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HARDENABLE PLASTIC COMPOSITIONS

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Our invention relates to hardenable plastic compositions, and more particularly to improved magnesia base plastics.

This application is in part a continuation of our application Serial No. 77,592, filed May 2, 1936.

Our improved compositions are particularly suitable for use in the formation of articles of relatively large surface area and of relatively small cross sectional area.

The present invention includes the process of preparing improved hardenable magnesia base plastic adapted for a variety of purposes such as the making of slabs, caskets, sarcophagi, vaults, boxes, and other containers, monuments, statuary and other ornamental pieces and objects subject to weather and soil conditions, as well as articles intended for other uses.

The present invention also includes the provision of various plastics having the same basic characteristics but which may be used respectively for surfacing, body or filler, and assembly, together with a plasticising fluid, all capable of conjoint use for the purpose of finally producing objects of monolithic character, although certain of the hereinafter described plastics are capable of commercial use separately from the other described plastics.

Our invention further consists in the preparation of improved hardenable magnesia base plastics of such nature that the exposed surfaces of articles made therefrom can be treated or decorated and finished by usual surface finishing methods such as water-proofing, painting, lacquering, oiling, and waxing.

A further object of our invention is to produce a magnesia base plastic material capable of being cast or otherwise molded, without heat or pressure, the material setting uniformly without warping or cracking, with small change in final volume, and with shrinkage of such uniformity that sections cast therefrom are substantially alike in size and can be readily assembled together and interchanged at will. In addition, the material will adhere to surfaces of similar material and to other surfaces such as wood, fabrics, and metals.

The invention further consists in the provision of a basic material capable of hardening to an article which will also be light in weight, of high mechanical strength, of porous character, shock-proof, resistant to weather and soil erosion, resistant to various acids and alkalis, and resistant to moisture and water.

As a full exposition of the objects of our invention would unduly lengthen this specification, the other and further objects of our invention will be understood from the following specification.

By way of example, this specification will be written from the standpoint of burial caskets which heretofore have been made commercially either of wood or metal, the latter being either stamped, cast or electro-deposited.

Prior to this invention attempts have been made to use moldable plastic compositions in the production of caskets, but these have not proven commercially feasible for a variety of reasons. The most common of hardenable plastics is cement, concrete and the like. These compositions are objectionable for the uses contemplated by this application because of excessive weight, poor surface, incapability of being molded in thin sections, readily affected by water, soil and weather conditions, brittleness, and other objections. Among the further objections may be mentioned that concrete, cement and the like, cannot be practically satisfactorily decorated or painted, and finished.

Attempts have also been made to use other plastic compositions for the molding of objects referred to above but in all such attempts known to us the resultant product has been too brittle for handling in commerce, or the surface has not been adaptable for decorative finishing, or the objects were too heavy, or of a character that would be readily attacked by soil or weather elements or other acids likely to be encountered in service. For example, there has been used a magnesia base plastic in which the filler was marble dust, which is principally calcium carbonate. Such material is unsuited for the purposes of this application because it is very heavy, and it is so dense and solid that a firm bond cannot be created between it and applied finishing materials, such as paint, varnish, lacquers, etc. Furthermore, such material is not chemically inert. Being a carbonate, it is attacked and decomposed by all acids, such as soil and weather acids, releasing gaseous carbon dioxide during the reaction. This gas is generated within the material and in escaping will crack the material.

In the production of burial caskets, for example, according to this invention there may be used material made from one formula as a surfacing composition, and a material made according to another formula as a backing or filler material, and, if desired, material made according to a third formula may be used as an assem-

bly cement for precast sections; and in all of these formulae a specially prepared plasticising fluid is used.

Examples of compositions having the foregoing and the hereinafter described characteristics and which have been found to be satisfactory will now be described in sufficient number to illustrate the principles involved.

First, a body or backing material, which is light in weight and free from warping, cracking, etc., yet strong and shock-proof may be produced according to any of the following formulae, when it is desired to have all the ingredients mineral in character and the filler materials inert:

Ingredients	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6	Ex. 7	Ex. 8	Ex. 9	Ex. 10
	Parts by weight	*Parts by weight*	*Parts by weight*	*Parts by weight*	*Parts by weight*	*Parts by weight*	*Parts by weight*	*Parts by weight*	*Parts by weight*	*Parts by weight*
Magnesite	40.0	40.0	40.0	40.0	55.0	55.0	55.0	37.8	38.4	40.0
Silex					5.0	5.0	5.0	1.7	2.2	27.0
Asbestos (short fibre)	40.0	45.0	21.0	48.0	3.0			7.0	8.0	12.0
Asbestos (long fibre)					15.0	18.0	15.0			
Diatomaceous earth			12.0					10.5	11.8	16.0
Pumice	14.0	10.0	23.0	7.0	22.0	22.0	25.0	37.8	39.6	5.0
Asphalt emulsion	6.0	5.0	4.0	5.0				5.2		
Solution	100.0	100.0	100.0	100.0	122.0	150.0	122.0	73.5	78.5	81.8

In the foregoing as well as in the other formulae hereinafter set forth the magnesite is ground to a fine particle size, such as all through a 325 mesh screen, and the other ingredients, when used, are of various sizes, i. e., substantially all the pumice will pass through about a 16 mesh screen, the silex is about the same particle size as the magnesite, and the short asbestos fibre has a maximum length of about one-eighth of an inch, while the long asbestos fibre has a maximum length of about one-quarter of an inch. The asphalt emulsion is approximately 75 percent concentration.

Certain substitutions may be made in whole or in part in the ingredients listed above without altering the major characteristics of the finished article. For example, talc or fine ashes may be substituted for the silex; and a slag known by the trade-name "Pottsco" may be used in place of the pumice. Infusorial earth, kieselguhr, celite and diatomaceous earth are interchangeable. Also, a small percentage of asphalt emulsion may be added to any of the above formulae when it is not specified, if desired. We have used throughout a calcined magnesite sold under the trade or brand name "Bald Eagle" by West Coast Chemical Company. If magnesite of other grade is substituted due allowances will need to be made in the formulae herein given. For example, more or less silex may be used depending upon the amount of silica, etc., present; more or less magnesium sulphate may be needed to neutralize the lime impurity; and the amount of plasticizer used may vary from the proportions indicated herein.

The plasticising fluid used throughout the formulae given in this specification may be made according to the formula:

	Parts by weight
Magnesium chloride	37.4
Magnesium sulphate	8.2
Water	54.4

In preparing this plasticizer the magnesium chloride and water are mixed together to form a 22° Baumé solution and the magnesium sulphate is added.

Using the above mixes we are able to obtain a comparatively light weight resultant material partly because the pumice, diatomaceous earth and asbestos fillers are all materials of low specific gravity, are cellular in character, and are present in substantial volume. Magnesite is also of relatively low specific gravity. The term cellular is meant to include also those mineral fillers made cellular by mechanical, physical and chemical means.

The surface of the hardened material made according to the foregoing formulae contains large pores and is comparatively rough. Such surfaces are suitable for many uses and purposes but in the case of burial caskets, for example, it is desirable to have smoother, and hard, finely textured, easily decorated outer surfaces. The following examples are given of suitable compositions for such purposes, again preserving the all mineral character of the composition:

Ingredients	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6	Ex. 7	Ex. 8
	Parts by weight	*Parts by weight*	*Parts by weight*	*Parts by weight*	*Parts by weight*	*Parts by weight*	*Parts by weight*	*Parts by weight*
Magnesite	45.0	45.0	45.0	45.0	45.0	40.0	45.7	40.0
Silex	40.0	30.0	30.0	30.0	30.0	35.0	49.7	50.0
Asbestos	5.0	10.0	10.0	10.0	8.0	8.0		6.0
Talc	5.0	10.0		10.0	12.0	12.0		
Diatomaceous earth	5.0	5.0					4.6	4.0
Bentonite			15.0	5.0	5.0	5.0		
Solution	96.0	100.0	100.0	96.0	96.0	96.0	80.0	100.0

The compositions just recited will be referred to as the surface material, but it is to be understood that we have found that complete articles may be produced which are made solely from this so-called surface mix.

The talc will preferably all pass a 325 mesh screen, and the bentonite will desirably be of somewhat smaller particle size such as to pass through a 400 mesh screen. If desired, a small percentage of a coloring matter such as iron oxide or carbon black may be added to these latter formulae, in which case the amount of silex used may be reduced slightly and not over a corresponding amount to that of the added coloring material.

The finished product made according to any of the latter formulae is denser than those made according to the formulae first given above so that the surface is very smooth, and hard. While the weight of the latter is greater than the former,

where an article is made from a composite of both materials, as will be described, only a thin coating of the surface material will be needed.

For certain purposes it has been found desirable and possible to obtain a hardenable plastic composition producing articles having all the above major characteristics, such as freedom from warping, uniformity in size, inherent strength, resistance to weather and acid conditions, etc., without using all mineral ingredients. In such cases organic materials have been substituted for some of the mineral fillers, and this has resulted in a finished product that is lighter in weight, more resilient to shocks and stresses, and cheaper to manufacture.

Examples of such compositions which have been found to be satisfactory and which may be used in place of the aforesaid body or backing material are as follows:

Ingredients	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6
	Parts by weight	*Parts by weight*	*Parts by weight*	*Parts by weight*	*Parts by weight*	*Parts by weight*
Magnesite	38.4	40.0	40.3	55.0	50.0	55.0
Silex	37.3	39.0	39.5			
Saw dust	10.5	16.0	11.0	10.0	10.0	13.0
Wood flour	6.8	5.0	4.1	3.0	3.0	3.0
Asbestos (short fibre)	7.0		5.1			
Asbestos (long fibre)				2.0	2.0	
Fibre (vegetable)				4.0	5.0	4.0
Pumice				17.0	20.0	15.0
Talc				9.0	10.0	10.0
Solution	78.5	78.5	75.4	150.0	150.0	150.0

Similarly with the so-called surface material, acceptable compositions using fillers of vegetable origin, and yet with the hard, smooth and other characteristics of articles made from the all mineral surfacing material, are as follows:

Ingredients	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6	Ex. 7	Ex. 8	Ex. 9
	Parts by weight	*Parts by weight*	*Parts by weight*	*Parts by weight*	*Parts by weight*	*Parts by weight*	*Parts by weight*	*Parts by weight*	*Parts by weight*
Magnesite	53.5	48.0	47.6	45.8	45.0	45.0	45.0	45.0	47.6
Silex	42.7	48.2	48.2	50.0	42.0	40.0	40.0	35.0	48.2
Wood flour	3.8	3.8	4.2	4.2	3.8	3.8	3.0	3.0	4.2
Asbestos						3.2	3.0	3.0	
Talc					9.2	8.0	6.0	6.0	
Diatomaceous earth							3.0	3.0	
Bentonite								5.0	
Solution	88.6	88.6	81.8	81.8	88.6	92.3	96.0	96.0	82.0

Again, these compositions produce articles or surfaces that are more resilient than that using all mineral materials, as well as being cheaper and lighter in weight.

In the latter two sets of examples the wood flour is very finely ground to approximately 400 screen mesh, the talc is such as to pass all through 325 mesh screen, and the bentonite is in the lower micron sizes, i. e., finer than 400 screen mesh. The vegetable fibre which we have found to be satisfactory up to the present time is hemp, used in lengths from one-quarter to one-half inch. This fibre adds considerable strength to the finished product, being a stronger fibre than asbestos, for example.

Contrary to the conditions in the all mineral materials above, while it appears in some of the formulae just given that the non-cellular silex dominates the filler materials as expressed in percent by weight, this is not the case when considering the volume occupied by the ingredients in the finished product. Because of the very low specific gravity and large bulk of the cellular fillers, those fillers predominate and occupy the greater space in the finished product in spite of the fact that by weight the silex appears more.

In preparing all the above mixes, the dry ingredients are very thoroughly mixed together either mechanically or by hand. Thereafter the required quantity of the dry mix is placed in a mechanical mixer and the indicated amount of plasticising material is added, the whole being stirred until complete distribution of the fluid has been obtained throughout the batch.

In the case of the backing or filler mix, the material at the end of the mixing is of the consistency of dough, while in the case of the surface mix the material at the end of the mixing is thinner, more of the consistency of batter. The backing or filler material in its dough-like form can be cast, molded, extruded, or worked with forming tools. The surfacing material may be poured, sprayed or applied by brush.

In the foregoing tables various proportions, ranges and combinations of materials are given revealing the principles used to obtain a properly balanced composition having the advantages and characteristics outlined in this specification.

Other formulae can be devised in the same or substantially similar proportions and within the ranges given, which will produce articles having the described characteristics; and the ingredients can be varied as it may become important to accentuate or reduce some particular characteristic or characteristics. However, the proportions of each formula are critical in that the amount of any ingredient cannot be varied more than two percent without seriously affecting the physical and chemical properties of the resultant product. It is important that a proper balance be maintained, such as that between the magnesium oxide and the magnesium chloride, and that between the calcium oxide and the magnesium sulfate; and, as further explained hereinafter, to obtain a sufficient distribution and absorption of the fluid in and around the pores of the cellular filler materials, and to maintain the viscosity of the final mixes such that the calcium sulphate will not settle in the mass during the setting periods.

One method that may be used in producing

articles using the foregoing materials is as follows:

The surface of a suitable mold is covered with one or more thin layers of the surfacing material, after which a layer of the backing or filler material, of desired thickness for the article, is applied over the surfacing material. The backing material may be applied immediately after the surface material has been applied, but we prefer that a time interval intervene between the respective applications of the two materials so as to allow for the preliminary setting of the surface material. If desired, the whole plastic mass can be rolled or smoothed to an even thickness, or the laminations may be extruded as layers of desired thickness. In our experience to date we have successfully used both open top and gated molds, without the use of heat and pressure.

The mold and its contents are then set aside for the initial drying and setting periods, which require respectively two hours to four hours and eight to ten hours. It is understood that these times are merely relative and depend somewhat upon the temperature and humidity of the surrounding air at the time of drying and setting. At the end of this time the article can be removed from the mold, and it is then set aside for a period of aging of from ten to fourteen days to thirty days, after which the article is ready for use as is, or after surface decoration, as desired. It is also to be understood that this aging is relative and also depends upon temperature and humidity of the surrounding air during the aging period. We have found that objects formed of the mixes outlined above, or a combination thereof, can be dried in the air without the use of forms or other means to prevent warping during the drying, setting, and aging times. The articles or parts are merely dried in open racks, in a room of the factory, or a drying chamber may be set up with regulated conditions as to humidity and temperature.

We have found that at the end of this time the surface material and the body or filler material have become a hard mass with the strata firmly bonded or combined together into one unitary structure of monolithic character. The original interfaces of the two strata are so united that they are inseparable.

Caskets can be made according to our invention either as a whole or in sections. In practice we have found that sections such as the sides and ends of caskets manufactured according to the above process and after aging may be assembled into the finished casket. In such cases we have found the following to be a satisfactory assembly cement:

Calcined magnesite	27.0
Silex (SiO_2)	30.0
Zonolite (expanded mica)	2.0
Plasticising fluid	41.0

We have also found that wood flour can be successfully substituted in the above formula for the Zonolite.

In the instances where this cementing composition has been used we have found that the separate interfaces of the several assembled joints have lost their identity, in fact the entire article has become a single monolithic structure, as is the case where the object is cast or molded in one piece originally.

As an alternate method of assembly of the sides, end and bottom of the casket, as soon as the backing material is in place in the mold and without waiting for the initial setting period, the component parts can be assembled together by locking the molds or mold sections together, filling any spaces that may exist between adjacent faces of the sections with the backing composition mix and, if desired, forming fillets in the corners. As soon as the final setting period is completed the molds may be removed and the casket set aside for the aging period.

With articles made according to this invention the surface decoration can be applied in any one of a number of different ways after the aging period is completed. It may be painted by the brush method, or by spraying in any ordinary manner with the usual priming coat, paints, lacquers, enamels and varnishes, and finished off as is usually done with painted surfaces. The surface may also be treated with various finishing oils and lacquers without the application of any paint substance. If desired, the undecorated surfaces may have a coat of asphaltum or other water proofing material applied to the outer surface.

We have found that in the formation of the above plastic masses a solid solution results, which solution contains in suspension all of the filling ingredients used in the mix.

In the commercial form of calcined magnesite there is always present as an impurity a percentage of calcium, which is present in the original magnesite rock. The presence of this calcium would adversely affect the properties of the finished material because of its action either as calcium oxide (the form in which it is present in the calcined magnesite) or as calcium chloride, the form in which it would be present after reacting with the magnesium chloride of the plasticising fluid. Calcium oxide, if unchanged and present in the final material as CaO, would in the presence of water, form calcium hydroxide $Ca(OH)_2$.

Any moisture, whether present in the atmosphere or in the soil surrounding the finished article, would so combine with this calcium oxide. The combination of calcium oxide and water would result in a large increase in volume and the generation of considerable heat. Those reactions should be avoided because the change in volume will cause warping during setting and after the material has set will develop cracks in the material with resultant loss in mechanical strength and appearance, while the generation of heat inside the body of the mass would destroy part of the body structure rapidly because there are not available the means of rapid dissipation of this heat.

The deleterious effects of calcium present in the final product as calcium chloride are due, among other reasons, to basic chemical properties of calcium chloride, such as the fact that calcium chloride is a salt highly soluble in water. This action would result in the leaching of the calcium chloride from the mass with accompanying weakening of the mechanical properties and spoiling of the appearance of the product because voids would be left in the resultant material wherever the crystals of calcium chloride originally existed.

Further, it is well known that calcium chloride is a very high hygroscopic salt, and the great affinity for water that calcium chloride has results in its actual absorption of water whether the water is in the form of water vapor or in its common liquid state. When calcium chloride absorbs water it expands substantially and since

the material of the finished article has already set and will not give, the mass will either crack or warp out of shape.

While it has heretofore been proposed to add magnesium sulfate to magnesia base cements, we have found that the addition of magnesium sulphate in making our original plastic mix results in the combination of the active calcium (present in the calcined magnesite) and the sulphate ion SO_4, so that there is precipitated in and throughout the mass calcium sulphate, or in other words, gypsum, a crystalline product unaffected by water. The viscosity of the mass at this time in our cases is such that the precipitated gypsum does not settle out of the mass notwithstanding its relatively high specific gravity but is at once imprisoned at its many points of formation by the surrounding highly viscous material, and remains where it was formed.

After being placed in the mold, the entire mass begins its initial set, which is primarily a process of dehydration. The second set, which has already begun during this period of dehydration, is caused by the union between the calcined magnesite and the magnesium chloride of the plasticizing fluid. Both of these settings occur in the material which surrounds the insoluble gypsum and also the inert filling materials used.

As recited above, by the thorough mixing of the dry ingredients before the addition of the plasticising fluid, plus the further mixing during the addition of the plasticizing fluid, we obtain a uniform distribution of the calcined magnesite throughout the mass and therefore a uniform distribution of the precipitated gypsum throughout the mass and in and around the cells of the filler materials, since the sulphate of our plasticising solution reacts in place with the active calcium of the calcined magnesite.

One important effect of this distributed gypsum on the mechanical properties of the hardened mass is that this finely dispersed gypsum forms a lattice work of crystals throughout the mass by which formation shocks, stresses and strains on the material of the finished product become evenly distributed over a wide area, thus preventing excess loading at any one point. The crystals of gypsum have a definite form, mechanical strength and certain elasticity to return to their original shapes after deformation by the application of a force below that necessary to rupture the crystals.

These desirable mechanical properties will be retained in the finished product because calcium sulphate is highly insoluble in water, so cannot combine with any water with which it may come in contact, is inert to soil, water, alkalis, and the normal organic acids, and will not react with substances ordinarily found in polluted atmospheres, water or soil.

The distributed calcium sulphate lattice work adds to the inherent strength, resilience, etc., imparted to the finished product by the ingredients selected for the particular composition. Accordingly, objects made by these formulae have the ability to withstand mechanical shocks and strains such as might be encountered in the handling thereof in the factory, in shipping and transportation, and in use, which heretofore has not been true of magnesia base plastics, especially in articles of large size and thin cross section.

Having eliminated the possibility of the formation of calcium chloride and converted the calcium into an insoluble form, as well as either using filler ingredients which are inert and cellular or organic filler ingredients which have been effectively rendered inert by coating the same with the cementing materials with or without the water-proofing emulsion, we have found that the finished material will have the property of mechanically holding in its pores water and water vapor. The presence or absence of this water vapor will depend upon the relative humidity of the surrounding air. Air of high relative humidity will impart some of its moisture to the pores of our material. On the other hand, it has been shown by tests that in surrounding air of lower relative humidity, material made according to the above formulae after aging, will readily give up the water held in its pores to the surrounding air. If the surrounding air is held at zero percent relative humidity, all of this mechanically held water or water vapor will come out.

Now in the case of burial caskets, containers, and the like, this breathing action permits gases that may be generated inside a closed or sealed casket, or other container, to escape without damage to the casket or container. This breathing is likewise of advantage in that articles which may be subject to varying atmospheric and humidity conditions remain unaffected thereby and will return substantially to their dry state.

In addition to all of the above materials being water-resistant as pointed out above, they are also shown by many tests to be resistant to acids, alkalis, and the organic chemicals normally used in the preparation of bodies for burial, to preserve the tissues thereof. Likewise, those organic acids which are the result of body decomposition do not affect this material under normal service conditions.

Above, attention was called to the fact that articles made from our composition will have outer surfaces of such character that they can be directly painted and decorated without further preparation, in the same manner that wood and metal are now finished. That is to say the surface is composed of materials that are chemically inert to paints, lacquers, varnishes, and other similar ingredients, and also to waxes.

Articles made according to the above formulae will have outer surfaces that are clear, clean, finely textured, smooth, and slightly porous, enabling a firm bond to be formed between the paint or applied finished material and the surface of the article. The articles will have hard surfaces which will not be readily marred in handling, transportation and use.

It will be apparent that only a thin, film-like outer coating of surface material is needed to fulfill the objects outlined above for articles made according to our invention.

By reference to monolithic structures it will be understood that we are not precluding the use of reinforcing materials in the body of the material or articles made according to our invention. That is to say, we found that if a foreign body such as wood, fabric, or metal be inserted in this material while in its plastic state, the foreign body will be firmly bound within the material, and this is also true even though the foreign body is only slightly imbedded in the surface of the material.

Modifications may be made in the methods and apparatus herein described without departing from the spirit and scope of our invention, and such modifications are intended to be covered by the appended claims.

We claim:

1. A magnesia base hardenable plastic composition consisting of calcined magnesite, pumice, diatomaceous earth, asbestos, silex, and an asphaltum emulsion, to which is added a plasticising fluid consisting of magnesium chloride, magnesium sulphate and water, the ratio of water to magnesite being approximately 1:1.

2. A magnesia base hardenable plastic composition consisting substantially of calcined magnesite 22%, pumice 22%, diatomaceous earth 6.1%, asbestos 4.1%, silex 1.0%, asphaltum emulsion 3.0%, and plasticizing fluid 41.8%, the plasticising fluid consisting substantially of magnesium chloride 37.4%, magnesium sulphate 8.2% and water 54.4%.

3. A magnesia base hardenable plastic composition consisting substantially of calcined magnesite 25.5%, silex 27.5%, diatomaceous earth 2.5%, and plasticizing fluid 44.5%, the plasticising fluid consisting substantially of magnesium chloride 37.4%, magnesium sulphate 8.2%, and water 54.4%.

4. A magnesia base hardenable plastic composition consisting substantially of calcined magnesite 21.5%, silex 20.9%, hardwood sawdust 5.9%, asbestos 3.9%, wood flour 3.8%, and plasticising fluid 44%, the plasticising fluid consisting substantially of magnesium chloride 37.4%, magnesium sulphate 8.2%, and water 54.4%.

5. A hardenable plastic composition comprising the following ingredients within and inclusive of the proportions indicated:

	Parts by weight
Calcined magnesite	37.8 to 55.0
Silex	1.7 to 27.0
Asbestos fibre	3.0 to 48.0
Diatomaceous earth	10.5 to 16.0
Pumice	5.0 to 39.6
Asphalt emulsion	4.0 to 6.0

and a plasticising solution consisting of magnesium chloride, magnesium sulphate and water, 73.5 to 150 parts by weight.

6. A hardenable plastic composition comprising the following ingredients within and inclusive of the proportions indicated:

	Parts by weight
Calcined magnesite	40
Asbestos fibre (short)	21.0 to 48.0
Pumice	7.0 to 23.0
Asphalt emulsion	4.0 to 6.0

and a plasticizing solution consisting of magnesium chloride, magnesium sulphate and water, 100 parts by weight.

7. A hardenable plastic composition comprising the following ingredients within and inclusive of the proportions indicated:

	Parts by weight
Calcined magnesite	40.0 to 45.7
Silex	30.0 to 50.0
Asbestos	5.0 to 10.0
Talc	5.0 to 12.0
Diatomaceous earth	4.0 to 5.0
Bentonite	5.0 to 15.0

and a plasticising solution consisting of magnesium chloride, magnesium sulphate and water, 80 to 100 parts by weight.

8. A hardenable plastic composition comprising the following ingredients within and inclusive of the proportions indicated:

	Parts by weight
Calcined magnesite	38.4 to 55.0
Silex	37.3 to 39.5
Saw dust	10.0 to 16.0
Wood flour	3.0 to 6.8
Asbestos	2.0 to 7.0
Vegetable fibre	4.0 to 5.0
Pumice	15.0 to 20.0
Talc	9.0 to 10.0

and a plasticising solution consisting of magnesium chloride, magnesium sulphate and water, 75.4 to 150 parts by weight.

9. A hardenable plastic composition comprising the following ingredients within and inclusive of the proportions indicated:

	Parts by weight
Calcined magnesite	38.4 to 40.3
Silex	37.3 to 39.5
Saw dust	10.5 to 16.0
Wood flour	4.1 to 6.8
Asbestos	5.1 to 7.0

and a plasticising solution consisting of magnesium chloride, magnesium sulphate and water, 75.4 to 78.4 parts by weight.

10. A hardenable plastic composition comprising the following ingredients within and inclusive of the proportions indicated:

	Parts by weight
Calcined magnesite	50.0 to 55.0
Saw dust	10.0 to 13.0
Wood flour	3
Vegetable fibre	4.0 to 5.0
Pumice	15.0 to 20.0
Talc	9.0 to 10.0

and a plasticizing solution consisting of magnesium chloride, magnesium sulphate and water, 73.5 to 150 parts by weight.

11. A hardenable plastic composition comprising the following ingredients within and inclusive of the proportions indicated:

	Parts by weight
Calcined magnesite	45.0 to 53.5
Silex	35.0 to 50.0
Wood flour	3.0 to 4.2
Asbestos	3.0 to 3.2
Talc	6.0 to 9.2
Diatomaceous earth	3
Bentonite	5

and a plasticizing solution consisting of magnesium chloride, magnesium sulphate and water, 81.8 to 96.0 parts by weight.

12. A hardenable plastic composition comprising the following ingredients within and inclusive of the proportions indicated:

	Parts by weight
Calcined magnesite	45.8 to 53.5
Silex	42.7 to 50.0
Wood flour	3.8 to 4.2

and a plasticising solution consisting of magnesium chloride, magnesium sulphate and water, 81.8 to 88.6 parts by weight.

13. A magnesium base hardenable plastic composition comprising substantially the following ingredients in approximately the proportions given, such proportions being stated in parts by weight: calcined magnesite 37.8, silex 1.7, short fibre asbestos 7.0, diatomaceous earth 10.5, pumice 37.8, asphalt emulsion 5.2 and plasticising fluid 73.5.

14. A magnesia base hardenable plastic composition comprising substantially the following

ingredients within and inclusive of the proportions indicated:

	Parts by weight
Calcined magnesite	55.0
Silex	5.0
Asbestos	15.0 to 18.0
Pumice	22.0 to 25.0

and a plasticising solution consisting of magnesium chloride, magnesium sulphate and water, 122.0 to 150.0 parts by weight.

15. A magnesia base hardenable plastic composition comprising substantially the following ingredients within and inclusive of the proportions indicated:

	Parts by weight
Calcined magnesite	40.0 to 45.0
Silex	30.0 to 40.0
Asbestos	5.0 to 8.0
Talc	8.0 to 12.0
Bentonite	0 to 5

and a plasticising solution consisting of magnesium chloride, magnesium sulphate and water, 90.0 to 100.0 parts by weight.

16. A magnesia base hardenable plastic composition comprising substantially the following ingredients within and inclusive of the proportions indicated:

	Parts by weight
Calcined magnesite	40–55
Silex	5–10
Asbestos	3–18
Pumice	15–25

and a plasticising solution consisting of magnesium chloride, magnesium sulphate and water, 100–150 parts by weight.

17. A magnesia base hardenable plastic composition comprising substantially the following ingredients within and inclusive of the proportions indicated:

	Parts by weight
Calcined magnesite	45.0 to 48.0
Silex	35.0 to 40.0
Wood flour	3.0 to 4.0
Asbestos	2.0 to 3.2
Talc	6.0 to 9.2
Diatomaceous earth	3.0
Bentonite	0 to 5

and a plasticising solution consisting of magnesium chloride, magnesium sulphate and water, 90.0 to 96.0 parts by weight.

18. A magnesia base hardenable plastic composition comprising substantially the following ingredients within and inclusive of the proportions indicated:

	Parts by weight
Calcined magnesite	45–60
Saw dust	8–12
Wood flour	2–4
Fibre	4–5
Pumice	10–20
Talc	9–10

and a plasticising solution consisting of magnesium chloride, magnesium sulphate and water, 120–130 parts by weight.

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