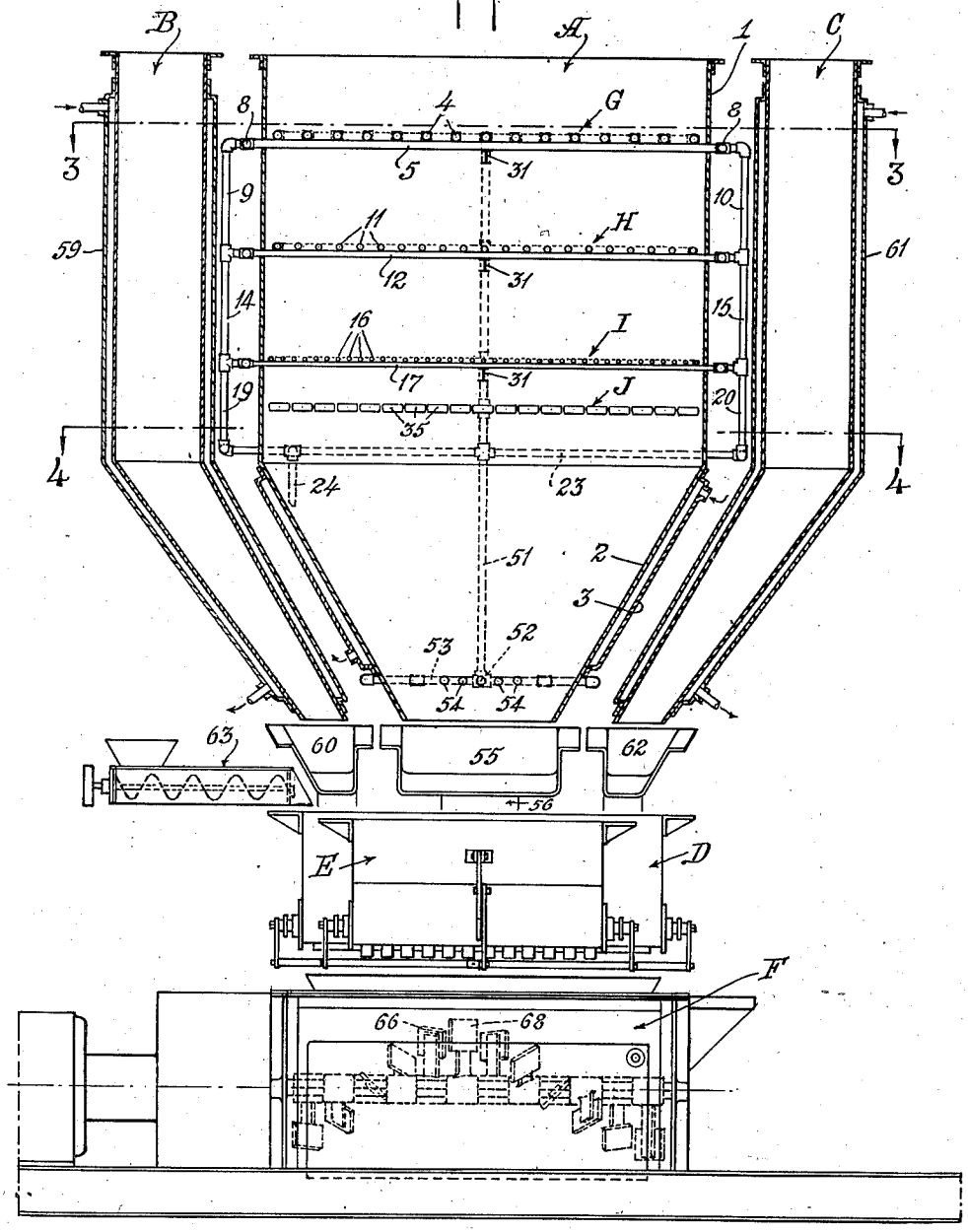
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APPARATUS FOR CONDITIONING PAVEMENT MATERIAL

Filed Aug. 4, 1942 5 Sheets-Sheet 1

Fig. 1.



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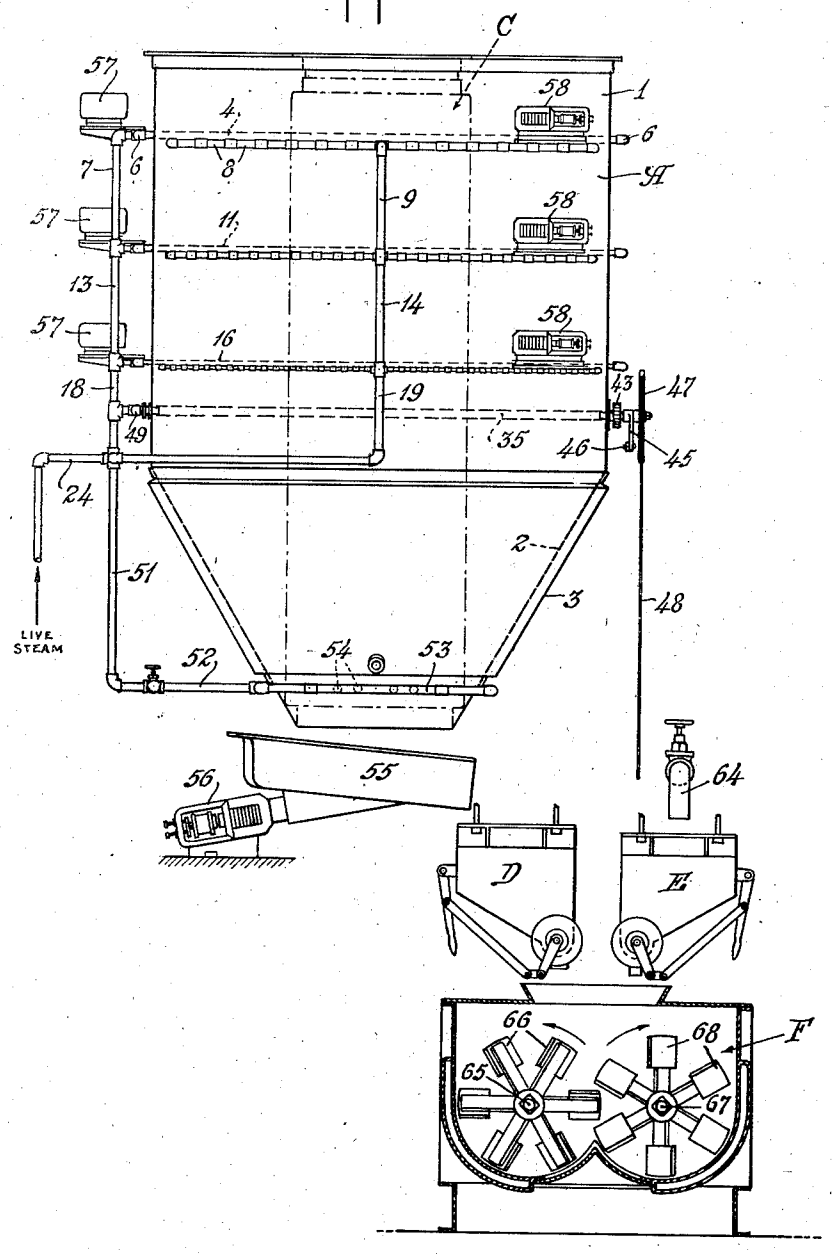
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FIG. 2.



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APPARATUS FOR CONDITIONING PAVEMENT MATERIAL

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FIG. 3.

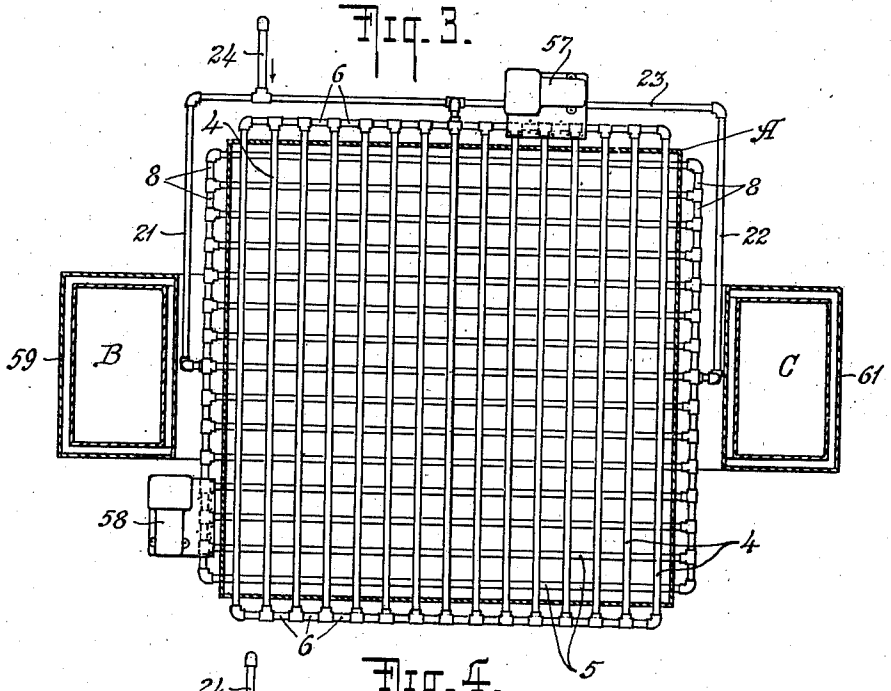
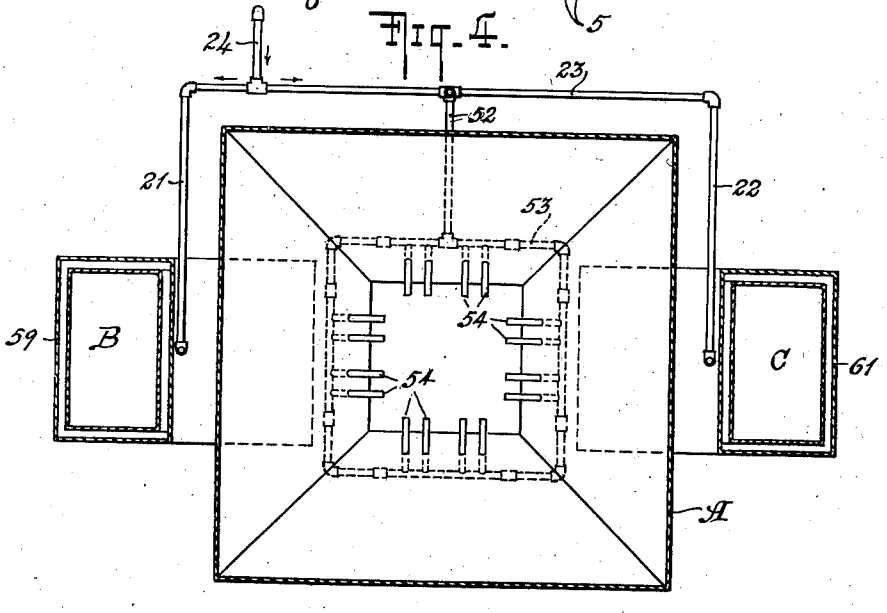


FIG. 4.



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APPARATUS FOR CONDITIONING PAVEMENT MATERIAL

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Fig. 5.

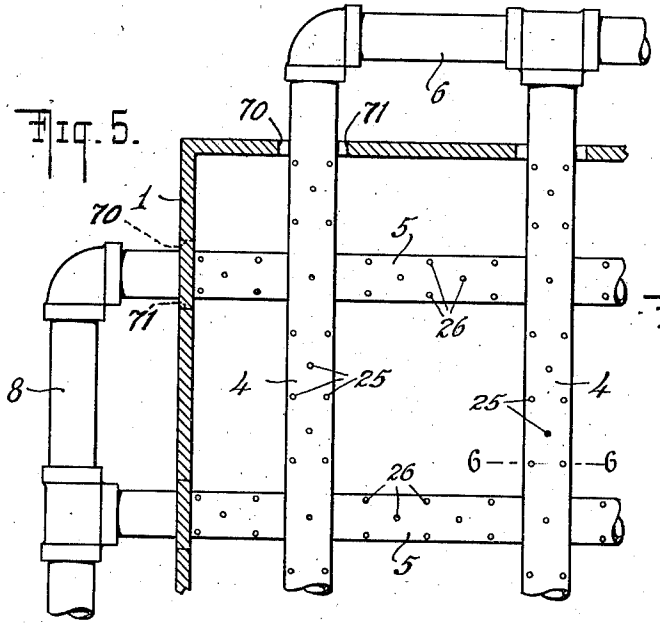


Fig. 6.

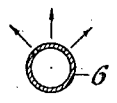


Fig. 7.

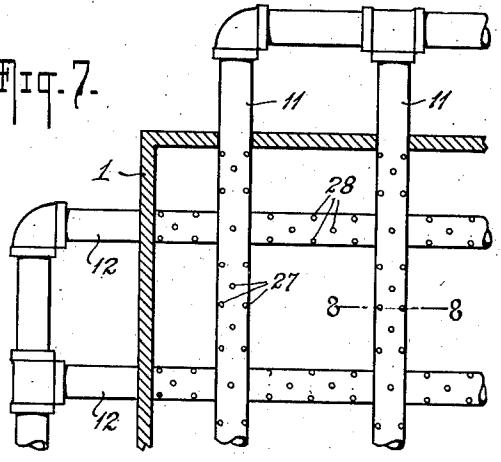


Fig. 8.

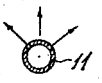


Fig. 9.

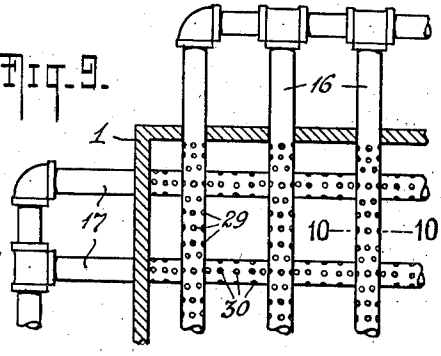
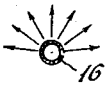


Fig. 10.



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Fig. 11.

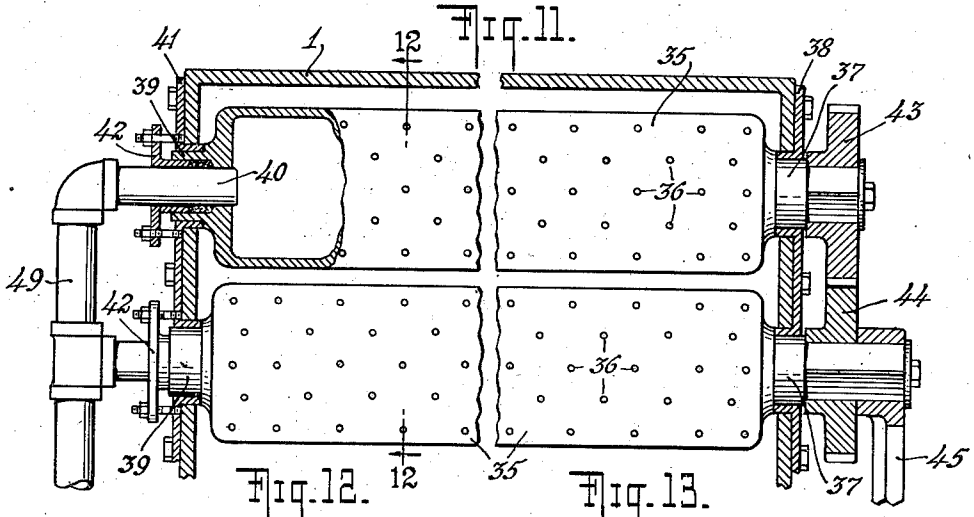


Fig. 12.

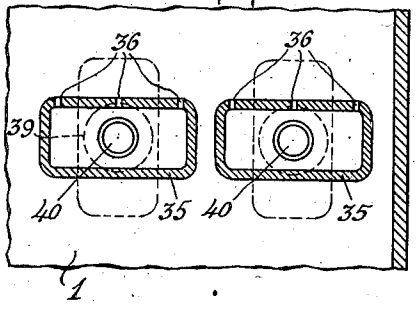


Fig. 13.

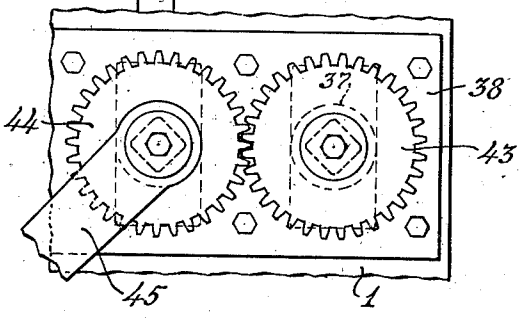
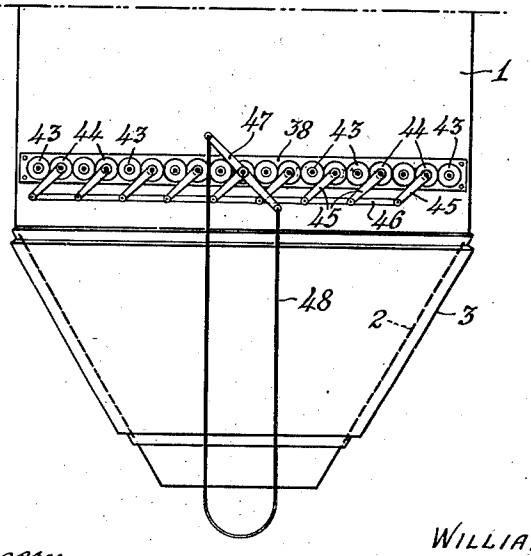


Fig. 14.



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UNITED STATES PATENT OFFICE

2,413,908

APPARATUS FOR CONDITIONING PAVEMENT MATERIAL

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Application August 4, 1942, Serial No. 453,607

10 Claims. (Cl. 94—42)

1

This invention relates to pavements and more particularly to the re-use of pavements in which are incorporated binding materials of a bituminous nature and which have to be replaced or have served the purpose for which they were designed.

Pavements or roads of a bituminous nature must be replaced at varying ages for a number of reasons other than the actual wearing away of the material itself. The most general causes necessitating replacement are:

1. Eventual failure in the base (either concrete or macadam) which may result from one or more causes such as, improper design of the base, excessive contraction or expansion of the base, severe vibration, improper preparation of the subgrade, undermining of the subgrade, etc. The failure of the base is always followed by failure in the bituminous portion.

2. Cracking of the bituminous portion of the pavement which ultimately leads to deterioration, caused by the hardening of the binding material itself, which in turn has been caused either by overheating during the process of manufacture or by the natural aging of the binding material or by poor original design of the pavement itself.

3. Bad settlement, where it has been necessary to place a bituminous pavement upon fresh fill or over swampy ground.

When replacement has become necessary for the first of the above reasons, the usual procedure in this field has been to remove and to discard the bituminous portion, make the necessary repairs to or replace the base, and then repave with new bituminous pavement. In the case of a badly cracked pavement, the usual practice is to remove and discard it and lay a new bituminous pavement in its place. Where a bad settlement has occurred the old pavement is either removed and discarded, the grade corrected with new fill and a new pavement laid, or the new fill is placed directly upon the old pavement and a new pavement laid upon this new fill.

It will be noted that in each of the aforementioned cases the old bituminous pavement was heretofore discarded and no further use made of it. It thereby became a total loss to its owner because the art, so far as I am aware, has never been able to make use of the torn up material in a new bituminous pavement. This is true also of pavements which have been laid to serve a temporary purpose or which have been cut out due to the relocation of a road, the usual practice in such cases being simply to abandon

2

them. Those intimately associated with this field have made many attempts to re-use this waste material as it represents a large capital investment, the magnitude of which can be realized from the fact that on the site of the recent World's Fair in New York city alone there are between 50,000 and 60,000 tons of pavement material for which there is no further use. To my knowledge, however, no one has heretofore provided a satisfactory method by which such material could be successfully reclaimed and which was sufficiently practicable so as to be adopted by those connected with this field, with the result that enormous quantities of such material have been and are still being wasted in spite of the fact that the problem is especially pressing today, in view of the difficulties of obtaining new binding material for pavements.

The principal purpose of this invention is to provide a satisfactory solution to the above indicated problem and more particularly to make it possible to re-use in a new pavement any bituminous pavement which has deteriorated to the extent that it is necessary to replace it, or which is no longer serving the purpose for which it was designed.

A better understanding of the objects of the invention as well as the features of novelty thereof, will be had after a perusal of the following description, read in connection with the accompanying drawings in which Fig. 1 is a front elevational view, partly in section, of a pavement reclaiming plant made in accordance with the invention; Fig. 2 is a side elevational view, partly in section, of the plant shown in Fig. 1, one of the side hoppers being removed to show more clearly the construction of the main, central hopper; Fig. 3 is a sectional plan view taken along the line 3—3 of Fig. 1; Fig. 4 is a sectional plan view taken along the line 4—4 of Fig. 1; Fig. 5 is an enlarged detailed, fragmentary view of the cross pipes which form the grate-like structure at the top of the central hopper of the apparatus; Fig. 6 is a sectional view of one of the pipes in such structure and taken along the line 6—6 of Fig. 5; Fig. 7 is a view similar to Fig. 5 of the second tier of pipes in the central hopper; Fig. 8 is a sectional view taken along the line 8—8 of Fig. 7; Fig. 9 is a view similar to Figs. 5 and 7 of the third tier of pipes in the central hopper; Fig. 10 is a sectional view taken along the line 10—10 of Fig. 9; Fig. 11 is an enlarged detailed view of the bottom layer of pipes in the central hopper of the apparatus, many of the parts associated with such pipes

being shown in section and the central portions of such pipes being omitted; Fig. 12 is a sectional view taken along the line 12—12 of Fig. 11; Fig. 13 is a side elevational view of the parts illustrated in Fig. 11 and looking toward the right of such figure, and Fig. 14 is a side elevational view of the operating mechanism for controlling the portions of the pipes in the bottom grate of the central hopper.

Pavements or roads of a bituminous nature are generally laid upon either a concrete or macadam base approximately six inches thick. Upon these bases usually is placed a surface mixture of either two inches of bituminous concrete, composed of stone, sand, mineral dust, and bituminous binder, or a sheet mixture consisting of one and one-half inches of an undersheet, composed of stone, sand, and bituminous binder, and one and one-half inches of a top sheet, composed of sand, mineral dust and a bituminous binder. Where these pavements are placed upon a concrete base there is relatively no trouble in stripping the old pavement from the base as the overlying layer of bituminous pavement is not bonded to the concrete. In the case of the sheet pavement, it is contemplated to combine both layers of the pavement to form a bituminous concrete suitable for use as a new bituminous pavement. Where a macadam base has been used the bituminous pavement will probably be so intimately bonded to the base that it is impossible to separate the two, this condition will cause no trouble for it is contemplated in this case to combine the layer of bituminous pavement with some or all of the base material to form a new bituminous concrete suitable to be laid as new pavement. In preparing these pavements for re-use it will be necessary to incorporate certain amounts of any or all of the following materials, stone, sand, mineral dust or bituminous binder. This is made necessary in order:

1. To revivify the hardened bituminous binder by the addition of a new binding material.

2. To obtain the desired texture in the new pavement.

3. To add sufficient new binding material to thoroughly coat any uncoated base material which is to be included in the new pavement.

In accordance with the practice of the invention, an analysis of the original pavement to be replaced is first made before the pavement is torn up. This is accomplished by taking, in any suitable manner, a number of samples from various portions of the road, care being taken in the preparation of such samples so that they are truly representative of the stretch of pavement to be torn up. Where the paving mixture to be re-used consists of several layers of different type materials, as for example a layer of sheet top, a layer of binder and in some cases a layer of bituminous base, care must be taken to see that the proper proportion of each layer is included in the samples. The samples are either obtained in a broken up condition or subsequently broken up and then mixed and subdivided until there remains a large sample which is representative of all portions of the road to be torn up. From the large sample, a smaller example of from 40 grams to 1000 grams is taken up for the actual analysis. The bitumen is first extracted using a solvent such as chloroform or carbon bisulphide with a Soxhlet apparatus or a centrifuge machine. The difference in weight before and after extraction will give the percentage of bitumen in the paving sample. The extracted mixture will then consist of all the aggregate such as stone, sand and filler. These may be separated by sieving with a series of different sized sieves so that the percentage of material of any stated size may be determined. Having the analysis of the original material and knowing what is desired in the new pavement, there may be readily calculated the percentage and size of the stone, sand and filler that must be added to obtain the texture desired in the new pavement and the percentage of binding material that must be added to satisfy the needs of the new composition desired.

The type of binding material needed in the new pavement is determined by analyzing the characteristics of the binding material in the old pavement. This is accomplished by taking the solution of the binding material and the solvent from the analysis above and recovering the binding material by separating it from the solvent. Having recovered the binding material as it existed in the sample of the old pavement, tests may then be made on it to determine its character, such as by a penetration test or a softening point test. Knowing the character of the old binding material and knowing the percentage of additional binding material to be added, a binding material can be selected which will blend with the binding agent already present in the pavement and which will give a resulting binder having the desired characteristics. All of these materials may be added to the old pavement in a manner which will hereinafter become more clear.

When the old pavement has been properly analyzed to see what components are needed to revivify it, the old pavement is stripped from its base, in the course of which operation it will be broken into pieces greater than twelve inches by twelve inches, and fed into the apparatus now to be described.

In the drawings, the reference character A indicates the hopper into which the broken pieces of the old pavement is fed. The central hopper A is flanked by a pair of smaller hoppers B and C which contain the stone and sand to be added to the old pavement material. The contents of the three hoppers A, B and C are discharged into a weighing box D which in turn empties into a suitable mixing device F. The required binding material for the new composition is fed into a weighing box E which empties into the mixing device F. The several devices are properly supported in the manner illustrated in Figs. 1 and 2 of the drawings, and the unit may be stationary or mounted on a suitable truck by which it can be moved from job to job.

The size and form of the central hopper A will depend upon the amount of material it is expected to handle and other considerations. In the drawings, the central hopper A has been illustrated as having an upper portion 1 of square shape and about fifteen feet by fifteen feet in size. Connected to the upper portion 1 is a tapered lower portion 2 which preferably is enclosed in a steam jacket 3 to maintain the interior of such portion at a predetermined temperature. In the upper portion 1 of the hopper A are four spaced banks of steam pipes which are indicated generally by the reference characters G, H, I and J. The pipes in each bank extend through and are supported by the side walls of the hopper and are connected so that they may be removed for repair or changed to take care of different operating conditions. The banks

of pipes G, H and I are also supported by the I-beams 31 to prevent any possibility of sag under the weight of the material passing through the hopper.

The top bank of pipes G is positioned about four feet from the open end of the hopper in order to provide sufficient space to permit the formation of a sufficient head of the broken pavement to force the treated material through the banks and at the same time to seal the steam in the hopper. The bank G includes an upper layer of pipes 4 and a lower layer of pipes 5, the pipes of each layer being arranged in spaced relation and extending at right angles to the pipes in the other layer to produce a lattice-like formation, as can be seen more clearly in Fig. 3 of the drawings. The spacing between the pipes in each layer is about six inches so that the two layers form a grate-like structure in which the openings are six inches by six inches. As is shown more clearly in Figs. 5 and 6, the pipes 4 and 5, which are one and one-half inch steam pipes, are each provided with a plurality of ports arranged to discharge steam in the directions illustrated by the arrows in Fig. 6 of the drawings. The ports of the pipes 4 are indicated by the numeral 25 in Fig. 5 while the numeral 26 designates the ports of the series of pipes 5. The pipes 4 are connected at their ends by suitable T fittings and pipe sections 6 and are connected to a source of steam by the vertical pipe sections 7 (see Fig. 2). The pipes 5 are likewise connected at their ends by T fittings and pipe sections 8 and are connected to a source of steam by the vertical pipe sections 9 and 10 (see Figs. 1 and 2). In this manner a free circulation of steam is established through the pipes 4 and 5 for delivery through the ports 25 and 26, respectively, into the interior of the central hopper A. The set of pipes 4, like the set of pipes 5, may be provided with a plurality of steam inlets in the event that it is found desirable.

The second bank of pipes H, positioned about three feet below the bank of pipes G, is like the latter composed of two layers of steam pipes arranged in crosswise relation, the pipes in the upper layer being designated 11 and the pipes in the lower layer being designated 12. The spacing between the pipes in these two layers, however, is about four inches so that the openings between such pipes are four inches by four inches. Like the pipes of bank G, the pipes 11 and 12 of bank H, are connected by T fittings and pipe sections corresponding to the sections 6 and 8, respectively. The layer of pipes 11 is connected to the vertical pipe sections 7 and 13 while the layer of pipes 12 is connected on one side to the vertical pipe sections 9 and 14 and on the other side to the vertical pipe sections 10 and 15. Also like the pipes of bank G, the pipes 11 and 12 are provided with a plurality of steam ports 27 and 28, respectively (see Fig. 7), arranged to discharge steam in the directions indicated by the arrows in Fig. 8.

The bank I of pipes 16 and 17 is constructed in a manner similar to banks G and H, except that the openings between the pipes 16 and 17 are two inches by two inches and the steam ports 29 and 30 thereof (see Fig. 9) are arranged to discharge steam in the directions indicated in Fig. 10 of the drawings. The upper layer of pipes 16 is connected to the upper layers of pipes in the banks G and H and to a source of steam by the vertical pipe sections 13 and 18, while the lower layer of pipes 17 is similarly connected to

the lower layers of such banks, and a source of steam at one side by the vertical pipe sections 14 and 19, and at the opposite side by the vertical pipe sections 15 and 20.

The bottom bank of pipes J is composed of a single layer of pipes 35 which are substantially rectangular in cross-section, and which are positioned about a half inch apart so that as a whole they present a substantially flat, closed grate to the material falling from the banks of pipes G, H and I. As can be seen more clearly in Figs. 11 and 12 of the drawings, the pipes 35 are provided on their upper, substantially flat surfaces with a plurality of steam ports 36 arranged in predetermined relation to thoroughly steam any material falling on such pipes from the overlying banks of pipes. The ends of the pipes 35 are rotatably supported on two opposed walls of the main hopper A to enable the pipes to be moved from the positions shown in Figs. 1, 11 and 12 to positions for dumping the fallen material into the lower portion of the hopper. As is shown in Fig. 11 of the drawings, each pipe 36 is provided with a reduced bearing end portion 37 which is rotatably supported in the flanged bearing supports provided on a plate 38 and extending through a series of apertures in the side of the hopper. The plate 38 is bolted to the side of the hopper in any suitable manner and the inner ends of the bearing supports thereof engage shoulders provided on the pipes 35 to limit movement of the pipes towards such supports. The other ends 39 of the pipes 35 are rotatably mounted in a similar fashion on the flanged bearing supports provided on the plate 41. The ends 39 of the pipes are provided with a reduced passageway through which extends the pipe sections 40, which are all piped together as by T fittings and pipe sections 49, and are connected to the vertical pipe section 18 (see Fig. 2). Packing units 42 make a fluid tight connection between the pipe sections 40 and their associated pipes 35 without interfering with the rotational movement of the latter.

The terminal ends of the pipes 35 adjacent to the bearing portions 37 thereof are provided with squared shafts upon which are secured gear wheels 43 and 44 in alternate relation. The gears 43 are driven gears and are rotated by gears 44 whose movements are controlled by arms 45 which are mounted on the shafts supporting such gears. The outer ends of the arms 45 are linked together by a bar 46 (see Fig. 14) so that such arms and consequently the gears 44 move in unison. Movement is imparted to the gears 44 by a beam 47 which is fixedly connected to one of the gears 44 and which may be hand operated by the chain 48 illustrated in Fig. 14 of the drawings or connected in a suitable fashion to automatic control mechanism. It will be noted that as a result of this arrangement the pipes 35 will operate in pairs, that is, two adjacent pipes 35 will pivot toward and away from each other during their rotational movements.

Steam is furnished to the above described banks of pipes from a suitable source which is connected to such banks through a lead-in pipe 24 (Figs. 2 to 4), then through pipe 23 to which is connected the vertical pipe section 13 and through pipes 21 and 22 which are connected to the vertical pipe section 19 and 20, respectively. The supply of steam to the several banks of pipes is controlled by appropriately placed valves but is admitted into each pipe at a relatively high pressure. The inlet pipe 24 is also connected by pipes 51 and 52 to a closed pipe line 53 which

surrounds the lower end of the central hopper A. Connected to the pipe line 53 are a plurality of steam jets 54 which extend through the four side walls of the portion 2 of the hopper and project into the interior of such portion.

It will be understood from the foregoing that the relatively large pieces of broken pavement fed into the central hopper A will be loaded upon the uppermost bank of pipes G through whose ports 25 and 26 steam at a high temperature (approximately 300° F.) and at a high pressure of the order of from twenty-five pounds to two hundred pounds is being discharged. The hot, live steam from the pipes 4 and 5 attacks the pieces of pavement adjacent to such pipes causing them to soften and crumble. The portions of the pavement pieces between the pipes become partially heated in part by the steam from the pipes 4 and 5 but principally by the steam which rises from the underlying banks of pipes. When those portions of the pavement immediately overlying the pipes soften to the extent that they offer no support for the portions between the pipes, the latter under the pressure of the head of material are caused to fall through the bank G and down upon the bank of pipes H. This same operation occurs at the banks H and I. As a result of this steam treatment, the large pieces of old pavement are reduced to six inches by six inches in size and then to four inches by four inches in size by the time they reach the bank of pipes I. At the same time, due to the progressively greater thoroughness of the penetration of the steam, much of the old pavement has been reduced to sizes less than four inches by four inches. At the bank of pipes I the directions of the steam jets are such that the whole of the old pavement will be thoroughly softened and disintegrated and ready for mixture with the new materials. I have found it desirable, however, to give the mixture a further steam treatment by holding the mass at the bank of pipes J for a predetermined period while thoroughly saturating it with steam under high pressure and then dumping the mass collected on such bank of pipes quickly into the lower portion of the hopper A. This additional step assures a thorough softening and conditioning of the mass for re-use, but it is within the contemplation of the invention to omit this step and rely upon the banks of pipes G, H and I as I have found that these three banks generally condition the old mixture for re-use in an efficient and satisfactory manner. Preferably in carrying out the steps of the process the pressure of the steam in the pipes should be sufficiently great as to cause such steam to agitate the material, especially at the banks of pipes H and I. Preferably also vibrator units 57 and 58 are mounted upon the banks of pipes G, H and I to constantly agitate the pipes during the carrying out of the process in order to facilitate the material dropping through the openings.

The material discharged by the bank of pipes J falls into the heated portion 2 of the hopper A and through the steam area created by the nozzles 54 to the pan 55. It is to be noted, at this time, that due to the restricted opening in the bottom of the hopper, the steam is retained within the hopper while cold air is kept out thereby preventing any chilling of the material while it is on the bank of pipes I or J or dropping through the lower portion of the hopper. The pan 55 is mounted upon a vibrator unit 56 (see Fig. 2) which is ordinarily inoperative so that the heated mixture piles up in the lower end of the hopper A to plug the discharge end of such hopper. When the vibrator unit 56 is put into operation, the heated mixture is fed into the weighing box D until the desired amount of the mixture is obtained for admixture with the new ingredients which may be needed to obtain a paving mixture having the predetermined characteristics desired therein. The weighing box D is of a type well known to the art and need not be described here in detail.

New hot stone may be stored in hopper B which preferably is provided with a steam jacket 59 to maintain the stone heated. The feed of hopper B is controlled by a vibration feed unit 60 similar to that shown in connection with hopper A. New hot sand or a mixture of hot sand and filler such as limestone dust or cement may be stored in hopper C which is also provided with a steam jacket 61 and a vibration feed control unit 62. If the sand is to be kept separate the filler may be fed to the weighing box D by a screw conveyor 63 (see Fig. 1). The new hot bituminous binding material is fed in through a conduit 64 (see Fig. 2) to a weighing box E of known type. If desired, all new materials to be added, including any bituminous binding material, may be mixed together prior to being added to the old pavement. This would be of great advantage where operations were being carried on in the street as all dust would thereby be eliminated. The material would be added from either hopper B or C. When the required amount of stone, sand and filler needed has been added to the mixture from hopper A, the contents of the weighing boxes D and E are discharged into a mixing device of any suitable type such as the pug mill mixer F. The blades 66 and 68 mounted on the shafts 65 and 67, respectively, of the mixer F, thoroughly and completely mix the several ingredients together in a known manner after which the new mixture is discharged through a gate in the bottom of the mixer F.

It will be understood from the foregoing that the process essentially consists in using steam at a relatively high temperature and pressure to break down and condition the old pavement material and then mixing with such conditioned material, a bituminous material that will blend with and revivify the binding agent already present in the pavement material and other ingredients which may have to be added to obtain a paving mixture of predetermined desired characteristics. Preferably the process is carried out in progressive heating stages, as has been described, to properly and thoroughly condition the old pavement mixture for the mixing operation. Not only may the old pavement be reclaimed in this fashion, but by taking advantage of the latest developments in the design of pavements there will result in many cases a new paving mixture far superior to the original. The process is simple, less expensive to carry out than that required in the use of all new materials, while at the same time saving the cost of such new materials and may be carried out at a central plant or on the job itself so that one section of the road may be progressively relaid while other sections thereof are being torn up. As the pipes in each bank are readily removable, they may be replaced by pipes of smaller diameter than the holes in the hopper A and arranged to vary the size of the openings in the bank by changing the spacings between the pipes in the upper and/or lower layers 4 and 5, respectively, by displacing the pipes in one layer relative to the other or by displacing the pipes in both layers

4 and 5. Furthermore, it is believed to be obvious that the sizes of the holes in the hopper may be enlarged to permit a sidewise movement of pipes of a particular size in layers 4 and 5 in one direction or the other to enable the openings in the bank to be enlarged or made smaller. Thus, referring to Fig. 5 of the drawings, whether pipes of smaller diameter replace pipes of larger diameter or whether the holes in the hopper are originally large enough to permit a sidewise movement of the pipes of a particular size to attain a maximum or minimum in the size of the holes in each bank, the end pipes in each layer 4 and 5 are positioned against the outer sides 70, or the inner sides 71 of the holes through which they extend, while the pipes intermediate such end pipes on either side of the centrally disposed pipes of such layers (see Figs. 1 and 3) are moved in the same direction as the end pipes with which they form half sections of the layers 4 and 5, but a progressively smaller amount outwardly or inwardly from such end pipes to make the openings in the bank of uniform size. To attain openings in each bank intermediate the maximum and minimum sizes, the pipes are repositioned lesser amounts in the same fashion. Whether pipes of a smaller diameter are used or the pipes shifted in the holes to vary the size of the openings in the bank, it will be necessary to use different sized T fittings at the ends of such pipes and/or different lengths of pipe sections 6, to enable such adjustment to be made. It is also believed to be obvious to one skilled in the art from the description of banks G, H and I, that the spacings of the holes in the hopper through which the pipes extend may be varied or that additional holes may be provided to permit of any desired spacings of the pipes of a particular size. Thus, different types of pavement mixtures can be readily accommodated by the apparatus disclosed for carrying out the process.

It will be understood that the above disclosure is by way of illustration only since many changes may be made therein without departing from the spirit of the invention, as will be understood by those skilled in the art. Hence reference is made to the appended claims, rather than the foregoing description to indicate the scope of the invention.

I claim:

1. Apparatus for conditioning old pavement material for reuse, including a hopper, a plurality of banks of steam pipes arranged one above the other in spaced relation in said hopper, each bank of pipes including pipes arranged to form a grill-like support and the openings between such pipes in an underlying bank being smaller than the openings between the pipes in an overlying bank, the openings in the lowermost bank of pipes being such that the progressively broken down material discharged therefrom is thoroughly disintegrated, a multiplicity of steam ports provided in said pipes and arranged to thoroughly permeate with steam the pavement material falling on such banks and means for supplying live, hot steam to said banks of pipes at a predetermined pressure.

2. Apparatus such as defined in claim 1, in which each bank of pipes includes an upper layer of pipes connected together and a lower layer of pipes connected together as a unit separate from said upper layer of pipes and arranged transversely to the pipes of the upper layer, the pipes in each layer being so connected at their ends as to enable the spacings therebetween to be varied.

3. Apparatus such as defined in claim 1, in which said hopper includes a lower layer of pipes constructed and arranged to provide in one position thereof a substantially solid grate and in another position thereof relatively large openings through which the heated material may be discharged, said pipes being provided with a plurality of steam ports arranged to discharge steam into the material resting on said pipes and means for supplying steam to said pipes.

4. Apparatus for conditioning old pavement material for reuse, including a hopper, a plurality of banks of steam pipes arranged one above the other in spaced relation in said hopper, each bank of pipes including pipes arranged to form a grill-like support and the openings between such pipes in each underlying bank being smaller than the openings between the pipes in the overlying banks, a multiplicity of steam ports provided in said pipes and arranged to thoroughly permeate with steam the pavement material falling on such banks, a bottom layer of pipes constructed and arranged to retard the feed of material through the hopper and provided with a plurality of steam ports arranged to discharge steam into the material overlying said pipes, means supporting the pipes of said lower layer for rotational movement about their longitudinal axes, means operable to rotate said pipes to discharge the material therebetween and means for supplying live, hot steam to all of said pipes at predetermined pressures.

5. Apparatus for conditioning old pavement material for reuse, comprising a plurality of screening means located one above the other in spaced relation and lying directly in and across the path of flow of the material, each of said screening means being composed of steam pipes constructed and arranged to provide a multiplicity of openings therebetween and having a multiplicity of steam ports arranged to thoroughly saturate broken pieces of the old material with steam, the openings in each underlying screening means being smaller than the openings in the overlying screening means so as to break down such material into smaller pieces in a progressive fashion in its progress through such means and means for supplying to the ports of said screening means steam at such temperature and pressure as to thoroughly soften the old pavement material and to intimately mix the ingredients from which it was formed.

6. Apparatus for conditioning old pavement material for reuse, including a hopper, a plurality of banks of steam pipes arranged one above the other in spaced relation in said hopper, each bank of pipes being arranged to form a screen and being provided with a multiplicity of steam ports by which broken pieces of the old pavement can be thoroughly saturated with steam, the openings in each underlying bank of pipes being smaller than the openings in an overlying bank and the openings in the lowermost bank being such that the progressively broken down material discharged therefrom is thoroughly disintegrated, and means for supplying to said pipes steam at such temperature and pressure as to thoroughly soften the old pavement material and to intimately mix the ingredients from which it was formed.

7. Apparatus for conditioning old pavement material for reuse, including a plurality of screening units lying one above the other in the

path of flow of the old pavement material and located in such spaced transverse relation across the path of flow of the material as to permit the formation of a head of the material on each unit, each of said units being composed of steam pipes constructed and arranged to form a grid provided with a multiplicity of openings and having a multiplicity of steam ports arranged to successively subject broken pieces of the old pavement material during their passage through the units to steam at a relatively high temperature and pressure until such pavement material is thoroughly softened, the openings in each underlying unit being smaller than the openings in an overlying unit so that, at the same time, the flow of pieces of the material is successively retarded and the pieces broken down into smaller pieces in a progressive fashion until the material is thoroughly disintegrated.

8. Apparatus for conditioning old pavement material for reuse, including a hopper, a plurality of screening units located one above the other in said hopper in such spaced relation as to permit the formation of a head of the material on each screening unit and said units being composed of steam pipes constructed and arranged to provide a multiplicity of openings therebetween and having a multiplicity of steam ports arranged to thoroughly saturate broken pieces of the old pavement with steam at a relatively high temperature and pressure and until such pavement material is thoroughly softened, the openings in each underlying screening unit being smaller than an overlying unit so that, at the same time, such material is broken down into smaller pieces in a progressive fashion until it is thoroughly disintegrated.

9. Apparatus for conditioning old pavement material for reuse including a plurality of screening units located one above the other in spaced relation across the path of flow of the material, each of said units being composed of steam pipes

constructed and arranged to provide a multiplicity of openings therebetween and having a multiplicity of steam ports arranged to thoroughly saturate broken pieces of the old pavement material with steam at a relatively high temperature and pressure and until such pavement material is thoroughly softened, the openings in each underlying unit being smaller than the openings in an overlying unit so that, at the same time such material is broken down into smaller pieces in a progressive fashion until it is thoroughly disintegrated, and means adapted to retard the feed of the material after leaving said units while subjecting the material to the further treatment of freed steam.

10. Apparatus for conditioning old pavement material for reuse including a hopper, a plurality of banks of steam pipes arranged one above the other in spaced relation in said hopper, each bank of pipes including pipes arranged to form a grill-like support and the openings between such pipes in an underlying bank being smaller than the openings between the pipes of an overlying bank, the openings in the lowermost bank of pipes being such that the progressively broken down material discharged therefrom is thoroughly disintegrated, a multiplicity of steam ports in said pipes and arranged to thoroughly permeate with steam the material falling on such banks, and means for supplying live, hot steam to said banks of pipes at a predetermined pressure, said hopper below the lowermost bank of pipes being provided with a restrictive opening and having means for maintaining the temperature of the heated material dropping into the region adjacently above said opening and below said lowermost bank of pipes, said last mentioned means comprising a plurality of steam jets arranged in the region of such restricted opening so as to thoroughly steam the material passing therethrough.

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