### Railroads in India.

The total length of track in operation at the end of March, 1884, was 10,806 miles, and at the same period in 1885, 11,975 miles, an increase of 1,169 miles, of which 989 miles were narrow gauge. The total of 11,975 miles comprised 7,477 miles (of which 858 were double track) on the Indian gauge of 5 feet 6 inches; 4,290 miles, single track, on the metre gauge, and 208 miles, also single track, of narrower gauges. This same total is made up as follows: 4,424 miles belonging to the State (3,028 to the Imperial, and 1,396 to the Provincial Governments); 1,505 miles purchased and operated by the East Indian Railroad Company (468 miles double track); 4,517 miles owned by private companies and guaranteed by the State (390 miles double track); 867 miles owned by subsidized companies, and 662 miles belonging to the native states.

Of the State lines the principal are the Indus Valley Railroad, single track, 5 feet 6 inches gauge, total length, 651 miles; the Punjab Northern Railroad, same gauge, 446 miles, and the Rajputana Railroad, metre gauge, 1,117 miles.

The following is the mileage of the East Indian and guaranteed lines:

| Railroad. | Length. | | |
|---|---|---|---|
| | Single. | Double. | Total. |
| East Indian | 1,038 | 467 | 1,505 |
| Madras | 817 | 42 | 859 |
| South Indian* | 653 | | 653 |
| Great Indian Peninsular | 961 | 324 | 1,285 |
| Bombay, Baroda & Central India | 414 | 23 | 437 |
| Scind, Punjab & Delhi | 689 | 2 | 691 |
| Oude & Rohilkund | 594 | | 594 |
| Total | 5,165 | 858 | 6,023 |

* Gauge, 1 metre—all the others 5 feet 6 inches.

The mileage of the narrow gauge lines is as follows:

| | 1 Metre. | 4 Feet. | 2 ft. 6 in. or less. |
|---|---|---|---|
| Guaranteed lines | 653 | | |
| Subsidized " | 661 | | 59† |
| State " | 2,580 | 27 | 63 |
| Native state " | 396 | | 59 |
| | 4,290 | 27 | 181 |

A total of 4,498 miles.

† 51 miles of this are on a gauge of 2 feet.

There are 1,448 stations and the passenger cars are of four classes. The nationality of the operating staff is as follows: Europeans, 2.06 per cent.; East Indians, 2.15 per cent.; natives, 95.79 per cent.

The following is a table of the locomotives and rolling-stock at the end of 1884:

| | 5 ft. 6 in. Gauge. | Narrow Gauge. | Total. |
|---|---|---|---|
| Locomotives | 1,943 | 811 | 2,754 |
| Passenger cars | 4,785 | 2,585 | 7,370 |
| Freight cars | 36,473 | 14,490 | 50,963 |
| Total | 41,258 | 17,075 | 58,333 |

### PERSONAL.

COL. J. T. FANNING, Hydraulic Engineer, is engaged the present season in the preparation of plans for the more complete development of the great water power of St. Anthony Falls on the Mississippi river, at Minneapolis, Minn.

EDW. BARRINGTON has been appointed Division Engineer of the Minnesota & Northwestern R. R., with headquarters at Oelwein, Fayette county, Iowa

O. M. SHEPARD has been appointed general superintendent of the New York, New Haven & Hartford R. R., in place of G. M. Reed, who has resigned on account of ill health.

S. H. McELROY has been recommended for appointment as engineer to supervise the work at the new county farm at St. Johnland. MR. McELROY'S father, Mr. Samuel McElroy, prepared the original plans.

EDWARD DAVIS, a prosperous railroad contractor, of Chanute, Kan., en route to Grand Island, shot and killed himself in the waiting room in the Union depot at Kansas City, Mo., in the presence of his wife and six small children.

PROF. J. A. WADDELL, of Tokio, Japan, was at the meeting of the American Society of Civil Engineers on Wednesday evening. PROF. WADDELL will not return to Japan. His present address is Council Bluffs, Iowa.

ARNOLD MELLERT, Chairman of the Mellert Foundry and Machine Company and also of the Reading Foundry Company, died at Reading, Pa., on the 17th inst. MR. MELLERT was born in Germany, June 24th, 1824. He has lived in Reading since 1837, being engaged as boy and man in the iron trade, with every branch of which he was thoroughly conversant. He was also an active participant in the political history of his adopted place, in the Select Council of which he served several terms. In addition to his practical qualities, MR. MELLERT was a good business man of large executive ability and as thorough in administration as in practical details.

### American Society of Civil Engineers.

At the meeting on Wednesday evening the paper by Capt. O. E. MICHAELIS, Corps of Ordnance U. S. A., M. Am. Soc. C. E., postponed from meeting of April 17th, on "A Note of the Cost of Concrete," was read and discussed. The paper by H. V. HINCKLEY, M. Am. Soc. C. E., on "Errors in Railroad Levels," discussed. The time of the Convention at Denver to meet is changed to July 2nd.

### Engineers' Club of Philadelphia.

At the meeting May 1st, Mr. Frederic Graff presented "Notes Upon the Early History of the Employment of Water Power for Supplying Philadelphia with Water, and the Building and Rebuilding of the Fairmount Dam." This is a very interesting paper, and should be read in full by interested parties. It will be published in the transactions of the Society, and can be had by addressing Howard Murphy, Secretary, 1122 Girard street, Philadelphia, Pa.

### Liverpool Engineering Society.

The usual fortnightly meeting of this society was held on Wednesday, the 21st ult., at the Royal Institute, Colquitt street; the vice-president in the chair.

A paper by Mr. E. G. Ferber, entitled "Wasting in Marine Boilers" (with some curious instances) was read by the author. The author in the course of his remarks drew attention to the troubles and perplexities of engineers, as well as the expense to owners, caused by the strange freaks of corrosion in marine boilers. He then referred to the recent researches in connection with the anti-corrosive properties of iron v. mild steel, in which it was found that mild steel—the material now coming into general use for boiler construction—was much more liable to corrosion than iron, and stated that in his opinion the anti-corrosive properties, as well as the strength and ductility, of the material ought to be considered in deciding the material to be used in the construction of boilers, as otherwise, in the absence of a means of preventing the corrosion, steel boilers must have shorter lives than iron ones. The author then described several "appliances" and "fluids" now in the market for preventing corrosion, and remarked that, as far as his experience went, their novelty generally exceed their usefulness. The "Electrogen" and "Zinc Slabs" were then treated of, as well as a certain make of "fluid," which had done its work well as a scale preventer, although it had failed to stop the corrosion, which was of a curious and local character.

The "Bower Barff Rustless process" was then referred to, and he instanced several cases in which iron brackets treated by this process had been used in marine boilers, and stated that after twelve months' trial they showed no signs of corrosion, although the stays which were attached to them had suffered slightly. In conclusion, the author described in detail some curious and unaccountable instances of corrosion and wasting in boilers in which none of the appliances referred to in this paper would, in his opinion, have been of any avail in preventing that decay which appears to be inherent to the marine boiler.

### Montpelier, Vt., Water Supply.*

Montpelier, Washington county Vermont, in lat. 44° 17′ N. long. 72° 38′ W., is in a valley closely surrounded by hills. Settled in 1787 it was incorporated a village in 1818. The supply of water for domestic purposes, was begun about 1820, by Mr. John Hubbard who laid a line of pump logs from a spring in his pasture about 150 feet above his dwelling and a quarter of a mile distant, first to his own home, and then from time to time extended it to his neighbors. After a time, these logs were lined with lead pipe made in the village, in lengths of 10 or 12 feet and soldered together. The lining was effected by pushing into the wooden pipe a long wire as far as it would go, and then digging down to the end of the line and cutting the log and pulling through the lead pipe attached to the other end of the wire. The lead pipe was 1 inch near the spring and ¾-inch lower down. As the number of takers increased, another line of pipe was added, coming from the opposite side of the village, from three large springs—distant about one mile and at an elevation of over 450 feet—this was a lead pipe, 1¼-inch at the start reducing to 1 inch, and then (after taking off a few branches) to ¾ inch. This line comes across a valley and over a ridge about 100 feet in height before reaching the village. Later, another line was added coming about one-half mile from two springs, with an elevation of a little more than 100 feet—with 1-inch lead pipe reducing to ¾-inch. This line supplies consumers almost from the very beginning and comes down a long hill, with several branches going to houses on the upper side of the street, 30 or 40 feet higher than the main pipe. In 1884 a line of cast-iron pipe was added coming from a very large spring distant one and one-half miles, and at an elevation of 450 feet. The first 1,200 feet after leaving the spring is of 1½-inch pipe weighing five pounds to the foot, and has a fall of 185 feet. The pipe is then enlarged to 2 inches, and in the next 1,450 feet has a fall of 255 feet more—making 440 feet in all—it then crosses a stream and flat for 1,350 feet. In the next 1,200 feet it rises 210 feet and goes over a ridge and down about 30 feet and discharges through an open pipe into a small reservoir. The 2-inch pipe is of three weights according to pressure—six, seven and one-half and nine pound per foot. From the reservoir a 2-inch pipe goes about one-half mile with a fall of 190 feet to the village.

This reservoir is made of stone and cement and is entirely underground, with a manhole in the top. It is partitioned into two compartments, each having a supply, and outlet, and waste pipe. The waste pipes are 2-in. standing or "bath wastes," which can be pulled out to empty the compartment for cleaning strainers or for repairs. There are gate valves on each pipe and one on a pipe through the partition.

The other lines of pipes have no reservoirs.

All of these different lines are brought together in the cellar of the dwelling of the present proprietor, Mr. John E. Hubbard, the grandson of the originator of the works, near the center of the village, and by a curious looking combination of crooked pipes, valves

*No 812. History and Statistics of American Water Works. By J. J. R. Croes, M. Am. Soc. C.E.; M. Inst. C.E.

and stop-cocks they are arranged so that they can be worked together or separately, or in all possible combinations. Here also are five pressure gauges on the different lines, which show at a glance whether all have the proper pressure or whether some line is a little weak and in need of assistance from its stronger brothers. In addition to the pipes above named there are about two miles of street pipes, and a little over two miles of ½-inch branches. There are about 230 consumers.

The system of supply is by gauged streams which run continuously into some sort of cistern (in many cases a common barrel) which is provided by the water-taker, and furnished with a proper waste pipe. The old style of gauges was a small copper tube (made by drawing sheet copper through a wire plate) about 2 inches long, inserted in a pine plug which had been turned to the proper size to fit the ½-inch pipe where it came through the cistern. But these plugs were so easily taken out to obtain a larger quantity of water that they gave a great deal of trouble. To meet this difficulty a brass gauge and connection between the cistern and the pipe was designed having a gauge in the end, which cannot be stopped by sediment or anything in the water and which, while it is easily taken off by the proper wrench, has thus far stood proof against all attempts to tamper with it by the consumer. This gauge is not injured by freezing, and when taken off leaves the full size of the pipe open to insert thawing tube or attach force pump. The stream delivered may be of any size, but for an ordinary house the hole through the gauge is not larger than a medium sized sewing needle, which will deliver about 100 gallons per day. The gauge in most case is in the bottom of the cistern.

The water is very pure spring water and contains a small amount of carbonate of lime which speedily forms an insoluble coating on the inside of the pipe, which effectually prevents any action of the water upon the lead.

Nearly all of the springs are built up of bricks and cement from where the spring comes out of the slate stone rock, to about a foot below the level of the ground, then a flat stone is cemented over them and they are covered up with dirt. Such of them as have to be opened occasionally are provided with an iron "man-hole" cover bolted down. Thus the water is secured just as it comes out of the bed rock and is exposed to daylight for the first time, as it boils up in each individual cistern.

The proprietor considers that the system of supply has many advantages in a cold climate like that of Vermont as the pipes are nearly proof against freezing. It is cheaper than any other on account of the small pipes used. It is stated that a single ¾-inch pipe has supplied satisfactorily over 100 houses. In some cases the cistern is in the attic and supplies an elaborate system of house piping and in others, where cheapness is the main object, a barrel is placed beside the kitchen sink and a pipe led to it which keeps it always full of fresh cold water. The proprietor says, "The locating of leaks in some of these old pipes and the curious results which are obtained when a little air gets into the pipes, might perhaps puzzle engineers who have had a life-long experience in water works on a larger scale."

In 1884, works for a general supply were built by the village, taking the water from a stream flowing from Berlin Pond from which is a natural lake in the hills, covering an area of two miles long by half a mile wide. A mile below the pond, a dam of rubble masonry in cement, 14 feet high and 25 feet long forms a reservoir holding 4,000,000 gallons at 364 feet above the village, to which the water is conveyed by 12-inch cast iron pipe.

Distribution is by 10½ miles of cast iron pipes of 12 to 4-inches diameter, and wrought iron pipes of 2 inches diameter, with 233 taps and 53 fire hydrants. The pressure is 158 pounds.

The cost of the village works has been $66,-406 and the bonded debt is $60,000 at 4½ per cent. interest. The expense of maintenance in 1885 was $3,535 and the revenues from water rates $3,325. The interest on the bonds is paid out of the public taxes.

The works are managed by the village bailiffs. The population in 1880 was 1,847.

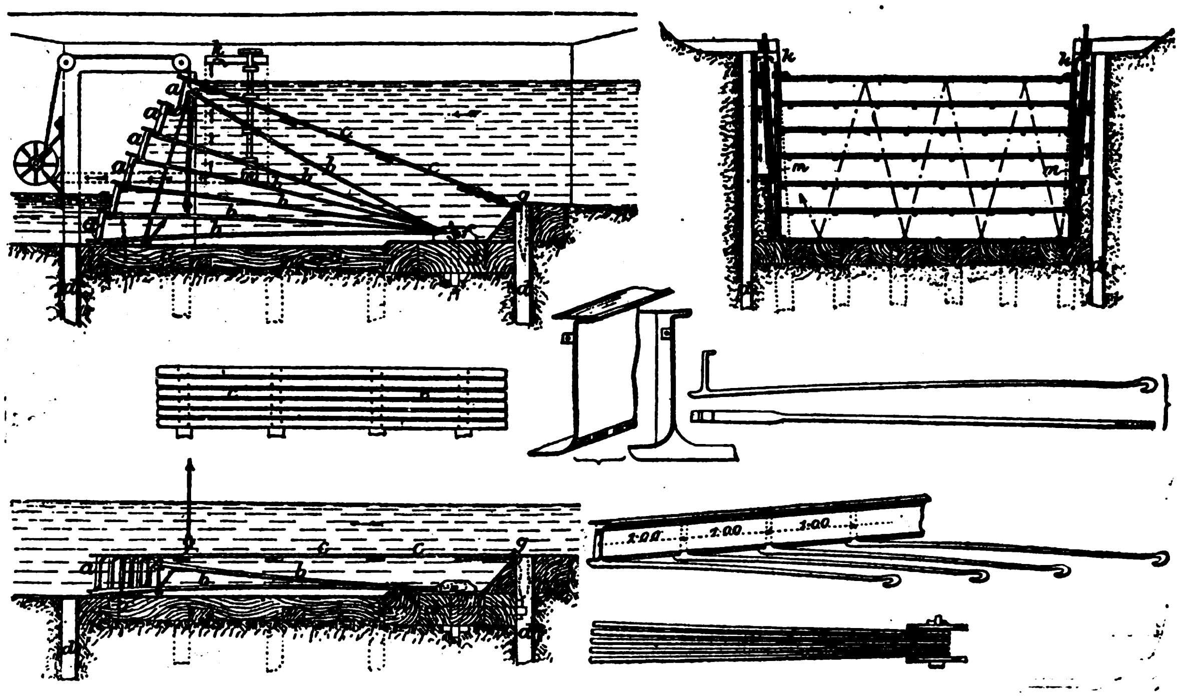
### The Automatic Lock Gate.

M. Czvetkovics, of Esseg, is the inventor of a new lock-gate the principal characteristic of which is its automatic movement under the action of the vertical pressure of water.

This gate, held between two abutments which may be of piles or even steep banks, is made up of a variable number of stop-planks *a* placed one over the other and each as long as the space between the abutments and from 8 to 10 inches wide. They are made up of two or three sections of sheet-iron.

The top and bottom of each stop is bent out at a right-angle forming interlocking ledges which enable each stop to raise the one below it. These stops are worked by the iron rods *b*, of special form, which fold and unfold like a fan around a fixed horizontal axis *f*. A protecting grating *c* made of wood stops any floating material and allows only sand and small gravel to pass it. This grating also turns on a horizontal axis *g*, and rests upon the upper stop plank to which it is sometimes attached; it assists this upper stop-plank in lifting both under the water pressure and by reason of its lightness.

The working of this lock gate is simple and easily understood. When the gate is in position in the bed of a stream the upper stop offers a certain resistance to the current and causes the water to rise. As a result of this change in level the hydrostatic pressure, which is constantly increasing, acts upon the lower flange of the stop and raises it and by reason of the interlocking of these flanges also lifts the next lower stop. The pressure of the water becoming greater constantly raises these stops successively until the very last one is lifted slightly from the sill and a space there left through which a certain portion of the imprisoned water can escape and take with it the sand and gravel which may have accumulated behind the dam.



Automatic Lock Gate.

It can readily be seen that the wider the lower flanges of the stops are made the greater will be the concavity of the raised gate and the greater also the lifting power. But at the same time the stops lose more of their absolute weight and it is possible for the water pressure to raise the gate above the surface. To prevent this it it anchored firmly to the bed of the stream by the rods shown just behind the lower stop-plank in such a manner that this can only raise a slight distance above the sill.

The figures show the gate both raised and lowered and the rods and their attachment.—*Le Genie Civil*, March 20, 1886.

The Blackville (S.C.) & Alston R. R. Co. has been organized with D. H. Salley, President, and Direct rs E. S. Hammond, J. J. Whaley, Nathan Porter, M. Brown, Alfred Aldrich and J. M. Price. The road will be standard gauge, and work will be commenced as soon as possible.