THE WATER SYSTEM OF DENVER.

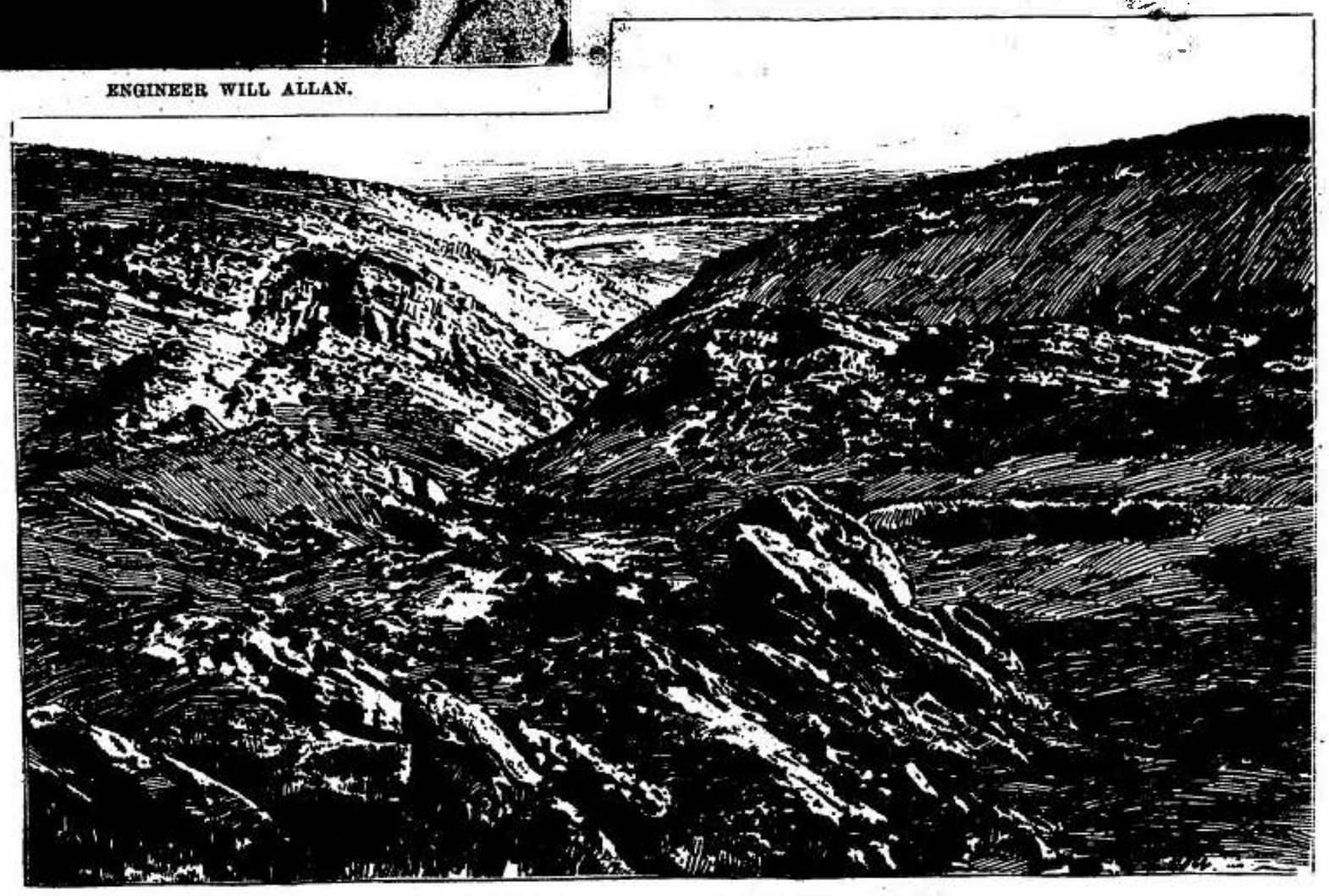
DENVER, Colorado, is to have the greatest gravity water system in the world. A company has been organized with a capital stock of $3,000,000, all of which will be expended within the next three years in constructing two gigantic water dams, and thereby converting two mammoth natural basins in the foot-hills of the Rocky Mountains into supply reservoirs, with a combined capacity of nine and a half billions of gallons.

The projectors of this great enterprise are citizens of Denver entirely, and the capital to be used is also wholly local. Dissensions in the Denver Water Company, which had hitherto been the only water supply company in Denver, caused some of the members of that company to withdraw. A new company was organized with Mr. D. H. Moffatt, President; Mr. Richard Holmes, Secretary; and Messrs. E. F. and Charles Hallack, Governor J. A. Cooper, H. B. Chamberlin, Donald Fletcher, and Wilson Waddingham as prominent stockholders and projectors. The avowed purpose of the new organization was to provide a supply of mountain water for Denver through an economical system, and such system to be of such magnitude as to meet the demands of the city after it had grown to many times its present size. The result promises to be that Denver will have a water supply system many years in advance of its population.

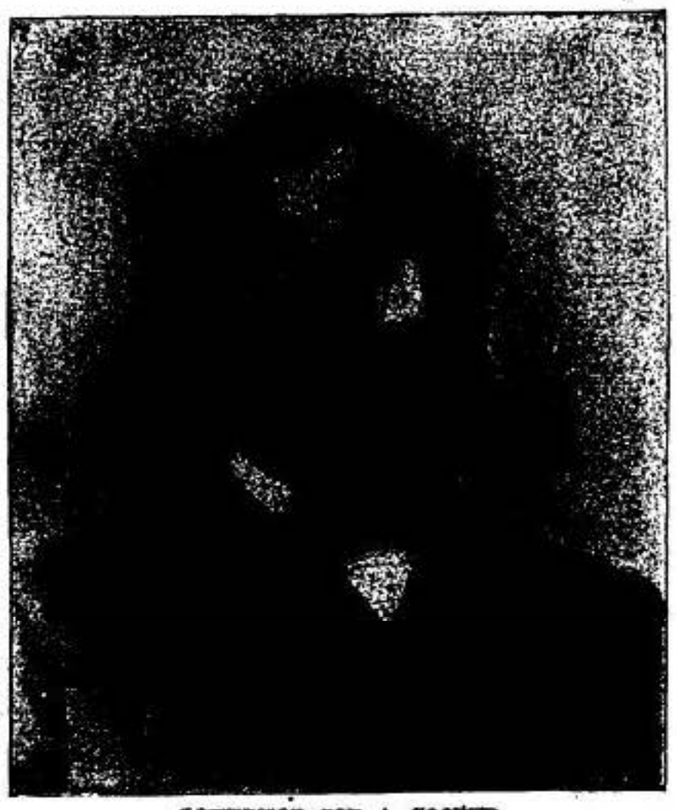
(Continued on page 384.)

ENGINEER WILL ALLAN.

THE BASINS IN THE FOOT-HILLS OF THE ROCKIES.



SHOWING BOTH OUTS, AND DENVER IN THE DISTANCE.



GOVERNOR JOB A. COOPER.

AS THE RESERVOIR WILL APPEAR AFTER THE DAM IS COMPLETED.

THE NEW WATER SYSTEM OF THE CITY OF DENVER.—WATER CONDUCTED FROM NATURAL MOUNTAIN BASINS A DISTANCE OF SEVENTEEN MILES.—FROM PHOTOS AND SKETCHES.

THE WATER SYSTEM OF DENVER.

(*Continued from page 387.*)

As a site for the new reservoirs Chief Engineer Charles P. Allen, assisted by Consulting Engineer J. D. Schuyler, of San Diego, California—the latter perhaps the greatest authority on hydraulics in the United States—selected two vast natural basins in the Hog Back Mountains, foot-hills of the Rockies. The site is one of rugged beauty. Two miles west of Wheatland and seventeen south of Denver, the basins are embraced by the Little Deer and Brushy creeks.

Gaining an eminence on the foot-hills of the western mountain range, a rarely picturesque scene is spread before us. Toward the north are ranges of rugged mountains, whose craggy peaks are clambering one above another until the red of the sandstone and the blue of the sky blend together in the distance. A similar view meets the eyes toward the south, varied only by the intervening of Platte River and Peverill Park. Directly in front spreads "a landscape as sweet and beautiful as a dream of peace." A rolling surface, waving fields of alfalfa, villages dotted here and there, and clouds of smoke pierced by the spires of Denver, crown the scene at the horizon's edge, seventeen miles away.

At our feet yawn the great basins and the greater cañons, the latter vast indentations in the mountain ridge wherein the dams are to be constructed. The Johnstown water dam is famous, but is only eighty feet high. San Francisco's water dams are respectively ninety-two and ninety-three feet in height, while the great Sweetwater dam at San Diego, California, so eagerly viewed by tourists, is ninety-eight feet high. Each of Denver's new dams will be 275 feet in altitude. In all dimensions the inner and outer dams of this immense water-storage system will be similar.

The great inner dam will be 1,020 feet, or about one-fifth of a mile through at the base. Its base will cover an area of eighteen acres. At the top the embankment will narrow to thirty feet, or the width of an ordinary street from curb to curb, but the other top dimensions, from mountain tip to mountain tip,

will be 680 feet. When completed this gigantic structure will contain 2,050,000 cubic yards of select and solidified material, and will weigh 3,000,000 tons.

The process of constructing two such colossal dams and equipping the reservoirs, is no less wonderful than the dams and reservoirs themselves. The engineers have established a supply camp of thirty buildings outside the walls of the outer reservoir. From the South Park Railroad, two miles down the valley, a railroad has been extended to Camp Allenville. The line of railroad has been further extended into the inner reservoir, inside of which alone there is three miles of trackage.

One to two locomotives, two steam shovels, and one hundred freight cars, with several hundred laborers, are to be used in removing all natural earth and *débris* within the basins and the cañons. This will be removed to a depth varying from one to fifteen feet until a foundation of solid sandstone formation is reached. This natural underlying foundation has been shown to be absolutely impervious.

In the great cañons, where the dams will be, a succession of grooves or flanges thirty feet wide is to be cut in the solid rock from bottom to top of the mountain. These will be filled with layers of native clay and gravel, rammed and rolled by steam rollers for the purpose of making a foundation to the dam and intercepting any little thread of water that might find its way through the base of the embankment. Following this process, the entire dam will be built up in layers of six inches each. Each layer will be rolled and sprinkled separately, however, then plowed and harrowed preparatory to receiving the next layer, so that when the entire work is completed the embankment will be a kneaded, solidified mass, and not a mere succession of layers.

For fear that water might break through the dams sometime, the engineers propose to make "assurance doubly sure" by paving the entire inner and outer surface slopes of the dams. This will be done by laying stone in mortar, and then covering it with two inches of asphalt. The western face of the inner dam will contain enough asphalt to pave Sixteenth Street in Denver, three miles, or twice the length of that street from Bowlder, in North Denver, to Broadway Street.

To prevent any possible overtaxing, overtopping, or breaking of the dams, in addition to their safe construction the builders will provide for complete control over the entire body of water the reservoirs will contain, or that will flow into them. The watershed adjacent to the reservoirs only covers an area of six square miles. The great source of supply is Platte Cañon, five miles farther up the mountains, by means of a forty-two-inch conduit. Such will be the means for controlling the influx of water that, should there be a cloud-burst in the immediate vicinity, with a rain-fall of twelve inches per hour, all of the collecting waters above the capacity of the reservoirs would be diverted through spill-ways and flood-gates, and it would be impossible to injure the dams. The highest point to which water will ever attain is fifteen feet below the top of the dam, and at that high-water line the dam is ninety feet in thickness.

On the other hand, there will never be a scarcity in the water supply. From the immediate and Platte Cañon water-sheds, an area of over two thousand square miles, in the winter season at least, by rain-fall and the melting of snow a sufficient amount of refined water will accumulate, and the reservoirs hold a sufficient amount to supply Denver, if there were not a rain for six months. The water standing for that length of time in the reservoir will not become stagnant as one might aver. The outlet gates make it possible to draw the water from any depth, and authorities on hydraulics say that alternating in depth and constant use from so large a body of water make stagnation impossible.

Altogether, Denver's new system will be wonderful. When complete, the outer reservoir will cover a surface area of 157 acres; the inner one 323 acres. They combine 480 acres. The inner reservoir will have a capacity of six billions of gallons; the outer three and a half billions. Their combined capacity will be nine and a half billions of gallons, or a sufficient amount for a per capita supply of 350 gallons for the inhabitants of Denver, perhaps the largest water supply in this country. The reservoirs are at an elevation of 835 feet above the city base, and the pressure of the water running through a 42-inch pipe seventeen miles makes it possible to run a stream four hundred feet high in the city. The pipe system will extend over 150 miles. Four large storage reservoirs are being constructed in the city to equalize the pressure and supply. The expense of operating this vast system of works, when once completed, will not exceed $5,000 per annum. Surely this is to be the the greatest gravity water system in the world.

ROBERT L. HARPER.