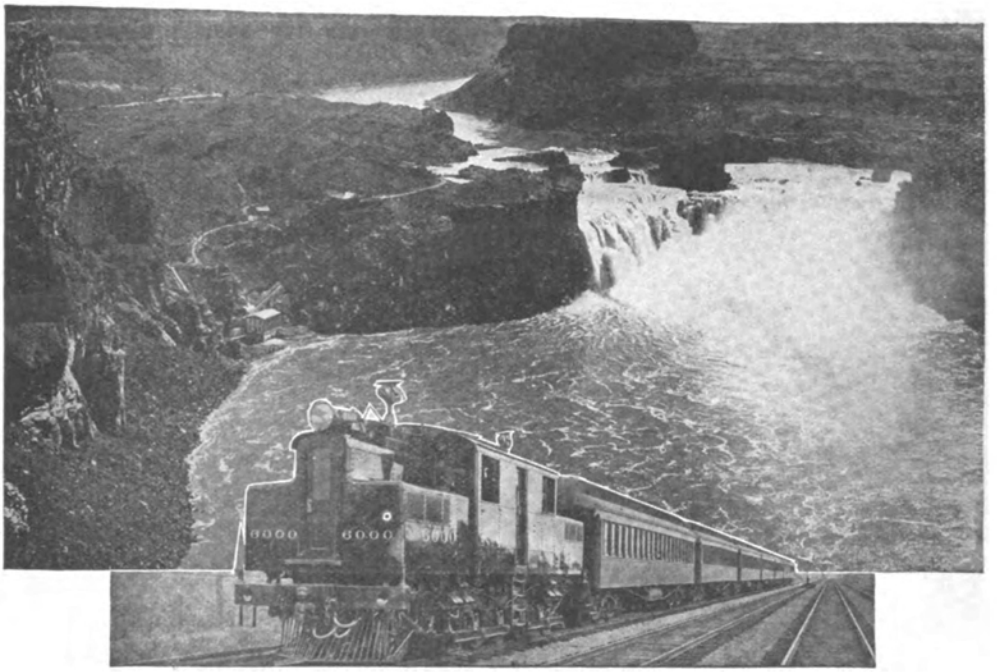


TO ELECTRIFY THE MOUNTAIN ROADS

By

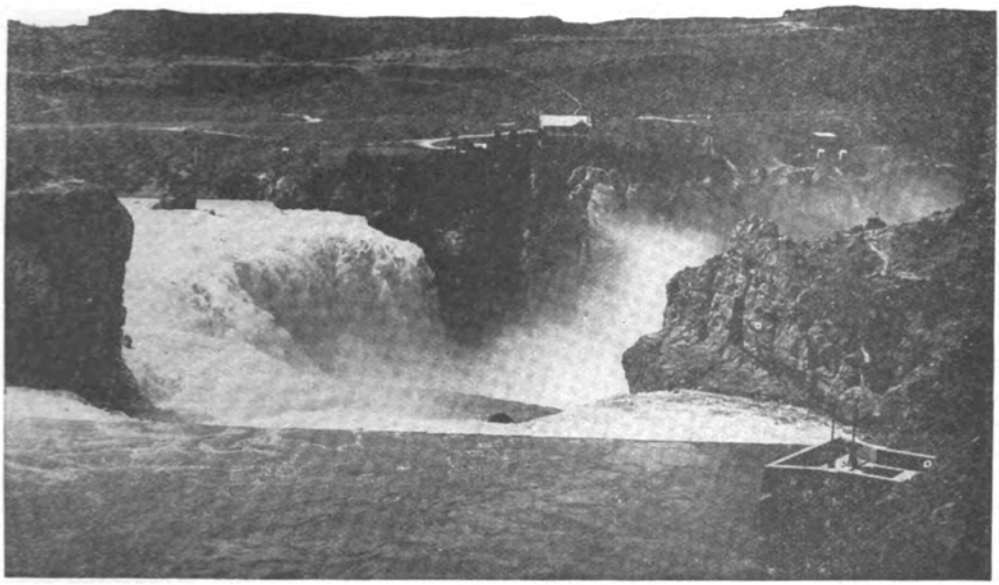
G. F. STRATTON AND A. CHAPMAN

"DURING the immediately forthcoming years every mile of railroad from the Rockies to the Pacific Coast, and from Utah to the northwestern cities, will be electrified. It will be possible to ride from Denver through Salt Lake City to San Francisco, Seattle, and Portland by electric line."

The man who made that fervent prediction is Col. D. C. Jackling, President of the new Utah Power and Light Company, which has just suceeded in purchasing almost every hydro-electric power plant in Utah and southern Idaho.

Even among men who are in that great western section and who keep closely informed on the development of its resources, the revelations of the past ninety days are astounding. It is less than three months from the date this is written that the Utah Light and Power Company completed its stupendous organization; and in the same period the Great Falls Electric Power Company of Montana has secured nearly all the plants in northern Idaho and Montana. Across the Sierras, the Sierra-Pacific Company controls over 400,000 horsepower at Lake Tahoe, and on the Truckee and Washoe Rivers; and another great merger of power plants is under way south of San Francisco.

Great mergers and combinations are no more unusual on the Pacific Coast than in the near West and East; and the comprehensive purpose of the unification of these immense power resources was unsuspected, even by men on the ground, until very recently. Now, the biggest men in those big enterprises publicly announce the purpose.



A POWER HOUSE ON THE SHOSHONE RIVER, IDAHO
There is no reservoir or dam and probably 60 per cent of the available energy is going to waste

Mr. John D. Ryan, President of the Great Falls Power Company, in a recent interview made the following authoritative statement:

"Recently the Great Falls Power Company was granted a franchise by Secretary Fisher of the Interior Department over public lands in Montana and Idaho. The purpose thereof is to supply electric power to the Chicago, Milwaukee and Puget Sound Railroad for four hundred and fifty miles of its lines west of the Rockies. For this purpose of electrification, the railroad has appropriated $7,500,000.

"Secretary Fisher has gone into the question of conservation thoroughly and has given every consideration to the needs of the power company and the railroad company; and the grant confers upon the power company—which has owned its water-power sites for many years—a right of way for fifty years over public lands for reasonable compensation to the Government under reasonable conditions, which provide for compliance on the part of the power company with state regulations covering business of the kind in which the company will engage.

"The power company found no desire on the part of Secretary Fisher to impose any conditions that were not justified by the protection of public interest, and it is believed that general legislation will be enacted along the lines laid down in this grant which will give a great impetus to water-power development and to railroad electrification.

"The water powers in the Rocky Mountains and the Cascades would be sufficient to operate every mile of railroad west of a line drawn north and south through the center of the State of Montana, and north of a line drawn from the southern boundary of Colorado to the Pacific Coast. The necessity for the consolidation of water powers by collecting transmission lines, and provision for interchange of powers, is recognized by all who have given the question any consideration. Railroads could not possibly depend on power derived from one source, or one transmission line.

"It is certain that not less than 10,000 miles of mountain railroad will be electrified within the next few years as the result of the step taken by the Chicago, Milwaukee and Puget Sound Railroad. The Government, through Secretary Fisher, has done a great deal to avert the waste which has gone on before this, both by the failure to harness water power and in the consumption of coal. In addition to this, the danger of fires from coal-

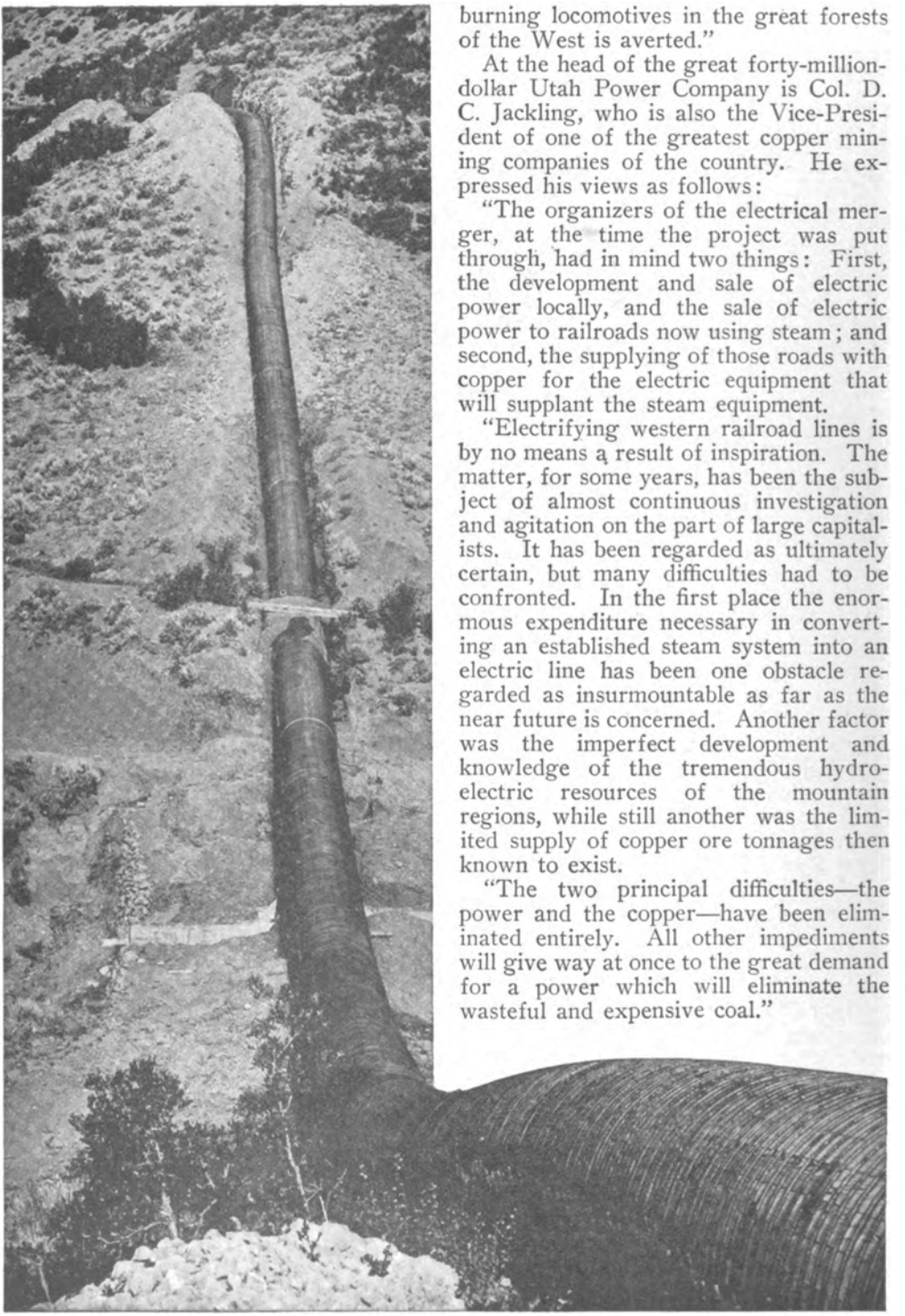
burning locomotives in the great forests of the West is averted."

At the head of the great forty-million-dollar Utah Power Company is Col. D. C. Jackling, who is also the Vice-President of one of the greatest copper mining companies of the country. He expressed his views as follows:

"The organizers of the electrical merger, at the time the project was put through, had in mind two things: First, the development and sale of electric power locally, and the sale of electric power to railroads now using steam; and second, the supplying of those roads with copper for the electric equipment that will supplant the steam equipment.

"Electrifying western railroad lines is by no means a result of inspiration. The matter, for some years, has been the subject of almost continuous investigation and agitation on the part of large capitalists. It has been regarded as ultimately certain, but many difficulties had to be confronted. In the first place the enormous expenditure necessary in converting an established steam system into an electric line has been one obstacle regarded as insurmountable as far as the near future is concerned. Another factor was the imperfect development and knowledge of the tremendous hydro-electric resources of the mountain regions, while still another was the limited supply of copper ore tonnages then known to exist.

"The two principal difficulties—the power and the copper—have been eliminated entirely. All other impediments will give way at once to the great demand for a power which will eliminate the wasteful and expensive coal."



GETTING WATER FOR ELECTRIC POWER

Through giant flumes of this sort streams are conducted to be dropped into the water turbines that set the generators in operation.

NATURE GIVES AID TO THE MOUNTAIN RAILROADS

The Denver & Rio Grande following the rivers, has them for allies in the electrification scheme. The upper photo shows the type of locomotive it is expected to use.

The change is already commencing. Contracts are now made with the Chicago, Milwaukee and Puget Sound Railroad Company for electric current for four hundred and fifty miles of track across Montana and Northern Idaho; and at a recent meeting of the authorities of the Denver and Rio Grande Railroad, it was decided to electrify that road from Denver to Salt Lake City. E. L. Brown, Vice-President of the road, has made the following announcement:

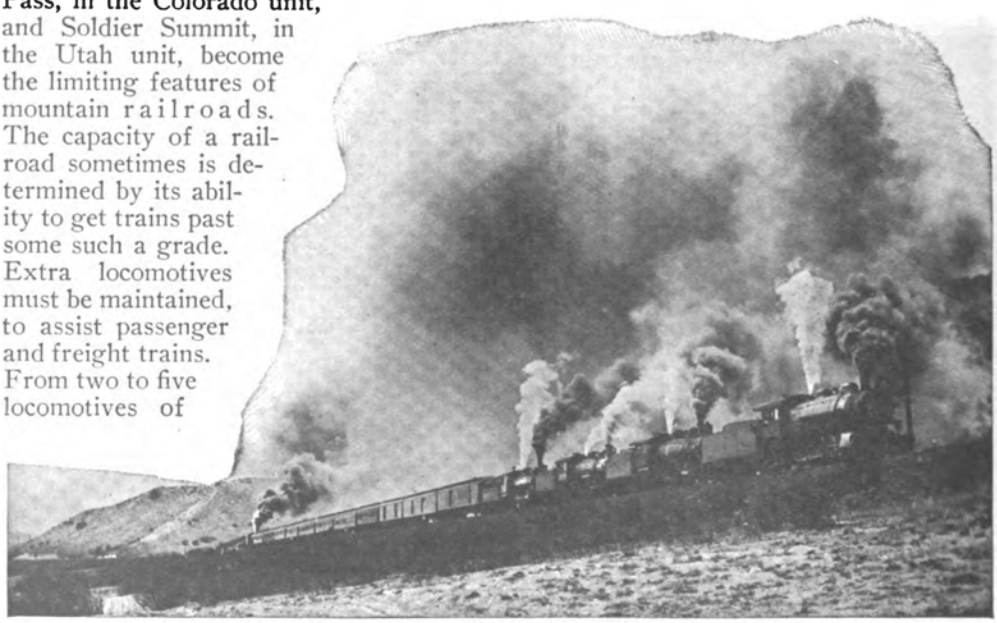
"According to our plans the first unit of the Denver and Rio Grande's electrification scheme comprises the division from Helper to Salt Lake—a distance of one hundred and twenty-one miles. The second unit is the line over Tennessee

Pass into Denver. Three millions will be the cost of the first unit and two millions, of the second unit. The plan also includes the electrification of the Bingham and Garfield branch, which will cost another two millions. Altogether the new system of power, which will be furnished by the Utah Power Company and the Colorado Power Company, will aggregate between twenty and twenty-five millions, and this sum will be spent during the years 1913 and 1914."

When President Bush took charge of the affairs of the Denver and Rio Grande system he was quick to realize how Nature had favored that railroad. Other roads crossing the Rockies touch water-courses only incidentally. Steam plants must be erected and operated by coal if they make the change to electricity which railroad men assert all competing lines must do in the near future if they are to keep abreast in the struggle for business. The Denver and Rio Grande builders, however, faithfully followed the water-courses of the Arkansas and Grand across Colorado, and therein all unknowingly they made it possible for that railroad to be among the first to adopt the "power of the future".

Such points as Tennessee Pass, in the Colorado unit, and Soldier Summit, in the Utah unit, become the limiting features of mountain railroads. The capacity of a railroad sometimes is determined by its ability to get trains past some such a grade. Extra locomotives must be maintained, to assist passenger and freight trains. From two to five locomotives of the heaviest type are required to assist a train up a grade like that which the Denver and Rio Grande has been compelled to combat at Soldier Summit. Even then trains cannot be hauled faster than seven or eight miles an hour. When there is a tunnel at the apex, as at Tennessee Pass, the difficulties become still more pronounced. Under such conditions, where electric locomotives have been installed, the main difficulties have been overcome. A notable example is found on the Great Northern Railroad at the summit of the Cascade Mountains. The tunnel at this point practically limited the operations of the road. Steam could do no more in keeping traffic moving up both grades.

The Cascade tunnel was the chief stumbling block. The smoke and steam from the locomotives coated the rails with a greasy soot which made the wheels slip, and the heavy fumes from the engines made operation a matter of positive danger to train crews. Special locomotives, burning specially selected coal, were used, but still the problem was not solved. Electric locomotives were installed. All the dangers and discomforts rising from steam, soot, and smoke, were overcome,



FIVE STEAM LOCOMOTIVES TO A PASSENGER TRAIN ON A HEAVY GRADE
The use of electric locomotives would eliminate this tremendous effort.

and trains, steam locomotives, and all, were hauled through the tunnel at double the best speed that was made under the old conditions.

It is interesting to note that power for this work is generated from a mountain stream and transmitted over a thirty-mile line. The modern elec-

TYPES OF THE SPLENDID WATERFALLS THE WESTERN RAILROADS CAN DRAW ELECTRIC POWER FROM

tric locomotive of the one hundred-ton type is suitable for the heaviest steam railroad service. Indeed one of these locomotives will "back" the heaviest steam locomotive. From the engine cab of one of these locomotives, the engineer commands an unobstructed view along the entire right of way ahead of him, or of the train behind him. One of the great advantages of the electric locomotive over the steam engine is in the handling of heavy traffic in switching or in starting long trains. A train of forty or fifty cars is not a rigid mass, but a long, elastic body, and any inequality in the starting torque results in waves of jerking strains which occasionally become so pronounced as to work actual damage to rolling stock or to freight shipments, to say nothing of giving discomfort to passengers. The control system of an electric locomotive is so graduated that its practical effect is apparent to the observer standing in the caboose of a long train. Instead of being nearly jerked off his feet, the observer finds that the beginning of motion is almost imperceptible.

MARSHALL PASS, COLORADO—ON THE DENVER & RIO GRANDE—WHICH IS BEING BROAD-GAUGED AT AN EXPENSE OF $2,000,000

The sudden discovery of the great value of water power to the Denver and Rio Grande shows how wisely those conservationists, who have secured water rights to the people, have planned in the interests of posterity.

Already construction work has been commenced on the first unit, and it is announced that the line will be electrified by July 1st of the present year.

As now organized, there are four great power companies heavily capitalized, splendidly organized, and in control of sufficient power for the enormous electrification projects of which Colonel Jackling spoke. They are the Utah Power Company, with at present over 200,000 horsepower; the Great Falls Power Company, with 350,000 horsepower; the Central Colorado Power Company, with approximately 200,000 horsepower, and the Sierra Pacific Power Company, with 400,000 horsepower.

The Utah Company will develop the hydro-electric field throughout Utah as far east as Grand Junction, and throughout Southern Idaho. The Central Colorado Company will contribute the Rocky Mountain link from Grand Junction to Denver. North of the Idaho field of the Utah Company are the hydro-electric plants of the Great Falls Company, and west of them is the Sierra Pacific Company.

It should be understood that these tremendous powers are not developed at any one point. They are the totals of very many plants at very many locations. The Utah Company acquired fully two score of separate plants in Utah and Idaho. Many of these are mountain torrents, and range from 600 horsepower to 16,000. It is so with the other great companies; and but for these mergers which place the development of power from numerous sources, and its transmission, under an

organized, unified system, and under one management instead of very many conflicting managements, no great trunk railroad would dare electrify.

All over the Intermountain Region between the Rockies and the Sierras are mountain ranges; and at short intervals along those ranges, and back in the cross cañons, are mountain torrents coming from such heights that the power capacity is often astounding. And on many of these torrents it is practicable to build two, or even more, power plants at different elevations up the cañons. In a recent report of the Utah State engineers covering the streams on a single forty-mile stretch of the Wasatch Mountains, it is stated that the Bear River has water enough for several additional plants; that the Logan River could furnish power for two or three more plants; the Blacksmith Fork River, at least one additional plant; the Ogden River, at least one more; the Weber, two more; City Creek and Parley's Cañon, one each; Big Cottonwood, one additional; Little Cottonwood, one plant; Prove Cañon, two, and possibly three more plants; and the Strawberry River project, one very heavy plant.

In most cases the development of power from these mountain streams is surprisingly low in cost, because the construction of great dams and reservoirs is frequently unnecessary. In most of the ranges, the winter snows pile up in the deep ravines in enormous quantities, and at such elevations that they melt slowly through the summer, furnishing a constant never-failing supply of water. But a far greater item in the consideration of cost is, that when the power is taken from the water, not one-half—frequently not one-quarter—of the value is taken from that water. Immediately below the turbine outlets the stream is run into canals, diverted into laterals, and distributed over the farm lands, transforming into astounding productivity lands which until that water was utilized could show nothing but greasewood and sage-brush.

It has already been thoroughly proved that electric current in the mountain regions is cheaper than coal. Numerous trolley lines, lighting lines, and uses of electric power in the many mining operations, have shown its great economy. All through the Cache, Salt Lake and Prove valleys of central Utah, and the valleys of Idaho, the majority of farmers have electric lights and power for small purposes, and yet it is stated by engineers—government as well as private—that the possibilities of hydro-electric power in the whole mountain district are vastly in excess of the actual developments.

On the necessarily severe grades of mountain railroads a very strong incentive to the companies to electrify their lines—aside from the reduction of operating expense—is the recognized superiority of the great electric locomotives on such grades. Mr. George Westinghouse, in an address a few months ago, stated the salient points of steam and electric traction very clearly:

"For the handling of freight trains, there are electric locomotives that weigh 180 tons, and have a traction power of 80,000 pounds starting. In the belt-line tunnel under Baltimore one of these giant motors has no difficulty in drawing a 1,800-ton train through, and up the one and one-half per cent grade, while three steam locomotives with their tenders weighing 370 tons, have great difficulty in performing the same service.

"It is interesting to compare one of these motors with the types of steam engines. The motors are built in two sections, each of which weighs 90 tons. The Pacific type of steam locomotives, such as are used for heavy passenger service, weigh about 75 tons. On the other hand, the freight locomotives of the mikado type weigh from 90 to 100 tons on the driving wheels, so that the electric 180-ton engine is therefore comparable from that point of view. By placing together a pair of these 90-tón electrics, both under the control of one man, the engineer has under control 3,500 horsepower, or a maximum tractive power of 90,000 pounds developed by that motor. One of the huge Mallet steam locomotives weighs 239 tons, but of this weight only 167 tons is on the drivers, and the engine is therefore capable of only 71,000 pounds tractive effort.

"Taking into consideration the weights on the driving wheels, which is the weight that counts most in traction, the electrics are on their drivers practically, pound for pound, while their steam brethren are not, by about one-half."