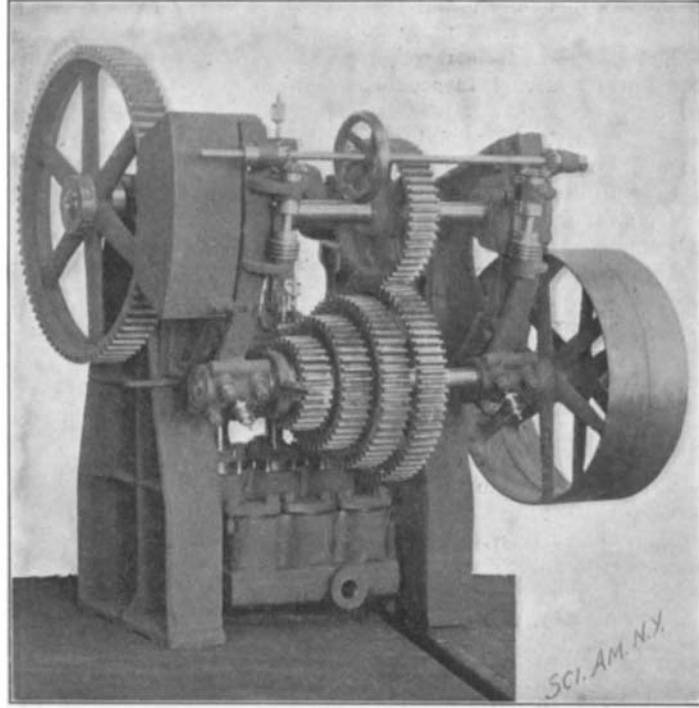


**A VARIABLE SPEED GEAR FOR PUMPS.**

The variable speed gear shown herewith is the joint invention of Mr. Charles O'Connor, of 142 Norman Avenue, Greenpoint, and of Mr. George C. Ahrens, Blissville, New York city. The accompanying diagrammatic side elevation, together with the photographic perspective view of a triplex pump, will serve to illustrate the broad features of the invention.

The frame of the pump carries on each side arms for a segmental support, the arc of which is struck from the center of the pump-shaft. In each case a journal-box, *A*, is arranged to travel. The projecting convex edges of the boxes are provided with teeth, meshing with a worm, *B*, the shaft of which carries at its upper end a bevel-gear, *C*, meshing with a bevel-gear, *D*. The journal-boxes, *A*, serve to journal a driven shaft provided with an attached gear, *E*, at its middle, and with a pinion at its one end, which pinion meshes with a large gear carried by the pump-shaft. The main drive-shaft carries a cone of gears, *F*, which can be shifted along the shaft by a lever. The gear, *E*, is designed to mesh with any one of the series, *F*.

**A VARIABLE SPEED GEAR FOR PUMPS.**

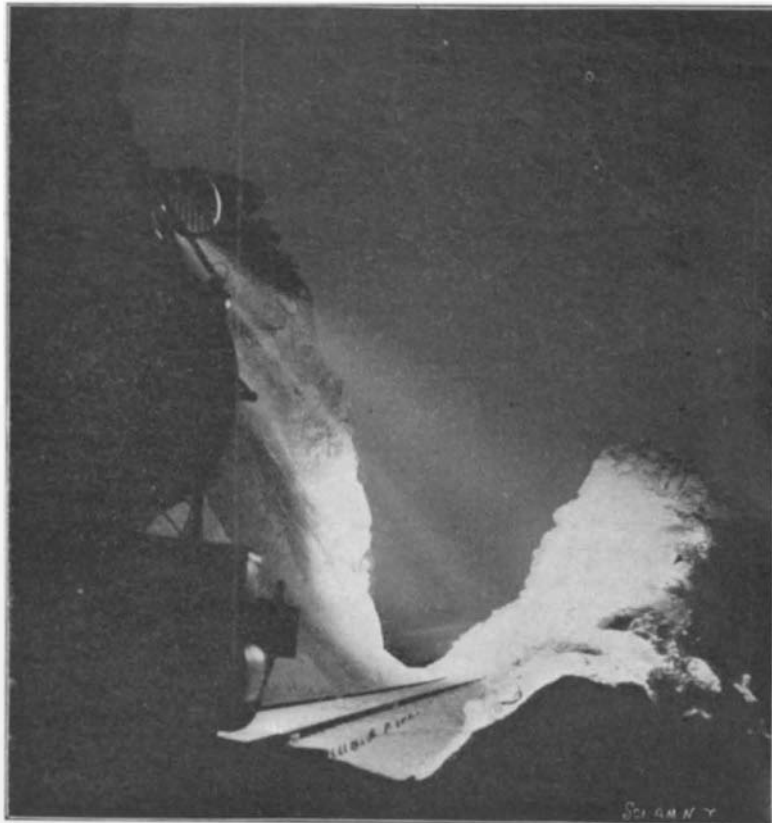
By turning the shaft carrying the bevel-gear, *D*, through the medium of a handle or crank, it is evident that the worm, *B*, will raise or lower the journal-boxes, *A*, and with them the shaft carrying the gear, *E*. By raising the journal-boxes, *A*, the gears, *F*, can be shifted to the right or to the left, in order to bring the desired gear, *F*, into alinement with the gear, *E*. By lowering the journal-boxes, the alined gears will be caused to intermesh.

The device is particularly noteworthy for the rapidity with which speed can be changed.

**PHOTOGRAPHING BY ELECTRIC HEADLIGHT.**

BY WALDON FAWCETT.

Some very remarkable specimens of night photography were recently secured on the line of the Colorado Springs and Cripple Creek District Railway—a new Colorado mountain road and in many respects one of the most interesting railway lines in the world—by Mr. George R. Simmons, of the executive staff of the operating company. The photographs, specimens of

**PHOTOGRAPH OF A ROCK CUT TAKEN WITH THE AID OF THE ELECTRIC HEADLIGHT.**

which are presented herewith, were secured by means of an electric headlight, and were taken in bright moonlight between the hours of nine o'clock in the evening and midnight. A Premo camera was employed, and extra rapid plates were utilized.

Perhaps the most interesting feature of the work was found in the length of the time exposure. The

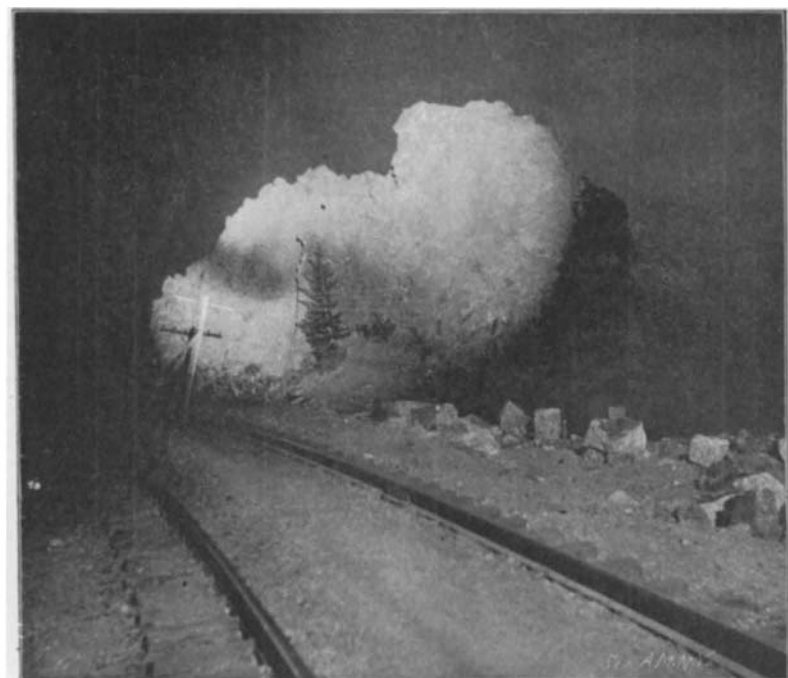
Cripple Creek Railroad, which is only forty-five miles in length, probably has, on the basis of total length, the highest average altitude of any railroad now in operation in North America. The altitude ranges at various points from 6,076 feet to 10,000 feet. In planning for the photographic work along the road, it was taken into consideration that at this altitude the rarefied condition of the atmosphere is conducive to more rapid ac-

tion of the light waves than would be found at a lower altitude.

In securing the negatives of the night scenes, the time of exposure varied from twenty-three to thirty-five minutes, each of the plates being over-exposed. As the result of the demonstration thus afforded, Mr. Simmons believes that even better results may be obtained by reducing the time of exposure to an interval not exceeding fifteen minutes, and possibly limited, in some cases at least, to ten minutes.

Still greater interest will center, however, in still another experiment to be undertaken in the near future by this mountain photographer; namely, an attempt to move the locomotive carrying the camera on a curve of the road so as to take in the entire field of the lens. This can be done without interfering with the photograph in any way, inasmuch as the changing of the light rays will change the portion first photographed in darkness and bring into the light an entire new scene, thus covering the entire field.

The Cripple Creek Railroad, which, by the way, is designed to afford a short line of communication to the richest gold-mining district on the continent, is admirably adapted for experiments of the character

**PHOTOGRAPH OF TRACK LIGHTED BY ELECTRIC HEADLIGHT.**

of that last outlined, inasmuch as the entire line is little else than a continual succession of curves, many of them very sharp. It may be noted also that the headlight employed in the photographic work described is the standard locomotive headlight operated by a steam dynamo located just forward of the engine stack

**Electric Railroads in Sweden.**

BY PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The Swedish government has lately appointed a commission of engineers and railroad men to examine the question of replacing steam by electric traction upon the State railroads, making use of the numerous waterfalls of the country. After a careful study of the problem and an examination of the country, the Commission has presented a report which is favorable to the use of electric traction, and considers that the financial advantages which would result are so incontestable that the government should not hesitate to make the considerable sacrifice resulting from the abandonment of steam and the transformation of the rolling stock. The introduction of electric service would have the result of suppressing the long trains which are now towed by two and even three locomotives, and they would be replaced by lighter and more frequent trains. This would be necessary in order to obtain a more economical working of the system, and also the desired continuity of the service. Relative to the utilizing of the waterfalls, they find that there are a number of falls that might be used for the purpose, especially in the provinces of Norrbotten,

Westerbotten and Jentland; besides there are other good falls in the Gefeborg and Halland districts. The Commission has made a thorough study of the existing falls, and in the present report only considers those which during the low-water period give at least 1,500 horse power, and which on account of their geographical position make it possible to transmit the energy without great loss to the nearest railroad station. They recommend utilizing the celebrated fall of Harsproenget, although it is distant more than 25 miles from the nearest railroad, because the enormous power developed here would permit of supporting a considerable loss in the transmission line. It is considered that electric traction might be introduced first in the lines of the Botten region, especially on that of Lulea, on the Norwegian frontier, and after that on the Bracke-Storlien railway, then on the two main lines which traverse the upper and lower Norrland, and lastly on all the government railroads of the Southwest. Electric traction will be especially advantageous upon the Trans-Scandinavian railroad (Gelivara-Ofoten) where a reduction of the rates would favor the exportation of Swedish minerals. An important consideration is the fact that Sweden is obliged to import nearly all her coal, and therefore the use of electric traction would economize a considerable sum. As a result of this report the Swedish government

has decided to hasten as much as possible the preliminary projects which the question involves, so that the matter may be presented at the next session of Parliament.

A few drops of turpentine added to the starch prevents flat irons from sticking.