INTERMITTENT WORKING. The intermittent working of coal mines has been much spoken of lately. It is a fact to reckon with, for the frequent idle times necessitate skeleton organizations in order to reduce overhead expense. When work comes the jump is from no production to full production. For the foreman with a large area to cover, it means that he must do his work in a rough and ready fashion, depending on the workman to find in some way their own work and take care of themselves. It is the perfecting of the manner in which a mine foreman does his work that has been most neglected.

TWO MAIN CLASSES OF WORKMEN. There are two main classes of workmen in coal mines, divided according to the manner in which they are paid, known as "company men," who are paid by the hour, and "miners" (or loaders) who are paid by the piece, mainly by the car of coal loaded. The company men are only twenty-seven per cent of the number employed (in bituminous mines) while the loaders are seventy-three per cent, roughly one quarter and three quarters.

PHILOSOPHY OF EMPLOYING NUMBERS. There are many false ideas regarding the conduct of underground work. One of the most prevalent is that output is directly in proportion to the number of men employed. This does work out when transportation is very simple, as it is at the start of a mine when only a few men are employed. But where transportation becomes divided into parts and large trackage systems exist, then it does not hold. Another false idea is that the evil of poor attendance of the men can be obviated for the company by putting more men at work than are needed for the output. At one place only seventy-five per cent of the men came out for work each day and so they frankly employed more men than they needed. No individualization of the men was done there, and the transportation was spread so thin that men were not getting mine cars and so were not earning, and that come and go which is always attendant upon poor organization of work was occurring there. At the end of the year they had thirty-seven per cent of the men with which they started. On one road in that mine the men changed over two and one half times in one two-weeks period.

AN INCIDENT. An incident happened several years ago; I was a mine foreman at the time. My superintendent came to the mine one morning, and having gone over the mine map with me to find out how many new places could be started, ordered me to put men to work in each possible place. He wanted more output from the mine. At the same time we were limited in the number of company men which we could employ. Now we knew that we were not getting all the output from the miners which we had had and that consequently, as we were not giving them the mine cars and as they were paid by the car, that they were not earning as much as they should. And yet here were our orders to confound our position, to try to stretch our already stretched transportation still further. The company would not suffer from it as much as the men in the mine, but the company would suffer.

NO MEASUREMENT OF NEEDS. The thing to note about this incident is that there was no measurement of our needs, no determination by any system of records of any coordination in our work, no analysis of work to determine what would happen if more men were put at work mining coal. There had been no time measurements of transportation. Nothing.

Larger outputs were expected simply from the employment of a larger number of men. The mine was sixty years old. You are experienced enough to know that such things do not happen.

PRACTICAL MAN. Those orders were issued by a man who had spent his whole life in the mines, starting, as he boasted, when he was nine years old. He was the embodiment of the *practical man*. You who have not been around the mines do not know how they harp on the subject of the practical man. Even the mine law requires that a practical man shall be employed as mine foreman. The college man is at a discount; even the man with a high school education. The mining law of Pennsylvania requires that a man should have five years experience in and around the mines before he can get a mine foreman's certificate. Five years work for a poorly paid job is not a thing to tempt a college man.

In coal mining the mining engineer is generally merely a surveyor. I was standing at the head of a shaft one day timing the operation of hoisting men out of the mine, when a miner asked me what job I had. I told him that I was an engineer. "Where is your transit?" he asked me scornfully, as much as to say I was not an engineer.

COAL A TRANSPORTATION PROBLEM. Coal mining is mainly a transportation problem underground. Large tonnages in small units have to be handled over a small railroad system involving a large amount of switching. The majority of the company men are employed on transportation. They have to handle the empty mine cars, delivering them to the miners to load. If transportation is not provided in proportion to the needs of the miners, then they will not get the cars and their earnings will be low. And if transportation is spread too thin, there will be a higher cost to the company.

TIME TO LOAD. A ton of coal can be easily loaded into a mine car in twenty minutes. The price paid for machine-mined coal in the bituminous mines is $.72 a ton. At this rate a man should earn between $8.00 and $9.00 a day. Twelve tons a day is not too hard work for an ordinary man accustomed to shoveling. It is a standard for amount in some regions. Recent statistics give the amount mined per man as an average of 4.6 tons per day. The accepted day rate is about $5.00. You will see that it takes about seven tons a day for a miner to earn what is the accepted rate and that instead of that amount being the average, it is 2.4 tons less.

COST TO OPERATORS. The cost to the operators, because the men do not work up to their capacity, comes up at the times of argument concerning the increases of wages. Then increase must be granted. But no matter how much increase is granted, the pay of the men never comes up to the point that it should, because the opportunity to work is so small.

As all the operators are in the same boat and as blanket agreements are made with the men, the increased cost due to increased pay rates are passed on promptly to the consumer. And the companies do not suffer. Their basis of competition has not been changed.

TABULATIONS TO SHOW LACK OF BALANCE. In order to show the usual lack of balance and coordination in underground work, I will present tabulations of the work of two mines in transportation. In the first of these (Table I) in order to have a comparative basis for the work of motors and mules, cars-per-thousand-feet-of-haul has been used. The number of mine cars from any road varies and the distances over which they are moved are unequal but the unity of quantity over the unit of distance gives a means of measuring the equality in the amount of work performed. A fair day's work for a mule is 100-tons-1000-feet over a fairly level road, though cases have occurred where a mule did forty per cent more than this. The work of motors is not as simple as that of mules, as it is not often a direct haul between two points, but is confounded with switching. On this account a new standard has to be worked out at each mine (where the conditions under which the various motors are working are probably similar) according to the best performance of the motors.

TABLE I

Road	Mules	Drivers	Motors	Distance Cars in 1000 ft.	Cars	Cars per 1000 ft.		Man-Days	Cars Per Man Per Days
A	1	1		1.250	288	361	383	184	1.56
B				0.100	220	22		60	3.67
C	1	1		0.550	249	137		183	1.36
D	1	1		1.250	240	300	376		
E				1.950	39	76		38.6	1.00
F	1	1		1.950	361	705		104	3.47
G	1	1		1.500	203		360	65	3.13
H				0.700	79			35	2.26
I				3.950	248		3425	175	1.42
J			1	2.750	654				
K				2.650	245				
L				2.700	362		1871	163	2.22
M	1	1	1	2.400	280			238	1.18
N	2	2		0.800					
				2.400	557			224	2.48
O	1			0.400	164	66	447	65	2.52
P			1	1.500	298			122	1.10
					134				
Q				4.200	160		2479	62	2.58
R				3.000	9			51	
S			1	2.200	320		79		
T				4.600	131				
V				4.00	118			49	2.41
								85	1.18

FIRST TABULATION. The period over which this tabulation was made, was for twelve days of work, one two-weeks period. And although it is not absolutely mathematically correct, it does give the relative amount of work done by the several units, which have no correspondence one with the other. For, considering the size of the mine car, a mule should have had about 400-cars-1000-feet, but this amount varies from 137 to 705, while the performance of the motors shows as great a discrepancy. Even averaging the last three motors, whose work was somewhat mixed up, as one motor was often taken to do another's work, the amount for the three would only average 1599 as against one motor's 3425. When time measure-