

MAKING ASBESTOS FIRE CURTAINS AND FIREPROOF FABRICS.

BY A. FREDERICK COLLINS.

With all the inventions and improvements in methods and apparatus for fire-fighting, it would seem that the quenching of accidental fires would be a comparatively easy matter; but experience has shown that after a certain critical burning point has been reached, the best-directed efforts fail. If the extinguishing of fire has not developed into an exact science, the art of building construction has; and it is now possible to make not only buildings absolutely fire-proof, but all their interior furnishings as well. A building of steel, brick, and fireclay offers but little protection from fire to the occupants if its interior is furnished in woods, silks, and cottons, and it is these inflammable products that are often placed where ignition is most easily possible. But these materials may be easily substituted by heat-resisting, chemically-prepared fabrics, or what is better, by products of asbestos, a mineral composed of flax-like fibers, which may be woven into cloth, spun into rope, made into paper, or compressed into a form that possesses all the qualities of wood except ignition. The purpose of this paper is to describe some of these processes.

Asbestos is one of the most remarkable substances found in nature, and is classified by geologists as a peculiar species of the hornblende family of minerals. Its composition is chiefly silica, magnesia, alumina, and ferrous oxide, and consequently unconsumable, hence its name. The fibers formed by the chemical combination above given are perfectly smooth, and in this respect are different from all other known fibers.

Paradoxically, it is the link which completes the chain between the vegetable and mineral kingdoms, and is in fact a mineralogical vegetable possessing the curious properties found in both, for it is at once fibrous and crystalline, elastic and brittle, heavy as a rock in its crude state, yet as light as thistle-down when treated mechanically.

Added to this, its fibers, soft, white, and delicate, have, by their inherent quality of indestructibility, withstood the action of the elements since the world began; and through all the countless ages, during

which the hardest rocks surrounding it have been reduced, this mineralogical mystery has remained intact, having successfully resisted the assaults of fire, acids, and time. Asbestos is found widely distributed throughout the world, although the principal supply of crude asbestos suitable for the manufacture of fire-proof cloths and curtains comes from Canada, about seventy-five miles from Quebec.

The Italian mineral has a fine, silk-like fiber, but is

asbestos, which may be vertical or horizontal, are found in practically detached deposits, and are as elusive as those of zinc-bearing ore, and can only be determined by exploring for them.

The rock to which the mineral is attached shows on fresh fracture a serpentine mineral of a green shade containing finely-divided particles of chromic and magnetic iron. The asbestos on cleavage presents a brilliant, dark-green surface by reflected light, but the fibers after they are detached are perfectly white. The act of separating the mineral from its matrix of rock is termed "hand cobbing," and after this process the mineral is shipped to various factories in the United States.

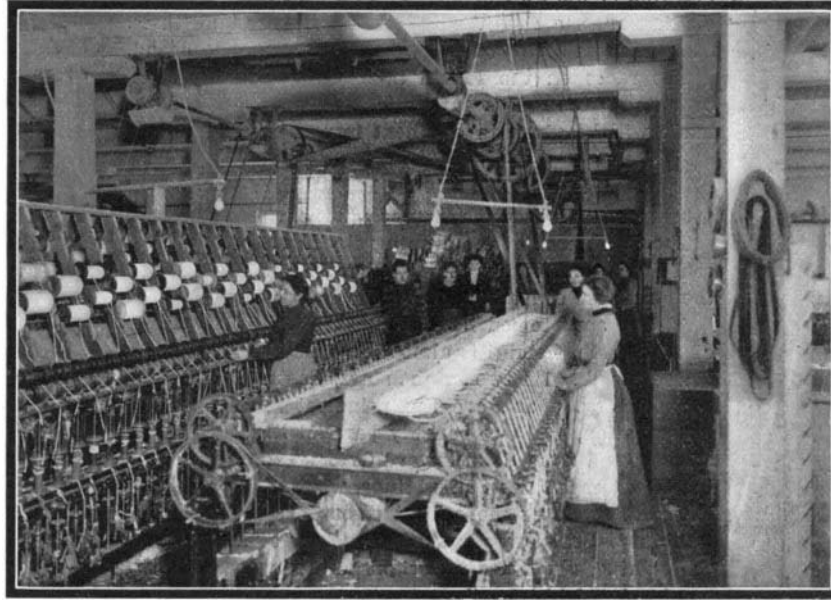
The process of manufacture begins by placing the asbestos mineral in a chaser mill, a machine comprising a rotating edge-wheel revolving at the end of a radial arm in a trough, which crushes the mineral, dividing the fibers without destroying them. The result is a snowy mass of mineral wool ready for winnowing, a method of removing the minute particles of rock still clinging to the fibers very much like the winnowing of grain; this is done by means of a blast of air, which separates and blows away the foreign matter, leaving the fibers in a refined state and in proper condition for the third stage of manufacture.

This is termed air fiber raising, and as the name implies, the fibers are raised by a current of air produced by a blower

of large dimensions through a vertical pipe inclined at a small angle. The object of this procedure will be obvious, when it is stated that the air blown across the fibers causes those of coarser texture to be deposited in a compartment near the bottom of the pipe. The medium fibers will be projected a little higher, and these will fall into a second compartment. The finer fibers will be blown to a higher point, and there collected, while the dust will be carried to the top and deposited.

The fibers are in this way sorted into different lots according to their texture, and are ready to be made into articles for which they are best adapted. The fluffy stuff now goes to the carding room, just as though it were genuine wool sheared from a sheep or

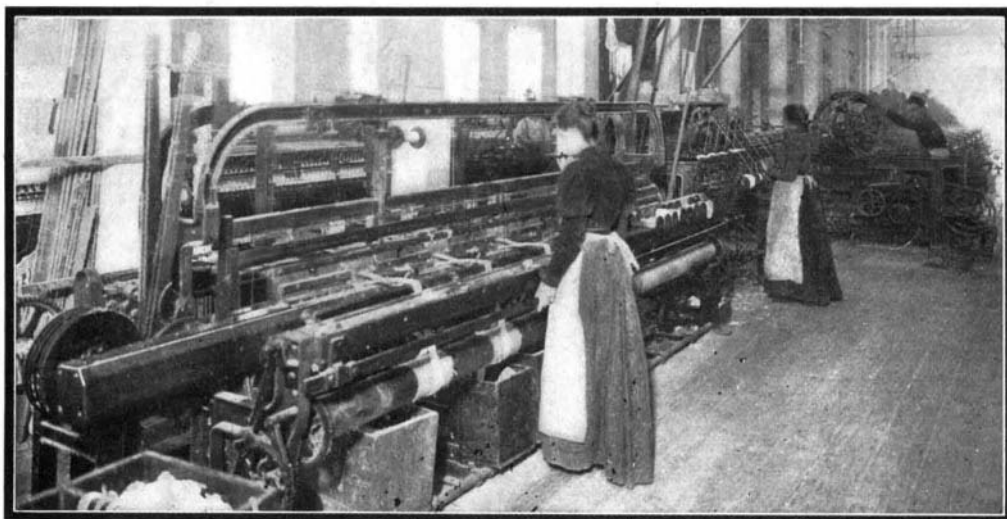
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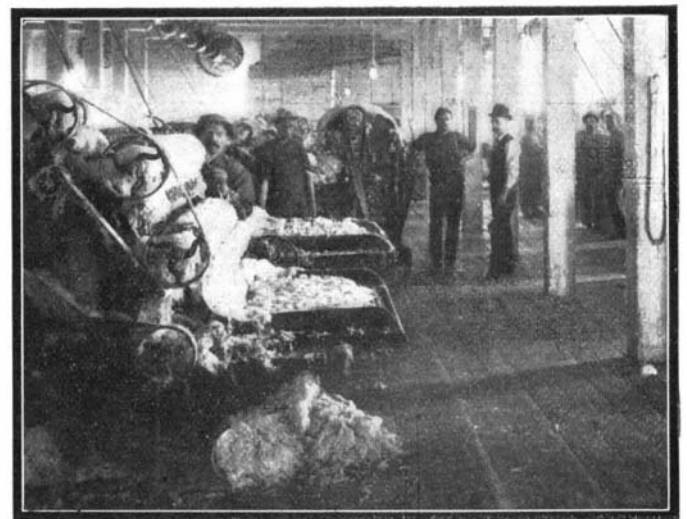
Weaving Asbestos Cloth.

lacking in the essential characteristic of strength. The product obtained from South Carolina has a soft, woolly, yellowish fiber, which quickly powders under pressure. The South African asbestos, as one might naturally infer, is of a dark slate or black color, with exceptionally long, strong fibers, but owing to its stiff and horny texture, it cannot be manufactured into a fine fabric, hence the superiority of the Canadian asbestos, and its large consumption in the United States.

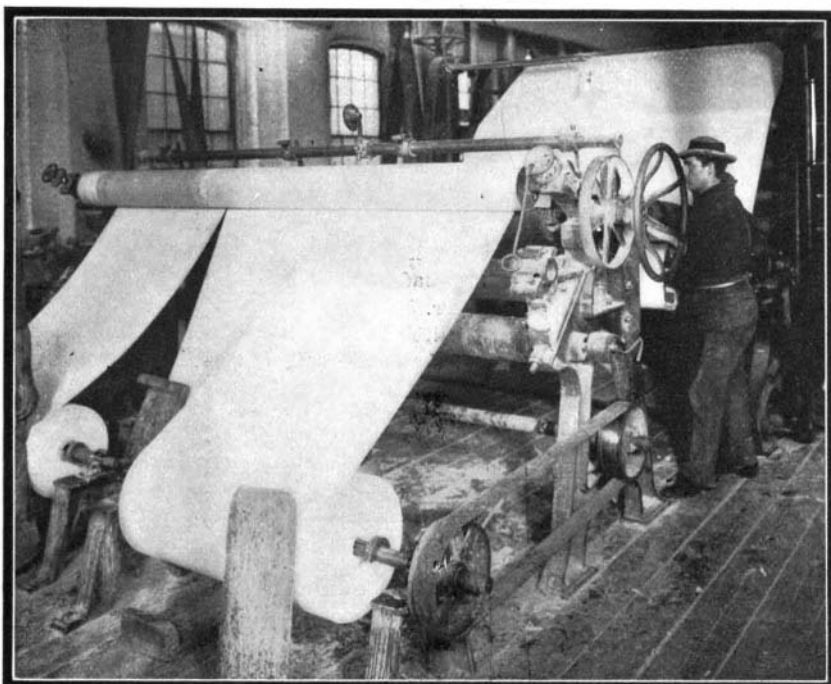
The mining of asbestos differs radically from the mining of other minerals, since no shafts are sunk, but excavations are made in the open, somewhat after the manner of a stone quarry. Canadian asbestos, however, is found in narrow veins or seams about an inch and a quarter in thickness, and embedded in rock which is easily severed from it. The strata of



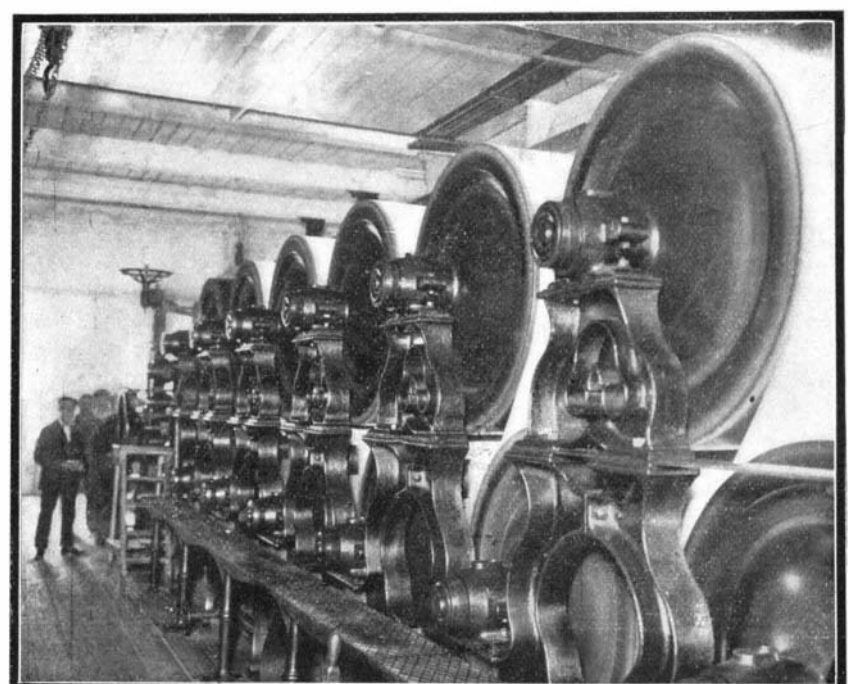
Weaving Asbestos Listing.



Carding Asbestos Fibers.



Cutting Asbestos Paper.



Manufacturing Asbestos Paper.

HOW ASBESTOS CURTAINS ARE MADE.

The people believe in a great many gods and deities, good and bad, who reside in and control the forces of nature. The inao are pieces of whittled willow wood, with the shavings left attached to the top. They are symbolic offerings in prayer, presented to the distant gods. Some are shaved upward, and others backward. They are hung up in the windows, doorways, and looked upon as charms, safeguards, and evils. They are also placed near springs, river-banks, storehouses, by the fireside, and in fact in every domain where the particular god is supposed to dwell. Near each hut is a small plot, which might be called the Ainu church or temple, for it is his special place of worship. This consists of a number of inaos or poles, upon which are placed the skulls of animals, which have been killed in a hunt or sacrifice, especially the bear. The men, old and young, with solemn faces, sit before these weird-looking objects and offer sacrifices, pour out libations of wine, and utter prayers to the gods, and implore them to reward the supplicant with success in hunting.

The material for the garments of both sexes is made from the inner bark of the elm tree, which is put into water to soak and to soften, after which it is taken out, and the fiber divided into threads and balls. It is then woven into narrow rolls of cloth on a primitive loom. The garments are quite rough, and have a faded brown color. The women are somewhat expert in executing fancy needle-work, and in their arrangement of patterns and designs, the embroidery and decoration is done with Japanese colored thread, upon the groundwork of their own elm-bark fabric. In winter the women sew bear, deer, and wolf skins over the elm fiber for greater warmth. The Ainu bear hunters undoubtedly outclass the best civilized sportsmen in bravery and courage. The latter consider one hundred yards off with a modern Winchester a safe distance for a shot for such an animal. The Ainu method, on the contrary, is as unique as it is thrilling and dangerous. The bears spend their winters in caves. To rout them out, long poles are pushed inside; if one shows himself in fair view, he falls severely wounded by the poisoned arrow. Often they are smoked out. When a bear is first shot, he savagely and furiously attacks his enemy. At close quarters, the Ainu discards his bow and arrow, awaiting one final onslaught. The wounded and enraged beast stands upon his haunches, ready to pounce upon his assailant. If the Ainu be a brave and experienced hunter, he watches his chance to make the final and fatal thrust. At the right time he rushes into the animal's embrace, and plunges his knife into his body. But he does not always escape without a reminder of the encounter. Some of the less venturesome hunters employ another method. Armed with a long, sharp-pointed spear, they await the charge, and keep the points of their weapons well hidden and covered by a piece of cloth under the arm. The animal seeing the hunter evidently without a weapon, makes a wild dash for him; quick as a flash, the hunter merely steps aside, and the beast falls upon the spear, which penetrates far into his body.

The most important ceremony of the year is the great bear feast, held in September and October. The bear is universally worshiped, and is looked upon as one of the most honorable representatives of their various gods. To give a bear festival is considered a great honor, and is likewise quite expensive, owing to the large amount of *saké* the host is required to serve. The young cub in the interval, before he is to be sacrificed, is kindly cared for and given the best food and fish obtainable, and is treated with great affection by the master of the household. For a year or more he is the "star boarder" of the family, and shares in all of the luxuries of his master's table. The ceremony is quite lengthy, and lasts several days. A few of the main features are here set forth. For the feast, the host several weeks ahead sends out invitations to his relatives and distant friends. It is the gala social event of the whole season, and the favored ones come arrayed in their best ornamented bark clothes, the women dress up their husbands in the most gaudy and showy garments, while they in turn appear in bark gowns, adorned with large earrings, necklace of glass balls with large copper pendants, and with a new coat of tattoo over their lips. It is said that the bear festival is one of the two occasions when the Ainu men and women wash their faces and hands, the other being at funerals. After general greetings have been exchanged, the host and his visitors inspect the cage quarters of the bear, after which they adjourn to the interior of the house, where the drinking of *saké* and prayer offerings are made. The mustache sticks are dipped into the *saké* and the guests throw several drops into the fire and other sacred places. After this the *saké* is quaffed in long draughts by the women and men, the beards of the men being held up with the mustache sticks. One of their number is delegated as a spokesman to go to the bear, and advise him of his forthcoming execution. This person sits down before the cage, and tells Bruin that he is about to be sent to his forefathers. He craves pardon for what he and

his fellows are about to do, and hopes that he won't be angry, comforting him by saying that a great many inao, plenty of wine and millet cakes will be sent along with his body on its last journey. After this he is taken out of the cage by a noose fastened around his neck, and led around, that he may enjoy a farewell bit of freedom. He is then made a target of by the men, who proceed to tire and wear him out by shooting him with blunt-headed and wooden arrows. Then comes the crucial moment for poor Bruin. He is seized and thrown down, and after being rendered helpless, two long poles are used to end his torture. One is placed under his throat, and the other on the nape of his neck, and he is gradually choked to death. After this his form is spread out on a mat before the sacred hedge or praying place, lamentations and dancing are held, and food and drink placed before him. The men seat themselves before the mat, and again libations of *saké* are offered and consumed, which the women join in drinking, and also dance in a hilarious fashion. Soon the effects of the *saké* are shown upon the men, who usually fall upon the mat in a stupor. On the next day the bear is cut up, and certain parts distributed to the guests, who participate in it. The head is then stuffed with inao shavings, and placed upon a pole stuck in the sacred hedge. This is also accompanied by dancing, weeping, and drink-offering. Thus the bear is consigned to his fathers, and the guests disperse to their various homes, and the village settles down in quietude for another year. A great diversity of opinion exists among anthropologists as to the origin and relationship of the Ainu to other peoples. They have no linguistic affinity to any neighboring or distant nations. Baelz, a foreign investigator, owing to their rather white skin and non-savage appearance, advances the theory that they were formerly allied to a branch of a European Caucasian race, which became divided and separated by encroachments of Mongol-Turkish invasions. Prof. Franz Boas, however, considered the foremost American authority, disagrees with this statement, and is of the belief that they probably belonged to the East Siberian and Asiatic tribes. The accompanying illustrations are reproduced through the courtesy of the American Museum of Natural History.

THE MAKING OF ASBESTOS FIRE CURTAINS AND FIREPROOF FABRICS.

(Continued from page 120.)

pure cotton fresh from the plant on which it grows, instead of a mineral substance that in its original state was mined like a lump of anthracite coal.

A carding machine, similar to that employed in preparing wool, cotton, or flax fibers before spinning, has been adopted by the manufacturers. The problem of mechanically combing these fibers was no small one, and the carding takes place in a machine having a large central rotating cylinder covered with card clothing, that is, strips of leather set with projecting wires termed teeth. Around the main cylinder there are a number of smaller cylinders, also provided with card clothing, which engages the teeth of the central cylinder rotating in the reverse direction.

This machine straightens out the fibers and lays them parallel; after passing through the first breaker, they are fed into a second carding engine or breaker, which is set to a finer gage than the preceding. A third and last carding process takes place in a machine called a finisher or condenser, when all the irregularities are eliminated, and the fibers are stripped from the final cylinder by means of a fly-comb, and are converted into unspun threads, when they are delivered on a traveling apron or endless band, and are gathered into rows by reciprocating scrapers; they are then condensed, and the process is continued in the coiling cans.

In spinning the yarn, the rovings are delivered to the spindles on a carriage, which then recedes, when the fibers are twisted, and returns when the spun asbestos yarn is wound on the spindles. The spinning frames do not draw the yarn, and no strain is placed on it until after it is twisted. This brings the manufacture of the fireproof material to a point where it is to be woven into cloth, packing, or other forms; for asbestos is used for divers other purposes than those appertaining to theaters.

While adulterated asbestos may be used in some of the mechanical arts, for theatrical hangings its purity should be 100 per cent; it then forms one of the safest barriers against the calamity of fire. As a matter of fact, much of that which is termed commercially pure asbestos cloth contains from five to twenty per cent of combustible matter, but absolutely pure American-made cloth may be obtained, where price is not a primary consideration.

Not only is purity essential in asbestos cloth where used for protection against fire, but strength as well; and after asbestos is subjected to a high temperature, it has a tendency to powder, when, owing to its weight, it may break through, and its utility be impaired.

One of the leading manufacturers has made an im-

provement in weaving asbestos cloth for theater curtains; it consists of two strands of asbestos spun around a strand of high-temperature-melting brass wire, so that the wire is completely embedded and concealed. These asbestos metallic strands form the warp, so that the threads run the long way of the cloth when finished. The weft, or filling-in cross threads, is made of plain, pure asbestos.

Such a curtain will stand well under a severe high-temperature test without breaking. The illustrations show clearly the different mechanical processes for converting the mineral into the finished cloth. Not only theater curtains, but set scenery of all kinds may be constructed of asbestos. Scenic artists find it more difficult to paint, but the finer textures may be utilized for this purpose; and although asbestos cloth does not take colors as satisfactorily as cheese cloth and burlap, yet its use should be provided for wherever audiences are to be assembled.

Flooring and woodwork in general may be easily replaced by compressed asbestos fiber board, and it has been shown that the latter may be stained, polished, and finished to as high a degree as wood. All the upholstery should be of pure asbestos cloth, and carpeting is also made to take the place of the combustible vegetable and animal fibers now used so extensively. One of the peculiar properties of asbestos carpeting is that the longer it is in service, the tougher it becomes.

Asbestos is utilized in the arts in many other forms than cloth; it may be worked into a pulp, and a fireproof paper is obtained. This paper is now used on roofs, between walls, flooring, etc. Fireproof rope three-eighths inch in diameter for the suspens of curtains and other uses is made having a tensile strength of 1,650 pounds per foot. High-grade asbestos plaster is fireproof, soundproof, and hangs together with great tenacity when subjected to water.

Asbestos mineral with rock as it comes from the mine costs \$200 per ton, but after it is stripped the long fibers are worth \$1,500 per ton. When these are made into cloth it sells for \$3 per square yard; when made into curtains, the sewing is done with asbestos thread.

The Current Supplement.

The current SUPPLEMENT, No. 1466, opens with an excellent description, illustrated by several large engravings, of the construction of Globe Island Bridge, Sydney, New South Wales. Electrical engineers will read with interest an article in which the results of the German high-speed railway trials are critically analyzed. The article on the Edison Portland Cement Works is concluded. The summary of the grants made by the Carnegie Institution is concluded. Mr. Samuel P. Langley, Secretary of the Smithsonian Institution, presents an interesting biography of James Smithson, the founder of the institution that bears his name. The article is particularly timely, inasmuch as Smithson's body has been transported from Genoa to Washington, in order that it may rest in the grounds of the Smithsonian Institution. Mr. W. A. Del Mar attacks the problem of melting sleet on a third rail, and shows what the prospects of success are of heating the rail. A new panoramic telescope has been exhibited in Germany, which gives to the man behind the gun an opportunity of completely examining a field of 360 degrees without moving either himself or the eyepiece of the instrument. The instrument is described in full. The Paris Automobile Show description is continued.

Transatlantic Turbine Liner.

The "Victorian," the first of the Allan Line's new turbine steamers for the Atlantic service, is fast nearing completion in Clarke & Co.'s shipbuilding yard at Belfast. She will probably make her first visit to Canada during the fall of this year.

Turbine steamers in cross-Channel service have proved a great success, chiefly because of insuring more comfort to passengers in rough weather, but great modifications and alterations in the system had to be devised to suit Atlantic requirements.

While the French submarine boat "Narval" was leaving Cherbourg Harbor recently, she came into collision with a tugboat which was traveling at right angles to the course of the submarine. The officer of the latter observed the approaching tug, and immediately reversed his engines, the "Narval" at the time making a speed of five knots. Although the momentum of the submarine was thus considerably reduced, she struck the tugboat with sufficient force amidships to force her nose through the hull of the latter to the extent of 16 inches, and the tug ultimately foundered, when the nose of the "Narval" was withdrawn. This accident affords a conclusive estimate of the strength and power of these submersible craft for ramming purposes, when driven at full force against another craft; and, according to French Admiralty experts, opens new possibilities concerning naval tactics.