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A STUDY OF COMPOSITION FLOORING

A Thesis Submitted to the Faculty of
THE MICHIGAN STATE COLLEGE
of
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by
//
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COMPOSITION FLOORING

What it is

Composition flooring is a preparation formed from a combination of magnesite tempered with a chloride solution as the binder. The other materials in the mixture may be asbestos, cork, wood fiber, coloring, sand, or marble. The above ingredients make a floor surface that has a good appearance and is economical, also it requires but a comparatively short time to place it.

Where it is used

Composition flooring makes one of the most excellent types of floor surfaces known for such buildings as hospitals, schools, hotels, and dwelling house kitchens, hallways and bathrooms. Architects have quite generally accepted composition for use in all public buildings and the general public are beginning to demand its use in the place of tile in the modern home. It is not only used for the floor surface itself but is carried up onto the wall for the baseboard. This process eliminates the undesirable crack at the ordinary floor line and gives a floor that is much easier to keep clean. A third use to which it is put is in wainscoting. In many public buildings where this type of floor is used a wainscoting of the composition is carried to a height of approximately six feet, more or less as the case may be. This is of particularly good use in school houses where

children are rubbing their dirty hands along a wall all of the time and consequently soon having a plaster wall looking pretty dirty. In the case of the composition wainscoting being put in, a dark color may be used which will give a good-looking, permanent, and sanitary wall, with a low upkeep. Another very important place to use the composition is in the toilet rooms of public buildings. Due to its fine texture very little water is absorbed in the floor and it is much easier to keep in a sanitary condition. Again, the color which may be used is a valuable asset for such a floor. Store buildings, show rooms, theaters, industrial buildings, banks, etc., are examples of buildings other than those mentioned which offer a good place for composition flooring.

Advantages as advertised

Different companies give slightly different advantages for their respective products. The advantages stated by a couple of companies will be repeated.

First - the Granatile composition flooring advantages as stated by the National Magnesite Stucco Company, of Wyandotte, Michigan. Granatile composition floors are free from cracks, crevices, voids or interstices; they possess a high degree of resiliency and a high erosion-resistance point. They are practically dustfree, fireproof and water resisting, light, economical and attractive.

Second - The Asbestone Composition Floor Company gives the following merits for their floor. It is hygienic, fire-

proof, non-dusting, comfortable, quiet, non-slippery harmonizing in color, adaptable, may be laid over any sub-base, and it is enduring.

It will be noticed that two additional advantages as stated here are that the floor is quiet and non-slippery. Undoubtedly these characteristics and the others as well will appear in any type of the composition floors. The characteristics stated above, if obtained in a floor, would make a floor that would be absolutely uncomparable and the only question is - to what extent are these characteristics obtained in this type of flooring?

Comparison with other types

It would be well at this point to compare the composition floors with the other types. I would first like to show a comparison chart published in a pamphlet put out by the Asbestoloied Products Company of Kalamazoo, Michigan. It will be noticed that it is a very clear and concise chart showing the relative characteristics of several types of floors.

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Key to Abbreviations

App.	Appearance
Cl.	Cleanliness
Qu.	Quietness
Abr.	Abrasion
Res.	Resiliency
Wa.	Warmth
F.P.	Fire Proof Properties
W.P.	Water Proof Properties
G.A.	General Average

Material	App.	Cl.	Qu.	Abr.	Res.	Wa.	F.P.	W.P.	G.A.
Composition	80	100	75	100	90	98	100	90	91.6
Cork tile	85	40	100	95	100	100	0	25	68.1
Wood (maple)	90	35	50	95	90	90	0	25	59.4
Asphalt	0	70	75	95	40	60	0	100	55.0
Wood Block	15	10	75	100	90	90	0	50	53.8
Terrazo	80	90	0	40	4	5	100	100	52.4
Marble	100	85	6	20	3	5	100	90	51.1
Mosaic Tile	85	75	5	40	4	0	100	90	49.9
Concrete	45	90	5	10	1	5	100	100	44.5

According to this rating, composition flooring ranks very high compared with other types, while concrete floors appear at the bottom of the list. Cork tile ranks very favorably with the rest as far as quietness, resiliency and warmth is concerned, but, of course, it is difficult to keep clean and is absolutely not fireproof and makes a very poor

wearing surface.

The Asbestone Company have put out an interesting comparison of six types of floors, and the values for resiliency and durability will be shown here.

Type	Resiliency	Durability
Asbestone	90	70
Tile	4	100
Terrazo	3	95
Linoleum	100	5
Wood	90	50
Cement	1	90

It is interesting at this point to note that Linoleum makes one of the most perfect resilient floors known but so far as durability is concerned, it is no good at all. Here again, the composition has the best average or one of 80 while the next closest is wood, which has an average of 70. However, the main fault with wood has been neglected and that is that it will not stand the water.

As for how the floor wears, the floor in the Clinton County Courthouse was observed. It has been in for a period of about five (5) years and has stood the wear in remarkably fine shape. The floor has had a lot of traffic and shows practically no wear at all, nor were there any cracks other than construction cracks which appeared at the time of setting. Another job observed was that of the corridors and stairs in the St. Joseph Parochial School at St. Johns.

This has been in use for a period of practically two years and there are no signs of wear at all. The floor appeared to be very clean and as people walked over it there was very little noise noticeable. Another good example looked over, was the Everitt school on South Cedar street, Lansing. Here is an excellent example of Composition wainscoting. This job has been in use for a period of about four years and, as far as was noticeable, there was not even a crack in the wainscoting. Outside of a few construction cracks over steampipes the floors were in fine shape. The janitor, who claimed to have been doing that kind of work a good number of years, said that the composition flooring was by far the nicest kind of floor to keep clean and in good shape of any type he had ever worked on. The floor at this place seemed to be giving the very best of satisfaction. It seems to be the general opinion of people who have been using the composition flooring that it is just about the very best thing as far as appearance and general utility is concerned that is on the market.

Method of mixing and applying

The Granatile Composition Flooring is applied in two coats, the bottom and the finish, each coat being one-quarter of an inch in thickness. It is applied directly over a base of wood, steel concrete or tile hence it is equally applicable in either a new or an old structure. Instead of the mixture being tempered with water, a chloride solution is used and the proper consistency of the solution has been found to be

twenty one (21) Baum. Sometimes this proves to be too much, and "Blooming" occurs but this matter will be discussed later. The consistency to which the materials must be mixed is one at which they can easily be worked with a trowel. In the case of a concrete base, it must be left level but rough, in order to secure a good bond. With a wood base, it is a very good idea to roughen it before applying the base coat. The main thing to look out for is to see that a good bond is secured at this point. After the base has been thoroughly prepared and the base coat mixed, the next step is to apply the bottom coat in a layer about one-quarter ($\frac{1}{4}$) of an inch thick and see to it that it is thoroughly troweled down with plenty of pressure on the trowel to secure a first class bond. A steel trowel may be used for the reason that the texture of the material is such that it will leave a surface that is amply rough for the top or wearing coat to bond to. If a proper temperature is maintained, namely about seventy degrees Fahrenheit, the base will require about twenty-four hours to sufficiently set up. However, if the temperature falls much below this, the set will take place much more slowly and, if it is a great deal above it, the mixture is apt to dry out before setting and then cracks are very likely to appear which makes another very serious condition. It is highly important to keep people off from this bottom coat for two reasons: - first, the floor is not made to stand traffic at this point and if used for such is likely to be found full of holes and very uneven; secondly, it would

become very dirty and due to its comparative roughness it is almost impossible to clean and, of course, the top coat could not be expected to bond to a base like that. When the base is properly set up, the top coat may be mixed to its proper consistency and it is best applied in two layers with the bottom layer proceeding only a foot or so in front of the top layer. The bottom layer would be very thin and trowled securely into the base coat in order to secure the proper bond, then enough more is added to bring the thickness of the top layer up to one-quarter of an inch. It will be found necessary to give it a first troweling at this time and then allow it to set some five or six hours before a final troweling can be accomplished. It is highly important in this second troweling to give the surface as smooth a finish as is absolutely possible. A good safe practice is to then protect the floor from any traffic and leave it for twenty four hours. However, in case any markings are to be placed on the floor, as is advisable in the case of large surfaces, it is done at sometime between the first and last troweling, whenever the floor has reached a set so that it may be easily marked.

After a period of forty-eight hours the dressing of the surface may be done. The first step to this is rubbing the floor with steel wool or some such substance in order to remove any stains or dirt spots that may have come on the surface. When this is done ordinary linseed oil is applied and allowed to thoroughly dry in. A coat of some good wood wax is then applied and polished in the ordinary way. It is generally necessary in the case of a new floor to apply a second coat of the wax and rub it down. This gives a floor which is very good looking and is ready for use. It might be well to say at this point that the floor is generally in two colors, a field of one color and a border and base of another. In this case the border with its wall-base is put down first and a special curved trowel is used to form the angle at the base. On the larger floors some type of mesh re-inforcing is used over the sub-base on which to lay the bottom coat of the flooring. If the floor is not too large, ordinary chicken wire will answer the purpose satisfactorily. However, the type generally used is the diamond expanded metal type of reinforcing.

Investigation of properties

The following part of this thesis shall be taken-up with a discussion of tests run to determine to what degree the advertised properties of this type of flooring are true.

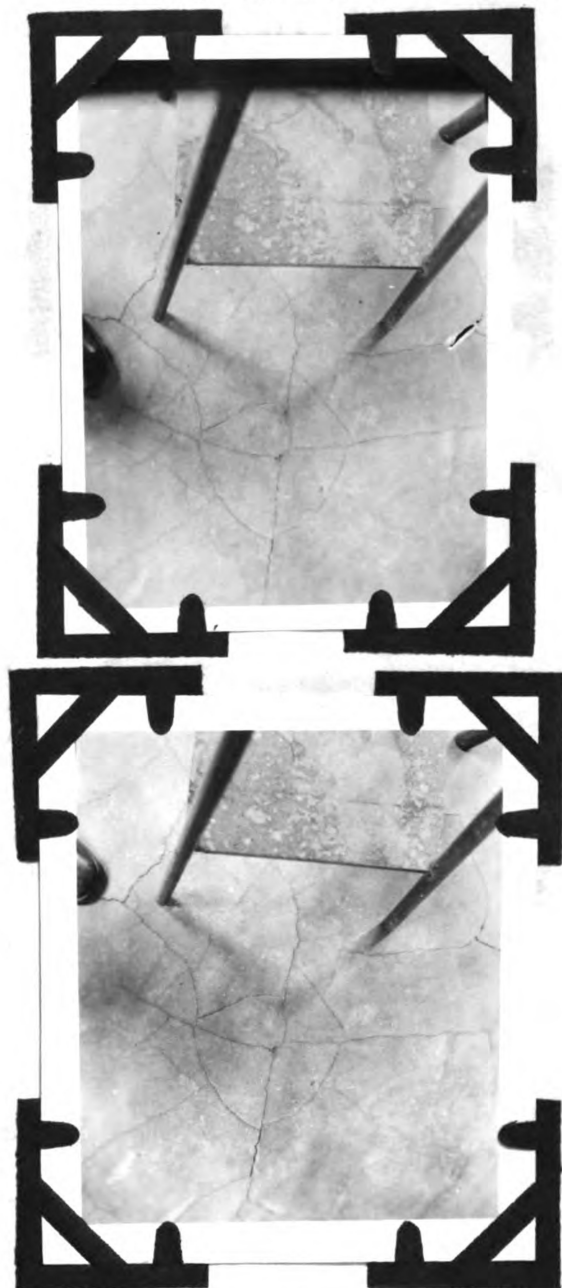
The type of flooring used in this investigation was the Granatile Composition Flooring, manufactured by the National

Magnesite Stucco Company of Wyandotte, Michigan.

Cracking

Cracking was one of the first things that was investigated. Of all of the faults of composition flooring, this one causes the greatest amount of trouble. Cracking often happens with no apparent cause at all. For example, let us look at the picture shown here.

We will notice that there is a perfect net work of cracks. This floor was in a gas station, and it was made up of three rooms. Two of the rooms remained in excellent condition, but the third room cracked up in the manner shown. No reason could be given for the failure. The top, alone, failed and the base coat remained intact. There was no buckling in evidence and all of the cracking seemed to be in the field, the border remaining in good shape. In this particular case the top was ripped off and a new coat applied, leaving the floor in excellent



condition. Another peculiar feature of this failure was that it did not occur until about ten days after the floor was completed, and then it occurred all of a sudden. Such things as this happen occasionally and spoils people's opinion of this type of floor, but the times that the floors have nothing like this happen to them are numerous enough so that it is a great incentive to use them.

One cause of cracking was discovered during the experimenting. A number of soundness specimens were made according to the portland cement standards; that is, a pat about four inches in diameter, a half inch thick at the middle and tapering down to zero thickness at the edges, the whole specimen being in the form of a disc. A number of these were cured in a moist atmosphere at a room temperature of about seventy degrees (70°)



Fahrenheit. These specimens cured in fine shape and stood the soundness test without a sign of a crack or failure showing up at any point. The rest of the specimens were cured above a radiator where the temperature was higher and the air was drier. After twenty four hours these specimens showed a complete net work of cracks around the edges. By careful inspection of the picture a couple of these more prominent

cracks will show up. This cracking is attributed entirely to the fact that the specimen dried out before it had a chance to properly set and develop its strength.

Quantity of voids

The next step was the determination of the quantity of voids. This was carried on in two steps;- the first, was the determination of the quantity of voids in the top coat; and the second, the quantity of voids in the whole floor. For the first part, a box, shown in the picture, was made of the composition and the inner surface was troweled as smooth as possible and dressed down with the oil and the wax. Next, the box was filled with water and allowed to stand for twenty four hours. It was weighed before the operation of filling with water and afterward. The weight while dry was 642.0 gms. and the weight after soaking was 731.3 gms. the difference being 89.3 gms.



or the percentage of voids was determined to be 13.9% for the surface coat of the composition flooring of the Granatile Co. The second test was to determine the percentage of voids in the specimen as a whole, both the vase and the top coat. In this case, a flat specimen was used and soaked in water for a

period of twenty-four hours. The weight while dry was 342 gms., the weight wet was 377.1 gms., the difference being 35.1 gms., and the percentage of voids being 14.5% which seems exceedingly low considering the apparent porosity of the base coat. The chances are that percentage of voids on the surface coat is a little bit high because of the fact that it was impossible to get an absolutely smooth surface and it is believed it was due to the smooth surface along with the oil and wax that makes the top surface so water-proof. Nevertheless, we see that the percentage of voids in the whole floor is very low and the surface is particularly dense.

Resiliency

The third matter looked into was the question of resiliency. Here, considerable difficulty was encountered and the results obtained were of no value. The reason was, that with the small specimens dealt with, it was nearly impossible to get the flooring on such a base that the resiliency obtained was due entirely to the flooring but also to the material used as the base. The only good way to test this property is to go to the actual floor and test it by the method of dropping steel balls of known resiliency and obtaining their rebound. Laying aside the unreliable results obtained from the experimenting, we will consider only the results published by a couple of the companies and what could be learned by talking with people using the flooring. Perhaps the best comparisons of resiliency of different floors can be had from the charts as shown in the fore part of this discussion.

Let us first look at the values of resiliency as shown in the chart of the Asbestoloid Products Company. The values given are simply comparative values of the different types and (100) does not necessarily mean perfect resiliency but simply the resiliency that seems to be the best at this time, while the other values are simply comparative values with this best type.

table

<u>type</u>	<u>resiliency</u>
composition	90
cork tile	100
wood (maple)	90
asphalt	60
wood block	90
terrazo	4
marble	3
mosaic tile	4
concrete	1

This table seems to show pretty clearly just how the different floors rank according to this particular property. Of course, every one has always said that a wood floor was the easiest thing to walk on and, as far as comfort is concerned, it has always been the only floor considered. However in the present age of construction, where everyone is striving to get only fireproof materials in the job, people are looking for a floor that is fireproof and still as easy to walk on as the old wood floor. Composition flooring seems to have solved this particular problem, at least from

this one angle. We may also be interested in noticing that the concrete floor seems to be the poorest construction of all. This also checks up in pretty good shape with experience, for nearly everyone in the construction field has seen and heard women throw up their hands and moan when any one mentions putting a concrete floor in a kitchen or dining room in which they may have to work. The concrete seems to tire a persons legs out about the quickest of any type of floor known.

The chart shown by the Asbestone Company seems to check pretty closely with the Asbestoloied Chart only in this case we get one other common type of floor shown.

table

<u>type</u>	<u>resiliency</u>
Asbestone	90
tile	4
terrazo	3
linoleum	100
wood	90
cement	1

Linoleum seems to be another type of flooring that possesses the maximum amount of resiliency, but it has many bad features that are holding it down, the main one of which is durability.

In inquiring around as to how people who use the floor like it, it was found that every one seems to think that it is one of the easiest floors to walk on that they have ever used, and resiliency is nothing more than the ease with which

people can walk on the floors without tiring themselves out.

Wearing properties

The fourth quality, namely, wearing is another hard thing to get at very accurately. This was arrived at in two ways;- the first, was to rub a specimen with some coarse sandpaper to see the effect on it. This was tried and it was found out that it would take a lot of hard rubbing in order to wear the surface enough to be noticed. The second method, was to observe several floors to see how they were standing up under use. In this case we were unable to find out the types of floors used other than that they were composition floors. All of the jobs examined have been in use for a period of from three to five years and in only one was there any signs of wear at all. This was at the Everitt school located south of Lansing on Cedar Street. In this case, there is a playground on the outside apparently covered with cinders. The children would naturally track in a number of these cinders and then the small pieces would be walked on and ground into the floor. This has resulted in the surface being covered with little holes about the size of a pin head. The surface as a whole, has not worn down apparently but the appearance of it has been impaired considerable. This floor has been in use, I believe, for four years. A general idea of the wearing qualities can be obtained from the Asbestoloid Company's chart under the column head of abrasion. This rates the composition as standing one hundred percent abrasion.

Dustfreeness

Composition flooring is also advertised as being structurally dustfree. This would mean that the surface was dense and that each individual particle was well cemented to the whole. To get at this property, we looked at several specimens under the lense of a microscope. This showed the surface to be very dense and as far as could be seen it certainly was dust-free structurally. Of course, the specimen with the wax coat seemed to be much more dense than the other one. The wax had filled up the small holes. Now with such a smooth surface, it seems almost impossible for any dirt to lodge, and any dirt settling on it could be easily wiped off, leaving a clean and sanitary floor.

Fireproof properties

Stating that composition flooring is fireproof, seems to be putting it rather strongly. It would be much better statement if it were worded fire-resisting. Both sections of the floor were tried out separately in this test and both were discovered to be harmed considerably although they did not burn themselves. It is strange to say that the base coat with its high percentage of wood fiber was the part that seemed to stand the fire the best. In performing this test a piece of the base which had been molded in an ordinary cup was used and it was put over a gas flame for about three quarters of an hour. One of the things observed was its loss in

weight. Before burning, it weighed 253.5 gms.; after burning it weighed 188.3 gms., or a loss of weight of 65.2 gms. occurred during the burning. This amounts to a matter of 25.75% loss in weight. Undoubtedly some of this was due to evaporation of water but it seems unreasonable to presume that it was all due to this, for the specimen had been drying out for a period of two weeks after its setting. As for the appearance of the specimen after the test, the edges were burned to the crumbling point and the surface seemed to be soft but as a whole the specimen seemed to be very solid and it took considerable pounding in order to break it. Upon breaking it and looking at a cross section of it, it was discovered that the fire had effected it to a depth of nearly an inch. The effect appeared to be in color only, for the material had been apparently charred to this depth and the strength did not seem to be materially effected.

In the case of the burning of the top coat, some very peculiar things took place. An ordinary standard tention specimen was put in the gas flame for about three quarters of an hour. The color of the top used was a buff; After the burning, the color had changed to a pale red on one side and that nearest the flame to a light yellow. The surface was so soft that you could stick your finger nail into it with ease. Upon breaking the specimen, it was found that about an eighth of an inch under the surface this color changed to a dark gray but this also was soft. With these results it is plainly seen, that, though the flooring will not burn itself that it

will be completely destroyed in case a very severe heat came over it and thus the best that can be said for it is that it is fire-resisting.

Soundness

Several soundness pats were put through the standard steam test of six hours and they came out in excellent shape. There was no curling of the edges nor was there any cracks. One of the pats was removed from the glass before putting it in the boiler and even that one showed no signs of warping, so it is safe to say that composition will stand the soundness as good as any flooring material that is known.

Tensile stress

The next step was the examining of the tensile strength of the material. In this case specimens were prepared with the top alone, with the base alone, and with the top and the base together. Below are the tabulated results.

Specimens of the top coat

#1-- a wet mix--	tensile strength in #	per sq. in.	390
#2----			455
#3-- normal mix--			390
#4----			385

By a normal mix, we mean a mix of such consistency that it is just easily trowled. By a wet mix, we mean a consistency such that the mix is sloppy. All tests were made after a period of seven days. The values of composition tensile

strength after a period of seven days are quite considerably higher than those of cement after a similiar period but this experimentation has not gone into tests for a longer period and we do not know how much strength the flooring would gain after a longer period of time of, say, twenty one days.

The cross section of the specimen shows up the grains of silica sand and this is the only place that the sand seems to show up at any time. A cross section will occasionally show a little white spot that is apparently a little bit of chloride that has settled in a pocket leaving a soft spot, but these spots are so small that they will do no harm. The only difficulty of these are that they help to furnish the surplus chloride which causes "blooming".

Specimens of the bottom coat.

#1----	tensile strength per square inch in lbs.	230
#2----		260
#3----		230
#4----		245

Of course the tensile strength runs much lower in the base than in the wearing surface as is to be expected because of the fact that the base is made up of a much looser construction and more yielding materials. The way the break took place in these particular specimens was of a peculiar nature. They pulled apart in a sort of a slow and easy way indicating that they had reached a yield point before they came to the breaking point and the material after this yield point had been reached was more or less elastic, and it is due to this

quality, it is believed that the base coat does not show up cracks as readily as does the wearing coat.

Now to consider the combination of the two coats, the following data is more or less surprising in the strengths that are shown. There seems to be no appreciable increase in strength over the base coat.

table

specimens of both bottom and top coat

#1----	tensil strength in lbs. per sq. in.	270
#3----		220
#3----		260

The picture below shows one of the ordinary tension specimens made up of the base and the top coats.



Setting properties

It is difficult to give any very definite data on the question of how long it takes for composition to set up. The time of set depends very much on the temperature of the room in which the floor is being laid. If it is in the winter and the temperature is down around fifty degrees, setting will take place very slowly indeed. It may take as high as eight or ten hours before the material will set hard enough so that a final troweling may be successfully done. On the other hand, if the room is warm the setting will take place much faster and it may be that the final troweling can be done in a period of from two to three hours. However, it is advised that the floor be laid in a temperature of about seventy degrees and at this temperature it takes about five hours for the composition to become set and sometimes even less than that. After the initial set has once taken place, the final set follows comparatively rapidly and after a period of forty-eight hours the floor is all ready for use, following, of course the oiling and waxing. The above discussion applies to the surface or wearing coat. The bottom coat sets up in very much the same manner and speed. The top surface should not be laid until the bottom seems to be hard and apparently dry. Under conditions of cool temperature this bottom coat sets much more slowly than the top, and even after a period of twenty-four hours, the layer is soft enough that one may easily push his fingernail into the surface.

General consistency

It is scarcely fair to say anything here about the consistency of the material to obtain the best results for the reason that enough experimenting was not carried on to justify any conclusions. It will be remembered that a few of the tension specimens were made at a different consistency and the values given did not vary appreciably, however, there were not enough of these tests made to draw any definite conclusions. The company advises a consistency that is just sufficient in order to make a good workable mortar and this seems like pretty good advise. At this consistency, the material can be worked much more quickly and economically and, better than that, it will set up much more quickly. It is a certain fact that it could not be put in any drier than this advised consistency for the reason that a good dense finish could not be obtained and that is one of the desirable features of this floor. It may be that after experimentation it would be shown that the wet mix would give a stronger mortar or that some other unknown features would be shown up, but it is certain that it would be more difficult to lay the floor and for this reason would probably never prove to be practical. However, it is a field that might profitably be looked into.

Chemical Contents

The various companies are very tenacious in keeping their chemical analysis's or in giving any of the formulae for the making of the flooring, which is perfectly logical and just proceeding, but we were able to get the general materials and

their percentages. Below are shown two outlines. The first is of the cheaper variety of composition and it will be noticed that it is low in magnesite. In the case of the second type, the percentage of magnesite has been doubled. Composition flooring is fundamentally a matter of magnesite mixed with a quantity of chloride to give it its setting properties. The chloride is always added in the mixing solution.

outline #1

magnesite-----	20%
asbestos-----	5%
georgia marble-----	30%
wood fiber-----	2%
color-----	5% (variable)
silica sand-----	<u>38%</u>
total	100%

outline #2

magnesite-----	40%
asbestos-----	5%
cork-----	15%
color-----	5%
silica sand-----	<u>35%</u>
total	100%

The asbestos is added to give the fireproof qualities to the mixture; the cork, in order to give the required resiliency. The cork can be changed to a wood fiber with practically the same results. The purpose of the color is quite obvious and

the silica sand is used simply as a filler, and gives a good wearing property to the floor. It is probably well worth while in buying the composition flooring to pick out some type that has a high value of magnesite even though it costs the higher price because the satisfaction gained from the results will be enough to amply repay the user.

General adaptability.

Composition flooring has a few outstanding characteristics that make it a most adaptable floor for many important buildings. For instance, its sanitary properties and its quietness make it most useful for hospital purposes. Then, the same qualities accompanied with its good wearing properties, make it an excellent type for use in the public schools. The colors of the floor are highly advantageous in making it a generally adaptable floor, for everyone wants a good looking floor as well as a practical one from the standpoint of general utility. Then, too, there is a great field for composition in public buildings such as libraries, churches, courthouses, auditoriums, etc. In these places a quiet floor is needed and also one that is easily kept clean. Probably one of the biggest fields opened up to the small contractor, is the place composition is taking in the ordinary home. Here this type of floor is being used for kitchens, halls, bathrooms and in some cases inclosed porches, and even for tops of work tables. In use in such places the floors can be waxed sufficiently to give them a very lusterful polish and at once please the eye and the mind. There has been some objection offered to its use in the

kitchen for the reason, that in cooking, grease spatters around on the floor and every grease spot will show up very plainly and is very difficult to remove. In this case it would probably be best to use a dark colored floor or in the cleaning of it to use steel wool or sandpaper, Better still, protect the floor around the area of the stove where the grease is apt to discolor it.

The third section of this thesis will be taken up with a discussion of a few of the common troubles to be encountered in the laying of this floor and in the ways that they can be best solved with our present knowledge.

"blooming"

Many times when a floor has been laid and it seems to be smooth and free from any signs of cracks or other such defects we hear the objection that the floor is spotted and not of a good even color. These spots will be of a light color and will not always appear all over the floor but in certain sections. Sometimes, they will be little spots and many of them, sometimes a considerable area will appear to be of this lighter color and the effect will be far from pleasing to the eye. This particular feature is known as "blooming" or sometimes as "flowering", due to its characteristic of appearing on the floor in the shape of crude flowers. The only immediate cure for this defect, if it is wanted removed, is to paint the floor and this, naturally, is not what is desired on this type of surface and people are apt to become discouraged. The cause

of this action is that a little too much chloride has been used with this particular magnesite and it is not all used up. Gradually it works to the surface and shows up in these spots. If one will but have patience this blooming will disappear in the course of time. Usually it will not take more than a period of two years and after that the floor will assume its natural color and be perfectly clear. It is best to wait for this process to take care of itself and not try to apply the paint.

Cracking

Cracking is the fault that probably causes more trouble than anything else with the composition flooring, and in many cases the cause of it can not be determined. Below we are listing some of the causes that are known to cause difficulty but there are evidently some other causes of which we know nothing whatever. One bad thing is the use of unseasoned wood for a subbase. If this is done the wood will gradually dry out and shrink causing a tension to be thrown into the floor and thus cracking it. Another very common cause is the laying of the top course on the base when it is very dry. This draws the chloride solution out of the top and causes it to dry out before it sets and thus will check badly. A third cause of cracking is the running of steam or other heat thru the heating pipes while the material is setting. This causes a portion of the floor to become much warmer than the rest and thus set faster, causing cracks. These cracks are usually confined to straight ones running along parallel to the buried heating pipe. A fourth reason for cracking is one that has al-

ready been stated elsewhere and that is the laying of the floor in a room that is too hot and dry.

As for guarding against some of these difficulties it is best to use plain common sense. For instance, in the case of the subbase it is extremely wise to use some wood that has been properly seasoned or better yet, use a cement for this purpose. In case a wooden subbase is used, it has been suggested that some common wrapping paper be spread onto the wood and tacked down, then an expansion or contraction of the subbase would not necessarily pull the surface with it, on account of the broken bond. (It is believed that some experimenting is being done on this at the present time.) In the case of the base being too dry, it can easily be fixed by sprinkling a little water or perhaps the chloride solution around on it before applying the surface coat and this will destroy the tendency of the base to draw the moisture out of the top. Care must be taken, however, not to soak the base coat too much as this would cause a slow set to take place and perhaps harm the bond between the two coats. In case of steam pipes running thru the subbase it is undoubtedly best to shut off the heat before laying the floor so that an even temperature may be maintained throughout the whole surface. Then, too, is the all important question of maintaining a proper temperature in the room, namely about seventy degrees Fahrenheit.

Dressing of the Surface

In the matter of dressing the surface, there are just a couple of points that need watching. The first is not to use too much oil for the reason that if too heavy a coat of oil is used it will take too long for it to dry in. It is believed

that one of the best ways to apply it is to pore a little onto the floor and with the use of a rag spread it around so that it completely covers the floor but does not stand on it anywhere.

The second point is not to use too much wax. Usually a new floor will require two coats of wax to bring it to a good surface, but care must be taken to make the second coat a light one. This is the reason;- if too heavy a coat of wax is over the floor it is very easily spotted up. For instance, if a drop of water should get on the floor by the time it had evaporated a little white spot will be left and about the only way to get rid of it is to re-oil that section of the floor and re-wax it and do a lot of strong rubbing or it might even be necessary to remove the wax all over the floor before a new coat could be applied and the spot cleaned out. It was found out during the experimentation that if some fine sandpaper is rubbed on the floor sufficiently that it will give a first class polish and in this case only a very light coat of wax would need be applied over the oil in order to have a very good looking floor and one that would not be easily spotted up. It is absolutely believed that this latter method is much the better method of dressing the composition flooring in any place. The oil used in this operation is the common linseed oil and the wax used may be any of the good types of floor wax now on the market for use on wood floors either in the liquid form or in the paste form although it is much handier to use that in the liquid form.

Keeping the floor clean

One of the worst troubles in keeping the floor clean is

the removing of the wax spots and this has just been discussed in the topic above called Dressing of the Surface and need not be repeated. The other matter to be looked after is the dirt that appears from the ordinary traffic and from grease spots. First in cleaning such a floor, it is necessary to mop it as any floor would be mopped and remove any of the loose dirt. After the floor is dry, if there are any other spots left a little gasoline may remove them. If they go too deep for that and still appear the only remaining thing to do is to use the steel wool or sandpaper thoroughly and after this is done a new coat of oil and then wax may be very profitably employed. This more thorough cleaning should not be necessary very often and the ordinary mopping should take care of it in ordinary conditions. It would be advisable, however, to use some small piece of linoleum or other carpet near the stove where grease is apt to spatter on the floor, if it is a kitchen floor under consideration.

Trouble from the base

It is sufficient here to simply remind the reader that this is one of the troubles that causes cracking of the floor and it is the one that causes the most troublesome cracks. The way to treat this difficulty has been discussed under the topic of cracking. It should be remembered that trouble may arise either from the base or from the sub-base and it will well pay the builder to see that the proper steps have been taken when these two important parts of the floor are laid.

Following are three other pictures which are typical of composition flooring



a section thru the floor
showing two layers.



a piece of the base coat.
note the porosity.



a section broken from the
floor noted in the first
part of this discussion.

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