(No Model.) 3 Sheets—Sheet 1.

E. F. BADGLEY.

APPARATUS FOR TREATING BITUMINOUS COMPOUNDS.

No. 542,701. Patented July 16, 1895.

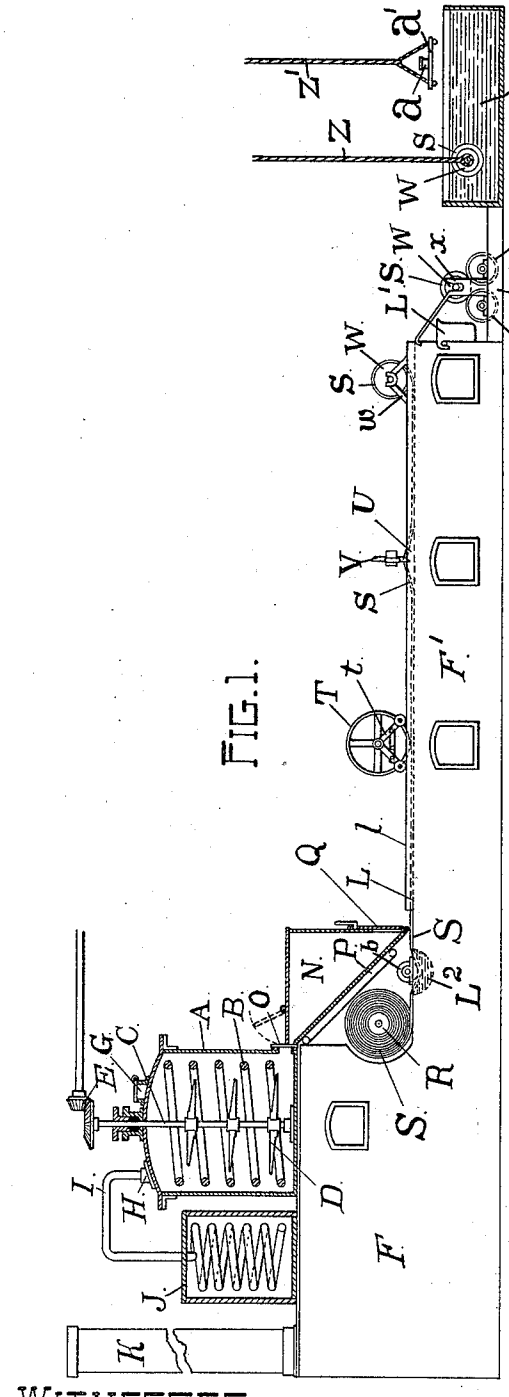

FIG. 1.

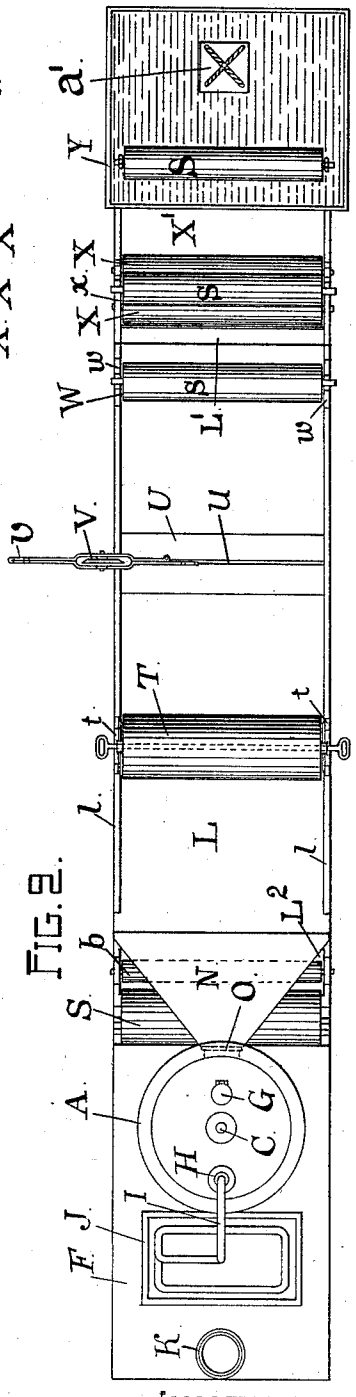

FIG. 2.

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(No Model.) 3 Sheets—Sheet 2.

E. F. BADGLEY.

APPARATUS FOR TREATING BITUMINOUS COMPOUNDS.

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FIG. 4.

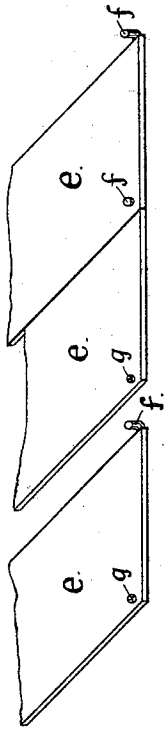
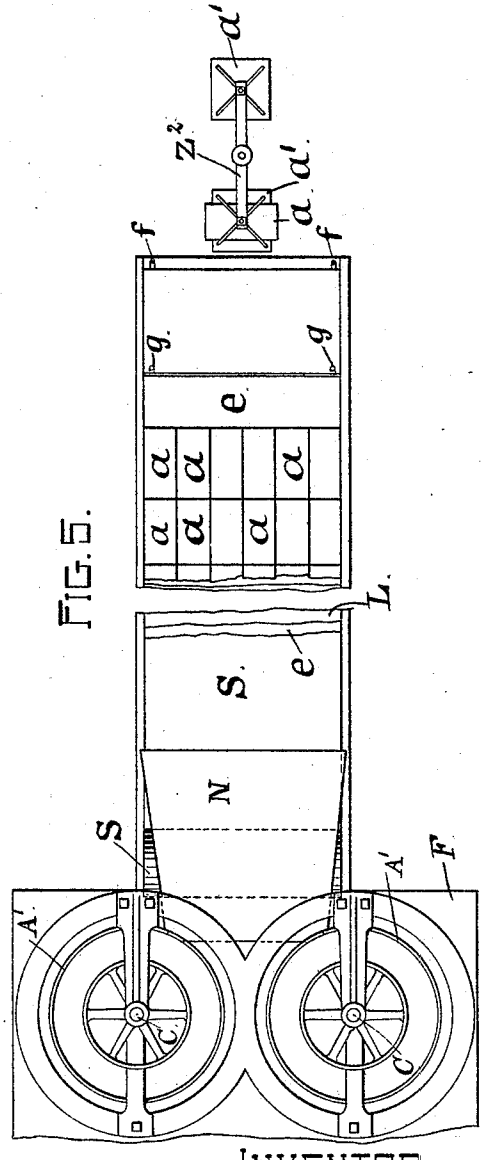


FIG. 3.

FIG. 5.



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(No Model.) 3 Sheets—Sheet 3.

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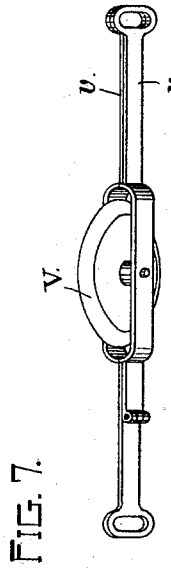

FIG. 7.

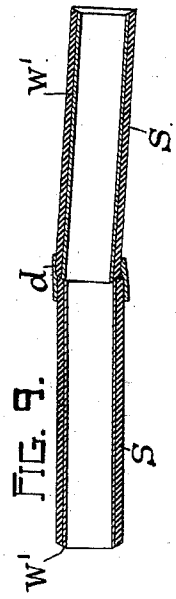

FIG. 9.

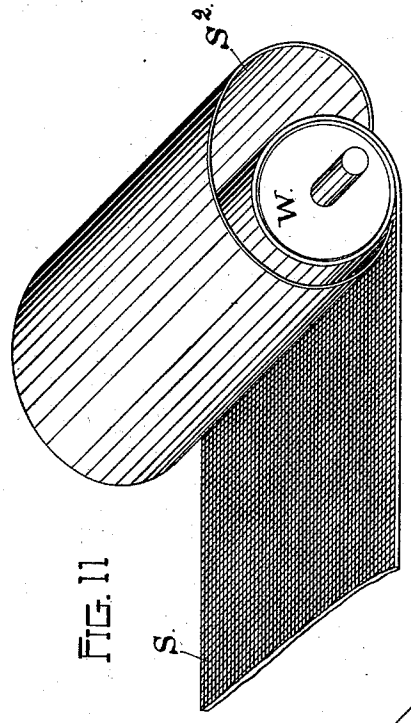

FIG. 11

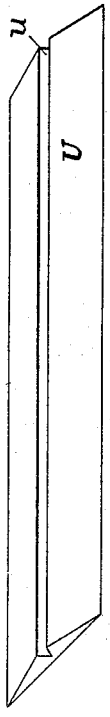

FIG. 6.

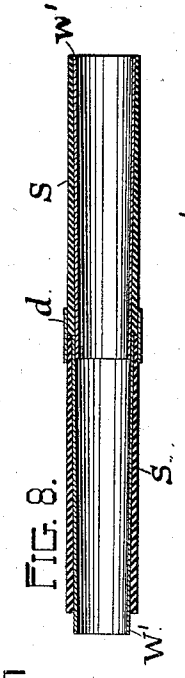

FIG. 8.

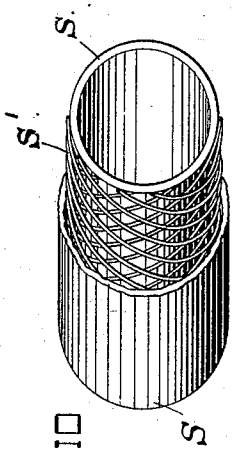

FIG. 10

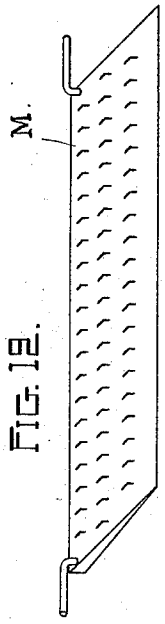

FIG. 12.

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UNITED STATES PATENT OFFICE.

EUGENE F. BADGLEY, OF SAN FRANCISCO, CALIFORNIA.

APPARATUS FOR TREATING BITUMINOUS COMPOUNDS.

SPECIFICATION forming part of Letters Patent No. 542,701, dated July 16, 1895.

Application filed May 31, 1894. Serial No. 513,079. (No model.)

To all whom it may concern:

Be it known that I, EUGENE F. BADGLEY, a citizen of the United States, and a resident of the city and county of San Francisco, State of California, have invented certain new and useful Improvements in and Relating to Apparatus for Treating, Working, and Handling Bituminous or Similar Compounds; and I hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention has for its object improvements in the manufacture of articles that can be made from earthy compounds or mixtures containing a certain proportion of maltha, asphaltum, bitumen, residuum of black petroleum, or similar substances, whether these compounds or mixtures be used alone or combined with a sheet of paper or textile or other fabric.

The said improvements are carried out by means of the process and apparatus hereinafter described.

The process consists, first, in tempering the compounds by driving out the oily or lubricating matters, wholly or partly, as the case may require, thus eliminating the vaseline or other greasy portion thereof, with the result that the compounds develop greater tensile strength and resisting power and will stand solar heat, an advantage not to be had where the oily substances are allowed to remain, since these substances act as a flux and soften the mixtures containing them when exposed to the rays of the sun, as is the case with the ordinary mixtures employed for street use. The tempering is effected by means of dry heat generated and applied in any suitable manner, and particularly by directing a blast of hot air through the compounds while they are being mixed.

A second part of the process consists in rendering the compounds more tractable for manipulation and manufacturing purposes—that is to say, preventing their sticking, gathering in lumps, or forming ill-shaped objects—which is effected by handling and working the compounds in a hot state in or upon structures and with appliances and tools hotter than the compounds themselves.

A third part of the process is to hasten the setting and hardening of the articles made with the compounds, which is done by chilling or cooling the same through the agency of wet implements or water in suitable receptacles.

The above-mentioned process is carried out by means of the apparatus illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation, partly in section; Fig. 2, a plan; Fig. 3, a view similar to Fig. 1, showing a modification of the structure represented in that figure; Fig. 4, a detailed view in perspective of certain plates used when handling heavy or thick compounds; Fig. 5, a plan of the modified form of construction shown at Fig. 3; Fig. 6, a perspective view of a two-edged scraper used upon the apparatus; Fig. 7, a perspective view of a rotary cutter used in connection with said scraper; Fig. 8, a longitudinal section of composition pipes with metal core made on the apparatus; Fig. 9, a view similar to the preceding, but showing a different pipe-joint; Fig. 10, a perspective view of a composition pipe comprising a wrapping of wire; Fig. 11, a perspective view of a composition pipe between the layers of which a sheet of metal is inserted; and Fig. 12, a perspective view of a pin-studded plate used in making composition pipes.

In the figures, A represents a mixer consisting of a closed tank, the inside of which is surrounded with a coil of steam or hot-air pipes B and having a central vertical shaft C provided with blades or stirrers D and rotated through gearing E by means of a suitable engine or motor. This mixer is set upon a furnace F, which supplies the heat that keeps the various parts of the apparatus hot. The earthy compounds to be treated and afterward fashioned into divers forms, and which consists of bituminous or similar substances combined with silicates or other composite matter in the required proportions, are introduced into the mixing-tank through an opening G. There they are thoroughly mixed and

subjected to a comparatively high degree of heat derived both from the surrounding steam or hot-air pipes and from a hot blast of air forced through the compounds by any known form of blower. The heating is continued until the compounds have been tempered to suit—that is, more or less deprived of the oily matters, according to the purpose for which they are to be utilized. If, for instance, they are to be used for street pavements and therefore soon to be exposed to solar heat, they may be rid of all the oil or greasy matter which they contain. If, on the other hand, they are to form underground pipes or conduits, it is thought best to use the tempering or refining process sparingly and let nature perform the work of eliminating the oils, which it will do by slow degrees.

The oily or greasy matters arising from the mixed and heated compounds are driven out of the mixer through an outlet H and a pipe I into a condenser J, where they are collected. By the use of the condenser one can save the lubricating-oils and judge about the mixture in the mixing-tank—that is, ascertain its exact state and the quantity left.

The condenser may be removed from the position given to it in the drawings to some other place, if desired, and the heat from the smoke-stack K may then be utilized to heat and dry the silicates or composite matters in the space thus left vacant before mixing in the tank. This previous heating of the silicates is desirable, as it has been found from experience that when so heated they mix with the other ingredients much better than when they are cold.

An open mixer A′ (represented in Figs. 3 and 5) is employed when refined asphalts are used—for instance, in the prepation of cements for pipe-joints. In such cases the ingredients are first heated in separate kettles and then poured into the mixer, which is left uncovered and is operated without the hot-air blast. Two mixing-tanks can be conveniently employed at the same time, one by the side of the other, as seen in Fig. 5, the prepared compounds being drawn from one while the mixing is going on in the other.

F′ is an extension of the furnace F, or may be a separate furnace if preferred. Over it extends a table or plate L having raised edges *l* and designed to be heated by the said furnace F′ underneath or by any heating apparatus that it might be found convenient to substitute for it. It is upon this table that the compounds treated or tempered in the mixing-tank are to be worked. If desired the table L may be set at a slight incline toward a scrap box or pan L′ located at its outer end to allow the scrap or waste material to run off easily.

The compounds are transferred from the mixer onto the table L through a feeder N, which is suitably supported above said table. However, they are allowed to cool down to a suitable condition before this is done. The cooled material is let out of the mixing-tank through a door O and runs down into the feeder N, which is heated by hot-air or steam pipes P and kept at a temperature a few degrees higher than that of the material. From the feeder the material runs down by gravity onto the table, which also is maintained at an advanced temperature, said material passing through an opening or slot controlled by a gate Q. This gate is so arranged that it can be raised or lowered to permit different thicknesses of material to come out, according to the purpose in view. One feeder only need be used where two mixers are employed, for both tanks can be made to discharge into a single feeder, as represented at Fig. 5.

Upon the inner end of the table L, under the feeder N, is mounted a reel or spool R, designed to carry a roll of perforated paper, canvas, open-mesh cloth, wire-cloth, or sheet metal S, which is used in the manufacture of various articles made out of the bituminous or similar compounds and may be either wound in a continuous web or cut up in sheets of convenient dimensions. The reel, being located below the mixer and behind the feeder, is brought very close to the furnace and consequently the material thereon absorbs much of the heat of its surroundings and is therefore freed from moisture, being in good condition when unwound and drawn out from under the feeder to be worked with the heated compound that is to be spread over it. Were the paper or other sheet of material carried by the reel wet or damp, the compound would not adhere to it, or only imperfectly so, whereas, by having it dry and hot, the compound readily sticks to it and the work may be done with ease and dispatch.

T designates a roller, which serves to smooth down or iron the compound on the table before, while, and after it is fashioned, molded, or manufactured. This roller is hollow and is heated in any approved manner, as by gas-jets or by a wood or charcoal fire made in it. This roller is mounted in the movable carriage or standards *t* adapted to travel over the table. It will be readily understood that by setting these standards at a greater or less angle the roller may be adjusted vertically, so as to accommodate any desired thickness of the material on the table.

U is a scraper and cutting appliance consisting of a plate thinned down at the sides to form two edges and provided with a central longitudinal groove *u*. It is used for loosening the compounds from the table L and cutting the same into sheets, blocks, or pieces of suitable dimensions. When employed for the latter purpose, it is used in conjunction with a rotary cutter or cutting-wheel V, as represented at Figs. 1 and 2, the plate U being slipped under the material to be cut and the cutter run over it along the groove *u*. Both the scraper and cutter are kept hot, like/

the other parts of the apparatus. The wheel V is held and worked by means of two detachable bars *v*, which are suitably clamped or hinged together, as indicated at Fig. 7.

Numerous articles can be made from the bituminous or like compounds treated, worked, and handled upon or with the apparatus herein described according to the process herein set forth. Among other things may be mentioned pipes or tubing of all sizes for conducting water, gas, sewerage, drainage, &c., underground conduits for telegraph or telephone wires or cables, pile-covering or armor, fence-posts, panels for wainscoting, floor-tiles, slabs for various uses, flower-pots and vases, insulators, and other electrical appliances, &c.

To make pipes, one has to employ a core or mandrel W, which may be used with or without the supports *w*, as preferred. This core or mandrel may be made of wood, but is preferably formed from nickel, or may be formed of any metal plated with nickel, as it has been found by experience that the compounds will not cling to this metal as they do to others. Furthermore, by forming a pipe or the like upon a core or mandrel formed from nickel or having a nickel surface the interior of the pipe is rendered as smooth as if polished and the danger of the pipe being clogged by sediment or filth is consequently reduced to a minimum. A metallic core or mandrel is preferred to a wooden one for the reason that it expands under the influence of the heat imparted to it by the hot compound from which the pipe is formed, and it can therefore be removed from the pipe more easily when afterward allowed to cool and contract. The core or mandrel should be slightly tapering and covered with a suitable paste or wash before forming the pipe thereon, so as to provide for its ready removal subsequently.

When it is desired to make pipes, the sheet S is drawn off the reel—if metal by tongs, or if cloth, wire-cloth, or paper by the pin-covered plate M shown at Fig. 12—and pulled forward under the feeder, so that the prepared compound may be spread over it. As it is drawn out and coated with the mixture coming from the feeder, it is ironed—that is, smoothed and pressed down—by means of the roller T, so that the compound may take through the perforations or meshes or otherwise cling to the sheet. The sheet is then carried around the rotary mandrel or core W until the requisite number of layers have been formed, according to the strength or thickness of pipe desired, when, if not of the exact size wanted, it is cut by means of the rotary cutter V and cutting-plate U. The mandrel or core can be rotated with either a crank or pulley upon the supports in which it is journaled, or else it may be removed from its supports and rolled toward the feeder, bearing upon and taking up with it from the table the sheet of flexible material S and the plastic substance thereon. After the pipe has been formed the mandrel and the ironing-roller T are brought together and rotated in opposite directions, sufficient pressure being exerted to cause the roller T to iron the pipe on the outside and spread out the lumpy portions, if any, and even the pipe from end to end. The pipe is now ready to be chilled or cooled, and it is therefore carried over to chilling-rollers X, located in a water box or pan X′, and upon which the pipe formed of the compound-covered sheet S can be dampened or wet and cooled and the layers thereof caused to cling more closely to one another. Running the chilling-rollers in water (or spraying or pouring water thereon) keeps them wet, and thereby prevents the pipe from adhering to them, it being one of the peculiar characteristics of the composition of matter entering into the formation of the pipe that just as it does not stick to appliances hotter than itself so it will not stick to appliances which are kept wet. These rollers may be made of metal or wood and, by preference, are covered with cloth or other absorbent material. The pipe and core are held in position between the wet rollers by means of stays *x*, each of which has an arm extending upwardly toward the end of the table L to assist in guiding said pipe and core to place. There the pipe is cooled or chilled, principally on the outside, and the layers of which it is composed are pressed more closely together. There, also, one may give the pipe the finishing touches with wet tools or the hands covered with wet gloves, evening and polishing the outer surface, cutting or trimming the ends, forming sockets, &c. This done the pipe and mandrel or core are ready to be plunged into a bath or tank of water Y, where they are allowed to cool completely. Ropes Z, engaging the trunnions of the mandrel or core and passing over pulleys running along a suitable track above, are used to carry the pipe and keep it suspended in the water, so it may not touch the bottom of the tank, and therefore be exposed to flatten by reason of its weight, which would occur with large-sized pipes if released before they got sufficiently cold. When cooled enough to hold its shape, one end of the pipe (the smaller, if a tapering core be used) is allowed to drop in the water and the mandrel or core is hoisted out, leaving the pipe in the water until cold enough to roll outside, where it will improve by age and exposure. It is preferable to use a tank of sufficient depth to stand the pipe on end in the water after the mandrel or core is removed. Sometimes it may be found necessary to chill the hot pipe as it leaves the ironer T in the water-tank Y before placing it on the wet rollers; but the process is substantially the same. As will be understood, several mandrels or cores may be used at the same time, so that when one is removed from the table with the covering S wound around it another may take its place for forming another pipe. Other parts of the

apparatus may be duplicated in the same manner.

In the case of a stiff or low-grade mixture—that is, one containing a small proportion of bitumen or similar matter and therefore not well adapted to readily saturate or stick to the sheet S or bind the layers thereof closely together—it may be found advisable at times to first pass the said sheet S through a thin solution of bituminous substance before covering it with the thicker or lower grade compound. This may be accomplished by running the sheet S, as it leaves the reel, under an idler or depression roller *b*, which will cause it to dip into and pass through a basin L^2 containing the lighter mixture before reaching the outlet of the feeder. Both the light solution and the heavy mixture can be prepared in the same mixing-tank.

It is not always necessary to run the hot roller T over the material spread on the sheet S while it lies upon the table; but it is preferable to do so, since the heat draws the maltha and light waxy portions and softens the material on top, so that in forming the pipe the layers will more readily adhere to each other. Ironing the material in this way will also even the pipe.

A permanent metallic core W′ may sometimes be used with advantage in making composition pipes, particularly a core made of aluminium, as it is believed there is no metal to which the bituminous compounds will stick with such tenacity as aluminium. In such case the core is left in, forming a part of the pipe. It may then give the benefit of a slip or sort of stovepipe joint, as illustrated at Fig. 8, which is safe and regular and made doubly secure by wrapping it with strips of open-mesh canvas or burlap *d* dipped in the hot mixture and wound around the outside where the two ends of pipe come together, thus making a perfect and strong joint. A ball-joint can also be made, as represented at Fig. 9. This form of joint allows adjoining lengths of pipe to be set at various angles, as indicated in the latter figure. The wrapping *d* is used with this kind of joint also.

In Fig. 10 is illustrated another form of pipe, which, in addition to the compound described and the sheet S, comprises a wrapping S′, of wire, that serves to render the pipe very strong and capable of resisting great pressure. In making this form of pipe it is taken when only half made on the mandrel or core W, and after plunging it into the cold bath or chilling it on the wet rollers it is wrapped from one end to the other with the wire S′, after which the mandrel or core is remounted in its bearings in the supports *w* and one or more layers of the compound-covered sheet, according to strength wanted, are wrapped around the wire, so as to cover, protect, and preserve the same. Other ways of wrapping the wire may be resorted to, if desired; but whichever mode is followed the wire should be always cut shorter than the compound-covered sheet, so that it may be fully embedded in the pipe and hermetically sealed.

A sheet of metal S^2 may be substituted for the wire wrapping S′ in certain cases, as shown in Fig. 11. The sheet S^2 is then placed between the layers of the sheet S while forming the pipe on the core or mandrel W, inserting it and making it a part of the pipe. The composition sticks to it and preserves it from oxidation. It is also hermetically sealed by lapping the sheet S, coated with the mixture, over and beyond its edge. Said sheet S^2 may be cut in various lengths for one or more wraps, according to the strength of pipe needed. It helps form a pipe of light weight and which can stand a high pressure.

In making panels, blocks, slabs, or tiles, for floors, wainscoating, and other commercial or industrial uses, the sheet S is drawn outward over the table L, as when making pipes, and the compound fed to it to such thickness as may be desired by raising the gate of the feeder to suit. The material having been smoothed and ironed with the hot roller, it is cut into strips, squares, or any other requisite form, as *a*, and made into the desired articles, which are afterward transferred onto a board or table *a′* suspended from a rope Z′ or the arm of a derrick Z^2 and carried over to the cooling bath. The derrick Z^2 should be as high as circumstances will allow, so that it may be swung above the table L, and thus facilitate the removal of the articles therefrom.

When heavy slabs are made, or similar articles that necessitate the spreading of the compound to a considerable thickness over the sheet S, which is, therefore, exposed to be torn, owing to the excess of weight bearing thereon, it is thought best in such cases to employ auxiliary plates *e*, which are made of sheet-iron of suitable strength and adapted to support the sheet S as it is passed under the feeder and while the compound is pored on it. These plates are coupled to one another by pins *f* projecting upwardly from one of their edges and entering corresponding holes *g* in the adjoining edge of the next plate, as shown in Figs. 3, 4, and 5. The plates *e* are slid under the feeder, back of the reel R, and thence passed under the roll of paper or other material, so the sheet S will bear on them. The sheet and plates supporting it can then be run under the roller *b* into the basin L^2, which is made larger for this kind of work, and from the basin onto the table L. Once upon the table and covered with the compound, the sheet can be ironed in the usual manner and cut up into slabs, as shown. The slabs having been transferred to the cooling bath by the derrick, the auxiliary plates are removed from them and used over again as many times as desired. The effect of the cooling or chilling is to hasten the setting and hardening of the pipes and other articles so cooled or chilled. It assists in tightening the cloth, paper, canvas,

or other fabric worked with the bituminous compounds and helps preserve the articles in as good a form as when they leave the ironer.

When making slabs with paper or cloth underneath one can lay on top of the compound a thin sheet of aluminium, which readily adheres to it, thus making a strong slab with aluminium plating.

For molding or casting vases, flower-pots, basins, and burial-caskets the compound is allowed to run out on the hot plate or table L, as in the other cases. There, by keeping the table hotter than the compound and using hot tools, one can fashion or make articles of any desired shape or form. The molded articles may be left to cool with or without the wet chilling process, as may be deemed best. One may for this class of work dispense with the feeder and reel by setting the mixer on a lever with the hot table or plate and remove also the roller and mandrel.

It has also been found that bituminous compounds undergoing the above described treatment and manipulation are particularly serviceable in making coverings for ordinary metallic pipes. Wrapping a metallic pipe or tube in this way with a sheet of flexible material impregnated or coated with a bituminous compound will keep it from denting and afford it protection when handling it or laying it in rough or rocky ground, thus improving, strengthening, and preserving it and making it possible to have a metal pipe or tube of great pressure strength without waste of material and at a small expense.

Among other advantages offered by the process and apparatus hereinbefore described is that by the use of the hot table or plate one is enabled to work and handle the bituminous compounds irrespective of their consistency. It has been found that a thick strong mixture, such as is calculated to give the best and most satisfactory results for certain purposes, cannot well be taken up from a kettle by a sheet of paper, cloth, and the like, run through it from a reel to a mandrel, pipe-former, or core, as is done in other apparatuses, since the heavier portions tend always to separate from the lighter ones and settle at the bottom of the kettle, whereas by having the paper or other material and the mixture on a table or plate, as in the above described apparatus, the mixture remains practically the same throughout and the paper or other material is properly charged, the compound being dropped upon the sheet that receives it instead of the sheet being dipped into the compound. It follows that the sheet gets the benefit of both the heavy and the light portions, the work is uniform, and the best results are obtained, the articles made with the compounds being harder, more durable, and better finished than it is possible to make them otherwise.

Another advantage is to be found in the uniform spreading of the paper or other sheet of material which is not subject to sagging or so liable to shrinkage upon the table or plate as it is when passed through the compound in a kettle.

Composition pipes, especially that have been made according to the process and with the apparatus above described, will be found to be strong and durable, though comparatively light, and not liable to scale or peel nor to be affected by climatic changes.

What I now claim, and desire to secure by Letters Patent of the United States, is—

1. The combination of a furnace having a lateral extension or table, a mixer arranged over the furnace, a feeder at the end of the table adjacent to the furnace and receiving compound from the mixer, and a reel placed in rear of the feeder and below the mixer whereby it is brought close to the furnace and source of heat, said reel carrying a roll of suitable material adapted to pass under the feeder and receive the plastic compound therefrom.

2. The combination of a table, a feeder arranged over the table and discharging onto the same, a mixer located at the end of the table and above and discharging into the feeder, and a vertically adjustable ironing roller movable over the table to compress the compound thereon.

3. The combination of a table, a feeder arranged above the table, a mixer located at the end of the table above the feeder and discharging into said feeder, a reel located in rear of the feeder and carrying a roll of suitable material adapted to pass under the feeder and receive plastic compound therefrom, a mandrel at the opposite end of the table upon which said material and the compound deposited thereon is wound, an ironing roller mounted upon and movable over the table between the feeder and the mandrel, and means for heating the table, the mixer and the feeder.

4. The combination of a table upon which compounds may be spread, a grooved scraper placed on said table, and a rotary cutter adapted to co-act with said scraper to cut the compounds.

5. The combination of a mixer, a hot table, a feeder receiving a compound from the mixer and discharging it onto the table, a mandrel for forming articles from the compound, a water-pan, and an absorbent roller arranged in the water-pan and adapted to receive moisture and transmit it to the article on the mandrel.

6. The combination of a hot table, a feeder, a sheet of suitable material adapted to pass under the feeder and to receive a plastic compound therefrom over the table, and an intermediate basin containing a lighter compound through which the material is passed.

7. The combination of a hot table, a feeder, a roll of material adapted to pass under the

feeder and to receive a plastic compound therefrom over the table, an intermediate basin also containing a plastic compound through which said material is passed, and auxiliary plates supporting the material through the compound in the basin and onto the table.

In testimony whereof I affix my signature in presence of two witnesses.

EUGENE F. BADGLEY. [L. S.]

Witnesses:
A. H. STE. MARIE,
LEE D. CRAIG.