ES PATENT OFFICE.

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PROCESS OF LAYING CONCRETE PAVEMENTS.

941,886. Specification of Letters Patent. Patented Nov. 30, 1909.

No Drawing. Original application filed August 14, 1902, Serial No. 119,673. Divided and this application filed June 25, 1903, Serial No. 163,043. Renewed March 6, 1907. Serial No. 360,884.

To all whom it may concern:

Be it known that I, FRANKLIN S. LAMSON, a citizen of the United States, residing at Washington, District of Columbia, have discovered a new and useful Process of Laying Concrete Pavements, of which the following is a specification.

This discovery relates to the laying of that class of concrete pavements in which the concrete is formed of Portland cement, as the binding material, in combination with sand, gravel, crushed-stone and water; and it has for its object the construction of such pavements by the use of such a process and such appliances as will give to the plastic mass, formed by the combination of the material above named, such rigidity as will enable it to be forced from the mixing machine, through openings of desired form, in a compressed continuous mass of form-retaining consistency which will permit it to be received upon conveyers, cut to desired lengths, carried to the prepared bed, there to be laid at once in the desired number of layers, compressed at one operation, blanketed to protect from injury, and further compressed during the period of the setting of the cement; completing the pavement in one series of operations.

As stated in my application filed Aug. 14, 1902—Serial No. 119,673, (patented Nov. 5, 1907, No. 870,370) of which matter herein formed part, I have discovered that when the combination of such materials, in proper proportions and properly worked, is made with the temperature of the materials at about the expansion decreasing-temperature of water—39° to 32° F., it gives sufficient rigidity to the plastic product to enable the performance of all the operations named in the above statement as to object; thereby giving opportunity to use machines whereby great rapidity and accuracy are obtainable, both in the preparation of the material and the performance of the work—since the product (of regular size), after being forced out of the machine and cut to lengths, can be conveyed directly to the workmen, and evenly laid and rolled while fresh *i. e.* before the cement sets, thus making the pavement a homogeneous mass of even quality and endurance. At the above-named temperature the initial and final settings of the cement are retarded (varying in extent with the brands used) so that sufficient time is given for the completion of the work described, without injury to the product from premature setting.

In the practical application of this process, the grading should be accurately done, so that the regular thickness of material may produce a surface of regular contour (although inaccuracies may be corrected by the application of loose material, of similar quality and temperature, during the rolling process); a layer of non-conducting and non-absorbent material should then be laid—to prevent the absorption, by the earth, of water from the concrete, and as a non-conductor of heat—upon which the layer, or layers, of concrete blocks should be regularly and closely placed, and thoroughly rolled to the correct contour. By the use of two or more machines—or of one machine having two or more mixing and forcing chambers—two or more layers of differing quality (such as a base and a surface) can be laid, and by one rolling operation the mass can be united and compacted before the setting of the cement. After rolling, and before the setting of the cement, when desired, the surface of the pavement can be scored, indented or otherwise roughened (to prevent slip in wet or frosty weather), by the use of properly prepared rollers, or other tools. Should it occur that concrete blocks be reduced to too low a temperature, and their surfaces become partially frozen, the roller compression would crush together and equalize them, and the cement not having set no injury would be done. During the period of initial and final setting the pavement should be blanketed with non-conducting material, to prevent absorption of heat and consequent injury; and heavily loaded, as by having the machinery and material used in the work moved forward upon it as the work progresses, in order to continue the compression during such period.

From the above description it will be seen that the mixed material receives compression first, in being forced from the mixing chamber; second, in the rolling which unites and compacts the layers of blocks of fresh ma-

terial; third, in having the rolled pavement loaded during the period of the setting of the cement. The sequences in the process are: First, the mixing of the material at the stated temperature; second, forcing it into concrete form; third, separating it into sections; fourth, conveying the sections to the place of deposit; fifth, placing the sections in layers on the prepared bed; sixth, rolling the layers to contour; seventh, covering, and compressing, the pavement during the setting period. The initial period of setting varies, from two to three hours; the final period, from six to seven hours, or more.

In the construction of the street pavement the blocks, or sections, are laid in layers from curb to curb; the roller, or rollers, compress to contour, working forward at the proper distance from the block-layers; the blanketing and compressing pavement-cover (of wood, or metal, with the under surface covered with non-conducting material)—accurately made, in sections convenient for handling—is laid to cover the rolled pavement, following the completed rolling process closely (and after the entire set of cover-sections is in use, passing the rear sections consecutively to the front), and the cover heavily loaded to continue the compression; as the rear sections are carried to the front and laid the compression-load is moved forward upon them; the whole operation thus moving forward continuously—day and night when desired. It is evident that in this additional-compression process it is necessary to place a suitable cover on the freshly-rolled pavement to support the adjustable load, and its weight combined with that of the adjustable load forms the full compression-load. In order to facilitate the forward movement, and adjustment, of the compression-load upon the said pavement-cover, each section thereof can be provided with car-tracks which would properly connect with those of its adjoining sections, so that trucks containing desired portions of such load may be moved thereon at will. The graduated automatic movement of this load, to correspond with the forward progress of the work, may be made by a suitable connection with the operative motive-power of the plant. A part of the car-tracks which may be placed upon the said cover may be used for the purpose of transporting the separate sections from the rear to the front thereof, as the work progresses; still other tracks may be laid on which to transport the concrete blocks from the mixing machine, located on the finished pavement in the rear, to the workmen at the front. When desired the lower surface of the said pavement-cover may be provided with projecting strips, or pieces, of any desired form, size, arrangement, or material, whereby indentations or grooves may be made upon the surface of the pavement. Each section of the pavement-cover should be detachably connected to each adjoining section in such manner as to cause the production of a finished contour of the pavement, free from ridges, lumps, and hollows.

The mixing machine and motive-power may be placed in any desired position relative to the front line of the pavement being laid; and the delivery of the freshly made concrete sections to the workmen may be made by endless conveyer, truck, barrow, or hand labor, as desired.

In the construction of floors, or covers, over arch, vault, or other openings, beneath or in pavements, sidewalks, bridges, etc., metal rods, bars, lath, netting, expanded sheets, etc., may be used in combination with the concrete material; the method of such combination may be varied, adapted to condition and circumstance, one such method being the introduction of such strengthening material between layers of concrete, which, when united by compression and becoming set, would form the homogeneous strengthened mass desired.

The object of the final compression of the series is the production of continued increased pressure during the setting period—as compared with the temporary roller-compression, whereby added density, and consequent hardness, is given to the product. The weight of the compression-cover, and load, will operate to force the scoring or indenting strips or pieces (which are preferably of metal, and strongly fastened to the cover) into the surface of the freshly-rolled pavement, and a V-section shape of such strips will facilitate their entrance into the concrete, and by their wedge form aid in giving the pressure desired. The non-conducting blanketing material should also be non-absorbent of water, in order to not extract the water required in the proper chemical combination and crystallization in the formation of the concrete stone; such material, in these respects, being similar to that on which the concrete is laid.

In arranging the compression-load upon the pavement-cover care should be taken to so place the loaded trucks as to equalize the pressure over the surface covered; having been so arranged, and connected by proper mechanism to form a simultaneously operative system, the entire system of loaded trucks may, by suitable clock-work—or other—devices, be so moved by the motive-power of the plant as to give an automatic movement forward thereto, so graduated as to correspond with the forward movement of the work. From the block-forming machines to the block-laying workmen the blocks may be brought by endless belt, or chain, conveyers, capable of proper speed adjustment, so as to synchronize with the other

operations; the position of such machines should be such as best to aid the progress of the work.

The edges of the pavement-cover sections may be provided with coördinating metal mortise-and-tenon plates, detachable hinge joints, and bolt-and-socket devices, whereby accuracy of surface contour and quickness of adjustment may be produced; such sections may also be so arranged as to have each course—from curb to curb—"break joints" with each adjoining course, whereby the entire "set" of sections, when fastened together, will form a mutually strengthened whole; when, however, it may be preferable such courses of pavement-cover (as well as the layers of pavement blocks) may be laid, in sections, lengthwise of the street instead of transversely.

When the pavement-blocks are laid in two or more layers, each superposed layer should break joints with its adjoining layer below, both longitudinally and transversely; in order to accomplish this result the initial block in each such layer (also each final block) should be cut to proper length; and this may be done by the block-layer (since the blocks are yet of operative consistency), or such blocks may be halved before delivery to the block-layer; also, each consecutive layer (from curb to curb) should break joints with each preceding layer, so that the subsequent compression may the more thoroughly unite and compact the plastic blocks of concrete into a pavement formed of a monolithic mass of stone.

In order to insure the completion of the process before the initial setting of the cement takes place, when desired, the sections of the pavement-cover may be made to a pattern so as to be interchangeable, in which case the metal section-connecting devices (mortise-plates, hinge-plates, bolt-sockets, etc.) should be so constructed as to allow some lateral variation, at the same time retaining (vertically) the accuracy of the surface-contour of the sections, thereby adapting to practical application the theoretical requirement, and making allowance for slight possible variation.

In the construction of such pavements their curb-form and gutter-form sections may be emplaced in advance of the rest of the pavement, or simultaneously with it; or the main pavement and gutter-form sections may be emplaced in advance and the curb sections superposed, but in such case the placement of the plastic curb-sections should closely follow that of the sub-sections in order that the compression may unite them while both are plastic.

I claim:

1. The process of Portland concrete pavement construction which consists in mixing the material with its temperature at about 39° to 32° F., giving the plastic mass concrete forms of varied figure—such as curb-forms, gutter-forms and main-pavement forms, and emplacing them while fresh in a pavement construction.

2. The process of Portland concrete pavement construction which consists in mixing the material with its temperature at about 39° to 32° F., giving the plastic mass concrete forms of varied figure, emplacing them while fresh in a pavement construction, and by rolling pressure bringing them to correct contour.

3. The process of making Portland concrete pavement which consists in mixing the material with its temperature at about 39° to 32° F., giving the plastic mass concrete forms of regular size, laying them while fresh upon a prepared bed, and rolling them to the correct contour while still fresh.

4. The process of making Portland concrete pavement which consists in mixing the material with its temperature at about 39° to 32° F., giving the plastic mass concrete forms of regular size, laying them while fresh upon a prepared bed, rolling them to the correct contour while still fresh, and blanketing the rolled pavement with non-conducting material while the cement sets.

5. The process of making Portland concrete pavement which consists in mixing the material with its temperature at about 39° to 32° F., giving the plastic mass concrete forms of regular size, laying them while fresh on a prepared bed, rolling them to the correct contour while still fresh, and subsequently applying to the rolled pavement additional pressure during the period of the setting of the cement, to impart additional density and hardness to the pavement.

6. In a process for compressing the plastic material of a concrete pavement, the step of rolling said material to contour—such rolling giving temporary compression, and the step of providing a pavement-cover—emplaced upon said rolled pavement, and placing upon said cover a continued-compression load, whereby continued, and additional, pressure may be given to such pavement.

7. In a process for compressing the plastic material of a concrete pavement which consists in a temporary roller-compression, and a continued, or additional, compression, the step of adjusting said continued, or additional, compression-load upon its supporting pavement-cover—as by means of car-tracks and trucks, whereby the pressure of said load may be equalized.

8. In a process for compressing the plastic material of a concrete pavement which consists in a temporary roller-compression, and a continued, or additional, compression, the

step of automatically moving forward said continued, or additional, compression-load in synchrony with the prior steps in the process.

9. In a process for compressing the plastic material of a concrete pavement, laying an extended, extensible, load-supporting cover on the surface of a freshly-rolled pavement, placing an equalized load on said cover, and moving forward said cover and load as the work progresses.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FRANKLIN S. LAMSON.

Witnesses:

ELIZABETH H. LAMSON,

CAROLINE T. LAMSON.