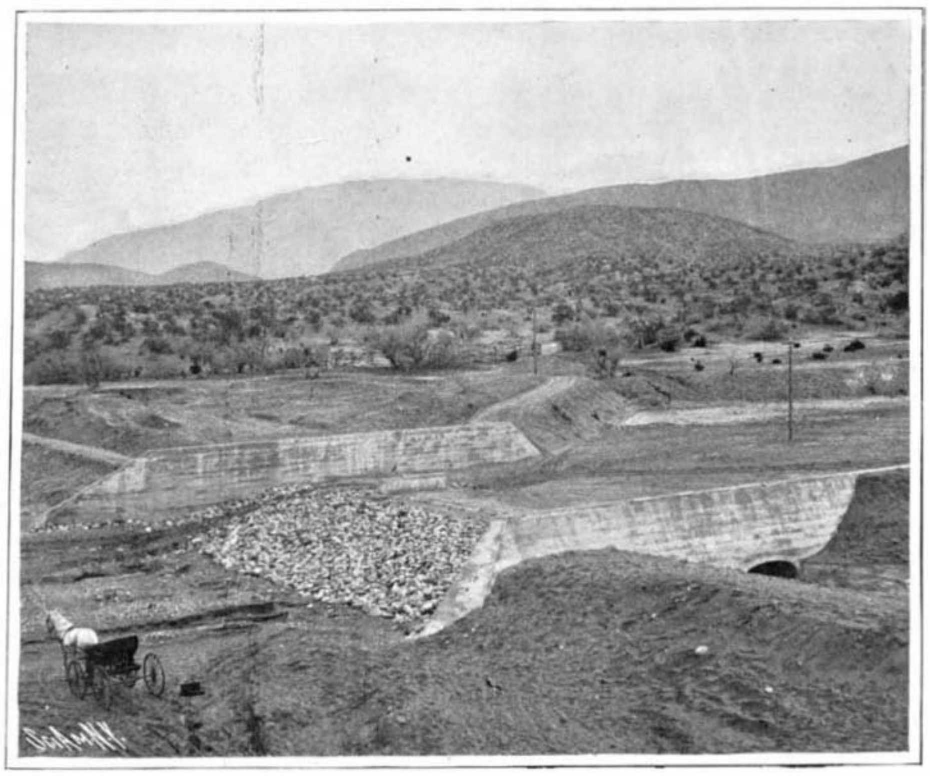
Our contemporary, La Genie Civil, makes the reason of this phenomenon clear. In tunnels there are, in fact, two new introductions of heat—in the first place that disengaged by the respiration of the passengers, and, in the second, that much more considerable one which results from the conversion of all the energies brought into play in the exploitation into calorific energy. These are furnished entirely in the form of electric current for lighting and for traction. A little reflection shows that all, whatever transitory form they may affect, resolve themselves definitely into heat. The radiation of the lamps appears immediately in the form of heat, without any other transformation. The traction current contributes, indeed, to furnish kinetic energy to the train in starting and, in normal running, to maintain the speed despite the passive resistances; but the effect of such resistances is to cause the immediate appearance of a quantity of heat equivalent to the work that they absorb; and finally, at the stoppage of the train, the braking resolves the energy of the motion acquired at the preceding start totally into heat.

If we imagine that the furnaces of the boilers of the central stations of the Paris Metropolitan were utilized not for producing an electric current, but for directly heating the tunnel, by steam pipes or some other process, the result would be nearly analogous to what we now find. Analogous and not identical, however, for it would be necessary to take into account the rendering of the boilers, of the steam motors, of the dynamos, and of the entire electric wiring external to the tunnel. In fact, the heat of the furnaces would reappear in part in many other places besides the tunnel. However, the calculation of the heat produced in the Metropolitan is easy. It suffices to know the number of kilowatts introduced into the tunnel.

It is the ventilation almost solely that intervenes to dissipate these introductions of heat, for at the end of a few months the walls of the Metropolitan took on the temperature of the air and, since their conductivity is but slight, they contributed but little toward the cooling. The air enters and makes its exit through the station doors and the open sections. The violent currents of air which prevail at the entrances are a proof that the ventilation is extremely active in the Metropolitan of Paris. For the New York subway, a calculation has been made of the volume of external air that must circulate daily in order that the variation in temperature shall remain within the indicated limits of 6 deg. F. Estimating the losses of heat by conduction as 10 per cent, it is found that all the air of the tunnel is renewed about two hundred times in twenty-four hours.

The running of the trains does not intervene profitably in the ventilation of double-track tunnels. The trains create solely violent and purely local vortices, of which the action is no longer felt at a few score feet in the rear.

As natural ventilation is inadequate in summer, it is necessary to install a forced one, if it is desired to render the atmosphere of subways supportable during hot weather. The question is under study for the New York subway, where it is proposed to install powerful electric fans. But it is necessary to resign ourselves to the fact that although an infinite volume of air should be supplied, the passengers in subways will never enjoy an agreeable coolness in summer, since the temperature of the tunnel cannot descend below that of the exterior.—Translated from Cosmos for the SCIENTIFIC AMERICAN.

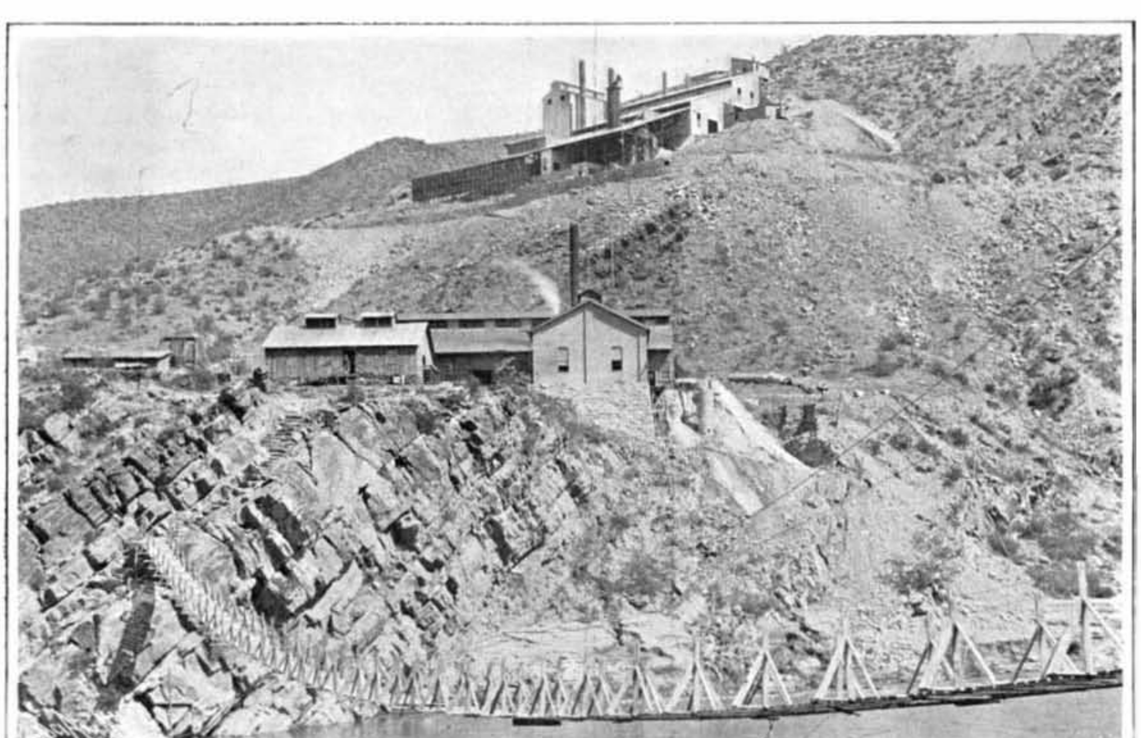


Concrete Culvert for Carrying the Power Canal Below a Mountain Stream.

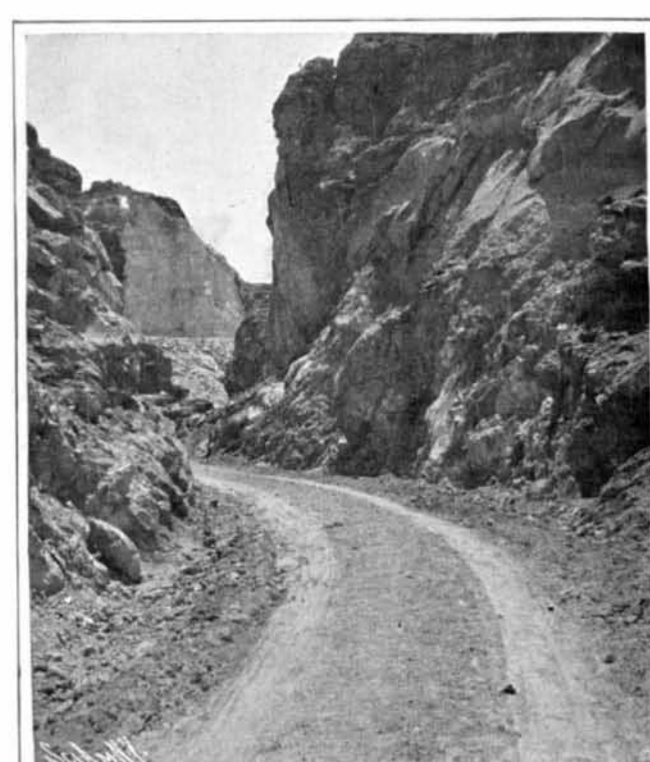
Paper Gas Pipes.

Paper gas pipes are among the novelties to be reported from Europe. It appears that paper can be used to advantage for this purpose. As to the method of manufacturing the pipes, Manila paper is cut up into strips whose width is equal to the length of the pipe section to be used. The paper bands are then passed into a vessel filled with melted asphalt. After coming out of the bath the prepared strip is rolled uniformly and very tightly around an iron rod or pipe which serves as the core and has the same diameter which the gas pipe is to have. The rolling of the paper is stopped when the right thickness has been secured. After the pipe section which is thus formed has been put through a high pressure it is covered on the outside by a layer of sand which is pressed into the asphalt while still hot. Then the whole is cooled off by placing it in water. The core is taken out and the outer surface of the pipe is treated with a waterproof compound. It is said that the pipe is very tight and is cheaper than metal piping.

The establishment of the silk industry in the United States must be a matter of slow accomplishment. Eventually enough mulberry trees will be planted to insure a supply of food for a large crop of worms. Numbers of people have become familiar with the methods of silk raising, and conditions will soon be ripe for the establishment of commercial filatures. In the meantime and under the existing conditions the establishment of some sort of market for cocoons is necessary; and it is for this reason that the Department of Agriculture, out of its appropriations, is buying and reeling a crop of cocoons which, though small at present, will increase as the work progresses from year to year.



One of the Concrete-Mixing Plants Built Near the Site of the Dam.



Heavy Cutting on Construction Road, Built by the Canal Engineers.

THE GREAT ROOSEVELT IRRIGATION DAM IN ARIZONA.