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asbestos-cement manufacturing technology

PLAINTIFF'S EXHIBIT

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filtration of asbestos-cement suspension, the output of the sieve cylinders and their influence on the physical-mechanical properties of the end product

based on work by Dr. I. I. Berney — part VII

It is impossible to investigate the output of the sieve cylinders independently of its influence on the physical-mechanical properties of the manufactured product. Any calculation of the output of the sieve cylinders can only be accepted as correct, if under the operating conditions, the yielded product is of satisfactory quality. Otherwise, such calculations will not be representative and will have no practical use. The same applies to the influence of the conditions of filtration on output and quality of product.

It is proposed to analyse the data obtained experimentally, on the above criteria; this method will permit to draw correct conclusions and secure answers to the fundemental problems of the asbestos-cement manufacturing cycle among which are the improvement of quality and the increase of production.

The relation existing between the conditions of filtration of the asbestos-cement suspension and the physical mechanical properties of the manufactured end product, have been investigated both in the laboratory and under actual manufacturing conditions.

Experiments.

A quantity of asbestos-cement suspension was investigated using the special filter (see AC/M No. 7-8, July-August 1968). The characteristics of the suspension were the following:

ratio asbestos to cement: 14,4 : 85,6%;

asbestos furnish: all chrysotile, 50% grade 5 and 50% grade 6;

Fineness of grinding of cement: 3200 Blaine.

Cement type: 400.

The sample was made adopting the method described in AC/M No. 7-8, 1968; the sample was composed of a number of individual layers. As the properties of the manufactured product depend to a great extent on the pressure applied and to exclude any variations which could result from pressure conditions, each layer was pressed at 3 kg/cm² and the layers to each other at 20 kg/cm²; temperature of the suspension was also maintained constant at 20 °C and only the conditions of filtration were allowed to change during the formation of the elementary asbestos-cement layer.

The volume of the filtrated material was registered and the average rate of filtration was calculated. Average rate of filtration times concentration of the suspension gives the delivery of asbestos-cement per unit of surface of the wire which in other words represents the specific productivity of the sieve cylinder (see AC/M No. 1-2/1969).

Relative values of the specific productivity, will in all cases, be expressed in percent of the specific productivity, under certain known conditions admitted to represent 100 percent.

In order to compare the physical mechanical properties of samples obtained in the laboratory with the properties of the product obtained on the factory machines, a special series of experiments were carried out as follows:

Asbestos-cement suspension was drawn in equal quantities from the first and third vats of a machine in operation.

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The mixer of the special filter used (see AC/M No. 7-8, 1968) was fed with this suspension. A number of samples measuring 10 x 100 and 400 x 400 were then produced in the laboratory.
The moisture content of the layer from which these samples were made and the moisture content and the strength of these samples were measured.
Measurements were also taken of the thickness of the layer from which the industrial product was manufactured of the machine and also of its moisture content before suction and of the moisture content and strength of the green-end product.
On the strength of the results of fifteen experiments, it was established that when using the same raw materials, the properties of the samples made in the laboratory correspond to those of the product manufactured on the factory machine if the respective values are multiplied by the following coefficients:

For moisture content of layer before suction	0,94
Moisture content of fresh product	0,95
Tensile strength of fresh product	0,68
Flexural strength of hardened product after 7 days	0,88
Water absorption	0,85
Specific weight	1,08

Variations, resulting from different technogilocal conditions, of the above coefficients, do not exceed 6-8% and the above information led to the conclusion that the method of forming the samples in the laboratory was quite satisfactory.

The influence of the thickness of the elementary asbestos-cement layer, on the physical mechanical properties of the product.

The thickness of the elementary asbestos-cement layer, in industrial production, is one of the most varying values. The non constancy of the concentration of the suspension in the vats seems to be the basic cause of this variability.
In the course of the conducted experiments, the concentration of the suspension was made to vary from 6 to 14% and the thickness of the layer from 0,7 to 1,5 mm. Hydrostatic pressure was 40 cms. The prevailing conditions of filtration, the moisture content of the layer and the physical mechanical properties of the freshly formed samples are shown in table 11; for strength and specific weight of the hardened product, see fig. 29.
Variation of the concentration of the suspension and the resulting change in the thickness of the layer have a great overall influence on the technological cycle. The following differences can be noted where one A/C sheet was obtained with a concentration of 8% (see table 11, experiment No. 2) and another

TABLE 11
Conditions of filtration, moisture content of the layer and the physical mechanical properties of the fresh asbestos-cement product.

Experiments	Time of filtration-secs.	Percent concentration of the suspension	Thickness of layers mms.	Number of layer per item	Percent moisture content of layer on the wire	Percent moisture content of layer on the felt, before suction	Moisture content of product	Strength of green product kg/cm²	Rate of filtration cm/sec.	Percent specific output of sieve cylinder
1	3	6	0,732	6	72,3	55,06	30,3	2,74	0,33	100.0
2	3	8	1,100	5	71,7	51,40	28,5	2,09	0,31	125.0
3	3	10	1,120	4	69,6	48,20	27,2	2,09	0,27	135.0
4	3	12	1,340	3	69,2	47,50	26,0	1,98	0,24	14[illegible]
5	3	14	1,500	3	67,4	45,80	28,0	1,38	0,21	149.2

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with a concentration of 12% (see table 11, experiment No. 4):

a) The layers forming the first sheet were filtrated at a higher rate (0,31 cms/sec) than those forming the second sheet (0,24 cms/sec).

As it was already established (see AC/M No. 9-10/1968), different rates of filtration influence the structure of the layer and the ratio asbestos to cement in the layer; consequently the layers forming the sheets under consideration will be quite different not only in thickness but mainly in structure.

b) The first sheet (exp. No. 2) has been formed with 5 layers, in other words it passed 5 times under the Harvester roll and the second sheet was formed with 3 layers and consequently passed only 3 times under the Harvester roll. This is a considerable difference in pressure and will influence the strength characteristics in as much as the first sheet will result to be more compact.

The above 2 differences are not necessarily connected and can be met separately; for instance when a machine is running with a felt speed of 36 m/min. and concentration of the suspension equal to 10%, the thickness of the layer will be the same as that delivered by a machine running with a felt speed of 31 m/min. and concentration of the suspension equal to 8%.
Consequently the number of times the sheet under formation is pressed in this case, will be the same but the formation of the layer on the sieve cylinder will take place under different conditions as the rate of filtration of a faster machine will be higher and forcibly the structure of the layers delivered will differ. This establishes a fact: that with 2 machines manufacturing a product with layers of the same thickness, the respectively yielded products can have quite different physical mechanical properties.
In order however to determine the reasons which cause the difference in the properties of the products

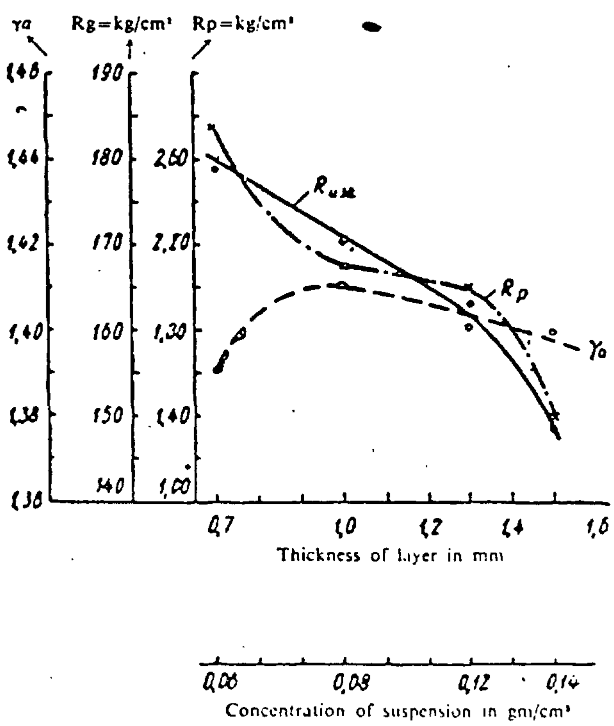

Fig. 29. - The influence of the thickness of the layer, on the physical-mechanical properties of the end product, with changing rates of filtration Rg = flexural strength at 7 days of age; Rp = tensile strength of green product; γa = specific weight in gm/cm³

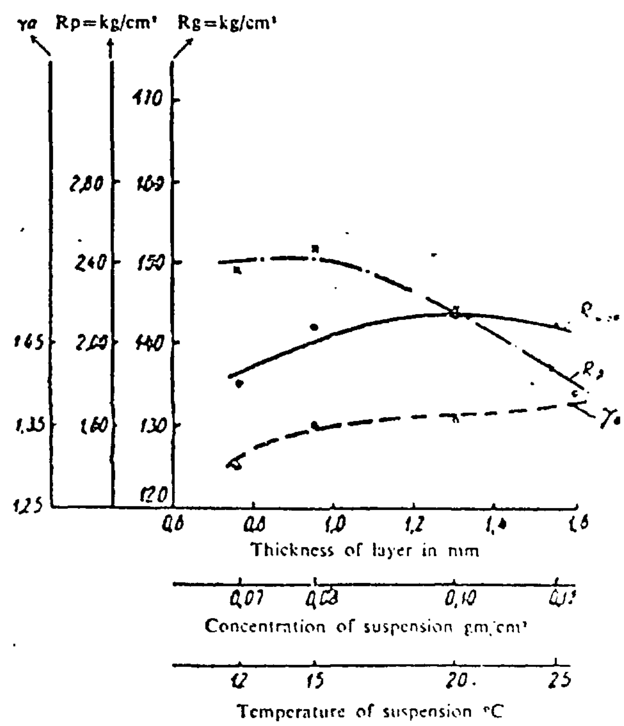

Fig. 30. - The influence of the thickness of the layer on the physical-mechanical properties of the end product, when rate of filtration is constant.

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TABLE 12
The conditions under which a constant thickness of the layer is secured with different values of the rate of filtration.

Percent concentration	Time of filtration secs.	Rate of filtration cm/sec.	Specific output of sieve cylinder percent
10	1,8	0,378	257
9	2,5	0,322	196
8	3,5	0,286	155
7	5,0	0,210	100

TABLE 13
The conditions of filtration with changing values of hydrostatic pressure.

Hydrostatic pressure, cms.	Percent concentration of suspension	Time of filtration secs.	Rate of filtration cm/secs.	Specific output percent
10	10	3	0,162	100
15	9	3	0,204	113
20	8	3	0,267	131
35	7	3	0,284	123

manufactured by the 2 machines, it has been necessary to investigate separately the influence of the two factors i.e. the thickness of the layer and the rate of filtration.

In the course of the experiments, the results of which are referred in table 11, both the thickness of the layer and the rate of filtration were changing at the same time and having more than one variable at a time, it was quite impossible to establish which of the two factors was responsible for the change of the properties of the product.

It became therefore necessary to conduct a further series of experiments allowing only one variable — in this case the thickness of the layer — while the rate of filtration was maintained constant. This is possible by increasing the concentration and the temperature of the suspension as necessary to maintain a constant rate of filtration. This experiment has a practical significance as it is exactly by this method i.e. by increasing the concentration and temperature of the suspension, that the production of the machine is increased in many plants.

In comparing these values with those of previously conducted experiments, the resulting differences should not be seen as absolute values because the cement used in this series differed in composition; however, for the purpose of establishing the influence of the thickness of the layer on the physical-mechanical properties of the end product, such relative values are sufficient. Graph fig. 30 gives an entirely different picture from that of graph fig. 29. The elimination of any influence from a change in the rate of filtration, shows that the strength characteristics of products manufactured with layers of a thickness ranging from 0,76 to 1,55 mm, are the same; only the green product showed a decrease in strength.

Having established that within certain limits, the thickness of the layer hardly influences the strength characteristics of the end product when the rate of filtration is kept constant, it is now necessary to establish the influence of the rate of filtration n the thickness of the layer is maintained constant.

In order to establish the influence of the rate of filtration on the strength characteristics of the product, a series of laboratory experiments were conducted. In the course of these experiments, the thickness of the layer was maintained constant when the concentration was increased, by reducing the time the filter was kept immersed in the suspension. Similar conditions can be obtained with the forming machines if the speed of the felt is increased when concentration is increased. This is the method for increasing the production of asbestos-cement manufacturing machines.

The conditions under which the elementary asbestos-cement layer was obtained in the course of these experiments, are referred in table 12.

Hydrostatic pressure, in the course of the experiments was 40 cms. The thickness of the layer was always equal to 0.9-1.0 mm. The sample in all cases was formed with 5 layers.

The moisture content of the layer on the felt was varying between 50.4 and 52.2% and the moisture content of the fresh sample ranged between 27.1 and 28.2%. These variations can be considered negligible and consequently their influence

The influence that the rate of filtration exerts on the physical mechanical properties of the end product, when the thickness of the layer is maintained constant are shown in fig. 31.

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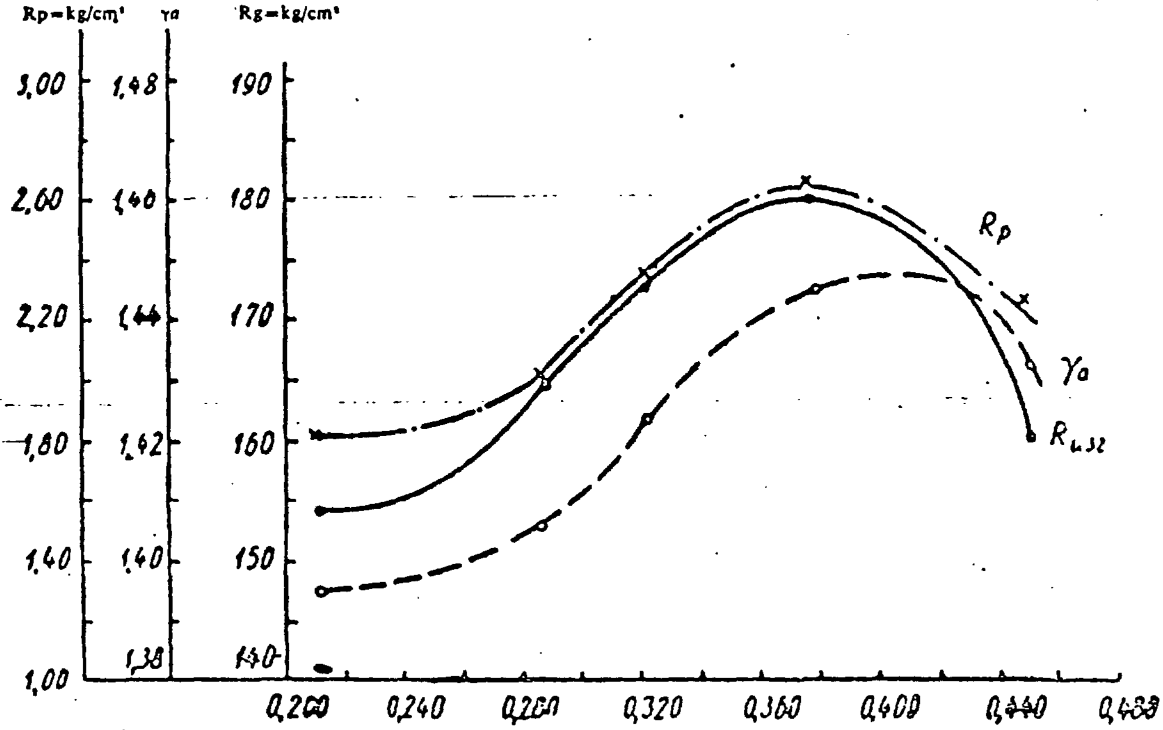

Fig. 31. - The influence of the rate of filtration on the physical-mechanical properties of the end product, when the thickness of the layer is constant.

Another series of experiments was conducted for the purpose of investigating the influence of hydrostatic pressure, on the properties of the asbestos-cement product. The conditions under which these experiments were conducted, are given in table 13. In the course of the experiments, the thickness of the layer was maintained between 0,6 and 0,7 mm. Moisture content of the layer on the felt between 52,6 and 53,9% and the moisture content of the green end product between 27,3 and 28,9,%.

The influence of hydrostatic pressure on the strength and density of the hardened asbestos-cement product can be seen on fig. 32.

A series of experiments were also conducted on a sheet forming machine and the method of carrying out these experiments has previously been illustrated (see AC/M No. 7/8-1968). The results of these experiments, i.e. the influence of the thickness of the layer, of the speed of the felt, of the rate of filtration and of the hydrostatic pressure on the physical mechanical properties of the asbestos-cement product, are shown in table 14.

The results of the laboratory and factory investigations are analysed hereunder.

Conditions of operation of the sieve cylinders and their influence on the quality of the product.

The best conditions of operation of the sieve cylinders can be established by analysing the results of the investigations of the influence of the conditions of operation of the sieve cylinder on the quality of the end product. The investigation will first involve the dependence of the properties of the product on the thickness of the layer.

The experiments carried out both in the laboratory and under actual manufacturing conditions, indicate that when the concentration of the suspension is increased from 6 to 12% and the thickness of the layer is increased from 0,732 to 1,340 mm, the strength of the product both fresh and hardened decreases and so does the specific weight. Under the above conditions, however, the output of the machine increases by 44,8%. It has been a common

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error to think that the decrease in strength of a product made with a suspension of high concentration is connected with the greater moisture content of the thicker layer. This is wrong and it can be seen in table 11 which shows that the moisture content of a thicker layer, on the wire, is dropping continuously. The moisture content of the thicker layer on the felt, before suction, is also considerably lower. It is evident that due to the above, the moisture content of the product, within certain limits (thickness of layer up to 1,3 mm), is also lower.

When a highly concentrated suspension is used, the resulting decrease of the moisture content of the layer on the wire and on the felt allows to produce a product of relatively low moisture content and this in spite of the fact that further dewatering by pressure (exercised by the Harvester rolls or pressure rolls) is considerably reduced because the product under formation is pressed less times.

It is for the same reasons that the specific weight of the product decreases only insignificantly (see graph fig. 29).

It is in fact in consideration of the above characteristics of the process of filtration that a great number of plants throughout the world have been able to operate satisfactorily with an increased production by increasing the thickness of the layer by 50-80% in respect to previously recognised principles.

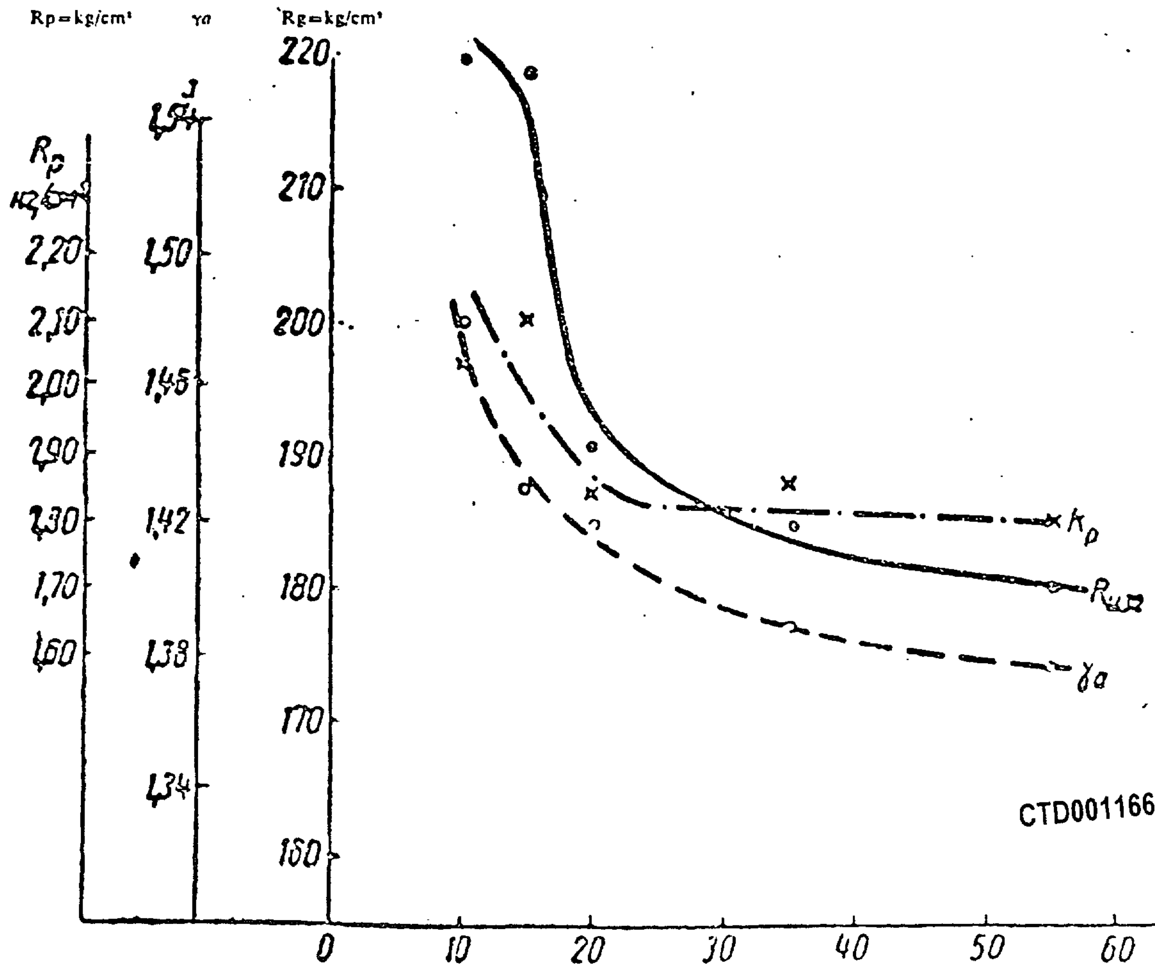

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Fig. 32. - The influence of hydrostatic pressure on the physical-mechanical properties of the end product when thickness of the layer is constant.

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This of course does not mean that the quality characteristics of the product did not change at all. In fact the green product obtained with a thin layer, is considerably stronger than the product obtained with a thicker layer (see table 11). It can also be observed that the products manufactured with 1,5 mm layers have a smaller specific weight and a greater water absorption than the products manufactured with layers of 1 mm thickness, although the moisture content of both, at the green state is the same.

In order to clear the reasons of these phenomena, it is necessary to distinguish clearly between density of the individual layer and density of the product as a whole; later, it will be demonstrated that the compactness of the end product depends not only on the force of pressure of the pressing equipment (Harvester roll or pressure equipment) but also on the number of times the elementary layer undergoes such pressure. In fact when a machine operates with a thin layer, the individual layers which form the product, in spite of the fact that they have a lower specific weight, are pressed more compactly as a result of the increased number of times they pass under the pressure equipments. When the machine works with a thicker layer, these layers have a higher specific weight but are not as compactly pressed in the product under formation and consequently, in between them will exist a great number of pores filled with air. It results that the thicker the layer is, the greater will be the difference of compactness of the individual layers and also the average compactness of the end product.

The presence of pores filled with air has no influence on the moisture content of the green product. When on the other hand the water absorption of the hardened product is determined, the pores become filled with water and it is due to this phenomenon that the ratio between moisture content of the green product and the capacity of the hardened product to absorb water, is disturbed.

The premature destruction of some roofing sheets for example is due to the loosening of the bond between layers with a resulting greater porosity and this porosity increases with the increase of the thickness of the elementary layer during manufacture. The porosity among the layers appears to be the weakest point of these roofing materials.

When, however, the porosity among the layers increases — this happens when working with a thick layer — the average compactness of the product changes only insignificantly and is hardly detectable with the currently used laboratory equipment.

This explains why products still deteriorate, although when tested they showed negligible changes and in some cases even a stability in strength and in capacity to absorb water.

On the basis of the above, the conclusion can be drawn that the increase of porosity is connected with the pressure equipment and not with the filtration equipment of the machines. The fact that with a higher concentration of the suspension a more compact layer is delivered, has already been demonstrated. Furthermore any change in the moisture content of the layer is due to the effect of hydrostatic pressure and not to the change of the concentration of the suspension. This is even more evident when considering that the upper part of the layer formed on the wire of the sieve cylinder, being nearer to the liquid phase of the suspension, will have a lower moisture content when the suspension is heavily concentrated and consequently also the average moisture content of the whole layer will necessarily be lower.

Often noted reductions in strength of products obtained with highly concentrated suspensions, have led to the error of believing that the deterioration of the quality of the product has been caused by the increase of the thickness of the layer. The experimental work carried out has proved beyond doubt that such an assumption is incorrect.

The assumption that any increase of the output of the machines, inevitably leads to a deterioration of the quality of the product, could have seemed correct at the time when the technological process of manufacture was not properly investigated and more specifically when the influence of the rate of filtration and of other factors, on the properties of the product, was not known.

The increase of the concentration of the suspension and the increase of the thickness of the layer which follows, are not the only means in the hands of the technicians for increasing the output of a plant. The output can in fact be increased without increasing the concentration, by increasing the speed of the felt in which case, sometimes, the thickness of the layer is even reduced (see AC/M No. 1 2-1969). Output of a plant can of course be further increased by increasing both the concentration of the suspension and the speed of the felt to such values that the thickness of the layer will remain constant. Such a case was created in the course of the experiments for the investigation of the influence of the rate

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TABLE 14

The influence of the working conditions of the sieve cylinder, on the physical mechanical properties of the asbestos-cement end product. Data based on the experimental work carried out on a factory sheet forming machine.

For the characteristics of the raw materials see table 8, AC/M No. 1/2 - 1969

Thickness of layer cms.	Hydrostatic pressure cms.	Speed of felt m/min.	Rate of filtration cm/sec.	Flexural stregth kg/cm²	Percent water absorption	Specific weight gm/cm³	Specific output percent
0,030	48	17,7	0,204	270	27,5	1,44	100
0,028	48	23,6	0,250	301	20,7	1,67	124
0,040	48	23,6	0,225	290	20,92	1,61	177
0,027	48	28,9	0,266	318	19,5	1,70	146
0,037	48	28,9	0,253	312	18,9	1,72	200
0,030	48	33,0	0,253	314	19,2	1,73	187
0,031	30	23,6	0,240	320	18,4	1,74	137
0,024	15	23,6	0,200	380	15,8	1,80	107

of filtration on the physical mechanical properties of the product (see table 12 and fig. 31). When conditions such as those shown in table 12 are met in a machine equipped with sieve cylinders of 850 mm ∅, 5 seconds of filtration will correspond to a felt speed of 18 m/min. and 2,5 seconds will correspond to a felt speed of 36 m/min. The increase of the felt speed from 18 to 36 m/min. and of the concentration from 7 to 9% will correspond theoretically to an increase of the output by 96% although the thickness of the layer remained constant. At the same time the strength of the product will increase by 11% (see fig. 31).

This was also established in the course of the experiments carried out on a sheet forming machine (see table 14). The increase of the felt speed from 17,7 to 33 m/min. resulted in an increase of the strength characteristics of the sheet by 15%. The thickness of the layer in this case was practically unchanged.

As it has been possible to demonstrate that the strength of the product can be increased while the thickness of the layer is constant, it results that quality depends not only on the thickness of the layer but on other factors too and specifically on the rate of filtration.

When comparing the two methods described hereabove, for increasing the output of a plant, i.e. by increasing only the concentration and secondly by increasing both the concentration of the suspension and the speed of the felt, a considerable difference will be observed in the conditions of filtration of the asbestos-cement suspension.

In the first case (see table 11) the rate of filtration decreases as the concentration of the suspension increases while in the second case the rate of filtration increases (see table 12) together with the increase of the concentration.

It has already been established that an increase of the rate of filtration causes the asbestos-cement layer to become less heterogeneous and improves the ratio of asbestos to cement in the layer (see AC/M No. 9, 10-1968). It was then assumed that these factors must have a positive effect on the quality of asbestos-cement. The experiments have now confirmed the correctness of the supposition. It is in fact the improvement of the structure of the layer that explains the improvement of the strength and density of the product (see fig. 31).

Having established that the strength characteristics of the product depend on the thickness of the layer and on the rate of filtration, the investigation must be

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carried further in order to determine to what extent each of these factors exerts an influence on the strength of the product. This can be done by analysing graphs figs. 30 and 31.

The analysis shows that the increase of the rate of filtration from 0.250 to 0,380 cm/sec. (52%) causes an increase in strength of the green product from 1,80 to 2,60 kg/cm² (45%) and that of the hardened product from 155 to 180 kg/cm² (16%), see fig. 31. It results that every one percent of increase of the rate of filtration leads to an increase in strength of the green product by 0,86% and to that of the hardened product by 0,31%. The decrease of the rate of filtration leads to a reduction in strength of the product in the same proportions.

On the other hand, the increase of the thickness of the layer, while the rate of filtration is constant, from 0,75 to 1,5 mm, or by 100% (see fig. 30) reduces the strength of the green product from 2,40 to 1,95 kg/cm² or by 19%. The strength of the hardened product can be considered as having undergone no change as the 4% registered is within the limits of possible errors.

The increase of the thickness of the layer from 0,73 to 1,50 mm or by 105% (see fig. 29) and the simultaneous decrease of the rate of filtration from 0,38 to 0,21 cm/sec. or by 36% (see table 11) reduces the strength of the green product by 48% and that of the hardened product by 18%. In this case, if only the rate of filtration is decreased at the same proportion without increasing the thickness of the layer the reduction in strength of the green product is 31% and that of the hardened 11%.

It results that every one percent of increase of the thickness of the layer, causes a reduction of the strength characteristics of the green product equal to 16% and of the hardened product equal to 0,07%. It can consequently be concluded that every 1% of increase of the rate of filtration exerts a considerably greater influence (approximately 5 times) on the strength of the product than the equivalent change in the thickness of the layer and that the change of the thickness of the layer affects only the strength characteristics of the green product. This investigation has explained why a factory could still produce a good quality product even though the thickness of the layer, in respect to previous methods of operation, was increased in some cases by 1,5 times.

This happens because the thickness of the layer has practically no influence on the strength characteristics of the end product; strength is affected by the rate of filtration mostly. It was observed that in this case, simultaneously to the increase of the thickness of the layer, the temperature of the suspension and the speed of the felt were increased.

The above is correct as far as the hardened product is concerned but things are quite different when the green product is involved. Machines working with a thicker layer, yield a green product which has a considerably reduced strength.

The result of this investigation can therefore be summarised as follows: any increase of the thickness of the layer will influence only marginally the strength characteristics of the hardened product but will reduce considerably the strength of the product in the green state, and this is confirmed both in the laboratory and under actual manufacturing conditions.

The assumption that the strength of the end product was influenced by the thickness of the layer, was based on the fact that the more easily measurable factor — thickness of the layer — was only investigated while the real cause — the rate of filtration — was neglected.

Considering the influence that the change of the rate of filtration and of the thickness of the layer. have on the properties of the end product, it may be assumed that these are solely connected with the working conditions of the forming machines; in practice, however, and in the course of the investigation, cases were met where the rate of filtration and the thickness of the layer were changing while the speed of the felt and the concentration of the suspension were maintained constant. This happened when the filtration properties and the temperature of the suspension were altered.

In fact the composition of the raw materials, has a great influence on the rate of filtration. Optimum rate is obtained when the fibres are treated and opened to a correct degree.

It is in a following article that the influence of the properties of the raw materials, on the filtrating properties of the suspension, will be discussed.

At this point, attention should be drawn to the fact that bad filtration resulting from different factors or causes, leads not only to a reduction of the output of machines but also to a decrease of the strength of the product due to the deterioration of the structure of the asbestos-cement layer which influences the properties of both the green and hardened end product. Any deterioration of the quality of the product, due to low temperature and reduced filtration pro-

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perties of the suspension, compels the machine operators to work with a low concentration of the suspension in the vats and thus reduce the output of the plant.

It is also to be noted that increase of the rate of filtration is not unlimited. Graph fig. 31 shows that the increase of the rate of filtration is useful only to a certain extent, up to 380 cm/sec. Going above this rate, will cause a decrease of the density and strength of the product.

The limit beyond which the rate of filtration cannot be increased, seems to have strong foundations if the figures referring to the ratio asbestos-cement in the elementary layer (see AC/M No. 7/8 - 1968) are remembered and which show that a too thin layer is never well saturated with cement.

In this case, with a rate of filtration higher than the mentioned limits, cement is not only carried away with the filtrated material, but a disturbance occurs which causes not only the free cement to be carried away by the filtrated material, but also part of the cement which had in the meantime adhered to the asbestos fibre. Such a thin layer, formed under the above conditions can neither be strong nor compact.

In the asbestos-cement industrial plants, machines are equipped with sieve cylinders of different diameters; the hydrostatic pressure differs according to the diameter of the sieve cylinder. The data shown on table 13 and fig. 32 (laboratory experiments) and table 14 (experiments on a factory machine) indicate that with the reduction of the hydrostatic pressure, the strength and compactness of the product increases though the increase can be considered insignificant when pressure reduction oscillates between 60 and 20 cms.

Consequently, it can be established that the difference in hydrostatic pressure resulting from the use of sieve cylinders ranging in diameter between 1200 mm and 500 mm is unimportant and has no influence on the quality of the product. However, the diameter of the sieve cylinders is also connected with the rate of filtration and this dependence will be discussed later.

The experimental work carried out has shown that when hydrostatic pressure is reduced below 20 cms, the strength of the product shows an increase of 20-25% (see fig. 32 and table 14).

Operating with a hydrostatic pressure of 15 cms, it has been possible to produce flat asbestos-cement sheets which at the age of 28 days had an average flexural strength (both directions) of 380 kg/cm² and water absorption of 15,8%. This is much more than what is currently obtained in practically every asbestos-cement plant and testifies to the fact that the possibility exists to improve the standard quality of asbestos-cement products by improving the technological cycle of manufacture.

Analysing the above results it became obvious that this increase in strength could only be explained by the improvement in the structure of the layer, as all the other factors were unchanged.

When in the work published in AC/M No. 9/10 - 1968, the formation and structure of the layer during the process of filtration was investigated, it was pointed out that the part of the layer which was in direct contact with the wire, is poor in cement content as a result of the fact that cement was carried away by the filtrated material. It was observed that during the formation of the layer, with high hydrostatic pressure, the particles of cement are prevented from depositing on the layer because of its great compactness; however, at the very moment this compactness is reduced to the extent that saturation of the layer with cement becomes possible, then the layer becomes more homogeneous and consequently the strength of the product improves. Hydrostatic pressure corresponding to such a moment, as the experiments have shown, is between 10 and 17 cms. In order to obtain a hydrostatic pressure within the above indicated values, sieve cylinders of 300 to 400 mm Ø should be used.

Alternatively hydrostatic pressure can also be reduced where cylinders of a larger diameter are used, by increasing the level of the water inside the sieve cylinder, thus reducing the difference between the level in the vat and the level inside the sieve cylinder, to the required values.

Table 14 contains data on products obtained on a machine, operating with different thicknesses of layer and rates of filtration. If the data is used for the calculation of the change in strength, it will be found that the strength of the product should increase theoretically by 7,2% when the rate of filtration is increased from 0,204 to 0,250 cm/sec. The experiments showed that the increase was 11%.

The comparison of the results of the calculations with the results of the experimental work, indicate that the established relation in the laboratory between the strength characteristics of the product and the conditions of operation of the sieve cylinder, is also valid under actual manufacturing conditions.

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