8.....	4.7 "	0.06	88.71	11.23
9.....	8 "	0.04	92.23	7.73
11.....	9.5 "	0.05	93.35	6.60
12.....	12 "	0.03	90.38	9.69

As has been stated, the German Development Company has purchased two concessions: one on Bighorn river, and the other extending across George and Blackstone creeks, a short distance within the Bighorn range. Other holdings have been secured on Wapiabi, Smith, and Chungo creeks. The Bighorn property, situated above the falls, could be reached by a railway skirting the hills north of the river from the end of the Bighorn range. A little cutting near the head of the canon is probably all that would be necessary to open up the seams of coal which it will be possible to mine from above the entry, for, not only is the valley of the river situated near the axis of the shallow synclinial wave traversing the measures in this locality, but the hills on each side of it have not been dissected into narrow ridges by erosion, as is the case farther north.

This is due to the presence here of a thick bed of sandstone and conglomerate near the top of the Kootanie, which has protected the seams under it.

The gaps through the Bighorn range which gives access to the other properties are narrow, and some rocky spurs would probably have to be tunnelled before railways could be built to them. The grades would be high just outside the gaps, but beyond, the valleys appear to broaden out and probably present no engineering difficulties.

Estimate of the Amount of Workable Coal in Bighorn Basin.

In making the following estimate of the amount of workable coal in the Bighorn basin a number of factors were considered. The most important of these were, of course, the aggregate thickness of the workable seams in the section, the area underlaid by the portion of the measures containing these seams, the increase in the amount of coal underlying the area owing to the dip of the strata, and the reduction of the amount of coal which it will probably be profitable to work owing to crumples and faults of the strata.

The only approximately complete sections of the measures are those measured by Mr. Dowling on a tributary of Blackstone creek, and that by Mr. McEvoy on George creek. Mr. Dowling classes as workable nine seams, with a total thickness of 64 feet 4 inches, and Mr. McEvoy eight seams, with a total thickness of 60 feet. Mr. Dowling's section was not complete, however, and several of the seams in Mr. McEvoy's were locally reduced in thickness by crumples, so that the aggregate thickness workable is probably above the figures quoted. Mr. McEvoy's section on Bighorn river is incomplete, less than 1,300 feet of strata having been examined. Seven workable seams were measured, which gave a workable thickness of 46 feet 2 inches.

In the north-west corner of the basin, the Brazeau formation—uppermost in the section—underlies an extensive area, and, after allowing for the portion along the edge which could be reached from shafts less than 6,000 feet in depth, and levels 2 miles long, an area of 17 square miles remains, which must be subtracted from the area of 190 square miles obtained above. This reduction leaves the area at 173 square miles, but the dip of the strata increases the area of the underlying seams by about 8 per cent., so that the figure used in the calculation amounted to 187 square miles.

Great difficulty was also experienced in deciding the amount of coal which it will probably not be profitable to mine owing to the crumples and faults which traverse the strata. A list of the localities, where crumples were observed on the surface, has already been given, and it is extremely improbable that the deeply buried strata will be free of them—though probably they will be less numerous, for the beds are flatter, and the irregularities observed in the overlying strata are largely of the nature of gentle flexures rather than sharp folds. The writer finally reached the conclusion that in the estimate resulting from the above data as to area and thickness of the coal seams a reduction of 40 per cent. should be made, in order to allow fully for the detrimental effects which these faults and crumples will have on the profitable extraction of the coal. The final data for the estimated area, therefore, is 60 per cent. of the coal in an area of 187 square miles, having a thickness of 60 feet. The estimate is accordingly 6,600,000,000 long tons

SERIES OPERATIONS OF ARC AND INCANDESCENT LAMPS.*

C. M. Wills, E.E.

The Direct Current Series Arc Circuit has been used for distributing light in cities and towns for many years. In later years the very wide adoption of alternating current by central stations in all parts of the world has been responsible for the development of the constant current arc transformer and for the A. C. series arc lamp system. For certain classes of service the series arc system cannot be excelled, but in residential and suburban districts, parks and boulevards where the foliage of the trees interferes with the distribution of the light, the arc lamp becomes less efficient. For the same amount of energy expended, a much better distribution of light may be had by the adoption of the Mazda Incandescent Lamp.

Among the systems which already have installed the A. C. series arc circuit, there may be those who would be interested in knowing that the Mazda Incandescent Lamps may be connected by the series arc circuit. Both the series arc and the incandescent lamps burn very satisfactorily together, with the only condition that the incandescent lamps have the same current rating as that of the arc lamps.

The following is the experience that The Nevada-California Power Company has had with the street lighting system in Goldfield, Nevada:

In 1909 the Power Company secured a contract for lighting the streets of Goldfield for a period of two years. The series arc circuit was the plan adopted, and a G. E. constant current arc transformer of 25 lamp capacity was ordered. The current rating was to be 6.6 amperes. Before this contract had expired, the city had asked for 25 lamps, which was the full capacity of the transformer.

At the beginning of the current year, the city renewed the contract and asked for an addition of one more arc lamp and nine 60 watt incandescent lamps, with the privilege of adding more lamps as occasion demanded. The incandescent lamps were to be installed in the alleys in the main business section of the town. This wiring was arranged in a loop which can be short-circuited in case of a disastrous fire in the business section, thereby allowing the lights of the remainder of the city to burn undisturbed.

The capacity of the constant current transformer was increased by the use of an ordinary 6,600 to 440 volt transformer. The primary of this transformer was connected in parallel with the primary of the constant current transformer, and controlled by the same oil switch. The secondary was connected in series with the arc circuit so that it would act as a booster and would add its 440 volts to the capacity of the arc circuit. This plan is now working in a very satisfactory manner.

* From the Iowa Engineer