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GEORGE OTIS SMITH, DIRECTOR

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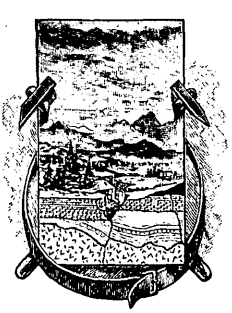
BRIQUETTING TESTS

AT THE

UNITED STATES FUEL-TESTING PLANT NORFOLK, VIRGINIA, 1907-8

BY

CHARLES L. WRIGHT



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BRIQUETTING TESTS AT THE UNITED STATES FUEL-TESTING PLANT, NORFOLK, VIRGINIA, 1907-8.

By CHARLES L. WRIGHT.

INTRODUCTION.

Previous work.—The general plan of work outlined for the United States Geological Survey fuel-testing plant erected at the Louisiana Purchase Exposition, at St. Louis, Mo., in 1904, included investigations relative to the briquetting of coals found in the United States. These investigations embraced the possibility of making satisfactory commercial fuels from lignite or low-grade coals which do not stand shipment well; of benefiting culm or slack coals that are wasted or sold at unremunerative prices; and of improving the furnace efficiency or ability to withstand transportation of good coals. This work was begun in 1904 and was continued in 1905, 1906, and 1907 as an essential part of investigations looking to the determination of methods for reducing waste in coal and increasing efficiency in the utilization of the fuel resources in the United States.

The initial briquetting tests at St. Louis, which included examination into the behavior of different coals or mixtures of coals in the briquetting press, experimental study of the merits of various substances used as binders, and consideration of the physical properties and resistance to weather and abrasion of the briquets, have been described.[a] They demonstrated that satisfactory briquets could be made from most coals, and that by briquetting the commercial value of many low-grade coals and lignites could be raised enough to more than cover the cost of manufacture.

Norfolk plant.—The briquetting plant of the Geological Survey was moved from St. Louis, Mo., to Norfolk, Va., in 1907, along with the steam boiler and producer-gas equipment of the fuel-testing plant, as the closing out of the affairs of the Louisiana Purchase Exposition and the consequent removal of the buildings from Forest Park made a change of location necessary. Norfolk was selected largely with a view to the testing of coals for naval purposes, and because of facilities in the way of buildings and materials offered

[a] See Professional Paper 48, pt. 3; and Bulletins 261, 290, 332, and 343.

by the Jamestown Exposition Company. The work at Norfolk was chiefly devoted to making steaming and briquet tests of coals which reach the Atlantic seaboard at Norfolk and Newport News and are used by the navy and merchant marine.

Two briquet machines were installed at the Norfolk plant, one being the English machine used in briquetting tests by the Geological Survey at St. Louis in 1905 and 1906, and the other an American machine. The briquets made at this plant were tested on locomotives of several railroads entering Norfolk and on the United States torpedo boat *Biddle* in comparison with the run-of-mine coal used in making them. Some of the tests were conducted by the railroads on their own locomotives, but those on the *Biddle* and on the locomotive of the Seaboard Air Line Railway were carried on by W. T. Ray and Henry Kreisinger, of the Geological Survey.

Personnel.—Charles T. Malcolmson continued in general charge of the briquetting section after the removal to Norfolk until January 1, 1908. Walter J. Chapman continued in charge of operation of the briquet machines and of the observations reported under the heading "Details of manufacture." Charles L. Wright supervised the installation o the English briquet machine and later in the year continued the physical tests of briquets and the analyses in the chemical laboratory of the section until January 1, 1908, on which date he was placed in general charge of the work of the section. G. E. Ryder and Ralph Galt also continued with the staff, but the former was obliged to resign soon after the plant was in operation on account of ill health; the latter continued with the section as computer until the close of work on December 1, 1908.

DEFINITION OF BRIQUETS.

Briquetted or "agglomerated" fuel is fuel made by pressing in molds a mixture of coal dust and small-sized pieces of coal or other fuel material and a binding substance which holds the particles together. The most common binder at present commercially available is a pitch made either from coal tar or water-gas tar, but other substances, such as starch, lime, sulphite liquor, etc., have been used with more or less success. The mixture of coal and binder is heated and subjected to heavy pressure in molds.

Briquetted fuel has been manufactured in foreign countries for many years. Railroads and steamship companies operating in certain countries are required to keep a reserve supply of fuel on hand, and briquetted fuel has been found superior for this purpose to run-of-mine or slack coal, as it is free from danger of spontaneous combustion, which frequently occurs in large piles of fine coal. Briquetted fuel also resists the effect of weather better than slack or run-of-mine coal.

Foreign briquets vary in weight from a few ounces to 100 pounds, but the larger cakes are usually so marked off in pressing that they can be readily broken into small pieces suitable for use in stoves and steam boilers. The shapes and relative sizes of some foreign and American briquets are shown in Plate II.

BRIQUETTING TESTS.

PURPOSE.

The briquetting work undertaken at Norfolk had these specific objects:

1. To determine what per cent of pitch or other binder was necessary to make a satisfactory briquet out of the coals tested.
2. To investigate the relative merits of different binders.
3. To provide briquets for comparative combustion tests of run-of-mine coal and the same coal briquetted.

COALS BRIQUETTED.

During the period covered by this report, that is, from July, 1907, to January, 1908, 41 briquetting tests were made on the following coals:

Field designation.	Character and source of coal.	Briquets made.	Where tested.	Number of tests.
		Tons.		
J-2	Bituminous, r. o. m., Pocahontas, Va	161.85	Torpedo boat Biddle	4
J-3	Bituminous, r. o. m., Davy, W. Va	23.3	Testing station	3
J-5	Bituminous, r. o. m., Sewell, W. Va	69.0	Torpedo boat Biddle	2
J-6	Bituminous, r. o. m., Red Star, W. Va	20.7	do	1
J-7	Bituminous, r. o. m., Derryhale, W. Va	40.6	do	2
J-8	Bituminous, r. o. m., Lawton, W. Va	42.6	do	9
J-9	Bituminous, r. o. m., Winona, W. Va	25.0	do	3
J-10	Bituminous, r. o. m., Stanaford, W. Va	26.78	do	1
J-11	Bituminous, r. o. m., West Raleigh, W. Va	36.38	do	[a] 4
J-12	Bone coal, Switchback, W. Va	27.0		2
J-13	Bituminous, r. o. m., Ennis, W. Va	121.48	Seaboard Air Line Railway.	2
J-14	Semianthracite culm, Merrimac, Va	11.0	Kitchen stoves and grates.	1
J-15	Bituminous, r. o. m., Minden, W. Va	182.9	Chesapeake and Ohio Railway.	2
J-16	Bituminous, r. o. m., Midvale, W. Va	93.02	do	4
J-17	Bituminous, r. o. m., West Virginia	80.0	Battleship Connecticut	1
J-18	Anthracite, buckwheat size, Pennsylvania	3.0	Torpedo boat Biddle	[a] 1

[a] One test was made of 50 per cent of Jamestown No. 11 and 50 per cent of Jamestown No. 18.

BINDERS USED.

Two kinds of binders were used in these tests:

(*a*) Water-gas pitch.

(*b*) Flour.

Six different lots of water-gas pitch were used, the total weight consumed being 59 tons.

One lot of flour was tested as a binder.

The characteristics of the water-gas pitch binders used are found in the following table of results of tests and analyses:

Tests and analyses of water-gas pitch binders.

Chem. Lab. No.	Calorific value.	Flowing point.	Oils by distillation.				Pitch extracted by CS_2 from sample as received.
			Up to 572° F.	572° to 680° F.	680° to 743° F.	Total up to 743° F.	
	B. t. u.	*°F.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
4879[a]	16,805	126	1.33	16.53	15.15	33.01	94.50
5458	16,893	189	.88	12.34	22.44	35.66	92.92
5563	16,718	201	1.45	10.32	11.30	23.07	90.33
5939	16,781	194	1.87	4.21	14.54	20.62	98.13
5940	16,780	178	1.27	9.88	17.75	28.90	96.60
5941	16,978	196	1.71	14.05	16.20	31.96	98.44

[a] This binder was reported in Bull. No. 332, but it is included in this report also, as some of it was used in briquet tests herein described.

The flour binder used (laboratory No. 6110) had a calorific value of 6.998 British thermal units and the following proximate analysis:

Analysis of flour binder.

Moisture	13.30
Volatile combustible	72.30
Fixed carbon	13.50
Ash	.90
Sulphur	.10
Total	100.10

A few briquets were made from sulphite liquor, but as no record was kept of the details of manufacture and as not enough briquets were made for any of the physical tests, this binder can not be reported on until further experiments are made.

CHARACTER OF TESTS.

COMBUSTION TESTS.

Combustion tests of the briquets manufactured at the Norfolk plant were made in locomotive and marine boilers. A brief account of the tests appeared in Bulletin 363.[a]

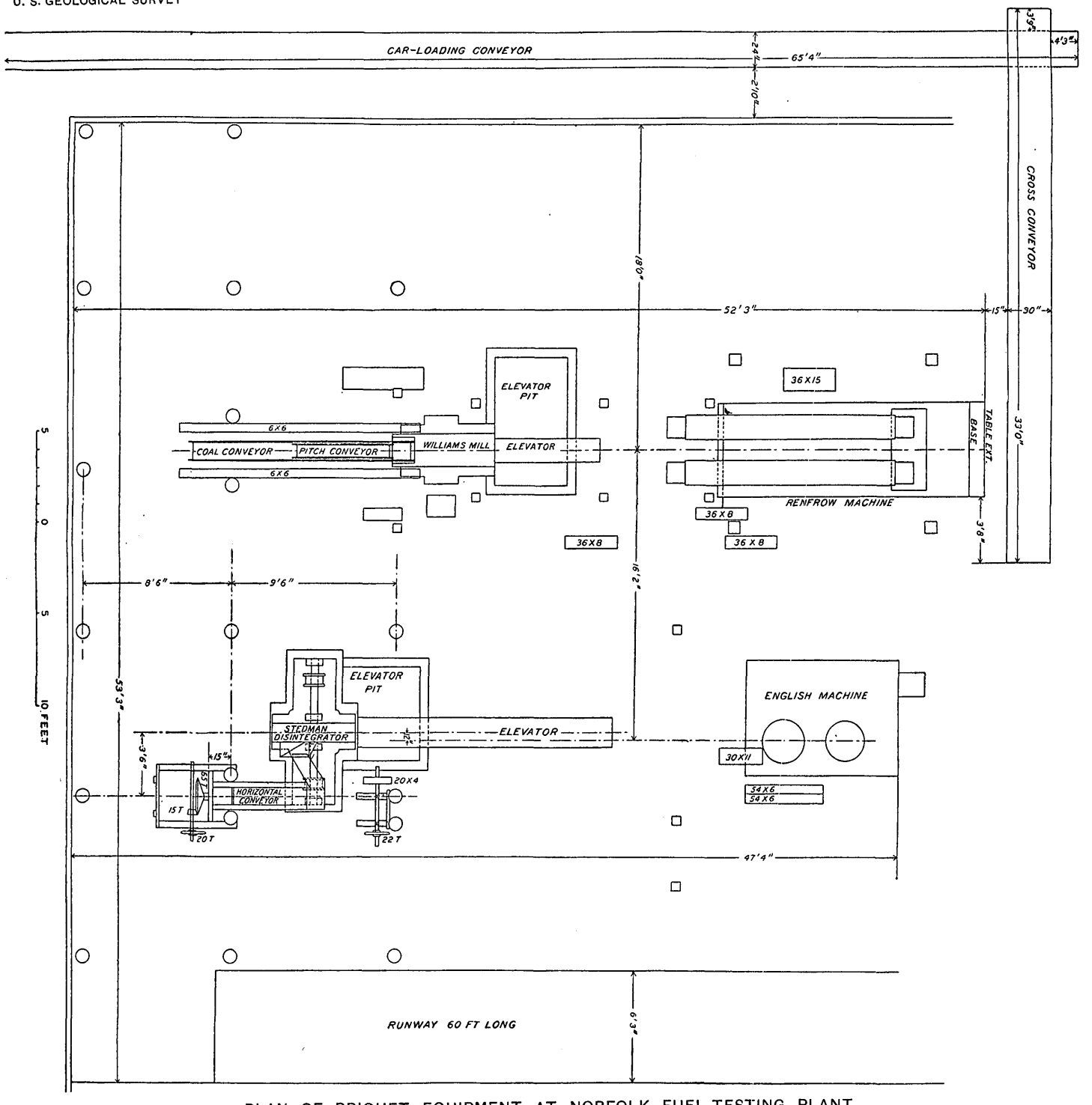
PHYSICAL TESTS.

The methods of making the physical tests and of sampling the briquets can be found in Bulletin United States Geological Survey No. 332. Briefly these tests were as follows:

DROP TEST.

Fifty pounds of briquets were put in a box 24 inches square and 12 inches deep, with a drop bottom, 6½ feet above a cast-iron plate in

[a] Goss, W. F. M., Comparative tests of run-of-mine and briquetted coal: Bull. U. S. Geol. Survey No. 363. 1908, 57 pp.



PLAN OF BRIQUET EQUIPMENT AT NORFOLK FUEL-TESTING PLANT.

the bottom of a second box. The briquets were suddenly dropped on the plate, then screened on a 1-inch mesh wire screen. The pieces held on the screen were again dropped, the total number of droppings being five. At the last screening the percentage that the weight of the pieces held bore to the original weight of the briquets was called "per cent held by 1-inch screen," and the remainder was called "per cent through 1-inch screen."

TUMBLER TEST.

The briquets (as nearly as possible 50 pounds) were placed in a tumbler, a horizontal sheet-steel cylinder, and rotated two minutes at a uniform speed of 28 revolutions per minute, after which the contents of the tumbler were sized by a 1-inch mesh screen, and the portion passing through was screened through a 10-mesh sieve. The weight of the pieces held by each screen was determined and the percentage held computed.

WEATHERING TEST.

The conditions of briquets that had been placed in small piles in a yard and exposed to weather were noted. The time exposed and the condition of the briquets at the end of that time are stated in the tabulated results of tests. The key to the designated conditions A, B, C, D, and E is the same as stated in Bulletin 332:

A: Briquets practically in same condition as when put out. Surfaces show no signs of erosion or pitting. Briquets hard, with sharp edges, and fracture same as that of new briquets.

B: Shape of briquets unchanged. Surfaces of those on top of pile have lost luster, with evidences of pitting, corners and edges worn off by erosion. All briquets firm, with fracture practically the same as that of new briquets.

C: Top briquets appear similar to those in condition B, and show signs of further disintegration, having lost original sharp fracture. Erosion more evident on all briquets on outside of the pile. Inside briquets still firm, retaining original characteristics.

D: Top briquets so badly disintegrated that they crumble to pieces on handling. Briquets in center of pile show signs of disintegration; luster of surfaces gone; edges soft, and break easily in the hand. Fracture not so sharp as when newly made, but briquets firm, and handled without breaking.

E: Entire pile disintegrated. In many cases the only briquets retaining their original shape are those protected from the weather. Briquets can not be handled safely, but crush easily in the hand.

ABSORPTION TEST.

Samples of the briquets, one English briquet or four American briquets, were weighed in air and in water by a hydrostatic balance; the briquets were then kept covered in water and weighed in water daily

for varying periods up to several weeks. The results show the time immersed, the percentage of water absorbed, and the percentage absorbed in the first four days of the test.

DENSITY TEST.

This was determined from the first weighings for the absorption test.

BRIQUETTING TEMPERATURE.

The "briquetting temperature" reported in the tables of results (pp. 16 to 35) is the temperature of the mixture of fuel, binder, and moisture just before it was pressed into briquets.

The amount of moisture desirable in the briquet mixture before briquetting has been a disputed point among engineers. Consequently during this series of tests samples of the briquet mixtures were taken just before being briquetted, and were immediately sealed and forwarded to the chemical laboratory of the fuel-testing plant. The total moisture determined by analysis is reported in the tables as "moisture in briquet mixture."

BRIQUETTING EQUIPMENT.

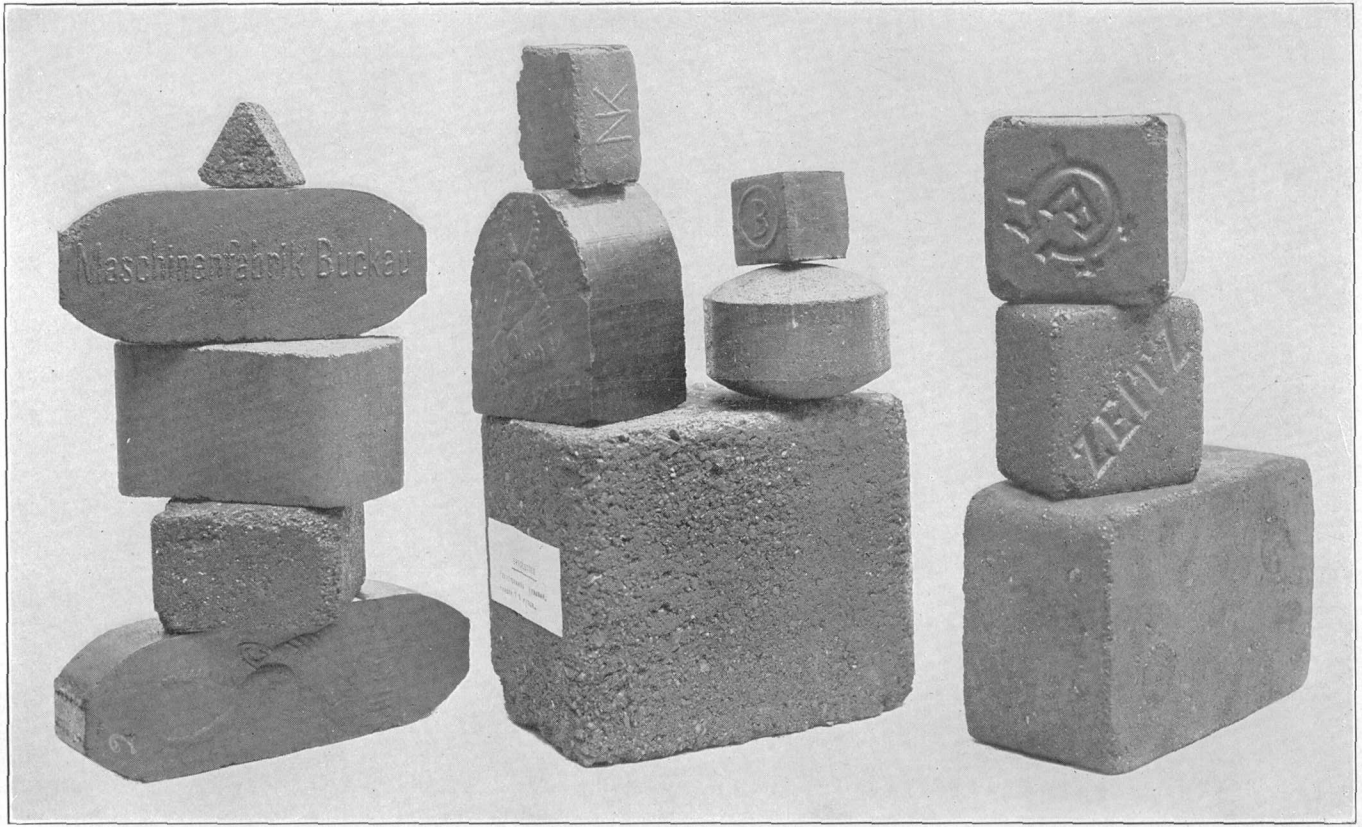
GENERAL DESCRIPTION.

The equipment of the United States Geological Survey briquet plant at Norfolk comprised two briquet machines (English and American), heating and mixing apparatus, storage bins for the raw fuel, crushers, grinder, and disintegrator for reducing the fuel to the desired fineness, machines for crushing or "cracking" pitch, scales, and the necessary elevators and conveyors. Most of the equipment had been used for varying periods of time at the St. Louis plant, but the American briquet machine had not been used before.

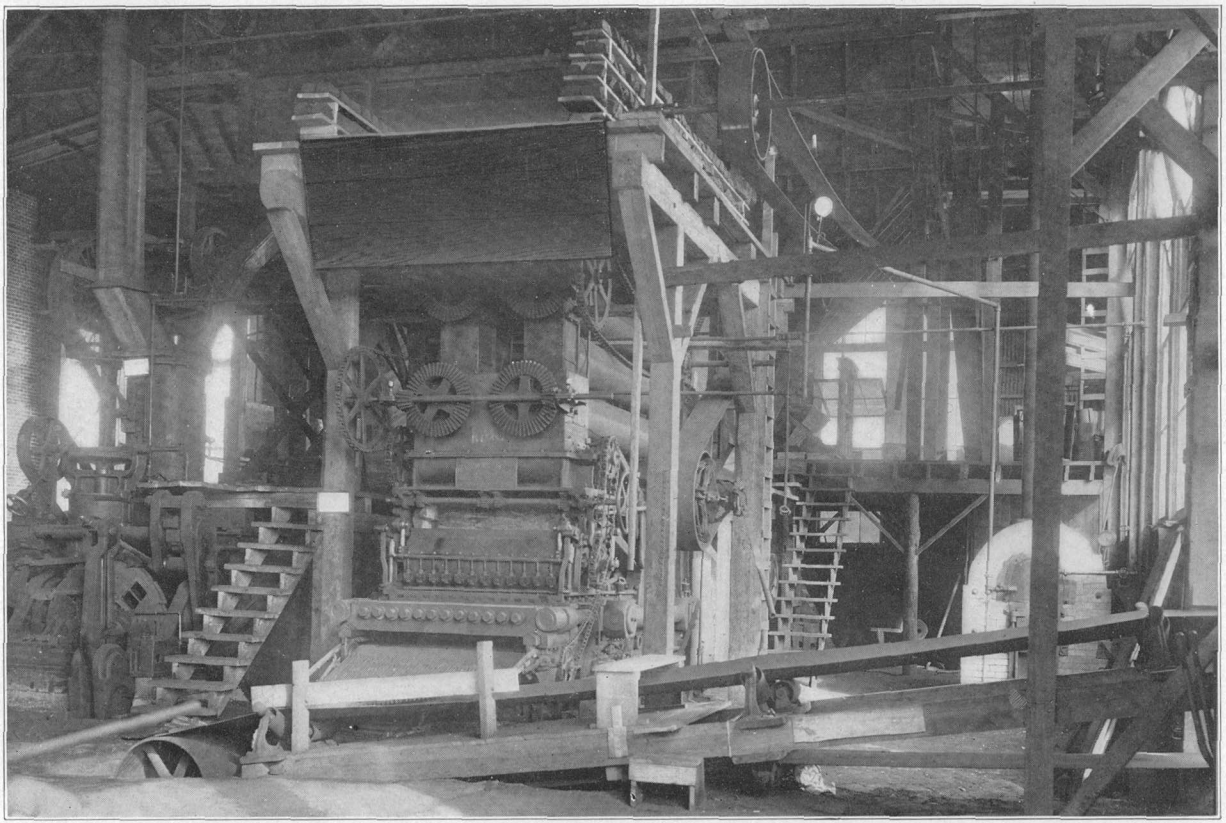
The general plan of the plant, including the location of the briquet machines, the coal-crushing machinery, and the course of some of the conveyors, is shown by Plate I.

There were three storage bins for raw fuel at the plant, two each of 25 tons capacity behind the English machine and one of 50 tons capacity behind the American machine. The samples of fuel to be tested were brought by rail over a spur track leading to the building and dumped from the car into a pit. From this pit a bucket elevator and a 16-inch belt conveyor carried the fuel to the desired storage bin. A tripper on the conveyor discharged the raw fuel into either of the bins back of the English machine or passed it on to be run into the bin back of the American machine.

Under the coal-storage bins and behind the briquet presses a floor, called the "pitch-mixing platform," was built 10 feet above the ground, and a runway 60 feet in length was provided to roll barrels of pitch up to it.



SOME AMERICAN AND FOREIGN BRIQUETS.



GENERAL VIEW OF BRIQUETTING MACHINES.

On this "pitch platform" back of each machine were scales having hoppers, into which coal could be drawn from the storage bins and weighed. Back of the English machine were other scales to weigh the pitch used as a binder. The American machine had an adjustable mechanical device (to be described later) for keeping the ratio of pitch to coal constant, so that it was not necessary to weigh the pitch used with this machine.

In addition to the conveyors that formed part of the necessary equipment for each machine there were loading belts for conveying the finished briquets from the two machines to the storage yards or to cars. One, a 30-inch Jeffrey belt conveyor 33 feet long (see Pl. III), carried the briquets from the front of the machine to the outside of the building, while the other, a 24-inch Robbins belt conveyor 65 feet long (see Pl. IX, *B*), carried the briquets from the first conveyor and loaded them into the railroad cars. Plate IX, *A*, shows the delivery end of this conveyor. Briquets were scraped from the front conveyor to the second by a quarter-circle iron band supported above the crossing of the two conveyors.

BRIQUETTING MACHINES.

NATURE AND CAPACITY.

The two briquet machines installed at Norfolk were of different types and differed radically in details of construction. The English machine was the same that was erected at the St. Louis plant at the time of the Louisiana Purchase Exposition and used in the briquetting tests at that place. It was built by William Johnson & Son, of Leeds, England, and is one of the standard types of machines for briquetting with stiff pitch. It consists of a closed-mold double-compression vertical-table press, forming two briquets at each stroke. As originally installed at St. Louis, the press had molds that formed rectangular briquets, measuring $6\frac{3}{4}$ by $5\frac{1}{2}$ by $4\frac{1}{4}$ inches, with rounded corners, that weighed on the average 6.8 pounds each. The maximum capacity was 6 tons of briquets per hour. To obtain a briquet better adapted to the requirements of domestic use and locomotive-boiler practice the mold wheel on the machine was, in 1905, planed down so as to reduce the thickness of the briquets, and in the later tests at St. Louis and the Norfolk tests the machine turned out briquets measuring $6\frac{3}{4}$ by $4\frac{1}{4}$ by $2\frac{1}{2}$ inches. Those made at Norfolk weighed about $3\frac{3}{4}$ pounds apiece. The capacity of the machine when making briquets of this size was 3.8 tons per hour.

The American briquet machine was built by the Renfrow Company. Briefly, it was a closed-mold double-acting plunger machine, forming 12 briquets at the end of each stroke or 24 at each revolution. The machine used at Norfolk was an improvement on one built by the same company and used in briquetting tests at St. Louis from May,

1906, to March, 1907, a certain weakness of design in the old machine, brought out by these tests, having been corrected in the new one. This new machine had a stronger frame to permit the use of heavier pressure; the working parts not subjected to pressure were of bronze to prevent corrosion; the dies, the cams, and the rollers were of tool steel. Provision was made in the design of the housing for the removal of any working part without dismantling the machine, and the arrangement of the die plunger and the length of spring behind the plunger were such as to reduce to a minimum the chance of a double charge entering the press and to prevent damage to the machine if one did enter.

The shape of the Renfrow briquets was cylindrical, with convex ends. They measured $3\frac{1}{4}$ by $1\frac{1}{2}$ inches and weighed on an average 11 ounces. Running at 9 revolutions or 18 strokes per minute, the capacity of the machine was about 8.9 tons per hour.

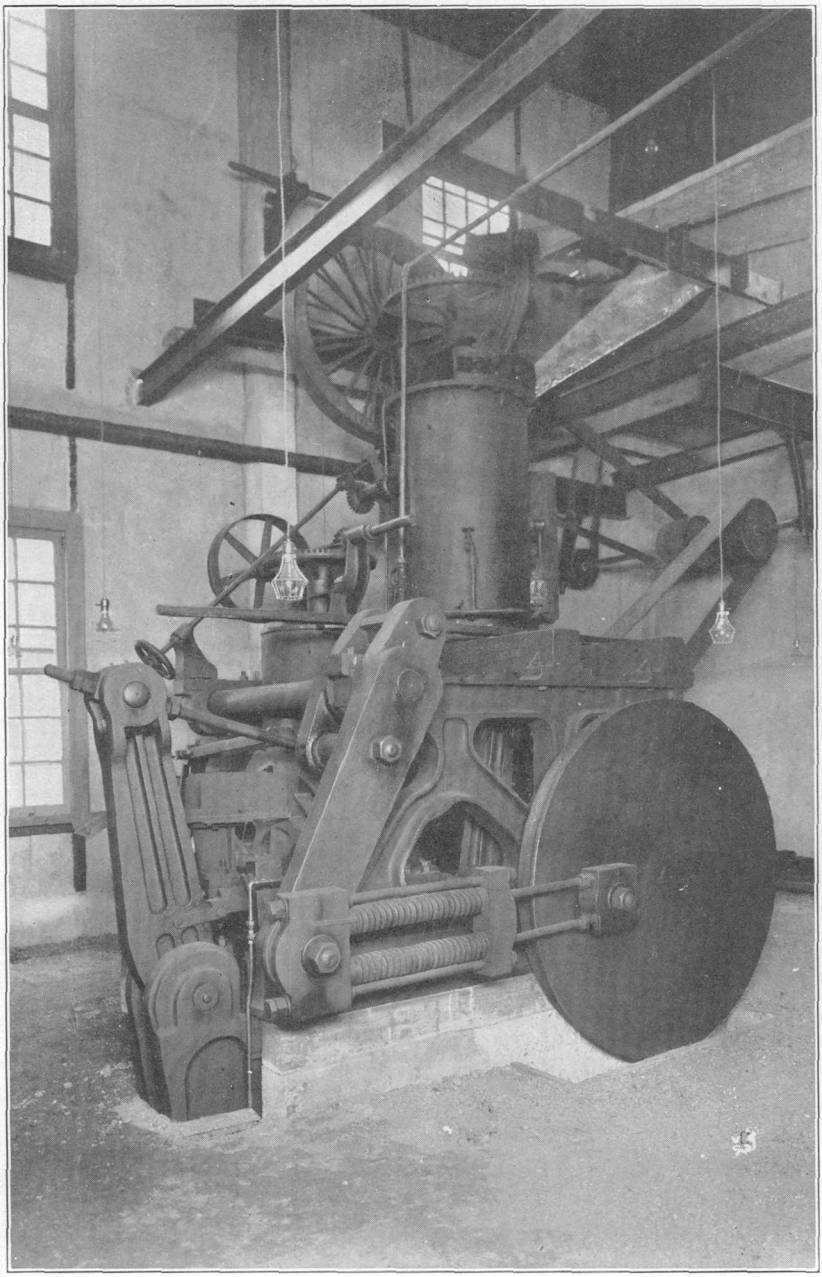
The appearance of both machines from the front is shown by Plate III, while a side view of the English machine appears in Plate IV.

DETAILED DESCRIPTIONS.

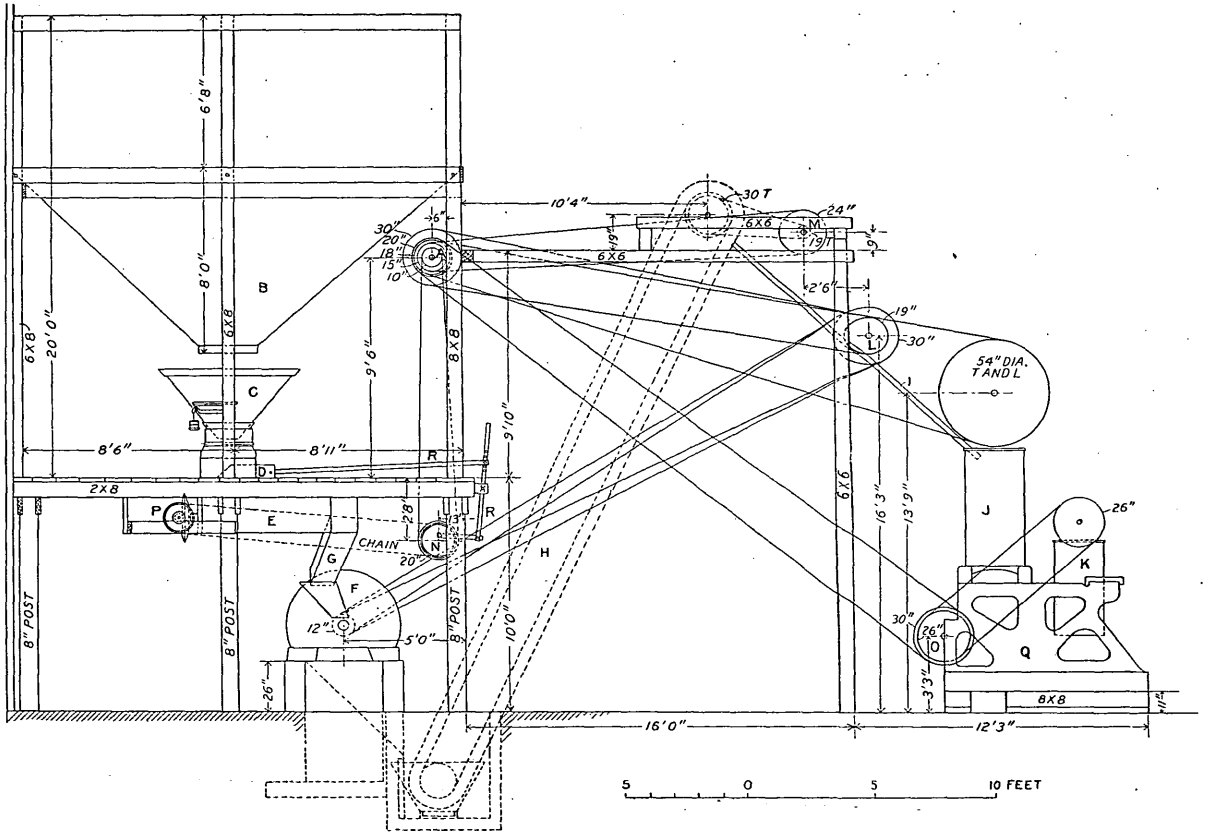
English machine.—The position of the English machine with reference to the American machine and the coal-grinding equipment at the Norfolk plant is shown in Plate I. Plate V, an elevation of the machine, gives further details, showing the coal-storage bin, the mixing platform and coal-weighing scales, the coal breaker, various chutes, the main elevator, and the driving pulleys and belts.

The scales back of the English machine (see Pl. VI, *A*, and C, Pl. V) were placed about 6 inches above the floor to allow room for a square wooden plunger sheathed with sheet iron (D, Pl. V) to work back and forth under them and push the weighed fuel into a hole in the floor in front. The plunger was operated by a lever and connecting rod (R, Pl. V) from a crank on the jack shaft (N, Pl. V) below the mixing floor, and the jack shaft was driven by a belt and pulleys from the main shaft (A, Pl. V).

Fastened to the under side of the floor was a horizontal worm conveyor (E, Pl. V) to carry the fuel and pitch from the scales to a chute leading to the Stedman disintegrator (Pl. VI, *B*, and F, Pl. V). This conveyor was driven by a bevel-geared sprocket (P, Pl. V) and chain from the same jack shaft that worked the plunger. The conveyor delivered the material into the chute (G, Pl. V). Suspended in this chute was a powerful electro-magnet (Pl. VI, *B*) intended to pick up any pieces of iron or steel that might be in the stream of material, and prevent them from causing damage to the disintegrator or the press. The two sets of hammers in the disintegrator revolved in opposite directions at 790 revolutions per minute and were driven from the jack shaft (L, Pl. V) above and back of the briquet machine, which in turn was driven from the main shaft (A, Pl. V).

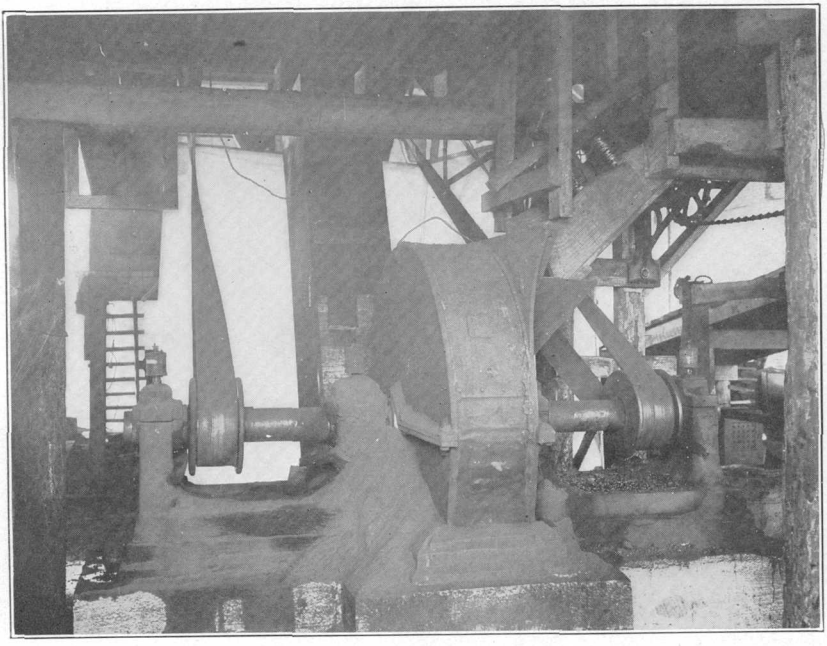


SIDE VIEW OF ENGLISH BRIQUETTING MACHINE.



ELEVATION OF ENGLISH BRIQUETTING MACHINE.

A. HOPPER AND SCALES BACK OF ENGLISH MACHINE.



B. STEDMAN DISINTEGRATOR.

This disintegrator (Pl. VI, *B*) stood on a concrete foundation and its base was 2 feet above ground level.

In front of the disintegrator a pit 5 feet deep, 3½ feet wide, and 5 feet long, walled in and floored with concrete, was provided for the boot of a bucket elevator (H, Pl. V). The ground mixture from the disintegrator slid into this boot through a chute left in the concrete foundation.

The elevator lifted the ground fuel and pitch to a point above and back of the briquet machine, whence a covered wooden chute lined with sheet iron (I, Pl. V) led to the upper mixing cylinder (J, Pl. V) of the machine (Q, Pl. V).

The elevator (H, Pl. V) was driven at the upper end by sprockets and chain from a jack shaft (M, Pl. V), and the latter was driven by belt from the main shaft (A, Pl. V). At the base of the upper mixing cylinder steam could be admitted through several openings. A water pipe supplied water at the top of this cylinder when required. Below the mixing cylinder and supplied from it was the feeding cylinder (K, Pl. V) of the briquet press. The plunger and die table of this press were driven by pulley (O, Pl. V) and a belt from a pulley on main shaft (A, Pl. V).

To run a briquetting test on the English machine, coal was drawn from one of the storage bins back of it into the hopper on the scales and weighed. The slide under the hopper was then opened and the coal fell into a groove under the scales, whence the plunger pushed it forward at a uniform rate into a hole in the floor. The pitch, which had been broken up by hand and weighed, so that its weight might be the desired percentage of the weight of fuel in the hopper, was added by hand to the coal as it fell through the hole in the floor, the intent being to supply the pitch at a uniform rate and to have all the pitch weighed out added by the time all the coal had run through the hole.

After passing through the hole in the floor of the mixing platform the coal and pitch fell into the horizontal screw conveyor, which not only carried them to the chute leading to the disintegrator, but also helped to mix them. The electro-magnet suspended in the chute demonstrated its usefulness during the tests by catching bolts, rivets, spikes, and pieces of cast iron in the material passing under it.

The fuel and binder from the chute fell into the disintegrator, where they were ground to coarse particles and fine dust. This ground mixture of fuel and binder was then taken by the bucket elevator to the chute leading to the upper mixing cylinder of the briquet machine.

In this cylinder the mixture was heated by the introduction of saturated or superheated steam, according to the softening point of the binder used, and mixed by vanes carried on a revolving shaft.

No steam jacket was used on this machine. With very dry fuel, it was often found advantageous to add water to the mixture.

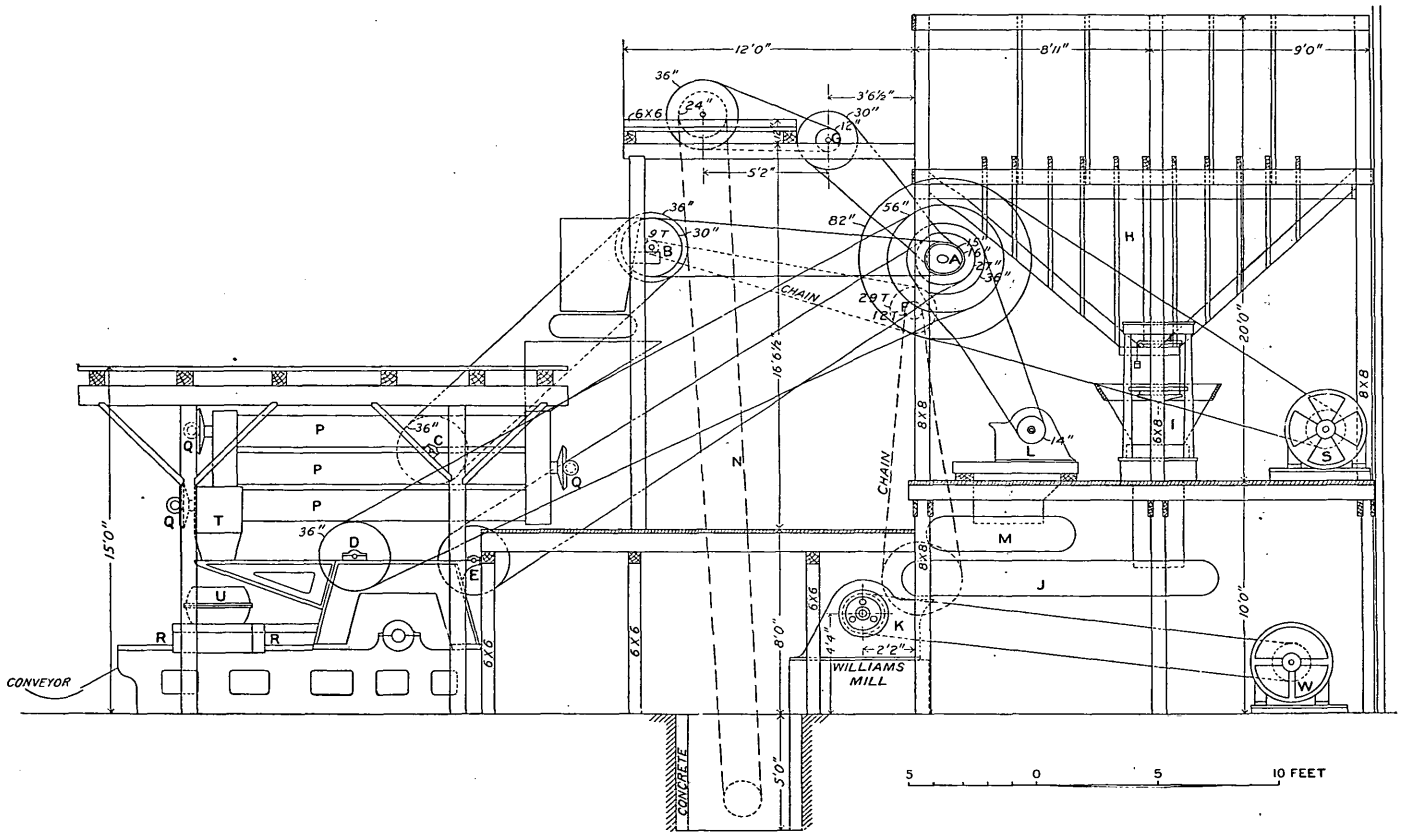
After the fuel and binder were thoroughly mixed and properly heated the mass became more or less plastic according to its briquetting qualities, and was drawn off through a door in the lower part of the cylinder into another cylinder, the feed box, set lower in the machine. From the feed box the mixture was forced by a plunger into the molds in the vertical revolving table of the press. The plunger speed was 17 strokes per minute, 1 stroke for each revolution. At half a revolution the mass in the mold was pressed by a system of levers from each end, the maximum pressure being about 2,500 pounds per square inch. Two briquets were formed at each stroke or 34 briquets per minute.

The finished briquets were removed from the machine by hand and either stacked near the machine or placed on the conveyor in front of the American machine, and by it loaded directly into a car, if one was available. They were of rectangular shape, with molded corners, and were $6\frac{3}{4}$ inches long, $4\frac{1}{4}$ inches wide, and $2\frac{1}{2}$ inches thick. Their average weight was about $3\frac{3}{4}$ pounds. The maximum capacity of the machine was about 30 tons per eight-hour day.

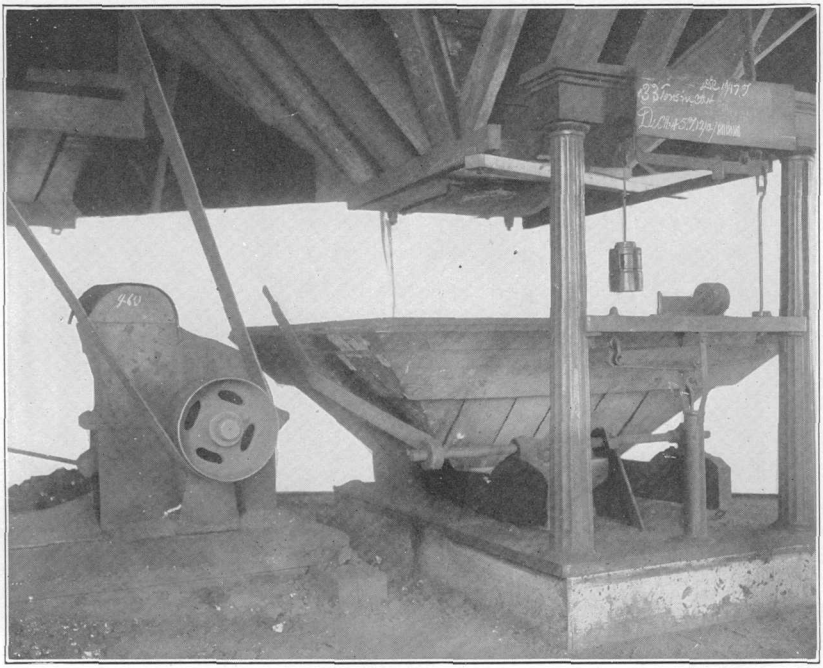
When the machine had reached a uniform condition of working, the operator took the temperature of the briquet mixture and the temperature of the finished briquets.

American machine.—The location of the storage bin, mixing platform, coal crusher, conveyor, and the pulleys and belting that drove the press and the various accessories are shown in Plate VII, the location of the machine with reference to the English machine in Plate I and a front view of the machine in Plate III.

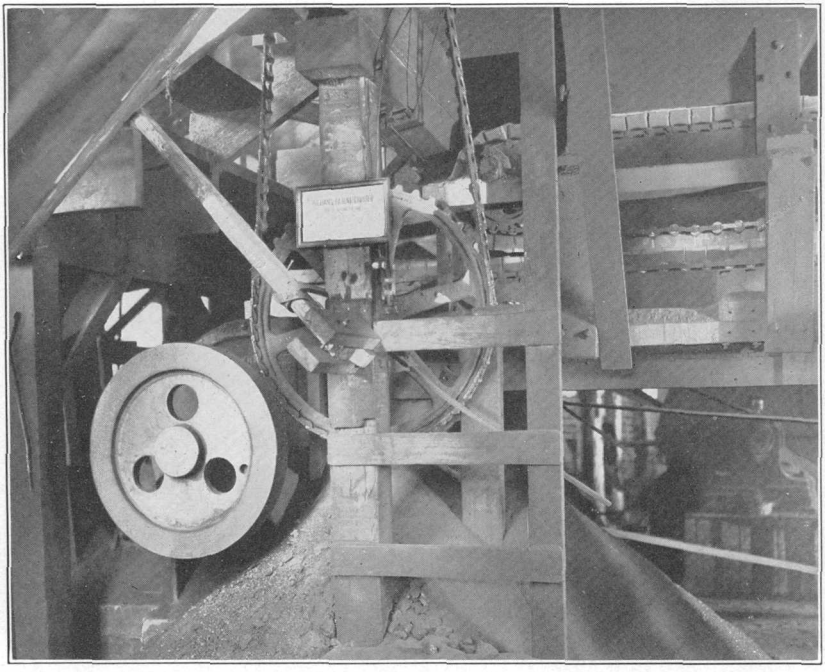
The American machine equipment included a bin of 50 tons capacity (H, Pl. VII), situated above and behind it; hopper scales (I, Pl. VII, and Pl. VIII, *A*); pitch cracker (L, Pl. VII, and Pl. VIII, *A*), driven by pulleys and belt from main shaft (A, Pls. V and VII); a hopper with adjustable slides in the bottom at the coal scales and over the apron conveyor (J, Pl. VII), this conveyor being driven by a chain and sprockets from the jack shaft (F, Pl. VII), which took power from main shaft (A, Pl. VII); an apron conveyor for the cracked pitch (M, Pl. VII), taking power from jack shaft (F, Pl. VII); a Williams mill (K, Pl. VII), driven by a belt from the 20-horsepower electric motor (W, Pl. VII); and a bucket elevator (N, Pl. VII), operated by chain and sprocket from the countershaft (G, Pl. VII), which in turn was driven through belt and pulleys by the main shaft (A, Pl. VII). The machine itself included steam-jacketed cylinders (PPP, Pl. VII) for heating and mixing the fuel and binder; worm conveyors driven by bevel gears (QQQ, Pl. VII), which took power from countershaft (C, Pl. VII), which in turn was driven by a belt from countershaft (B, Pl. VII), for forcing the mixture through the cylinders; a feed-box



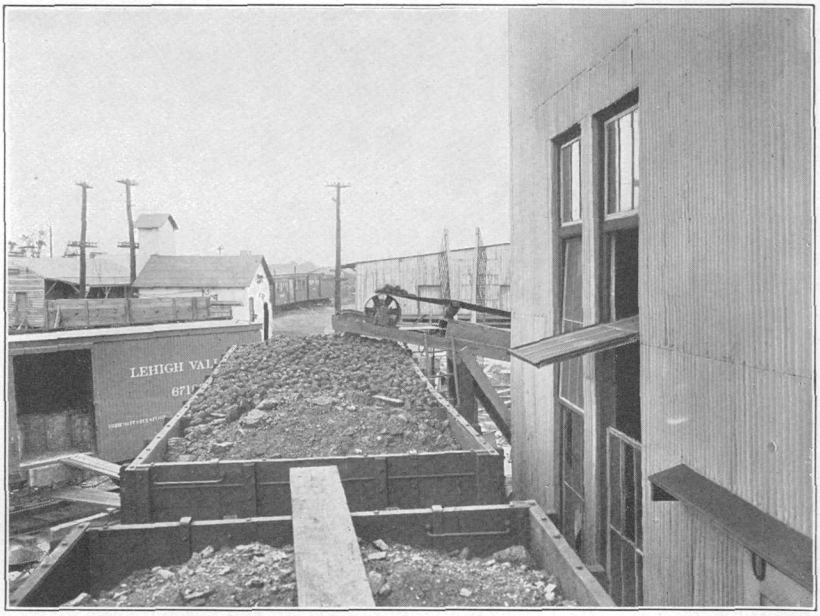
ELEVATION OF AMERICAN BRIQUETTING MACHINE.



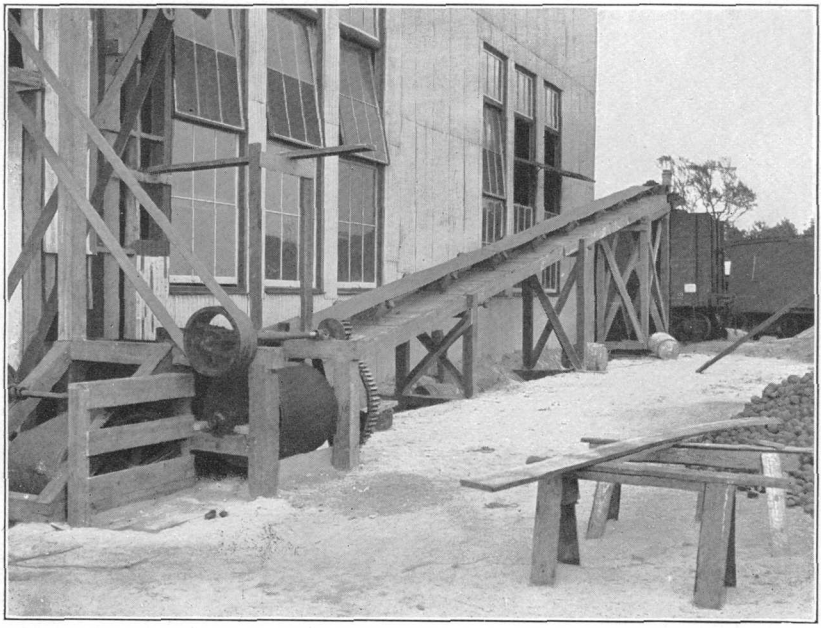
A. PITCH CRACKER AND SCALES AND HOPPER BACK OF AMERICAN MACHINE.



B. ARRANGEMENT AND DRIVING GEAR OF PITCH AND COAL MIXING CONVEYORS.



A. CAR-LOADING CONVEYOR FILLING CAR WITH BRIQUETS.



B. PLANT END OF CAR-LOADING CONVEYOR, SHOWING CROSS CONVEYOR.

(T, Pl. VII); a die filler (U, Pl. VII); and a conveyor, not shown in Plate VII, for bringing the briquets to the front of the machine, all of which were driven by the countershaft (E, Pl. VII), which took power through pulleys and belt from main shaft (A); and a double-acting press (R, Pl. VII) operated by a drive pulley (D, Pl. VII), driven from the main shaft (A).

The main shaft (A), which furnished power to the American or to the English machine, was driven by a belt from the 50-horsepower electric motor (S, Pl. VII). The English machine required about 25 horsepower and the American machine about 50 horsepower. The 50-horsepower motor drove the English machine and its equipment; it drove the American equipment except the Williams mill.

For a test on the American machine sufficient fuel to fill the hopper on the scales (Pl. VIII, *A*) was drawn from the storage bin and weighed, the slide at the bottom of the scales was opened, and the fuel passed through a hole in the floor of the pitch platform into a hopper over the apron conveyor. A sliding door on the side of the hopper facing the direction in which the conveyor was moving could be raised or lowered to vary the thickness of the layer of fuel on the conveyor.

Pitch broken by hand into lumps was fed into the pitch cracker (Pl. VIII, *A*). The pulverized pitch fell into a hopper similar to the fuel hopper and having like it an adjustable door in one side. The apron conveyor under the pitch hopper carried away from it a layer of pitch which was discharged in an even layer upon the fuel lying on the fuel conveyor below. Plate VIII, *B*, shows the arrangement of these conveyors. The fuel and pitch fell from the fuel conveyor into the Williams mill, which reduced them to a mixture of small pieces and dust. The bucket elevator raised the ground fuel and binder from the Williams mill and dumped them into the hopper above the American briquet machine. The screw conveyors moved the material flowing from the hopper through the three pairs of horizontal steam-jacketed drums, in which the fuel and binder were suitably heated and thoroughly mixed. To heat the mixture and also to supply moisture if needed, steam was let into the drums, this steam being either saturated or superheated according to the softening point of the binder used. From the drums the heated briquet mixture passed to the press box, whence plungers forced it into die fillers, which filled the dies or molds with proper-sized charges. Then the briquets were formed by the plungers, 12 on each side of the die holder, pressing the mixture into the molds under an average pressure of 1,000 pounds per square inch. The speed of the plunger was 18 strokes per minute, making the capacity 216 briquets. On the return strokes the briquets were discharged from the molds and dropped on a conveyor which carried them to the front of the machine and dumped them on the belt conveyor (Pl. I), which carried them to the storage bin or

the railroad car. The capacity of the American machine, on the average, was 71 tons per day.

When the machine reached uniform conditions, observations were made of the temperature of the mixture before being briquetted and the temperature of the finished briquets as they came from the machine.

DETAILS OF TESTS.

JAMESTOWN No. 2.

Sample consisted of several cars of semibituminous coal from a mine working the Pocahontas No. 3 bed, Pocahontas, Tazewell County, Va., on the Norfolk and Western Railway.

Excellent briquets were made from this coal. Those made with 6 per cent of binder (Lab. No. 5458), however, stood the cohesion tests as well as those made with 8 per cent of binder (Lab. No. 5563). The warm briquets from all four of the tests had smooth firm surfaces, and those from tests 251 and 252 fractured with difficulty. Those from tests 254 and 255 were more brittle, though not easily broken. The surface of fracture of tests 251, 252, and 254 were smooth and firm, while that of test 255 crumbled easily. The cold briquets of tests 251, 252, and 254 were excellent, had smooth firm surfaces, broke without crumbling, and the fractured surfaces were smooth and firm. The cold briquets of test 255 were rather brittle, fractured easily, and surface of fracture crumbled easily.

Briquet tests.

Test No.	251.	252.	254.	255.
Size of coal as used:				
Over ¼ inch.....per cent..	1.3	0.1	0.0	0.0
⅛ to ¼ inch.....do....	3.4	6.3	9.4	7.4
1/20 to ⅛ inch.....do....	13.7	22.6	24.2	23.5
1/70 to 1/20 inch.....do....	27.2	32.3	28.0	28.3
Through 1/70 inch.....do....	54.4	38.7	38.4	40.8
Details of manufacture:				
Machine used.....	Eng.	Am.	Am.	Am.
Briquetting temperature.....°F..	192	200	204	205
Binder—				
Kind.....	W. G. P.	W. G. P.	W. G. P.	W. G. P.
Laboratory No. (see p. 8).....	5458	5458	5563	5563
Amount.....per cent..	6	6	8	6
Weight of—				
Fuel briquetted.....pounds..	138,101	181,600	2,000	2,000
Briquets, average.....do....	3 27	0.633	0.581	0.595
Heat value per pound—				
Coal as received.....B. t. u..	14,632	14,632	14,632	14,632
Briquets.....do....	14,549	14,726	14,794	14,796
Binder.....do....	16,893	16,893	16,718	16,718
Moisture in briquet mixture.....per cent..	7.62	3.99	.....	.....
Drop test (1-inch screen):				
Held.....do....	74.0	66.5	65.0	46.0
Passed.....do....	26.0	33.5	35.0	54.0
Tumbler test (1-inch screen):				
Held.....do....	79.0	69.0	71.0	60.5
Passed.....do....	21.0	31.0	29.0	39.5
Fines through 10-mesh sieve.....do....	93.4	95.5	95.2	95.5
Weathering test:				
Time exposed.....days..	171	178	161	161
Condition.....	A	A	A	B
Water absorption:				
Time immersed.....days..	30	21	21	21
Water absorbed.....per cent..	15.38	14.02	15.46	16.62
Average for first four days.....do....	2.04	2.74	2.78	3.29
Specific gravity (apparent).....	1.097	1.108	1.101	1.086

Chemical analyses of briquets.

Test No.	251.	252.	254.	255.
Laboratory No.	5466	5454	5455	5457
Proximate:				
Moisture.....per cent..	2.45	1.64	1.60	1.40
Volatile matter.....do....	18.52	19.73	19.70	19.88
Fixed carbon.....do....	72.79	72.65	73.08	73.22
Ash.....do....	6.24	5.98	5.62	5.50
Sulphur.....do....	.63	.61	.50	.58
Ultimate:				
Hydrogen.....do....	4.53	4.62	4.76	4.32
Carbon.....do....	80.63	83.47	84.56	83.62
Nitrogen.....do....	.84	.87	.97	.89
Oxygen.....do....	4.19	4.45	3.59	5.09

Extraction analyses.

	Pitches.		Fuel.	Briquets.			
			J-2.	Test 251.	Test 252.	Test 254.	Test 255.
Laboratory No.	5458	5563	5333	5466	5454	5455	5457
Air-drying loss.....per cent..	0	0	1.20	1.80	1.10	1.10	0.90
Extracted by CS_2:							
Air dried.....do....	92.92	90.33	.564	5.946	5.808	7.74	5.92
As received.....do....	92.92	90.33	.557	5.830	7.745	7.65	5.87
Pitch in briquet as received.....do....	.....	.....	.....	5.71	5.62	7.90	5.92

JAMESTOWN No. 3.

Sample consisted of two cars of semibituminous run-of-mine coal from a mine working the "Thin Vein" Pocahontas bed, Davy, McDowell County, W. Va., on the Norfolk and Western Railway.

Excellent briquets were made on the English machine with this coal and 6 per cent of binder (Lab. No. 5458), and good briquets were made on the American machine with the same coal and binder. The briquets made on the American machine (test No. 257), with 7 per cent of binder (Lab. No. 5563), also had a good appearance but were not so strong as those from the other two tests.

Briquets from test No. 253, while warm, had a smooth surface and metallic luster and no cracks, but were easily crushed in the hand. When cold, however, they had a fine metallic ring when struck, a firm fine-grained surface, broke with difficulty and with a firm, fine-grained, lustrous fracture.

Briquets from test No. 256, while warm, had a smooth surface, were plastic, and broke with a rough fractured surface. When cold, these briquets had rough ends, broke without slacking, and had a smooth and glossy fracture.

Briquets from test No. 257 hardened at a rather high temperature, and fractured with difficulty. When cold, these briquets had a firm smooth surface, were somewhat brittle, and formed some slack when broken.

Briquet tests.

Test No.	253.	256.	257.
Size of coal as used:			
Over ¼ inch, per cent	0.8	.....	0.1
1/16 to ¼ inch, do	3.5	.....	6.1
2/16 to 1/16 inch, do	14.7	.....	28.8
1/16 to 2/16 inch, do	27.0	.....	29.5
Through 1/16 inch, do	54.0	.....	35.5
Details of manufacture:			
Machine used	Eng.	Am.	Am.
Briquetting temperature, °F	202	204	205
Binder—			
Kind	W. G. P.	W. G. P.	W. G. P.
Laboratory No. (see p. 8)	5458	5458	5563
Amount, per cent	6	6	7
Weight of—			
Fuel briquetted, pounds	24,600	12,000	10,000
Briquets, average, do	3.53	0.617	0.588
Heat value per pound—			
Coal as received, B. t. u.	14,443	14,443	14,443
Briquets, do	14,828	14,728	14,836
Binder, do	16,893	16,893	16,718
Moisture in briquet mixture, per cent	6.09	2.71	4.91
Drop test (1-inch screen):			
Held, do	76.4	62.0	37.5
Passed, do	23.6	38.0	62.5
Tumbler test (1-inch screen):			
Held, do	71.8	58.5	47.5
Passed, do	28.2	41.5	52.5
Fines through 10-mesh sieve, do	89.7	95.0	95.0
Weathering test:			
Time exposed, days	162	154	154
Condition	A	B	B
Water absorption:			
Time immersed, days	30	21	21
Water absorbed, per cent	12.02	14.46	15.79
Average for first four days, do	2.04	2.71	3.12
Specific gravity (apparent)	1.143	1.121	1.101

Chemical analyses of briquets.

Test No.	253.	256.	257.
Laboratory No.	5477	5478	5743
Proximate:			
Moisture, per cent	1.86	1.69	1.06
Volatile matter, do	17.26	18.40	17.30
Fixed carbon, do	75.54	74.26	76.13
Ash, do	5.34	5.65	5.51
Sulphur, do	.66	.64	.65
Ultimate:			
Hydrogen, do	4.58	4.61	4.70
Carbon, do	83.87	83.87	85.15
Nitrogen, do	1.07	1.09	1.09
Oxygen, do	4.48	4.14	2.90

Extraction analyses.

	Pitches.		Fuel.	Briquets.		
			J-3.	Test 253.	Test 256.	Test 257.
Laboratory No.	5458	5563	5459	5477	5478	5743
Air-drying loss, per cent	0	0	0.90	1.30	1.20	0.70
Extracted by CS_2:						
Air dried, do	92.92	90.33	.47	5.086	5.33	5.90
As received, do	92.92	90.33	.466	5.025	5.28	5.86
Pitch in briquet as received, do	.....	.....	.....	4.93	5.20	6.00

JAMESTOWN No. 5.

Sample consisted of two cars of semibituminous run-of-mine coal from a mine working the Sewell bed, 1 mile east of Sewell, Fayette County, W. Va., on the Chesapeake and Ohio Railway.

Of the two tests made on this coal, the briquets of test No. 258 were better than those of test No. 259. The warm briquets of test No. 258 had smooth surfaces and were difficult to fracture. The cold briquets were very hard and brittle and formed some slack when broken. The warm briquets from test No. 259 had smooth surfaces, were very plastic, and high in moisture; the cold briquets had a very hard, firm surface, and fractured without slacking.

Briquet tests.

Test No	258.	259.
Size of coal as used:		
Over ¼ inch ..... per cent..	0.1	.....
⅛ to ¼ inch ..... do....	6.5	.....
1/20 to ⅛ inch ..... do....	27.0	.....
1/40 to 1/20 inch ..... do....	31.1	.....
Through 1/40 inch ..... do....	35.3	.....
Details of manufacture:		
Machine used	Am.	Am.
Briquetting temperature ..... °F..	199	200
Binder—		
Kind	W. G. P.	W. G. P.
Laboratory No. (see p. 8)	5563	5458
Amount ..... per cent..	7	7
Weight of—		
Fuel briquetted ..... pounds..	136,000	2,000
Briquets, average ..... do....	0.568	0.588
Heat value per pound—		
Coal as received ..... B. t. u..	14,522	14,522
Briquets ..... do....	14,542	.....
Binder ..... do....	16,718	16,893
Moisture in briquet mixture ..... per cent..	6.14	.....
Drop test (1-inch screen):		
Held ..... do....	70.0	48.5
Passed ..... do....	30.0	51.5
Tumbler test (1-inch screen):		
Held ..... do....	71.5	67.5
Passed ..... do....	28.5	32.5
Fines through 10-mesh sieve ..... do....	95.5	95.2
Weathering test:		
Time exposed ..... days..	154	154
Condition	A	A
Water absorption:		
Time immersed ..... days..	21	21
Water absorbed ..... per cent..	14.99	15.28
Average for first four days ..... do....	2.52	2.62
Specific gravity (apparent)	1.092	1.103

Chemical analyses of briquets.

Test No	258.
Laboratory No	5744
Proximate:	
Moisture ..... per cent..	1.32
Volatile matter ..... do....	24.97
Fixed carbon ..... do....	67.91
Ash ..... do....	5.80
Sulphur ..... do....	.63
Ultimate:	
Hydrogen ..... do....	4.90
Carbon ..... do....	82.77
Nitrogen ..... do....	1.14
Oxygen ..... do....	4.76

Extraction analyses.

	Pitch.	Fuel.	Briquets.
		J-5.	Test 258.
Laboratory No	5563	5453	5744
Air-drying loss ..... per cent..	0	2.60	0.90
Extracted by CS_2:			
Air dried ..... do....	90.33	.514	6.68
As received ..... do....	90.33	.514	6.62
Pitch in briquet as received ..... do....			6.81

JAMESTOWN No. 6.

Sample consisted of two cars of semibituminous run-of-mine coal from a mine working the Sewell bed, Red Star, Fayette County, W. Va., on the Chesapeake and Ohio Railway.

The briquets made from this coal were excellent in their physical characteristics and when warm had smooth surfaces, sharp edges, and were sufficiently strong to be loaded on cars direct from the machine. When cold these briquets were hard and firm but somewhat brittle on the edges.

Briquet tests.

Test No.	260.
Size of coal as used:	
Over ¼ inch ..... per cent..	0.8
⅛ to ¼ inch ..... do....	3.1
1/16 to ⅛ inch ..... do....	11.2
1/32 to 1/16 inch ..... do....	26.3
Through 1/32 inch ..... do....	58.4
Details of manufacture:	
Machine used	Eng.
Briquetting temperature ..... °F..	203
Binder—	
Kind	W. G. P.
Laboratory No. (see p. 8)	5563
Amount ..... per cent..	6
Weight of—	
Fuel briquetted ..... pounds..	41,400
Briquets, average ..... do....	3.52
Heat value per pound—	
Coal as received ..... B. t. u..	14,783
Briquets ..... do....	14,715
Binder ..... do....	16,718
Moisture in briquet mixture ..... per cent..	5.47
Drop test (1-inch screen):	
Held ..... do....	80.2
Passed ..... do....	19.8
Tumbler test (1-inch screen):	
Held ..... do....	77.4
Passed ..... do....	22.6
Fines through 10-mesh sieve ..... do....	88.5
Weathering test:	
Time exposed ..... days..	135
Condition	A
Water absorption:	
Time immersed ..... days..	35
Water absorbed ..... per cent..	13.19
Average for first four days ..... do....	2.24
Specific gravity (apparent)	1.117

Chemical analyses of briquets.

Test No.	260.
Laboratory No.	5558
Proximate:	
Moisture, per cent	2.15
Volatile matter, do	21.87
Fixed carbon, do	71.13
Ash, do	4.85
Sulphur, do	.81
Ultimate:	
Hydrogen, do	5.09
Carbon, do	83.37
Nitrogen, do	1.53
Oxygen, do	4.35

Extraction analyses.

	Pitch.	Fuel.	Briquets.
		J-6.	Test 260.
Laboratory No.	5563	5489	5558
Air-drying loss, per cent	0	1.50	1.50
Extracted by CS_2:			
Air dried, do	90.33	.364	5.40
As received, do	90.33	.359	5.32
Pitch in briquet as received, do			5.51

JAMESTOWN No. 7.

Sample consisted of three cars of semibituminous run-of-mine coal from a mine working the Sewell bed, Derryhale, Fayette County, W. Va., on the Chesapeake and Ohio Railway.

The briquets made on the American machine from this coal with 7 per cent of binder (Lab. No. 5563) stood the cohesion tests better than those made on the English machine with 6 per cent of the same binder. Both were excellent briquets, gave fine metallic rings when struck, had smooth firm surfaces, broke with difficulty, and had a firm and glossy fracture.

Briquet tests.

Test No.	261.	262.
Size of coal as used:		
Over ¼ inch, per cent	3.0	0.3
⅛ to ¼ inch, do	6.9	6.0
1/20 to ⅛ inch, do	10.8	25.1
1/40 to 1/20 inch, do	22.4	29.3
Through 1/40 inch, do	56.9	39.3
Details of manufacture:		
Machine used	Eng.	Am.
Briquetting temperature, °F.	198	193
Binder—		
Kind	W. G. P.	W. G. P.
Laboratory No. (see p. 8)	5563	5563
Amount, per cent	6	7
Weight of—		
Fuel briquetted, pounds	43,200	38,000
Briquets, average, do	3.53	.617
Heat value per pound—		
Coal as received, B. t. u.	14,465	14,465
Briquets, do	14,886	14,717
Binder, do	16,718	16,718
Moisture in briquet mixture, per cent	5.48	4.71

Briquet tests—Continued.

Test No.	261.	262.
Drop test (1-inch screen):		
Held, per cent	69.3	71.0
Passed, do	30.7	29.0
Tumbler test (1-inch screen):		
Held, do	74.0	80.5
Passed, do	26.0	19.5
Fines through 10-mesh sieve, do	88.6	95.2
Weathering test:		
Time exposed, days	132	132
Condition	A	B
Water absorption:		
Time immersed, days	35	11
Water absorbed, per cent	11.09	12.21
Average for first four days, do	2.14	2.85
Specific gravity (apparent)	1.139	1.029

Chemical analyses of briquets.

Test No.	261.	262.
Laboratory No.	5583	5559
Proximate:		
Moisture, per cent	2.70	0.93
Volatile matter, do	20.28	18.52
Fixed carbon, do	72.74	74.65
Ash, do	4.28	5.90
Sulphur, do	.81	.81
Ultimate:		
Hydrogen, do	4.94	4.75
Carbon, do	83.75	83.67
Nitrogen, do	1.45	1.50
Oxygen, do	4.77	3.37

Extraction analyses.

	Pitch.	Fuel.	Briquets.	
		J-7.	Test 261.	Test 262.
Laboratory No.	5563	5501	5583	5559
Air-drying loss, per cent	0	1.40	2.10	0.30
Extracted by CS_2:				
Air dried, do	90.33	.410	5.094	6.58
As received, do	90.33	.404	4.990	6.56
Pitch in briquet as received, do	.....	.....	5.12	6.85

JAMESTOWN No. 8.

Sample consisted of two cars of semibituminous run-of-mine coal from a mine working the Quinnimont (Fire Creek) bed, Lawton, Fayette County, W. Va., on the Chesapeake and Ohio Railway.

This coal was briquetted with binders as follows: Tests 263, 264, and 270 with flour binder alone; test 271 with water-gas pitch alone; and the remaining tests, Nos. 265, 266, 267, 268, and 269, with various mixtures of flour and water-gas pitch.

All the briquets made with flour alone disintegrated very rapidly on exposure to the weather, and one sample (from test No. 270) crumbled to slack when handled after being immersed in water for

twenty-four hours. The briquets made with 1 per cent of flour binder were not strong enough to be satisfactory, but all the other briquets made with flour alone or with a mixture of flour and water-gas pitch stood the cohesion tests better than the briquets which had only water-gas pitch for a binder. A comparison of tests 267, 268, and 269 with test 271 shows that in the first three tests the drop and tumbler percentages are higher than in the fourth test. All briquets containing any flour soon became covered with a green mold when stored in a damp place and lost strength, but those stored in a dry place developed no mold, and even after eight months were apparently as good as when first made. In making briquets with flour alone, some difficulty was experienced from the briquets sticking to the dies of the press, but it is probable that when the conditions are better understood this trouble may be obviated. The briquets from test No. 268 were the strongest of the nine tests made on this coal, but those from test No. 269 were almost as strong. The briquets made with 7 per cent of water-gas pitch alone (test No. 271) were of excellent quality, but were somewhat sticky when hot, although they loaded into the car direct from the machine with very little breakage. No samples were taken for sizing tests and chemical analyses from tests 263 to 270, inclusive, as all these tests were of a preliminary nature.

Briquet tests.

Test No.	263.	264.	270.	265.	266.
Details of manufacture:					
Machine used	Am.	Eng.	Am.	Eng.	Eng.
Briquetting temperature, °F.	198	201	.....	201	.....
Binder—					
Kind	Flour.	Flour.	Flour.	Flour W. G. P.	Flour W. G. P.
Laboratory No. (see p. 8)	6110	6110	6110	Fl. 6110 W. G. P. 5939	Fl. 6110 W. G. P. 5939
Amount, per cent	1.0	2.0	4	1 Flour 3 W. G. P.	2 Flour 2 W. G. P.
Weight of—					
Fuel briquetted, pounds	500	500	500	500	500
Briquets, average, do	0.558	3.55	0.595	3.47	3.55
Heat value per pound—					
Coal as received, B. t. u.	14,701	14,701	14,701	14,701	14,701
Binder, do	6,998	6,998	6,998	6,998 Fl. 16,781 W. G. P.	6,998 Fl. 16,781 W. G. P.
Moisture in briquet mixture, per cent	.....	.....	7.29	.....	.....
Drop test (1-inch screen):					
Held, do	65.5	60.2	79.5	60.2	76.1
Passed, do	34.5	39.8	20.5	39.8	23.9
Tumbler test (1-inch screen):					
Held, do	31.9	56.0	89.0	67.2	75.6
Passed, do	68.1	44.0	11.0	32.8	24.4
Fines through 10-mesh sieve, do	92.7	92.0	96.0	94.0	89.2
Weathering test:					
Time exposed, days	132	132	132	132	132
Condition	E	E	E	C	D
Water absorption:					
Time immersed, days	8	9	1	8	4
Water absorbed, per cent	5.94	9.76	10.60	9.31	10.29
Average for first four days, do	1.53	2.44	(a)	2.31	2.57
Specific gravity (apparent)	1.222	1.184	1.079	1.168	1.157

a Sample crumbled after one day's immersion.

Briquet tests—Continued.

Test No.	267.	268.	269.	271.
Size of coal as used:				
Over ¼ inch ..... per cent.				0.0
⅛ to ¼ inch ..... do.				9.3
1/16 to ⅛ inch ..... do.				35.5
1/32 to 1/16 inch ..... do.				29.2
Through 1/32 inch ..... do.				28.0
Details of manufacture:				
Machine used	Am.	Am.	Am.	Am.
Briquetting temperature ..... °F.				196
Binder—				
Kind	Flour W. G. P.	Flour W. G. P.	Flour W. G. P.	W. G. P.
Laboratory No. (see p. 8)	Fl. 6110 W. G. P 5941	Fl. 6110 W. G. P. 5941	Fl. 6110 W. G. P. 5941	5941
Amount ..... per cent.	2 Flour 2 W. G. P.	2 Flour 3 W. G. P.	2 Flour 2 W. G. P.	7
Weight of—				
Fuel briquetted ..... pounds.	500	500	500	81,250
Briquets, average ..... do.	0.562	0.588	0.562	0.633
Heat value per pound—				
Coal as received ..... B. t. u.	14,701	14,701	14,701	14,701
Briquets ..... do.				14,584
Binder ..... do.				16,978
Moisture in briquet mixture ... per cent.		6.29	5.72	5.21
Drop test (1-inch screen):				
Held ..... do.	84.0	87.0	84.5	46.5
Passed ..... do.	16.0	13.0	15.5	53.5
Tumbler test (1-inch screen):				
Held ..... do.	81.0	91.0	88.0	58.0
Passed ..... do.	19.0	9.0	12.0	42.0
Fines through 10-mesh sieve ..... do.	95.7	96.7	97.0	95.5
Weathering test:				
Time exposed ..... days.	132	132	132	127
Condition	E	B	C	A
Water absorption:				
Time immersed ..... days.	4	5	4	12
Water absorbed ..... per cent.	11.47	8.09	16.56	15.31
Average for first four days ..... do.	2.87	2.00	4.14	3.56
Specific gravity (apparent)	1.150	1.196	1.087	1.100

Chemical analyses of briquets.

Test No.	271.
Laboratory No	5713
Proximate:	
Moisture ..... per cent.	3.28
Volatile matter ..... do.	18.50
Fixed carbon ..... do.	73.44
Ash ..... do.	4.78
Sulphur ..... do.	.84
Ultimate:	
Hydrogen ..... do.	4.95
Carbon ..... do.	82.26
Nitrogen ..... do.	1.07
Oxygen ..... do.	6.10

Extraction analyses.

	Pitch.	Fuel.	Briquets.
		J–8.	Test 271.
Laboratory No	5941	5575	5713
Air-drying loss ..... per cent.	0	2.20	2.90
Extracted by CS_2:			
Air dried ..... do.	98.44	.534	4.94
As received ..... do.	98.44	.523	4.80
Pitch in briquet as received ..... do.			4.38

JAMESTOWN No. 9.

Sample consisted of two cars of semibituminous run-of-mine coal from a mine working the Sewell bed, Winona, Fayette County, W. Va., on the Chesapeake and Ohio Railway.

This coal was briquetted with three different kinds of binders. The briquets from test No. 274 made with water-gas pitch (Lab. No. 5939) were the strongest of the three. All three tests made excellent briquets, which gave good metallic rings when knocked together, had smooth, hard surfaces, were broken with difficulty, and had firm and glossy fractured surfaces.

Briquet tests.

Test No.	272.	273.	274.
Size of coal as used:			
Over ¼ inch, per cent	0.0	.....	.....
⅛ to ¼ inch, do	7.9	.....	.....
1/20 to ⅛ inch, do	22.9	.....	.....
1/70 to 1/20 inch, do	30.5	.....	.....
Through 1/70 inch, do	37.1	.....	.....
Details of manufacture:			
Machine used	Am.	Am.	Am.
Briquetting temperature, °F.	195	198	198
Binder—			
Kind	W. G. P.	W. G. P.	W. G. P.
Laboratory No. (see p. 8)	5941	5563	5939
Amount, per cent	7	7	7
Weight of—			
Fuel briquetted, pounds	46,000	2,000	2,000
Briquets, average, do	0.625	0.602	0.610
Heat value per pound—			
Coal as received, B. t. u.	14,238	14,238	14,238
Briquets, do	14,699	.....	.....
Binder, do	16,978	16,718	16,781
Moisture in briquet mixture, per cent	5.65	.....	.....
Drop test (1-inch screen):			
Held, do	57.5	71.0	73.0
Passed, do	42.5	29.0	27.0
Tumbler test (1-inch screen):			
Held, do	64.0	77.0	83.5
Passed, do	36.0	23.0	16.5
Fines through 10-mesh sieve, do	95.1	96.7	96.6
Weathering test:			
Time exposed, days	125	52	125
Condition	A	A	A
Water absorption:			
Time immersed, days	12	21	13
Water absorbed, per cent	16.66	13.02	13.14
Average for first four days, do	3.49	2.75	2.79
Specific gravity (apparent)	1.072	1.118	1.117

Chemical analyses of briquets.

Test No.	272.
Laboratory No.	5745
Proximate:	
Moisture, per cent	2.64
Volatile matter, do	25.29
Fixed carbon, do	67.61
Ash, do	4.46
Sulphur, do	.65
Ultimate:	
Hydrogen, do	5.16
Carbon, do	82.34
Nitrogen, do	1.11
Oxygen, do	6.28

Extraction analyses.

	Pitches.		Fuel.	Briquets.
			J-9.	Test 272.
Laboratory No.	5941	5939	5709	5745
Air-drying loss, per cent	0	0	3.00	2.10
Extracted by CS_2:				
Air dried, do	98.44	98.13	.706	4.78
As received, do	98.44	98.13	.685	4.77
Pitch in briquet as received, do				4.18

JAMESTOWN No. 10.

Sample consisted of two cars of semibituminous run-of-mine coal from a mine working the Beckley bed, Stanaford, Raleigh County, W. Va., on the Chesapeake and Ohio Railway.

Test 275 gave a satisfactory briquet with 6 per cent of water-gas pitch (Lab. No. 5941). The briquets had smooth, firm surfaces, sharp edges, were broken with difficulty, and had firm and glossy fracture surfaces.

Briquet tests.

Test No	275.
Size of coal as used:	
Over ½ inch, per cent	4.5
½ to ¼ inch, do	16.0
¼ to ⅛ inch, do	28.8
⅛ to 3/16 inch, do	25.4
Through 3/16 inch, do	25.3
Details of manufacture:	
Machine used	Eng.
Briquetting temperature, °F	182
Binder—	
Kind	W. G. P.
Laboratory No. (see p. 8)	5941
Amount, per cent	6
Weight of—	
Fuel briquetted, pounds	53,550
Briquets, average, do	3.83
Heat value per pound—	
Coal as received, B. t. u.	14,024
Briquets, do	13,871
Binder, do	16,978
Moisture in briquet mixture, per cent	6.45
Drop test (1-inch screen):	
Held, do	33.7
Passed, do	66.3
Tumbler test (1-inch screen):	
Held, do	55.0
Passed, do	45.0
Fines through 10-mesh sieve, do	90.0
Weathering test:	
Time exposed, days	120
Condition	A
Water absorption:	
Time immersed, days	21
Water absorbed, per cent	8.75
Average for first four days, do	2.07
Specific gravity (apparent)	1.203

Chemical analyses of briquets.

Test No.	275.
Laboratory No.	5746
Proximate:	
Moisture.....per cent..	3.83
Volatile matter.....do....	18.69
Fixed carbon.....do....	69.03
Ash.....do....	8.45
Sulphur.....do....	.91
Ultimate:	
Hydrogen.....do....	4.88
Carbon.....do....	78.21
Nitrogen.....do....	1.19
Oxygen.....do....	6.36

Extraction analyses.

	Pitch.	Fuel.	Briquets.
		J-10.	Test 275.
Laboratory No.	5941	5719	5746
Air-drying loss.....per cent..	0	1.40	3.40
Extracted by CS_2:			
Air dried.....do....	98.44	.652	5.25
As received.....do....	98.44	.643	5.07
Pitch in briquet as received.....do....	.....	.....	4.53

JAMESTOWN No. 11.

Sample consisted of two cars of semibituminous run-of-mine coal from a mine working the Beckley bed, West Raleigh, Raleigh County, W. Va., on the Chesapeake and Ohio Railway.

Test No. 276. Excellent briquets were made from this coal with 7 per cent of water-gas pitch (Lab. No., 5941).

Test No. 277. Six tons of briquets were made on the English machine from this coal with 3 per cent of flour for a binder. These briquets were strong even after standing for three months in a damp place, and samples of them which have been kept in a dry place for seven months appear as good as when first made. After exposure to the weather for six weeks in the winter time, a sample of the briquets could be handled and was still serviceable, so that it would seem that flour may be considered a satisfactory binder when the briquets made from it are not exposed to the weather for more than two months.

Test No. 289. In order to compare flour and pitch binders, 6 tons of this coal was briquetted with 6 per cent of water-gas pitch (Lab. No., 5940), and an excellent briquet was obtained. A comparison of the briquets from this test with those made with flour binder (test No. 277) shows that the flour briquets were stronger by physical tests but did not resist the effects of weathering as well as the pitch briquets.

Test No. 290. A mixture of 50 per cent of Jamestown No. 11 and 50 per cent of anthracite coal (buckwheat size), designated as Jamestown No. 18, was made to see if fine anthracite could be improved by briquetting with a bituminous coal. A very satisfactory briquet was obtained which had a firm smooth surface, was hard to break, and firm, hard, and glossy fracture surfaces.

Briquet tests.

Test No.	276.	277.	289.	290.[a]
Size of coal as used:				
Over ½ inch ... per cent	0.1	.....	0.4	5.7
⅛ to ½ inch ... do	7.4	.....	4.2	17.2
3/16 to ⅛ inch ... do	29.9	.....	23.2	19.6
1/16 to 3/16 inch ... do	27.7	.....	39.6	18.9
Through 1/16 inch ... do	34.9	11.41	32.6	38.6
Details of manufacture:				
Machine used	Am.	Eng.	Eng.	Eng.
Briquetting temperature ... °F.	190	185	.....	191
Binder—				
Kind	W. G. P.	Flour.	W. G. P.	W. G. P.
Laboratory No. (see p. 8)	5941	6110	5940	5940
Amount ... per cent	7	3	6	6
Weight of—				
Fuel briquetted ... pounds	42,000	12,000	12,750	12,350
Briquets, average ... do	0.610	3.78	3.77	4.15
Heat value per pound—				
Coal as received ... B. t. u.	14,391	14,391	14,391	(b)
Briquets ... do	14,630	14,186	14,584	13,921
Binder ... do	16,978	6,998	16,780	16,780
Moisture in briquet mixture ... per cent	4.60	11.41	10.10	8.48
Drop test (1-inch screen):				
Held ... do	70.0	77.2	68.2	68.3
Passed ... do	30.0	22.8	31.8	31.7
Tumbler test (1-inch screen):				
Held ... do	77.5	60.7	72.0	78.5
Passed ... do	22.5	39.3	28.0	21.5
Fines through 10-mesh sieve ... do	94.0	88.3	88.2	87.5
Weathering test:				
Time exposed ... days	120	120	102	102
Condition	A	D	A	A
Water absorption:				
Time immersed ... days	9	5	31	31
Water absorbed ... per cent	13.45	4.43	9.82	9.85
Average for first four days ... do	3.25	1.05	1.21	1.31
Specific gravity (apparent)	1.117	1.239	1.161	1.247

[a] Jamestown No. 11, 50 per cent; Jamestown No. 18, 50 per cent.
[b] No sample for Jamestown No. 18.

Chemical analyses of briquets.

Test No.	276.	277.	289.	290.
Laboratory No.	5756	6111	6112	6113
Proximate:				
Moisture ... per cent	2.73	3.83	1.61	3.42
Volatile matter ... do	18.27	15.77	20.30	13.03
Fixed carbon ... do	73.56	74.50	71.98	75.93
Ash ... do	5.44	5.90	6.11	7.62
Sulphur ... do	.66	.69	.79	.63
Ultimate:				
Hydrogen ... do	4.72	4.40	4.12	3.77
Carbon ... do	82.83	79.43	81.25	80.77
Nitrogen ... do	1.32	.85	1.45	1.45
Oxygen ... do	5.03	8.73	6.28	6.36

Extraction analyses.

	Pitches.		Fuel.	Briquets.			
			J-11.	Test 276.	Test 277.	Test 289.	Test 290.
Laboratory No.	5941	5940	5718	5756	6111	6112	6113
Air-drying loss.....per cent..	0	0	1.50	2.30	.....	0.80	2.20
Extracted by CS_2:							
Air dried.....do....	98.44	96.60	.598	5.33	.....	4.67	5.37
As received.....do....	98.44	96.60	.590	5.21	.....	4.63	5.25
Pitch in briquet as received.....do....	.....	.....	.....	4.72	.....	4.21	5.12

JAMESTOWN No. 12.

Sample consisted of one car of bone coal from a mine working Pocahontas No. 3 bed, Switchback, McDowell County, W. Va., on the Norfolk and Western Railway.

This "bone" coal was briquetted first with 6 per cent water-gas pitch (Lab. No., 5941), and such excellent briquets were obtained that test No. 279 was made to see if 5 per cent of the same binder would make a satisfactory briquet. The 5 per cent briquet was found to be better than the 6 per cent one. Both tests made excellent briquets, which had firm, smooth surfaces, were broken with difficulty, and had firm, close-grained, and shiny fracture surfaces.

Briquet tests.

Test No.	278.	279.
Sizes of coal as used:		
Over $\frac{1}{4}$ inch.....per cent..	5.6	5.6
$\frac{1}{10}$ to $\frac{1}{4}$ inch.....do....	18.1	18.1
$\frac{1}{20}$ to $\frac{1}{10}$ inch.....do....	33.8	33.8
$\frac{1}{40}$ to $\frac{1}{20}$ inch.....do....	23.2	23.2
Through $\frac{1}{40}$ inch.....do....	19.3	19.3
Details of manufacture:		
Machine used	Am.	Am.
Briquetting temperature.....°F..	195	194
Binder—		
Kind	W. G. P.	W. G. P.
Laboratory No. (see p. 8)	5941	5941
Amount.....per cent..	6	5
Weight of—		
Fuel briquetted.....pounds..	38,000	16,000
Briquets, average.....do....	0.676	0.709
Heat value per pound—		
Briquets.....B. t. u..	12,938	.....
Binder.....do....	16,978	16,978
Moisture in briquet mixture.....per cent..	5.03	.....
Drop test (1-inch screen):		
Held.....do....	59.0	66.5
Passed.....do....	41.0	33.5
Tumbler test (1-inch screen):		
Held.....do....	72.0	78.5
Passed.....do....	28.0	21.5
Fines through 10-mesh sieve.....do....	90.9	93.2
Weathering test:		
Time exposed.....days..	137	137
Condition	A	A
Water absorption:		
Time immersed.....days..	5	4
Water absorbed.....per cent..	11.73	12.18
Average for first four days.....do....	2.91	3.05
Specific gravity (apparent)	1.251	1.248

Chemical analyses of briquets.

Test No.	278.
Laboratory No.	5856
Proximate:	
Moisture ..... per cent.	1.71
Volatile matter ..... do.	13.96
Fixed carbon ..... do.	68.36
Ash ..... do.	15.97
Sulphur ..... do.	.42
Ultimate:	
Hydrogen ..... do.	3.99
Carbon ..... do.	73.14
Nitrogen ..... do.	.77
Oxygen ..... do.	5.71

Extraction analyses.

	Pitch.	Briquets.
		Test 278.
Laboratory No.	5941	5856
Air drying loss ..... per cent.	0	1.10
Extracted by CS_2:		
Air dried ..... do.	98.44	5.74
As received ..... do.	98.44	5.67

JAMESTOWN No. 13.

Sample consisted of three cars of semibituminous run-of-mine coal from a mine working the Pocahontas No. 3 bed, Ennis, McDowell County, W. Va., on the Norfolk and Western Railway.

This coal was briquetted on both the English and American machines for locomotive tests, and was shipped from the plant without any samples being retained, so no physical tests could be made on the briquets. In appearance, just after making, the briquets made on the English machine were very satisfactory and had firm, smooth surfaces.

Briquet tests.

Test No.	286.	287.
Details of manufacture:		
Machine used	Eng.	Am.
Binder—		
Kind	W. G. P.	W. G. P.
Laboratory No. (see p. 8)	5940	5940
Amount ..... per cent.	6	6
Weight of—		
Fuel briquetted ..... pounds.	82,950	160,000
Heat value per pound—		
Coal as received ..... B. t. u.	14,290	14,746
Briquets ..... do.	14,299	.....
Binder ..... do.	16,780	16,780

Chemical analyses of briquets.

Test No	286.
Laboratory No	5848
Proximate:	
Moisture ..... per cent..	3.10
Volatile matter ..... do....	17.08
Fixed carbon ..... do....	73.11
Ash ..... do....	6.71
Sulphur ..... do....	.52
Ultimate:	
Hydrogen ..... do....	4.37
Carbon ..... do....	80.75
Nitrogen ..... do....	.97
Oxygen ..... do....	6.63

Extraction analyses.

	Pitch.	Fuel, J-13.	Briquets.
			Test 286.
Laboratory No	5940	5829	5948
Air-drying loss ..... per cent..	0	2.80	2.60
Extracted by CS_2:			
Air dried ..... do....	96.60	.346	5.31
As received ..... do....	96.60	.336	5.17
Pitch in briquet as received ..... do....	.....	.....	5.02

JAMESTOWN No. 14.

Sample consisted of a car of Virginia semianthracite culm from a mine working the Big vein, Merrimac, Montgomery County, Va., on the Virginia Anthracite Railway.

The coal designated as Jamestown No. 14 was semianthracite culm, and a test was made to see if it could be briquetted into a serviceable fuel. As received it was very wet, and serious difficulty was experienced in crushing it with the Williams mill because of its tendency to pack in the mill and stop it. About 11 tons of briquets were made, however, and these were stronger than necessary when made with 8 per cent pitch binder, but were rather weak with 6 per cent; 7 per cent would probably make a satisfactory briquet. When tested in a kitchen range, these briquets did not burn with satisfactory results, but after breaking them into three or four pieces a better fire was obtained than with a good grade of anthracite coal of egg size. These briquets made a satisfactory fuel for an open-grate fire and for large heating stoves. They had a peculiar property of "banking" themselves, due to the high percentage of ash in them (22.5 per cent), and a fire could be kept over night with them even in a small kitchen range.

Briquet tests.

Test No.	291.
Size of coal as used:	
Over ¼ inch.....per cent..	0.0
⅛ to ¼ inch.....do....	11.9
1/20 to ⅛ inch.....do....	32.8
1/40 to 1/20 inch.....do....	24.3
Through 1/40 inch.....do....	31.0
Details of manufacture:	
Machine used.....	Am.
Briquetting temperature.....°F..	187
Binder—	
Kind.....	W. G. P.
Laboratory No. (see p. 8).....	5940
Amount.....per cent..	6
Weight of—	
Fuel, briquetted.....pounds..	22,000
Briquets, average.....do....	0.746
Heat value per pound—	
Coal as received.....B. t. u..	9,688
Briquets.....do....	11,598
Binder.....do....	16,780
Moisture in briquet mixture.....per cent..	7.35
Drop test (1-inch screen):	
Held.....do....	16.0
Passed.....do....	84.0
Tumbler test (1-inch screen):	
Held.....do....	28.0
Passed.....do....	72.0
Fines through 10-mesh sieve.....do....	94.1
Weathering test:	
Time exposed.....days..	102
Condition.....	B
Water absorption:	
Time immersed.....days..	31
Water absorbed.....per cent..	12.76
Average for first four days.....do....	1.63
Specific gravity (apparent).....	1.299

Chemical analyses of briquets.

Test No.	291.
Laboratory No.	6114
Proximate:	
Moisture.....per cent..	2.07
Volatile matter.....do....	9.93
Fixed carbon.....do....	65.48
Ash.....do....	22.52
Sulphur.....do....	.52
Ultimate:	
Hydrogen.....do....	3.21
Carbon.....do....	66.72
Nitrogen.....do....	.98
Oxygen.....do....	6.05

Extraction analyses.

	Pitch.	Fuel, J-14.	Briquets, test 291.
Laboratory No.	5940	5938	6114
Air-drying loss.....per cent..	0	1.60	1.10
Extracted by CS_2:			
Air dried.....do....	96.60	.06	5.25
As received.....do....	96.60	.06	5.19
Pitch in briquet as received.....do....			5.32

JAMESTOWN No. 15.

Sample consisted of several cars of semibituminous run-of-mine coal from a mine working the Sewell bed, Minden, Fayette County, W. Va., on the Chesapeake and Ohio Railway.

Test No. 280. Owing to the presence of an excessive amount of moisture in this coal, it was very difficult to make satisfactory briquets on the English machine. Water cracks formed, and the briquets had a porous surface which was easily rubbed off. They were easily broken, forming considerable slack. As the flowing point of the binder used in this test was 194° F., the briquetting temperature of 187° F. was not high enough to soften the pitch sufficiently to obtain the best results.

Test No. 281. The briquets which were made on the American machine were probably stronger than those of test No. 280, made on the English machine, but the sample saved for the physical tests was mislaid, making it impossible to apply the tests. The briquets were very hard and showed no water cracks, although the coal was very wet.

Briquet tests.

Test No.	280.	281.
Size of coal as used:		
Over ¼ inch ..... per cent	0.1	0.0
⅛ to ¼ inch ..... do	8.9	5.1
1/20 to ⅛ inch ..... do	27.1	28.6
1/40 to 1/20 inch ..... do	27.0	32.8
Through 1/40 inch ..... do	36.9	33.5
Details of manufacture:		
Machine used	Eng.	Am.
Briquetting temperature ..... °F	187	190
Binder—		
Kind	W. G. P.	W. G. P.
Laboratory No. (see p. 8)	5941	5941
Amount ..... per cent	6	6
Weight of—		
Fuel briquetted ..... pounds	65,800	300,000
Briquets, average ..... do	3.57	0.720
Heat value per pound—		
Coal as received ..... B. t. u.	14,009	14,009
Briquets ..... do	14,548	14,575
Binder ..... do	16,978	16,978
Moisture in briquet mixture ..... per cent	7.04	6.87
Drop test (1-inch screen):		
Held ..... do	19.6	.....
Passed ..... do	80.4	.....
Tumbler test (1-inch screen):		
Held ..... do	48.8	.....
Passed ..... do	51.2	.....
Fines through 10-mesh sieve ..... do	88.9	.....
Weathering test:		
Time exposed ..... days	137	125
Condition	B	B
Water absorption:		
Time immersed ..... days	5	11
Water absorbed ..... per cent	7.87	12.01
Average for first four days ..... do	1.95	2.92
Specific gravity (apparent)	1.185	1.079

Chemical analyses of briquets.

Test No.	280.	281.
Laboratory No.	5857	5859
Proximate:		
Moisture.....per cent..	1.09	3.21
Volatile matter.....do....	18.70	19.49
Fixed carbon.....do....	73.60	72.67
Ash.....do....	6.61	4.63
Sulphur.....do....	.95	.68
Ultimate:		
Hydrogen.....do....	4.70	4.83
Carbon.....do....	80.88	81.97
Nitrogen.....do....	1.20	1.27
Oxygen.....do....	5.66	6.62

Extraction analyses.

	Pitch.	Fuel.	Briquets.	
		J–15.	Test 280.	Test 281.
Laboratory No.	5941	5774	5857	5859
Air drying loss.....per cent..	0	3.00	0.40	2.50
Extracted by CS_2:				
Air dried.....do....	98.44	.43	5.57	5.92
As received.....do....	98.44	.42	5.54	5.77
Pitch in briquet as received.....do....			5.22	5.46

JAMESTOWN No. 16.

Sample consisted of semibituminous run-of-mine coal from West Virginia.

This coal was briquetted with four different kinds of water-gas pitch binders, 6 per cent of each being used. Apparently the test briquets were those of test No. 285, while those of test No. 282 were practically as good. Both of these tests were made on the English machine. Test No. 283, made on the American machine, was a satisfactory briquet, but the briquets of test No. 284 made on the English machine with water-gas pitch (Lab. No. 5939) were not satisfactory, as they did not stand the physical tests well.

Tests 283 and 285 made briquets with smooth, firm, fine-grained surfaces, they broke with difficulty, and had firm and hard fracture surfaces.

Test No. 282 made good briquets as far as strength was concerned, but their surfaces were rough and coarse-grained, and their edges rubbed off somewhat easily. They broke with difficulty and the fractured surface was coarse, firm, and dull black in color.

Test No. 284 furnished very poor briquets, the surfaces of which were rubbed off easily, owing either to too small a percentage of pitch or to too low a briquetting temperature; the briquets were easily broken, and the fractured surfaces were rough and easily rubbed off.

Briquet tests.

Test No.	282.	283.	284.	285.
Size of coal as used:				
Over ¼ inch ..... per cent	5.0	0.1	.....	.....
¼ to ⅛ inch ..... do	16.0	14.4	.....	.....
⅛ to 1/10 inch ..... do	31.4	36.0	.....	.....
1/10 to 1/20 inch ..... do	26.3	25.9	.....	.....
Through 1/20 inch ..... do	21.3	23.6	.....	.....
Details of manufacture:				
Machine used	Eng.	Am.	Eng.	Am.
Briquetting temperature ..... °F	174	189	.....	.....
Binder—				
Kind	W. G. P.	W. G. P.	W. G. P.	W. G. P.
Laboratory No. (see p. 8)	4879	5941	5939	5940
Amount ..... per cent	6	6	6	6
Weight of—				
Fuel briquetted ..... pounds	52,048	66,000	30,600	37,400
Briquets, average ..... do	4.10	0.641	3.83	3.68
Heat value per pound—				
Coal as received ..... B. t. u.	13,480	13,480	13,480	13,480
Briquets ..... do	12,780	13,754	13,939	.....
Binder ..... do	16,805	16,978	16,781	16,780
Moisture in briquet mixture ..... per cent	9.55	7.55	.....	8.40
Drop test (1-inch screen):				
Held ..... do	77.3	35.5	39.2	78.8
Passed ..... do	22.7	64.5	60.8	21.2
Tumbler test (1-inch screen):				
Held ..... do	82.7	56.0	47.8	82.8
Passed ..... do	17.2	44.0	52.2	17.2
Fines through 10-mesh sieve ..... do	88.0	90.1	90.1	89.5
Weathering test:				
Time exposed ..... days	137	125	118	118
Condition	B	B	B	A
Water absorption:				
Time immersed ..... days	31	31	31	31
Water absorbed ..... per cent	9.79	10.55	15.98	11.23
Average for first four days ..... do	0.89	1.12	1.82	1.13
Specific gravity (apparent)	1.206	1.126	1.112	1.143

Chemical analyses of briquets.

Test No.	282.	283.	284.
Laboratory No	5946	5945	5947
Proximate:			
Moisture ..... per cent	2.21	2.27	2.06
Volatile matter ..... do	30.97	32.56	31.65
Fixed carbon ..... do	52.97	56.52	58.74
Ash ..... do	13.85	8.65	7.55
Sulphur ..... do	0.89	0.85	0.80
Ultimate:			
Hydrogen ..... do	4.43	4.81	4.82
Carbon ..... do	70.30	75.97	76.66
Nitrogen ..... do	1.09	1.22	1.24
Oxygen ..... do	9.44	8.50	8.93

Extraction analyses.

	Pitches.			Fuel.	Briquets.		
				J-16.	Test 282.	Test 283.	Test 284.
Laboratory No	4879	5945	5939	5828	5946	5945	5947
Air-drying loss ..... per cent	0	0	0	3.40	1.20	1.40	1.20
Extracted by CS_2:							
Air dried ..... do	94.50	98.44	98.13	.71	5.50	6.48	5.16
As received ..... do	94.50	98.44	98.13	.68	5.43	6.39	5.10
Pitch in briquet as received ..... do	.....	.....	.....	.....	5.06	5.84	4.54

JAMESTOWN No. 17.

Sample consisted of semibituminous run-of-mine coal from the Pocahontas No. 3 bed of West Virginia.

Eighty tons of this coal were briquetted for a special test on the battle ship *Connecticut* of the United States Navy, and as it was shipped without any samples being retained no data exist on which to make a report.

Briquet tests.

Test No.	288.
Details of manufacture:	
Machine used	Am.
Binder—	
Kind	W. G. P.
Laboratory No. (see p. 8)	5940
Amount, per cent	6
Weight of—	
Fuel briquetted, pounds	160,000
Heat value per pound—	
Coal as received, B. t. u.	14,746
Binder, do	16,780

Extraction analysis.

	Pitch.
Laboratory No.	5940
Air-drying loss, per cent	0
Extracted by CS_2:	
Air dried, do	96.60
As received, do	96.60

JAMESTOWN No. 18.

This coal was anthracite coal of buckwheat size and was briquetted in a mixture with Jamestown No. 11 coal in test No. 290. The data obtained from this test can be found under Jamestown No. 11 coal, test No. 290.

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