work only, or for temporary relief, and as little as possible. But if glasses are needed at all they are really more beneficial when worn for resting or distant vision than for close work; but that is exactly opposite, the author tells us, to what people wish to do or find agreeable. Too many people decide to follow their own inclination, but are sure to find later that the cost of so doing is much greater than they had expected.

Glasses do not do a bit of the work the eyes ought to do; they simply correct imperfections. In conclusion Dr. Dixon states that, contrary to the general idea, sharp, clear sight, so highly prized and the boast of many, is not the proof or the test of a good eye; for many who have the keenest vision cannot use their eyes much or with any comfort. Easy vision, he maintains, vision that can be used and enjoyed freely, without thought or fatigue, is the proper test of a good eye.

ELECTRIC WAVES AND LIQUIDS.

An Italian scientist, Prof. V. Buscemi, has recently made a series of observations in order to determine the transparency of liquids for electric waves. For such experiments it is necessary to have a very sensitive apparatus for detecting the waves and making the comparative measurements. The author used an apparatus which is based, like Prof. Fleming's, upon the magnetization of iron by the action of the electric waves, but here he uses a galvanometer instead of a telephone. To produce the waves he places the oscillator in an iron case provided with a copper cover. In order to have a complete metallic continuity of the case, the border of the cover has a flange form and dips into a circular groove containing mercury. In one of the sides of the case is a two-inch opening, over which he can dispose a glass tank some 0.25 inch thick. The latter is fixed to the case by a lead cement which is found to be entirely opaque to the electric waves. In this way none of the waves can leave the case without passing through the liquid contained in the tank. By this arrangement Prof. Buscemi found that among the liquids which absorbed the electric waves, the acids occupy the first place, as their absorbing power is greatest. Distilled water is much less transparent than air, and the latter is less so than vaseline oil. A solution of salt (one per cent) is opaque when in a thin layer, also sea water which contains some three per cent of salt. Ether, benzine, and petroleum are more transparent than distilled water, but less so than air.

RECLAMATION WORK IN SOUTHERN CALIFORNIA.

BY C. J. BLANCHARD.

The American Riviera, that beautiful valley in southwestern California in which nestles the delightful city of Los Angeles, is confronted with a perplexing problem. It is a question of water supply to meet the increasing needs of a community growing with remarkable rapidity.

The cultural development and rapid increase of population in the valleys are limited by the available water supply. As far back as a quarter of a century this supply was fully appropriated, and underground sources began to be drawn upon. To-day these wonderful reservoirs, hidden deep in the earth, which the optimistic westerners had come to regard as inexhaustible, are showing signs of giving out. Within ten years the artesian areas in which flowing water is or has been found have shrunk from 375 to 250 square miles, a loss of 33 per cent. The conditions naturally occasion grave concern, for it is recognized that upon the regulation of the acreage which safely may be supplied with underground waters for irrigation, depends in a large measure the future greatness of these coastal valleys.

Several years ago the United States Geological Survey began a systematic study of the peculiar conditions in this district, and very interesting and important data have been collected concerning the geologic and hydrographic features. The people of southern California are squarely facing these problems, and a determined effort on their part is being made to bring into this section new and distant water supplies, not only to provide for present conditions, but to meet fully the needs of the future. Distant watersheds are being examined, and plans for lifting streams from their present beds and carrying them over and through mountain areas, at a cost of millions of dollars, are being discussed in a manner thoroughly characteristic of this progressive people.

Historically, southern California offers one of the most interesting chapters on irrigation to be found anywhere in the arid West. It was during the period when our nation was yet in embryo, before Boston's tea party and the Declaration of Independence had startled the great monarchies of the Old World, that the mission fathers in this far-off valley on the Pacific slope began to teach the Indians the gentle art of husbandry. Coincident with the establishment of the Church, the cultivation of the soil by irrigation was undertaken. With the aid of the Indian converts stone dams were thrown across some of the streams, lines of canals were constructed covering wide areas, and even pipe lines made of burnt tile and mortar were utilized to make tillable the stubborn glebe.

When the American pioneer came to California, attracted by the discovery of gold, he quickly noted the abundant crops of the missions which followed irrigation, and it was not long before many of the abandoned mining ditches were utilized for agriculture.

Early in the sixties of the last century there began an era of substantial development, with works of more permanent and enduring character. By 1880 so precious was the water found to be, and so abundant the rewards following its application to the soil, that practically the entire flow of the streams was diverted and utilized. Stimulated by the very high values of the California citrus lands and the small acreage under irrigation compared with the irrigable area, a thorough investigation was begun of all the possibilities for water development.

The physiographic features of the valley are varied and interesting. The San Gabriel and San Bernardino mountains, which constitute the northern and eastern boundaries of the valley, intercept the moisture-laden clouds from the Pacific. The precipitation on their western slopes forms the perennial streams, the diversion of which has made possible the high state of cultivation that has given some of the orchard lands values of from $500 to $2,000 per acre. Owing to the steep slopes of the mountains, and to the fact that the greater part of the annual rainfall occurs during winter storms of short duration, there has always been a heavy loss of water through floods. The narrow river canyons offer slight opportunity for storage, and but few projects of this kind actually have been constructed.

These valleys and plains are not normal, but are made up of a series of deep filled troughs separated by ridges, which rise higher and higher toward the interior. These troughs and their separating ridges have been formed by geologic processes. The rivers, having existed before the geologic period which created the troughs and ridges, have maintained their way across them from the higher mountains to the sea, cutting their channels through series of ridges and filling the intervening basins with sands, gravels, and clays. As the streams emerge from the mountain canyons their velocity is lessened, and the heavier bowlders, gathered by erosion, are first deposited. The deposit becomes finer and finer as the streams proceed, until the tiny particles which sift downward form a sheet of impervious clay. These clay caps slope with the streams, and the water percolating through the gravels of the basins accumulates behind them, gathering pressure from the ever-increasing weight of waters, and producing artesian wells wherever the clay covering is pierced. When the underflow encounters the ridge at the outlet of an upper valley, the water is forced to the surface, and flows on to the next basin where, unless diverted, it sinks into another gravel-filled basin. These basins are not only storage reservoirs, but act as effective regulators of the hide-and-seek rivers, protecting them from evaporation and contamination, and producing a remarkable uniformity of flow at the canyon.

The history of irrigation in this valley is one of steady growth and development. Southern California now leads the United States in the diversity of methods of application, in scientific and detailed distribution, and in the expensive character and boldness of design of its irrigation works. All the irrigation conduits are either cement-lined canals or pipes. The irrigation systems in this part of the State are known all over the world. Surface water, drainage water, seepage water, water from artesian wells, from tunnels penetrating the mountains, and waters impounded in reservoirs are alike utilized.

This intensive development was partly the result of a series of dry years which began about a decade ago. The preceding ten years were years of unusual rainfall, and the acreage brought under cultivation was in excess of that which could be supplied by surface streams when the dry period came on. California's most important and valuable crops are perennial plants, citrus and deciduous fruits, and walnuts, and the failure of the water supply for a single season means an enormous loss to the irrigator. The successful installation of the Gage canal system, which was completed in 1886 to cover 7,500 acres of citrus lands, and which furnished a splendid example of the feasibility of utilizing the underground waters, gave an impetus to the development of this source which has been continued until now there are nearly 3,000 wells and about 1,600 pumping plants in operation, representing a capital of approximately $3,500,000, and having a combined continuous flow of from 400 to 500 second-feet. There are few important irrigation systems whose supply has not been augmented during the past ten years by artesian or pumped waters, to make up the deficiency in stream flow.

While the underground reservoirs, which have proven of incalculable value to the irrigators of southern California, are of such enormous extent that they more than compensate for the lack of storage facilities, the fact can no longer be overlooked that the drain put upon them in the past few years has resulted in a notable decline in the water levels. A system of observations upon the fluctuations of ground-water levels is in progress under the direction of the United States Geological Survey, but it will be of increasing value if continued for a period of years. One notable fact has been discovered. The water level has been steadily declining, even in years of normal rainfall, so that the reclamation of virgin lands through the indiscriminate increase in the number of wells is a menace to the present irrigation systems. A series of years of increased rainfall may possibly restore the volume of ground water, but it is an unsafe assumption to make in the absence of scientific records showing this to be a fact.

ENGINEERING NOTES.

Like so many other details not only in marine engineering but in other lines of work, features which are introduced in a practical way in recent times are found to have a comparatively ancient origin. This is true of the water tube boiler, which in its recent use dates from about 1880. The excavations at Pompeii have shown small boilers almost identical in construction with some of the best of our water tube boilers, although they were doubtless only used for a circulation of hot water.

During the official trials of the new turbine steamer "Onward" for the Dover-Calais channel service of the South-Eastern Railroad, a record for this class of vessel was established. The "Onward," which was built by the Messrs. Denny Bros., of Dumbarton, is practically a sister ship to the "Queen," which has been plying upon this route for many months past with complete success. A large number of improvements, however, have been embodied both in speed and comfort. In the mile run on the Firth of Clyde, a mean speed of 22.54 knots was attained. Another noteworthy feature of the trials was the remarkable speed of fifteen and a half knots which was attained with turbines reversed. The "Onward" will be able to cover the distance between Dover and Calais in 45 minutes, which is an acceleration of ten minutes upon the scheduled time of the sister ship "Queen."

Municipalities have a right to insist upon the abatement of black smoke by all users of steam boilers, without regard to the purposes for which the steam is used or the means to be adopted for abatement. This, because smoke is a public nuisance and because it can be abated without hardship to the owner of the plant. Nevertheless, when the evil is present and has been present for a period of years, it is not good policy to be too radical in the enforcement of the statutes. The law should be definite and stringent and the penalties adequate, but they should be enforced with discretion by officials who have some technical and practical knowledge of smoke abatement. It is absurd to talk of putting this matter into the hands of the police or of the health officer. The official having charge of this work should be a trained engineer, if possible a technically educated man, and he should be entirely above graft in any of its disguises.

German papers state that acetylene gas, generated from calcium carbide by the simple addition of water, has not met expectations, which, however, were very great. On account of the ease with which a gas for lighting purposes could be obtained, it was believed that it would be used very extensively, but the boom in the acetylene industry did not last long. New uses for the gas have been looked for for some time. The latest invention is its use as an explosive. By means of an air mixture, explosive force is obtained which can compete with that of powder and dynamite. The explosion takes place in an air chamber and is caused by an electric spark. For this purpose carbide of calcium is reduced to small particles and put into a cartridge, consisting of a tin box. In this the carbide lies at the bottom and above it is a partition filled with water. Above this is a vacant space with the electric percussion device. On the side of the cartridge is an iron pin by means of which the partition between the carbide and the water can be perforated. After the drill hole has been completed the cartridge is placed into it and the hole is closed with a wooden stopper. Then the protruding iron pin is dealt a blow, by which the partition is perforated and the water is caused to come in contact with the carbide, whereby acetylene gas is generated. This mixes with the air of the drill hole. After five minutes the gas is ignited by an electric spark. By this method of blasting the rock is said to be not thrown out but rent with innumerable cracks, so that it can be easily removed afterward. About 1.7 ounces of carbide, which produce about 16 quarts of acetylene gas, is used for each cartridge.—Mines and Minerals.

At the commencement exercises of the Western University of Pennsylvania, the honorary degree of Doctor of Science was conferred upon Dr. Marcus Benjamin, of the United States National Museum, whose name will doubtless be familiar to the readers of the SCIENTIFIC AMERICAN as that of a frequent and valued contributor.