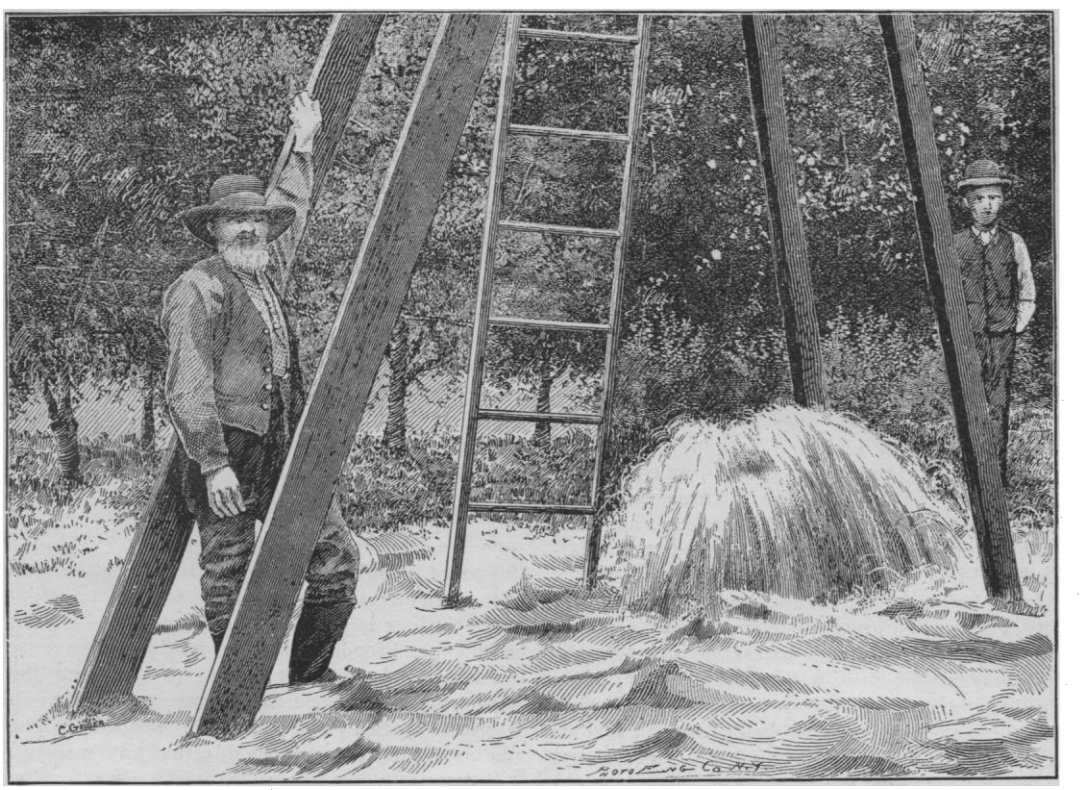
steadily and smoothly out of the car-house, around a curve, and over a switch to the main cable-track. Here another device, intended to lessen the labor of the grip-man, was brought into play. Air was admitted to a small cylinder on the grip, causing the latter to close firmly upon the cable, and the car sped on its way, up and down hill, out to the terminus at Fort George. The brakes were also operated by means of the compressed air acting upon a separate brake cylinder. To stop the car, the grip was let go, the air-brake put on, and, if the pressure-gauge showed much decrease of pressure, the compressor-clutch was thrown into gear, thus utilizing the motion of the car to renew the supply of compressed air. The compressor was put into action also, to keep the pressure at the proper point; so that, with a little additional work thrown on the cable, the car always held in reserve sufficient motive power to work the grip and brakes, as well as to run switches and to propel itself to or from the car-house. The trial trip, though it revealed some defects in the mechanism, was essentially a success. The general adoption of this or similar devices upon cable-roads will depend, of course, upon the economic results attained by extended trials in actual use.

THE ARTESIAN WELL AT BELLE PLAINE, IOWA.

SIMULTANEOUSLY with the report of the recent earthquake came sensational stories of an artesian eruption at Belle Plaine, Io., and speculation at once connected the two events with each other, and with renewed geyser activity in the Yellowstone park and seismic movement on the opposite hemisphere, as factors of a common disturbance of the earth's crust. Without reposing faith in such broad hypotheses, it seemed worth while to investigate the artesian phenomenon for its own sake.



ARTESIAN WELL AT BELLE PLAINE, IOWA.

The more sensational elements of the accounts were found to be chiefly the work of a romancing reporter whose moral faculties present the only similitude of seismic disturbance the case affords. The well is indeed phenomenal in some respects, but these are surely of the artesian order, and entirely without mystery. The following are essentially the facts: —

Last spring it was incidentally discovered that

flowing wells could be obtained by deeply boring into the drift. Six wells were put down, varying from 210 feet to 301 feet in depth, wholly in drift, and without reaching its bottom. Five of these flowed, while the water in the sixth, which was on higher ground, came within three feet of the surface. These wells gave clear evidence of a common source which had an effective head of from 70 to 80 feet above the now famous well. This latter was the seventh attempt, and was located on ground from 15 to 30 feet below the five then flowing. A three-inch well was contracted for, but only a two-inch well sunk; the driller intending to take advantage of the wash of the current, and force in a three-inch pipe. Out of this rose the trouble. As in the preceding wells, only drift was penetrated. The record is defective in detail, and perhaps in precision, but doubtless represents the general truth: soil, 4 feet; yellow clay, 10 feet; fine sand, 16 feet; gravel, 18 feet; blue stony clay, 145 feet; sand and gravel in which flow was struck, depth unknown; total, 193 feet.

In the other wells, beds or pockets of sand were struck in the blue clay; and the subsequent history of this well makes it probable that they were present here also. A flow of water was obtained at the base of the blue clay in sand and gravel. Pieces of wood and other vegetal remains were brought up by the current. This also occurred in the other wells, indicating the presence of one of the 'Old Forest beds.'

The flow was struck Thursday evening, Aug. 26, and, though strong, was in due proportion to the preceding ones. On Friday, in attempting to force in the three-inch pipe, the water broke a passage outside of it, which it rapidly enlarged until a vast volume of water poured forth, inundating the street and adjoining lots, bearing with it much sand and some pebbles, among which a great variety of northern rocks were represented.

The eruption of water was impressive because of its volume, but not because of the height of its ejection. Instead of 'several hundred feet,' or any thing excusing such an absurd exaggeration, photographs show it to have been about waist-high when unconfined, and about shoulder-high when a sixteen-inch pipe was inserted in the endeavor to control it. At present writing (Sept. 9) it wells up vigorously, but does not form a jet. The minimum diameter is now not less than 3 feet; a cone of that dimension, inserted in the effort to govern the flow, having been pushed through to the bottom without entirely cutting off the current outside of it. The more trustworthy estimates of the volume during the higher stages range from 9,000,000 to 5,000,000 gallons per diem. My own data for Sept. 9 indicate a flow of about 3,000,000 gallons.

The other flowing wells promptly felt the effects of this lower and more capacious outlet, and declined steadily. The record of one is given as follows: on Monday morning, Aug. 30, three days and a half after the great well started, it ceased to flow; on Wednesday at 6 P.M. it had fallen 7 feet; Thursday evening it had fallen 23½ inches in 24 hours; and measurement Friday morning showed a fall still at the rate of about 1 inch per hour. All wells but one had ceased flowing prior to Sept. 8, and this I found then sinking at about 5 inches per diem. It is evident that the great well obtains its supply from the same subterranean body as these, — the lower water-filled stratum of sand and gravel, — and that it is rapidly drawing this off. It has already lowered its head at least two-thirds of the whole. It must continue to decline in the force of its flow until the discharge is reduced to equality with the supply, when it will settle into equilibrium. It will then indicate the maximum amount of permanent flow, a knowledge of which will be of service in its future utilization. This particular method of arriving at that fact is not, however, to be recommended for general use.

I infer that the elevated portion of the saturated stratum, forming the reservoir, is not very large, else even the great flow would not draw the head down so rapidly. Assuming a discharge of 5,000,000 gallons and a lowering of the head 5 inches per day, and taking no account of inflow, the reservoir indicated has a clear surface of less than 40 acres. A mixture of sand and gravel may easily contain one-fourth its volume of water, as may be shown by experiment; but, assuming one-tenth, the upper edge of the water-bearing stratum need not exceed 400 acres in extent. It is not therefore necessary to suppose any unusual subterranean source, either in area or kind. Nor is it necessary to suppose a distant origin. The head is not greater than could be supplied by the country adjacent on the north, which is the probable supply-ground.

It is simply a flowing drift well, run rampant for want of control. It has its phenomenal feature in its magnitude, and its lesson in its expensive and destructive career through injudicious handling. When it has drawn off its head, it can probably be put under control — which it has thus far defied — without serious difficulty, and the drained wells restored.

That it has no causal connection with the earthquake is evident from its character and the fact that it broke forth three days earlier.

T. C. CHAMBERLIN.