The utilization of sawdust, shavings, spent tanbark, chemical bark, and chips in the manufacture of fuel in the form of briquets has been successfully carried on in several European countries for many years. During the past 30 to 40 years wood briquetting operations have been conducted more or less sporadically in this country, but only recently have they achieved any considerable degree of financial success.

Wood waste briquets can be profitably made in America only under exceptionally favorable conditions of manufacture and sale. Other forms of fuel are relatively cheap in most parts of the United States, and wood briquets cannot usually be sold in competition with them on the basis of heat units delivered per dollar of cost.

The requisites for success in wood waste briquetting operations are (1) a large and continuous supply of suitable raw materials, (2) low production costs, and (3) a ready sale for the finished product at fair prices. On account of the bulkiness and low value of the materials used in making briquets the stock must be obtained locally; for the same reasons, the principal market for the briquets must be found in the general region of production. Because of special properties some briquets will, however, find sale in distant localities, especially in the larger cities.

Manufacturing Processes

In general, the wood waste briquet is made by compressing previously dried sawdust, shavings, or shredded wood in a heavy press. The hardness of the briquet depends upon the process used and upon the pressure applied.

In systems which utilize the refuse of resinous woods, the resinous material in the wood waste serves as a binder to hold the briquet together, and a very heavy pressure produces a very firm and hard briquet. In other systems, some sort of binder is mixed in before compressing, this binder often being coal-tar pitch, petroleum refuse, or waste liquors resulting from the manufacture of wood pulp by the sulfite process. Still other systems rely entirely upon mechanical binders; one uses a wire tie which encircles the briquet; another uses a tarred jute core which runs throughout the length of the briquet.

Briquetting of wood waste using added binders, rope, or metal ties to hold the briquet together is chiefly of historical interest in this country, since briquetting methods employing such binders have not been used here for many years. The latest type of equipment for wood waste briquetting and the method exclusively employed in current commercial briquetting operations in this
country develop pressures so great that, in the formation of the briquet, the elasticity of the wood is destroyed and no added binder is required to get a stable product.

The preliminary drying of the sawdust or other wood waste for briquetting is a necessary step, since it is practically impossible to make wet wood stock cohere properly. The problem of drying has been a stumbling block of serious proportions in more than one installation. The actual drying of small quantities of wood waste is a simple matter, but the design of a mechanism for the continuous drying of large quantities has presented difficulties. In former years, either live or exhaust steam was used almost exclusively in the drying operations, the material passing over steam-heated plates or floors or being carried along in a stream of air which has been heated by forcing it through steam-heated coils of pipe. In present-day briquetting operations, heat for drying is largely supplied by flue gases from sawmill and factory stacks. If a binder is to be employed in making the briquet, it is usually mixed in mechanically just before the final heating takes place, the mixture being fed into the machine through steam-heated hoppers and pipes.

Types of Equipment

Although the various presses for making briquets differ greatly in their details of construction, most of them work on the cylinder and plunger principle, the plunger being driven by means of crank and connecting rod or by some toggle-joint system of levers designed that it is capable of exerting great pressure at the end of the stroke. Practically all of the presses are automatically fed, the only attention required being to provide a supply of raw materials and to remove the finished briquet. In systems in which binders such as pitch are used, and in those in which the resins of the wood serve as binders, it is necessary to provide a long cooling trough for the finished briquets. These troughs are sometimes as much as 150 feet in length. In systems using mechanical binders, cooling troughs are unnecessary.

Several European briquetting methods employ some kind of binder mixed with the wood waste or rely upon the resinous material in the wood to hold the briquets together. In this country, cohesion of particles in briquets is obtained by employing pressures sufficiently high to destroy the elasticity of the wood, which results in high stability of the finished product. Currently, all commercial wood waste briquets, as far as is known, are made by one type of machine.

The raw material used in this machine is chiefly shavings from dry lumber. It is further dried, usually by flue gases, to 6 percent moisture content. The stock is ground to a uniform size, similar in appearance to pre-cooked oatmeal, and in that condition is delivered to the mold. Pressure exerted on the material in the mold ranges between 15,000 pounds and 20,000 pounds per square inch. The resulting briquet is 12 inches long and 4 inches in diameter and weighs 8 pounds. The density of the briquet is about 1.3. These briquets yield about 8,250 British thermal units per pound of material. The capacity of the briquetting machine is about 11 tons per day of 24 hours.

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Of the 55 or more machines operating in the United States, all but two are located in the Pacific Coast states, Idaho, and northwestern Montana. The annual production is about 200,000 tons. The price to the consumer ranges from $7.50 to $9.00 per ton, delivered, at points of manufacture.

A method of briquetting in which sawdust only is used as raw material has been devised. By this method, green sawdust is preheated in a retort to an end temperature of 275° C. (527° F.) which requires about 40 minutes. Heating is discontinued just before full distillation of the wood begins. In the preheating, the wood loses its elasticity and can be readily compressed into stable briquets under a pressure of 6,500 pounds per square inch. The preheated sawdust is allowed to cool to 100° C. (212° F.) at which temperature it is ready for briquetting. The density of the finished briquet is about 0.90. The loss in weight in preheating is about 35 percent of the original weight of the sawdust used, and consists largely of water. The British thermal unit yield of the briquets is about 10,400 per pound.

A method of producing charcoal from pine sawdust has recently been announced. The charcoal obtained is reported to be highly dense, with a specific gravity of 0.51.

The briquetting of wood waste is generally considered profitable only with large-scale operations. Small-scale production of briquets has rarely, if ever, been successful. A possible reason for lack of success in briquetting in a small way is the lack of suitable equipment for such operations. If some feasible method could be devised, it would result in the salvaging of considerable amounts of sawdust and shavings for local fuel use. It could also make possible the production of special briquets, such as those impregnated with chemicals to yield colored flames, for which higher prices are received. A type of briquet that produces colored flames is quite common on the market during the Christmas season.

Fuel Value and Burning Qualities of Briquets

There seems to be a wide range of opinion concerning the fuel value and burning qualities of wood waste briquets. Some ardent enthusiasts claim all the virtues for them and others, equally sincere, declare them unsuitable under many conditions. Certain German-made briquets are reported as unsuited for use in the tight porcelain stoves, so common in that country, on account of rapid combustion. Rapidity of combustion is also claimed to be a distinct disadvantage in places where it is desired to bank a fire over night.

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1 Basore, C. A. "Fuel Briquettes from Southern Pine Sawdust," Bul. No. 1, Engineering Experiment Station, Alabama Polytechnic Institute, Auburn, Ala.


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It seems reasonable to suppose that the more loosely formed briquets will burn more rapidly than those formed under greater pressure or with firmer binding material; and it is believed that it may be possible to regulate the speed of combustion to a certain extent by varying the conditions under which the briquets are made. It is pointed out by one of the manufacturers of briquetting machinery that briquets made by his machine can be used for kindling wood by breaking the binder. This bears out the deduction just drawn, since kindling must make a quick, hot fire to be satisfactory.

The fact remains, however, that notwithstanding the failure of a number of both foreign and domestic wood briquetting plants, there are certain conditions under which the industry appears to flourish, and it should not be difficult to find out, in a general way, what those conditions are.

Before analyzing outside conditions which may have a bearing upon the success or failure of a briquetting plant it will be well to look at the briquet itself, and study its fuel value.

It seems rather peculiar that it has been found necessary heretofore to lay especial emphasis on the fuel value of briquets. It is quite logical to suppose that since the briquet is merely wood, 1 pound of briquet should have as many heat units stored in it as 1 pound of the same species of wood, moisture conditions being equal. As a matter of fact, data at hand uphold this view entirely. Another fact concerning wood, which is borne out by tests made by the Forest Products Laboratory, is that, disregarding the heat value of the resins which appear abundantly in various species, a pound of absolutely dry wood has a very nearly constant fuel value (heat units) irrespective of species.

It is probably true, therefore, that thoroughly dry wood briquets will also have a nearly constant fuel value, weight for weight, regardless of the kind of wood used. Well-seasoned wood has a fuel value of about 8,000 British thermal units per pound. Briquets of the same moisture content probably have the same fuel value as wood. If the wood contains resins the same result may be expected on account of the high heat value of the resins.

In comparing briquets with cordwood or stove wood it must be remembered that the briquet is usually much dryer, therefore will generate more heat per pound of material than wood.

**Conditions Necessary for Successful Manufacture and Sale**

Certain conditions are needed for the successful sale of briquets because of their heating and other properties.

In the first place, the fuel value per pound is much less for wood than for coal, so that to obtain the same amount of heat much more wood (dry) than coal must be used. If the wood is green instead of dry, still more must be used, because all the water in the wood is useless from a heating standpoint, and some of the heat of the wood is used up in converting this water to steam during combustion.
This means that, if one is buying primarily on a heat unit basis, he can afford to pay much more for coal than for wood or wood briquets -- usually from one and a half to two times as much for coal as for wood when both are dry. If the wood is green, it is quite possible that the coal will have three or four times the effective heating value of the wood.

If the kindling, appearance, cleanliness, burning qualities, and other special properties of the briquet are of value, as in domestic use, the price obtainable will be proportionately higher.

In the second place, the cost of manufacturing briquets is considerable, conservative estimates placing the figure at not less than $5 or $6 a ton.

In the third place, the bulkiness of the fuel prevents its general shipment for long distances. This applies to the finished briquet and to the raw materials alike.

It is believed that the ultimate consumer will have to pay at least $7.50 a ton for the briquets to assure profitable manufacture, and on that basis it can readily be determined, under normal conditions, what the minimum price of coal must be to allow competition. Assume, for convenience, that the coal under consideration is bituminous, possessing one and one-half times the heat value of the briquet. That coal must sell for at least $11.25 a ton before the briquet at $7.50 can offer the same heat value for the same price. Wood briquets are currently selling at $8 to $15 per ton to the consumer in Pacific Coast states.

The main market for briquets will probably be for domestic use, so that the cleanliness and easy kindling qualities of the briquet will be an asset, and it might be able to compete with coal at a somewhat lower price, the housewife being willing to pay a little more for the same heat value on account of other desirable properties. The small percentage of ash and the absolute absence of clinkers are great advantages in favor of briquets or wood over coal. The small volume of smoke is also pointed out as an advantage.

In competing with cordwood the briquet has certain advantages, such as less labor in preparing for the fire, less moisture and therefore more wood per pound, and less need for kindling wood.

In conclusion, it may be stated that the best chances for the success of the wood waste or sawdust briquet are in those regions where suitable wood waste is abundant and coal is expensive. The region fulfilling those conditions best in this country is the Pacific Coast; and it is a significant fact that companies that have attempted to establish the industry in America are chiefly in that part of the country.
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"Wood Briquettes," Published in the West Coast Lumberman, Seattle, Wash., Oct. 1931.


