pitch, melting at 38 deg. C., must be shipped in barrels, as they often flow like wax at summer heat or from the heat absorbed from direct sunlight even in cool weather. The harder specimens, or those which melt above about 55 deg. C., can be handled in bulk or in sacks, and do not require barrels if kept shaded from the sun. This matter is quite important as an element of the cost of pitch. A saving of between \$2 and \$3 per ton is effected if the pitch does not require to be shipped in barrels.

Both soft and hard pitch are used for the manufacture of briquettes, but we note that most European manufacturers are using rather hard pitch.

Briquetting Presses.

That part of the machinery of a briquetting plant which is used for handling the material, crushing, screening, elevating into bins, measuring and mixing the ingredients, etc., is all such as may be seen at work elsewhere in this country. The press used for briquetting, while it is often very similar to our brick-making machines, is really the only special machine required. It is also the most expensive and important. The press must be adapted to the kind of material to be worked, to the size and shape of the briquettes desired, as well as to the quantity to be produced in a unit of time.

In Europe, where the industry has been developing for the last forty years and more, the press question has been pretty well exploited, if we may judge from the number of different kinds of presses that are in use and offered for sale by manufacturers.

In general, the presses are divided into classes according to their mechanical design. I will note a few of the more important classes.

Open-Mold Presses.

Open-mold presses are those in which the material is forced through a tube-shaped mold by a reciprocating plunger or a screw. The continuous column delivered from the tubular mold is usually cut by wires to the desired length of the briquettes. Sometimes the reciprocating plunger produces a briquette at every stroke, each being formed against the preceding one, the tube being long enough to contain several briquettes. In this case the column issuing from the mold being composed of separate briquettes does not require to be wire cut, as the briquettes fall apart as they issue from the mold. The resistance against which the plunger or screw acts in this case is the friction of the material against the sides of the mold. Open-mold presses are used in this country for wire-cut brick, and those of the reciprocating plunger kind are worked not far from Detroit on peat, for which they are well adapted. It is evident that the consistency of the material used in these presses must be carefully gaged, as the density of the briquettes and the pressure will depend on the viscosity of the material fed to the press.

Closed-Mold Presses.

Of these there are a large number. There are single-plunger presses, in which the material is filled into a mold and pressed by a single plunger against a solid resistance, which may be a plate covering the opposite end of the mold. This press is successfully worked on lignite, but it is not generally adopted for other coal.

The double-plunger press is simply a mold with a pair of opposing plungers. In this press the material receives pressure on both ends at once. Where heavy pressures are required, and especially on large briquettes, foreign engineers recommend this press.

Most of the larger briquette factories of Europe use some form of the double-plunger press. In the Couffinal type, which is one of the most successful in use, there is a large disk, usually about 54 inches in diameter and about 5 inches thick. This disk revolves in a horizontal plane. The molds, usually eight in number, are simply holes cut through the disk. The material is filled into the molds and receives pressure from below and above at the same time by a pair of vertical plungers which usually give a pressure of about 2,000 pounds per square inch. After each stroke and when the plungers are withdrawn, the disk revolves far enough to bring another mold under the plungers, and the already pressed briquette is moved under an ejecting plunger and forced out upon a conveyor. Presses of this type, working on large briquettes, produce as high as fifteen tons or over per hour. When working on small briquettes the production falls as low as two tons per hour and under.

Another type of the closed-mold press is that which has been known as the eggette press of Belgium. This machine has two tangent cylinders whose axes are parallel. The cylinders roll together and the eggettes are formed in the semi-egg-shaped depressions which cover the surfaces of the cylinders.

This eggette machine is quite largely used. It has the advantage of yielding a rather large production, usually about five tons per hour. Its disadvantages are, that it requires more power than almost any other machine; it is difficult to keep in good running order and it is necessary to adjust the mixture of material to suit the machine rather than for any other conditions. Furthermore, there is more or less material wasted.

Size of Briquettes.

It may be noted that the machines producing the larger briquettes usually yield them at a somewhat lower cost than those producing the smaller sizes. This accounts for the fact that some consumers break up the larger briquettes for domestic use. In America, however, the domestic trade demands small briquettes.

There seems to be a tendency also in Europe at present toward the smaller sizes.

For shipment and use in steamboats, where economy of space is of the first consideration, large rectangular briquettes are used because of the quantity that can be piled in a given space. A common briquette in France for this purpose is one weighing 10 kilogrammes or 22 pounds. Briquettes measuring 7 by 4 by 4.75 inches, and weighing 2 kilogrammes 500 grammes, or 5.5 pounds, are now used for ocean shipment and also for locomotive use. Rectangular briquettes from these sizes down to less than one pound each, and eggettes weighing a few ounces, are common for domestic use.

Briquettes of every conceivable solid figure have been made.

It is important to note that good briquettes may be stored out of doors for years without suffering any deterioration. Spontaneous combustion in large piles is said to be impossible.

So important are the considerations of economy of space and safety of storage, together with some other advantages, that we are told the very best coal is sometimes ground up and briquetted for the bunkers of steamships.

Conclusion.

In the matter of introducing the briquetting of fuel into this country, it is but natural to regard it as simply a transplanting of a foreign industry from European into American soil, but it seems to be much more than this. Quite a number of attempts at starting the industry here have failed. The writer examined, quite carefully, into the causes of some of these failures and obtained some valuable information.

In regard to cost of manufacture we note that Mr. Robert Schorr, of San Francisco, in his valuable paper in the Transactions of the American Institute of Mining Engineers, February, 1904, gives the cost per ton of briquettes in western America, as follows:

Labor, exclusive of stacking.....	\$0.16
Oil and grease.....	.006
Sundry stores.....	.01
Steam fuel.....	.04
Interest and depreciation.....	.05
Total	\$0.266

The total of these figures coincides so closely with the writer's own estimates that we believe them to be sufficiently correct for approximate estimates near any large city.

In regard to the cost of pitch we have not been able to obtain close figures, but we believe this item may be estimated for the Eastern or Middle States at about \$7.50 per ton, or an 8 per cent mixture would give for the briquettes per ton \$0.60. This gives a total, exclusive of the cost of anthracite culm, slack coal or coke breeze, of \$0.87 per ton of briquettes.

If the cost of anthracite culm, for example, is taken at \$0.50 per ton, and 67 per cent is used, this item would give \$0.33 per ton of briquettes. If also we add to this 25 per cent of slack coal at \$1.60 per ton, we should have for this item \$0.40. This would give a grand total for the cost of anthracite briquettes \$1.60 per ton.

In regard to the selling price of briquettes there are no figures at hand for this country. It is estimated, however, that they will command a price between the best bituminous and anthracite coals.

In regard to the proper location for a briquette plant, of course, this depends on the location of a supply of the material to be used and of the market. At the anthracite mines there is sufficient culm to last several briquetting factories for many years.

Many other places there are where, on account of coke plants and large coal distributing points, coke breeze and slack coal are to be had. Some of these places are at long distances from the mines and have an advantage on freight for a higher selling price. Lignite and peat are important sources for the future briquetting industry in America.

HOW FILLED CAPSULES ARE MADE.*

By F. F. ROBIN.

THE manufacture of filled capsules in the United States has made such rapid progress during the past few years that it is no longer a simple process, but, on the contrary, requires for success complicated and expensive machinery. Although the capsule was invented by a Frenchman, the pharmacist, M. A. Mothes, in 1833, the present manufacturing process has been largely perfected by Americans. The year 1836 saw the start of the industry in that country and it was not until 1863 that empty capsules were turned out in quantity. In the old days the work was done entirely by hand. During the years between 1875 and 1877 great strides were made in the process and several ingenious machines invented, and to-day the modern mechanical process of production has been perfected remarkably.

Machinery and Plant.—The present-day capsule plant of minimum capacity requires expensive machinery, consisting of a press with a capacity of one hundred and fifty tons pressure on the surface of the die or mold, steel-tinned plates, racks, steam kettles, a hot-water bath, a steam table, metal molds of different sizes, oval or round, a steam closet, and a machine for making gelatin leaves. The amount of floor space required for such an equipment is, however, not large, although it is capable of turning out twenty thousand capsules a day. A room 20 by 20 feet is large enough

for all purposes, more especially as certain of the fixtures must of necessity be placed near together.

The steam closet is built into one corner of the room and fitted with a steam coil near the floor. The upper portion of the closet is fitted with shelves, or rather supports, on the side walls, which receive the drying plates like shelves. These are upheld by pieces of iron piping which are put across the front and back of the closet with about four inches of space between them. The steel-tinned plates, as well as all other utensils which are to hold gelatin, are given a coat of mercury to prevent the gelatin from adhering to them. The press, it will be seen, is put near the closet with the steam table directly in front of it and the kettles and water bath are placed near by so that the capsule maker can watch the preparation of his gelatin mass while molding capsules.

Ingredients and Process.—The modern process of manufacture may be divided into four distinct steps for the sake of description. These may be termed the preparation of the gelatin mass, the making of gelatin leaves, the drying of these leaves and the actual molding of the capsules.

Hard French pearls are made with a compound of gelatin, acacia, sugar, glycerin, and glucose, while the soft elastic capsules are made with a compound of gelatin, glycerin, and a small percentage of acacia. The latter is first dissolved in cold water and then the gelatin is added and left to soak over night. In the morning the gelatin is dissolved with gentle heat and the rest of the ingredients added. The whole mixture is then boiled for about two hours to give it tenacity and to evaporate the excess of water. Next it is run through a fine sieve into mercury-coated pans, from which it can be removed with ease when it has cooled.

To mold capsules by pression it is necessary to run the gelatin mass into leaves of a thickness varying with the size of the capsule to be made. This is done by dissolving the gelatin mass in a hot water bath fitted with a spigot at the bottom. When the material has cooled sufficiently the hot water bath is put on the gelatin leaf machine. This mechanism is simply an arrangement of two pieces of angle cast steel set far enough apart to allow the plates to be run freely between them. A knife or scraper is fitted on one end which can be raised or lowered at the pleasure of the capsule maker by two screws at any desired speed so as to produce sheets of the particular thickness required. The gelatin is run in a stream large enough to feed freely and the plates are pushed one after another past the scraper, which spreads the gelatin on them in sheets of a uniform thickness. An attendant takes the plates off the machine at the other end and deposits them on wooden racks to cool. In a few minutes the gelatin has set and can be carried into the steam chest.

Drying Gelatine Leaves.—The drying of the gelatin leaves is the third process, one of the most important. Great care must be exercised, as a little too much heat will liquefy the gelatin on the plates and cause it to run off. The sheets will then become too thin and so be worthless. The usual method of governing this delicate process is to have the steam valve in the closet itself so that the heat can be regulated at will. There is no set rule by which gelatin can be dried, for, as it will absorb moisture very quickly, every change in the atmosphere will make necessary a change in the drying process. If the sheets are not dry enough when the capsules are molded they will not form at all or many will be found leaking.

When the gelatin leaves have dried sufficiently they are taken out of the closet and about forty plates are left in the closet for immediate use. The room is then heated to a temperature of about 80 deg. F., and the liquid to be encapsuled, as well as the mold, is kept lukewarm. Two plates are brought out of the closet and the sheets stripped off. One sheet is put on the lower part of the mold and the liquid poured in the depression made by the collar; the other sheet is put on top of the liquid. Air is excluded from between the sheets, the top part of the mold is fitted on, and the whole mold put in the press. Pressure is then quickly applied and in a few seconds from one to three hundred capsules are made.

The Actual Molding.—It is interesting to study the capsule molds. They are made in two halves and the tubing of one side is the exact counterpart of the other. The top part is made to slide up and down on the lower half. The lower part is made with raised edges and on the upper part there is a groove in which the raised edges fit. When the pressure from the press is applied the first pressure comes on the collar of the die. This clamps the two sheets of gelatin together and keeps the liquid from escaping and, as there is no other place for the liquid to go, it is forced into the space of the tubing. Thus it bulges the gelatin into the form of half a capsule on each of the dies. As more pressure is put on and the gelatin sheets on the two plates of the press are brought together, the halves of the capsules are united, stuck together, sealed, and finally cut clear from the sheets. The capsules are then brushed off the mold into a tray and the operations repeated. Alcohol, or benzine, is used to wash the finished capsules, after which they are ready for boxing. In the case of hard pearls they are first dried and then varnished with a solution of gum sandarac dissolved in alcohol and ether.

Pastilles to Keep Off Mosquitoes.—Four parts by weight of eucalyptus oil, 1 of anise oil, 35 of fluid paraffine, 60 of solid paraffine. Melt the ingredients together and mold in pastilles.—Dietrich's Manual.

* Canadian Pharmaceutical Journal.