SCIENTIFIC AMERICAN

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LVIII.—No. 13. [NEW SERIES.] NEW YORK, MARCH 31, 1888. [$3.00 per Year.

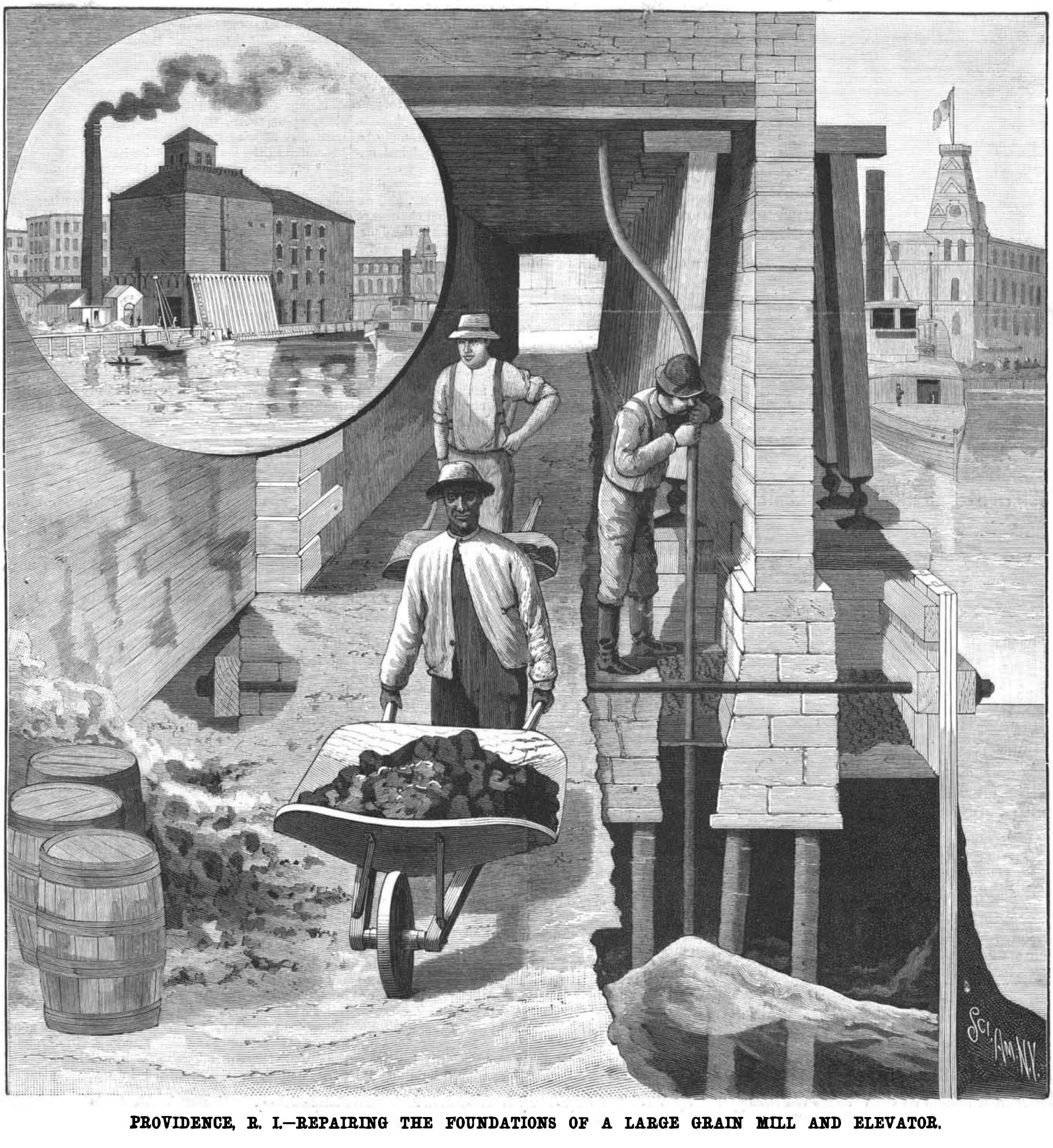
REPAIRING A FOUNDATION.

An interesting piece of engineering work has been recently completed at the Columbia Elevator, Providence, R. I. It consisted in constructing a new foundation wall under a large, substantial brick building, without seriously disorganizing its internal arrangement, and without great expense. The building consists of a brick storehouse and, separated by a brick wall, a wooden granary (slated), with the two lower stories, which are used for milling purposes, built of brick. Serious cracks had occurred in the brick walls in the north and east sides of the building, containing the milling and granary departments which made it evident that steps should be taken to prevent the structure from falling about the ears of the occupants. Upon examination it was found that the ground where the building was erected, and which formerly was a low marsh, was so springy and soft that the wash from the steamers constantly coming into an adjoining slip, and the movement of the tides, had affected the stability of the piles upon which the foundation wall had been erected. The dredging carried on in the harbor had also added its share of the work of destruction. The piles were pushed out under the thrust caused by the weight of the building, and, not having any backing at the top to hold them, cracks large enough to receive the doubled fist had appeared in the brick walls.

The work of reconstruction was put in the hands of Mr. J. Herbert Shedd, C.E., and the general plan decided upon was the laying of a concrete bed under the wall, and its subsequent rebuilding while the structure was temporarily sustained on beams and jack screws. The first steps taken were the building of a bulkhead almost parallel with the north wall, of sheet piling, made up of sticks of Southern pine, 8 inches thick by 12 or 14 inches wide, and about 30 feet in length. Each stick was grooved to receive a 2 inch spline, and, in order to drive each pile as close as possible to its neighbor, the side next to the adjoining pile was beveled, thus assuring its close contact. The spline was driven after each pile, serving as a guide for the next, and rendering the wall more solid and tight. The piles were held while being driven by two stringers, which were used as guides. Both the hydraulic system and the steam hammer were employed in driving the piles. As may be seen by examining the plan, the piling was turned in at each end to prevent the inflow of water at these points.

In order to tie the bulkhead firmly in position, 3 inch iron bolts were passed through the north and the inner

(*Continued on page* 194.)



PROVIDENCE, R. I.—REPAIRING THE FOUNDATIONS OF A LARGE GRAIN MILL AND ELEVATOR.

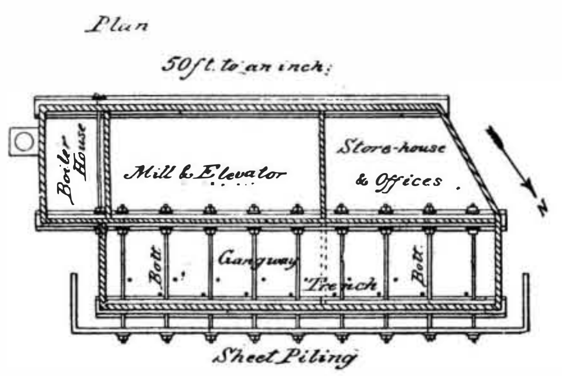
REPAIRING A FOUNDATION.

(*Continued from first page.*)

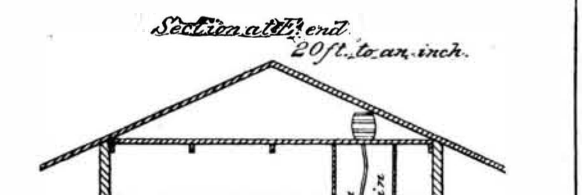
walls at intervals of 16 feet, thus binding the piling firmly in place. At the east end, where the thrust was greatest, a supplementary bolt was used, which passed through the entire building to the south wall, thus bringing the strain equally on the whole building.

After a piece of the sheeting was finished, concrete (1 part hydraulic cement, 2 parts of sand, and 3 parts of gravel) was run in between it and the foundation wall. This filled the larger cavities, and, forming a wall with the sheeting, made a watertight bulkhead. A trench was dug on the inner side of the foundation wall to enable a 20 foot 4 inch pipe to be sunk, through which cement was to be forced to supplement the work that was not completed on the outside.

In order to procure enough head to force the cement



through the pipe, the concrete, consisting of 1 part hydraulic cement and 1 part of sand, was mixed on the fourth floor of the building, at which elevation it was fed into a hose which connected the receiving tank with the pipe in the trench below. This pipe had a head with a hose coupling on the top, and a valve to be opened to relieve undue pressure. Enough water was used in sinking to keep the head free of mud. As the concrete was forced out of the pipe, it spread out, filling the mud cavities under and about the wall, and setting about the old piles, driving the light mud and sand ahead of it, and gradually taking its place. As the cement was very heavy and sank under the pressure, the lighter materials were forced to the surface, where they could be easily removed. When the space about the bottom of the pipe became filled enough to stop the flow, the hose was filled with clear water to the top, and allowed to stand. Sometimes, however, the pressure would break out in a new channel, and then filling would be carried on again. After the concrete had thoroughly set, the pipe would be lifted and the concrete would begin to flow again. The work was carried on in this way until the concrete had been filled in to the required height, when the pipe would be removed and the cavity filled in from the surface with grout. It was necessary to have the line from the barrel to the pipe as straight as possible, with no sudden bends or sags for the material to collect in, as it sets very quickly under pressure. During early stages of the work, the sag of the hose when the pipe was partially drawn up as the filling progressed caused great inconvenience, but this was remedied by swinging the receiving tank and its platform so that it



could be raised and lowered as required. Only the best quality of hose could stand the wear and tear and the weight of the material when the pipe became clogged. It was found convenient to use short pieces of irregular length, which rendered it easy of repair. The pipe was sunk at intervals of about eight feet, about twenty feet behind the place where the driving was going on. After the concrete hardened, the work of repair became similar to that usually followed in building new foundations under old houses, which has been often described in these pages. Beams with jack screws under them were erected upon the concrete and the piling, and these were made to carry the weight of the building, when the wall, as well as that of the lower story of the building, was taken down, as far as the level of mean high water, and the foundation and wall above were then rebuilt on the new and solid bed.

A New Chloride of Gold.

Some years ago a new chloride of gold was discovered by Professor Thomsen, but as his results could not be obtained by other chemists, who did not follow his method of production in its entirety, it has been assumed to be a non-proved discovery. Lately, however, by improved methods, he has completely demonstrated the existence of the new chloride. The process is very simple, and the result beyond dispute. All that is required is gold in a fine state of division and a supply of chlorine gas. He took fifty grammes of finely divided gold, obtained by precipitation of the trichloride with sulphurous acid, and thoroughly washed, and dried to the consistency of thick mud, was placed in a weighed glass tube, a rapid stream of the gas was passed under suitable conditions, and the gold end of the tube slightly heated. Being kept afterward covered with cotton wool, enough of heat was supplied by the process of decomposition to continue that initiated from external sources, and in half an hour the action was completed. The operation was repeated several times with identical results, thus establishing the fixed character of the new salt, whose formula is Au_2Cl_4.—*Br. Jour. Photo.*

AN IMPROVED KNAPSACK.

An invention designed to improve and simplify the form of pack it is necessary for soldiers to carry, and to render the equipment adjustable to all sizes and forms of men, is illustrated herewith, and has been patented by Col. Henry C. Merriam, of the 7th Infantry, U. S. A., headquarters at present at Fort Laramie, Wyoming. The pack is formed upon a rectangular iron frame, its vertical arms being slightly curved, so that when the

MERRIAM'S KNAPSACK.

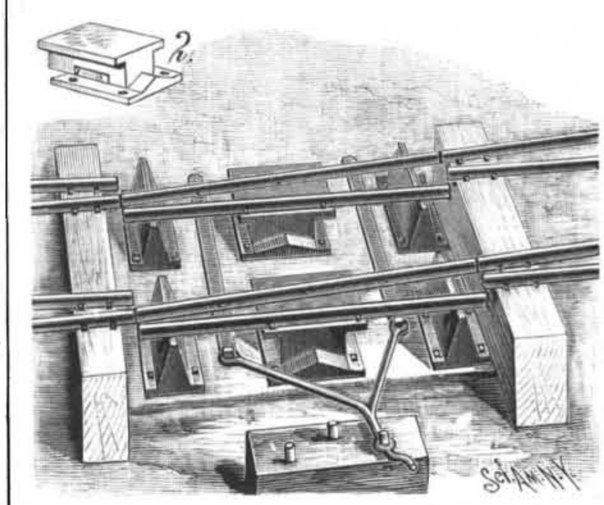
pack is slung to place, its inner face will approximate the contour of the wearer's back. The pack is supported by side braces stepped in sockets carried by the forward ends of a hip strap, whereby the weight is thrown directly upon the strong bones of the hips, thus relieving the shoulders and the spinal column from strain, and preventing pressure upon the shoulder blades. With this form of pack the shoulders and arms are left entirely free for action, and, the cross belts being done away with, the coat of the wearer may be thrown open without deranging the equipment. This pack has been tested at several stations of the army and the marine corps with eminently satisfactory results, it being found that the men can therewith carry a considerably increased quantity of clothing, etc., and with greater ease than is possible with the ordinary form of knapsack. Samples of the improved equipment have also been placed on trial in European armies, and the reports thus far are said to be equally favorable.

Great Waterfalls.

According to a recent calculation, the highest waterfalls in the world are the three Krimbs Falls in the Upper Prinzgau; these falls have a total height of 1,148 ft. The three falls next in height are found in Scandinavia—the Verme Foss, in Romsdal, 984 ft.; the Vettis Foss, on the Sogne Fjord, 853 ft.; the Rjuken Foss, in Thelemarken, 804 ft. With a decrease in height of 213 ft., the three Velino Falls, 591 ft., near Zerni (the birthplace of Tacitus), follow next in order, and they are succeeded by the three Tessa Falls, in the Val Formazza, 541 ft. The Gastein Falls, in the Gastein Valley, 469 ft., rank between the Skjaggedal Foss, in the Hardanger Fjord, 424 ft., and the Boring Foss, in the same fjord. If the width of the falls is taken into consideration, the most imposing are those of the Victoria Falls of the Zambesi, which are 394 ft. high, with a width of 8,200 ft. A long way behind these falls come the Niagara Falls, 177 ft. high and 1,968 ft. wide.

AN IMPROVED RAILROAD SWITCH.

An invention providing a railroad switch of less length than switches now in use, thereby reducing friction, and also enabling the placing of more tracks on a given parallel space than can be done under the present system of switch construction, has been patented by Mr. Isaac M. Brown, of Columbus, Ind., and is illustrated herewith. Sections of three feet long each are cut from the main track rails and securely bolted to the upper portion of V-shaped slides or center rests, the ends of these sections resting on chairs on each side of



THE ISAAC M. BROWN TABLE SWITCH.

the center rests, and one section being inside and the other outside of a throw rail. When a train or car is to be thrown from the main track to the switch track, the switch is drawn back or forced forward by the "throw" at the side. A pivot on the upper surface of each of the sliding center rests passes loosely into a drilled hole on the under side of each of the throw rails, thus permitting the throw rails to be adjusted to the right or left, as may be desired, the ends of the throw rails being connected by rods with the "throw." The sliding center rests and their lower sections, as shown in Fig. 2, have checks or stops, whereby the distance to which the switch is to be moved is regulated.

The switch yard shown represents the long street switch, as now in use in all yards. Yet only three full tracks and two fractions are represented. The first contains room for 9 cars, the next three 11 cars each, and the last 7 cars, thus giving storage for 49 cars. It is claimed that by the use of the Isaac M. Brown improved switch one or more additional full tracks can be put upon the same space. The switches are numbered from 1 to 5, and when a freight comes in it is thrown upon the switch track and run to the right of the yard and cut in sections between streets and alleys. This gives a free passage, as but one section is taken out at a time, and the switching is done in front of the yard, thus saving the wear and tear which occurs in moving a heavy train back and forth to throw a car out here and there. The cars designed for the first station are placed in number 1, and so on to number 4, while number 5 will contain the cars belonging beyond the run. When thus placed in the pockets, the cars in number 5 are moved

THE SWITCH YARD.

out and run down upon the switch track. Then number 4, and so on to number 1, leaving them in sections, as in the first place, until the train is ready to move out. A train thus managed forms but little obstruction in town or city, the facilities for storage being materially increased on account of the short space occupied by the switch. This plan also leaves the main track entirely unobstructed. Track "A," as represented in the plan of yard, illustrates the utilizing of both sides of a track by four different turnouts, in different directions, by putting in two of these improved switches, with the throw on opposite sides.