Evaporation per sup. foot of grate surface per hour,	"	775·106
Coal burned	"	171·822
Evaporation from and at 212° per hour,	"	13855·92

Twin Creek to Dayton.

Duration of run,		50 min.
Mean temperature of air,		92·130
" " feed-water,		86·326
" " evaporation,		349·380
" pressure above atmosphere,	pds.	119·610
Water pumped into the boiler,	"	9650
" primed, estimated 5 per cent.,	"	482·50
Net steam furnished,	"	9167·50
Coal burned,	"	1474·700
Steam actually furnished per pound of coal,	"	6·216
Equivalent evaporation from and at 212°,	"	7·300
Evaporation per sup. ft. of heating surface per hour,		
actual,	"	12·241
Evaporation per sup. foot of grate surface per hour,	"	729·025
Coal burned	"	117·272
Evaporation from and at 212° per hour,	"	12918·37

(To be continued.)

THE BUTLER MINE FIRE CUT-OFF.

By HENRY S. DRINKER, E. M., Philadelphia.

(Read at the Lake George Meeting of the American Institute of Mining Engineers, October, 1878.)

The Butler Mine property is situated in the vicinity of Pittston, in the Wyoming coal-field of Pennsylvania. The coal has been worked out from the fourteen-foot or Baltimore vein for a number of years on part of the tract, the old chambers remaining open as when originally abandoned. This vein outcrops on the Butler property, and is nowhere more than sixty feet below the surface of the ground on the line of the cut-off to be described. Above the fourteen-foot vein and about, say midway, between it and the surface of the ground, there is another small vein or rider of coal, about twelve inches in thickness. The rock between the two veins is a carbonaceous slate, about twenty-five feet in

thickness. Above the smaller vein is a bed of sandstone, varying in thickness, but generally not less than from eight to ten feet. This sandstone is also carbonaceous, but the proportion of carbon is much less than in the slate below. Both rocks have been analyzed, and before the next Institute meeting the writer hopes to be able to furnish the exact proportions. The sandstone is overlaid with *débris* up to the surface of the ground.

Some time during the spring of 1876 it was found that the coal left in the worked-out mine had been set on fire, and that the fire was gradually spreading. Inquiry developed the fact that the fire had originally been started by a woman, who had taken up her abode in an old tunnel leading into the workings. Owing to some delay in the early attempts made to extinguish the fire, it finally gained such headway that no ordinary means were found to be effectual. Finally, Mr. C. F. Conrad, civil and mining engineer, of Pittston, Penna., was called in as consulting engineer. He advised the making of a thorough cut through such portion of the old workings as had not been reached by the fire. It was found by survey that this cut could be limited to a length of about one thousand two hundred feet, as the vein faulted on both sides, and that the greatest depth of the cut would be about sixty feet. Subsequently it was decided to tunnel part of the way, thus saving the deepest portion of the cut.

In 1856-7 there occurred a fire in the same mine. Two stone walls in V shape, running from the apex of the V towards the out-crop, were built to cut the fire off, and these walls were carried as far as the vein had at that time been worked. After the walls were finished the old workings were filled in on both sides with clay and sand, making the spaces air-tight; this helped to stay the fire; it, however, finally broke through to the surface of the ground, and only went out when it reached the solid coal.

The present cut passes through the point of junction of the old V walls, and is, therefore, located directly through the *débris* and ash of the old fire. This location for the cut-off was decided on by Mr. Conrad, after a careful survey, for two reasons. 1st. In the hope of finding all combustible matter, coal, gob, carbonaceous slate, etc., burnt to ash by the old fire. In this case much excavation would be saved, as the ashes of an extinct fire might fairly be assumed to be an impassable barrier to a new one, and 2d. In the hope that if the material

were not found to be fully calcined, still that its burnt condition would render it more workable, and thus more easily removed.

After removing the surface material the walls above described were found, and then about twenty-five feet beyond them a solid pillar of coal in place. Where this opening was thus first made to the old fire, the covering over the vein was from thirty to thirty-five feet thick, about three to five feet of surface soil and earth, and the remainder yellow slaty sandstone and coal slate, the slate and the sandstone being parted by the rider or small coal vein above noted. It was at this point that a curious fact was developed, and it is in order to bring it to the attention of the Institute that the writer has prepared the present communication. On investigation, it was proved that the old fire had not penetrated the solid coal *in place*. Where it met a pillar in the workings, the coal was simply calcined on its surface; but in all cases *the overlying slate rock was calcined throughout*. Nay more, for the 14-foot vein on the Butler property is nearly equally divided by an 8-inch parting of slate, and it was found that this slate rock (with sound, bright coal on both sides), had been thoroughly calcined. Above the 14-foot vein the rock was also found to be calcined up to and above the 12-inch rider, or small vein, while this small vein of solid coal was also found to be unburned and perfectly sound and bright, as in the case of the larger vein.

Finally, it was found on excavating further, that when the old fire had reached the face of the workings, its progress had been arrested.

From this experience it would appear to be established that coal *in situ* cannot be burned *en masse*; but that the walls of carbonaceous slaty rock inclosing solid coal *can* be burned or calcined *in situ*. On what theory this fact can be explained may be an interesting matter for discussion to some members of the Institute, more directly connected than the writer can claim to be with problems of this nature. At the February meeting (1879) the writer expects to be able to present samples of the coal and rock referred to, both in its calcined and in its natural state, and by that time he hopes also to have the analyses above referred to, showing the proportion of carbon in the slate and sandstone. It should also be stated here, that even the sandstone was found to be burned, though not so thoroughly as the slate.

At present the question to the company, of course, is, whether the new fire, now raging, will be stopped by the cut or not. The cut was made about 30 feet wide, and is carried from one end of the coal to

the other, and down to the foot-wall of the vein. About 200 feet of the distance has been tunnelled. At this point the vein has been removed, and heavy walls built on either side of the tunnel. Also the adjacent old workings towards the fire have been filled with clay and incombustible *débris*, and it is believed by the engineer in charge that this, with the cut, will afford an effectual stay to the fire, which is expected to reach the line of the cut some time in January or February, 1879. When the present fire becomes extinct, it will be an interesting matter to note, whether in the old workings in which it has been raging, the pillar coal has remained unburned as in the old fire. That the superimposed slate and sandstone is being calcined is evident, for the craters formed over the surface show on all sides, at night, glowing masses of incandescent rock, extending often up to the surface.

The writer hopes to be able to supplement the present paper by another, at some subsequent meeting, giving a full account of the construction of the cut-off and of its result. This, of course, cannot be done until the fire has progressed farther, and actually reached the cut.

Since the original publication of Mr. Drinker's paper, above, in the Transactions of the American Institute of Mining Engineers, the fire described has been gradually nearing the cut, and at some points smoke has been observed coming into the side of the cut towards the fire. It is however, still too soon to state definitely whether the cut will have its desired effect in arresting the fire or not, or whether the fire may still travel across, over the tunnel, through the carbonaceous slates overlying it. The discussion of Mr. Drinker's paper by mining engineers seems to have established the general opinion, that the slates in the old fire were not actually burned, but that the carbonaceous matter in them was rather subjected to a process of distillation. It is said that some careful tests are about to be made on this point, by subjecting a quantity of the slate to a high heat under various conditions, and the results, together with some further notes on the Butler Mine, will be submitted to the Institute of Mining Engineers, at their next meeting, in May, at Pittsburgh.—ED. JOURNAL.

German Petroleum.—Near Heide, in Holstein, a flowing petroleum well has been bored which yields an oil of a quality similar to that of the American wells.—*Der Techniker*.

C.