Recent Dwelling Construction in Pennsylvania

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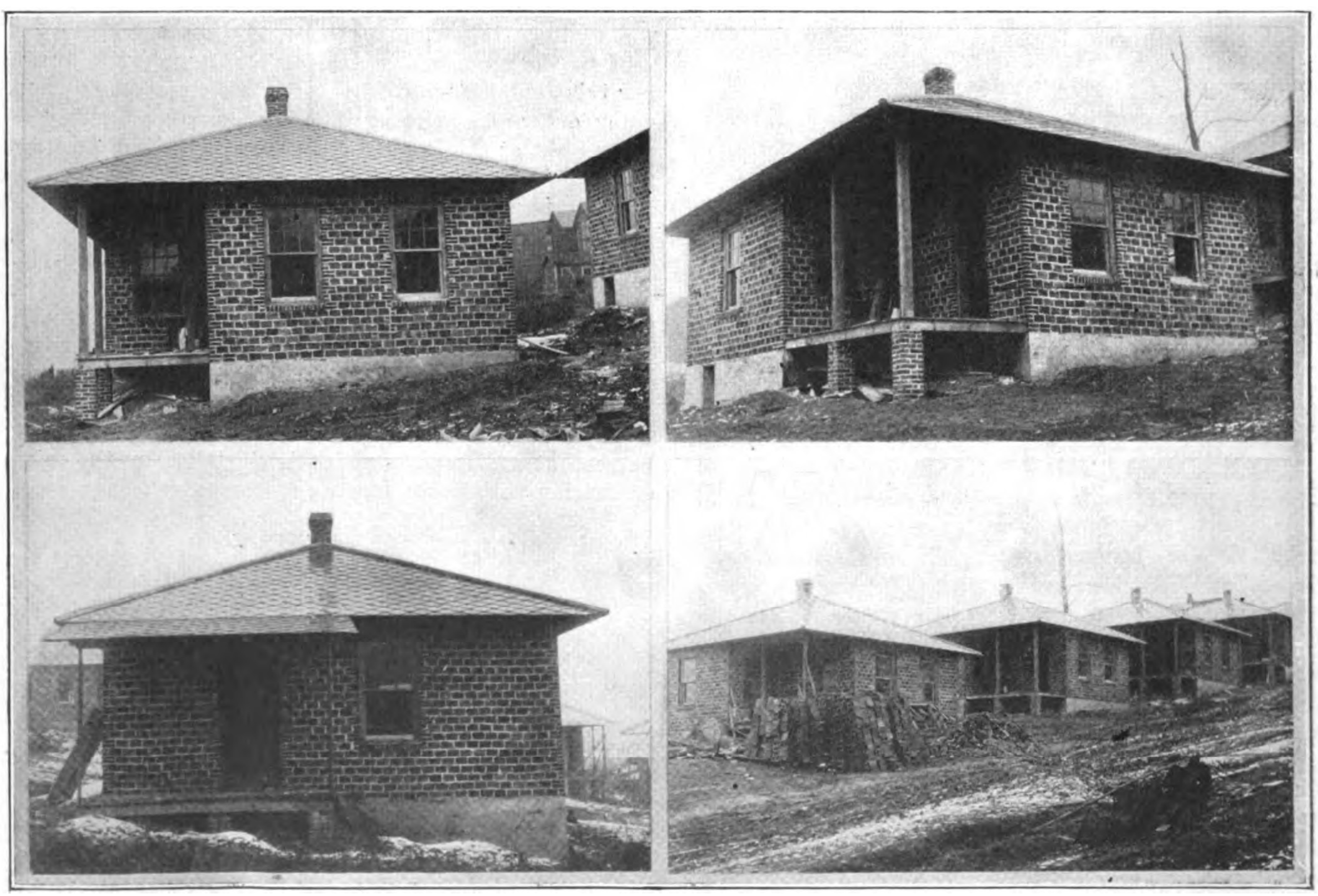
SYNOPSIS—*Tile bungalows at Rossiter, Penn. Two-story tile houses at Clymer, Penn. Single-family framehouses at Coal Run, Penn., capable, with some small changes, of being used for either a miner's or a superintendent's house. Two-family houses at Coal Run, Penn. Some illustrations of houses at Ebensburg, Penn. Bills of materials and working drawings for the first four houses.*

A NUMBER of houses of new design, of which this article covers only a few, have been erected in Indiana County, Pennsylvania, during the last few years. The Clearfield Bituminous Coal Corporation seems to have concentrated all its efforts in the erection of tile dwelling houses, of which it has two distinct types—a small three-room bungalow and a six-room two-story dwelling.

The bungalows, illustrated in Figs. 1, 2, 3 and 4, and shown in working drawing in Fig. 5, are being built at the Rossiter mine. Seventy-two of these are now either partly or wholly finished. These bungalows have over-all dimensions of 24 x 28 ft. They contain a front porch 7 x 12 ft., a living room 12 ft. by 15 ft. 6 in., a bedroom 11 x 14 ft., and a kitchen 11 x 14 ft. The houses are well lighted both by night and by day. They have three windows in each room. Each room has an electric light as has also the front and back porch. The kitchen door opens on a back porch 6 x 12 ft. Running water is provided in the kitchen. The rooms are heated by coal stoves furnished by the tenants. The use of tile in the construction of these houses tends to keep them cool in summer and warm in winter.

At the Sample Run mine of the Clearfield Bituminous Coal Corporation, at Clymer, Indiana County, Pennsylvania, the second type of house already mentioned is being used. This house is built of tile, is two stories in height and contains six rooms—three upstairs and three down. The house is not so attractive as the bungalow, but it is much better adapted to the needs of large families. These houses have a small front and back porch.

The front door opens into a large living room 10 ft. 6 in. by 17 ft. 6 in. To the rear of this is either a dining room or bedroom 9 ft. by 14 ft. 6 in. and also a kitchen 11 ft. 6 in. No running water has been provided within the houses. Upstairs there are bedrooms and a small hall. The front bedroom is 10 ft. 6 in. by 17 ft. 6 in. and has an angle closet in the



FIGS. 1 TO 4. VIEWS OF THE TYPE OF BUNGALOW BEING BUILT AT THE ROSSITER MINE

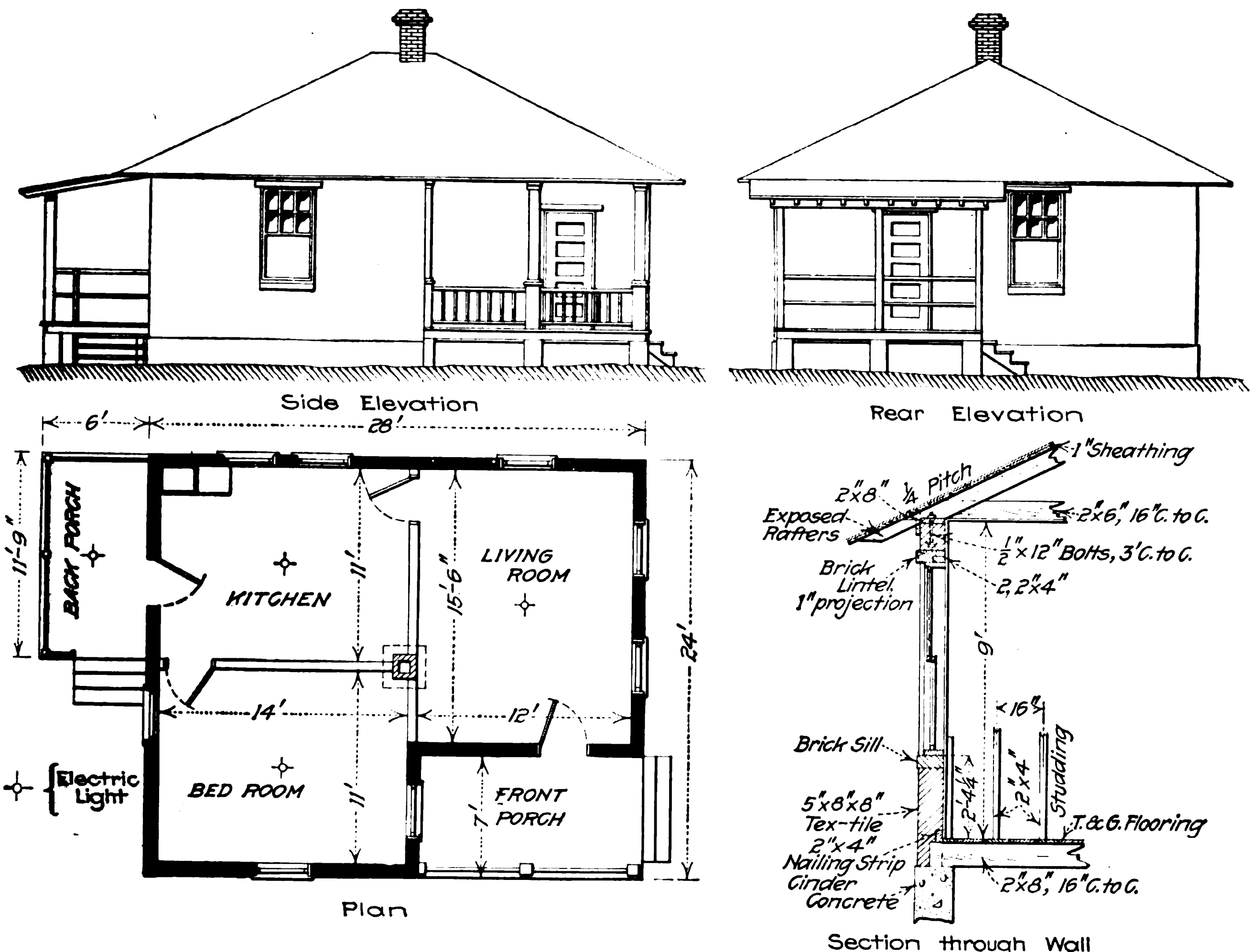


FIG. 5. WORKING PLAN OF BUNGALOWS ILLUSTRATED IN FIGS. 1 TO 4

rear. The bedrooms are 14 ft. 6 in. by 9 ft. 9 in. and 11 ft. 3 in. by 10 ft. 3 in. The chimney is in the center of the house. The roof is covered with Johns-Manville asbestos sheet roofing. The details of construction are shown in Fig. 6.

The following bill of material is approximately correct. In fact the amounts are slightly in excess of what would probably be required.

BILL OF MATERIAL, THREE-ROOM BUNGALOW, CLEARFIELD BITUMINOUS COAL CORPORATION, ROSSITER, PENN.

Finished Lumber

2 outside doors, 2 ft. 8 in., by 6 ft. 8 in., by 1¾ in	5 panels
2 inside doors, 2 ft. 6 in., by 6 ft. 8 in., by 1¾ in	5 panels
8 windows, two sash to window, one 30 x 28-in. light in lower sash and six 10 x 14 in. lights in upper sash glazed	
8 window frames for above sash	
2 outside doorframes	
2 inside doorframes	

	Board Feet
3 pieces, 1 x 4 in., by 12 ft., stools	12
3 pieces, 1 x 4 in., by 12 ft., aprons	12
8 pieces, 1 x 4 in., by 12 ft., window casing	32
4 pieces, 1 x 4 in., by 8 ft., window casing	11
6 pieces, 1 x 4 in., by 14 ft., door casing	28
2 pieces, 1 x 4 in., by 12 ft., door casing	8
160 lin. ft., ¾ in. by 8 in., base board	107
160 lin. ft., ¾ quarter-round molding	
9 pieces, 1 x 8 in., by 12 ft., border board	72
2 pieces, 1 x 4 in., by 10 ft., front porch post	7
4 pieces, 1 x 8 in., by 10 ft., front porch post	27
5 pieces, 1 x 6 in., by 10 ft., front porch post	25
2 pieces, 1 x 8 in., by 12 ft., front porch post	16
2 pieces, 1 x 10 in., by 12 ft., front porch post	20
2 piece, 5 x 5 in., by 14 ft., front porch	29
1 pieces, 1 x 6 in., by 14 ft., front porch	14
1 piece, 1 x 6 in., by 8 ft., front porch	4
2 pieces, 2 x 4 in., by 12 ft., front porch railing	16
36 lin. ft., 2 x 2 in., front porch balusters	12
3 porch posts, 5 x 5 in., by 8 ft., back porch	50
4 pieces, 1 x 6 in., by 12 ft., back porch	24
2 pieces, 5 x 5 in., by 12 ft., back porch	50
4 pieces, 2 x 4 in., by 12 ft., back porch railing	32
14 pieces, 2 x 4 in., by 10 ft., back porch rafters	93
160 lin. ft., 1 x 2 in., nailing strip	27
Total	728

Rough Lumber

60 pieces, 2 x 6 in., by 16 ft., roof rafters	960
9 pieces, 2 x 6 in., by 12 ft., back porch joists	108
9 pieces, 2 x 6 in., by 14 ft., front porch joists	126
1 piece, 3 x 6 in., by 10 ft., front porch posts	15
2 pieces, 6 x 6 in., by 10 ft., front porch posts	60
16 pieces, 2 x 8 in., by 14 ft., floor joists and sills	299
30 pieces, 2 x 8 in., by 12 ft., floor joists and sills	480
14 pieces, 2 x 6 in., by 14 ft., ceiling joists	196
26 pieces, 2 x 6 in., by 12 ft., ceiling joists	312
11 pieces, 2 x 6 in., by 8 ft., ceiling joists, porch	88
34 pieces, 2 x 4 in., by 10 ft., studding	227
1,200 sq.ft., 1 x 8 in., and 10 in., sheathing	1,200
9 pieces, 2 x 8 in., by 12 ft., wall plates	144
15 pieces, 2 x 4 in., by 12 ft., window and door caps	120
700 sq.ft. tongue and groove, ⅞ in. flooring	875
100 sq.ft., tongue and groove, ¾-in. flooring, front porch ceiling	125
300 lin.ft., 1 x 2 in., bridging	50
3 pieces, 2 x 12 in., by 6 ft., front steps	36
3 pieces, 2 x 12 in., by 12 ft., back steps	72
80 pieces, 1 x 2 in., by 10 ft., facing	133
3,000 4-ft. spruce laths	
4 pieces, 2 x 6 in., by 18-ft. ridge pole	72
Total	5,698
Grand total	6,701

Brick Tile, Etc.

2,100—5 x 8 in., by 8 in. tile
450—4 x 5 in., by 8 in. split tile
1,500—standard size trimming brick
500—standard size chimney brick
1,150—sq.ft. of roofing
200—sq.yd. of plaster

Estimates for foundations are not included

A rather interesting type of single house is being built by the Coal Run Coal Co. at Coal Run, Penn. This house is entirely frame, is two stories in height and is covered with Johns-Manville Brooks brand roofing. The house has a front porch 6 x 16 ft. and a smaller back porch. There are six rooms and bath in the house and a cellar excavated under the entire dwelling. Fig. 7 shows the details of construction while Fig. 8 shows the houses under construction.

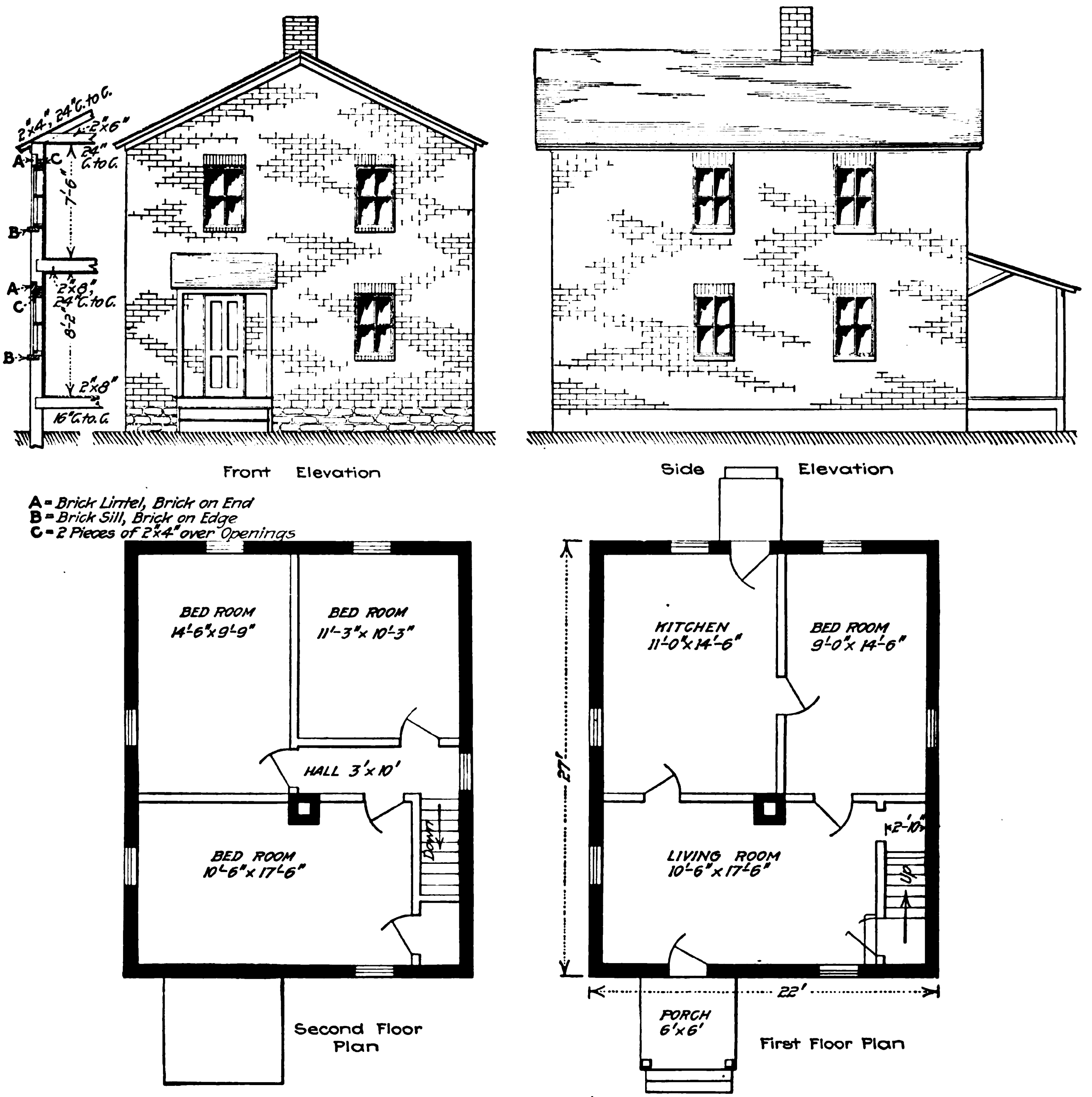


FIG. 6—DETAILS OF CONSTRUCTION OF TWO-STORY, SIX-ROOM TILE HOUSE

BILL OF MATERIAL FOR SIX-ROOM TWO-STORY HOUSE CLEARFIELD BITUMINOUS COAL CORPORATION, ROSSITER, PENN.

Finished Lumber

2 inside doors, 2 ft. by 6 ft. 6 in.
2 outside doors, 2 ft. 8 in., by 6 ft. 8 in., by $1\frac{3}{4}$ in.
7 inside doors, 2 ft. 6 in., by 6 ft. 6 in. by $1\frac{3}{8}$ in.
13 windows, 2 sash to the window, two 12 x 22 in. lights to sash
13 window frames for above sash
2 outside door frames
9 inside door frames

	Board Feet
20 lin.ft. $\frac{7}{8}$ x $3\frac{1}{4}$ in., net facing windows	6
4 pieces, 1 x 4 in., by 12 ft., stools	16
4 pieces, 1 x 4 in., by 12 ft., aprons	16
13 pieces, 1 x 4 in., by 13 ft., window casing	60
6 pieces, 1 x 4 in., by 12 ft., window casing	24
400 lin.ft., $\frac{7}{8}$ x 8 in., base board	260
400 lin.ft., $\frac{3}{4}$ in. quarter round molding	
4 pieces, 6 x 6 in., by 8 ft., front and back porch	96
358 lin.ft., 1 x 2 in., nailing strip	9
2 pieces, 2 x 10 in. by 14 ft., stringers	
4 pieces, $1\frac{1}{8}$ x $9\frac{1}{2}$ in., by 12 ft. stair treads	4
4 pieces, $1\frac{1}{16}$ x $7\frac{1}{2}$ in., by 12 ft. stair rises	2
3 pieces, 1 x 6 in., by 12 ft., front and back porch	18
27 pieces, 1 x 4 in., by 14 ft., door casing	121
	819

Rough Lumber

50 pieces, 2 x 6 in., by 12 ft., joists	600
50 pieces, 2 x 4 in., by 16 ft., roof rafters	533
23 pieces, 2 x 6 in., by 12 ft., 2nd floor ceiling joists	336
28 pieces, 2 x 8 in., by 12 ft., 2nd floor joists	448
40 pieces, 2 x 8 in., by 12 ft., 1st floor joists	640
2 pieces, 2 x 6 in., by 16 in., ridge pole	32
200 lin.ft., 2 x 8 in., cap for tile "D," Fig. 6	270
8 pieces, 2 x 4 in., by 12 ft., see "C," Fig. 6	64
1,200 sq.ft., 1 x 8 in., or 10 in., sheathing	1,200
1,400 sq.ft., tongue and groove $\frac{7}{8}$ flooring	1,750
200 sq.ft., tongue and groove, $\frac{5}{8}$ in. porch ceilings	262
6.400 4-ft. lath	
72 pieces, 2 x 4 in., by 16 ft., studding	739
180 pieces, 1 x 2 in., by 10 ft., furring	300
600 lin.ft., 1 x 2 in., bridging	100
3 pieces, 2 x 12 in., by 6 ft., front steps	18
3 pieces, 2 x 12 in., by 12 ft., back steps	72
5 pieces, 2 x 6 in., by 12 ft., back and front porch joists	60
108 lin.ft., 2 x 8 in., wall plates	144
Total	7,568
Grand total	8,387

Brick, Tile, Etc.

3,750 5 x 8 in., by 12 in., tile
250 4 x 4 in., by 12 in., tile
600 5 x 4 in., by 8 in., tile
800 common chimney brick
400 sq.yd. plaster

Estimates for foundations are not included

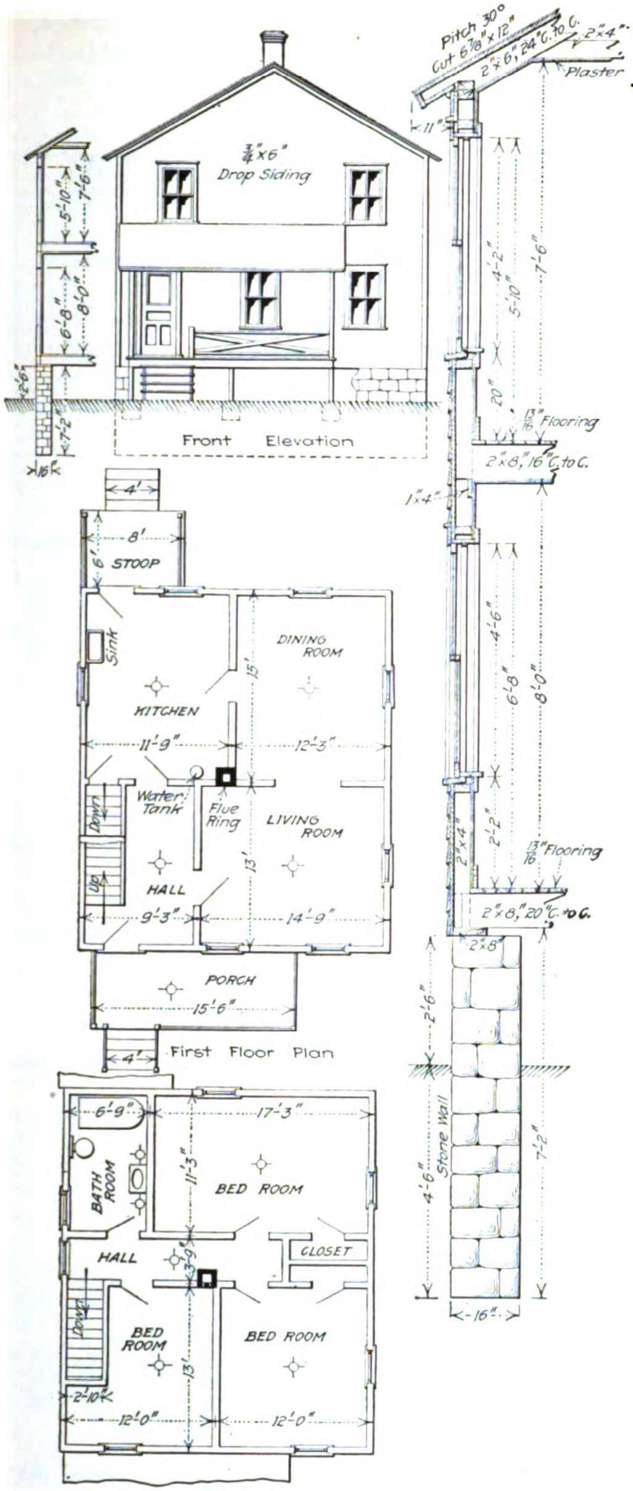


FIG. 7—DETAILS OF TWO-STORY SINGLE HOUSE

On the first floor is an entrance hall 9 ft. 3 in. by 13 ft., in which the stairway is located. There are two doors from this hall, one into a well-lighted living room which measures 13 ft. by 14 ft. 9 in. The other door from the hall opens into a kitchen 15 ft. by 11 ft. 9 in., provided with hot and cold water. A door from the kitchen opens into the dining room, and a large double door connects this latter room with the living room, which room measures 12 ft. 3 in. by 15 feet.

Upstairs there are three bedrooms, a hall and a bathroom. Two of these bedrooms are across the front of the house and have the same dimensions—namely, 12 x 13 ft. In the rear of the house there is one large bedroom measuring 11 ft. 3 in. by 17 ft. 3 in. The bathroom is of ample size—6 ft. 9 in. by 11 ft. 3 in. Between the back bedroom and the two front bedrooms is a hall 3 ft. 9 in. wide. At the end of this hall are two closets.

An exceedingly interesting feature in this design is the ease with which the house can be converted either into a superintendent's house or into a residence for the mine foreman. To prepare for the latter all that is necessary is to change the front porch by adding turned balustrades. For a superintendent's house about eight changes are necessary: (1) Use shingles, instead of drop siding, on the roof gables. (2) Use asbestos shingles on the roof. (3) Use large posts and turned balustrades on the porches and lattice the spaces below the porch floor. (4) Use a two-light instead of a four-light window. (5) Provide a steam-heating plant. (6) Cut a cellar door in the foundations so as to give an outside entrance. (7) Replace the closet space on the second floor by a bathroom; then convert the space in the rear of the house into two bedrooms of equal size, thus giving the house seven rooms and a bath. (8) Decorate the inside of the house to accord with its more elaborate construction. The bill of material is shown in the table on the next page.

At its Coal Run mines, Coal Run, Penn., the Coal Run Coal Co. has erected for its miners 72 double houses of two-story construction and is proposing to build many more in the spring. These double houses

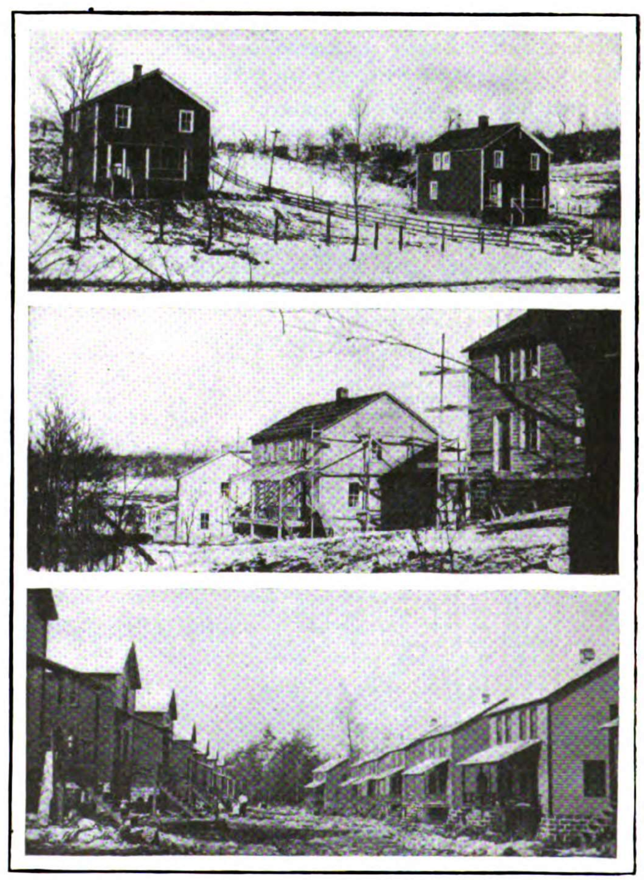


FIG. 8—HOUSES IN PROCESS OF CONSTRUCTION

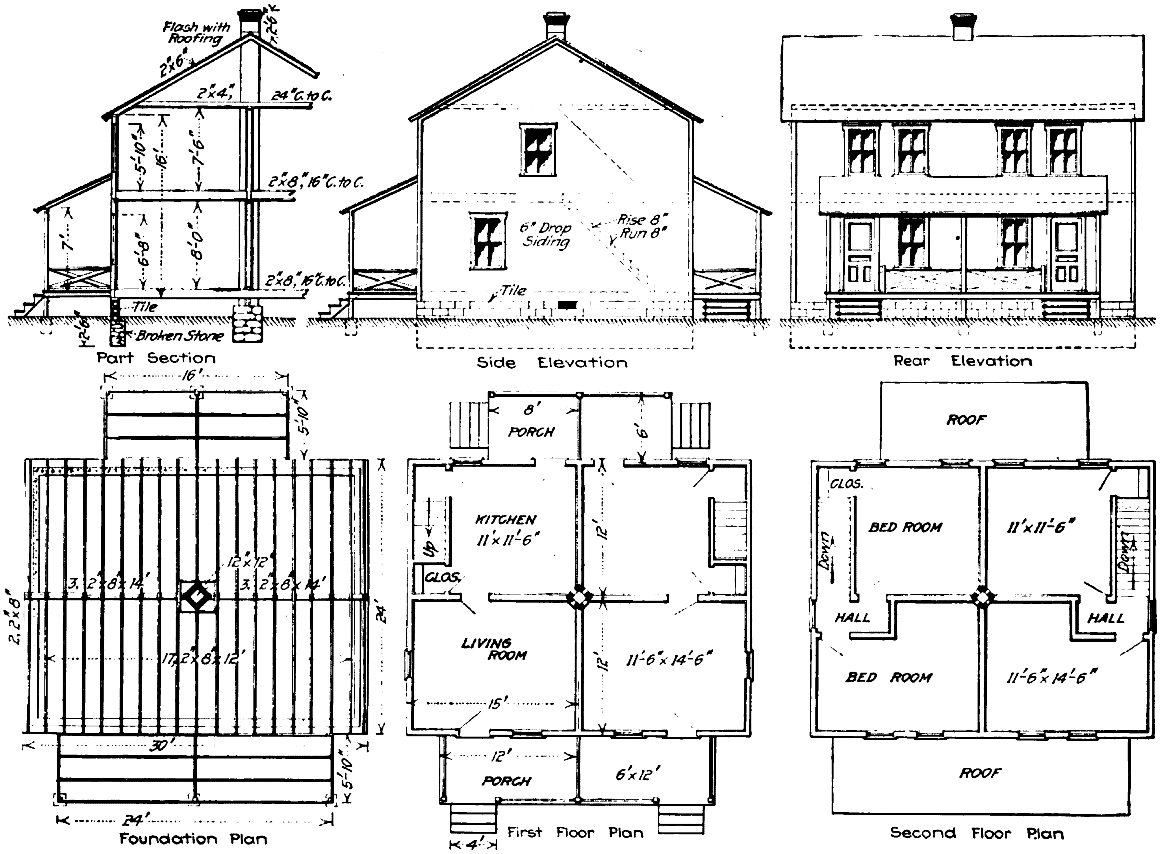


FIG. 9—DETAILED DRAWING OF DOUBLE HOUSES BUILT AT COAL RUN, PENN.

are neat and attractive in design. They are constructed of wood and painted a dark gray. The roof is covered with Johns-Manville Brooks brand roofing. There is a front porch 6 x 24 ft., divided into two equal parts for each family. The back porch is 8 x 16 feet.

Each side of the house contains four rooms, two upstairs and two on the main floor. The front rooms up and downstairs are 11 ft. 6 in. by 14 ft. 6 in., and the two back rooms 11 ft. by 11 ft. 6 in. The stairway is located in the kitchen. At the head of the stairs is a small hall 3 x 6 ft. No running water or heat of any kind is provided within the house. The chimney is in the center of the house, and flues open into every room. Light and air are generously provided, there being two windows of ample size in each room. Fig 10 is an illustration of these houses partly finished. Fig. 11 shows one of the rows in the village completed. Fig.

BILL OF MATERIAL FOR SINGLE HOUSE COAL RUN COAL CO., COAL RUN, PENN.

Finished Lumber

1 outside door, 2 ft. 8 in., by 6 ft. 8 in., by 1¾ in	5 panels
1 outside door, 2 ft. 8 in., by 6 ft. 8 in., by 1¾ in	Glazed
1 inside door, 2 ft. 8 in., by 6 ft. 8 in., by 1⅜ in	5 panels
6 inside doors, 2 ft. 8 in., by 6 ft. 8 in., by 1⅜ in	5 panels
3 inside doors, 2 ft. 8 in., by 6 ft. 8 in., by ⅞ in	5 panels
7 windows, 2 sash to the window, 12 x 24 in	2 lights to sash
7 windows, 2 sash to the window, 12 x 22 in	2 lights to sash
4 windows, 1 sash to the window, 12 x 24 in	2 lights to sash
7 frames for 12 x 24 in., 2 lights	2 sash to window
7 frames for 12 x 24 in., 2 lights	2 sash to window
4 frames for 12 x 24 in., 1 light	2 sash to window

	Board Feet
2 pieces, 1 x 6 in., by 12 ft., front and back porch	12
1 piece, 2 x 6 in., by 16 ft., front and back porch	16
1 piece, 1 x 6 in., by 16 ft., front and back porch posts	8
3 pieces 4 x 4 in., by 14 ft., front and back porch	56
1 piece, 4 x 4 in., by 10 ft., front and back porch	13
4 pieces, 1 x 2 in., by 12 ft., front and back porch	8
1 piece, 2 x 6 in., by 8 ft., front and back porch	8
2 pieces, 1 x 2 in., by 10 ft., front and back porch	4
4 pieces, 1 x 1 in., by 14 ft., front and back porch	5
7 pieces, 2 x 4 in., by 14 ft., front and back porch rafters	70
2 pieces, 1 x 2 in., by 8 ft., front and back porch	3
1 piece, 1 x 1 in., by 8 ft., front and back porch	1
7 pieces, 1 x 4 in., by 12 ft., stools	28
7 pieces, 1 x 4 in., by 12 ft., aprons, back porch	28
7 pieces, 1 x 4 in., by 10 ft., window casing	23
7 pieces, 1 x 4 in., by 8 ft., window casing	21
10 pieces, 1 x 4 in., by 12 ft., window casing	40
475 lin. ft., ¾x8 in., base board	475
475 lin.ft., ¾-in. quarter round, molding	
475 lin.ft., 1 x 2 in., nailing strips	80
2 pieces, 2 x 10 in., by 14 ft., stringers	48
2 pieces, ¾-in. quarter round, molding	
9 pieces, $1\frac{1}{16}$ x 9½ in., by 6 ft., treads	45
9 pieces, $\frac{13}{16}$ x 7½ in., by 6 ft., rises	32
12 pieces, 1 x 6 in., by 18 ft., corner trims	108
3,900 lin.ft., ¾ x 6 in., drop siding	3,225
Total	4,357

Rough Timber

	Board Feet
2 pieces, 2 x 8 in., by 16 ft., ridge poles	42
32 pieces, 2 x 6 in., by 16 ft., roof rafters	512
32 pieces, 2 x 4 in., by 12 ft., ceiling hoists	256
42 pieces, 2 x 8 in., by 12 ft., 2nd floor	672
36 pieces, 2 x 8 in., by 12 ft., 1st floor	576
6 pieces, 2 x 12 in., by 14 ft., girder	168
188 pieces, 2 x 4 in., by 16 ft., studding	1,880
954 lin.ft., 1 x 2 in., bridging	160
1,900 sq.ft., 1 x 8 in., or 10 in., sheeting	1,900
1,100 sq.ft., 1 x 8 in., or 10 in., sheeting roofs	1,100
9,000 lath, 4 ft.	
1,344 sq.ft., $1\frac{1}{16}$ tongue and groove flooring	1,680
144 sq.ft., ¾ tongue and groove, porch flooring	180
144 sq.ft., ¾ tongue and groove, porch ceiling	180
477 lin.ft., 2 x 4 in., wall plates	318
477 lin.ft., 2 x 8 in., joists	636
Total	10,260
Grand total	14,617

Miscellaneous

600 sq.yd. plaster	Bath room fixtures
1,100 sq.ft. roofing	Kitchen sink
1,200 common brick	

9 is a detailed drawing of the same dwellings. The bill of material is only approximate:

BILL OF MATERIAL FOR DOUBLE MINERS HOUSE, COAL RUN COAL CO., COAL RUN, PA.

Finished Lumber

4 outside doors, 2 ft. 8 in., by 6 ft. 8 in., by 1¾ in., glazed	
8 inside doors., 2 ft. 6 in., by 6 ft. 6 in., by 1⅜ in.	
4 inside doors, 2 ft. 6 in., by 6 ft. 6 in., by ⅞ in.	
8 windows, 2 sash to the window, 12 x 24 in	2 lights
8 window frames for above	
10 windows, 2 sash to the window, 12 x 20 in	2 lights
10 window frames for above	
	Board Feet
12 pieces, 1 x 4 in., by 16 ft., outside trim	64
3 pieces, 4 x 4 in., by 14 ft., porch posts	52
1 piece, 2 x 6 in., by 16 ft., back porch	16
2 pieces, 2 x 6 in., by 12 ft., front and back porch	24
2 pieces, 2 x 6 in., by 12 ft., front porch	24
2 pieces, 2 x 4 in., by 16 ft., back porch	22
2 pieces, 1 x 4 in., by 18 ft., back porch	12
2 pieces, 2 x 4 in., by 14 ft., front porch	18
2 pieces, 1 x 4 in., by 16 ft., front porch	10
2 pieces, 2 x 4 in., by 12 ft., front porch	16
2 pieces, 1 x 4 in., by 14 ft., front porch	10
2 pieces, 2 x 6 in., by 12 ft., front porch	24
1 piece, 2 x 6 in., by 16 ft., back porch	16
9 pieces, 1 x 4 in., by 14 ft., aprons, porch	42
9 pieces, 1 x 4 in., by 14 ft., stools, porch	42
9 pieces, 1 x 4 in., by 14 ft., window casing	42
18 pieces, 1 x 4 in., by 18 ft., window casing.	108
20 pieces, 1 x 4 in., by 14 ft., door casing	140
500 lin.ft., 1 x 8 in., base board	335
500 lin.ft., ¾-in. quarter round, molding	
500 lin.ft., 1 x 2 in., nailing strips	85
4 pieces, 2 x 10 in., by 12 ft., stringers	80
6 pieces, 1 1/16 x 9½ in., by 12 ft. treads	60
9 pieces, 1 1/16 x 7½ in., by 12 ft. rises	42
4,000 sq.ft., 6-in. drop-siding siding	3,000
Total	4,284

Rough Lumber

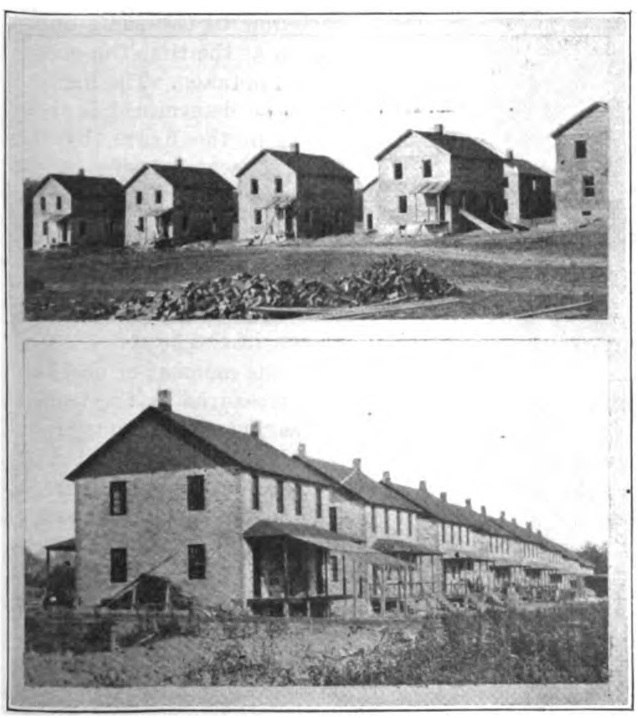
	Board Feet
2 pieces, 2 x 8 in., by 18 ft., ridge pole	38
32 pieces, 2 x 6 in., by 18 ft., rafters	576
32 pieces, 2 x 4 in., by 16 ft., ceiling joists	160
46 pieces, 2 x 8 in., by 16 ft., 2nd floor joists	966
40 pieces, 2 x 8 in., by 16 ft., 1st floor joists	840
9 pieces, 2 x 8 in., by 12 ft., sills	144
163 pieces, 2 x 4 in., by 16 ft., studding	1,630
6 pieces, 2 x 8 in., by 14 ft., girder	114
1,000 lin.ft., 1 x 2 in., bridging	166
4,000 sq.ft., 1-in. sheeting side	4,000
1,100 sq.ft., 1-in. sheeting roof	1,100
9,000 laths, 4 ft., lath	
1,440 sq.ft., tongue and groove flooring	1,820
240 sq.ft., tongue and groove, flooring porches	309
240 lin.ft., tongue and groove, flooring porches, ceiling	333
500 lin.ft., 2 x 4 in., wall plates	333
13 pieces, 2 x 4 in., by 14 ft., rafters for porches	130
Total	12,527
Grand Total	16,811

Miscellaneous

3,000 common brick

600 sq.yd. plaster

1,100 sq.ft. roofing



FIGS. 10 AND 11.—UNCOMPLETED AND COMPLETED HOUSES

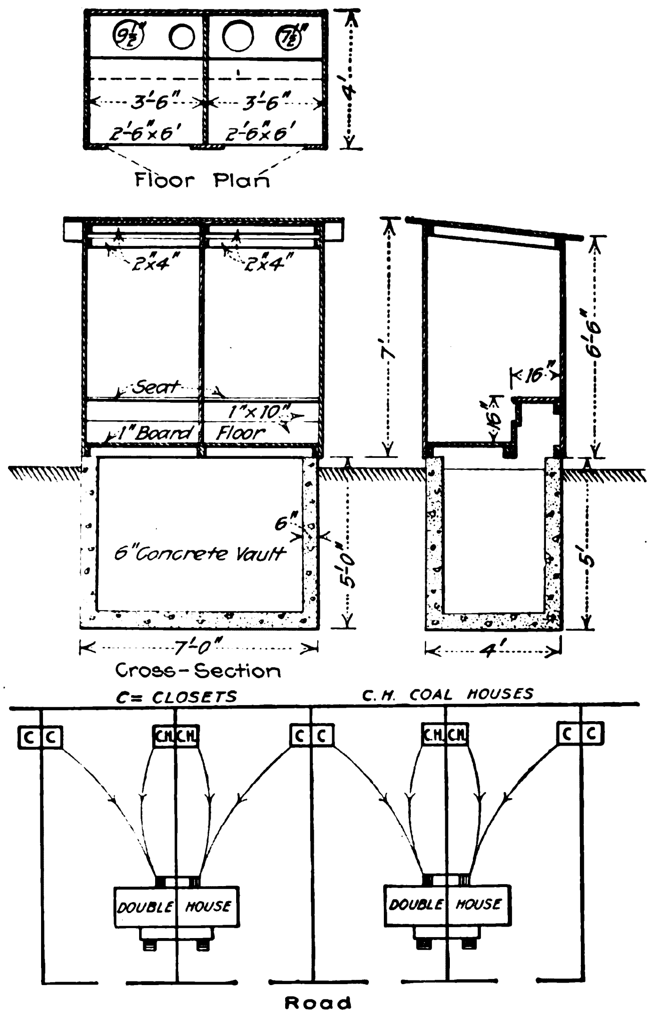


FIG. 12—ARRANGEMENT OF CLOSETS AND COAL HOUSES

The interesting arrangement of closets and coal houses is shown in Fig 12. It will be noticed that the coal houses are set nearer the dwellings than the closets. The following is a bill of material for the appurtenances, see Fig. 12:

BILL OF MATERIAL FOR CLOSETS, COAL RUN MINING CO.

Rough Lumber

	Board Feet
13 pieces, 1 x 12 in., by 14 ft	182
4 pieces, 1 x 12 in., by 10 ft	40
1 piece, 2 x 16 in., by 8 ft	20
1 piece, 2 x 10 in., by 14 ft	24
1 piece, 2 x 4 in., by 14 ft	9
1 piece, 2 x 4 in., by 12 ft	8
2 pieces, 2 x 4 in., by 18 ft	12
140 cu.ft. excavation	
54 cu.ft. concrete	
20 sq.ft. flooring	25
28 sq.ft. roofing	
Total	310

BILL OF MATERIAL FOR COAL HOUSES, COAL RUN MINING CO.

Rough Lumber

	Board Feet
23 pieces, 1 x 12 in., by 14 ft	322
4 pieces, 2 x 12 in., by 12 ft	96
8 pieces, 2 x 4 in., by 12 ft	64
Total	482

When the rate of combustion is doubled the quantity of the volatile matter distilled per unit of time is doubled. However, to burn this double quantity of volatile matter with the same excess of air to the same completeness, the combustion space is increased only about 20 per cent.—*Bureau of Mines Bulletin No. 135.*

The Ross Meridiograph

By J. T. BEARD
Senior Associate Editor "Coal Age"

SYNOPSIS — *Need of a simple means of making a quick and accurate determination of the true meridian at any suitable time and place. The "meridiograph" devised for this purpose. Description of the instrument, its use explained. Diagram for ascertaining at a glance the actual change in declination from that given in the Ephemeris for Greenwich noon, to that for any suitable time and place of observation at any longitude east or west of Greenwich.*

IT IS a rare privilege to be able to present to the readers of *Coal Age* the description of a successful practical device whose need has long been felt by mining and civil engineers and surveyors, but which has heretofore defied many ingenious attempts to construct in a simple and compact manner.

All engineers and surveyors realize that the quick and ready determination of the true meridian of a place is not only a matter of first importance but is, at the same time, a most troublesome feature of the work in hand. As is well known, the indications of the magnetic needle are wholly unreliable. Astronomic methods for determining the true north are not only inconvenient and difficult, but require more knowledge of the heavens than is possessed by the average mine foreman. Such determinations are rarely attempted, even by the more skilled United States deputy mineral surveyors, the accuracy of whose work depends on the correct determination of the true meridian.

The so-called "solar attachment" of the engineer's transit has served the purpose till now of determining true north and has been used very largely by engineers and deputy mineral surveyors throughout the country. The delicacy of the adjustment of this device, however, required a degree of mechanical skill that few possessed; and this fact, together with the added expense of the attachment, is fast rendering its use obsolete in present-day practice.

The meridiograph is a new instrument, designed by Louis Ross, a former United States deputy mineral surveyor of San Francisco. Mr. Ross is to be congratulated on his mechanical ingenuity and the success that has attended his efforts. With the aid of this device, the engineer or surveyor is enabled to locate a true north and south line, in a few minutes, at any time of the day when an observation of the sun for this purpose is practicable.

As in the use of the solar attachment, the observation with the meridiograph will give the best results when made in the early morning or late in the afternoon, at which time the sun's altitude is changing more rapidly. An observation for azimuth taken in the hours approaching or following noonday are naturally unreliable. Observing the sun's altitude at noon, or when it is crossing the meridian, serves to determine the latitude of the place when this is not known. The altitude of the sun at noon is always the co-latitude of the place.

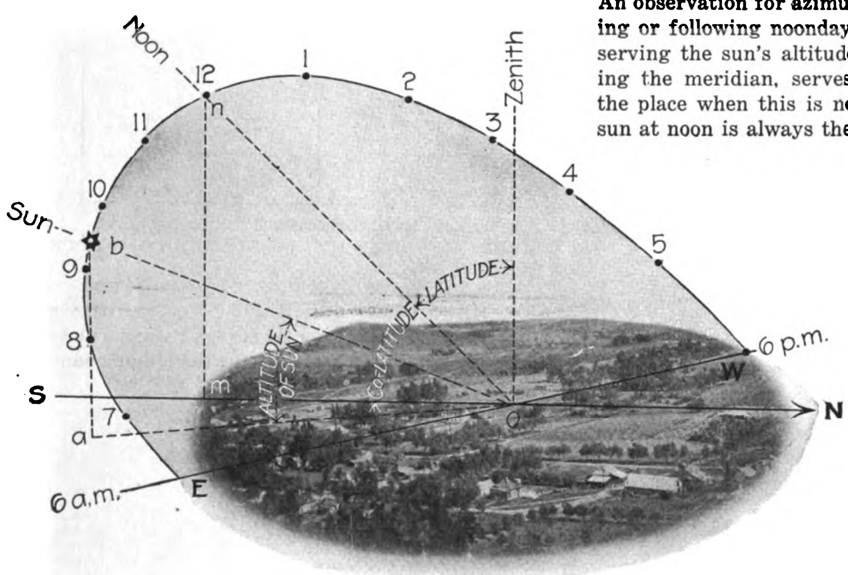


FIG. 1. ILLUSTRATING THE USE OF THE MERIDIOGRAPH IN THE FIELD

The accompanying illustration (Fig. 1) shows an observation taken at the crossroads at *O*, in the center of a landscape. The hour circle, or path of the sun, is described in a plane corresponding to the sun's declination at the time the observation is taken. The meridian to be determined is indicated, in the figure, by the line *NS*, which is the center line of the north and south road, in the landscape. The line *EW* represents the east and west line and is the center line of the crossroad, also shown in the figure.

At the moment of observation, the altitude of the sun, as measured by the transit at *O* is the angle *aOb*. The bearing of the sun, or its angular distance from the meridian *NS*, is indicated by the angle *aOS*. This angle is read on the meridiograph when the latitude of the place and the sun's altitude are set to correspond to each other on the respective scales of the instrument.

The manner of finding this angle of the sun's bearing, by means of the meridiograph, will be described later, but it may be stated here that the latitude of the place, if not previously known, may be ascertained from the co-latitude, indicated by the angle *mOn*, in the figure. This angle is measured by the transit when the sun has attained its greatest altitude at noon when crossing the meridian. The latitude of the place is always the complement of the co-latitude, or 90 deg. minus the co-latitude. As indicated in the figure, the latitude is the angular distance of the sun at noon from the zenith.

The meridiograph instrument is shown in Fig. 2. It consists of two graduated disks and a reading arm equipped with a magnifying glass adjustable to any focus. The two circular disks are concentric, the outer graduated circle having a diameter of 7 in. This scale is engraved on a silvered surface, while the inner dial is finished in gunmetal. The arrangement of the scales is such that, although the diameter of the graduated circle does not exceed 7 in., the angular graduations are as open as a protractor 60 in. in diameter.

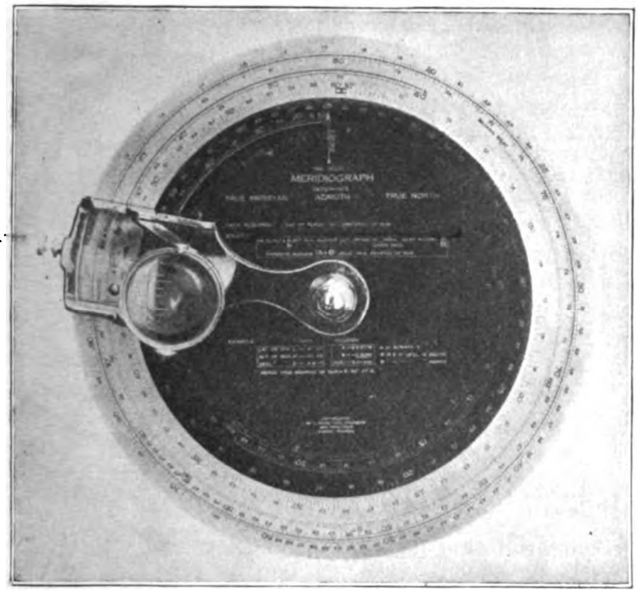


FIG. 2. THE MERIDIOGRAPH

One has but to use the meridiograph once or twice, in the field, for the purpose for which it was intended, to be convinced of its practical value as a time saver and a guarantee against casual error in calculations. None realizes this better than the engineer who is familiar with common practice in the use of a solar.

There are several scales on the two disks of the meridiograph, the principal ones being known as the A scales, of which there are two, and the B scales, the same in number. There is, beside, a scale for determining sun time, by observation, if desired.

Manner of Using the Meridiograph in the Field

Briefly described, the operation of the meridiograph depends on two steps, assuming that the latitude and longitude of the place are known and that the sun's altitude has been measured with the transit, the first step is to ascertain the declination of the sun at the time of observation. The Ephemeris, or Nautical Almanac, used by engineers and surveyors, gives the sun's declination for each year, at Greenwich mean moon.

An inspection of the Ephemeris shows that the sun attains its greatest declination (23° 27′) twice a year; namely, at the solstices, about June 21 and Dec. 21, the declination being north in the former case and south in the latter. Again, the declination of the sun is zero when crossing the equator, which is twice a year; namely, at the equinoxes, about Mar. 21 and Sept. 22.

Further inspection of the Ephemeris shows that the daily change in declination is greatest at the equinoxes when it is approximately 23.7 min. in 24 hr. At the solstices when the sun attains its greatest declination

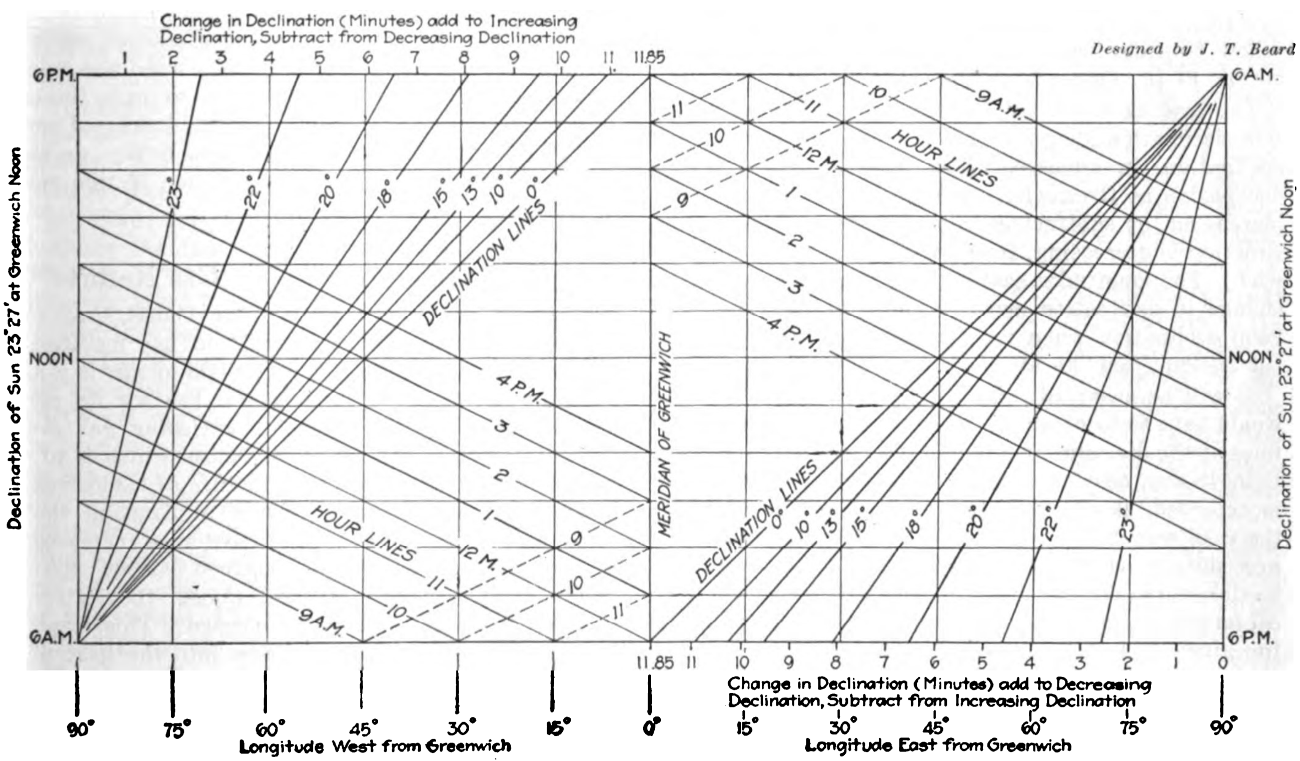


FIG. 3. DIAGRAM FOR ESTIMATING THE APPARENT DECLINATION OF THE SUN, FOR ANY LONGITUDE AND TIME FROM 9 A.M. TO 4 P.M., BY ADDING OR SUBTRACTIN G THE CHANGE TAKEN FROM THE DIAGRAM TO OR FROM THE DECLINATION AT GREENWICH NOON, AS GIVEN IN THE EPHEMERIS

either north or south, the daily change is least, being approximately one or two-tenths of a minute in 24 hours.

The diagram shown in Fig. 3 is based on the varying change in declination, for various altitudes of the sun, and shows at a glance the actual change that must be added to or subtracted from the declination at Greenwich noon, as taken from the Ephemeris. The amount of such change will depend on the difference in time as determined by the longitude of the place of observation east or west of Greenwich, and varies also with the declination. It is important to observe that, for all places north or south of the equator, the declination *increases* from the equinox to the solstice, and *decreases* from the solstice to the equinox. It is necessary, of course, to add the estimated change in declination to that given in the Ephemeris when the declination is increasing to obtain the correct declination at any given time for places west of Greenwich and subtract such change for places east of Greenwich. On the contrary, for a decreasing declination, it is necessary to subtract the estimated change from the declination given in the Ephemeris, for all places west of Greenwich, and to add the change for all places east of Greenwich.

The diagram (Fig. 3) makes it possible to ascertain the amount of change in declination for any longitude east or west of Greenwich, and any mean sun time at which an observation is taken, having due regard to the declination of the sun at that time.

To Find the Declination With the Diagram, Fig. 3

Follow the diagonal hour line corresponding to the time of taking the observation to its intersection with the vertical line corresponding to the longitude of the place; and project this point of intersection horizontally on to the diagonal corresponding to the declination at Greenwich noon, as taken from the Ephemeris. Then, follow this declination-line to the scale at the top or bottom of the diagram, as the case may be.

The reading of the scale at the point indicated by the said declination-line will give the estimated change of declination, in minutes, which must be added to the declination at Greenwich noon when the declination is increasing, or subtracted from the same when the declination is decreasing, for all longitudes west of Greenwich. For longitudes east of Greenwich, the estimated change in declination must be added to the Greenwich noon declination when the declination is decreasing or subtracted from the same when it is increasing.

It will be observed that when the diagonal hour-line would have to be extended below or above the horizontal lines of the diagram, in order to intersect longitudes less than 45 deg. east or west of Greenwich, such hour-line is extended, as a dotted line, upward or downward, as the case may be, so as to cross these longitudes. The procedure, in that case, is the same as before, the intersection of the dotted hour-diagonal with the given vertical longitude-line being then projected horizontally onto the given declination-diagonal, whose intersection with the scale, at the top or the bottom of the diagram, will indicate the change in declination for the given time and place.

This diagram is somewhat different from the diagram proposed by the inventor of the instrument. It is one I have devised as being a more logical and simple presentation and one that will be more readily used in practice. Fig. 4 shows the leather should bag for carrying the meridiograph, together with ample pockets for field notebooks. As a simple, complete and practical device for finding the true meridian, I can strongly

FIG. 4. BAG FOR CARRYING THE INSTRUMENT

recommend this instrument for field use. It is a remarkable time saver, which will be well appreciated by those whose daily work compels the use of the solar attachment for ascertaining the meridian of a place. The possible error in the use of this device will not exceed one or two minutes at the utmost. Full instructions for its use accompany each instrument. As is well known, the best time for taking observations on the sun, for the purpose of determining a true meridian, is in the early forenoon or later in the afternoon when the error of the determination will not exceed one minute. When the observation is taken closer to noon, the error may reach two minutes. Owing to the increased refraction of the sun's rays, it is inadvisable to take an observation before 9 a. m. or after 4 p. m., if this can be avoided.

Coal Carbonization in Gas Retorts

The present heavy demand for benzol, toluol and other byproducts of coal distillation has modified the gas engineer's methods. A high yield of gas is a prime necessity to meet the demands for gas for its various services. But certain elements enriching gas are reduced to increase the supply of benzol which is of such prime importance in the manufacture of explosives.

At the Macclesfield gas works in England the gas yield per ton of coal is said to have been increased and at the same time to have obtained largely increased yields of tar and ammoniacal liquor, the latter furnishing fertilizers so urgently needed. This result has been attained by injecting steam into the base of the retorts, thus generating blue water gas. This method removes the last trace of gas from the coal and washes out the tarry matter before the tar has been subjected to destructive distillation. No deterioration has been noticed in the retorts as the result of steaming, and scurfing has been reduced to a minimum.

Strip Mining Where Bad Roof Prevails

By RALPH W. MAYER
Connellsville, Penn.

SYNOPSIS — *A considerable area of the Pittsburgh bed of coal near Burgettstown, Penn., has comparatively shallow cover and an extremely bad roof. This is being profitably recovered by means of stripping. Because of the nature of the overlying rock blasting must be extensively practiced and carefully executed.*

A LARGE area of coal at Burgettstown, Penn., about 25 miles west of Pittsburgh, has a poor roof, one that it is almost impossible to hold up without lagging between timbers placed close together. The cover is shallow. The coal worked is the Pittsburgh bed, is of good quality and varies from 5 to 7 ft. in thickness. The same district contains a considerable amount of coal which has a good roof and is easily secured by the usual methods of underground mining.

The Harmon Creek Coal Co. is successfully mining out large areas of this coal which has a poor roof by means of stripping. Six-inch holes are drilled from the surface down to the top of the coal. These are placed 25 or 30 ft. apart. Keystone steam drills and gasoline drilling machines are used. These are self-propelled, moving from place to place under their own power. The covering on the coal is from 20 to 40 ft. thick and consists of soil, shale, slate, and in some places a harder rock closely resembling limestone.

After the machines have finished drilling the holes, they are sprung three times to form a chamber above the coal to hold the final charge of powder. The first springing charge consists of six or eight sticks of dynamite. This shoots the mud out of the hole and slightly enlarges the bottom. The second charge consists of about half a box of dynamite, and for the third springing charge about a 50-lb. box is used. It is unnecessary to clean the borehole after each charge. The shots throw the dirt up through the borehole onto the surface.

After the holes have been sprung three times they are given the final charge, which consists of black powder. Twenty to thirty 25-lb. kegs of FFF black powder are used for each hole. The tops of the kegs are cut partly off and the powder poured from the keg directly down the borehole.

The powder is exploded by using No. 6 electric detonators with 30-ft. wires. Two detonators are placed in each hole, so that in the event of the failure of one a second could be fired. Each detonator is placed in the end of a stick of dynamite and two half hitches of the lead wires of the detonator are taken around each end of the stick. Thus the stick of dynamite with the detonator in it hangs vertically in the borehole when it is lowered into it by means of the 30-ft. lead wires. This prevents the dynamite from catching on the sides of the hole and refusing to go farther. One or two kegs of powder are then poured on top of the dynamite sticks which contain the detonators. After the explosives have been placed in the hole it is filled with tamping, the soil surrounding the hole being used for this purpose.

A stick about 25 ft. long and 2 or 3 in. in diameter is used as a tamping tool. A ½-in. rope is fastened to the end of this stick, so that it hangs perpendicularly in the hole when supported by the rope.

One man continuously uses the tamping stick while the powder and tamping is being put into the hole, pounding both firmly into place. He also holds the lead wires of the detonator to prevent them from dropping into the hole. He does this by taking a couple of turns of each lead wire around each of his feet, thus holding the wires against the side of the hole. He has free use of both his hands for tamping the hole. Two men usually pour out the powder, while a fourth man occasionally helps and in general oversees the work of loading and tamping. It is necessary to exercise care in filling the holes with tamping and not introduce the soil into the hole so fast that it chokes and gets clogged.

Holes Fired at One Time by Electricity

When 10 or 15 holes have been loaded and tamped they are all fired simultaneously by means of an electric current. The resultant explosion has the effect of lifting the rock for a considerable space or area up off the coal and dropping it back again, thus shattering it but causing little disturbance upon the surface. The charge of explosives for a hole is of course varied according to the depth and nature of the overburden.

Where the rock is unusually hard, or the hole a trifle moist, four or five boxes of dynamite in the bottom of the hole, then 15 to 20 kegs of powder and three or four boxes of dynamite on top of the powder may be used. The holes are almost all dry after being sprung. Occasionally a wet hole will occur. In such a case a hanging charge of dynamite is exploded at the top of the water in the hole. This cracks the rock so that the water drains off, leaving a dry hole. The dynamite used is of 40 per cent. strength.

As a protection in inclement weather for the persons loading the holes and to keep the explosives dry, a V-shaped shelter is used. Each side of this shelter is about 6 ft. wide, and 6 ft. high. It is set on its end over the hole to be loaded, the point of the V facing the wind. The top of the V is covered with a flat roof affording protection from above. This shelter is made strong and light in weight so that it can easily be moved from hole to hole.

The drilling machine has a small blower or fan which is placed just in front of the flywheel of the engine. The fan has a pulley of small diameter fastened to its shaft and is mounted on a small swinging platform which may be swung so that the pulley of the fan comes into contact with the circumference of the revolving flywheel of the engine, thus rotating the fan. A 2-in. hose leads from the fan to a forge, which is used for heating the bit of the drill when it is necessary to sharpen it. The hose terminates in 3 ft. of iron pipe which finally leads the blast to the forge. This pipe is buried a few inches underneath the ground and over its end a simple forge made. The air from the fan coming through this hose and pipe makes a good fire.

A few loose bricks set up on edge, two high and others laid loosely across their top and across one end, and covered with dirt, leaves an opening large enough for the bit of the drill. This makes an effective forge, and one that is quickly built and easily moved from place to place. It has only the opening at the bottom where the air enters through the 2-in. pipe and the opening at the end which receives the bit. Into this the coal is fed, and from it the smoke issues. A few small lumps of coal will quickly heat the bit of the drill.

This forge is made two brick lengths long. These two bricks are placed on edge and two more are placed on edge on top of them. Four bricks thus form one side. The two sides are so placed that bricks can be laid lengthwise from one side to the other. The top and end are built up in this manner. They are covered with dirt to give the entire structure firmness.

When the overburden has been broken by the use of explosives it is shoveled back off of the coal and deposited upon the ground from which the coal has been removed. A strip of ground across the coal field is drilled and loosened by explosives. This strip is then cleaned of its overburden and the coal underneath removed. The strip from which the coal has been removed makes room for depositing the overburden of the next adjoining strip.

Waste Shoveled Back by Steam Shovels

Four Marion steam shovels, Model 300, are used for stripping or shoveling back the waste. The buckets range in capacity from 6 to 8 cu.yd., and the booms are from 85 to 95 ft. in length. Each shovel runs on short lengths of rail which are removed from its rear and placed in front as the machine advances. The track for the railroad cars is placed immediately upon the coal and on the side of the stripping next the virgin ground, or on the opposite side of the strip from the waste pile or dump.

These works are on the main line of the Pennsylvania R.R. Panhandle route. The railroad cars are left on a siding. The Harmon Creek Coal Co.'s locomotives take them from this siding and haul them directly into the pit or onto this track laid upon the top of the coal. Here they are loaded by means of a Marion steam shovel, Model 36. This model is provided with a caterpillar truck, and can travel over the inequalities of the floor with ease. It works in the lowest part of the cut into which the water drains if any is present and where it might be troublesome to lay track. This type of truck gives it great freedom of movement.

The shovel moves by its own power, but in a hard place where this is insufficient the power of the dipper engine is also utilized. This is done by means of a piece of cable or sling having an eye spliced in each end. This cable is passed underneath the top half of the caterpillar belt a few feet back from its front end. The eyes on the two ends of the cable are then hooked over the teeth of the shovel. When the dipper is raised or pushed ahead the cable tightens and pulls on the belt, thus helping to move the machine ahead. The coal in the seam is not shot, the shovel being powerful enough to loosen it.

This shovel runs upon the floor of the coal bed and loads the coal directly into the railroad cars. The shovels work in pairs, each stripper being accompanied by a digger. Each stripping shovel works two 10-hour shifts per day, while each loader works one shift.

Several men work ahead of the loading shovel, sweeping off the top of the coal with wire brooms and throwing back the sweepings. Three men also work in the car while it is being loaded, throwing out slate and refuse. Picks are here used to break the pieces of slate loose from the coal when necessary. They also signal the shovelman not to dump a shovelful of coal when they have not all the slate thrown out of the car. The craneman dumps the coal into the car in such a manner that it is spread out so that the slate may be easily seen. The slate is thrown off the car on the side opposite the shovel or between the railroad track and the face of the next stripping. The stripping shovel throws this slate back along with the waste when it makes its next cut.

Locomotive Works in Conjunction With Shovel

A locomotive constantly serves the loading shovel to shift the cars to the proper position for easy loading and to take away the loads and return with empties. Only a few minutes are required to take out the loads and return with empties from the sidetrack. While the locomotive is doing this the shovelman is loosening up the coal for loading succeeding cars. The company has its own locomotives and sidetracks.

The coal seam lies practically level and high so that the water drains off into the valleys, which cut the seam where it outcrops. Where there are swamps or depressions the water is pumped out with gasoline pumps. Box drains made of planking are laid on the floor and covered with the waste piles where the deposits of waste would dam back the water from flowing out of the pit or open cut.

The water-supply for the boilers of the steam shovels and locomotives is obtained from a reservoir made by damming a small creek. The face of the dam is riprapped with flat stones, and a concrete spillway takes care of the overflow. A pumping plant at the reservoir forces the water through pipe lines to the different works, connections being made to the steam shovels by hose. The locomotives fill their tanks from stand pipes placed at convenient points.

Part of the field carries another seam about 2 ft. thick, overlying the Pittsburgh bed but separated from it by several feet of rock. This bed (known as the Rooster seam) also contains a good quality of coal, but aside from being used in the steam-shovel boilers, where it can be conveniently secured, it is wasted as the cost of its recovery would be prohibitive.

Several men are employed to keep the waste shoveled up to the face in front of the stripping shovel on top of the coal. This top of the coal seam forms the floor upon which the stripping shovel operates. The stripping shovels easily handle any pieces of rock which they encounter without difficulty.

The company began stripping operations in February, 1917, and commenced loading coal in September, 1917. In this short time the shovels have uncovered a large area of coal a mile or more in length.

The Harmon Creek Coal Co. also has underground operations in this same vicinity. At present the output from these workings amounts to about 300 tons per day, but eventually it is the intention to secure at least 1000 tons from below ground. Power for underground mining and haulage will be purchased from the West Penn Power Co. It will be received at 22,000 volts and stepped down and converted before application to the various motors. At present power is supplied by a Western Electric generator direct connected to a three-cylinder gas engine working on natural gas.

The Coal Problem*

By E. G. Bailey
Boston, Mass.

The biggest and most important question before the American people today is the coal problem. The abnormally high percentage of ash and impurities in the coal is like sand in the bearings of transportation and of industry, slowing them down at the most critical time in our history. The less ash and impurities in coal, the less the number of tons required. The greater the demand for coal, the higher the price and, under present conditions, the poorer its quality. The price has been regulated; but the quality has run riot.

Why have we allowed this to happen just at the time when we need heat in concentrated form? Why are the railroads burdened today with hauling millions of tons of utterly worthless dirt? To say that this excess of ash in the coal is worthless, does not describe the situation. The price paid for this dirt is only a small fraction of the damage. The rest lies in the decreased efficiency, the lowered capacity, the increased labor and the excessive repair bills involved in the combustion of this coal—and in the necessity of closing down industries because of the lack of the coal which might have been shipped in place of these so called "worthless," but really exceedingly costly impurities.

Results show a 10% decrease in the amount of coal delivered to many plants during the past year. Considering that the Navy and other Government requirements receive a greatly increased tonnage of the best coal, a conservative estimate of 5 per cent. is made as representing the increased demand for coal due solely to the poorer quality of that received. This means that 30,000,000 tons of utterly worthless slate and dirt were loaded into railroad cars and delivered to the consumer, where it caused additional trouble in burning the coal with which it was mixed.

On the basis of the average price of coal delivered to the consumer being $4 per ton, this excessive amount of impurities has cost the country $120,000,000 during the past year. Adding to this the various estimates made of the cost of our heatless holidays, ranging from $1,000,000,000 upward, it is obvious that this question of impurities in coal is of such tremendous importance that an effective remedy must be found immediately. Manufacturers would be glad to pay a dollar per ton more for coal if they could get what they need and of standard quality.

Competition normally compels the mine operator to clean his coal, but when the coal shortage began, in 1916, manufacturers were so anxious to get fuel that they offered and gladly paid prices of $5 to $6 per ton at the mines and took anything that was black. For this reason quality went from bad to worse. Under the present system of paying the operator prices fixed by the Government, no distinction whatever is made between the best and poorest grades of coal. They both command the same price, so why should one operator go to additional expense of shipping clean coal when he receives no more pay than his competitor who loads dirt?

To simply appeal to the miners and operators, even on the grounds of patriotism, is not sufficient. To increase the Government price on the present basis of control of $5 per ton at the mines would not reduce the percentage of impurities in the coal one iota. We must apply a remedy that has some economic foundation.

The remedy suggested is to establish standards of quality and pay a premium for clean coal. The price paid to the operator should be based on standards established by the Fuel Administration according to different mining districts, etc., with premiums based almost entirely upon percentage of ash, and especially the free ash such as slate and rock which can and should be eliminated at the mines.

Coal-sampling stations should be established by the Government at certain central points where large quantities of coal are received direct from mines. Each station should be equipped with machinery for obtaining representative samples from as many individual cars as necessary to determine the average quality of coal shipped from each mine during each month.

The operator would not know what cars were to be sampled, for the Fuel Administration could consign or reconsign any cars in transit to the coal piers or power houses where the sampling stations were located. The mine operator would therefore have a real incentive to load every car with as clean coal as possible.

The car distribution at the mines, which is an important point to the operator, should also be based upon the quality of coal produced so that there would be an added incentive to load clean coal, and the market would always be supplied with a greater proportion of the better quality of coal than if the empty cars were prorated equally as at present.

Actual knowledge of the quality of coal would also be of great benefit to the Fuel Administration in classifying various mines into pools so that the consumer and particularly the railroads would receive coal of uniform quality, thereby enabling them to obtain maximum capacity and efficiency in the combustion of this coal.

There is sufficient labor at the mines to clean the coal, and the railroads can haul enough good coal, but they cannot get the necessary heat units to the consumer if they must be burdened with 30,000,000 tons of unnecessary dirt. We have our choice of either building thousands of locomotives and a hundred thousand cars and adding to the terminal facilities of our railroads within the next few months or removing the excessive impurities from the coal. The latter can be done quickly and effectively.

It is also urged that all power plant engineers put forth every effort to obtain maximum efficiency from the combustion of coal. A few simple points in regard to improving the work of the fireman by observing the appearance of the flame from the boiler furnace, and

*Abstract of a lecture delivered at the Johns Hopkins University, Baltimore, Md., Feb. 27, 1918, as one of the J. E. Aldred lectures on Engineering Practice.

maintaining boilers and baffles in good condition will secure worth-while results.

Are we going to have enough coal to see us through the coming winter? The present indications are that unless some radical steps are taken immediately, the coal shortage will be much worse than it has been. To be satisfied with preferential shipments and permit many of our basic industries to close down, is to be a quitter; when, by concentrating our efforts on loading clean coal at the mines, and improving the efficiency of its combustion in furnaces we can have ample coal for all.

We have heard the argument that we should be patriotic and be content with inferior coal—old culm banks and other refuse fuel—the same as we are with wheat substitutes in our bread. But the food and fuel problems are different.

Economy in the use of these commodities applies equally to both, but the neck of the bottle of the food question is production, while the weakest link of the coal problem is transportation. It is a crime to burden our railroads with hauling dirt when it is within our power to ship clean coal and supply heat in concentrated form.

It is as important to be on time for a business appointment or a business schedule as it is to meet a train or be prompt at a wedding. It's all a matter of habit and calculation. The man who never calculates to meet his appointments will be equally lax about his bills. Form the habit of arranging your affairs so as to be prompt or even a little better than prompt.

Increase in the Output of French Coal During the War

In spite of the difficulties caused by the submarine war, and the occupation by German troops of several important centers, the Chamber of Commerce of Paris states that the production of French coal is continually progressing, as will be seen by the following table giving, in tons, the whole monthly output of the different coal fields.

	1916	1917
January	1,691,399	2,011,377
February	1,689,566	1,903,179
March	1,879,527	2,367,090
April	1,710,394	2,181,172
May	1,904,478	2,296,950
June	1,751,180	2,345,251
July	1,771,769	2,410,039
Output for first 7 months	12,398,313	15,515,058

The monthly output, in France, rose in a year from 1,771,769 to 2,410,039 tons, making an increase of 36 per cent.

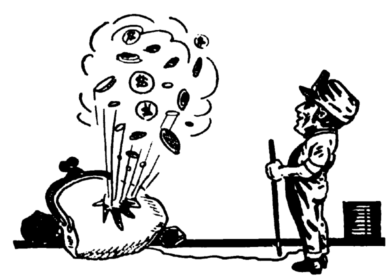
Each of the coal-fields has taken its part in the common effort. The Pas-de-Calais mines, some of which are in the hands of the enemy, have increased their output by 50,000 tons a month since May last. The Loire coal fields yielded, from 1916 to 1917, about 400,000 tons more than the previous year. In the Gard coal fields the increase from one year to another exceeds 33 per cent. The secondary fields of the Tarn, Saône-et-Loire, are also helping with the increase in the general output, which enables us to conclude, judging by the figures for the last four months, that the total yield for 1917 will be over 28 million tons, whereas in 1910 it hardly realized 20 million tons.

Dig!

Written Expressly for "Coal Age"
BY BERTON BRALEY

Blast away your selfishness, sink a shaft of light
Deep into the chambers of your heart;
Make your vein of loyalty plain to all men's sight
Mine it for your country—do your part!
Drill into your pocketbook, shoot the dollars free
(Even if the seam is not so big);
Trade them to the Nation for the Bonds of Liberty
Dig—the way a miner ought to dig!

Make a proper job of it, pick your pockets clean,
Don't leave any dust, a single pinch;
Bring up every particle that your eye has seen,
Uncle Sam can use it, that's a cinch.
Undercut extravagance with the chain of thrift,
Shovel up the savings, neat and trig,
Ship them into Washington, give the war a lift,
Dig—the way a miner ought to dig!



Shoot the Dollars Free

Shovel Up the Savings.

Tilt your spendthrift tendencies over on the dump,
In the test of war they're only slate;
Strip your purse and bank account—collar down to sump—
Do it now! Don't lallygag and wait.
Miner, trapper, engineer, checker, clerk and boss,
Hoist up all you've gathered, small or big.
Buy the Bonds of Liberty, smile and come across,
Dig—the way a miner ought to dig!

The Byproduct Coke Oven, Its Coke and Its Byproducts—II

By WILLIAM HUTTON BLAUVELT
Consulting Engineer, Syracuse, N. Y.*

SYNOPSIS—*The use of coke for domestic purposes has become widespread. Coke is now made from coals that formerly were considered unsuitable when the beehive oven was still the recognized medium for coking. Observations are made by the author on the recovery of ammonia and benzol and the use of coke-oven gas. Tar is used as a fuel in metallurgical furnaces.*

In addition to the iron blast furnace, foundry cupolas afford a steady market for coke, and in recent years the domestic market has grown to importance. Before the war, sales of coke for domestic use amounted to over 1½ million tons per annum, although these sales really rather demonstrated the value of coke as a domestic fuel than showed what were the ultimate possibilities of the trade. Foundry coke is usually made on a somewhat slower coking time than furnace coke, as cupola practice calls for larger and tougher pieces.

The production of domestic coke is now a greatly different industry from what it was in earlier days, when most of the domestic coke was produced in gas works. At that time it was often regarded as something to be got rid of with the least trouble, rather than as a regular and important source of income to the works. Great care is now taken in the sizing and preparation of domestic coke and the complete removal of breeze and dirt. The following table shows approximately the usual sizes produced:

	Size of Square Through, In.	Opening on Screen Over, In.
Egg coke	3.5	1.5
Nut coke	1.5	1.0
Pea coke	1.0	0.5
Breeze	0.5	....

These screens are varied locally to meet market requirements. It would be desirable to have a standard for each domestic size throughout the country, but where the demand for one size is large relative to another, it is natural for the operator to modify his screen openings accordingly.

In American practice, where domestic coke competes mainly with anthracite, a hard structure is generally regarded as desirable. This is contrary to English practice, where familiarity with bituminous coal as a domestic fuel makes quick inflammability a desirable quality, so that coke containing a considerable amount of volatile matter is often sold successfully. Even the partially coked coal, known as "Coalite," which is produced by a low-temperature distillation, is preferred to the hard clean coke which is becoming familiar to the American consumer.

*By an error the author of this paper was said in the previous instalment, which appeared Apr. 6, to be the coke expert of the United States Fuel Administration, thus confusing him with Warren S. Blauvelt. This paper was presented at the New York meeting of the American Institute of Mining Engineers, Feb., 1918.

The practice of locating American ovens at the point of consumption of the coke has made it easy to bring together several coals of different qualities, and this has in many cases permitted the production of a better coke by admixture than could be made from either of the coals used alone. For example, a coal of excellent coking qualities but high in ash can be mixed with a low-ash coal of poorer cokability, or an excess or deficiency in the coking quality of the main coal supply can be corrected by mixture with another coal.

Except in cases where the source of coal supply is fixed, it seems desirable to arrange the plant for the preparation and mixing of as many as three kinds of coal. Means permitting the accurate proportioning of the different coals are, of course, essential in such a plant. The mixture of coals generally calls for their being ground quite finely, in order to bring the particles of the different qualities of coal closer together. The general practice is to grind so that from 70 to 80 per cent. or more will pass through a ⅛-in. screen. This fine grinding is also often advantageous where there are many pieces of slate of considerable size in the coal, since a large piece of slate in the coke is usually a center of cracks that tend to shatter the structure.

Use of Coals Formerly Considered Unsuitable

Various degrees of fineness in grinding are often adopted to improve the structure of the coke, but in some cases, especially where only one coal is used, a better structure is produced from considerably coarser coal. Fine grinding reduces the weight of the coal mass per cubic foot, and consequently the capacity of the oven. With ordinary coals the weight per cubic foot of charge is generally taken at from 40 to 43 cu.ft. per ton, depending somewhat on the coals, and largely on the degree of fineness.

The byproduct oven, with its control of heats, coking time, mixture of coals and fineness in grinding, has permitted the use of many coals for making metallurgical coke which would not have been suitable with the beehive oven. As the best coals are being progressively exhausted, this point becomes more important. Owing to the extraordinary conditions caused by the war, some coals hitherto considered entirely unsuitable for making metallurgical coke have been successfully used; for example, the unwashed coals of southern Illinois.

To use these hitherto unsuitable coals successfully it is necessary to make a careful study of the coking qualities of each one in order that any deficiencies it possesses may be supplied by the proper selection of the coals forming the mixture. Very satisfactory furnace results have been gotten when using important percentages of coals heretofore considered unsuitable, and these results are encouraging on account of the progressive disappearance of the best of the coking coals now available. The distillation of coking of coal in closed retorts,