(40.) 3 Sheets--Sheet 1.

W. H. SMITH.

Improvement in the Manufacture of Concrete Pavement and Machinery for same.

No. 122,498. Patented Jan. 2, 1872.

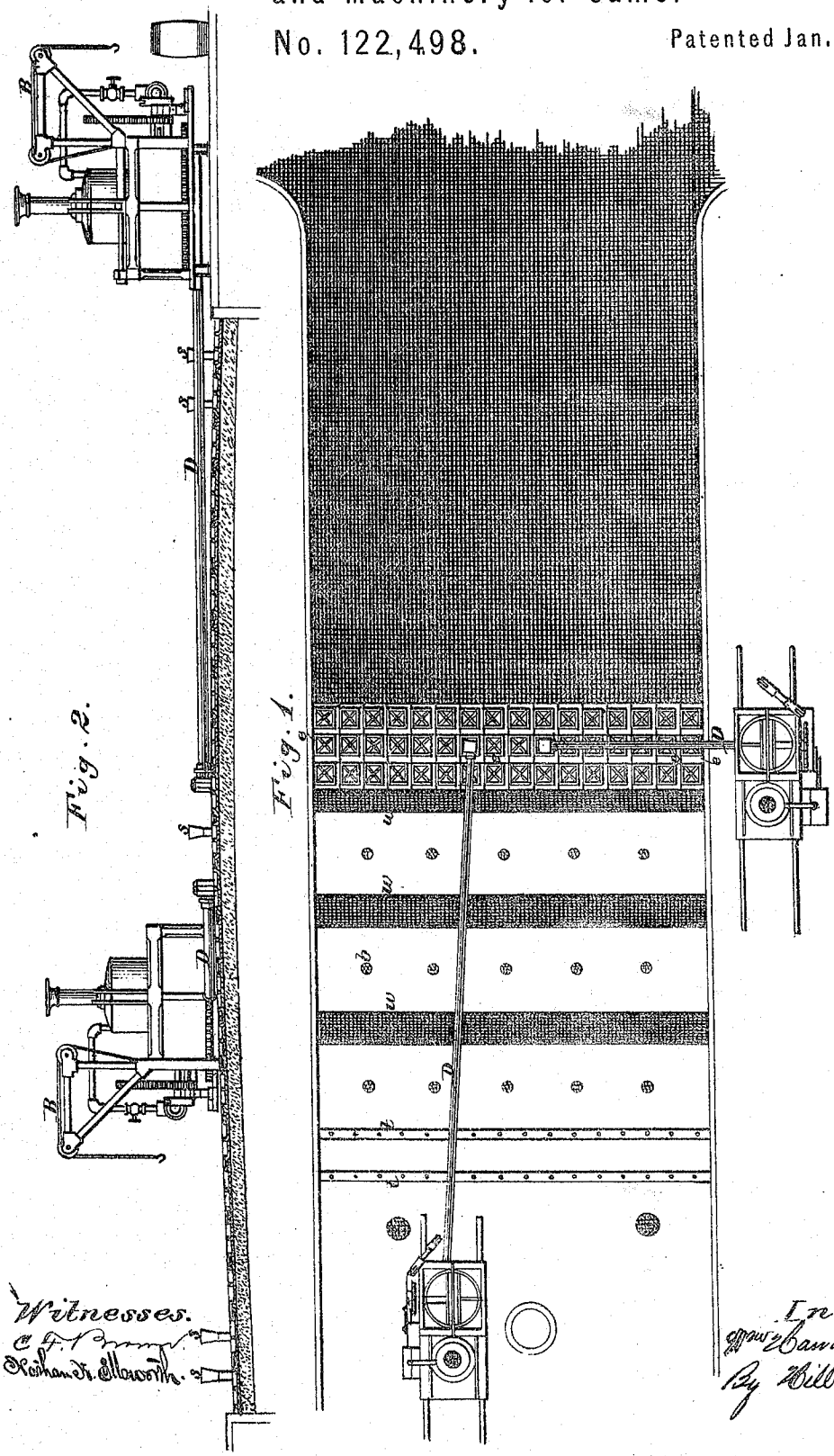


Fig. 2.

Fig. 1.

Witnesses.
C. F. Brown
Richard H. Ellsworth

Inventor
Wm. Harold Smith
By Bill & Ellsworth
Attys.

(40.)

3 Sheets--Sheet 2.

W. H. SMITH.

Improvement in the Manufacture of Concrete Pavement and Machinery for same.

No. 122,498. Patented Jan. 2, 1872.

Fig. 3.

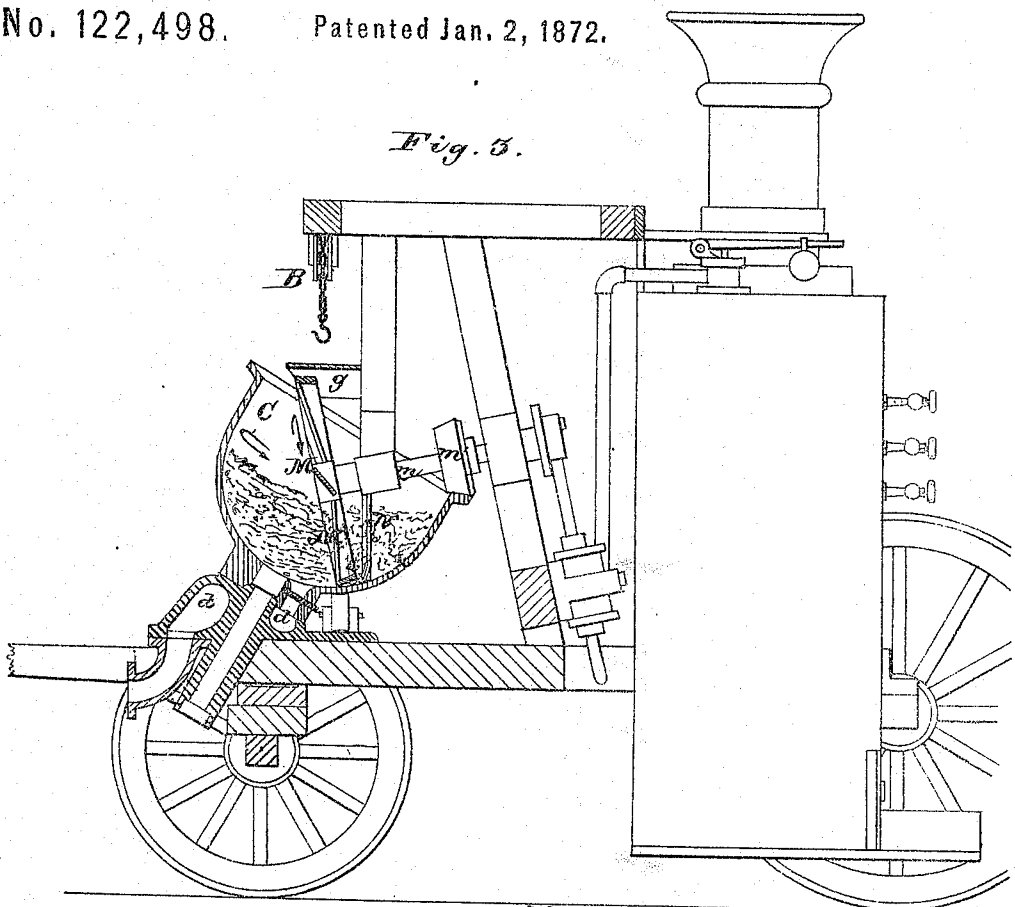
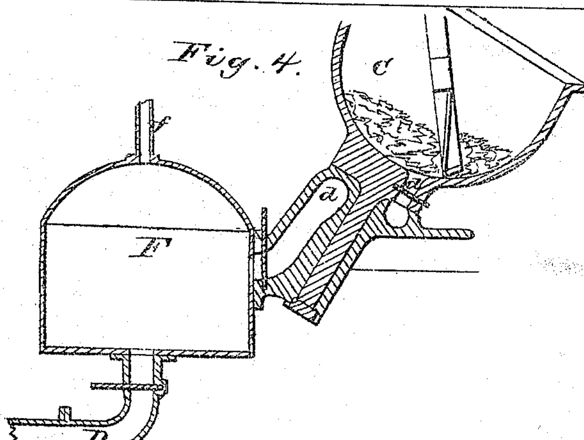


Fig. 4.



Witnesses.
C. F. Brown
Nathan K. Ellsworth.

Inventor.
Wm Harrold Smith
By Hill & Ellsworth
Attys.

(40.) 3 Sheets--Sheet 3.

W. H. SMITH.

Improvement in the Manufacture of Concrete Pavement and Machinery for same.

No. 122,498. Patented Jan. 2, 1872.

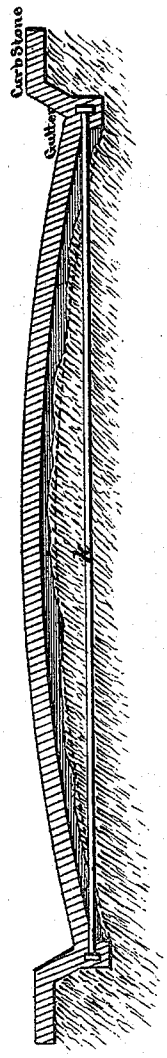


Fig. 5.

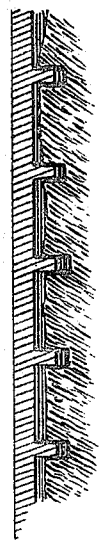


Fig. 6.

Witnesses.
C. F. Brown
Nathaniel H. Ellsworth.

Inventor:
Wm. Arnold Smith
By. Bill & Ellsworth.
Attys.

UNITED STATES PATENT OFFICE.

WILLIAM HARROLD SMITH, OF NEW YORK, N. Y.

IMPROVEMENT IN THE MANUFACTURE OF CONCRETE PAVEMENTS AND IN MACHINERY FOR THE SAME.

Specification forming part of Letters Patent No. 122,498, dated January 2, 1872.

To all whom it may concern:

Be it known that I, WILLIAM HARROLD SMITH, of the city, county, and State of New York, have invented certain new and useful Improvements in the Manufacture of Concrete Pavements and Machinery for the same; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawing forming part of this specification, in which—

Figure 1 is a plan. Fig. 2 is a vertical transverse section. Fig. 3 is a side elevation of the machine, showing a part in section. Fig. 4 is a detached sectional view of the mixing-vessel, forcing-vessel, &c. Fig. 5 is a cross-section of the street and pavement; and Fig. 6 is a longitudinal section, showing a modification of the pavement.

Similar letters of reference indicate the same parts.

The object of this invention is to provide for the public an improved street-pavement, an improved method of laying the same, and improved means for carrying said method into practice. To this end the invention consists in the improved machinery and appliances hereinafter described, and in the improved method of constructing pavements and other structures by the use of such machinery and appliance, substantially as hereinafter set forth.

A distinctive feature in my method of laying pavements consists in manufacturing the concrete composition in a fluid or semi-fluid state, so that it will flow through pipes, and in conveying it from the mixing-machine to the spot where it is to be laid, in pipes or conduits and flowing it from the pipes upon the ground, or upon a suitable foundation, where it immediately sets and forms the pavement, its surface being molded to any desired conformation by means of surface molds.

In thus constructing a pavement I preferably use the composition described in an application for Letters Patent of the United States filed by me contemporaneously herewith; but in my improved process or method of laying pavements as herein described, I do not confine myself to that particular composition, but propose to use any composition whatever, now known or hereafter to be discovered, the properties of which adapt it to be conveyed and laid while in a fluid state.

In preparing and laying my improved composition above referred to, I make use of machinery and other appliances, which I will now proceed to describe.

In the first place, for the purpose of thoroughly mixing the materials and conveying them in a fluid state to the spot where they are to be laid, I employ a portable machine, operated preferably by steam-power, said machine being moved along from time to time either by hand or its own motive power as the work progresses. The machine is provided with a rotary mixing-vessel, C, with a crane or other suitable hoisting apparatus, B, which dumps the materials into the mixing-vessel, with a series of grinding and mixing disks, and wheels M N working within the mixing-vessel, with adjustable and movable pipes or conduits D, through which the liquid concrete composition is conveyed from the machine to the street; and also, if preferred, with forcing apparatus, F, which forces the fluid into and through the pipes to its destination, the mixing-vessel being rotated by a friction-wheel, m', upon the shaft m of the stirring-wheel, which shaft is driven by a crank and pinion, or other suitable means, operated by the power of the engine. The fixed disks N and rotary stirrers M M are inclined to each other, as shown in Fig. 3, so as to more thoroughly mix the contents of the vessel. The liquid composition, after it has been thoroughly mixed with the pebbles, gravel, or broken stone, flows off from the mixer through passages d, provided with suitable valves, into the pipe D, which delivers it wherever it is required for use. When it is necessary to force the liquid up hill, or to convey it quickly or in larger quantities than usual, or through long pipes, or to press it in the mold and expel the air therein, in which it might begin to stiffen before reaching its destination, I employ a forcing apparatus to propel it through the pipes, the same consisting, preferably, of a tight chamber, F, capable of resisting great pressure, into which the liquid flows from the mixer, and a pipe, f, by which steam or compressed air can be introduced into the chamber F, upon the liquid, to force the latter, by pressure, into the pipe D. Any other species of forcing apparatus may, however, be substituted, if preferred. A guard or shield, g, is attached to the standard which supports the plate N, to

prevent the stirring-wheel from throwing out the liquid when in rapid motion.

Any form of steam-engine, and any construction of propelling apparatus may be used, which will answer the purpose, and the engine may be combined with or set up independent of the machine, and connected to it when in operation by belts, gear-wheels, or other suitable means. The pipe D may be jointed or flexible, to adapt it to be lengthened or shortened, or moved in any desired direction.

By reference to my application for Letters Patent upon the composition which I prefer to employ with this machine, it will be observed that the constituent elements of such composition are cement, sand, water, and gravel, or broken stones. In preparing such composition I place the cement and sand in the mixer, in suitable proportions, and add the water and the broken stones, the apparatus being either in motion or not, as preferred. If not in motion I start it up and run it till the cement and water have become liquid, and the sand and broken stones thoroughly and uniformly mixed therewith. I then open the valves and let it flow off through the pipe D. New materials may be continuously fed to the machine while it is in operation, or the mixing-vessel may be successively filled and emptied, as the manufacturer may prefer.

In laying pavements by means of this improved process and mechanism, where the ground or other foundation is level, it may not be necessary to use surface-molds, as the composition is sufficiently liquid to settle to a perfectly level surface, but where the street is "crowning," or the structure is to be molded to any particular form, surface-molds must, of course, be employed. These molds may be of any suitable structure, and may impress upon the surface of the pavement any desired configuration or design, from the simply-roughened or corrugated surface, shown in Fig. 1, up to the most elaborate patterns that the fancy may suggest.

My method of laying the pavement is preferably as follows, but can, of course, be altered as circumstances may require. First, having removed the old cobble-stones, or other material constituting the old pavement, and leveled the street down to the required grade, I place suitable side molds, *t t*, across the street, and run the liquid between them. It soon sets and forms parallel ribs or walls *w w*. I then place blocks *b b*, preferably of the solidified concrete, at suitable intervals between the walls *w* to assist in supporting the surface-molds, after which the latter are placed, as shown at *e e*, suitable sinking-heads, *s s*, being provided to compensate for the shrinkage of the material in setting. I then connect the pipes D D to the molds and run in the liquid composition, the molds being held down by weights, if necessary. The gutters, curb-stones, and side-walks may all be made at the same time, in one continuous piece with the center of the street, if preferred. In a few minutes after the molds have been filled the liquid will have set sufficiently to allow them to be taken up and advanced to the space between the next two walls, and so on until the whole is laid. Of course removable side molds or bulk-heads may be employed in place of the concrete walls *w w*. The pavement constructed by this process may be of any suitable thickness. Where the ground is soft or there are bad places, liable to settle, it may be made twelve inches or more in thickness, so that when complete it will stand like an arch of solid masonry, entirely independent of any local subsidence of the foundation. When built for this purpose chords or girders *k k* may be embedded in the composition, to operate in lieu of abutments to the arch, or may may be extended across the street under the pavement, as shown in Fig. 5, in which case it may be desirable to protect them from decomposition. So, too, the pavement may be laid upon any kind of foundation, and the foundation may rest flat upon the ground, or be supported above it upon piles, sills, blocks, or other sub-structure, in any manner that may be preferred. They may be protected from decomposition by means of a coating of concrete applied to them, as shown in my former patent, for protecting piles. So, too, the pavement may be cast with supporting ribs on the under side, as shown in Fig. 6.

Suitable provision may be made for the subsequent removal of sections of the stone concrete whenever it may be necessary to get at the water or gas-pipes for the purpose of repairing them, or to get to the ground beneath for any purpose whatever. Spaces may be left unfilled by the concrete and be afterward so filled in that the stones or blocks may be taken out independently of the rest of the pavement. In filling in such spaces a softer material may be used, which can be easily cut out or otherwise removed, or the hard material, if used, may be separated from the surrounding pavement by a thin partition of softer material by strips of wood, or by anything else that will allow the blocks to come out readily, and to give it the required degree of elasticity. If no provision should be made for the purpose blocks can be easily cut out anywhere by means of the newly-invented sand-blast apparatus, or by a saw or other device. To facilitate the cutting out of such blocks strips of wood, or other soft substance, may be embedded in the surface of the pavement, if preferred, to prevent the horses from slipping, though there will be no appreciable danger from such cause, as I design using stones of different degrees of hardness, in order that they may wear unequally, and cause the pavement always to present a rough surface.

A stone-breaking apparatus of any pattern may be used with the mixing machine, and be driven by the same engine, both machines being combined in one, if preferred. With such apparatus, when relaying pavements, I take up the old cobble-stones as the work advances, break them up, feed them to the mixing-ma-

chine, and lay them down again in the new pavement a few yards in rear, thereby saving all expense of transportation and effecting an immense reduction in the cost of the materials, beside obviating the necessity of having large tracts of the old pavement up at the same time. In laying the pavement in streets where street-railways are in operation, beds may be cast in the surface of the pavement to receive the rails.

Having thus described my invention, what I claim is—

1. The process of laying concrete pavements by flowing the liquid material upon the bed of the street, substantially as described.

2. The combination of the mixing-vessel with stirring mechanism, and with pipes or conduits to convey the mixed material from the vessel to the street, when adapted to the construction of pavements, substantially as described.

3. The compressing apparatus F, in combination with the mixer, and the pipes or conduits, substantially as and for the purposes described.

4. The portable machine herein described, combining a mixing-vessel, stirring mechanism, and apparatus for operating the same, substantially as described.

5. The surface-molds *e e*, in combination with the conveying-pipes or conduits, and the mixing and forcing apparatus herein described, when adapted to the laying of street-pavements with liquid material, substantially as set forth.

W. HARROLD SMITH.

Witnesses:
H. K. ELLSWORTH,
MELLVILLE CHURCH.

(110)