

DITCHING ACROSS THE GREAT DIVIDES IN THE ROCKY MOUNTAINS.

BY B. A. CRAFTS.

The Water Supply and Storage Company, of Fort Collins, Colo., upon the completion of the Larimer County ditch, found its water supply to be deficient. The ditch was taken from the north side of the Cache la Poudre River, near the foot-hills of the Rocky Mountain range, and leads through the eastern part of Larimer County and into Weld County. Its length is about seventy miles. It is thirty feet wide at the top and twenty feet wide at the bottom, and it has a carrying capacity of 660 cubic feet of water per second. Under it there are some 20,000 acres of land susceptible of irrigation. Owing to the amount of water taken from the Cache la Poudre by prior appropriations, there was not enough left to enable the company to carry out its original designs. Storage reservoirs in connection with the ditch were constructed on the plains, having a capacity of six hundred million cubic feet of water. These were filled at such times as there was water to spare from the river, but even with the water thus held in reserve there was not enough to supply the deficiency. It needed not only an additional supply for the ditch during the irrigating season, but for the proper filling of the storage reservoirs.

To secure more water from the Cache la Poudre River was out of the question, nor were there other streams having still unappropriated water at convenient distances and tending in the same direction.

At the head of the Cache la Poudre in the higher altitudes of the Rocky Mountains and some sixty miles above the headgates of the Larimer County ditch was Chamber's Lake. This had been formed by a deep depression, and covered at low water 135 acres, and at high water 212 acres. The ditch company incorporated Chamber's Lake as a storage reservoir, and constructed across its outlet an immense earthwork dam, which raised the lake and gave the company one hundred

headwaters of the Grand River, which flows southwesterly and empties into the Colorado River, which in turn flows to the Pacific. Yet the engineers upon investigation found that by tapping these streams at an elevation of some 10,000 feet above sea level, water could be conveyed over the intervening divides and delivered into the headwaters of the Cache la Poudre, and that the water could be legally appropriated, as the streams named yet held large quantities that had not been appropriated for irrigation purposes. The company thereupon decided to obtain a portion of this water by bringing it over the divides to the Cache la Poudre watershed.

They began by tapping the Big Laramie. They commenced their ditch, which was to act as a feeder, high up in a gulch on the northern slope of Mount Cameron, where the river had a discharge of some 500 cubic feet of water, and swung it round to the eastern flank of the mountain to Chamber's Lake, a distance of some five miles, where it discharges into the lake. It was a difficult piece of engineering, located as the ditch was at such a great altitude, and upon the side of a mountain whose slope was at an angle of about 45°. There were three principal classes of material encountered in the excavation—loose earth, loose rock, and solid rock. One tunnel 110 feet in length through solid rock was con-

to permit all floatage to be carried over the flume and discharged into the creek below. Our view was taken on June 25, 1899, and shows the snow banks up the gulch; the bank of the ditch on the left joining the flume in the center; the bridge across the gulch lying parallel to the flume, the automatic wasteway and the surplus water pouring over the apron. The flume is just back of the bridge and extends around to the right.

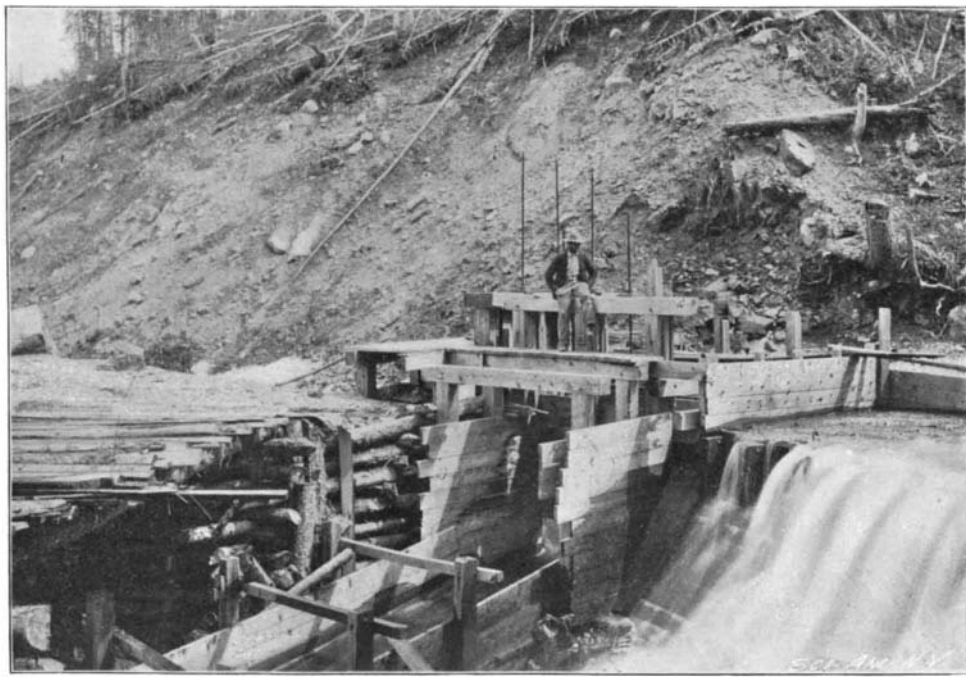
The ditch is five miles in length; eight feet wide at the bottom and twelve feet wide at the top, and will carry water to the depth of four feet. Its carrying capacity at its head is 240 cubic feet per second; but in order to embrace the water of the intersecting creeks its capacity is gradually increased until at its outlet it has a carrying capacity of 400 feet. The ditch has stood the test well. The lower bank has settled down very solidly and has not yet experienced a single break. The upper bank, however, is subject to a constant sliding process from above. Some parts of the mountain side are springy, and from these, earth slides result. It was also found that the swaying of the



INTERSECTION OF BIG LARAMIE DITCH AND TWO-AND-A-HALF MILE CREEK.



THE CHAMBERS LAKE DAM.



BRIDGE, WATERWAY, AND FLUME AT TWO-AND-A-HALF MILE CREEK.

and thirty million cubic feet of water to draw upon as they found it necessary. But one day, when the reservoir was full, there came a cloudburst above it, and the rush of water into it, coupled with a supposed weakness of the dam at the wasteway, burst the dam, and an immense body of water was let loose and poured down the cañon and into the valley below, causing great damage and entailing much vexatious litigation. The loss was so great that the company was slow to reconstruct its dam, and other sources of water supply were sought.

In the vicinity of Chamber's Lake are the head waters of several other mountain streams. Northward some five miles on the northern slope of Mount Cameron are the headwaters of the Big Laramie River, which flows northward and empties into the North Platte River in Wyoming. Westward about the same distance is Cameron Pass, where Michigan Creek and several other small streams have their rise and flow westward down into North Park and empty at last into the North Platte itself. Again, to the southwestward and lying beyond the continental divide are the

constructed. The difficulties of construction may be readily imagined when it is stated that the ditch was constructed at least 1,500 feet above the base of the mountain. In the first place, the timber was all cleared from the side of the proposed ditch and then about a foot of vegetable mould was scraped off down to solid ground, and banked on the lower side. With the felled timber, log curbing was constructed to hold the lower bank. Where there was standing timber on the lower side, the felled timber was rolled down against it thus forming another scheme of retention. At intervals for at least two-thirds of the distance around the flank of the mountain small streams were intersected. These were turned into the ditch to add their waters to the general supply. The principal of these streams was Two and-a-half Mile Creek, the intersection of which with the ditch is shown in one of our illustrations. The ditch was at first flumed across the gulch, and then the water from the creek was carried into it over a latticed apron. The apron was designed to both break the force of the water, for the better protection of the flume, and also

trees on the upper bank caused a loosening of the soil so the standing timber was felled some twenty-five or thirty feet further back from the bank. To prevent breakage from sudden floods caused by cloudbursts above, automatic wasteways have been constructed. Log cribbing has also been built upon the upper bank and along the most exposed parts in order to catch loose matter that may slide down from above.

The company has also reconstructed its Chamber's Lake dam, but in a more substantial manner than formerly. That part of the old earth dam which was carried out has been replaced by a strong dam of piling. The round piling was driven to depths varying from 23 to 25 feet, and the sheet piling from 10 to 14 feet. The dam is 11 feet high above the main floor, 190 feet long on top and 150 feet at the bottom. The dam is built into the old embankment, which is 63 feet wide at the base and 30 feet wide on top, and is faced with crib-work. The new dam and a part of the old are shown in one of our illustrations. The end of the old embankment may be seen at the left. The new dam may be seen in the center, and at the right

the water may be seen flowing over the outlet. The outlet consists of five gates, each 2 feet 8 inches by 4 feet, making 53½ square feet. The gates are operated by screw power. The up-stream front of the gates has an apron 16 feet wide with a drop of 3 feet well packed in gravel. On top, and level with the main floor of the dam, is a second floor, and also sides reaching nearly to the top of the dam to prevent the gravel filling on the apron and in front of the main dam being carried away by the current. Below the gates a flume 32 feet long was built in order to carry away the water from the main dam and prevent washing and undermining. The dam will carry 10 feet of water, and the amount of water that can be held in store is 55,000,000 cubic feet.

Sound Reflection and Refraction.

BY REV. JOHN M. BACON, M.A., F.R.S.

More than one recent disaster at sea, still unexplained, has pointed to the necessity of reconsidering certain accepted dogmas relating to the transmission of sound waves, and official reports of a disquieting nature from look-out stations have called once and again for serious investigation of the anomalous behavior under special conditions of such sound signals as are commonly in use at sea. In particular it has been insisted on that the hearing of the siren and fog-horn is apt to prove uncertain and that, on occasions at least, there are to be found areas or zones of silence where their warning will unaccountably fade or else cease altogether to be heard.

It would appear, however, that this peculiarity is not by any means confined to the signals of those instruments of which the siren is the type. The writer has had special opportunities of experimenting with explosive signals of many kinds, and has on three separate occasions, and under very different circumstances, carried out systematic trials on the penetration of the service cotton-powder cartridge fired at different heights from balloons while traveling over diversified open country as also over populated districts including London itself. These trials have drawn records from a large number of independent observers, whose statements, when carefully analyzed and compared, have proved beyond all reasonable doubt that even the most powerful and deservedly well trusted form of modern explosive signal is sometimes fickle in its character, failing or fading in unexpected quarters without obvious cause.

It will probably be readily conceded that the explanation of these facts must be sought not so much in any peculiarities in the sounds themselves as in the condition of the medium through which they are propagated, and it is here that the views expressed perhaps too confidently a generation ago may need to be modified. Certain conclusions as to states of atmosphere commonly affecting the passage of sound waves have perhaps remained too long unchallenged.

Thus Prof. Tyndall states that while conducting experiments with sound signals at the South Foreland there were present always and in all weathers invisible acoustic clouds which returned echoes from the instruments and cannon planted on the summit of the cliff overhead. Hundreds of cannon-shots, he states, were fired, and were always followed immediately by a rumbling which the Professor asserted must have come only from out of the empty air. If this were so, then we must conceive that there was constantly present in the air some form of obstruction that not only impeded but reflected back the waves of sound that were being emitted.

It is with regard to this point that some results recently obtained may be deemed instructive. In the first place, although during the experiments in which I have been concerned some scores of cotton-powder signals have been fired from balloons under very different meteorological conditions, nothing of the nature of an aerial echo has ever been suspected, and the dead silence aloft has always been absolutely unbroken after each report until, after an interval of several seconds, the earth itself has replied with a burst of sound which has reached the ear even at the height of a mile with all the intensity and reverberation of a thunder-clap. This striking result, invariably the same, appears highly significant, and would point to the conclusion that the initial report immediately consequent on a lightning flash is, like the fog-signal bursting below the ear, comparatively speaking only a trivial sound, while the great uproar of sound must practically be wholly due to echo, which is presumably largely off the ground. In support of this I would state that when one of the signal cartridges already described is fired, say, 150 feet above the ground, in moderately open country, an observer below hears a series of extremely powerful echoes which he can easily trace to each clump of trees or building around, and several seconds after this elapse before the subsequent conflict of reverberations ceases. Further, when such a rocket signal has been fired over a wide extent of quiet common terminating at some distance in an abrupt decline, it has awoke surprising and unexpected echoes from woods lying in the valley, although these have been completely out of sight and sheltered from the

ear by a considerable stretch of intervening level ground. In this case both the incident and reflected waves of sound had clearly been deflected or bent over the shoulder of the hill which hid the woods from view.

I would then submit, first, that a condition of atmosphere causing aerial echoes is by no means the normal condition, and, secondly, that the return of sound which Prof. Tyndall, when stationed under the cliff, appeared to hear almost instantly from the offing way in actual fact have been deflected from cliffs and headlands hard by but out of sight.

That aerial echoes are sometimes heard I would, as the result of my own experiences, very readily admit, and I would regard the condition of atmosphere favoring this phenomenon as one probable cause of that failure of sound at certain spots which has been already referred to.

But some other dogmatic statements which have already done service full long respecting the reflection of sound waves may well be questioned. Take the well-known example attributed to the Whispering Gallery of St. Paul's. Here as I have pointed out elsewhere the transmission of a whisper around the circular wall is obviously not due to reflection in the ordinary sense, as any one may convince himself by testing the phenomenon in quiet night hours. Or, again, if on a calm day a smooth crescent-shaped surface similar to a segment of the Whispering Gallery be constructed in the open—as may be readily done by means, say, of a length of continuous stout brown paper stretched on battens—an experimenter will find that the Whispering Gallery effect can be produced under circumstances where reflection from an opposite surface is impossible. A whisper communicated either by the mouth or suitable instrument against such a curved surface appears to course round in close contact with the surface.

I would note that the description given by Sir John Herschel of the peculiar phenomenon of the Whispering Gallery, which has been copied and re-copied into every text book, is obviously incorrect, and so also, as I am prepared with due permission to point out, is that relating to the echoes at Woodstock. From which I would gather that neither Herschel nor those who have quoted his words have ever investigated the phenomena in question.

In connection with echoes a very noteworthy result has presented itself in the course of the acoustic ballooning experiments in which I have been engaged—namely, that the echo from earth of exploding signals has been always and uniformly retarded. This result has been obtained and verified very many times by independent observers using carefully corrected instruments, and no doubt has been entertained of its truth. Whether, however, this retardation be due to a diminution in the rate of sound traveling vertically through the atmosphere or to any "dwell" or "lag" in the actual reflection of sound I am not at present prepared to state.

As suggesting a further cause possibly operative in the occasional local failure of sound signals, I would call in evidence certain experiences of my own with regard to the effect on sound of fog or cloud. Prof. Tyndall insists that fog has no sensible power to obstruct sound, while air associated with fog being, as a general rule, highly homogeneous is favorable to the transmission of sound.

I am able to assert that this view is very far from being generally accepted by practical men employed on look-out stations, and it is entirely opposed to the statements of Stevenson and other eminent authorities. My own observations gathered in balloon voyages, and also during a sojourn of several days and nights, generously granted me by Trinity House, on the Maplin Lighthouse in thick weather, go to show that whereas a condition of still and settled fog may aid the travel of sound, compacted cloud-heaps or wreaths and masses of rolling mist are capable of refracting and diverting sound waves in a manner that will deceive the most practiced ears. For example, the warning of neighboring light-ships' fog horns as heard from the Maplin are influenced in a far greater measure by the circumstances and qualities of intervening fog than by a gentle wind; moreover, a horn which had been nearly quenched by interposing mist has been observed to sound with far more than normal intensity as soon as the fog had rolled away behind, forming a background to gather and reflect the sound wave.

I would call attention to the fact that many accepted statements that have done duty in the past with regard to the travel of sound waves seem to have been based on the results of experiments conducted in the laboratory, and I would submit that a more unfavorable place for satisfactory experiments on sound could hardly be chosen, inasmuch as the six bounding surfaces must surely cause reflection seriously endangering the truth of results obtained. Conducting experiments of this kind must often rather resemble such a feat as trying to project lantern pictures in a room where walls, floor, and ceiling are all faced with brilliant mirrors.—Knowledge.

Automobile News.

The automobile never ceases to be an attraction at the modern country fair, and several persons make their living by making the circuit of the country fairs.

The Chiswick (London) Vestry has used motor vehicles for the removal of ashes, etc., for about two years, according to The Motor-Car Journal, with great satisfaction.

A motor fire engine has been constructed by an English firm of fire engine builders. Engines of this kind have been in use in the United States for some time and have been successful.

Baron von Anachetto has crossed the Alps between Switzerland and Italy by way of the Brenner Pass. The road was excellent and was largely used by vehicles drawn by horses until the Brenner Railway was opened.

A Philadelphia paper is trying to organize a race for motor-vehicles to take place on Broad Street, the longest asphalted street in the world. Competitions of this kind are most unfortunate for the industry, and their value is very slight.

An international congress of automobiles to be held in Paris during the Exposition is under consideration. There is little question that such a congress would be educational to the drivers of the vehicles themselves and of great benefit to the new industry.

There is one automobile paper in Austria, two in Belgium, and in France there are twelve, including two dailies, seven weeklies, one bi-weekly and two monthlies. There are two in Germany, three in Great Britain, and in this country we have seven or eight.

An automobile exchange and training school has been opened in West Fifty-eighth Street, New York city. Here vehicles propelled by different motive powers will be kept in service and competent teachers and repairers will be ready to instruct the novice and to repair vehicles. A course of five or ten lessons in the management of automobiles will be given.

The Automobile Magazine has at last come to hand and is the most thoroughly satisfactory periodical which we have seen in any language on the subject. It is of regular magazine size and has 111 pages. The quality of the articles is very high and the illustrations are of the best. Everyone who is at all interested in the automobile will find something in the new magazine which will interest him. Even the social side is far from being neglected, as there is an article on the recent floral parade at Newport and on the Automobile Club of France. The Automobile Index, which occupies some nine pages, is exactly what has been needed. On the whole the magazine is a most satisfactory one.

Manufacture of Artificial Sponges.

The process patented by Dr. Gustav Puum, of Graz, Germany, consists principally in the action of zinc chloride solution or pure cellulose. The results are amyloid and hydrocellulose-like products, which swell up with water, but turn horny and hard on drying. In order to retain for the product the property of also absorbing water after drying, alkali-haloids are employed in treating the cellulose with zinc chloride, and finally the product is subjected to a mechanico-plastic treatment. Thus, for example, 2,000 grammes of concentrated zinc chloride solution and 2,000 grammes of sodium chloride are used for 100 grammes of cellulose, whereby a pasty viscous mass is obtained which is mixed with about 1 kilo of coarse grained rock salt. The plastic mass thus obtained is pierced in a press mould with pins, after whose removal the pressed material appears traversed by small canals in all directions. The excess of salts is removed by washing one or two days with alcohol and water. The product thus obtained can take the place of natural sponges in all its uses, and may especially serve for filtering water for sanitary and industrial purposes. It is also suitable for filling up life preservers, for the production of anchor buoys, as well as in surgery for absorbing secretions, etc.—Chemische Revue über die Fett- und Harz-Industrie.

Fires in the United States.

The Chronicle Fire Tables which are published annually by the organ of fire underwriters give some curious details regarding the fire losses in the United States during the past year. They show that the average loss by fire has been reduced in ten years from \$6,922 in 1888 to \$1,860 in 1898. The insurance loss in the same period was reduced from \$3,993 to \$1,056. The extended use of electricity has brought about a large increase in the way of fires due to electric wires and lights. Ten years ago there were only sixty-six such fires, but in 1898 there were no less than 958. Defective flues are responsible for 11.23 per cent of the fires. Incendiarism is accredited as the next largest cause of conflagrations. No less than 6,891 incendiary fires are shown to have occurred in 1898. 3,479 fires were caused by lightning; 1,179 by spontaneous combustion; 295 by friction in machinery; 94 by natural gas; 14 by dust explosions, and 5 by the sun's rays passing through window glass. 12,204 fires had no assignable cause.

Science Notes.

There are twenty carbide manufactories in France, most of them obtaining their current by means of water power.

The British Association for the Advancement of Science has granted a thousand pounds sterling toward the expenses of an Antarctic expedition.

Prof. Kreutz, at Kiel University, has telegraphed the Harvard College Observatory, on October 1, that a comet was discovered by Gacobini at Nice, on September 29.

The work of equipping the elevated railroad of Brooklyn with the third-rail system of motive power is progressing rapidly. The Fifth Avenue line is already being operated by electricity.

One of the laundry trade journals recently noticed a new antiseptic which is intended to sterilize clothes when being laundered, thereby preventing contagion. A formaldehyde solution is solidified, and this is used by laundrymen.

United States Minister Merry at San José, Costa Rica, has informed the State Department that the government of the country has issued a decree establishing international copyright between Costa Rica and the United States.

The Nathorst expedition, which has been searching along the coast of Greenland for Andrée, arrived September 12 at Malmo, Sweden. No trace of the aeronaut was found, but a new series of inlets were discovered and valuable ethnographic material was obtained.

The London poor suffer terribly from overcrowding. According to The Sanitary Record, 15,150 persons lived in 4057 tenements with one room in the parish of St. Mary's, Newington; 40,184 persons in 7,670 two-roomed tenements; and 13,742 persons in 1,752 three-roomed tenements.

According to The Engineer, an American firm is turning out a large quantity of paper tiles for roofing purposes. They are said to be hard and tough, and the glazing somewhat resembles Japanese lacquer. They are said to be cheap, and can be made in any color or shape to suit the purpose.

The number of women in attendance at the German universities during the summer semester of 1899 was 355. There were 179 at Berlin, 45 at Bonn, 27 at Breslau, 29 at Göttingen, 13 at Heidelberg, and 19 at Halle. The University of Strasburg has just decided to admit women to its courses. Hitherto it has closed its doors to women, but now there is no German university where they may not pursue their studies.

In The Physical Review, Prof. E. L. Nichols states that he had utilized a spell of exceptionally cold weather at Ithaca to make experiments in thermal expansion. These were made on bars of artificial ice 45 cm. long, and the open-air temperature fluctuated between -3° and -17° . The marks observed in the microscopes were the rims of small drops of mercury lying in hollow cavities in the ice. The coefficient obtained was 54×10^{-6} , which agrees best with Struve's value.

Prof. Knight and his party have returned after visiting the fossil lands of Northern Wyoming. The expedition left on July 21, and returned September 1. In addition to the discovery of a large number of fossils, photographs were taken for the first time, and after great difficulties, of the Upper Platte Canyon and of Bate's Hole. The expedition has proved so successful in every way that the Chicago & Northwestern Railroad is now planning for next season a similar undertaking from the western terminus at Casper, Wyo.

Herr F. Czapek confirms the observations of Miyoshi and Marshall Ward, that the hyphae of certain fungi have the power, not only of perforating wood, but also of consuming the stores of starch and other food materials in the tissues of the host-plant. In the cases of *Pleurotus pulmonarius* and *Merulius lachrymas*, he succeeded in extracting the enzyme by means of which the lignified walls of the cells are destroyed, and proposes for it the term hadromase, in contradistinction to the cytase which consumes the cellulose.—Ber. Deutsch. Bot. Gesell., 1899, 166.

Mr. W. F. Rigby, of Philadelphia, says, regarding the effacement of the records from phonograph cylinders, "Place the cylinders on a mandrel and put it in the lathe or on the mandrel of the phonograph. In this case the motor of the phonograph is not quite of sufficient power to turn out a highly-finished cylinder. If, however, the hand wheel is connected direct to the phonograph, the results are better. Take a smooth rag and moisten it in spirits of turpentine and rub it on the cylinder, keeping it constantly rotating, then rub for a short time with a rag moistened with alcohol. After this dry and polish with a smooth cloth." By the above method a cylinder can be cleaned in about a minute with a finely-polished surface far surpassing any record that has been shaved. Records taken on the cylinders so treated have the grating sound so objectionable in low talking records reduced to a minimum.

Engineering Notes.

On January 1, 1899, the length of the whole Russian railway system opened for traffic was 26,958 miles. This included the lines in Russian Asia.

According to The Engineer, acetylene gas kept in its holder for some days falls off in lighting power and its deterioration is well marked even after twelve hours.

It is expected by the end of the year that a hundred locomotives on the Boston and Maine Railway will be fitted with water grates, so that coke can be used as a fuel.

The Board of Ordnance and Fortification has decided that the utmost care shall be exercised in having tests carried on at the proving grounds so that the character of the projectiles, explosives and guns experimented with, and the results of the tests, will not be made public.

The Eiffel Tower is being painted with five shades of enamel paint. The summit and the dome are to be a chrome yellow. The shades will graduate to the pedestal, which will be of dark orange. Two coats will be required and nearly fifty tons of enamel paint will be consumed.

Delaware Avenue, Philadelphia, Pa., has been widened from about 50 to 152 feet, and a strip 100 feet wide has been reclaimed from the river. The extension of the piers is also being made. It is being done by the Bureau of Surveys of the Department of Public Works, of which George S. Webster, C. E., is chief engineer.

During the Dewey land parade it is estimated that 800,000 people used the Brooklyn Bridge cars; the Sixth and Ninth Avenue Elevated Roads alone carried 490,000 passengers; 240,000 by Pennsylvania Railway and ferries, and 3,000,000 in all saw the parade. Notwithstanding the enormous volume of traffic on all of the roads, the percentage of accidents was trifling.

A manufacturing firm of Hamilton, Ohio, shipped on September 11 the equipment of one of the finest paper mills in the world. It was sent to Yokohama for the Japanese government, and was loaded on twenty-five cars. Japan has decided to make her own paper, as some of her state documents have deteriorated with age. The machine will turn out a 109-inch strip of the finest book paper 400 feet long each minute.

The Hydrographic Office of the Navy Department has published a new chart of the world showing the ocean tracks with distances given in nautical miles. The longest steamer route given on the map is that connecting New York and Esquimaux by way of Cape Horn, 16,290 miles. This is exceeded by the track used by sailing vessels connecting New York and Yokohama via the Cape of Good Hope. This is 16,900 miles in length.

The Italian Ministry has ordered 111 locomotives, 458 passenger coaches, 56 luggage vans and 3,050 goods wagons, or freight cars as we term them in this country. The total value of the order is over \$8,000,000. According to The Engineer, this increase in the rolling stock is in addition to the 112 locomotives and 1,050 goods wagons which have already been ordered to meet the needs of the Mediterranean and Southern Railway of Italy.

A correspondent, Mr. Nathan Appleton, of Boston, suggests that steamers of the size of the "Oceanic" could not pass through the Nicaragua Canal. According to the report of the Walker Nicaragua Canal Commission it is recommended that locks 665 feet in length be constructed. The length of the "Oceanic" being 704 feet, it would, of course, be impossible for vessels of this size to pass through the canal even if it should be finally built. Mr. Appleton recommends the construction of a tide-level canal at Panama.

An experiment is being tried by the High Wycombe Company of renting gas engines. High Wycombe is devoted almost entirely to chair making, and in this trade a small number of manufacturers are engaged. The locality seems a proper one, say Industries and Iron, in which to develop the renting of engines. A well equipped office has been opened for demonstration purposes, and the company will put in service pipes and fittings free of cost. The gas engines are not only rented, but are also sold on what they term in England the "hire-purchase plan."

Two acetylene gas plants are being installed at two of the shafts of the Washington aqueduct tunnel. The plants are of 60 and 300 burners capacity, respectively. In a report by Lieut.-Col. A. M. Miller, of the Corps of Engineers, United States Army, it is stated that the fumes and smoke from the blasting added to the smoke from torches and lamps rendered the atmosphere very offensive and discomforting to the workmen. Acetylene gas was selected as the most available and economical for the special purpose. The gas pipes are carried down shafts from the plants and run along the tunnel with cocks for burners every 30 feet, and this system suffices for the illumination of the tunnel for a distance of about 2 miles. Movable lights of several burners are connected with rubber hose and used to concentrate the light in the immediate vicinity of the work.

Electrical Notes.

There are 112 towns in France outside of Paris which are provided with telephone exchanges.

Hawaii is said to have more telephones in use in proportion to the population than any other locality in the world.

Telephone rates at the Paris Exposition will be \$60 for the installation and service during the period of the exposition.

The power station of Niagara Falls Park and River Railway was destroyed by fire September 4, and much valuable machinery was ruined.

In London the various underground electric systems for rapid transit involve the expenditure of about \$100,000,000 for their completion.

Catania, Sicily, will soon have twenty-four miles of electric railways, the municipal authorities having given the concession to German capitalists on terms advantageous to the city.

The automatic coin-controlled telephone is in considerable use in Berlin, and if the results of the experiments are satisfactory, this means of communication will be used all over Germany.

From 1893 to the present year the number of steam boilers in the Transvaal has increased from 1,071 to 2,282; three of the gold fields alone employing no less than 280 dynamos, supplying 1,400 motors and 33,000 lamps.

According to The Electrical World, the plant of the Société Lyonnaise de Force Motrice du Rhône has now 504 contracts for power, amounting to 2,465 horse power, and 834 contracts for current for lighting equivalent to over 36,000 incandescent lights.

According to reliable newspaper reports, dispatches from the Continent state that the telephone department of France has received \$90,000 for the dispatches which were sent out during the Dreyfus trial at Rennes. Between eight and nine million words were sent out.

The Pike's Peak Power Company proposes to develop 3,200 horse power for distribution for mines in the neighborhood of Cripple Creek, Col. The source of the water supply is Beaver Cañon and a steel and rock dam will be built, having a storage capacity of 150,000,000 cubic feet.

The Kashmir Railway is to be constructed over 186 miles in the most mountainous part of India. It will be operated by electricity, water power being used. This permits of a much lighter motor for drawing the same load, and also permits of grades which a steam engine could not climb without recourse to the rack system.

Many of the Young Men's Christian Associations are giving instructions in electricity to evening classes. Technical instruction for those engaged in the electrical industry is important, and unfortunately they are in too many cases deprived of opportunities for obtaining electrical knowledge beyond that which can be gained in connection with their everyday work.

Dr. E. W. Scripture described before the American Association for the Advancement of Science the method of producing an æsthesia by the direct application of an electrical current without the application of drugs. An alternating current with equal positive and negative phases was made to traverse the nerve. At a proper frequency of about 5,000 complete periods in a second it can be made to cut off all sensory communication by this nerve. Needles can be run into the part of the body supplied by this nerve without any pain being felt.

An electric fog horn has been invented by a Canadian electrical engineer. A naphtha engine supplies the motor power for a dynamo, which furnishes the electric current by means of which three pairs of electro-magnets operate half a dozen clappers, which strike against a large gong with the frequency of about 36,000 strokes to a minute, producing an almost continuous sound. Its effectiveness is enhanced by a mechanism on the principle of a megaphone, by means of which the sound is not only intensified, but thrown in the required direction. According to The Western Electrician, the sound from a small model was heard a distance of two miles. A full-sized fog horn is to be sent to the British Columbia coast, where it will be installed and put in operation at once.

A tunnel between the Post Office and St. Martin's-le-Grand, London, and the London and Northwestern Railway station at Euston, which has lain idle for nearly forty years, is now to come into practical use. It was built in 1859 for the purpose of carrying mails and parcels from the Post Office to the railway station pneumatically. The railway cost \$875,000. The difficulties of using pneumatic pressure on a large scale caused the project to end in failure. The power was increased from 100 to 800 horse power, but the results were the same. The tunnel is 4 feet in height and $4\frac{1}{2}$ feet in width. Now an electric train is to be run through it and a regular mail service between the important station and the Post Office can be maintained. The trip will require only about five minutes. The tunnel is also to be lighted electrically.