

NONSTRUCTURAL MATERIALS
USED IN SCHOOL SHOP BUILDINGS

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By

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INTRODUCTION

In keeping with the times, the shop departments in high schools are expanding. Also the number of high schools in which shopwork courses are offered is increasing. However, due to crowded conditions or other causes, many high schools will be required to expand their present facilities by building additions to the present building or constructing new buildings apart from the main buildings.

Reasons for Study. In anticipation of these new structures being built, this research project has been conducted to secure information concerning new building materials used in modern shop building construction. Several new materials which were developed during the late war, are now available for general use.

Methods of Research Used. In order to secure the information desired, form letters (see copy in Appendix) were sent to eighty-five of the leading manufacturers and distributors of the special building materials which could be used in shop building construction. This letter requested catalogues, bulletins, pamphlets, samples and other descriptive materials concerning their products. Replies were received from nearly all of the companies, to which letters were sent.

Results of the Study. It was found that several materials are available now for general use, which were developed during or following the late war. Several materials which were used before the war were greatly improved by research conducted during the war. New acoustical materials, which have recently been developed, will greatly decrease the noise which is so common in

school shops. Color systems have been developed to improve lighting conditions and make industrial plants, schools, factories, etc. more pleasant places to work. Glass-block masonry is rapidly coming into use. This material probably would be very suitable in school shop buildings. The items just mentioned, are probably the most improved of the building materials, but they are not the only ones discussed in this report.

Delimitations. This study does not include the basic building materials such as brick or stone, electrical wiring and lighting, plumbing, roofing and shop equipment.

The manufacturers and distributors listed in the appendixes are the ones from which materials were received. This list does not include all of the companies which have building materials for sale, neither does it list all of the materials handled by the companies. The materials listed are probably the ones best suited for use in shop building construction.

CHAPTER I

FLOORS

There are several different types of floor construction which could be used in shop construction. Wood floor on wood joists is the most common form of floor construction used in non-fireproof buildings. Other types are, heavy wood sub-floor on wood or steel beams, concrete slabs on light steel joists, reinforced-concrete flat-slab construction, reinforced ribbed slabs supported by steel beams, hollow clay-tile arches supported by steel beams and brick arches supported by steel beams.

Preliminary Construction

Where the floor is below ground or on ground level, the ground will have to be free from water. Where the ground is not free from water, an effective drainage system should be installed. One such system can be made with drain tile or sewer tile laid with open joints and leading to a sewer or drain to conduct the water away. A layer of crushed rock, gravel, or cinders are placed under the base to allow the water to get to the drains. Where the ground does not contain water, a layer of crushed rock or gravel should be used to keep dampness from the ground reaching the base by capillary action. A layer of asphaltic felt laid on the crushed rock or gravel will assist in making a dry floor if a concrete base is used.

When selecting the type of floor construction to use, Huntington¹ recommends that the following factors be taken into consider-

¹ Whitney C. Huntington, Building Construction, p. 479

ation:

- a. General type of construction used in the building.
- b. Plan of building.
- c. Floor loads.
- d. Resistance to fire.
- e. Ceiling; flat or exposed beams.
- f. Direct cost.
- g. Indirect cost; effect of weight and thickness.
- h. Floor covering.
- i. Position of floor; ground floor or above ground.
- j. Use of building.

Selection of a Wearing Surface

The selection of the material to be used on the wearing surface of a floor is an important factor, at the same time, a very difficult one. The appearance, usefulness and cost of a building are greatly affected by the type of floor used. It is difficult to devise a basis for selection of a floor surface. The manufactured floors, such as tile, linoleum and rubber will show less variation in quality than such floors as terrazzo, concrete and magnesite composition which are manufactured on the job. Properties which should be considered will be discussed here:

Appearance. The attractiveness of the material, its color range, texture and its decorative value in an architectural sense. There are several floor surfaces which are attractive such as hardwood when properly finished, terrazzo, clay tile, marble and to a lesser degree, rubber tile, cork tile, linoleum tile, asphalt tile and composition. Concrete and industrial wood blocks are not very attractive without special treatment, however, this is rather difficult where this flooring is normally used.

Durability. Factors to be considered include the resistance to wear, temperature, humidity changes, decay, and disintegration; and the adhesion of the material to its base. The most durable

materials for foot traffic are clay tile, terrazzo, slate and concrete. Hardwood, cork carpet, cork tile, asphalt tile, magnesite composition and asphalt mastic are fairly satisfactory. Concrete is the most satisfactory for heavy traffic.

Comfort Under Foot. The shock-absorbing qualities, sure-footedness, evenness of surface and heat conductivity are required for a comfortable floor. A floor which will conduct heat readily and will not always feel cold is essential for comfort under foot. Cork carpet, cork tile and rubber are probably the most comfortable floors on which the worker is required to walk or stand. Wood and asphalt tile are very satisfactory, while concrete, brick, clay tile and the like are tiresome on which to work.

Noiselessness. Cork, cork carpet and rubber are practically noiseless; wood, asphalt tile and mastic tile are less satisfactory, but still very good. Concrete, brick, marble and the materials in this class are the noisiest.

Fire Resistance. Many materials may be non-combustible, but still suffer severely in case of fire. Concrete, clay tile and brick are the most fire-resistant surfaces. Asphalt tile and mastic will not burn, but may suffer in a fire. Wood, cork and rubber are combustible, but if laid on a fire-resistant surface, are not considered as a serious defect in a fireproof building.

Sanitation. A floor that is hard to clean or has open joints is not considered very sanitary. The best surfaces for this purpose are marble, slate, clay tile and terrazzo. The asphalt and mastic tiles and rubber are fairly satisfactory.

Acid and Alkali Resistance. Immunity from damage by occasional spillings of strong acid solution and to the continuous use of

soap, lye, cleaning and scouring compounds, and disinfectants must be considered. Clay tile is the most satisfactory in this respect. Asphalt mastic is quite resistant for ordinary purposes.

Grease and Oil Resistance. Clay tile will not absorb this material nor does it affect it. Concrete, wood, brick, terrazzo, linoleum and cork will absorb greases and oil, but they have no serious effect on them other than appearance. Rubber and asphalt floors are seriously damaged by oils and greases, with the exception of one form of "grease-proof" asphalt tile.

Dampness. Clay tile, concrete, brick, terrazzo and asphalt tile are not affected by dampness. Wood, cork and rubber should not be used where there is a possibility that they will be damp.

Indentation. Hard flooring materials such as concrete, brick, marble, clay tile and terrazzo do not suffer indentation from chair legs, heels or shoes, or other objects which rest on them or strike them. Maple and oak flooring yield very little and do not retain imprints after the weight is removed. Asphalt and mastic tile may become permanently indented, while most other materials will dent, but will recover when the load is removed.

Trucking. Three factors are to be considered here, the abrasive action of the truck wheels, the tractive effort required to pull the truck must not be excessive, and the floor should have structural resistance sufficient to carry the load. Concrete, heavy maple flooring and industrial wood blocks stand up well in all three respects. Other types of flooring surfaces do not stand up too well to the wheels of a loaded truck.

Maintenance. The ease with which a floor can be cleaned, the necessity for repairs and the cost of such operations are all con-

sidered in the maintenance of a floor. Tile, marble, terrazzo, slate and rubber tile floors are easily cleaned and require very little care. Asphalt tile and wood are fairly easy to clean and require surface treatment. Concrete is not easy to clean if not painted. The monolithic floors, such as terrazzo, magnesite composition and concrete are difficult to repair satisfactorily, but floors composed of separate units, such as tile, are fairly easy to repair by a skilled mechanic. Cork and cork carpet are easily repaired. Maintenance cost of wood block, asphalt mastic, brick and concrete are relatively low except under extremely severe conditions.

Initial Cost. One of the first factors to consider when purchasing a floor surface is the cost, but even the most expensive materials do not possess all the features which are considered desirable.

Weight. Avoid the use of materials which require dead weight, which in turn require heavier construction to support it if it is above the ground floor. Clay tile, marble, and slate are sometimes bedded on 1/2 inch or more of cement which has no structural value. Cork tile, asphalt tile and the like require very little of this additional material.

Kinds of Flooring Surfaces

Several materials are used for floor surfaces, however, they are not all recommended for use in school shops. At the present time, wood and concrete are used on more shop floors, and are probably more durable than any of the other materials. Asphalt tile is being highly recommended for use on industrial floors. This material, laid on a solid base, would be very satisfactory

in shops and drafting rooms where the traffic is not too severe. The different kinds of floor surfaces will be discussed separately.

Wood. Several types of wood flooring are available from manufacturers of wood flooring. (see Appendix A) However, it is believed that the industrial wood block flooring or the strip flooring would be more satisfactory for shop floors. The industrial wood block flooring consists of blocks cut in lengths of 3 inch to 4 inch forming blocks, which are set with the end grain exposed to wear. The Jennison-Wright Corporation (see Appendix A, item 3) manufactures a wood block flooring which is widely used in school shops throughout the country. The blocks are bonded together by galvanized steel wire trusses and splines tightly embedded into their sides. This flooring can be finished natural, just like any other wood floor.

Strip flooring is the most common type of flooring consisting of long narrow pieces or strips with tongue-and-groove joints along the sides and usually across the ends, generally called matched flooring. For shops, where trucks will be run over the floors, strip flooring should be 1-1/4 to 2 inches thick. This flooring is made without tongue-and-grooves, but instead, this flooring has grooves cut across the ends in which a metal spline is inserted. This spline is 10 feet in length and designed to hold the strips together and in place.

Wood flooring may be nailed to wood joist through a sub-floor. Nailing strips are sometimes provided on concrete floor slabs. These strips are usually embedded in the concrete. Wood blocks are usually cemented down to the sub-floor, also short pieces of

strip flooring are sometimes cemented to concrete floors. An asphalt mastic is the substance used for this cement, it is divided into two types, hot mastic and cold mastic. Hot mastic is changed to a liquid by heat while cold mastic is changed to a liquid by adding solvent.

Strip, plank, parquet flooring and fabricated wood blocks are available in such hardwoods as white and red oak, maple, beech, birch and walnut. The oak may be plain or quarter sawed. Strip flooring is also available in the soft woods; fir, yellow pine, white pine and cypress, but only edge grain should be used except in the cheapest construction. Industrial wood blocks usually are made from yellow pine or redwood. Most any size can be ordered from the companies who manufacture flooring.

Wood floors are warm and elastic and are not so tiresome to people standing on them. They are durable and clean if proper care is taken of them. They are considered fairly safe if placed on a good fire-resistant base. Wood floors should not be laid until all the concrete and plaster work is completed and the building has a chance to dry out. Special care should be taken, if wood is to be laid over cement, that the cement be dry. An asphalt mastic damp-proofing layer should be between the wood and cement.

Concrete. Concrete wearing surfaces are used widely where the structural part of the floor is of concrete. The wearing surface may be an integral part of the construction beneath, or it may be added as a separate layer. Cement wearing surfaces or topping must be carefully laid, using a minimum amount of water and troweling as little as possible. Concrete floors are usually

allowed to dry out for at least ten days. Excess troweling will bring the excess water to the surface, causing hair cracks to form and the floor to give off dust which is objectionable.

Concrete surfaces may be painted, but are not usually satisfactory unless wear on them is small or they can be repainted often. A cement colored paint will show wear less, but it is not always satisfactory. A mineral pigment is available which can be mixed with the top layer of cement to color it the desired color. This pigment weakens the strength of the cement to a small degree, but is more satisfactory than paint.

Cement floors are widely used in school shops, but they are not too popular among the teachers because they are inelastic, cold and fatiguing to the worker. The percentage of broken or damaged tools, which are dropped on concrete floors, is higher than on some of the other more resilient types of floors. However, cement floors are durable if well constructed, easily cleaned, and relatively inexpensive.

Terrazzo. Wearing surfaces of terrazzo are constructed in a similar manner to concrete wearing surfaces, but a special aggregate of marble chips or other decorative material is always used. This aggregate is exposed by grinding the surface. Huntington² recommends that:

The mortar-base course should be at least 1-1/4 inches thick and should be composed of one part Portland cement and four parts of sand with only enough water to produce a mortar of the stiffest consistence that can be struck off accurately with a straight edge.

The terrazzo mixture usually consists of one part of gray,

² Ibid, p. 489.

white or colored cement, to not more than two parts by weight of marble chips, other decorative aggregate or abrasive aggregate, or such a mixture of any of these as is desired. The amount of water should be limited to just enough to produce a workable plastic mix. Wet mixtures do not give good results and any special coloring matter should be mineral pigments.

The terrazzo mixture is spread over the mortar base as soon as the base is hard enough to stand rolling. It should be rolled in all directions, then floated and troweled. When the terrazzo is hard enough, it is then ground.

Terrazzo floors are more expensive than concrete and less expensive than tile or marble. This type of floor is attractive and durable, but inelastic and cold. The greatest objection to terrazzo floors is their tendency to crack.

Magnesite Composition. In general, this type of floor consists of a dry mixture of magnesium oxide, asbestos or other inert material and a pigment to which liquid magnesium chloride is added on the job to form a plastic material which is troweled to a smooth finish and sets hard in a few hours.

Magnesite flooring may be applied over a sub-floor, is comfortable to work on and is not as noisy as clay tile, terrazzo and marble, but is less durable than these floors. It is easy to clean and is fire-resistant. The Thos. Moulding Floor Manufacturing Company (see Appendix A, item 11) makes a "spark-proof" magnesite flooring that was widely used during the war in ammunition depots.

Clay Tile. Clay tile is made by burning special clays or mixtures of clays which have been pressed into the desired shape.

Tile of this type are usually set in Portland cement mortar when used on the interior of the building.

Clay tile may be glazed or unglazed and the type used would be governed by the place it is used. Where the traffic is heavy, unglazed tile is more suitable. Clay tile is available in a number of shapes, sizes, colors and patterns.

Cork. Cork flooring may be obtained in two forms, cork carpet and cork tile. Cork carpet is laid similar to linoleum, but is less durable. It makes a very quiet floor covering and is more elastic and more absorbent than linoleum. It is not suitable where the floor is subjected to heavy traffic.

Cork tile are made from pure cork shavings compressed and baked in molds. The natural resins in the cork bind the particles together. David E. Kennedy, Inc. (see Appendix A, item 7) manufactures a cork tile 5/16 or 1/2 inch thick. This tile is sanded at the factory and a waxed finish is impregnated in the surface.

Cork tile have a non-slip surface and their soft surface causes less vibration when walked on. It is comfortable to walk on and stand on. However, cork does not stand up well to trucking or heavy traffic. It would probably be a good quiet floor surface for the drafting room or offices. Colors that are available are limited to shades of brown.

Rubber. Flooring surfaces are made of pure rubber, combined at high temperatures with fillers. These fillers are usually fibers and the desired color pigment. This type of flooring is cemented to concrete or wood sub-floors. Rubber tile are attractive, elastic, noiseless, durable and easily cleaned, but they are expensive. Most rubber floors are not resistant to oil,

grease, gasoline or fire and should not be used on floors in contact with the ground. However, the Taylor Manufacturing Company (see Appendix A, item 10) makes a rubber tile that is advertised to be highly resistant to ink, acids, grease and burns and their rubber content promotes greater flexibility, durability and prevention of cracking and chipping.

Asphalt Tile. This flooring is made from asphalt, asbestos fibers, mineral pigments and inert fillers by amalgamating under heat and pressure. Asphalt tile are made by a number of different manufacturers (see Appendix A) under their own trade names. Johns-Manville (see Appendix A, item 8) makes an asphalt tile that is recommended for industrial use because it provides an excellent solution to the dust problem. Their resilient qualities reduce foot fatigue and breakage and damage of articles that may be accidentally dropped on the floor. The tile for industrial use are available in thicknesses from 1/4 to 1/3 inches, and are usually black or mahogany in color.

Asphalt tile are resistant, non-absorbent, reasonably stain-proof and acid-proof. This type of floor is laid over wood or cement sub-floor. It is inexpensive and attractive, but only the special "grease-proof" is resistant to greases and oil. However, almost all companies make a "grease-proof" tile which they recommend for floors that are likely to come in contact with grease and oil.

Asphalt Mastic. Mastic is another type of asphalt flooring that may be obtained in two types, heavy asphalt mastic and light asphalt mastic. The heavy asphalt mastic floor consists of natural asphalt, crushed rock and a fine aggregate of sand or crushed

rock. These different materials are mixed hot and laid in continuous sheets or pressed into blocks. This type is designed for industrial use. It is elastic, dustless, durable, water-proof and acid-proof.

Light asphalt mastic flooring, composed of asphalt fluxed with mineral oil and mixed with an inert material and pigment, is usually placed cold in four or five coats over a wood or cement base. It is suitable for floors where the traffic is very heavy and should not be used where it will be subjected to oil or grease and heavy trucking.

At the present time, concrete and hardwood floors are the most common. In a few shops, an industrial asphalt tile is being installed, which should prove satisfactory. For the woodworking shops, the edge-grain maple is highly recommended. For the metal-working shops, concrete is probably still the best, even though it is hard and tiresome underfoot.

CHAPTER II

ACOUSTICAL CEILINGS

The school shop is always a noisy place and whether it is part of the main buildings or separate from the main structures, it is disturbing to the students in other classes as well as students in the shop classes. Since there are a number of manufacturers who make sound control products, it is believed that the new shop or the remodeled shop should have an acoustical ceiling.

The Theory of Acoustics

The science of acoustics is far too technical to be treated at length here. However, a simple understanding of the causes of noise and bad hearing conditions is necessary before attempting a discussion of the ways and means of correcting them.

Sound is a form of energy created by anything that is vibrating. Machines in operation, human speech, explosions and impacts of all kinds produce sound waves. Noise is sound which is generally considered discordant, confused or otherwise disturbing. When sound waves strike a smooth surface such as plaster, about ninety-seven per cent of it is reflected. This means that the sound must be re-reflected several times between the ceiling and floor and walls, before this energy is used up.

Noise causes many people to suffer from jumpy nerves, poor digestion, partial or total deafness and undue fatigue. Reducing the noise helps prevent accidents, since noise causes distraction which can very easily prevent persons from sensing danger in time to avert it.

Acoustical Materials

Acoustical ceilings are made from several materials, all of which would be satisfactory in shop buildings. Some of these materials are rated as incombustible while others are not. Both will be discussed here, but if funds are available, only the fire-resistant materials should be used. Several acoustical materials used for ceilings will be discussed separately.

Wood Fibers. Most of the companies, from which bulletins were received, make acoustical tile from wood fibers and a binder under some special fabrication process. Tile made from wood fibers are a mass of intercommunicating channels that tend to smother sound waves. This tile is light weight, durable and permanent. Wood fibers are usually rated as combustible and may be cemented to plaster or plaster board or nailed to wood furring. The National Gypsum Company (see Appendix B, item 4) makes a tough durable fibrous tile from wood and a hard-setting cement binder, which is supposed to retard fire.

Cane Fiber. The Celotex Corporation (see Appendix B, item 2) has been manufacturing an acoustical material from cane fibers for a number of years. This type of material has been widely used and has about the same acoustical properties as wood fibers.

Cork. Another material used in making acoustical tile is cork. Cork is ideal for use in rooms where the moisture content is high and where temperature changes are severe. Cork shrinks, swells, warps, or molds very little, thus making ideal material for the conditions mentioned above. The Armstrong Cork Company (see Appendix B, item 1) manufactures a cork tile that is tough, resilient and sufficiently flexible with a high noise-reduction coefficient. Cork tile may be cemented to a rigid level surface,

or may be fastened by nailing, or by the new mechanical systems.

Mineral Products. Several companies make acoustical ceiling material from mineral products. The two common forms are tile and a plaster. The Celotex Corporation (see Appendix B, item 2) makes a fireproof tile from mineral fibers felted with a binder to form a rigid tile.

Acoustical plaster is a mineral product that can be applied by any journeyman plasterer. It is applied over a base of gypsum plaster. It is fire-resistant and has good sound-absorbing qualities. The National Gypsum Company (see Appendix B, item 4) manufactures an acoustical plaster which does not deteriorate after application, either in strength or sound absorbing qualities. It may be repainted or vacuum cleaned to renew its fresh appearance. This plaster should not be where continued high humidity is expected. One acoustical plaster made by the United States Gypsum Company (see Appendix B, item 6) is designed for use over heated swimming pools, shower rooms or where high continued humidity is expected.

The Celotex Corporation (see Appendix B, item 2) manufactures a cast gypsum sound absorbing tile which has a fine textured surface, which has fissures varying in size and location in each tile.

Asbestos. The Johns-Manville Company (see Appendix B, item 3) and The Celotex Corporation (see Appendix B, item 2) both, manufacture a perforated asbestos cement panel to be used as a facing for a sound absorbing element, such as rock wool. This panel is highly fire-resistant and is easily repainted without losing its sound absorbing properties. The rock wool is installed between wood or metal furring strips to which the panel is fastened.

The National Gypsum Company (see Appendix B, item 4) makes a fireproof acoustical asbestos fiber that provides a smooth monolithic finish with high sound absorption. It consists of pure asbestos fibers mixed with a special binder and is sprayed on the surface to any desired thickness.

Metal. Several companies manufacture metal acoustical units. These units consist of a face of perforated metal with a pad of sound absorbing material, such as rock wool. This type of ceiling is suspended from the surface to be treated by "T" bars which clip to the metal facing. This type of ceiling is fireproof, may be repainted, washed, gives greater light reflection and one of its greatest advantages is that it can be removed to repair electrical wiring, plumbing and so forth.

The mineral products are rated as fire-resistant and are not usually harmed by insects. The wood fiber tile will burn, but some companies treat it to reduce the rate of combustion. It is usually treated also to repel insects. Ceiling tile may be cemented to plaster or plaster board or may be nailed to wood furring strips. Many of the tile are perforated, the holes extend from the face almost to the back except at the corners, where the holes are shallow to provide holding power when nails are driven in them to secure to the the furring strips.

CHAPTER III

INTERIOR WALLS AND WALL SURFACES

Interior walls present a problem that should be carefully studied. In this section of this report, both insides of outside walls and partition walls will be considered. In the past, several school shop buildings have been built with only the partition walls finished when the building was a brick or stone structure. There are several ways which interior walls may be finished.

Wall and Wall Surfaces

Glazed Dado or Wainscot. Some teachers prefer walls of glazed brick or tile from the floor to a height of four to six feet with plaster or some type of wall board or panel continuing to the ceiling. The glazed brick or tile are easily washed, thus making it easy to keep the walls clean where hands and material keep it dirtiest. Glazed tile and brick are available in almost any colors that would or could be used in a school shop. The Arketex Ceramic Corporation (see Appendix C, item 1) specializes in ceramic glazes. They do not manufacture salt glazed or clay coated units. This glazed tile is not affected by grease, acid, or other conditions which cause high maintenance cost. These tile are readily cleaned with soap and water. The colors will not fade or change. This tile may be obtained in all necessary shapes, to meet any architectural or structural conditions.

Plastered Walls. One of the most widely used finishes for interior walls is plaster. A large number of companies make plasters and plaster laths. Some plasters can be used on any plaster base while others should be applied over wood or metal

lath. The two natural colors of plasters are white and gray, however, some companies have plasters to which mineral pigments may be added, but this weakens the plaster. Plaster can be painted after it has been allowed to dry for from two to four weeks.

The same plaster may be used from floor to ceiling or the wainscot may be of a hard, more durable plaster such as Keene's Cement, which is used for finish coats where especially hard walls are desired. Most of the plasters are applied in separate coats, base coats and finish coats.

Acoustical Plaster. The main objections to the plasters just discussed is the fact that they reflect nearly all of the sound waves that strike them. To correct this, there is now available an acoustical plaster. This plaster is applied similar to the other plasters. The National Gypsum Company (see Appendix C, item 9) make an acoustical plaster to be applied over a gypsum plaster base. This plaster is porous and grainy, furnishing small channels to trap the sound waves. It is pre-colored in five standard ceiling tints, however, it may be redecorated with any good water paint.

The American Acoustics, Inc. (see Appendix C, item 11) makes an acoustical plaster from virgin cork and pure minerals. It can be applied to any type of lath or plaster or concrete base. It is fireproof and does not harbor vermin, nor permit fungus growth. Its natural color is medium brown, but may be painted with any standard non-bridging resin emulsion paint.

Glazed Tile. The glazed tile may also be used from the floor to the ceiling as well as for wainscoting, as described previously. It can be obtained in many light colors and color combinations

for wainscoting. This tile is widely used in different type buildings. Its hard slick surface would reflect most of the sound waves which strike it.

Other Wall Coverings. Metal wall coverings are now available from different manufacturers. The Armstrong Cork Company (see Appendix C, item 3) has a wall tile made up of individual tiles consisting of genuine porcelain, bonded and fused at 1560 degrees Fahrenheit to rigid 20-gauge steel. Each unit is completely covered with porcelain, double thickness on the face. The units are erected on a unique foundation board consisting of asphalt impregnated insulating fiberboard 1/2 inch thick.

Aluminum tile is now available for wall coverings. This new lightweight material has the colors baked on and is cemented to the walls. The Reynolds Metals Company (see Appendix C, item 9) and the Metal Tile Products, Inc., (see Appendix C, item 6) both, manufacture an aluminum tile on which color has been baked. Tile made from metal could possibly be used for wainscot, but it would probably be too noisy to use on the entire wall since it does not absorb sound waves.

Wood Fiber Products. In general, there are two types of wood fiber wall coverings. The soft fiber board or tile, which is made from wood fibers bonded together with some type of cement. The other is the hard slick fiberboard or tile such as that made by the Masonite Corporation (see Appendix C, item 5). This wood fiber product is made entirely of wood. Wood chips are exploded into fiber under high pressure steam. The fiber is then felted and pressed in heated hydraulic and flat bed presses into board form. The only cement or filler used is the natural lignin of the

fibers. This material has a much slower combustion rate than wood since the inflammable ingredients are removed in the manufacturing process. This pressed wood is widely used for walls and ceilings in many types of buildings. It is flexible to a certain extent and may be painted or left in its natural color. Being harder than the soft fiberboards, it will reflect more of the sound waves.

The ceiling materials discussed in Chapter II, may also be used on walls. However, when they are used on walls, they should not be used where they will be subjected to severe treatment. In the shop building, this would mean that they should be used above wainscoting.

Fireproof Wall Coverings. Asbestos boards are always a good covering since it is fireproof, rot-proof, insect and moisture resistant. Johns-Manville (see Appendix C, item 4) is probably the leading manufacturer of this material. This company has an asbestos wallboard which is made of asbestos and cement combined under tremendous pressure. This wallboard is highly recommended for industrial or commercial buildings. This same company makes a corrugated asbestos product which resembles corrugated sheet metal, which can be used either inside or outside.

When in place, this fireproof material is a barrier that will not rust or corrode, cannot be penetrated by rodents or termites and lasts through years of wear and tear. It was widely used during the war to help solve new and varied building problems.

Gypsum Products. A wallboard is made with a gypsum core enclosed in tough fibrous paper covering designed for nailing over wood framework. It is fireproof and does not warp or buckle.

This wallboard can be painted or calcimined since the joints are cemented and do not show. The National Gypsum Company (see Appendix C, item 8) makes this wallboard and gives it a wood grain finish.

Cane Fiber. The Celotex Corporation (see Appendix C, item 2) has for many years made a wallboard from cane fibers. This product is very widely used for interior walls and ceilings. Several sizes and patterns are available. This material absorbs a large per cent of the sound waves. For shops, it should be used above a wainscoting of a harder material.

The materials which have been discussed are probably the most used materials for wall surfaces in industrial buildings, where coverings are used. Plywood and glass blocks are also used. Plywood is used in the so-called "dry" construction. Its cost may make its use prohibitive. Glass-block masonry is discussed in another part of this report.

One of the chief factors in the appearance of the shop is the walls. Even though the equipment is in good order and clean, the walls attract one's vision. Human beings are affected by their surroundings, the type and color of wall coverings exert a decisive influence. Stores and other establishments which depend on the public, take advantage of this fact. The shop probably needs to be as highly decorated as these commercial establishments.

Partitions

In the future, most shop buildings will be built with more than one room. Partitions are walls between rooms, some partitions help support the structure, while others do not. Several types of partitions or wall units which are movable and salvage-

able are now available and at the same time, possess the stability and appearance of a permanent installation. Most of these partitions require less space than masonry partitions and are lighter in weight and in general, cost less.

Metal Partitions. The Detroit Steel Products Company (see Appendix C, item 7) makes wall panels from steel, aluminum and aluminum-steel. These panels have metal surfaces with fiberglass insulation between them. The covering width of the panel is 16 inches. The edges of the panels are equipped with a double tongue-and-groove for joining. The panels are fastened together by welding, bolting, sheet metal screws or clips as recommended by the manufacturer. This company has one panel which is acoustically treated. The metal faces of this panel are perforated which reduces the reflection of the sound waves, and less noise is transmitted to the next room. Since these panels are made from metal with a fiberglass insulation, they are fireproof.

Asbestos Board Partitions. The Johns-Manville Company (see Appendix C, item 4) makes two types of movable partitions. One type is an asbestos panel hung on steel studs in a patented construction, forming a rigid double-faced partition 4 inches in thickness and possessing great strength and solidity. Such a partition, built of fireproof materials, offers advantages of privacy and quiet that are usually associated with masonry building walls. Wiring, electrical outlets, etc., are easily incorporated within the walls. The surfaces are flush and projection free and lend themselves to any type of decorative treatment.

The other type of partition made by Johns-Manville is an asbestos-cement material facing on a sealed core and furnished as

complete wall sections 1-3/4 inches thick. Space for wiring is provided within the partition and is easily accessible. This type is furnished with metal or wood door bucks, borrowed light frames, etc. This is probably the easiest of all partitions to erect or relocate.

Other Non-wood Partitions. The National Gypsum Company (see Appendix C, item 8) also has two types of partitions. The two-inch solid partition is recommended for fireproof, non-bearing partitions in all types of buildings. This partition consists of ceiling runner, metal base, metal base clips, steel studs which are standard 3/4 inch cold rolled channel, a plaster base and plaster. Both sides are plastered, but only one plaster base is needed. The other type partition is a hollow wall system. It is easy to erect and is fireproof. It greatly reduces the noise from room to room. Wiring, plumbing and air ducts are easily installed since the two walls are independent of each other. Any thickness partition can be built from 4 inches to whatever width is desired. The type of materials required are about the same as for the solid partition, but since it is hollow, it requires two sets each being plastered on the outside.

The United States Gypsum Company (see Appendix C, item 10) manufactures a gypsum partition of furring tile. It is fireproof and is faced with a gypsum plaster. An acoustical plaster could be placed over the gypsum plaster base.

There are, no doubt, many other companies who manufacture and sell movable partitions. The advantages of the movable partitions, more than likely, outweigh the disadvantages. Usually they are cheaper in cost, easier to install and may be moved if need be at

some future date. Most of the new partitions transmit less noise from one room to another more than do the old type masonry or wood construction. However, the movable partitions could not be used where it is required to support weight other than its own.

CHAPTER IV

DOORS

Several concerns manufacture and sell doors of all types. For school shops, the best types to use would be the industrial and commercial doors. Considerable thought and care should be exercised as to the placement and sizes of doors when planning the shop building. A building can be built with too many doors or it can be built with too few doors. Doors are made from wood, steel and brass. Due to the cost of brass doors, they would probably not be used in school shops and therefore, will not be discussed here.

Wood Doors

Wood doors are very common in all types of buildings except where there would likely be fire hazards. These doors are not fireproof and should not be used where there is any danger of them igniting. Since most of them are made from pine, they will burn rapidly. Wood doors are divided into three classes according to their manner of construction; battened, framed and ledged, and framed and paneled.

Battened Doors. This type is usually constructed of two thicknesses of $7/8$ inch matched boards nailed together. The boards are arranged to cross each other at right angles and generally run diagonally with the door. These doors are often used as the foundation for metal-covered fire doors of rough and heavy type.

Framed and Ledged. Doors of this class consist of a frame of uprights and cross pieces called ledges with joints mortised

or halved together. Diagonal braces can be added. The frames are covered with matched boarding or panels.

Framed and Paneled. These doors consist of a frame filled in by wood or glass panels. The uprights are called stiles and the cross pieces are rails. The rails are mortised into the stiles. The panels are held in place in a groove in the inner edges of the stiles and rails or by a molding which is nailed to the stiles and rails. A variety of arrangements can be affected by changing the number of stiles and rails. This is the most used type of door. A veneer panel may also be solid or built of small strips.

Metal Doors

In the effort to render buildings fireproof and to retard the spread of flames, the use of metal doors or wood covered with metal has greatly expanded. Metal doors will resist severe treatment longer than wood and should be used where they will be subjected to rough treatment. The metal doors now required in most building codes for uses in structures of any height, may be divided into three classes, metal-covered doors, hollow metal doors and special steel doors.

Metal-covered Doors. The wood doors or frames are first made of kiln-dried white pine as in the best type of standard wood doors. The panels are of asbestos to avoid warpage and shrinkage due to heat. Metal coverings are then drawn or pressed on the frames and panels and glued with a water-proof glue. The joints are then welded or soldered and smoothed so as to prevent showing the joint. Sometimes the metal is formed before placing it on the frames.

Hollow Metal Doors. The stiles and rails are formed from single sheets of steel drawn through dies to the required shapes with all joints and miters made by continuous welds. The metal panels are usually arc welded to the stiles and rails. Cork is inserted into the stiles and rails to deaden the metallic ring made by hollow metal. A sheet of asbestos is usually placed between the panels. Where the hinges and locks are to be attached, the door is reinforced by welded steel plates. The Detroit Steel Products Company (see Appendix D, item 2) makes a door of this class from No. 16-gauge steel in several sizes and patterns. It can be obtained with two steel panels or with muntins and snap-on mouldings for glass. Louvers are available for use in the batten panel.

Special Steel Doors. This is the third class of steel doors. It includes the large doors used where vehicles, machinery or other large objects must pass.

Rolling Steel Doors. This type is used at loading platforms and show windows and in warehouses. They are also employed as fire doors within buildings. The construction consists of interlocking steel slats coiled upon a drum at the top of the opening and traveling in steel guides at the sides. The door is counterbalanced by means of helical springs inside the drum. The lighter doors may be operated by hand, but the heavier doors are equipped with a reduction gear and endless chain or electric motors may be installed.

Sliding Steel Doors. These doors are much used in elevator shafts and to a less extent, in other places where swinging doors are impracticable. These doors are suspended from the top by

hangers equipped with ball bearing wheels rolling upon a horizontal track. They consist of one, two three or four leaves with the one or two-leaf being the most common. The two-leaf type consists of two units which may slide behind the wall on opposite sides or on the same side. In the latter case, the two leaves slide past each other, one moving at twice the speed of the other. The Detroit Steel Products Company (see Appendix D, item 2) manufactures a sliding door recommended for shops. It is identical to the hollow steel door except for the hardware.

Counterbalanced Steel Doors. This type is widely used at the openings in freight elevator shafts. They are divided into two sections horizontally, the top section moving up and the lower section moving down.

Vertical Lift Doors. These doors can be used in buildings with a high ceiling. The doors are mounted in tracks and move up and down. They are available in one section or in two sections, divided horizontally in the center. In opening the two-section vertical lift door, both leaves slide upward simultaneously, the lower leaf traveling twice as fast as the upper. The Detroit Steel Products Company (see Appendix D, item 2) manufactures a two-section vertical lift door. This same company makes a vertical lift turn-over door. This door is divided into two sections the same as the one just described. In opening, the lower leaf slides upward in guides attached to the upper leaf until it has traveled about half the height of the opening. The nested leaves then swing inward at the top and upward at the bottom until they are in a horizontal position, clear of the opening and inside the building.

Another type of vertical lift overhead door is the old common type which is made by hinging several horizontal divisions together and mounting in a slide. When opening, the top moves inward while the bottom moves upward until it is in a horizontal position inside the building.

All doors which travel in a vertical direction, and the vertical turn-over type are equipped with some type of device to raise them. Some of the heavier ones are equipped with an electrical motor, while others can be equipped with a crank operated by hand, or counterbalanced with weights rigged with cables. Coil springs are also used in counterbalancing doors.

Accordion Type Doors. These doors are especially adaptable for use in extremely wide and high openings, as will be found in industrial buildings, railway shops, warehouses, garages, fire houses, etc. The Coco Steel Products Corporation (see Appendix D, item 1) makes a door of this type. The leaves fold together vertically and when open, clear the jambs to give a full opening width. Free leaves are hung on trolleys from an overhead track and the end leaves are hinged to the jamb. The doors require very little head room and can be made to open in or out.

Many of the doors may be obtained either solid or equipped for glazing. Most companies do not furnish the glass for the doors. Glass will have to be obtained from a manufacturer of glass. Some of the doors can be obtained with louvers built in.

CHAPTER V

WINDOWS

Windows serve in such seemingly obvious and simple ways that too generally, they are taken for granted. In the industrial world, a considerable variety of windows and skylights has been designed and is in existence. For years, new industrial buildings have been constructed with great areas of glass. However, the problems are varied and each situation must be discussed specifically.

Window sash are made from wood and metal. The wood sash will be discussed briefly, but it is not recommended that they be used. They are combustible and do not resist the elements, as do the metal sash.

Wood Windows

Wood windows are divided into classes according to the manner of handling the sash.

- Double-Hung Windows. The sash of the double-hung windows are divided horizontally into two parts, the upper and lower sash, which are set on separate planes so they slide past each other up or down. This is the most common type of window used in this country.

Casement Windows. The sash are hinged at the side and arranged to open inward or outward. This was the earliest form of movable windows and has never been equaled for appearance or comfort. These windows have to be hung with extra caution, to keep them weather-proofed, which is the main disadvantage in using them.

Pivoted Windows. The sash pivoted at the center of the sides is the most common. Its main use is in transoms or windows over doors.

Metal Windows

Metal windows have become widely used for the same reason as the metal doors. They are fireproof and more resistant to decay. There are three types of metal windows.

Metal Covered Windows. Wood sash and frames may be covered with sheet steel or bronze in the same way as the doors. For fireproof construction, they are being replaced by hollow metal and solid steel sash.

Hollow Metal Windows. This type of double-hung window has now been standardized through the efforts of the Board of Fire Underwriters, so that when their label of approval is placed on a window, it can be trusted. The stiles and rails are formed integrally with the glass mouldings. The joints are welded or soldered.

Solid Steel Industrial Windows. Industrial steel windows, the first metal windows to be produced in America commercially, have been consistently accepted as the standard for industrial and commercial construction of every description. The result of years of continuous development and improvement by experienced window engineers and craftsmen, they are now offered in a new range of types and sizes, conforming to modular standards recently adopted by manufacturers of brick, tile and other wall materials and by various building material associations.

The types of industrial windows will be discussed in the following paragraphs. The industrial type windows are usually pre-

ferred for shop buildings.

Pivoted Windows. This type is the most widely used of all windows for every type of industrial and commercial building where ample daylight and fresh air are considered important. They are equally suited for installation, as relatively small individual windows or in large bay windows. Pivoted windows are made in a wide variety of types of sizes, to meet design and construction requirements.

The ventilators are symmetrically located in the windows and are pivoted horizontally just above the center of the vent. The Cecco Steel Products Corporation (see Appendix E, item 1) makes a pivoted window of strong, hot-rolled sections which provide two point weathering contact at all ventilator perimeters. They are equipped with hardware of types suitable to meet normal operating conditions and to provide secure locking of vents.

Commercial Projected Windows. Windows of this type are preferred for industrial and commercial buildings where screening is required and where shading and control of ventilation is desirable. Projected windows open inside or outside the plane of the windows, to permit the attachment of screens without interfering with the operation of the ventilators.

Projected windows are made exactly like the pivoted type except for the hanging of the vents. The open-out vents swing out at the bottom and slide down from the top; the open-in vents swing in at the top and slide up from the bottom. This type of opening forms somewhat of a canopy over the openings. They can be opened in bad weather.

Open-out vents are easily and economically screened on the

inside, open-in vents on the outside. Screens for both types are conveniently attached from the inside of the building.

All manufacturers of windows make this type of window. The Hope's Windows Inc. (see Appendix E, item 3) is one such manufacturer of windows. Their windows are made from low carbon new billet steel. All joints are welded to form a solid unit.

Solid Metal Casement. This type of window is now available in aluminum, as well as steel or brass. This window is not often installed in industrial buildings, however, it can be used in shop buildings. Screens are safely attached on the inside.

The Reynolds Metals Company (see Appendix E, item 5) manufactures a casement window of aluminum. This type of window seems to be gaining favor with architects. It is light in weight and strong.

The windows come from the factory equipped with hardware that is needed for their operation. Glass, putty, wire clips, etc. are not furnished with the window sash. These items will have to come from another source. Only steel window putty is recommended for metal sash. The windows are factory painted with some type of paint to protect them until they arrive on the building site. It is recommended that they be painted before they are glazed. When the glazing is done first, no painting should be done for about three weeks, allowing the putty to dry.

Steel windows should be properly installed for best results and longer life. They should be handled carefully on the job. The metal should be prevented from being in contact with masonry walls. A layer of calking or mastic is used to prevent this.

Window Glass

Most window manufacturers recommend the use of double strength glass. The single strength is not satisfactory for use in shop buildings. The firms that make and sell glass have many patterns of figured or patterned glass, as well as the transparent, wire glass, and safety glass for the many uses.

The transparent sheet glass is the most likely kind to be used in school shops. The sheet glasses are drawn directly, under controlled conditions, from the bath of molten glass and after suitable annealing, are cut into the required sizes. The product is characterized by brilliant fire polished surfaces. It is not ground and polished as is the plate glass and does not possess the substantially optical flatness of surface of that product.

Marked improvements in the process of drawing sheet glass have in recent years, produced a sheet with a minimum of wave or surface distortion. The dense fire polished surface commends its consideration for uses where the small amount of wave or surface distortion is not objectionable.

The Libbey-Owens-Ford Glass Company (see Appendix E, item 6) makes an insulating unit which is a factory-built transparent glass unit composed of two or more lights of glass separated by 1/4 or 1/2 inch of dehydrated captive air. This glass unit is being widely used in commercial buildings. However, its cost would prevent its use in school shop buildings.

CHAPTER VI

GLASS-BLOCK MASONRY

Glass blocks are rather new as a building material, but are widely used at present in schools, office buildings, stores, factories and in other buildings where more light is needed. They are hollow, colorless, translucent masonry units formed by fusing, at high temperature, two sections which are cast separately. Their primary function is to transmit light through the walls and replace windows. The block is sealed in the manufacturing process which produces a partial vacuum in the interior. Various patterns are available for the exposed faces.

Glass blocks are not suitable for carrying loads, other than their own weight, and provisions for expansion should be made along the jambs and head of each panel.

Glass blocks are used principally as an insulated, light-transmitting masonry construction for non-load bearing exterior walls and for interior partitions. It is adaptable to all types of buildings and of particular advantage in air-conditioned structures where superior insulation often permits reduced operating costs as well as the installation of equipment with less capacity. This method of construction affords air, dust and water-tight glass areas.

Glass-block panels are used primarily to transmit light where window openings are not required for ventilation. They diffuse the light which passes through them, have a good heat-insulating value, reduce condensation, are reasonably soundproof and are attractive in appearance. Glass blocks are not laid with

verticle joints staggered as other masonry. The verticle and horizontal joints are continuous.

Windows and glass blocks are usually used together, with blocks on each side of the windows or a vision strip of transparent glass underneath the block panel. The bottom of the glass-block panel should be about six feet from the floor, however this is an arbitrary specification, depending on the type of glass block used. The windows offer a means of cooling the room through ventilation. The glass block reduces the amount of solar heat entering the room. The block panel will transmit about half as much solar heat to the interior as windows covering the same area.

The type of fenestration used on the north side of a building will vary from south, east and west exposures in this hemisphere. The north rooms are lighted almost entirely by the sky. The vision strips may be made smaller and more glass blocks added. The blocks may also be added below the vision strip. Here again, the distance of the blocks from the floor should be determined by the architects and school administrators.

This type of masonry should be used wherever possible, but should not be used without some means of ventilating rooms which are enclosed with it.

The Pittsburg Corning Corporation (see Appendix F, item 2) manufactures a glass block with the edges coated with a grit-bearing plastic material to insure permanent and effective bond with Portland cement mortar in which glass blocks are usually set.

Ventilators may be obtained for glass-block walls. These

windows or ventilators are used to provide regulated natural ventilation and see-through vision in walls of glass blocks. Sizes and construction have been carefully designed to conform with the dimensions of standard blocks .

CHAPTER VII

PAINT AND COLOR SYSTEMS

Studies in the field of paint and color systems have revealed that the colors around people greatly affect them. For many years, factories and schools were built with little or no thought given to color schemes. In the last few years, laboratory tests and practical experience have proved that there is energy in color which affects one's health, comfort, happiness and safety.

Industry has spent, and continues to spend, large sums of money on personnel work and on time-and-motion studies. Tools and machines have been repeatedly redesigned and improved of saving time and improving production. New and improved machines help improve production, but the plant environment is another great factor, a factor that is frequently ignored.

Color on Walls, Machines and Work Places

It is generally accepted that eye fatigue and complaints of headache can be caused by highly reflective walls and work benches, by color afterimage and by lighting that is too weak or too glaring. Scientifically applied colors or finishes not only cut down disturbing elements, but also produce a favorable psychological effect on people around them.

"Afterimage" is a menace in a place of work, many headaches and numerous reports of "spots before the eyes" are caused by this phenomenon. This can be corrected by treating the surroundings with complementary hues of special values.

Color Systems. Color schemes should not only be concerned with the floors, walls and ceilings of a shop, but also with the

machines. Methods for painting machinery have been developed which reduce the danger of personal injury and at the same time, reduce eye strain and fatigue.

The companies which are probably the leaders in this field, are the Pittsburg Plate Glass Company and the E. I. duPont de Nemours and Company (see Appendix G). The Pittsburg Plate Glass Company publishes Color Dynamics for Industry, a booklet in which the entire subject of colors and industry is discussed. The booklet published by DuPont is entitled Color Conditioning for Industry, in which colors are discussed pertaining to industry. These two color schemes differ somewhat in that the Pittsburg Plate Glass Company's colors are a little brighter than the DuPont. However, both are recognized as very good systems. The Pittsburg Plate Glass Company's system has been used on the machines in the Pattern Shop of the Industrial Arts Building, Oklahoma Agricultural and Mechanical College, Stillwater. This system is well liked by those who work in that shop. It is the writer's understanding, that the DuPont system will be tried in another shop in the same building.

Walls. Color has a psychological effect on the worker's mind as well as physiological effect on his eyes and body. One color will be inspiring to the worker, another will send him into the "blues". Still another, will have a disturbing effect on him.

All other things being equal, most people feel more light-hearted on a sunny day than they do on a cloudy, dreary day. Yet some shops have drab or unpainted walls and ceilings, which give the feeling of a cloudy day. Cheering up interiors is simple if colors that suggest sunlight are used. In rooms where the tem-

peratures are normally high, cool colors should be used to act as mental and emotional stabilizers. Warm colors are used in cooler rooms for the same reason.

During a greater part of the time, the walls are in the worker's field of vision and are glanced at frequently. When working on a machine or bench that is dark while the wall is light, or vice versa, the eyes of the worker will have to make quick adjustment. This adjustment takes energy, resulting in eye fatigue. For this reason, eye-rest surfaces should have about the same general color value as the one the worker sees when his eyes are trained on his work. Usually these color systems call for a light shade of green or yellow.

Ceilings. While ceilings probably are not noticed as much as the walls, it would be irritating for the walls to be painted and the ceiling left unpainted. Some surfaces should be made so they will not attract the attention of the workers, for example, a ceiling filled with pipes, beams, wiring, etc. In cases where direct lighting is used and reflected light from the ceiling is of little value, a color such as light blue gives an appearance of lightness and help make the distractions appear to recede, thus giving the worker more apparent space and air around him. When direct lighting is used, colors with very high reflective qualities are indicated for the ceiling. The ceiling is usually painted a different color from that used on the walls.

Machines. For years it was common practice to paint machinery in dark, light-absorbing colors. Industry has found that the color of the machine is an important factor in increasing the operator's output. The color on the body of the machine should

be complementary to the color of the working areas, so as to achieve the contrast necessary for good visibility and at the same time, eliminate the possibility of afterimage difficulties.

Table No. 1 Colors Recommended for Use on Machines

<u>Part of Machine</u>	<u>Pittsburg</u>	<u>DuPont</u>
Body	Viata Green	Horizon Gray
Operating Parts	Ivory	Buff
Electrical Switches	Orange	Blue
Handles and Leavers	Yellow	Horizon Gray

Colors of high saturation, of startling intensity, should be applied to all dangerous machine parts. The right degree of contrast in the working area is very important. The handling of white or brilliant objects against a black background is just as bad for the eyes as the handling of a black object against a black background or an aluminum object on an aluminum or white background. The contrast of the working surface of the machine and the object produced on that machine should be just right to provide maximum visibility without extreme eye adaptation. Table No. 1 shows the colors normally used on machines by Pittsburg and DuPont.

Safety Color Code

Colors used for safety warnings should be brilliant, pure colors. These colors attract the attention of people more quickly than the weaker hues. Colors used in the safety color code are:

Red is used to identify fire-fighting equipment because it has long been established as a symbol for fire-fighting.

Table No. 2 Safety Color Code Recommended by Pittsburgh Plate Glass Company and DuPont Company

	Pittsburg	DuPont
Fire Protection	: Red	: Red
Safety	: Green	: Green
First Aid	: White Cross : Green Background	: Green
Caution	: Yellow or Yellow : with Black : Parallel Bars	: Yellow with : Black : Parallel Bars
On Guard	: Orange	: Orange
Out of Order	: Blue	: Blue
Storage Areas	: White Boundary	: White Boun- : dary
Mobile Equipment	: Orange	: Orange

Yellow and black is the best color combination where quick attention is essential and where seeing at a distance is a factor. It is the most effective combination for indicating hazards.

Orange is a mixture of yellow and red and therefore has some of the high visibility of yellow and some of its danger symbolism, as well as some of the stimulating effect of red. Orange is used on dangerous or moving parts. This color is used extensively on highway markers and signs.

Green is always associated with safety and medical practice and should be used to identify safety equipment and first aid stations. The emblem of The National Safety Council is the "Green Cross of Safety".

Blue is suggested as a caution color. Blue tags should be used on machines being repaired. It symbolizes "out of order".

White should be used as boundaries for storage areas. In many cities, traffic lines, parking zones, etc. are being marked with white paint.

Table No. 2 shows the safety color codes of Pittsburg and DuPont. Basically, they are the same.

Paints

Hundreds of companies (see Appendix G) make a great variety of paints which will be very good to use. Paints that require a water thinner or oil paints could be used on ceilings and walls. It is believed that an oil paint should be used on machines. The better paints may be washed with water to remove the dirty spots. Any color desired may be obtained from any of the major companies.

CHAPTER VIII

CHALKBOARDS AND BULLETIN BOARDS

The shop or any classroom is not completely equipped without a chalkboard and a bulletin board. Chalkboards or blackboards are a very useful device in the shop lecture room. Very few shop lectures can be given without the use of a chalkboard. It is probably the most used visual aid. The bulletin board is not as useful as the chalkboard, but it also plays an important part in teaching. There are always materials which should be posted for the students' information. They will be discussed separately.

Chalkboards. The flexible nature of the chalkboard allows the teacher to adapt it to a great many teaching needs, and provides almost unlimited opportunity for variation and adaptation. It can be made to fit any type of teaching problem.

Since the chalkboard plays such an important part in teaching a lesson, thought should be given to it when planning a shop and at least one chalkboard should be in each room. In the past, most chalkboards have had a black writing surface, however, school administrators and architects do not consider this color desirable since it absorbs light and does not blend with modern classroom colors and lighting.

Recently, a new lighter and brighter chalkboard has been introduced by the Weber Costello Company (see Appendix II, item 2). This board is a cool and refreshing green color and aids in the proper distribution of classroom light. This color provides a better brightness balance between the chalkboard and adjacent walls, and plays an important part in making the classroom a

lighter, brighter, and more pleasant place than would the black.

The Pittsburgh Plate Glass Company (see Appendix H, item 4) makes a chalkboard by fusing to the face of polished plate glass, a colored vitreous material hardened to resist the abrasion of chalk and eraser. The process which fuses the writing surface to the polished glass gives the finished plate far greater shock resistance than ordinary plate glass of the same thickness. This chalkboard takes chalk easily and is easily cleaned. It is designed to minimize glare, to promote better classroom lighting, to lessen eye-strain for students, and also as a relief from the depressing black color of common black chalkboards. The standard colors are green, ivory and black, that are available.

The placement of the chalkboard is important. Chalkboards should be so arranged that all students should be able to see all chalk lines clearly with as little reflection as possible. The chalkboard probably should not start any closer than four feet to any wall with windows or glass blocks.

Bulletin Boards. Bulletin boards are another useful item in the shop. A good shop teacher will always have safety posters, price lists, shop rules, and other materials to post where the students may read them. The main bulletin board will probably be in connection with the chalkboard or located conveniently by a door leaving the room, however, boards for safety posters should be distributed around the shop so the students can read part of them from any place in the room.

The material used for the bulletin board should be soft enough to take a thumb tack without using a hammer to drive it, yet hold the tack after it is set. Cork is probably the best

material for this. It is widely used in school bulletin boards and display strips. Cork will hold pins and tacks firmly and the holes will close when they are removed. However, some prefer a fiber board made from wood or cane fibers and a binder. The Celotex Corporation (see Appendix G, item 3) makes a wall board which is used in some bulletin boards. This wall board is not made for that purpose, but it serves the purpose well.

Map Rail. A map rail is not available which is installed at the top of the chalkboard. This rail is equipped with clip-hooks for holding the material being displayed. This rail could be used to a good advantage by the shop teacher, for holding charts and drawings, which are used in connection with the lectures and demonstrations.

CHAPTER IX

SAFETY FLOOR COVERING

The school shop building will have several areas where a non-slip covering should be placed on the floor. Slippery floors are the cause of many accidents. An oily concrete floor, worn wood floors, steps and other oily or wet floor surfaces are the common causes of accidents that can easily be corrected by the use of a non-slip covering.

Many of the industrial asphalt tile floor surfaces are fairly safe if left unwaxed. It is not recommended that floors in shops be waxed. The areas which would require safety floor coverings in shops will be discussed separately.

Machines. The areas around machines, especially the place where the operator stands while operating machinery, should have some type of mat or non-slip covering. This applies to all types of power machines, whether woodworking or metalworking machines.

Several types of mats and coverings are available for use in the woodworking shop where oil and grease are not as likely to be on the floor. Several companies make mats and coverings that could be used for woodworking shops. The American Abrasive Metals Company (see Appendix I, item 1) make a durable fabric floor mat impregnated on the walking surface with a tough, flexible composition containing granular particles. It is non-slippery under all conditions. It is cemented to the floor with a special adhesive. This company also manufactures an anti-slip floor paint. It is a high grade floor paint with non-slip particles added.

Behr-Manning (see Appendix I, item 4) make a safety mat on

the same principle as heavy duty, waterproof abrasive cloth. It is also cemented to the floor surface.

Several companies have a different type of rubber and cord matting which can also be used. The Bird and Son, Inc., (see Appendix I, item 3) manufactures a composition floor covering that looks like rubber and feels like rubber, but costs only about one-third the cost of the rubber covering.

The Thos. Moulding Floor Manufacturing Company (see Appendix I, item 6) makes a flexible floor tile in which non-slip aggregate has been impregnated throughout the entire thickness and thoroughly distributed over the surface to give a firm, safe grip to the floor even under wet conditions.

In the school shop, the work area around the machines are probably the most important of all places calling for non-slip surface. Many accidents occur on the high-speed woodworking machines with the best safety precautions.

The covering used in the machine shop should be one that would resist grease and oils. The American Mat Corporation (see Appendix I, item 2) manufactures a grease and oil resistant safety mat from cord and "DuPont Neoprene". It contains no rubber. The American Abrasive Metals Company (see Appendix I, item 1) have an anti-slip floor troweling composition which was developed for the Navy. It is resistant to oil and mild acids. It may be applied over floors of wood, concrete and metal.

Stairways. Stairways are dangerous places. Many people have been injured due to slippery stair treads. Not all school shop buildings will have a second floor, but nearly all will have steps leading to the first floor. The Selflex Products Company,

Inc. (see Appendix I, item 5) manufactures a safety step tread from rubber and is moulded to fit over step edge in one piece. It provides a long non-slip service with little maintenance. This safety tread is cemented to wood, cement or steel steps.

Electrical Panels. A rubber mat in front of electrical switches, not only provides a non-slip surface, but provides insulation between anyone working on the panel or switch and the floor also. This mat should probably be a rubber mat for best results, and should be kept dry and free of oils and grease.

Safety floor mats and covering may be purchased for every purpose. Most of the companies have strip matting for hallways, mats for entrances, chair mats, etc. Mats are made in solid sheets with different designs or link mats. Some shop teachers have used composition roll roofing for safety mats around machines. It has proven satisfactory. The safety mats also reduce foot fatigue.

CHAPTER X

MISCELLANEOUS MATERIAL

The previous chapters have covered the major building materials used in school shop construction, omitting the basic building materials, roofing, electrical wiring, lighting and plumbing. In this chapter, minor materials not given a separate chapter title, will be discussed separately.

Expanded Metal

Expanded metal or heavy wire mesh is commonly used in shops. It is not a new material, but several shops have used a more expensive material where expanded metal could have been used.

Tool Crib Partitions. Partitions between the shop and the tool room or crib have been one of the most common uses of this material. It is usually used above a solid partition. The solid partition is usually from two to four feet high and sometimes shelves are built on the inside of it. This expanded metal gives the students a chance to see in the tool room without entering. It also gives those working in the tool room, ventilation and reduces, very little, the ventilation of the shop. The Stewart Iron Works Company (see Appendix J, item 1) specializes in the design and manufacture of chain link wire fences. This company makes a sectional wire partition complete with standard panels that may be interchanged or rearranged at any time. They are recommended for stock rooms, tool rooms, etc.

Machine Guards. Expanded metal is widely used as a fabric in construction of machine guards of various types. It possesses all of the requirements desired in a machine guard, strength, visi-

bility and free circulation of air. It can be bent or curved to any desired shape. The Wheeling Corrugating Company (see Appendix J, item 2) manufactures an expanded metal which is widely used for machine guards of all types and shapes.

Other Uses of Expanded Metal. Expanded metal has many uses besides the two just discussed. It is also used for guards on windows and guards for stoves and radiators. Expanded metal is used to make storage racks, trays, tool bins and display racks.

Shades for Windows

Window shades are coming into use in the shop building, as well as in industrial building and plants. The use of visual aids is requiring some type of blind to darken rooms for motion pictures. Shades may be used on shop windows to prevent direct sunlight from entering the shop.

Venetian Blinds. The newest type of blind and one which is fast gaining popularity, is the Venetian blind. Slats used in Venetian blinds are made from wood, aluminum or steel. They are usually two inches in width and the metal slats are convex in shape. Any width and length blind may be obtained. The Columbia Mills, Inc. (see Appendix J, item 3) makes Venetian blinds for any type of building.

Window Shades. This type of shade for windows has been used many years in classrooms. They consist of a cloth or paper shade mounted on a roller. However, the paper shade is not satisfactory where it is in constant use. In general, there are two kinds of window shade, the single roller shade and the double roller shade.

The single roller shade may be mounted at the top of the window or at the bottom. In the case where it is mounted at the bot-

ton, a cord attached to the shade and passing over a pulley at the top of the window, is necessary to raise or lower the shade.

The double roller shade is usually mounted in the center of the window. The top shade will move upward, while the bottom shade moves downward to shade the window. A cord and pulley is also necessary on the top shade of the double roller type.

Blackout Shades. The majority of schools are now using motion pictures as an aid in teaching. In schools where the pictures have to be shown in the individual classrooms, some type of blackout shade is recommended for best results. The Luther O. Draper Shade Company (see Appendix J, item 4) makes a darkening shade consisting of a black shade and roller, side channels for the edges of the shade and a flap cushion at the bottom of the shade to rest against the sill.

Window Screening

Window screens are used on some of the windows in shop buildings. Windows in wash rooms, drafting rooms and offices are the ones which would probably require screening. The windows in the shops are usually not screened. The manufacturers of the solid steel windows will usually furnish screens with their windows at extra cost.

A new type of window screen, manufactured by Ingersoll Steel Division, Borg-Warner Corporation (see Appendix J, item 5) which is actually a bronze miniature Venetian blind with fixed horizontal bars set to stop the greatest possible amount of sun ray heat before it enters the building. It is framed and applied to windows like ordinary insect screens. It is advertised to reduce room temperatures as much as fifteen degrees on the hottest days.

CHAPTER XI

CONCLUDING RECOMMENDATIONS

All the materials discussed in this report could be used in a shop building, however, some are not as desirable in school shops as others. Recommendations will be made for the types of materials which would probably be best suited for Oklahoma school shops.

Floors. Since the floors get more rough use than any other part of the building, considerable thought should be given when selecting a floor surface. For woodworking and handicraft shops it is believed that the edge-grain maple would be more satisfactory. However, the industrial asphalt tile could be used, but it is not as durable as the maple.

Cement is still probably the best floor for the metal working shops. Floors in these shops receive severe treatment and therefore, should be a tough durable floor. Wood or asphalt tile would not be very satisfactory in welding shops, forge shops, etc., where they are likely to come in contact with hot metal.

The asphalt tile would be a very good flooring surface for the drafting rooms, classrooms, and offices. Rubber tile could also be used, but it is not as resistant to fire and greases as the asphalt tile.

Ceilings. The acoustical ceilings are highly recommended for shop buildings, if funds are available the metal ceilings would be the best type to install. These ceiling units are fire-proof, durable and easily removed to permit maintenance on plumbing, wiring, etc. Some of the companies make an acoustical tile

from mineral fibers which is also good since it is fireproof. Acoustical plaster is now available and could be used. The wood fiber, cane fiber and cork tile are excellent acoustical materials, but they are combustible and should only be used when the other materials are not available.

Interior Walls. The walls normally receive rougher treatment than do the ceilings, especially to a height of about six feet from the floor. For that reason, it is recommended that glazed brick or tile, Keene's Cement or metal tile be used for wainscoting. The glazed brick or tile are usually the first choice among teachers. The remainder of the wall could very satisfactorily be surfaced with an acoustical plaster or asbestos board. Here again, the wood fiber, cane fiber and cork are not recommended because they should not be subjected to rough treatment and are not fireproof.

Shop buildings that are to be rearranged or new shop buildings will probably have partitions which do not help support the main structure. All three types of partitions, which were discussed, would be satisfactory to install. However, keeping in mind some future rearrangement, the movable type would probably be preferred. The acoustically treated metal partition would be exceptionally good for keeping down inter-room noise.

Doors and Windows. Only the industrial type doors and windows would be recommended for school shop buildings. They are fire-resistant and resist wear and severe treatment better than wood. The commercial projected windows are by far the most popular in all types of buildings. However, the pivoted and the casement type are widely used.

For the service doors in the building, either the sliding doors or the vertical lift turn-over type could be used. The turn-over type would not require a great amount of space overhead.

Class-Block Masonry. Glass blocks should be used wherever possible. The manufacturers of glass blocks recommend that they be used with windows or a vision strip underneath the glass blocks. They should not be required to support weight other than their own and should not be used in a building which is not well ventilated.

Color Systems. It would be difficult to make a choice between the two color schemes previously discussed. They are both recognized as very good color systems. The Pittsburg Plate Glass Company system calls for gayer colors than does the DuPont.

Chalkboards and Bulletin Boards. Chalkboards and bulletin boards should be in each shop. The black chalkboard seems to be being replaced by a green chalkboard. Recently, a chalkboard made of glass has been developed. This chalkboard has the writing surface fused to the plate glass. Another company makes one from cement and asbestos fibers. Both types would be satisfactory.

Cork or fiberboard are generally accepted as the best materials to use for bulletin boards.

Safety Floor Coverings. Any of the safety floor surfaces would be satisfactory around the machinery. However, a rubber mat would be recommended for the safety mat around electrical switch boxes or panels.

Blinds for Windows. The Venetian blinds are the most used type of window blinds in commercial and industrial establishments

at present. The metal slats will resist wear longer than the cloth window shades.

Conclusions. The recommendations for the various materials to be used in shop construction are the preferences of the writer. They were decided on after a study was made of the descriptive materials received from the manufacturers and distributors.

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APPENDIX A

Manufacturers of Flooring Materials.

1. Appalachian Hardwood Manufacturers, Inc., 414 Walnut Street, Cincinnati 2, Ohio.
 - a. "Appalachian Hard Maple" strip flooring is manufactured in accordance with the specifications of the Maple Flooring Manufacturers Association. It is available in standard widths and lengths.
 - b. "Appalachian Birch" and "Appalachian Beech" flooring is manufactured under the same regulations as Maple.
 - c. "Appalachian Oak" flooring is available in White and Red Oak, plain or quarter sawed, in standard widths and thicknesses.
2. Conners Land and Lumber Company, Box 112, Marshfield, Wisconsin.
 - a. "Laytite" Maple flooring is manufactured and graded in accordance with the Maple Flooring Association.
3. Jennison-Wright Corporation, 2463 Broadway, Toledo 1, Ohio.
 - a. "Kreolite Flexible Strip End-grain Wood Block Floors" are made from kiln-dried Southern Yellow Pine or Fir. Assembled in strips 2 to 8 feet in length, 2, 2-1/2 or 3 inches in depth parallel to the grain and approximately 3-1/2 inches in width.
 - b. "Kreolite Countersunk Lug Blocks" made from end-grain Yellow Pine or end-grain Upland Oak. These blocks have two or three lugs on each side and one lug on each end. Recommended for wet or dry areas.
 - c. "Kreolite Grooved Block" same as above except the sides and ends are grooved and recommended for interior dry surfaces.
4. Robbins Flooring Company, Rhinelander, Wisconsin.
 - a. "Ironbound" edge-grain hard Maple flooring. Made from edge-grain Maple 12 inches long by 1-1/8 inch wide in thicknesses from 1 inch to 2-1/2 inches. The strips are held in place by saw-toothed steel splines in 10 foot lengths.
 - b. "Ironbound" Continuous Strip" hard Maple flooring. A flat grain flooring with the same features as the flooring above except sizes, widths 1-1/2 to 3-1/4 inch thick-

nesses 25/32 to 53/32, and in lengths as desired from 8 to 15 inches.

- c. "Robbins Strip Hard Maple Flooring". Standard thicknesses and widths, also special thicknesses up to 53/32 inch.
5. Armstrong Cork Company, Lancaster, Pennsylvania.
 - a. "Armstrong's Industrial Asphalt Tile" is a flooring developed and made specifically for industrial use. Resistant to denting, grease-proof and comfortable to walk on. Black only.
 - b. "Armstrong's Accoflor" is a low-cost flooring recommended for use where traffic and wear are not excessive in light industrial floors.
 - c. "Armstrong's Cork Tile" is made of pure high-grade cork shavings compressed and baked in molds. Recommended for interiors where quiet and comfort are the main objectives.
 6. American Tile and Rubber Company, Trenton, New Jersey.
 - a. "Amtico Rubber Tile" are especially recommended where foot traffic is heavy. It is quiet underfoot and cuts down noise.
 7. David E. Kennedy, Inc., 58 Second Avenue, Brooklyn 15, New York.
 - a. "Kencork" is a cork tile flooring that is quiet, comfortable, safe and resilient. Not recommended where it would be subjected to severe traffic.
 - b. "Kentile" an asphalt tile flooring that is "grease-proof" and slip-proof. It is easily cleaned and is comfortable underfoot.
 8. Johns-Manville, 22 East Fortieth Street, New York, New York.
 - a. "J-M Asphalt Tile" flooring provides an excellent solution to the dust problem. They reduce foot fatigue and reduce breakage or damage of articles dropped on them.
 9. Mastic Tile Corporation of America, 153 West 57 Street, New York 19, New York.
 - a. "Ma-Ti-Co. Grease-proof" asphalt tile flooring is ideal for almost every interior use. Available in a large number of colors and patterns.
 10. Taylor Manufacturing Company, 3056 West Meinecke Avenue, Milwaukee 10, Wisconsin.

- a. "Wrightflor", a longer wearing, better looking hard rubber tile flooring. Available in a wide variety of sizes and colors.

11. Thos. Moulding Floor Manufacturing Company, 135 West Wacker Drive, Chicago 1, Illinois.

- a. "Moulstone Industrial" a plastic, troweled-on composition that converts old floors into new. Resistant to grease, oil and moisture. Fireproof and non-sparking.
- b. "Moultile" asphalt tile is a multi-purpose flooring which combines in the highest degree rich, colorful beauty, together with low initial cost and long-term economy.

12. The Tile-Tex Company, Inc., Chicago Heights, Illinois.

- a. "Tuff-Tex" industrial flooring, grease-proof plastic tile particularly adapted to meet the heavy demands of industry.
- b. "Tile-Tex" asphalt tile is a tough, sturdy flooring whose low cost and ease of maintenance make it ideal for use in institutional, commercial, residential and public building installations.

APPENDIX B

Manufacturers of Acoustical Ceiling Materials.

1. Armstrong Cork Company, Building Materials Division, Lancaster, Pennsylvania.
 - a. "Armstrong's Cushiontone" is a new, improved, perforated acoustical material in tile form, made of a special density fibrous composition. Available in two thicknesses of 1/2 and 5/8 inch and sizes 12 inches by 12 inches and 12 inches by 24 inches, ivory in color.
 - b. "Armstrong's Corkoustic" is a cork acoustical material of high efficiency and unusual decorative value. Available in three thicknesses, 1-1/4, 1-1/2 and 1-3/4 inch and a number of sizes. Colors are white, ivory, buff and special colors on order.
2. The Celotex Corporation, 120 South La Salle Street, Chicago 3, Illinois.
 - a. "Acousti-Celotex Can Fibre Tile" is perforated to within 1/8 inch of the perforations and assures repeated paintability. Sizes 12 inch by 12 inch and 12 inch by 24 inch.
 - b. "Acousti-Celotex Mineral Tile" is composed of mineral fiber felted with a binder to form a rigid tile, perforated and fireproof. Size 12 inches by 12 inches.
 - c. "Acousteel" combines a face of perforated steel with a wrapped pad of sound absorbing rock wool to provide excellent sound absorption, together with attractive appearance and incombustibility. Factory painted, sizes 12 inches by 24 inches, pad and facing is 1-5/8 inch thick.
 - d. "Gemesto", perforated asbestos board is used as a facing for "Celotex Brand Rock Wool Units".
 - e. "Standard Muffletone" is a cast gypsum product which provides a rigid, sound absorbing tile. Fire-resistant. Sizes 12 inches by 12 inches and 1 inch thick.
 - f. "Fissured Muffletone" like the standard type, but has a fine textured surface, which has fissures varying in size and location. Fireproof, size 12 inches by 12 inches in 1 inch thickness.
3. Johns-Manville, 22 East Fourtieth Street, New York, N. Y.
 - a. "Sanoacoustic Units" consist of perforated metal with a pad of rock wood which serves as the sound absorbing

medium. Fireproof. Colors, white and cream. Sizes 12 inches by 24 inches, 12 inches by 12 inches and 16 inches by 16 inches, in 2-1/2 inches thickness.

- b. "Transite Acoustical Units" consist of perforated facing 1/8 inch thick, backed by a rock wool sound absorbing element. Sizes 12 inches by 12 inches and 6 inches by 12 inches in 2-5/8 inches thickness. Colors, white, cream and natural gray.
- c. "Fibretone" is made of pine fibers. Has a pattern of circular perforations extending into the sound absorbing material. Size 12 inches by 12 inches, thickness 15/16 inch. Color, white.

4. National Gypsum Company, Buffalo 2, New York.

- a. "Gold Bond Acoustacoustic", an all wood fiber tile, beautiful in appearance, low in cost, light weight and easily installed. Color, natural cream. Sizes, 12 inches by 12 inches, 12 inches by 24 inches and 16 inches by 16 inches in 1/2 inch and 1 inches thickness.
- b. "Gold Bond Acoustifibre", low cost, light weight, wood fibre tile combining highest noise reduction per unit thickness with high light reflection. Perforated. Sizes 12 inches by 12 inches and 12 inches by 24 inches and 5/8 inch thick.
- c. "Gold Bond Acoustimetal", new improved metal units consisting of perforated metal pan, rock wool pad and metal mesh spacer grids. Fire-resistant and removable. Color white. Size 12 inches by 24 inches.
- d. "Gold Bond Acoustex", a tough durable fibrous tile recommended where ruggedness counts. Fire-resistant. Made from wood fibers. Sizes, 12 inches by 12 inches, 12 inches by 24 inches and 24 inches by 24 inches, in thicknesses of 3/4 and 1 inch. Painted in standard colors.
- e. "Gold Bond Sprayed Limpet Asbestos", a fireproof acoustical asbestos fiber that provides a smooth monolithic finish. May be sprayed on to any thickness.
- f. "Gold Bond Macoustic" is a decorative, fireproof, sound absorbing material that can be applied by any journeyman plasterer. Pre-colored, oyster white, ivory, cream, buff, calinstone.

5. Simpson Industries, Inc., White Bldg., Seattle 1, Washington.

- a. "Simpson Acoustical Tile", made from the long, strong, fibers of Douglas Fir. Perforated. Sizes 12 inches by 12 inches and 12 inches by 24 inches in thicknesses of 1/2, 5/8 and 7/8 inches.

6. United States Gypsum Company, 300 West Adams Street, Chicago 6, Illinois.

- a. "Acoustone P", mineral acoustical tile is manufactured by binding mineral fibers into a light-weight, highly sound absorbent tile form. Incombustible. Painted any color. Available in a number of sizes and thicknesses.
- b. "Motif'd Acoustone", same as above with decorations etched into the surface.
- c. "Auditone" wood fiber acoustical tile is a slotted wood fiber tile designed to give maximum acoustical efficiency and strength. Combustible. Sizes 12 inches by 12 inches and 12 inches by 24 inches in thicknesses of 3/4 and 1 inch.
- d. "Sabinite M" is a highly efficient acoustical plaster, scientifically prepared to produce a continuous trowel finish of exceptional sound absorbent qualities. Manufactured in four standard colors and white.
- e. "Sabinite P", same as above except provides a float finish.
- f. "Sabinite SS" is a hydraulic acoustical plaster prepared for use in locations subjected to high moisture conditions. It is manufactured in white only and provides a float finish.

7. American Acoustics, Inc., 120 South La Salle Street, Chicago 3, Illinois.

- a. "Softone Acoustical Units" are made from finely ground pure cork, the granules of which are coated with a fire-proof binder. Factory-painted "Sunny White Finish", but it may be painted and repainted with any standard resin-emulsion paint.

APPENDIX C

Manufacturers of Interior Walls.

1. Arktex Ceramic Corporation, Brazil, Indiana.

- a. "Arketex" glazed ceramic tile are designed for interior or exterior use. The finish will not craze or peel, and will not change color in the wall. Several colors are available.

2. The Celotex Corporation, 120 South La Salle Street, Chicago 3, Illinois.

- a. "Celotex Tile Board", a cane fiber material. Small and large square and rectangular units are used to create innumerable conventional patterns. Sizes, 12 inches by 12 inches, 16 inches by 16 inches and 16 inches by 32 inches in 1/2 inch thickness. Color is white only, concealed nailing joints.
- b. "Celotex Finish Plank", a cane fiber product. Long narrow, beaded units. Sizes 8 and 12 foot lengths and 12 and 16 inches wide. Thickness 1/2 inch with a white or four color blend finish. Concealed nailing joints.
- c. "Celotex Building Board", a cane fiber product. Large units well suited to wall and ceiling treatment. Sizes 4 feet wide and 8, 9, 10, or 12 feet in length, in 1/2 inch thickness. Color, white. The edges are square or beveled.
- d. "Delo-Rok" gypsum wallboard is made with a gypsum core inclosed in heavy tough fibered paper. They are fire-resistant. This wallboard is made with square, beveled or recessed edges. Sizes are from 4 feet to 12 feet long in even foot lengths, 4 feet wide in 3/8 and 1/2 inch thicknesses.
- e. "Celotex Hard Board" is a strong, durable, moistureproof wood-fiber material with a smooth surface that takes paint and enamel perfectly. Can be obtained in a variety of sizes and thicknesses.

3. Armstrong Cork Company, Lancaster, Pennsylvania.

- a. "De Luxe Monowall" is a decorative, durable, factory-finished hardened wood-fiber board for interior walls and ceilings.
- b. "Velos Wall Tile" is made up of individual tiles consisting of genuine vitreous porcelain, bonded and fused at 1560 degrees Fahrenheit to rigid 20 gauge steel.

4. Johns-Manville, 32 East Fortieth Street, New York, N. Y.
 - a. "Johns-Manville Transite Walls", "Imperial Type" are panels of an asbestos board hung on steel studs in a patented construction, forming a rigid double-faced partition 4" in thickness.
 "Universal Type", panels forming the finished wall consists of a sealed core faced on both sides with an asbestos sheet and furnished as complete wall sections 1-5/4 inch thick. Fireproof.
 - b. "Flexboard" is made of asbestos and cement combined under tremendous pressure, then hydraulically re-pressed for additional strength. Fireproof and insect resistant.
5. Masonite Corporation, 111 West Washington Street, Chicago 2, Illinois.
 - a. "Untempered Presdwood", to be used in interior work only, is an all wood fiberboard made from cleaned, refined, exploded wood fiber, felted and pressed into board form in heated flattened hydraulic presses, in special tempering process.
 - b. "Tempered Presdwood" is obtained by subjecting "Untempered Presdwood" to a special tempering process.
6. Metal Tile Products, Inc., Hastings, Michigan.
 - a. "Hastings Alunitile" is metal with the color baked on at 350 degrees in infra-red ovens. A range of 14 colors are available.
7. Detroit Steel Products Company, 2250 East Grand Blvd., Detroit 11, Michigan.
 - a. "Fenestra, Type C Wall Panels". Steel, aluminum and aluminum-steel. Consists of two members pressed together at the sides to form a structural unit. The panels are factory filled with a boro-silicate fiberglass insulation.
 - b. "Fenestra Acoustically Treated Panels". A "Type C" panel with the metal surfaces perforated to absorb most of the sound waves that strike the surface.
8. National Gypsum Company, Buffalo 2, New York.
 - a. "Gold Bond" gypsum plasters form a hard, tough base for finish coats for decoration. A full line of gypsum plasters may be obtained from this company.
 - b. "Best Bros. Keene's Cement" is the whitest finish plas-

ter obtainable and produces a wall with extreme durability. It excels for wainscots.

c. "Gold Bond Gypsum Wallboards" have a solid core of gypsum with paper faces. Fireproof and will not buckle or warp. Available in ivory finish or dark walnut, bleached walnut or knotty pine wood grain finishes.

d. "Gold Bond Hardboards" an all-wood product. Made from wood fibers exploded into fibers and pressed in board form.

e. "Gold Bond Partition Systems"

"2-in. Solid Partition System", with simplified metal base. Builds fireproof, non-bearing walls that cost less, weigh less, conserve space and resist cracking. The units required are the metal base, metal lath and plaster.

"Hollow Wall System" used the same metal parts and has all the advantages of the partition above. Two partitions together leaving a space between with plaster on the outsides. Reduces room-to-room noise.

9. Reynolds Metals Company, Building Products Division, Louisville 1, Kentucky.

a. "Lifetime" aluminum tile are made of rigid aluminum sheet coated with special colors baked to a hard smooth, permanent, wear-and-wash-resistant finish.

10. United States Gypsum Company, 300 West Adams Street, Chicago 6, Illinois.

a. "Pyrobar" partition tile are made from gypsum in various thicknesses, both solid and hollow, with indented surfaces to receive plaster. Fireproof and low in material cost.

11. American Acoustics, Inc., 120 South La Salle Street, Chicago 3, Illinois.

a. "Softone Acoustical Plaster" is manufactured from virgin cork and pure minerals. It is troweled directly to wood, brick, tile, gypsum lath, plaster or concrete. Its natural color is a medium brown tone which may be left unpainted if desired, or may be painted with any good non-bridging resin emulsion paint.

APPENDIX D

Manufacturers of Doors.

1. Ceco Steel Products Corporation, 5701 West 26 Street, Chicago 50, Illinois.
 - a. "Ceco Industrial Swing Doors" are made from 16-gauge steel, joints are welded. Intended for use in industrial buildings.
 - b. "Ceco Industrial Sliding Doors" are constructed the same as the swing door, but equipped for sliding.
 - c. "Ceco Accordion Doors" made for use in extremely high and wide openings. The panels are 14-gauge steel and the stiles and rails are 13-gauge steel. Joints are welded and ground smooth.
2. Detroit Steel Products Company, 2250 East Grand Blvd., Detroit 11, Michigan.
 - a. "Fireshield" swing doors are made from 16-gauge steel. The bottom panel consists of two sheets of steel with a layer of insulation between them.
 - b. "Fireshield" slide doors. Except for hardware, slide doors and swing doors are identical. Slide doors are provided with complete track equipment.
 - c. "Fenestra Two-Section Turn-over Doors". This door is composed of two sections. The bottom section travels vertically until it has traveled about half the height of the opening, then the leaves swing in at the top and upward at the bottom. Made from 14-gauge steel.
 - d. "Fenestra Two-Section Vertical Lift Doors". Particularly adapted to use in machine shops, foundries and industrial plants. To open both sections travel vertically, the bottom section twice as fast as the top section. Made from 14-gauge steel.
3. Michael Flynn Manufacturing Company, 700 East Godfrey Avenue, Philadelphia 24, Pennsylvania.
 - a. "Lupton Industrial Doors". Rails and stiles are 16-gauge pressed steel tubing, corners welded and ground smooth. The kick plate is 16-gauge steel and spot welded in place. Equipped with hardware for swinging or sliding.

APPENDIX E

Manufacturers of Windows and Glass.

1. Ceco Steel Products Corporation, 5701 26th Street, Chicago 30, Illinois.
 - a. "Ceco" commercial projected windows are especially designed, hot-rolled, billet steel. The ventilators have double contact weathering continuously around all four sides.
 - b. "Ceco" pivoted windows are the same as the projected, except for the ventilators.
 - c. "Ceco" casement windows are made from new billet, hot-rolled sections, having projections forming weathering contacts.
2. Detroit Steel Products Company, 2250 East Grant Blvd., Detroit 11, Michigan.
 - a. "Fenestra" pivoted windows are made from hot-rolled, solid steel angle bars with heavy fillets and vertex profile angles. Frame and vent corners are mortised and tenoned and air-hammer riveted.
 - b. "Fenestra" commercial projected windows have the same specifications as the pivoted, except for the vents that are hung at the top or bottom.
 - c. "Fenestra"-Fenmark Windows are slightly lighter than industrial windows, but could be used in some of the shop rooms. They are available in projected, casement and combination types.
3. Hope's Windows Inc., Jamestown, New York.
 - a. "Hope's Lok'd Bar Sash" are made from hot-rolled, low carbon steel. Ventilators are welded at all corners. They are available in commercial projected, pivoted and casement.
4. Michael Flynn Manufacturing Company, 700 East Godfrey Avenue, Philadelphia 24, Pennsylvania.
 - a. "Lupton" commercial projected and pivoted windows are designed for inside glazing. The joints are tenoned and riveted.
5. Reynolds Metals Company, Building Products Division, Louisville 1, Kentucky.

- a. "Lifetime" aluminum casement windows have joints that are rivited instead of welded. All frame members have glazing compound retaining grooves.
6. Libbey-Owens-Ford Glass Company, Nicholas Building, Toledo 3, Ohio.
 - a. "Thermopane" is the insulating glass unit for windows. It may be furnished in squares, rectangles or straight edge shapes, thereby providing angles that are not too acute.
 - b. "L. O. F. Quality Window Glass" is a sheet glass available in single strength, double strength and heavy sheet glass.
7. Pittsburg Plate Glass Company, Grant Building, Pittsburg, Pennsylvania.
 - a. Window, picture and heavy sheet glass that is available in single strength, double strength, picture and heavy sheet glass.

APPENDIX F

Manufacturers of Glass Blocks.

1. Owens-Illinois Glass Company, Insulus Products Division, Toledo 1, Ohio.

- a. "Insulus" glass blocks are a hollow, partially evacuated block, made of water-clear pressed glass, hermetically sealed when manufactured. They are made in a variety of designs for functional, decorative or general purposeful use.

2. Pittsburg Corning Corporation, 632 Duquesne Way, Pittsburg 22, Pennsylvania.

- a. "PC Glass Blocks" are hollow glass units made from clear glass in many patterns and sizes.

3. The Mills Building Products, Inc., 2036 East 22nd Street, Cleveland 15, Ohio.

- a. "Ventiblok" metal sash ventilator for glass block openings. Fits standard block openings with no alterations.

4. Winco Ventilator Company, Inc., 4725 Goodfellow Boulevard, St. Louis 20, Missouri.

- a. "Winco" ventilators are available in many sizes for all ventilating requirements in glass block masonry.

APPENDIX G

Manufacturers of Paint.

1. Pittsburgh Plate Glass Company, 632 Duquesne Way, Pittsburgh 22, Pennsylvania.
 - a. "Ironhide" is a fast drying, rust inhibitive and weather protective coating that bonds to metal. Colors are: black, gray and red. It may be sprayed or brushed.
 - b. "Sun-Proof Two Coat System", an exterior paint for wood. It comes in eight body colors and seven trim colors. Fast drying, resists weather hazards during the painting period.
 - c. "Wallhide" first coater is used for a sealer on interior walls. It is available in white only, but may be tinted.
 - d. "Florhide" floor enamel is a quick drying, tough elastic enamel for use on floors, but may be used on standing surfaces also. It is available in ten colors and also black and white.
 - e. "Wallhide PBX" wall paint is a finishing coat material with a slightly higher sheen than regular interior flat. Eight colors and white are available.
 - f. "Wallhide Interior Flat" wall paints are available in a wide range of colors to meet all requirements.
 - g. "Lavax" machinery enamel is designed to produce a most practical, quick-drying, wear-resistant finish for use on machinery and other factory equipment. Available in twelve color colors and black and white.
 - h. "Lavax PBX" enamel is a durable quick drying finish suitable for wood, metals, and other surfaces. Available in eight colors.
2. E. I. duPont de Nemours and Company, Inc., Finishes Division, Wilmington 98, Delaware.
 - a. "Dulux Hill White", an undercoat with amazing hiding power and fast drying.
 - b. "Dulux Super White" and undercoater are fast drying and have excellent hiding power.
 - c. "Color Conditioning Gloss" is available in many colors. Easily applied, covers solidly and dries quickly to a smooth finish.

- d. "Color Conditioning Dado Enamel", a gloss finish is made for the lower wall, dado, window sills and door frames.
 - e. "Color Conditioning Semi-Gloss" flows like enamel and dries without brush marks. A dull-lustre that can be washed is the result.
 - f. "Color Conditioning Flat" covers solidly, sets slowly and holds a wet edge that does not show laps.
 - g. "Safety Color Code Finishes" are available in "Dulux" quality.
 - h. "Dulux Machinery Finish" resists gasoline, oil and grease, which soften ordinary enamels. Its elasticity is unaffected by temperature changes and its tough, hard film withstands chipping.
 - i. "Dulux Metal Protective Finishes", a quick drying paint. Resists fungus, moisture, corrosion, cracking and checking.
 - j. "Acid and Alkali Resisting Finishes" stand up unusually well where fumes, acids and alkalis cause most paints to "go to pieces".
3. The Heardon Company, 2200 North Second Street, St. Louis 6, Missouri.
- a. "Bondex" is a patented waterproofing and decorating material for use on masonry wall and other surfaces. A water paint available in twelve colors and white.
 - b. "Firex" is a unique, two purpose product, being both a high quality paint and an excellent fire proofing material.
 - c. "Modex" is a casein-bound, lithophone-base, one-coat permanent interior finish supplied in dry powder form. It comes ready for mixing with cold water. Available in ten pastel colors and white.
 - d. "Whiticide", an insect killing paint with five per cent D.D.T., comes in white only.
 - e. "Lumalite" interior white paint is designed for industrial and commercial use.
4. The National Gypsum Company, Buffalo 2, New York.
- a. "Gold Bond Sunflex Delux" for interior walls and ceilings, comes in the form of resin emulsion, which is thinned by adding water. Available in eleven pastels and white.
 - b. "Gold Bond Sunflex", the original casein paste paint, is thinned with water and dries in 1 hr. Available in 10 pastels and white.

APPENDIX H

Manufacturers of Chalkboards and Bulletin Boards.

1. Armstrong Cork Company, Lancaster, Pennsylvania.
 - a. "Accopac", a cork composition suitable for bulletin boards, at a lower cost. Obtainable in 1/8 or 1/4 inch thicknesses and in natural cork color only.
 - b. Cork bulletin boards are made with a burlap backing. These bulletin boards are made in two colors: tan and green.
2. Weber Costello Company, 12th and McKinley, Chicago Heights, Illinois.
 - a. "Hyoplate", a chalkboard made of long-fibre pulpboard Available in green and black.
 - b. "Sterling", a chalkboard made of Portland cement and long fibre asbestos. Available in green or black.
 - c. "Webtex" cork tackboard, 3/8 inch thick, made from 1/8 inch cork, mounted on 4-ply composition backing. Available in several sizes and may be cut to any size on the job.
 - d. "Webco" display and map rail.
3. Celotex Corporation, 120 South LaSalle Street, Chicago 3, Illinois.
 - a. "Celotex Building Board" with square edges. Sizes 4 feet wide, 8, 9, 10, or 12 feet long in 1/2 inch thickness.
4. Pittsburg Plate Glass Company, Grant Building, Pittsburg, Pennsylvania.
 - a. "Mucite", a glass chalkboard made by fusing to the face of polished plate glass, a colored vitreous material hardened to resist the abrasion of chalk and eraser. Can be washed without harm to the writing surface. Colors: green, ivory and black.

APPENDIX I

Manufacturers of Safety Floor Coverings.

1. American Abrasive Metals Company, 460 Coit Street, Irvington 11, New Jersey.
 - a. "Ferrox" anti-slip floor troweling composition is a plastic abrasive composition which provides a very serviceable, low-cost safety surface for all types of walkways.
 - b. "Fera-Mat" anti-slip floor covering is a strong, durable fabric, impregnated on the walking surface with a tough flexible composition containing granular particles.
 - c. "Fera-Flow" anti-slip floor paint is a high grade floor paint containing non-slip particles. Colors available are black, brown, gray and green.
 - d. "Martex", a plastic safety material for stairways.
2. American Mat Corporation, 1717 Adams Street, Toledo, Ohio.
 - a. "New-Cord Counter-Tred", an oil and grease resistant safety mat made from cord and "DuPont Neoprene". It contains no rubber.
 - b. "Walrus Hide" rubber matting is a quality product of the finest rubber.
 - c. "Double Duty Rubber Stair Treads", a new type tread that covers the risers as well as the steps.
3. Bird and Son, Inc., East Walpole, Massachusetts.
 - a. "Rubberlike" is a composition floor covering that looks like rubber and feels like rubber, but is cheaper.
4. Behr-Manning, (Division of Norton Company), Troy, New York.
 - a. "Foothold Safety Tread" is built on the same principle as heavy duty, waterproof abrasive cloth. Effective when wet with water or oil.
5. Melflex Products Company, Inc., 410 South Broadway, Akron 8, Ohio.
 - a. "Melflex" corrugated rubber matting, a floor matting of quality for halls, stores, offices or other places calling for safety floor mats.
 - b. "Melflex" molded safety step treads are made from rubber

molded to fit over the edge of the step in one piece.

- c. "Helflex" link mats made from rubber links and held together with rustproof steel rods.
6. Thos. Moulding Floor Manufacturing Company, 165 West Wacker Drive, Chicago 11, Illinois.
- a. "Safety Tile" is a flexible floor tile in which non-slip aggregate has been impregnated throughout the entire thickness. It is a grip to the floor even under wet conditions.

APPENDIX J

Manufacturers of Miscellaneous Materials.

1. Stewart Iron Works Company, Inc., Cincinnati, Ohio.
 - a. "Stewart Sectional Wire Partitions" are complete with a standard panel end may be interchanged or rearranged at any time. Recommended for tool rooms, stock rooms, etc.
2. Wheeling Corrugating Company, Wheeling, West Virginia.
 - a. "Wheeling Flattened" expanded metal is recommended for use in constructing machine guards. It is also used in making display racks, storage racks, etc.
 - b. "Wheeling Safe-T-Mesh" expanded metal is widely used in partitions, guards, etc. May be obtained in different sizes, mesh and wire gauges.
3. Columbia Mills, Inc., 225 Fifth Avenue, New York 10, New York.
 - a. "Columbia" Venetian blinds are made in three groups. "Residential", made of 2 inch wood slats for residential windows. "Duralite", made from 2 inch steel slats. The slats are rust-proofed and finished with baked on enamel. All blinds may be obtained in any width and length.
 - b. "Columbia" window shades are made in a variety of types, sizes and colors for all types of buildings.
4. Luther O. Draper Shade Company, Spiceland, Indiana.
 - a. "Draper Sight Saving" window shades are available in both single roller and double roller shades complete with all the attachments needed for installing. Available in a variety of sizes and colors.
 - b. "Draper Pakfold" blackout shades are made for all types of windows. They are made from extra heavy black cloth.
 - c. "Lite-Lock" is a blackout shade consisting of a hinged cover roller box for easy removal or application of the roller shade, side channels and flap to cushion against the sill.
5. Ingersoll Steel Division, Borg-Warner Corporation, 310 South Michigan Avenue, Chicago 4, Illinois.
 - a. "Koolshade" is a bronze outside miniature Venetian blind, with the "slats" permanently slated outward and down at a 17 degree angle to block, reflect, absorb and radiate

as much as 90% of the sun's heat rays. It is framed and applied to windows like ordinary insect screening.

APPENDIX K

The following page is a copy of the form letter which was sent to the different manufacturers and distributors of building materials.

TO: Manufacturers and Distributors of
Special Building Materials.

Gentlemen:

I am starting a Masters Degree research project in which a study is to be made of unusual building materials for school shops. This research is part of the requirements for a Master of Science Degree under the direction of Dr. DeWitt Hunt, Head, Department of Industrial Arts Education and Engineering Shopwork, Oklahoma Agricultural and Mechanical College, Stillwater.

This work is being done in anticipation of new school shop buildings being constructed in this state in the near future. These buildings are usually apart from the main buildings; however, some will be connected to the main building by a covered passage-way.

I would like to secure all information on the materials available now or in the near future, which your company manufactures or distributes. Information, including catalogs, descriptive bulletins, circulars and even samples are desired for such building materials and equipment as:

- Metal windows, sash, doors, etc.
- Overhead doors, fire doors, etc.
- Special Floor materials.
- Accoustical wall and ceiling material.
- Glass block and other unusual building material.
- Paint and color systems.
- Safety floor coverings.
- Wire and expanded metal partitions panels.
- Blackboards and bulletin boards.
- Window coverings, etc.
- Prefabricated partitions, tool rooms, etc.

The research project is to include a study of new and unusual building materials, fixtures and supplies used in modern school shop construction. If possible, send two sets of information, one to my street address and the other to the office of Dr. DeWitt Hunt. Your immediate attention to this will be appreciated.

Very truly yours,

Ivan C. Richardson
410 $\frac{1}{2}$ West Maple St.
Stillwater, Oklahoma

Approved:

Dr. DeWitt Hunt, Advisor

BIBLIOGRAPHY

- Birren, Faber. Selling With Color. New York: McGraw-Hill Book Company, Inc., 1945.
- Brady, George S. Materials Handbook. New York: McGraw-Hill Book Company, Inc., 1940.
- Cheskin, Louis. Colors: What They Can Do for You. New York: Liverlight Publishing Corporation, 1947.
- Gay, Charles M. and Parker, Harry. Materials and Methods of Architectural Construction. New York: John Wiley and Sons, Inc., 1943.
- Huntington, Whitney Clark. Building Construction. New York: John Wiley and Sons, Inc., 1941.
- Knudsen, Vern O. Architectural Acoustics. New York: John Wiley and Sons, Inc., 1932.
- Ladd-Franklin, Christine. Colour and Colour Theories. New York: Harcourt, Brace and Company, 1932.
- Moore, Herbert F. Materials of Engineering. New York: McGraw-Hill Book Company, Inc., 1947.
- Paul, Hugh. Daylight in School Classrooms. Chicago: R. R. Donnelley and Sons Company, Inc., 1947.
- Rettinger, Michael. Applied Architectural Acoustics. Brooklyn: Chemical Publishing Company, Inc., 1947.
- Watson, F. R. Acoustics of Buildings. New York: John Wiley and Sons, Inc., 1930.

Typed by Marjorie Richardson