July 26, 1966 L. EIGENMANN 3,262,375

METHOD OF ROAD SURFACE MARKING

Filed March 4, 1963

Fig. 1

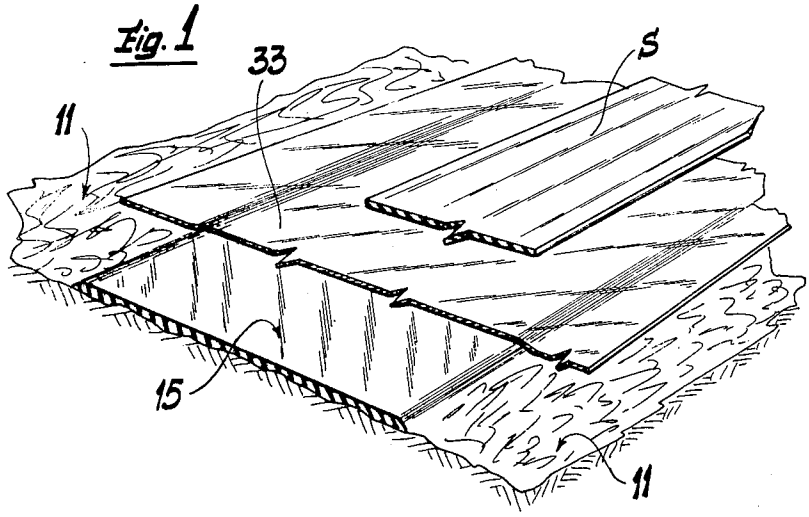
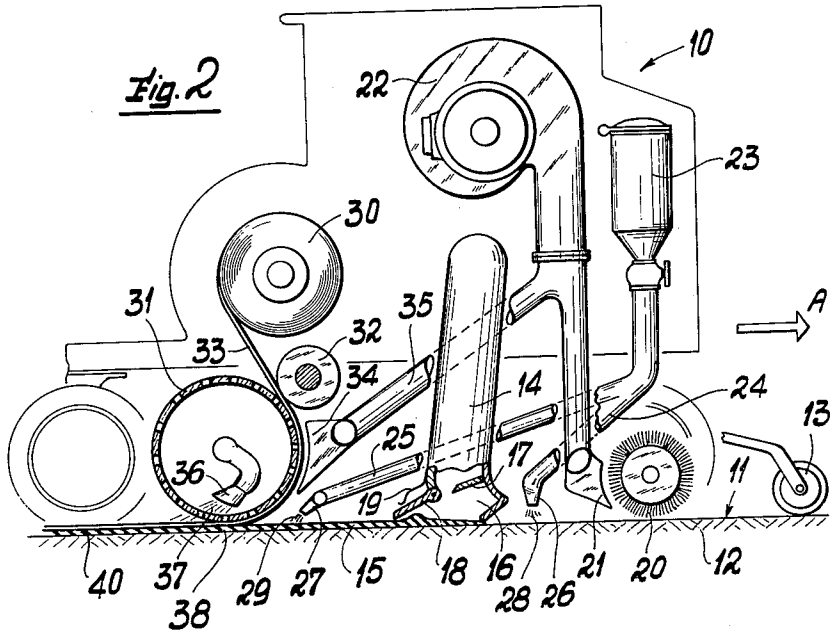


Fig. 2



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3,262,375
Patented July 26, 1966

3,262,375

METHOD OF ROAD SURFACE MARKING

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Filed Mar. 4, 1963, Ser. No. 262,538
1 Claim. (Cl. 94—1.5)

This invention is generally concerned with the art of road and highway marking with strip materials, namely for providing a road or highway surface with centre-lines or with track-dividing lines or the like, prevailingly but not exclusively arranged lengthwise of the road.

More particularly, the present invention is concerned with the art of providing traffic signs of the above type, consisting of strip material in particular of the so-called elasto-plastic cold-plastic nature, i.e. of a plastic compound adapted to be laid on and adhesively connected to the road surface in strip form, in essentially cold state.

It is known to those skilled in the art to which this invention appertains that such marking materials possess several advantageous properties, such as permanent illumination and color contrast effect, also at the edges of the laid strip, durableness either to weathering and to most severe traffic wearing effect, and so on. On the other hand, some problems are involved in ensuring proper and full adhesion of such cold-plastic strip material, which unavoidably has a certain thickness, on very rough and irregular road surfaces. Such material cannot fully mate any minor irregularity of the road surface, or an unacceptable amount of binding agent would be required to form a layer filling any road surface irregularity and to support the strip material. In addition, it is further known that such strip materials would be preferably laid on a surface as flat and smooth as possible, in view of visibility and of resistance to wearing of. Any salient or protruding portion in the applied cold-plastic marking material will cause an irregular light reflection and shadowing effects and the wear of material will develop mostly at such salients and protruding locations.

It has been proposed to prepare a road surface for laying a strip marking material thereon, by covering the road surface portions, where the material is to be laid on, with a relatively thin layer of asphalt or like matter, capable of thoroughly filling any road surface porosity, holes and hollows, by sleeking said asphalt layer upper face, and then by applying the strip material on said upper face.

Such proposed mode of preparing a road surface to application of marking strip materials thereon, while being effective and advantageous in view of proper application and service of the strip material, is subject to the serious objection that the asphalt layer requires a very long time to cool and set on the road surface, prior than the strip of alasto-plastic cold marking material could be laid on and secured to the smooth upper face of said asphalt.

Such time interval will seriously disturb the roadableness of the highway, and the traffic must be kept far from the areas to be marked. If the strip material is laid on the asphalt when the latter material is still soft, the asphalt will darken and spoil the required high visibility of the strip. Such objection is more particularly severe when fast mechanical marking of road surfaces is desired, such as performed by making use of a fast travelling and operating road-marking apparatus of the type shown in my prior U.S. Patent No. 3,007,838, for example.

It is therefore an object of this invention to provide a new and advantageous method for marking a road surface, in particular an irregular or coarse road surface not properly adapted for direct laying on and connecting thereto a marking strip material of considered cold-plastic nature, the same method including the steps of defining on said road surface an area to be marked, of forming a layer of asphalt-like material on said area by spreading on said area said material in fluidified state, of sleeking said layer to form a smooth upper face thereof, of laying a thin protective film on said upper face prior to solidification of such material, and of laying on and connecting to said protective film the marking strip.

For proper protection of said marking strip from the underlaid asphalt layer, and for actuating a proper smooth surface for application of said strip, which has a given width, an asphalt layer having a width greater than the said given width is spread on the road surface, and a protective film having a width greater than the width of said asphalt layer is laid on said latter layer, so that the asphalt is fully covered by said film, and the said film upper face, above said layer, actuates a smooth and flat surface adapted for laying the said strip thereon.

A further object of this invention is to provide a new and advantageous apparatus for preparing an irregular road surfaue to be marked by making use of cold-plastic marking material in strip or tape form, upon the provision and the sleeking of an asphalt layer on said surface, along a predetermined marking area defined by a marking line.

These and other objects and advantages of the invention are in part obvious and in part will be made apparent as this description proceeds, and the features which are believed to be new and characteristic of the invention are in particular set forth in the appended claim. The invention itself, however, will be best understood from the following detailed description of a preferred form of embodiment thereof, when taken in conjunction with the accompanying drawings, forming an essential component of this disclosure, and wherein:

FIGURE 1 is a diagrammatical, perspective and fragmentary view of a road surface wherein a marking material of the considered type is laid on and applied according to the invention; and

FIGURE 2 is a somewhat simplified showing of the essential components of an apparatus adapted for preparing a road surface to application of said marking material, said components being shown partly in side elevation and partly in section.

Referring first to FIG. 1, there is shown a marking material in strip form S, which is laid on a perfectly smooth and flat surface embodied by the upper face of a laminated or film material **33**. Such film **33** is at its turn laid on the sleeked upper face of a layer **15** of asphalt or asphalt-like material or composition, or thermoplastic nature, spread over an irregular surface **11** of a road or highway. The said layer **15** is positively wider than the said marking strip S, so that a smooth flooring for said strip is formed, and the said firm **33** is at its turn wider than said layer **15**, so that the said strip is fully protected from the asphalt.

Such arrangement of parts, which is essential and critical of the invention, makes it possible to apply the said strip just after applying and sleeking of the asphalt layer, i.e. to perform the whole road marking process as an uninterrupted sequence of steps, including either the preparation of the irregular road surface and the effective

laying on and connecting of a marking strip material of the above considered type thereto.

Such sequence of steps may be advantageously performed by making use of an apparatus of the type shown in FIG. 2 for example. Such apparatus may be advantageously operated as a fore or preparatory assembly of a road-marking apparatus of the type shown in my said prior patent, for example. It is obvious that the apparatus of FIG. 2, in some occurrence, may be however operated as an individual unit, to prepare the road surface for differing marking applications, such as for applying shaped signs, such as arrows, stop-lines and so on, for example.

The apparatus of FIG. 2, generally indicated **10**, has a wheeled frame adapted to travel in direction A on the surface **11** of the road featheredge **12**, which is supposed to be seriously irregular and consequently not adapted for direct application of a cold-plastic strip material thereon, the apparatus in operation being progressed in the direction, defined such as by marks on said surface **11**, of the area to be marked. The control of the apparatus along the desired direction might be facilitated by a guide wheel such as at **13**.

The apparatus includes conveying duct means such as **14** for progressively pouring liquefied or substantially liquified asphalt on said surface **11**, as the apparatus is progressed, to form the layer **15** thereon. Such conveying duct is fed by a properly heated tank (not shown) constructed and operated according to the art of spreading asphalt on road surfaces. The lower outlet portion of conveying duct **14** is provided with valve or floodgate means such as diagrammatically shown at **17** and with a scraper blade such as at **18**, pressed by spring means such as at **19**, for sleeking the upper face of the asphalt to form the desired smooth upper face thereof.

The apparatus is further provided with means designed for previously cleaning the road surface **11**, such as a rotary brush **20**. The operation of such brush may be completed by a blast of pressurized air from a shaped outlet **21**, fed by a centrifugal blower **22**, for example.

The firm and most complete anchoring of the asphalt layer to the road featheredge **12** and of the protective film to said layer is preferably ensured by making use of suitable binding agents. Such agents may be fed in liquid form from a container **23**, via ducts **24** and **25**, to nozzles **26** and respectively **27** positioned for ejecting metered sprays **28** and respectively **29** of said binding agents on surface **11**, just forwardly of outlet of asphalt, and respectively on the surface of asphalt layer **15**, just forwardly of the position at which the protective film **33** is laid theron.

Such protective film **33** is carried on the apparatus in and progressively unwound from a bobbin **30** and laid on the asphalt layer by means of a rotary perforated drum **31**; a guide roller **32** causes said film **33** to contact said drum and to progress in adherence relationship therewith. A further blast of pressurized air ejected by a second shaped nozzle **34** fed by said blower **22** via a second duct **35**, keeps said film **33** adjacent to said drum **31** until contact with the asphalt layer surface. A third nozzle **36** fed with pressurized air and located inside the perforated drum **31** ejects a blast **37** just rearwardly of point **38**, where the contact between the film **33** and the asphalt layer **15** occurs, through the perforation of said perforated drum, to cause the said film to abandon the drum surface and to be laid on said asphalt layer.

Reference numeral **44** in FIG. 2 indicates the road surface as prepared for proper application of the marking material in cold-plastic strip form, where such strip will find a properly smooth and levelled surface and where same strip is spoiled upon contact with asphalt, even if such asphalt is still in softened or also in essentially fluidified state.

It is obvious that the typical sequence of the above described operations might be modified. For example, the marking material in strip form may be previously bound to the protective film and therefore applied on and connected to the layer of asphalt in one step of the process.

In addition, the cooling of the asphalt layer may be facilitated and accelerated by suitable means adapted to improve the exhaustion of heat from fluidified asphalt, in addition to the heat absorbed by the road featheredge. A substantial amount of heat is however exhausted by the blasts of pressurized air ejected by nozzles **34** and **36**, and further blasts of air may be provided, if desired, to prevent overheating of the protective film as laid on and made adherent to the asphalt layer and for adsorbing heat therefrom.

For best exploitation of the method of the invention it is preferred to apply the asphalt or another matter of like character as more fluidified as possible, to ensure full and intimate penetration of the matter into the road featheredge porosities and a positive anchoring of the layer thereto. I have surprisingly found that very advantegeous unexpected results may be attained by modifying the asphalt composition by adding high molecular weight organic compounds thereto, such as a synthetic rubber.

It has been surprisingly found that, upon such addition, the fused asphalt will be adsorbed within the microstructure network of the additive organic compound and the resulting matter will acquire an extremely plastic state at a temperature well over to the melting point of asphalt, in particular a state which may be compared to a gelled molten matter. Such modified asphalt-based compounds had been proved as extremely useful when the layer is applied to road featheredges particularly rich of siliceous components.

In addition, by making use of suitable solvents, either the plastification and the dispersion of the additive polymer or high molecular weight compound in the asphalt will be substantially improved.

Some example of formulations and of proceedings which had been found as advantageous for carrying out the invention follow, such examples being however intended as not limitative of same invention.

Example 1

This example consider the case of preparation of a road surface embodied by a road featheredge which includes a relatively high amount of asphalt in its own composition, and it is assumed that it is desired that the whole procedure of road surface preparation and of the marking thereof with strip material of the cold-plastic nature will lead to minimum traffic disturbance.

A mixture of asphalt having its softening point of 40° C. and of asphalt having its softening point of 70° C. has been melted at 130° C.; such melted mixture has been spreaded on the road surface to cover a strip area wider than the marking strip to be applied and the excess has been removed while its surface has been sleeked to form the desired smooth upper face.

When the asphalt layer has been cooled at 90° C. about (such cooling occurred in a very short time, under air blast) on the surface thereof a thin film of polyethylene (.04 millimeter thick about) has been laid. The marking cold-plastic material in strip form has been applied shortly after the application of the said protective film.

Example 2

An asphalt mixture according to Example 1 has been melted at 140° C., under stirring, together with 5% of "A.C. Polyethylene 615—Allied" and with 1% of a solution at 50%, in petroleum naphtha, of poly-iso-butylene having high molecular weight.

Such molten matter has been spread and sleeked on the road surface to form the desired smooth layer, upon slight wetting of the road featheredge surface with a binding agent, compounded as indicated hereinbelow, preferably. By making use of same binder, as the layer upper face had been cooled at less of 100° C., a .06 milli-

meter thick film of polypropylene has been laid on and bound to said upper face.

A further cooling of the thus coated layer has been performed by a strong air blast and the marking strip has been applied thereto.

The binding agent composition (termed in parts in weight) is the following:

	Parts
Modified polyvinyl-chloroacetate (such as "Vinilite VMCH")	90
Acrylonitrilic gum ("Chemigum No. 3—Goodyear")	10
Benzol	10
Cyclohexanone	100

Example 3

An asphalt mixture according to Example 1 has been melted at a temperature over 200° together with 5% of butyl rubber "218 Esso," while stirring until full dispersion of the rubber. The molten compound has been cooled until 140° C. before spreading thereof on the road surface and sleeking of the layer formed therewith.

As the surface temperature of such layer has been cooled at 90° C. about, upon air blast, and upon slight wetting with a binder such as described in Example 2, a .05 millimeter thick film of polyvinyl chloride has been laid on and connected to the smoothed surface of said layer. A further cooling by air blast has been caused before the application of the strip marking material.

Example 4

A mixture 1/1 of acrylonitrilic gum "Chemigum No. 600—Goodyear" and of indene coumaronic resin (melting point 100° C.) has been laminated by means of a mixer, and an asphalt mixture such as described in Example 1 has been melted at 140° C. together with 7% of the former mixture. The molten compound has been stirred upon full dispersion of its components, and then spread and sleeked on the road surface.

As the surface temperature of the asphalt-based layer has been cooled at 100° C. about, a .04 millimeter thick film of terephthalate polymer "Videne—Goodyear" has been laid on and bound to said layer by making use of the binder formulated as hereinbelow. A further fast cooling of the thus coated layer has been performed upon air blast before laying on and application of the marking strip.

Composition of the binder:

	Parts
Terephthalic polymer "Vitel P. 200—Goodyear"	15
Methylethylketone	5
Cellosolve acetate	5
Butyl acetate	5
Toluene	5

Example 5

A mixture, 1 to 1 ratio, of neoprene rubber (of the type manufactured by "Dupont," for example) and of an indeno-coumaronic resin having its melting point at 100° C., has been masticated and then laminated from a mixer, and then melted together with an asphalt mixture according to Example 1. The former mixture amounts to 5% of the melt. The melting has been performed at 150° C., under stirring, until throughout dispersion of components, and the compound is spread on the road surface.

Upon cooling of the layer surface to 115° C., to the upper face thereof a .03 millimeter thick film of polyamide "Nylon—Dupont" is applied, upon wetting of such face with the following binder. The temperature of the coated layer is further lowered by air blasts, before laying on of the marking strip material.

The binder consists of:

	Parts
Chlorinated rubber "Parlon 10 cps. Hercules"	10
"Hercolyn D—Hercules"	1
"Vinsol (ester)—Hercules"	2
Cyclized gum "Alpex 450 J—Kurt Albert, Germany"	2
"Staybelite (ester)—Hercules"	5
Benzol	20
Dichloroethane	10
Cellosolve acetate	22

Example 6

90 parts in weight of blown bitumen has been melted at over 200° C., together with 2 parts of furfural extract of naphthenic type "Dutrex" and 5 parts of butyl rubber "Esso 218". The melting is performed under agitation until full dispersion of rubbery component, and the molten compound is spread on the road surface upon cooling thereof at 150° C.

On the sleeked asphalt-based layer, upon cooling at 105° C. about, a .04 millimeter thick protective film of "Pliofilm—Goodyear" is applied, and then the temperature of the coated layer is further lowered by air blasts prior to marking strip application.

Example 7

The asphalt layer has been provided and applied as described in Example 1. In the case that the road featheredge is poor of bitument or otherwise not properly adapted for application, the surface thereof is previously wetted with the binder hereinbelow described.

As the surface temperature of such layer has been lowered to 100° C. about, the layer surface is wetted with same binder and a .04 millimeter thick protective film of vinylether chloride is applied thereto. Prior to laying on of marking strip, the coated layer is preferably further cooled by air blasts.

The said binder consists of:

	Parts
"Pliolite S5—Goodyear"	20
Chlorinated rubber "Parlon 10 cps.—Hercules"	10
"Hercolyn D—Hercules"	1
Benzol	20
Xylene	20

While the invention has been described and shown in several forms of embodiment thereof, it is obvious that the invention itself is not limited to the very details shown, and that further modifications and variations might be made thereto, according to the art.

It is moreover believed to be evident that the present invention includes a plurality of advantageous features, and it will be understood that each of the new features described and any combination thereof may find useful application in other road marking strip applications and preliminaries differing from the ones described.

Without further analysis, the foregoing will so fully reveal the gist of this invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of this invention and, therefore, such adaptation should and are intended to be comprehended within the spirit, meaning equivalence of the invention, as defined in and by the appended claim.

Having thus described the invention and the mode of carrying out thereof, what is claimed as new and desired to have protected by Letters Patent is:

The method of providing an essentially irregular road surface with a marking material of cold-plastic type, which comprises the steps of melting in fluidified state a bitumen-based compound consisting essentially of a mixture of a major amount of a bituminous substance and a minor amount of a high molecular weight polymer appertaining to the group of synthetic rubbers, of spread-

ing the molten compound on said road surface to form an irregularities covering layer thereon, of sleeking the upper face of said layer to form an essentially smooth face thereon, of unwinding a protective film from a roll of preformed protective film and covering said essentially smooth surface of said layer with the thus unwound protective film while the compound included in said layer is still in a plastic state, and of laying a marking material on said film.

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