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'POLYSAND' BUILDING MATERIALS, THEIR PRODUCTION AND APPLICATION [1]

by

W.A. Benedikter,
Patentanstalt für neue Baustoffe,
Vaduz, Principality of Liechtenstein

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SUMMARY

'POLYSAND' BUILDING MATERIALS, THEIR PRODUCTION AND APPLICATION [1]

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The 3 requirements for a revision of the methods for producing building materials, which are supposed to enable any country and any area to manufacture the [illegible] required by means of local raw materials and available labour have been fulfilled by the technics and processes presented hereby.

The building material POLYSAND is won by direct conversion of ordinary sand, clay, loess, ashes or slag and by [illegible] special processes; polysand therefore does not represent merely a mixture of the familiar base materials; instead a completely new material with new and better properties than all conventional materials is obtained.

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Special charactcteristics and properties are:

POLYSAND has the same or higher compressive strength than concrete but nearly half its specific weight.
Depending on the requirements and the application envisaged the finished articles made of polysand can be varied with a view to their physical and constructional properties so that maximum economy can be achieved. Thus any specific weight between 400 - 2000 kg/m^3 can be chosen, also different compressive strength and any other requirement such as the insulation against heat and sound etc. can be considered. - Thus the material can be adapted in the factory to the constructional requirements and for any application a suitable material can be produced, i.e. specific weight, compressive strenght, insulating properties and abrasion resistance can be fixed and obtained as desired.
Therefore it is not necessary to produce all prefabricated parts from one compound as is the case with concrete, and then adapt these parts to their application by special insulation or other additional measures (see the uncomfortable concrete towers with their much condemned changes such as sensitiveness to noise, development of sweat and mildew, insufficient insulation qualities and uncomfortable climate of living, impossibility of subsequent insulation etc).

The manufacture of polysand material is fully automatic and can be effected by a few workers. The finished parts can be built up within 24 hours. The building elements are self supporting and for the erection of buildings no steel or concrete skeleton is required. - Small or big prefabricated parts or other elements of any specific weight and compressive strength can be produced.

The expenditure required for the erection of a POLYSAND plant can be compared to the costs of modern and efficient concrete works, the difference being that the concrete works do not produce the cement required themselves but have to buy it and are thus not realy on local raw materials.

The prefabricated parts can also be produced in colour or with any surface effect desired; they can be produced with or without reinforcement, their size is merely limited by transport problems.

At present no building material besides POLYSAND can be applied so universally, has similar excellent properties and is as economic and profitable.

Polysand materials produced by cold setting can be employed for any finished product so far made out of asbestos cement, natural or artificial stone, synthetic or ceramic materials, e.g. sheets, plates, facades, floors, staircases, building elements and tubes as well as coatings and moulded parts such as basins, tubs etc.

As a rule, POLYSAND is made out of sand; however, other locally available raw materials or industrial waste and mineral or non mineral fibres may be used.

The plant required for the manufacture of POLYSAND can be operated by unskilled labour so that production is also possible in industrially undeveloped regions without risking the high quality of the products. Moreover the capital investment required for the manufacture of POLYSAND is but a fraction of the cost for the processing of asbestos cement. Neither presses nor grinding or polishing devices are required and the space required for a production line is low so that it can be joined to an existing production.

Polysand pipes can be produced from local sand too, and can also be manufactured in those regions where the production of high grade pipes so far was impossible due the lack of raw materials and qualified labour.

Polysand products can be given any colour or composition of colours; moreover they are resistent to weather and aggressive materials as well as to corrosion. Polysand materials are mostly more solid and of better durability than concrete and asbestos-cement materials.

The polysand building materials, the application of which is to find in the application field of asbestos cement, no expensive and large machinery and equipment are required.

To produce POLYSAND all kinds it will be need only sand, clay, ash, slag, lime and water or unsaturated polyester resin as raw materials also industrial wastes while cement or asbestos fibres are not necessary.

The production can be installed everywhere.

The first step should be the erection of a plant to produce sheets, plates, facades, floors, staircases, roof tiles and plates, etc. with the described small equipment (see page 47 - 52). This is the possibility to start the manufacture of new POLYSAND building materials in a short time in every countrie.

The cheap raw materials, the low financial and personnel requirements as well as the economic method of industrial production result now in a material which does not only combine the advantages of conventional materials but in addition has far superior qualities and is less expensive, i.e. POLYSAND!

The technicue of new building materials described is therefore capable of solving any problem of construction anf of the manufacture of building materials in any part of the world radically and seccessfully. - Building methods of tomorrow is industrialisation based on Polysand the building material of tomorrow! - - -

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"Polysand" Building Materials, their Production and Application

The recent rapid scientific and technical development has brought outstanding results.

Men stepped on the moon, remote planets were explored, medicine successfully fought diseases and epidemics and extended human life, and every 5 years the knowledge of mankind doubled!

Merely one field - civil engineering - which for the existence and well being of mankind is just as necessary and indispensable did not change remarkably if closely looked at.

Although it has to be admitted that every now and then novel conceptions and architectonic dreams are carried out, the building materials themselves - brick, concrete, steel and glass - have remained the same which had been known and used for hundreds or even thousands of years.

It is therefore obvious that the discrepancy between architectonic development and the conventional building materials available is characterized by remarkable deficiencies. The result of these deficiencies is that an ever decreasing amount of housing space for the growing world population is being procued; the procurement is linked with growing problems so that the lack of housing space cannot be balanced and the suppressed demand cannot be met. - Moreover it is well known that the comfort of modern buildings out of concrete, steel and glass - the building materials permitting technical architecture - is considerably impaired unless additional, highly technical installations such as central heating and air conditioning systems are provided for every room and can be employed. In the absence of such installations it is simply unbearable to live in such rooms during the hot or cool seasons or with fluctuatings temperatures. This fact cannot be eliminated by questionable and insufficient additinal insulating measures such as the use of insulating cores in prefabricated concrete parts.

Therefore central heating and air conditioning systems have to be installed simply to create a climate of living permitting to live in concrete buildings; otherwise people will suffer from "Betonitis", a permanent indisposition caused by a cold; moreover the development of sweat and mildew in such rooms increases to a catastrophic extent.

On the other hand, the present highly technical way of construction is unthinkable without concrete and therefore the quantity of cement required rises steadily.

The production of cement as base material for the mass building material of concrete is, however, linked to certain restrictions. The conditions for the production of cement do not exist in all countries - and this fact could be altered since Portland cement was invented almost 150 years ago. - The same applies to the invention of asbestos cement for sheets and tubes, which dates back more than 60 years.

It was therefore not by accident that cement as well as asbestos became world commodities and the ever increasing demand for these materials was met by trusts which developed in the meantime.

Therefore the following claims are raised with a view to the suppressed demand of housing space and considering the procurement of living quarters for the growing world population:

1) The necessary building materials should be available without restriction and in any required quantity.
2) As far as possible, building materials should be produced from local raw materials of any type, independent of the stage of industrialisation and training of the labour in the country or region concerned.
3) Building materials should permit technical construction methods; moreover they should be better and cheaper than conventional building materials.

In search of building materials better than the conventional ones and able to replace concrete and asbestos cement - a group of scientists, research workers and companies made discoveries and found out new basic facts to the production of building materials - the results of their activity are administered by the 'PATENTANSTALT FÜR NEUE BAUSTOFFE', Vaduz, Principality of Liechtenstein.

It was further stated that the search for a "replacement" often leads to unsatisfactory solutions and results. Therefore new solutions were worked out resulting in new building materials which in turn set new standards for the quality requirements and characteristics of building materials in the future. -

For cheap mass building materials which are to supply the necessary construction elements for general as well as for house and industrial building, with the properties required for the application envisaged, sand which is available almost everywhere in the world was chosen as basic material. However clay, loess, ash and slags as well as industrial waste were successfully used as raw material so that the statement is justified that the technical conditions of producing building materials without cement exist in any country and in any region. –
The building materials mentioned are produced by steam curing and range from extremely light building materials (with or without fibres) to heavy and steel concrete.

Due to the [illegible] industrial process for their production the new building materials have improved or novel [illegible] properties and permit maximum economy in [illegible] applications. –

In further pursuance of the ideas and stimulated by the excellent results obtained when using the cheap raw material of sand and other locally available raw materials or industrial waste [illegible] production in the application [illegible], the "Polysand" process applying [illegible] was developed. –
In this process the [illegible] materials to be used are bonded by a quantity of polymer binder, adapted to the properties and the required application of the finished product; the term "Polysand" [illegible] binder – preferably unsaturated polyester resin [illegible] – is added at a small ratio as compared with the [illegible] materials.
[illegible] materials whose applications far exceed those of [illegible] require no fibre reinforcement in themselves, but can, however, be processed or combined with fibres of any type without difficulty.

In addition to the development of the new building materials and the successful modification of previous steps, the necessary machinery for the smooth, simple, economic and industrial production was designed and built and techniques for the application of the material were developed.

Moreover the necessary coefficients as well as the static problems and [illegible] were treated which have to be dealt with for solving all constructional questions connected with the use of "Polysand" building materials. It should therefore be mentioned that the development of the machines and the solution of the constructional and architectonic problems was effected in co-operation of Aust & Schüttler, Germany, Dipl.Ing., builders and architects Hans Pucik and I.Wessely, Austria and FAB-International, Netherlands, and others.

The above coordination of scientific and technical tasks resulted in the fact that the future has begun and the fields of building materials and civil engineering neglected so far participate in the rapid modern development mentioned in the beginning.

To demonstrate this development and pave the way for a new building era is the object of the subsequent statements. . . .

In Defence of the Towns of Tomorrow

To be happy and joyful, a man of today has plenty of needs to be satisfied. Necessity to lead a happy family life in a spacious and comfortable house or flat, to eat sufficient and palatable dishes, to travel and see other countries and nations, to experience musical, theatrical and other cultural sensations, and why not – to do useful and pleasing work. Satisfying of the last mentioned need, i.e. the need for working, must render sufficient material possibilities in order to satisfy all the other costly needs.

The greatest expenses among all others are those on building a house or a flat meeting fully the requirements of today. – A family with, for instance, three or four children, should have a house or flat comprising at least the following rooms: a spacious living or guest room used by all members of the family, a dining-room, a bedroom for the parents, a room for each child, a parlour, and all the auxiliary rooms. Thus, at least 8-9 rooms. Total area of such an abode is minimally 200 m^2. Unquestionably this can be afforded even in economically most developed countries by few families only, if not to spend on dwelling more than one third of One's income. Technology and culture being in continuous development, the circle of people's needs to be satisfied is expanding rapidly. Already nowadays it is abnormal to spend one third of one's income on the rent of a flat only. The more abnormal will it be in future. Therefore, the problems associated with building of dwellings or flats are most important in the progressive society of today, and their being of importance will continue still for a long time.

They say the [illegible] development of the [illegible] of today to be [illegible] within five years already, [illegible] to be [illegible].

To give a possibility for all families of the world in the next 50-100 years to live in a house or a flat of 8-10 rooms, one of the main conditions is that none of the buildings, as for its structure or location, would grow out of date in the course of at least a hundred years. It is a pity that erections in the country are sometimes demolished because of their site hindering to broaden existing or to build new roads. In large towns of today building and demolishing are almost always going hand in hand. - For example, there are already 11 million inhabitants in Tokyo, and one square metre of land in the city was said to cost more than 5000 dollars. - What happens when the number of inhabitants in Tokyo will be [illegible] millions? -

By means of 30-storied buildings we could concentrate on every square metre of Mother Earth at least one homo sapiens, i.e. ten thousand per hectare and a million per square kilometre. - It is quite clear that by this kind of town building the needs of people of today cannot be satisfied.

Men have been building towns for thousands of years, but still at the times of grandfathers of the present middle-aged men but a little per cent of the that time mankind lived in towns. No wonder then that the majority of town people yearn for being nearer to the country and nature. Just for this reason families from even such a small town as Salzburg/Austria, try to spend the summer and winter as much as possible with Mother Nature.

The philosopher Bacon has said that people who wish to enjoy life still in high age must certainly have a garden to take care of.

But towns offering to the people unprecedented modern conveniences have begun to demand ever higher price for it. The majority of towns have become nests of high stone barracks much close to each other. The average size and height of urban buildings are increasing at immense speed. And ever smaller becomes man among and inside of them. And still farther is he being removed from nature and the wise principle of the wise philosopher.

Some talented architects try to improve the situation by varying the structure of buildings or vivifying facades of similar big stone-concrete-steel-glass colossi with different colours or patterns. Others look for a solution in non-conventional placing buildings. -
In some West-European region it is the vogue to build in the centre of major cities islands with market places and parks, where modern means of communication cannot intrude and which remind of [illegible] small towns of old time. Does the [illegible] - does it save from wasting hours in order to work and return home? - Are the main problems of [illegible] solved by creating a green strip with [illegible] and a lawn for children around a house of [illegible]?

Towns as they are today with their sins and glory came actually into being after the birth and concentration of industry. The beginning was not bad at all. - A settlement or small town built around some industrial enterprise, about 100-150 years ago, [illegible] quite closely to the philosopher's ideal. It was not so bad even at the very beginning of big industry. Two-storied buildings in the close proximity of a factory (as they were built before War I), did not bring workers too far from nature and enabled them to be at work after a few minutes walk. However, it must not be forgotten that the flats of workers' families consisted in the overwhelming majority but of one or two chambers, and these were only factory owners or technical personnel who lived in conditions suggested by the philosopher. However, at present not this, but the principle itself is the goal.

Real towns [illegible] in connection with the concentration of large scale [illegible] appearances. Only [illegible] - large towns [illegible] the [illegible] of [illegible]. They [illegible] people wishing to live in towns. On the contrary, 100-150 years ago leaving from the country was [illegible] for a great number of the [illegible] of the present inhabitants of metropolises.
Together with the growth of industry specialization took place and the need for transport between enterprises increased. A hundred km long transport of semi-manufactured goods by horse took at that time 2-3 days. There was no telephone. Discussions of technical and commercial problems between enterprises 100 km apart could be carried out, only by time-consuming correspondence or long and tiresome travels. - This merely was the first stimulus for the concentration of industrial enterprises finally resulting in large towns. -
Today the situation has changed altogether. - A hundred kilometre distance is considered no distance at all. To phone from one town to another does not take much time.
Therefore, to solve the problems of town building, a radical means - deconcentration - may be used.

It means that in future, the distance between factories and institutions is such that people working at them may live in their neighbourhood, enjoy the days of their old age also, have a garden to take care of. It means that further expansion of large towns is eliminated and no new ones will be built.

What should be the matter then? Nevertheless, cinemas may be there, at hand. Intimate friends are made with in common work, less intimate friends need not be called on every day.

One does not go to the theatre every day. And if the great theatre is located at a distance of 50-100 kilometres, to go there by means of [illegible] of [illegible] now is as easy as to go by those of today from one district to another. - Coloured and spatial television bring people more and more into contact with all events of cultural life.

Factories of tomorrow are no more sources of dust and noise. Therefore, [illegible] no more pay more to bring districts of industry and living quarters far apart from one another.

In addition to all that, building [illegible] on "[illegible]" as a new artificial stone and building material and on industrial building methods etc., however, become so cheap that it does not pay to erect multi-storied, thin-walled dwellings with rooms of little height to economize building costs.

Why should not building of towns tomorrow be carried out in the following way?

A new factory or institution is built as big and high as is most fitted from the point of view of technology of the factory or organization of the institution work. People attending to it live in close proximity in comparatively small houses - if possible with a garden - in flats meeting their needs. Elementary schools and kindergartens are built, of course, near there.

Such scattered settlements are connected with one another and with existing towns by good motor highways and comprehensive communication services. Somewhere are built new theatres and highschools and around them dwellings for artists, professors and students. At such way of building the surface of the earth would suffice for thousand years even in case of the most rapid increase of mankind. The area of the continent of the world is 150 million square kilometres. No doubt, one fifth, i.e. 30 million square kilometres of it could be used in future to build dwellings on it and set up gardens for family utilization. The rest, i.e. 4/5 of the land remains for industrial and agricultural purposes.

Assuming a garden area of 1000 m² for each family and the latter to consist on the average of 4 persons, then every square kilometre would accommodate 1000 people, or the whole earth 150 milliards. During that time deserts and swamps should be changed to beautiful gardens and the earth declared to be a common homeland for the whole mankind.

Such should be the future of town building. One family houses dominating. For some time building has been going on in the country, and it will continue in future.
It is possible that this kind of town building will be dictated tomorrow not only by the development of industry and communication service. There are serious symptoms of the towns of today not promoting moral development of the people in keeping with the rate of total development of mankind.
The problems of the youths are not without foundation.
Deconcentration may be forced also by the eternal question, "To be or not to be?" –

We should like to mark here the wise politics of the Finns in selecting sites for their new institutions.
They are already intensivly carrying out deconcentration by locating new enterprises, state institutions and high schools in the country.
Bearing the future in mind they are already building with a view to avoid demolishing after a few years.

Summary: Building of one family houses is the main problem of the future house building.

Building Material of Yesterday, Today and Tomorrow

The whole life is interlinked with building. - Corals and snails build shells to protect their sensitive bodies, birds build nests for their young. Man, too, has been building continuously during his long development.

Primitive man was already dealing with building by improving some cave to shelter him from natural phenomena, and making it more comfortable as an abode. Combining handmills of sorts grinding corn or making the first bow man dealt with machine building thousands of years ago. - There are very many branches of building at present - industrial building, hydrotechnical building, road and bridge building, a.s.o. - Of all those branches, housing construction has been the most important and the most labour-consuming. Even to such an extent that usually all people, excluding specialists of construction engineering, associate the word "building" with housing construction only.

By the beginning of the historical period of human society the art of building was remarkably developed already. Examples of this are still admirable buildings erected by Egyptians during the earliest historical period. Wellknown are the magnificent memorials of building and architecture put up B.C. (before our era) in Ancient Greece and Rome.

All these splendid ancient buildings were made principally of natural stone. The latter was used for foundations, floors, walls, ceilings and even roofs. Stone, the hard shell of Mother Earth, offered in its grooves, splits and caves the first place of refuge to unprotected man. Surrounded by stone, man felt himself for many thousand years protected and sheltered. Like squirrels with tree cavities or moles with earth holes, primitive man was biologically connected with stone caves. Certainly, the influence exercised was mutual.

Man expanded caves and made them more comfortable. He began to build artificial caves, the first dwellings, from stone pieces. Stone, on the other hand influenced biological development of man. He got accustomed to live in more or less constant temperature held by stones and felt comfortable in the silence ensured by thick stone walling. This explaines the natural liking of man for stones and for dwelling built of stone.

Of course, one must not forget that migrating to different places all over the world, people fell into different conditions and adopted them.

People in the far north are known to make their abodes from ice and snow, in the tropics from bamboo and palm leaves. In Asia still millions of people are born, live and die in boats on water. Man's adaptability is high. But the following conspicuous regularity exists also.

The farher man has removed himself from the use of stone, the lower and more primitive is his living standard.

New houses meeting the needs of people of today are built neither of palm leaves nor snow, but of stone, be it in the tropics or far north. Only commercial and industrial buildings are erected in steel and glass. To abandon stone as principal building material is not a sign of high living standard but a need dictated by poverty.

After World War II), during the time of great needs and little possibilities, Finland developed a large scale manufacture of dwellings made of timber components. These houses were in mass exported to the countries where possibilities were perhaps still smaller and the needs more urgent.

With rising living standard and widening possibilities timber barracks lost their value.

Man is able to adapt himself quickly, nevertheless he is remarkably persistent as to principal biological changes. The advantages of stone as a material for abodes are as persistent.
A house with stone walling, the thickness, i.e. heat insulation of which is adequate, defends man well against temperature changes and various noises. The heat capacity of stone being several times higher than that of many other building materials, a large amount of heat is stored up in the walling of a house during heating. Due to the low heat conductivity of stone the stored up heat will last for a long time.

Continuously radiating it warrants a constant temperature throughout the rooms without noticeable motion of air or draught. In summer the sun is not able to make such walls too hot and even in the hottest days it is agreeably cool in the house. Rooms having all four walls, floor and ceiling of stone are especially pleasant to live in. Particularly in the case when the losses of heat are compensated for by the heating system installed in the ceiling.

A stone building is comfortable not only from the point of view of biology. The surface of stone itself is nice both in outer finish as well as in interior. At the time when people could not make artificial stones answering to natural ones, inner walls of houses were covered with marble or other beautiful natural stones. This, however, was too expensive and only governments or certain very rich people could afford it. - Nowadays people know how to make artificial stone of "[illegible]" in various shades of colours or marble effect, different density and surfaces and porosity. As to their appearance, no natural stone used in building is nicer. The finishing of interiors with the artificial stones is expected to spread still more and more.

It is only because people learned to make artificial stones in fa[illegible] already, that the use of stone in building to the extent of today has become possible. Particularly the invention of Portland cement about 150 years ago involved a new technical and economical progress to the general building activities all over the world and expanded the manufacture of [illegible]. This cement has facilitated the building of artificial stones, far cheaper than before. The making of natural building stones by cleaving rocks has always been and still is expensive. In the manufacture of artificial stone the cost of 1 m³ does not depend materially on either the configuration or the size of product. Cutting or sawing natural stone into suitable size and dimensions is, however, costly.

The concrete technique for the first time made it possible to produce building elements of large dimensions e.g. no-fines concrete, prefabricated concrete parts etc. Thus troublesome manual work is excluded to a certain degree. For about 40 years now the concrete technique stagnates as one could say, since there have been neither further important improvements of the concrete mixtures - also of mortar cement - nor were new application fields found. To this come the problems of having to keep up to a certain classification and quality of the sand and coarse gravel. It has to be taken into consideration also that cement bound concretes represent a so-called conglomerate where the cement at the addition of water has the functions of a binding or adhesive agent to the sand and coarse gravel. Consequently all concrete buildings and building elements have to be protected against corrosive influences by means of insulations or others. These additional measures are not only expensive but also limited in durability, because they are subject to natural wear, alterating processes etc. Lack of sufficient properties in respect to thermal insulation is also of disadvantage, so that additional measures become essential to ensure these properties to brick walls. As it is know, the thermal insulation properties of a brick wall of 38 cm strength correspond to those of a concrete wall of 115 cm strength. The lack of gas-diffusion involves to the development of mildew and condensation water and hereby the necessity of providing central heating systems.

All disadvantages [illegible] technologies and artificial stone [illegible] these technics represented the only [illegible] in a technical way basing on large [illegible]

By embedding [illegible] steel, fibres or any other material [illegible] having [illegible] building, [illegible] artificial [illegible] This [illegible] enabled the use of [illegible] thin and flat reinforced [illegible] ceilings instead of thick and heavy stone vaults [illegible], it is no wonder [illegible] technical, only [illegible] there. In some cases, as [illegible] has displaced for example [illegible] natural [illegible] artificial stone [illegible] almost without exception [illegible] binders.

Summary: artificial stone [illegible] the principal building material [illegible]

[illegible]
[illegible]

[illegible]

Historical Background

Since times immemorial man has been building.
Maybe thousands of years ago neither [illegible] nor [illegible]
boards existed, yet there were builders. In order to have
a sheltering roof one must erect walls. This necessitated to
pile up natural stone fragments of different size one upon
another and bond them together. - With what? -
At first watery clay was used which [illegible] in laying
between stones, and afterwards, [illegible] antiquity,
with sand-lime mixes. One [illegible] of lime [illegible] of sand
was taken. [illegible] buildings
even today. This was done in case of all stone buildings
also about 150 years ago, [illegible] invented.
And even in stone walls, [illegible], now and
again the use of sand-lime mixes [illegible]. -
The half [illegible] clay [illegible] between the stones [illegible]
a certain strength. [illegible] millenniums.
Sand-lime mixes [illegible] strength
equalling the strength of clay mixes. But the strength of
sand-lime mixes [illegible] during [illegible]
hundred of years. The slight amount of [illegible] in air
(less than 1%), which [illegible] penetrated the [illegible] between
the stones, turned the soft lime into a strong limestone again.
Mortar of air-hardening lime were [illegible] used by the
Greeks, the Etruscans and the Romans - these last ones more-
over [illegible] in many cases [illegible], thus
obtaining a material having some [illegible] features, that
was called "[illegible]". -

How to obtain a good building stone has been a problem for the builders of not only today. Difficulties in obtaining wall stones [illegible], to build a neat wall from stone fragments found here and there on the ground. is very laborious. [illegible] natural stone that would meet entirely the requirements of a mason is not as simple as finding a stone on the sea-shore for throwing ducks and drakes. - To cut building stones from big cliffs was a most difficult job. Stones obtained in this way have been very expensive in grey antiquity with primitive tools notwithstanding the cheap labour of slaves and as well as nowadays with contemporary stone-cutting, and finishing machines not [illegible].

Thus, one of the most urgent problems of builders has been and is the making of an inexpensive artificial stone of high quality.

It is quite natural that people tried to make the first artficial stones from wall mortars, half-liquid clay or sand-lime mixes.

Soon they mastered the art of forming clay into angular chunks which turned by drying into fairly hard bricks. Such bricks of dried clay are used to some extent even nowadays in [illegible] developed countries having a dry climate.

Before long people learned to increase the strength of dried clay bricks and make them resistant to all climatic conditions by kilning. The first artificial stone, red clay brick with technical properties exceeding those of several natural stones came into being.

As to sand-lime mixtures, the matter was not so simle. Angular stones formed of it were too weak to be used in walls. In kilning they fell apart altogether. Now we know that these bricks [illegible] for hundreds of years [illegible] in air. But making bricks is not [illegible] for the future generations. The work of a builder must either delight or grieve him during his lifetime. –

Once More a Bit of History and Chemistry

For untold centuries people did not succeed in obtaining high-grade artificial stones of simple sand-lime mixes. Hundred and fifty years ago this problem was solved in a roundabout way – by means of Portland cement. –
It is interesting to note that until recently even prominent scientists of all countries have [illegible] from this aspect. In what lies the problem?

With the help of some chemical formulas the explanation will be simple.
The formula of lime is CaO, [illegible] by the formula of mineral quartz SiO_2.
Practically the mixture of [illegible] should be about [illegible] parts of sand, [illegible] account the [illegible] in cement.
The substance of [illegible], i.e. $3 CaO.SiO_2$, contains [illegible] sand only [illegible] CaO and [illegible] SiO_2, [illegible] molecular weights.
This mineral alite is obtained by complicated and very costly production processes at [illegible]. As cement it represents a powdered binding agent. In combination with water the small particles of cement turn into a jelly-like mass, which will set within a short period, i.e. during a few days or weeks. In this way the so-called cement stone comes into being. – Pure cement is not suitable for making artificial stones. It would be too expensive and during its hardening, especially in case of large-sized products, inner stresses occur and cracks appear. –
Therefore, in making artificial stones cement is always

[illegible] of sand and gravel. -
But [illegible] the particles of sand and gravel [illegible] by cement into artificial stone. Concrete [illegible] gravel [illegible] by the formula 1:2:3 [illegible], the concrete [illegible] part of cement and [illegible] parts of sand [illegible] of gravel. - We have come back again to age-old [illegible]
The [illegible] of [illegible] artificial stones from these mixes - [illegible] - [illegible] at what a price, however! -
A new branch of industry - the Portland cement industry - had to be founded. And yet the invention of cement caused a whole revolution in building.

The only aim of [illegible] of concrete manufacturers is to produce artificial stones of [illegible] dimensions - building components. This [illegible] of the existence of cement [illegible]-cement [illegible] works. -
Would lime [illegible] be [illegible] directly into high-quality structural elements [illegible], cement for their manufacture could [illegible]. After all, cement is not edible, one cannot make clothes of it. It is used only for binding the particles of sand and gravel. -

It is quite [illegible] what a revolution would have caused the [illegible] of [illegible] sand and lime particles directly into an artificial stone, the technical properties of which would not yield to those of concrete. - -

Revolution has [illegible]

[illegible]
[illegible]
[illegible]
– The [illegible]
[illegible]
without cement. [illegible]
silicate brick [illegible]
earlier [illegible]
manufacture [illegible]
technical properties. – Professor [illegible]
in making autoclaved structural elements larger in size than
bricks. The silicate brick could [illegible] with concrete
by quality, too.
Since the first [illegible], in [illegible],
Sweden, Germany, and particularly in central [illegible]
Europe, Australia and USA, the production of silicocalcareous
building materials has enjoyed a remarkable development. It
is however always [illegible] of [illegible],
and so called "[illegible]", [illegible]
areas with bad quality of [illegible] sand – [illegible] content not
less than 90% – [illegible]; [illegible]
besides have mechanical properties [illegible] than
concrete.

The triumph of cement continued, while the [illegible]
discovery of Professor [illegible] had to content itself with
the unpretentious [illegible] of the silicate brick for about
80 years. –
For fully solving [illegible]
was necessary [illegible] done! –

In 19[illegible]-19[illegible], the [illegible] Dr. J. Hint
in Tallinn, [illegible]. – The [illegible] source for the comparatively
[illegible] of the silicate building materials
was found to lie in the sand!

formed in [illegible] of [illegible] water by wind and water, sand [illegible] than to [illegible] [illegible] [illegible] of [illegible] [illegible] comparatively [illegible] and [illegible] of [illegible] lime, [illegible] building the [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] formed, [illegible] obtained, distinguished [illegible] sand [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible] [illegible]

[illegible] [illegible] [illegible] [illegible] [illegible] time, improved [illegible] [illegible] [illegible] of [illegible], the technology and the equipment for [illegible] [illegible] [illegible] in [illegible] all the details to produce a material [illegible] for the possibility of [illegible] such a material on the [illegible] [illegible] [illegible] properties [illegible] a new building material.

CEMENTS. -

[illegible] properties of the [illegible] [illegible] [illegible] of the best concrete [illegible]

[illegible] - -

Already at that time the new building materials are a universal and cheap material. - Practically all kind of elements neccessary for building, from water and sewage pipes, wall and floor panels to roof panels or tiles, were manufactured from it. - - -

How Far We Have Got

For cheap mass building materials which are to supply the neccessary construction elements for general as well as for house and industrial building, with the properties required for the application envisaged, during the last years "[illegible]" was developed. It is a building material which [illegible] it unnecessary to use cement as a binder. This new building material can be produced from each [illegible] sand, clay, loess, ashes or slag or any other industrial wastes, with lime and water (if necessary [illegible] reinforcement) obtained by processing in an autoclave in the presence of saturated steam. -
The basic for this [illegible] new building material is mainly to find in the [illegible] of manufacturing of the known raw materials and mixtures of material due to the particular machinery equipment. Only by this way the finished products obtain those excellent properties, which [illegible] materials made by conventional methods could never be [illegible]. By the new production method also raw materials [illegible], which normally could not or only insufficiently be used for the manufacture of building materials. The new process ensures a thorough amalgation of the various components of the basic materials and in any case [illegible] finished products will be [illegible]. - [illegible] chemical properties which can be obtained as well [illegible]

economical [illegible] are [illegible] to the [illegible] and [illegible] of the same strength [illegible] other [illegible]

In the [illegible] in different [illegible] named. [illegible] called [illegible] POLYMA[illegible] conference [illegible] the required [illegible]

The [illegible] process which is here applied, are that mineral [illegible] (such as [illegible], [illegible] etc.) hitherto [illegible] can now, due to a direct conversion [illegible] using binders, be converted into monolith materials. The new building material is no conglomerate and therefore is not subject to disintegration processes.

The new building material offers completely new prospects in technical as well as in economical respects. Compared to conventional building materials it offers advantages as:

- considerably lower in weight compared to concrete
- at the same time higher properties of pressure resistance than concrete
- better thermal insulation properties
- better resistance against weather and corrosion
- no development of mildew and condensation water
- particular [illegible]
- resistance against [illegible]
- ability to be sawed like wood and nailed
- the building elements are self-supporting, but iron or fibre reinforcements are possible -

It can be [illegible] of that at same pressure resistance the new building material has only half of the [illegible] different variations of [illegible] volume weight between 400 and 1900 kg/m³ are possible. For general building construction activities volume weights are up to 1.600 kg/m³ while for road building as well as for industrial and water construction activities (also with fibrous reinforcements), they go up to 1900 kg/m³.

The economical advantages are:

- simple production methods
- possibility of using almost any locally available raw materials, (such as various sorts of sand, clay, ash, slag and industrial wastes etc.)
- saving of any time for drying and storage procedures (prefabricated parts can be used only 24 hours after leaving autoclaves)
- thus involved are lower production costs by possibility to automatisate production widely
- possibility of using [illegible] labour
- guarantee of constant quality of the products
- low weight and possibility of producing elements big or small, simply [illegible] building elements, [illegible] of technicalized building [illegible] and excellent building companies as well as to private home builders.
- extended field of application for prefabricated elements.

The results, which are available, give [illegible] already how many application possibilities exist, which concrete never before offered. -

The application possibilities for road surfacings have a special position here. So it could be assumed for example that the large highway programmes of future years to a wide extend will base on the new building material. The complicated technic of [illegible] will doubtlessly involve considerable savings of costs in general. The immunity against dew-icing salt as well as against oil and fuel will save mending works due to damages by frost and other influences. Also for restoration works on ordinary roads a construction programm could be built up basing on POLYSAND.

Agriculture has large requirements for corrosion resistant building materials in respect to the construction of silos, stables etc. (resistance against lactic acid, tartaric acid, dung water etc.). - It is absolutely thinkable that many countries take up the production of standardized silo and stable constructions out of prefabricated elements made with the new building materials.

The main application field, however, will always be housing construction respectively super construction work.

The following products may serve as examples:

1) - outside and inside walls
2) - ceilings
3) - floor tiles
4) - staircases and stairs
5) - foundation blocks for housing construction and bottom plates for sanitary
6) - large dimensioned panels for prefabricated construction
7) - large blocks
8) - beams
9) - columns
10) - drains
11) - bridge elements
12) - paving-slabs
13) - road surfacings
14) - stone tiles
15) - covering tiles
16) - roof tiles
17) - silos
18) - drainage channels
19) - stable construction
20) - industrial structural parts etc.

The mechanical characteristics of cellular [illegible] (from 400 kg/m^3 to 1200 kg/m^3 weight) or compact [illegible] ([illegible] kg/m^3) are very different from any other building materials known hitherto, except the [illegible] acid silicate material.

Mechanical characteristics

With respect to similar traditional materials (concrete, clay-bricks etc.) the new building material has a specific resistence (ratio compression resistance : specific weight) which is clearly superior. If for a very good concrete this value is 1.5, the new building materials easily reches and exceed values of 2.5 - 3, therefore by equal weights the mechanical resistance is higher.

Variability in specific weight

The new building material can be produced in widely different types of material: cellular or light material with specific weights of 400 - 1200 kg/m^3, which is obtained by adding to the mixture a leavening agent causing gas release from the mass. Also: Compact or heavy material, with specific weights of 1300 - 1900 (2000) kg/m^3, obtained by vibration or pressing or centrifugation of the mixture.

There is a great variability of physical and mechanical characteristics corresponding to the wide range of variation in specific weight, which make the new building material capable of applications complying with any particular requirement.

Those new building materials have not only passed factory tests but also tests of approved testing laboratories, how is said before. - All test results prove the extraordinary properties.

The diagram below shows the results of a test - ratio compression resistance : specific weight - made by the [illegible] VERSUCHSANSTALT FÜR BAUSTOFFE, [illegible]-Austria ([illegible] research laboratory for building materials, for example.

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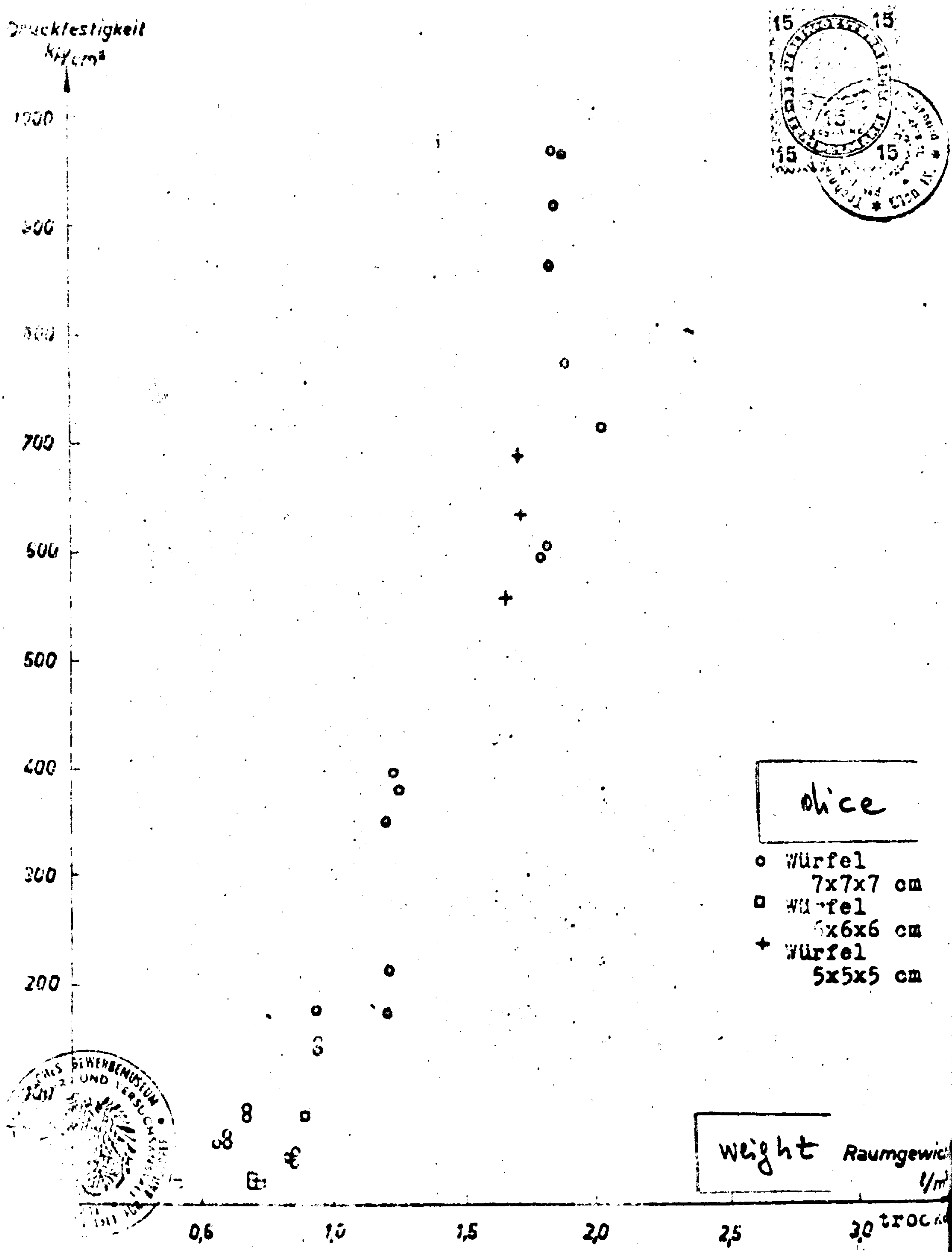
Compressive strength

Ihr Zeichen	vom	Unser Zeichen	Ausfertigungstag	Blatt
B/J	15.3.65	B 10407	8.10.65	E



No shrinkage

An important characteristic of the new building materials is the absolute absence of shrinkage and shape alteration during the hardening and drying processes in both cases of jet pressure forming.
From this view point, individual elements with no limit in dimension can be produced. Also a great precision in manufacturing is possible; it is therefore particularly suitable for prefabrication techniques.

Metal reinforcement

Adhesion between the new building material and metal frames varies from 30 to 60 kg/cm^2 for round smoth bars. The thermic elongation coefficient (cellular types) is $1-1,4x10^{-5}$, i.e. of the same order of magnitude as that of steel.
The new building material is therefore suitable also for reinforced concrete structures.

Heat resistance

The investigations show that with the increase in temperature to 250° C, the compression strength increases to 20% within the limits of 250 - 300° C, no increase in compression strength is obseved. - During a violent fire, the flexure of steels increases sharply until they are destroyed due to fluidity of reinforcing steel by analogy with ferro-concrete elements. The flexures observ in new building material elements during a less violent fire disappear when the elements get cold, and the latters acquire their initial form.
The new building materials are fire proof. -
Some indirect [illegible] about this are formed due to the fire resistance tests, when the temperature of the product under examination increases to 300° C during 3 minutes, to 700° C during 10 minutes, to 800° C during 30 minutes, to 900° C during 1 hour up to 1000° C. - [illegible] the response of the new building material [illegible] in length with the normal load), [illegible] to that of ferro-concrete and the [illegible] value of fire resistance

was 10 - 35% better than for ferro-concrete panels. -

Resistance to frost

Freezing and heating tests have demonstrated the capability of the new building materials to operate under very adverse weather conditions.

Thermic insulation

The thermal transmittance is 0.06 Kcal/m.h.°C (hours in degrees C) and varies markedly with the specific weight. The thermic insulation is very higher than that of concrete.

Abrasion resistance

The heavy new building material has a resistance to wear due to abrasion which is 5 - 8 times that of granite concrete and 8 times that of limestone concrete.

Resistance to chemical agents

Experiments on this aspect show, that the new building materials withstand the action of strong acids and alkalis much more than concrete can.

Special treatment

The surface can be treated with plasters, paint or other coating materials, as a consequence of the great variety of glues suitable for the new building materials. On account of its great heat resistance, fire enamelling is also possible, as for ordinary ceramic materials. -

The new building material can be coupled together in various layers, thus integrating the respective physical and mechanical characteristics.

By adding elements to the mixture, the material can be coloured without altering its [illegible].

The surface of manufactured articles is rather smooth and ready for painting. All kinds of paint which are used usually for work of [illegible] are suitable for painting the articles made from the new building materials.

There it is possible in connection with low-grade asbestos to produce those articles [illegible] asbestos cement - but with better [illegible].

The main components forming the new building materials are the sand, lime and water. The sand can be of any origin and does not need [illegible] are covered until [illegible], [illegible] treatment in the special [illegible] the required activization even to such sands.
Slacked as well as burnt lime is used for the production. The elaborated technology makes it possible to use lime of lower quality also.

A variation of the above process can be employed for the removal of refuse by utilizing the residues of refuse burning furnaces as described below.

The widely used method of removing refuse by depositing it on the ground is an [illegible] problem for every country due to the consequences [illegible], the rat plague and the contamination of water circulation. -
A striking example is [illegible], where the deposition of refuse on the so-called "[illegible] Island" has caused [illegible] danger for the town. [illegible] their refuse on the ground [illegible] the agricultural exploitation of this [illegible] for a long time.

The [illegible] of refuse burning furnaces therefore gains increasing importance.

Notwithstanding the [illegible] of the burning of refuse the incinerators are [illegible] uneconomic as compared with the [illegible] on the ground. [illegible], [illegible] etc.

and the erection of costly installations is dispensed with. [illegible] refuse is that the refuse [illegible] in volume. Considerable quantities of residues left by the incinerator have to be removed [illegible] the deposition of [illegible] compared with the costs is insufficient. - [illegible] partially [illegible] materials [illegible] condition of the [illegible] - All these arguments [illegible] final removal of refuse have been completely [illegible] process. - [illegible] almost [illegible] of refuse [illegible] of its chemical composition [illegible] can be used as base material for the manufacture of quality building materials by the new [illegible] process.

The efficiency of the [illegible] process is such that high grade building [illegible] strength more than 200 kp/cm^2) could even be produced if the residues were not burnt completely. - According to the new techniques the residues left after the burning of refuse are subject to the [illegible] process of transformation and are subsequently used for the manufacture of the building materials and finished products. The expenditure required in [illegible] the necessary electric and steam energy can easily be supplied by the refuse burning furnace itself. - It is therefore of advantage if the factory for building materials is combined with the incinerator so that the residues can be subject to the transformation process immediately. Thus the quantity of refuse slag or ashes yielded is transferred into building materials or the finished products desired [illegible] the refuse is not only removed completely but is also paid for separately in the form of the finished products. - The [illegible] dispenses with the removal of residues left by the burning of refuse as well as with the financial burden linked with it and the problem of deposition on the ground. -

Thus every refuse burning furnace becomes a very effective source of income for the [illegible] of every municipality; the number of personnel required for the manufacture of building materials out of [illegible] consist of the unskilled labour [illegible] refuse. According to the [illegible] building materials of different [illegible] can be produced [illegible], the weight of [illegible] that of normal concrete and the final product [illegible] flameless and germ-free. –

Usually [illegible] or cities who carry out regular [illegible] continuous sale of the building [illegible] is charged [illegible] the municipality [illegible] considerable [illegible] from a factory of building materials combined with an incinerator. Thus the incinerator as well as the factory are soon amortized [illegible] of refuse has been a debit item.
The new technique of converting the residues from the burning of refuse (or any other [illegible]) into high grade building materials and finished products does not only invalidate all objections to the method of burning refuse but also solves all existing problems linked with the removal of refuse and turns their removal into an economic asset. – – –

Ascertainings . . .

On the basis of this development it is possible to draw some reliable conclusion on the [illegible] of today and of tomorrow.

First: As to its structural technical characteristics, the new building material of much better quality than cement concrete can be produced. In high strength type the combination of sand and lime particles is nearly similar to that of soda and sand in glass. In concrete the mixing of sand and gravel practically do not take part in the formation of the inner structure of artificial stone. They are simply glued together. Considering this difference in structure, it is easily comprehensible why water permeability of dense POLYSAND is thousands of times lower than that of conventional dense concrete. The high resistance of the new building material to acids may also be explained by its peculiar structure. The new building materials are resistive to the effect of solutions which would reduce concrete to sand and gravel in a few days.

Second: The manufacture of the new building material has been extremely simplified and highly automated. [illegible] there is only one continuously operating mixer for all the mixes. By using automatic card, [illegible] the whole mix preparation process is automated. The mix is discharged into moulds travelling on conveyors, and is automatically fed into the autoclave.

In principle, there is no difference in the moulding processes of building components, either of the new building materials or concrete mixes. Both of the mixes may be moulded by pouring, vibrating, stamping, centrifuging, rolling, etc. Making polysand mixes is much simpler. Hardening of concrete mixes is simpler in general. For cement hardens at a normal temperature also - but for long time. till 28 days and more. Yet, to accelerate the hardening of cement, steam curing of moulded concrete in steam chambers or autoclaves proved reasonable and economical in the manufacture of structural elements. Therefore, expenses on hardening either of concrete or POLYSAND prefabricated products are equal. The manufacture of concrete and the new building material products are beginning from the mining of raw materials. There are 12 operations in the case of concrete, and but only 8 of them in the case of the new building materials.

In the production process the raw materials or mixes must be conveyed to each principal machine and removed from there; they must also be fed or dozed into principal machines.

Therefore in the manufacture of concrete the need for transportation as well as the number of loading operations and the devices needed for it, is nearly three times higher.
In operation all machines wear and consume power.

In the manufacture of concrete thermal energy is needed at five operations. These are drying of sand, [illegible] limestone, drying of sludge, kilning of clinker and steaming of products. In the manufacture of the new building material thermal energy is needed but at two main operations: kilning of lime and hardening of products. - The quantity of heat necessary for kilning cement clinker is about 2 times higher than that needed for kilning the equal amount of lime. - For producing 1 m³ of the new building material, depending on its density, in maximum 100-[illegible] kg of active lime is required. For making dense or light weight concrete at least [illegible] kg of cement is required.

As a example the necessary capital investment and expenses on heating, electric power and manpower for making 1 m³ concrete and 1 m³ [illegible] products were calculated. To these expenses on producing raw materials (sand, lime, [illegible]) and binder (cement) were added. Data on dense products are given in the table:

A	Expenses on building the factory, calculated for the annual output of the material shown in column A (unity)	For producing the amount of material shown in column A, the corresponding industrial enterprise, requires:		
		Heating in 1000 kcal	Electric power kwh	Man-power hours
I) Required for the manufacture of 1 m³ dense concrete are:				
a) Cement brand 400: [illegible]50 kg	9,7	96,3	35,0	1,5
b) [illegible] 0,[illegible]00 m³	7,3	-	9,0	0,1
c) Sand 0,[illegible]00 m³	1,0	-	0,5	0,05
II) Concrete plant: 1 m³ products	46,0	76,0	21,0	2,75
Total	64,0	172,3	65,5	5,4

A	Expenses on building the factory, calculated for the annual output of the material shown in column A ([illegible])	For producing the amount of material shown in column A, the corresponding industrial enter[illegible] require:		
		Heating in 7000 kcal	Electric power kwh	Man-power, hours
I) Required for the manufacture of 1 m³ POLYSAND are:				
a) Low-grade lime containing on the average 75% of CaO 230 kg	2,8	42,6	5,7	0,5
b) Sand 0.970 m³	1,9	-	1,0	0,1
II) Polysand plant: 1 m³ products	26,0	62,0	17,0	1,9
T o t a l	30,7	104,6	23,7	2,5

Depending on local conditions and production capacity of the plants, expenses on the manufacture of the new building material and concrete may differ for separate plants. Yet the average data given in the table should be well characterizing.
As can be seen from the table, expenses on 1 m³ POLYSAND are lower than on 1 m³ concrete as follows: capital investment [illegible].1 times, heating 1.[illegible] times, electric power [illegible] times, man-power 2.2 times.
The difference is nearly the same in case of cellular polysand and cellular concrete.
The new building materials are very cheap materials.

Third: Concrete products weigh about 30 per cent more than the new building material of equal strength. For example, the weight of [illegible] new building material is only 1000 [illegible], the weight of concrete of

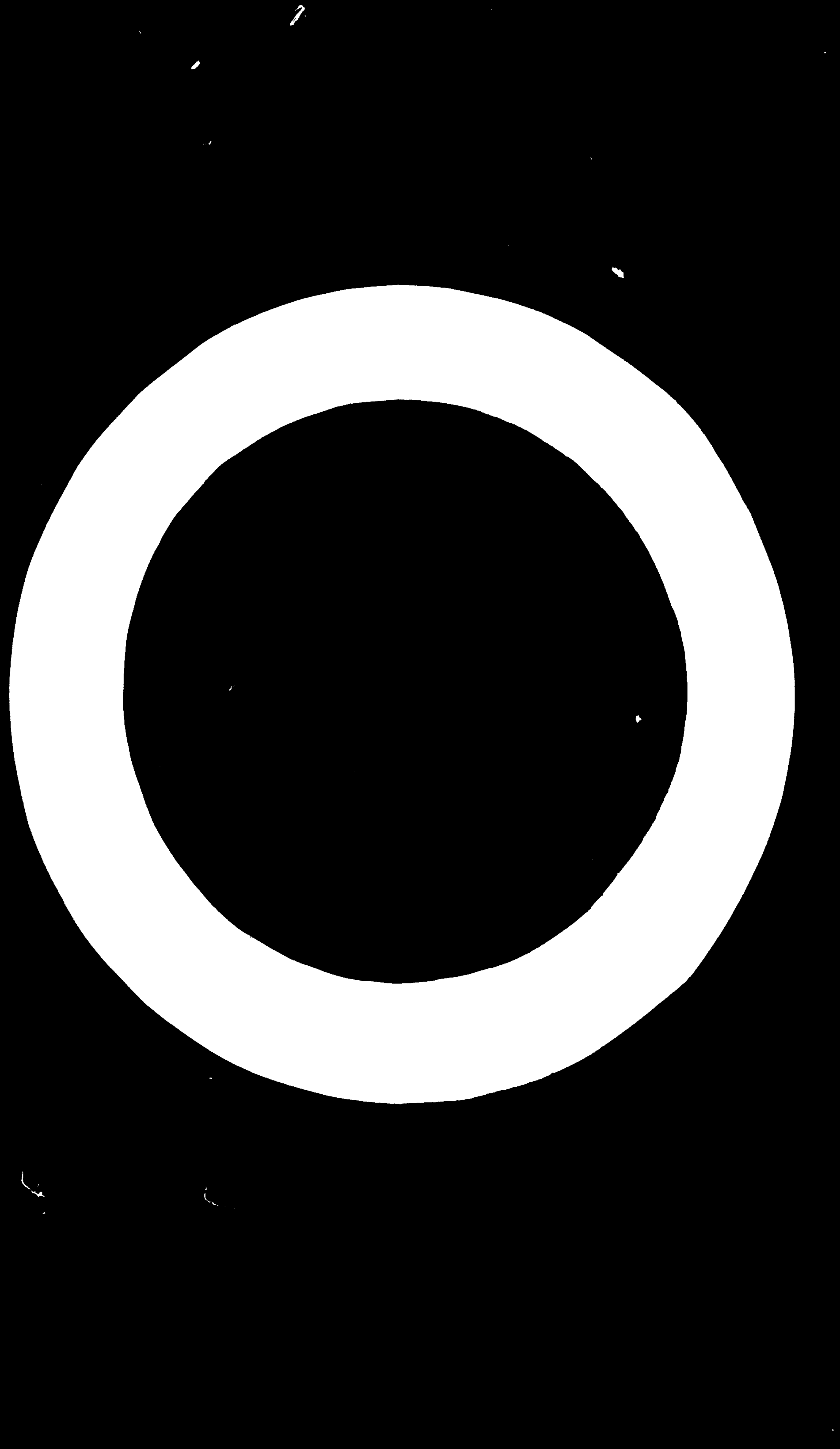
the strength five times lower, is at least 2400 kg/m³.
Arising from this great difference in weight, transport costs are diminished and the result is a great economy due the lower cost of foundation and bearing members of building.

Fourth: A plant to produce the new building materials can be built in a short time under one year. - The erection of cement and concrete plant is accomplished generally in not less than two years.

Fifth: The new building material products can be made of practically any kind of sand and lime. It is being made also of loess - a clayey ground suitable for cotton and fruit. Investigations have been carried out on sands of more than 1200 localities including the Sahara, Brazil, Asia, etc., of 20 countries in all. - All these sands proved suitable for the manufacture of the new building material. [illegible] has been made experimentally with good results also from slag and ashes. -
Raw materials for cement and suitable crushed rock and sand for concrete cannot be found everywhere. An economical production of the new building materials can be established all over the world.

Sixth: Taking into account that the manufacture of the new building material requires basically one single machine only, economically working travelling plants, too, can be established.

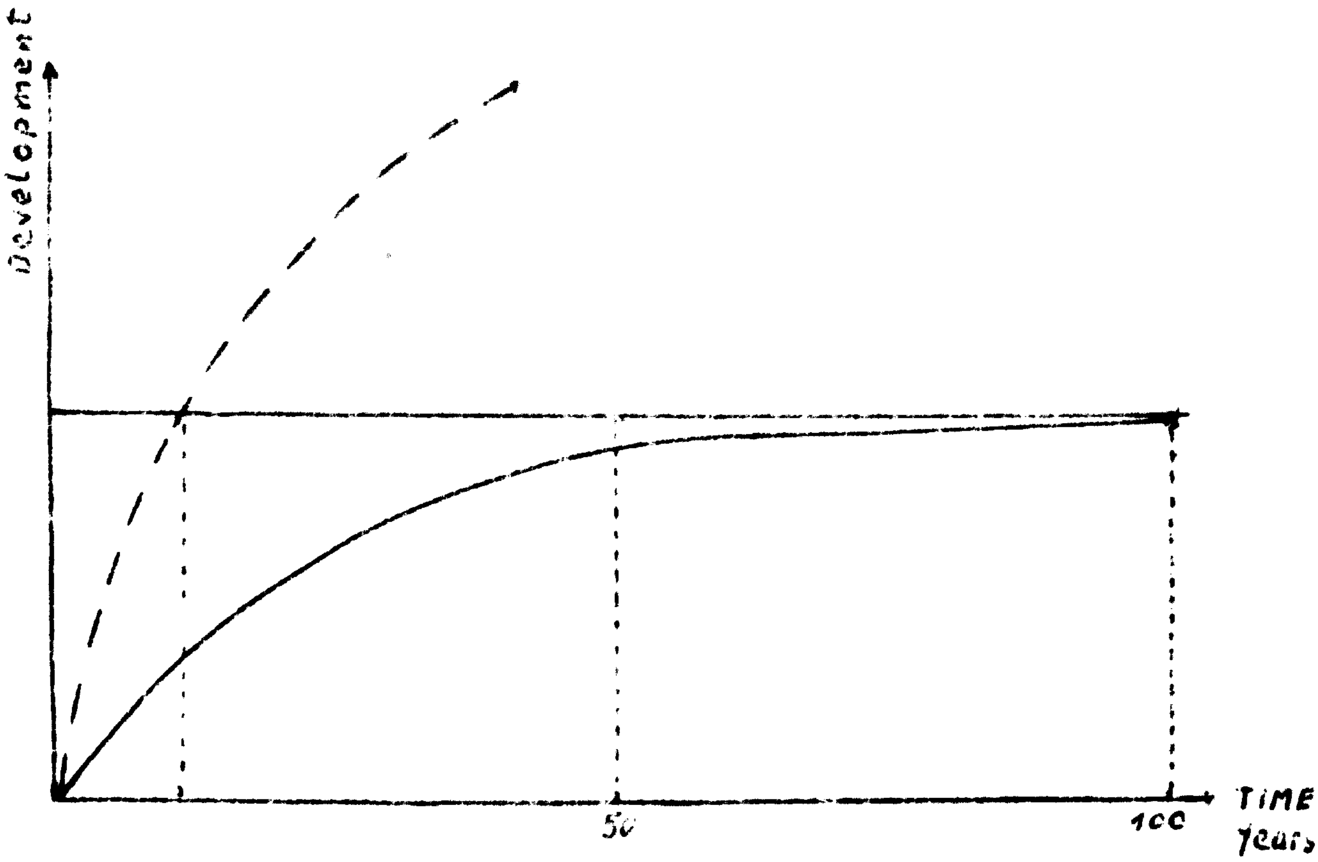
Seventh: The new building material is an excellent material for the manufacture of industrial structural elements. Even



the largest structural [illegible] practically free from [illegible] dimensions.
During hardening concrete [illegible].

<u>Eighth:</u> [illegible] products can be [illegible] to different colour shades. [illegible] structure: from [illegible] marble [illegible] with a cell diametre of several millimetres or centimetres.
All the advantages of the new building material are not yet exhausted as compared with concrete. [illegible] research has disclosed [illegible] number of them. It is impossible to deal with all of them here. [illegible] it should be mentioned that bearing constructions made of the new building material require to some extent less reinforcement steel than those made of concrete. -
But this is the beginning only. The [illegible] of cement and concrete [illegible] development of about [illegible] hundred years already. Even now hundreds of laboratories and [illegible] of design institutes with ten thousands of workers are dealing with investigation and development of concrete all over the world.
In the figure below the horizontal axis represents time and the vertical axis the level of development of any [illegible] or technics of the new [illegible] with the moment of [illegible]. The lower curve may denote, for example, the development of cement and concrete. During the first years and tens of years the development is rapid, every [illegible] essentially new is discovered. Later on, after tens of years, the development becomes less rapid. [illegible] almost of the same level it was five years ago [illegible] after five years. - So it is [illegible], with other inventions such as, for example, [illegible], [illegible] etc.

Already within ten years of industrial development, [illegible] and [illegible] has reached higher structural-technical characteristics at lower cost than concrete and asbestos cement. This is depicted in the figure by the dotted line.



Summary: [illegible] is the artificial stone of tomorrow!

A short step to produce building materials in the application field of asbestos cement was done by us with polysand types they are produced on a different production line. No expensive and large machinery and equipment or steaming are required. We could fix that sand with or without fibres with a polymer binder is a very good and cheap raw material to produce such products in the application field of asbestos cement.

Opposite to the production of asbestos-cement units, the polysand production requires only one, central production unit. This production unit supplies the homogeneous polysand-mix. Not considered of course are silos for material storage and transport units. - Compared to asbesto-cement production the amount of investment as well as the requirements for labour are extremely low.

The description and fabrication scheme to be seen below will make clear how simple a way a polysand production can be erected everywhere:

Sheets, plates, coatings, moulded parts, tubes

So far sheets and plates to be used in civil engineering, architecture or for other applications were produced of natural or artificial stone, asbestos cement or plastics. Therefore the products were relatively expensive and limited to certain raw materials and fields of application, moreover they could not be used but to a limited extent or not at all for coatings and for the manufacture of moulded parts.

The industrial process of production described below permits the manufacture of sheets, plates, moulded parts and coatings out of so-called POLYSAND, in any colour and marble effect, and of any shape.

Special advantages of the process are unequalled quality of the products and low investment cost for the machines and production facilities as well as the possibility of using unskilled hands.

Due to the original products plant which as far as possible was combined in one unit and in the first place is designed for using the cheap raw material sand together with a polymer binder, the process offers almost unlimited variability as well as high production sequence and economy.

The process permits the simple production of sheets and plates of any size and thickness, in any colour, colour mix or marble effect and the easy coating of any base material such as concrete, metal, glass, card board etc.

Another advantage of the new technique is the fact that no subsequent treatment of the finished products is required. For obtaining smooth and shiny surfaces neither grinding or polishing is required. Even the most complicated moulded parts or designs can be produced without expensive moulds, presses or similar costly equipment.

The new technique is particularly suited for the coating of building materials and finished parts with beautiful and durable surfaces, the manufacturers of prefabricated moulded parts can now readily produce facades with excellent architectonic effect, floor coverings, stairs and other parts necessary for prefabricated houses, in their own workshop, with the necessary development.

Applications are further extended by the possibility of using one or several colours or mixes and variations of natural or fancy marble effects as well as by the possibility of coating other materials. Thus the manufacturer of prefabricated moulded parts will e.g. save the surface treatment of the finished parts and the application of costly facade materials such as mosaic plates, face bricks or coats of paint.

In practive, completely novel, durable and beautiful building elements may be produced in sandwich construction by applying a Polysand layer to a cheap core of available materials. Such Polysand layers may be coloured as desired, have [illegible] effect [illegible].

POLYSAND material is produced mechanically with the final properties required and often no more than a few minutes are required to take the product out of the mould.

Due to the quick production process, the use of [illegible] sand as base material together with a polymer binder, preferably polyester, the omission of any subsequent treatment or storage for curing (the finished products can be used after intervals of a few minutes up to an hour) a high degree of economy can be achieved.

POLYSAND material has very high chemical resistance and mechanical strengths and it is [illegible] and can therefore be used for a combined chemical and mechanical as well as for other industrial applications. The excellent physical properties of POLYSAND are also indicated by the fact that its average compressive strength is 370 % and its flexural tensile strength 800 % that of the corresponding concrete standard.

POLYSAND is absolutely resistant to atmospheric influence and to most reagents; it is climate resistant and durable and permits applications impossible with conventional building materials.

POLYSAND has been used successfully for the applications listed below as basic material or for coatings:

General structures above the surface and underground, industrial and chemical plants, laboratories, petro-chemistry, hydraulic engineering etc. as well as window and balcony sills, stairs, floor coverings, plates for walls, floors and tables, curb- and border-stones, [illegible]ve-stones, moulded parts, coatings of other materials, finished parts, [illegible], tanks, curtain walls etc. Moreover for [illegible] in industry as well as for [illegible] in the construction of [illegible].

Applications are extended continuously. -

Therefore variations in the application of polysand material are unlimited; it permits the manufacture of washing basins and tubs as well as the subsequent covering of existing buildings out of wood, tiles, concrete or other building materials.

In spite of their better quality and technical superiority POLYSAND products are cheaper than asbestos cement or other conventional materials.

The special plant for the manufacture of the products indicated above permits the rapide quantity production of building materials, moulded parts, prefabricated parts and coatings of perfect quality.

The machine ensures precise adherence to the recipes, necessary for obtaining the desired strength and quality of the product, thorough mixture of the components as well as the constant addition of colours and the homogenizing of the ready mixture.

Properties of the finished products

To give a survey of the progress of the new process and the new technique as compared with conventional materials, and with cement concrete (asbestos cement) in particular, the results of tests carried out by the INSTITUT FÜR MATERIALPRÜFUNG UND FORSCHUNG DAS BAUWESENS DER TECHNISCHEN HOCHSCHULE HANNOVER, AMTLICHE MATERIALPRÜFANSTALT FÜR DAS BAUWESE - (Institute for testing materials and for research in civil engineering of the technical college in Hannover - Official laboratory for testing materials to be used in civil engineering), dated 27 October 1955, are indicated below, in extracts:

	POLYSAND	Concrete stand. DIN 1500	Increase in strength
Compressive strength:	1037 kp/cm²	[illegible] kp/cm²	370 %
Bending strength:	324 kp/cm²	[illegible] kp/cm²	800 %
Abrasion resistance:	14.1 cm³/50 cm	15 cm³/50 cm²	6 %

Similar results were obtained in the tests dated 11.1.1968 carried out by the INSTITUT FÜR BAUSTOFFKUNDE UND STAHLBETONBAU at Braunschweig with an average compressive strength of: 1131 kg/cm^2 and an abrasion resistance of: 10.5 $cm^3/50\ cm^2$. -

Another expertise established by the STÄDTISCHE PRÜF - UND VERSUCHSANSTALT, MAGISTRAT DER STADT WIEN, (= municipal test and research laboratory, in Vienna), of 1[illegible].11.1968 did not only confirm the good results indicated above but also the freeze resistance as well as the resistance to light and corrosions - tap water, limewater saturated, solution containing soap, solution containing sodium, solution conatining dtergent, soda lye, hydrochloric acid, mineral oil, petrol - - all unchanged. -

The above test results of official institutions clearly show the superiority of POLYSAND over concrete and asbestos cement on the basis of porsland cement.

Further properties of POLYSAND are: low specific weight, dimensional stability, colour stability, smooth surfaces without polishing and grinding, high impact and compressive strength and therefore reduced risk of breakage during transport. -

In addition to the applications listed above, the use of polysand mixes prepared according to special recipes, as casting and priming material was developed.

This process is of particular importance for the manufacture of "dry floor finishes" in building construction.

Building with prefabricated parts permits short periods of construction and - as far as the brickwork is concerned - the quick erection of buildings almost without humidity, as the prefabs are employed dry.

This advantage is considerably reduced when producing conventional floor finishes as according to conventional methods the floor finish is applied with big quantities of water in the building dry so far, it often takes many weeks until the rooms can be used because of the floor finish, or until the buildings can be completed. During the cold and humid season in particular. the conventional floor finish containing much water delays the completion of buildings considerably as the floor finish has to dry completely before the final floor covering can be applied; drying will often take many weeks.

The new process and the machines for its application permits the production of mixes for the manufacture of "dry floor finishes". - The mix can be taken to the site by special transport tanks or mixer trucks (vats) and can there be processed like normal concrete or asphalt. The curing time such mixes can be adjusted as required so that the completed floor finish can be walked on within - for example - 20 minutes and no humidity is present.

Due to its high strength and the extraordinary flexural tensile strength the new POLYSAND dry floor finish can be applied with low thickness and a completely dry and seamless floor is obtained within a very short time.

Anotner method is to lay prefabricated "floor finish sheets" consisting of coated carrier material of low specific weight and the cast or make smooth the joints with polysand material. In both instances, the floor finish can be walked after a few minutes; this is of particular importance for speedy building and plumbing.

POLYSAND mixes to be used as floor finish can be coloured as desired and if the floor is applied carefully it may even be possible to save the subsequent floor covering, depending on local conditions.

Similarly, the new process and the special installations for its application permit the execution of paving coats, bridge plates, runways and other large area applications in place or on the site. When the device for the production of the mix is mounted movable and the ready mix prepared according to special recipes is applied and smoothed immediately; the new coating can then be walked or driven on after intervals varying between a few minutes and an hour.

This new variant of the process is important where roads, bridges or runways have to be produced as quickly as possible or for obtaining a durable coating which meets extremely high requirements.
The new technique promotes and accelerates the building process considerably without requiring additional labour.

The basic idea of producing a valuable material based on sand or other raw material, without autoclave hardening, by using poweful special machinery which requires little room and is inexpensive, was realised under industrial conditions in the fields listed before by the machines described above.

Operation of the machine

The machine is designed for the processing of dry, flowable quartz sand. Depending on the recipe and the type of POLYSAND to be produced, the granulation varies between 0 and 25 mm; for very fine and smooth surfaces the grain will be 0-0.3 mm. The ratio between polymer binder and sand depends on the type of POLYSAND and varies between 1:4 and 1:1[illegible]. As the mix is highly compacted and homogenized the sand becomes the base material whereas the polymer does not represent but a cold-setting binder. Due to their low price polyester resins are used preferably and have shown excellent results for the applications indicated before. The curing time can be adjusted as required and depends on the type and the using [illegible] of the final products.
For fully automatic assembly lines, e.g. for the coating of concrete facade sheets, curing time will be adjusted to a few seconds; depending on the given requirements the curing time will amount to several minutes or curing will take place within the predetermined period.
Due to the automation of the production process for polysand mixes merely unskilled hands are required. They have to fill the moulds; for using one production line, 3 men are required. Therefore the cost of labour is low and the cost

of material specified below can be easily extended by the actual cost of labour and manufacturing and production is still economic.

To calculate the costs, the price of sand (or other raw - materials) the polymer resin have to be inserted at a ratio between 1:4 and 1:10 and further costs have to be added to this basic price and the result will be the producer's price. - Experience has shown that even if a mixing ratio of 1:4 is used the producer's and sales prices of perfect sheets are considerably lower than for asbestos-cement.

No other material and no other process offer the economy and competitiveness of the process described.

Production takes place as follows:

The mineral and liquid components are precisely dosed and metered after leaving their respective silo and tanks and are fed to a supply and mixing unit by remote control.

The polymer binder components meet with the metered sand in another mixing and dispensing unit and there the preselected mixture is homogenised. This part of the machine is also operated by remote control.

By metering colours as desired any composition of the mixture can be preselected so that finished products of any colour, or by using contrasting colours, of any marble effect can be obtained. Products with predetermined colour can be made without any difficulty.

The ready preselected mixture leaves the machine to fill the moulds. The moulds pass underneath the discharge of the mixture.

All stages of the production process are shown in a diagram with electronic control thus permitting complete control of the production process.

A cleaning installation fitted in the machine ensures that the machine is always ready for operation and works without failures.

After the desired mixing ratio of the materials, their quantities and colour have been preselected the machine is operated by remote control by a special sender and receiver.

The machine is built according to the output required: it can be operated continously or intermittently and can be fitted in assembly lines.

As the mixture is prepared fully automatic according to the predetermined formulation the quality of the products remains constant and is independent of the personnel.

Maintenance and cleaning of the machine are simple as is its operation and do not require but hands with short training.

The manufacture of sheets, plates, coatings and finished products according to the above description reflects the latest stage of development. The finished products can be used within a very short time; even if small quantities are made production is economic. Therefore special orders can also be carried out.

The machines described above can be supplied for any special output. - Further techniques and possible applications are being developed.

Esperience has shown that besides sand any mineral or non mineral solid material which is dry and flowable can be used as base material for the industrial manufacture of the products mentioned above or for novel products. Among such materials is industrial waste of any type, e.g. from the wood pape- or textile industries as well as industrial or volcanic granulated slag. Moreover all kinds of synthetic and natural fibres, even of minor quality, and fibrous waste can be processed.

According to local circumstances, the available base material and the problem to be solved, a special POLYSAND production method for the product desired can be worked out on the basis of the new technique.

The variety of materials which can be used for the manufacture of durable and cheap building materials by the process described results in a multiplicity of possible applications. Therefore almost any problem touching the line discussed but deviating from the standard due to different geographic conditions in the countries concerned can be solved.

Apart from the numerous applications mentioned previously it can be stated that the products made by the process described without cement and asbestos, can be used wherever asbestos cement was employed so far. It should not be forgotten that the properties and applications of POLYSAND are far superior to those of asbestos cement; moreover low capital investment and nothing but unskilled hands are required and production is more economic than that of asbestos cement.

The following description of further POLYSAND techniques is to contribute to a demonstration of their volume and efficiency and is intended further to explain them.

Coatings

The material mixtures mentioned in the description before are excellently suited for any type of coating.

Experience has shown that almost any carrier material such as

> wood, wood fibre sheet, metal, sheet metal, glass, stone, concrete, cardboard etc.

can be coated.

The mixture for coating is prepared according to the application envisaged and the carried material used.

The thickness of the coating may vary between several millimetres and centimetres.

In fact, cheap carrier material such as wood, wood fibre sheets, cardboard, concrete or prefabricated building elements can be coated with high quality materials, either on one side or universally. The inexpensive "core" materials which have been coated or covered can be used for applications they

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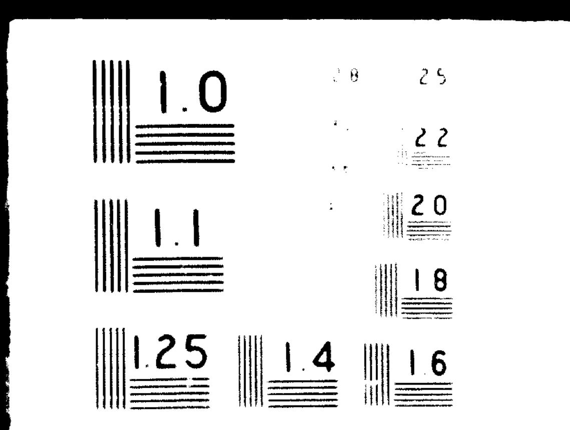


originally were not suited or intended for, e.g. for pre-fabricated parts, curtain walls, parts of furniture etc. produced in sandwich construction.

The coating mixes adhere to any carrier material without additional bonding or glueing.

Coatings are carried out without costly separate operations, expensive presses or polishing and as moreover the cheap raw material - sand - is employed at a ratio of at least [illegible]0%, they are extremely economic.

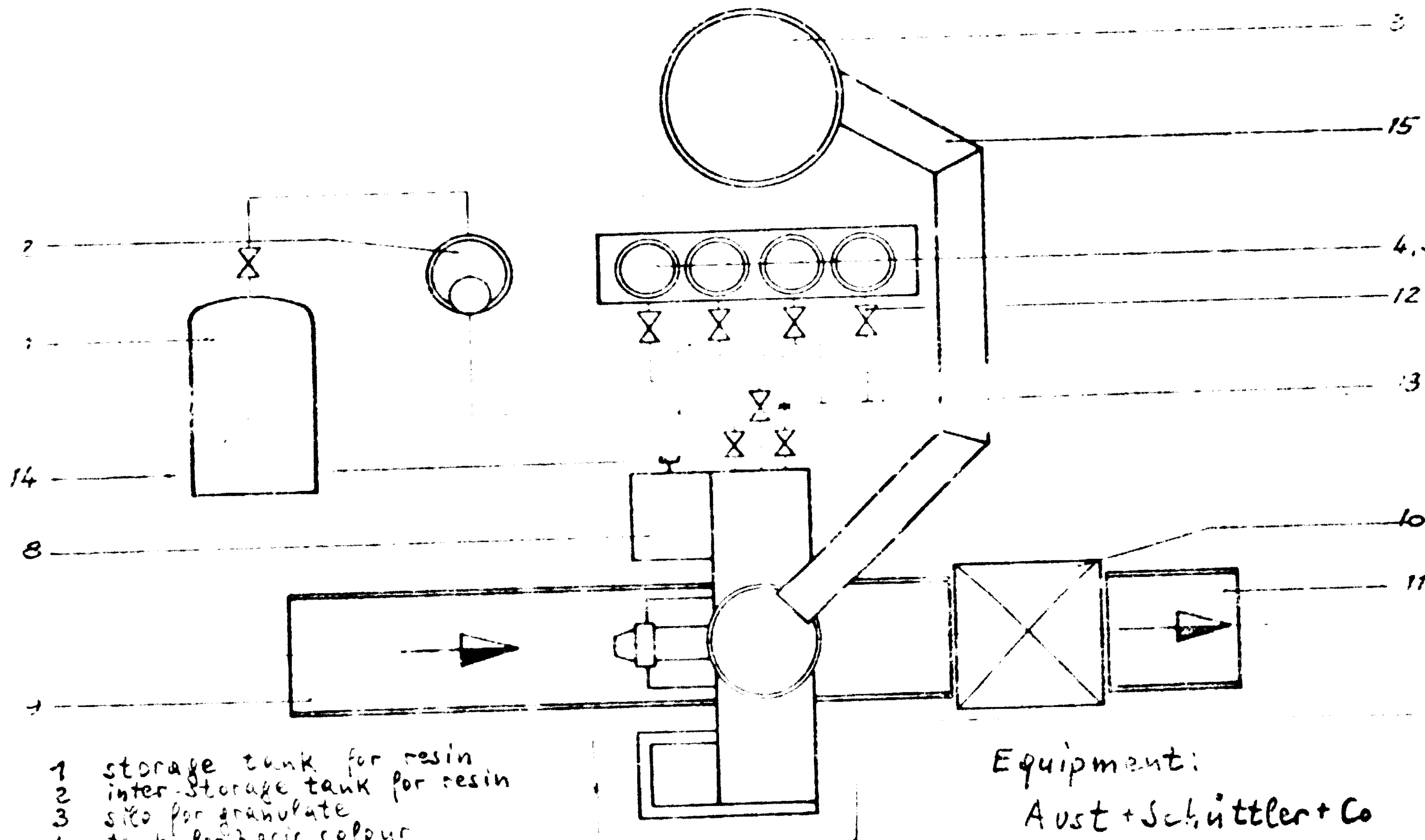
The coating materials can be given any desired and durable colour and have the same excellent properties as the tables and sheets described before.

The coating technique described above permits a variety of possible applications and carrier materials, which in fact are almost unlimited.
As the same time cheap carrier materials are considerably refined not only regarding their possible technical use but also with a view to [illegible] requirements in the building industry and extended applications; therefore the material value of such coated carrier materials is considerably raised.

Cheap carrier materials refined by coating can successfully replace expensive high quality materials as well as [illegible] and thus are very economic.

The coating materials are suited for civil and industrial use are resistant to corrosion.

The special machinery developed for the manufacture of the coating materials works smoothly even if operated ba unskilled labour and is identical with the installation for the manufacture of POLYSAND tables and sheets described before. The manufacture of tables and sheets as well as the application of coatings can be effected separately or within an existing plant. - The fabrication scheme to be seen below will make clear how simple a POLYSAND production can be erected everywhere. . . .



1 storage tank for resin
2 inter-storage tank for resin
3 silo for granulate
4 tank for basic colour
5,6,7 tank for contrast colour
8 polysand composition stone plant
9 roller conveyor for mould transport
10 vibrating table
11 roller conveyer for finished parts
12 throttle valve
13 quick coupling throttle valve
14 main air connection
15 feeding unit for granulate

Equipment:
Aust + Schüttler + Co
Düsseldorf

Productions scheme for polysand panels

Cast wood

The perfectly developed machinery and the [illegible] process permit the application of a new technique for the manufacture and processing of plasticized wood which is capable of being cast, i.e. cast wood.

The process permits the use of wood of low and lowest grade, wood waste, sawdust, bark, branch and burl [illegible] base materials.

The erection of a production plant for cast wood is economic and possible in places where wood waste, bark or low grade wood are available or can be supplied.

The machine permits the manufacture of castable mixes based on the available wood materials, out of these mixes large sheets or plates of different thickness with plane or corrugated surfaces, or any other finished product can be made.

The manufacture of window and door frames and of other products for civil engineering and technical requirements represent a special field of application.
The window and door frames are produced in the dimensions required and need no finishing. All woodworking machines usually required for the manufacture of conventional wooden window and door frames can be dispensed with.

Further remarkable advantages of cast wood are its permanent quality, its insensibility to humidity and moisture, its corrosion resistance and the retention of the dimensions as well as the complete absence of distortion of the frames.
Another advantage is that cast wood can be coloured as desired so that no additional painting is necessary.

The production method for cast wood largely depends on the special machinery employed and is based upon

a) the formulation
b) the preparation of the mixture and its discharge.

Another important operation is the preparation of dry mechanical wood pulp as base material.

The wood available - even old timber from wrecked buildings may be employed - is subject to preliminary breaking and is dried. Then the dry wood is ground; during this process the quality and type of wood, waste or bark are but of secondary importance.

According to the formulation the [illegible] wood pulp is bonded in the machinery with colours and polymers and the compound capable of being cast is filled into moulds.

The finished products which correspond to the mould are taken out of the mould within an hour at the latest - depending on the recipe employed - and are then ready for use. No subsequent pressing nor grinding is necessary.

The process is fully automatic the ratio of the different components being determined by the formulation so that maximum economic and technical results are obtained.

Cast wood can be machined, glued, drilled or screwed similar to hardwood. If suitable moulds are used no finishing of the products is required. The moulds are not complicated and can be made out of ordinary sheet steel.

The production [illegible] consists of a modified model of the machine for the manufacture of the [illegible] mixture, which is designed for the annual output of cast wood required.

After it [illegible] assembled the plant for the industrial production is taken into operation.

The process described [illegible] the economic exploitation of wood occurrence [illegible] It yields a maximum of technical and [illegible] advantages and permits the application of the latest results of research. -

"POLYSAND" - Tubes

So far a relatively small number of highly developed industrial [illegible] able to produce high grade tubes of [illegible].

However, such [illegible] for the cultivation of residential [illegible] therefore evident that [illegible] industrialisation and the [illegible] can be solved wherever a sufficient quantity of high grade tubes is available. [illegible] problems remain unsolved and continue to [illegible].

It is [illegible] that first quality tubes can only be produced if a highly technical production plant and qualified and trained personnel are available. Only this combination which in many countries is impossible because of the financial requirements and the training of specialists offers the possibility of [illegible] high grade tubes. Therefore the manufacture of such tubes is limited to relatively few centres.

In contrast to these facts the POLYSAND process also permits the industrial production of high grade corrosion resistant tubes in regions [illegible], for the manufacture of such pipes was impossible [illegible] mentioned above.

As the cultivation [illegible] residential or industrial areas is closely linked with the supply of water and the disposal of waste water and as the sanitary problems in many parts of the world [illegible] be solved but with first quality durable tubes, the possible local production of such tubes by the new POLYSAND process gains special importance.

The POLYSAND process and the relatively simple fully automatic machinery for the manufacture of tubes permit the production of first quality pipes also of big diameter even in industrial undeveloped regions employing unskilled labour.

It is also possible for extended lengths of tubes to produce the tubes with mobile plants and move the plant with the bedding of the pipes.

The major reason for these technical possibilities is the choice of the main raw material - sand - which is available almost everywhere in the required quality.

Experience has shown that first quality tubes which in many respects are superior to conventional pipes can be produced up to 2 m diameter (2000 mm) or more. The tubes are suited for the diversion of rivers and the irrigation of large areas and they are indispensable for future food production for the growing world population, in the cultivation of deserts and barren regions as well as for the supply of drinking water from the North to the industrial districts of Europe - a necessity which will become obvious sooner or later. Furthermore it should be mentioned that the life of the tubes is almost unlimited and the pipes need not be replaced at certain intervals as was the case so far. -

The advantages of tubes constructed from synthetically combined sand surpass the conventional tubes decisively by their quality and their economy.
The production can be installed wherever sand is at disposal or where it can be transported too. As said, the process is fully automatic and therefore does not require skilled labour, it cuts down the financial expense and the requirements for space to a minimum. The rapidity of the construction allows to take the tubes into use within an hour after production.

The tubes can be constructed up to a length of 2 to 8 m and a diameter of 100 - 2000 mm and more and they can be built with or without pipe bell. Pipe connections and joints can, on request and need, be manufactured also from mixtures on the sand basis and will then be technically equal to the tubes.

Pipes and moulded parts (pipe bends a.s.o.) produced according to the POLYSAND method represent duroplastic pipes which due to a new process can be produced economically and offer a number of the most various adventageous properties.

In case that pipes for very special applications are required it is also possible to admix to the basic material cut glass rovings additionally.

The following details show the superiority of the pipes in comparison with the conventional pipes from concrete, asbestos-cement, ceramics, [illegible] and partly steel:

1) weather resistance of the material towards wetness, humidity and decomposing bacteria,
2) resistance against UV-rays,
3) low specific gravity of 1,[illegible] – 2.4 therefore easy to transport and to lay,
4) highly resistant to impact and fracture,
5) corrosion resisting,
6) cover painting or insulation is not needed,
7) widely resistant against acids and alkaline solutions
8) poor electric conductibility
9) no formation of liquid residues, since inside surface of pipes is smooth. This also ensures low diminuation of flowing speed and low loss of pressure,
10) physiologically excellent,
11) frost resisting,
12) insensible to [illegible] acid and sour soil,
13) producible in colours,
14) fit for the transport of liquid and gas,
15) to transport hot or cold,
16) low cost of production – – –

The qualities of the POLYSAND pipes have been thoroughly tested and have produced results of which a few are mentioned under here:

1.) <u>Resistance to corrosion</u>

The pipes are absolutely resistant against corrosion – no protective coatings are necessary. Even highly concentrated acids and leaching solutions have not been able to alter the material. Conventional pipes are decomposed within a short time or even in a few minutes. Coverage paint is not of much use since it gets ruined after a certain time or it comes off the glaze. The hard cover cheramical pipes is after a while [illegible] by abrasion, also the concrete and asbestos-cement tubes. Only the POLYSAND pipes have the similar quality of glass against corrosion.

2.) <u>Abrasive resistance</u>

Even hard metal tools are not able to cut or demage the new pipe-material. Only by means of a 'separation disk' the pipe made out of polysand material can be easily worked on. The plate of the new sand pipes has such an even homogenity that it surpasses all other kind of pipes by its resistance abrasion. Quartz sand is a very good raw material.

3.) The composition of the material gives a resistance to a pressure of an average from 1.100 - 1.600 kp/cm² of the plate. This is more as about to 300 % higher than the compressive strength of the conventional material. The tests of the official testing department at Bielefeld BRD have shown a working load resistance 150 % higher than conventional tubes, at a thickness of the material of 1/3 less than the conventional tubes.

4.) <u>Burst pressure</u>

The POLYSAND pipes are adequate for extreme pressure. The tests have been broken off at a pressure of 30 atü without any [illegible] in the pipes. The resistance against high pressure is a question of the structure and the thickness of the material.

5.) <u>Resistance to weather and temperature</u>

The pipes have been exposed to temperature changes between - 20° C and + 50° C without any changes of the material to been seen, the same between - 20° C and + 130° C. A weather test through more than 3 years had the same result, the POLYSAND pipes have resisted sun, rain, heat, cold, snow, ice a.s.o.

6.) Others

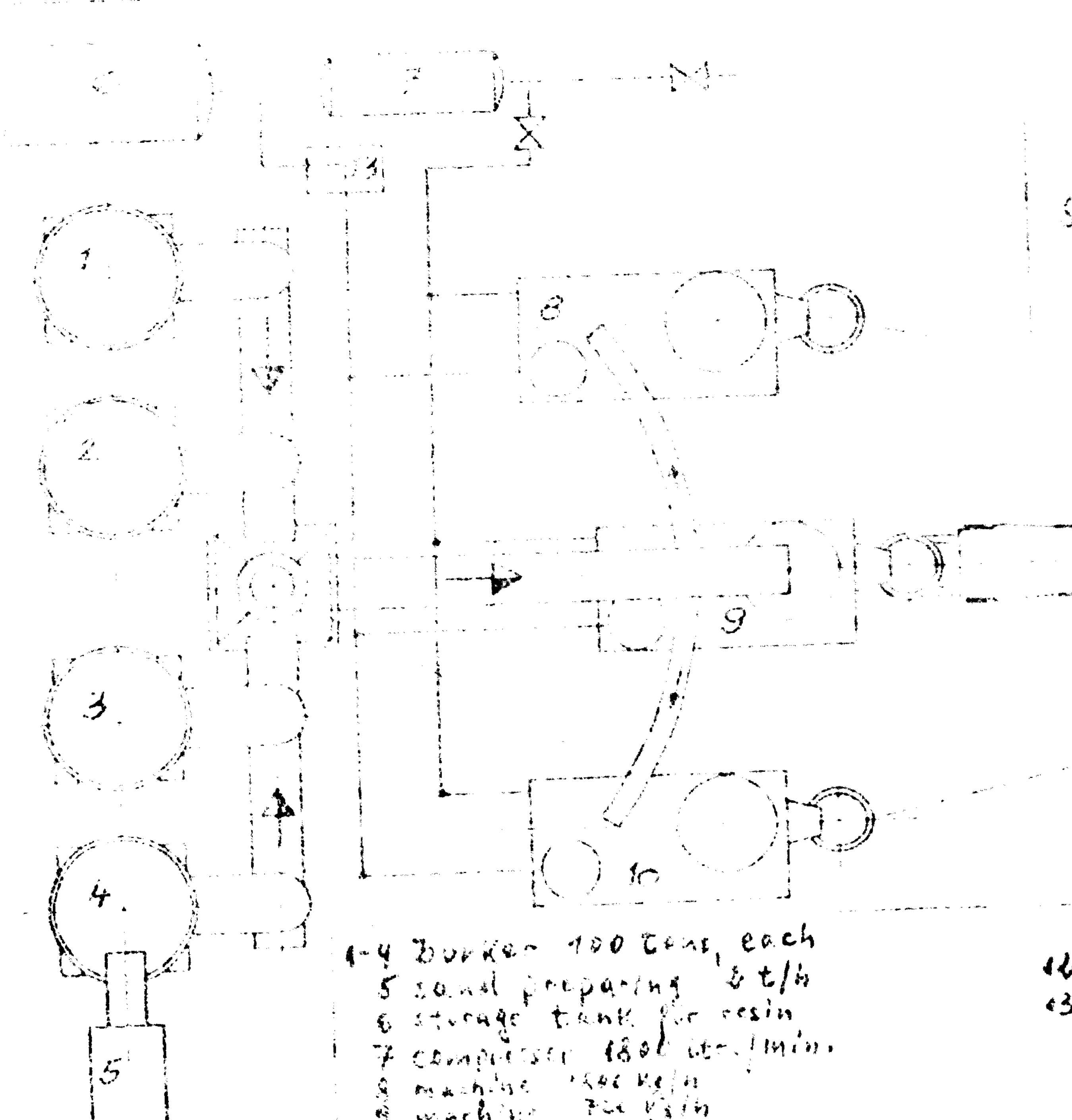
The pipes have, for testing purposes, been constructed in different colours. The pigmentum showed no effect to the pipes. The colour lasts as long as the pipes and does not drop off like from conventional material. The different colours for sight make an additional advantage for their use. - The homogene material is absolutely tight and allows, therefore, the transport of aggressive materials. Small tests have shown that the POLYSAND material is perfectly fit for that purpose.
The pipes are very safe for impact and fracture, Polysand pipes have been dropped from height of 1 m and even 2 m and 4 m without any damage.

The items described below may serve as an example for a production plant for POLYSAND pipes with a yearly capacity of 150,000 running meter of pipes with a nominal width of 300 mm.

- After leaving the sand processing plant the solids are fed in sensible co-ordination of various grains from the bunker group to the distribution bunker by means of belt conveyors.
- The distribution bunker delivers the solids to another slewing belt conveyor which in intervals supplies the discharge bunkers of the 3 mixing and metering units.
- The ready mixture is taken up by 3 mobile bunker wagons and delivered to the vibrating plants, where the mixture is taken up in storage tanks for charging the stored pipe and pipe head moulds.
- After having passed the compacting process the finished products are thrust out vertically. -

The complete installation is layed out to a capacity of 150,000 running meter of pipes with a nominal width of 300 mm per year - for example.

[illegible] + Co.
Düsseldorf
Scheme of manufacturing plant for polymer tubes



1-4 bunker 100 tons, each
5 sand preparing 8 t/h
6 storage tank for resin
7 compressor 180 ltr./min.
8 machine 1500 kg/h
9 machine 700 kg/h
10 machine 420 kg/h
11 fork-lift-truck with transport container
12 vibrating device with mould table
13 resin supplying pump

Concluding this it can be said that the POLYSAND pipes can be produced practically everywhere and they are fit for industriali-sation, irrigation, development of new [illegible] which so far [illegible] have an own pipe production. [illegible] can also be manufactured with machinery [illegible] in [illegible] where [illegible] can be achieved [illegible] it is possible to build the tubes in distance [illegible] without [illegible] of transport.

The [illegible] POLYSAND [illegible] multiple [illegible] with a maximum of quality [illegible]

The results [illegible] incomparable in quality and [illegible] conclusion [illegible] the specialists. - -

Building Technique of Tomorrow

How It Was

In old times the technique of building was on rather a high level as compared with production methods. At that time only manual tools, the most important [illegible] were hammer and axe, [illegible] in making commodities. [illegible] old times [illegible] mecha-nisms, such [illegible] were used in building for lifting or [illegible] heavy weights. It may be assumed that one of the most important inventions of mankind - roller and wheel - was first used in transport of heavy weights to the site.

During the middle ages neither in industry nor in building did the level of technology change [illegible]. Only in the production of commodities some organisational improvements were made: co-operation [illegible] in the [illegible] domestic handicraft. -

With the discovery of America the possibilities of [illegible] European goods were recognized. [illegible] for increasing the production of goods were [illegible]. At the beginning of the 16th century manufactory [illegible] as the main form of

[illegible] until the end of the 19th [illegible], then being [illegible] by industrial production employing [illegible] and [illegible] in [illegible] [illegible] work [illegible] efficiency of the [illegible] -
[illegible].

[illegible] partially in [illegible] [illegible] [illegible] [illegible].

[illegible] the [illegible] [illegible] the disappearance of manufactories with consequent industrial [illegible]ion. Factories were established, at first in the place [illegible], the power for [illegible], was readily available. [illegible] change was [illegible] substantially by the invention [illegible] steam-[illegible].

[illegible] is of interest that the [illegible] development in the production [illegible] [illegible] construction [illegible]eering. [illegible] of building materials, but [illegible] some machines [illegible] less, still at the beginning of the [illegible] before [illegible] timber was brought directly to [illegible] site and [illegible] material or into [illegible] the [illegible] [illegible] - All [illegible], even [illegible] of multi-[illegible] were transported by man-[illegible]. The [illegible] increased to such [illegible] degree [illegible] in [illegible] [illegible]. The [illegible] production [illegible] [illegible] building, ship building, [illegible] building itself as well as [illegible]

How I[illegible]ls

Already during the period between World Wars I and II, techically developed countries succeeded in using machines to accomplish building operations [illegible]. Earth-work was done by excavators [illegible] for the transport of bricks, mortar and other material special hoists were used. Yet the walling [illegible] in the manner of our fore-fathers, by hand. The floors were made of cast-on-site ferro-concrete. Placing concrete and reinforcement as well as making [illegible] was also done by manual labour. Only members of steel framework for some multi-storey buildings or skyscrapers were made in factories and assembled on site. Nevertheless, walls between the framework were built by hand either of bricks, small cellular concrete blocks or some other light weight material. Final finishing was almost amways done by hand. Building in this way has prevailed also after World War II even in many higly developed countries. -

During the first quarter of this century in Henry Ford's factories production was organized according to the so called conveyer method. This enabled a [illegible] reduction of man-power in making products. The idea of conveyer production was immediately applied in the manufacture of building materials also. Its application on building sites presents great difficulties. To mount conveyers and put them into operation is rather a complicated matter being often more [illegible] than [illegible]. Various experiments on using conveyers or [illegible] machines in building have always failed. To use conveyers in building floors or partition walls is absurd anyway. -

It seemed that because of its special nature the development of building could not keep up with the mechanization and industrialization of other fields of industry. Yet a suitable method for developing building was found. Industrialization of building was made possible by producing prefabricated building constructions and elements and mounting them on site. - In industrialization of building all building traditions will evidently be changed. Operations having been carried out during thousands of years on the building site only will be transferred to factories.

[illegible] building site itself [illegible] be [illegible] logical [illegible] a place for [illegible] big [illegible] and combines. All the advantages in the [illegible] of [illegible] offered at present [illegible] industry must be [illegible] into building [illegible].

[illegible]

[illegible] activity is [illegible] on the building materials [illegible] as well as on the [illegible] of these materials. It was [illegible] therefore [illegible] concentrated on the practical application with [illegible] to the general building activity. [illegible] materials [illegible] not only lead [illegible] new applications, [illegible] the general [illegible] problem could be [illegible] building activity.

[illegible] rule-of-thumb [illegible] so [illegible] that besides [illegible] or a few [illegible] motor car. It can be [illegible], if it were [illegible] of sheet-metal [illegible] manually. A [illegible] in the cost of motor cars [illegible] place only [illegible] conveyor production.

[illegible] industrializatio[n] in building has been the [illegible] of artificial stone suitable for this purpose. To make large-sized [illegible] structural elements is [illegible] possible, dimensions of concrete elements are not limited but in spite of [illegible] ferro-concrete plants, monolithic concrete constructions cast on site are remarkably [illegible] than prefabricated constructions. [illegible] has succeeded [illegible] will succeed in building [illegible] by industrial [illegible] mass-building [illegible].

It can be seen, that POLYSAND has all necessary preconditions for availing the first genuine revolution in industrialized building. Polysand is organically connected with industriality. A sharp reduction in cost of stone buildings erected by industrial methods becomes possible only by means of the new building material. And after all, this is the main point.

In the polysand land of tomorrow everything will be automated and mechanized. Building elements are completely finished and glued on conveyers to complete walls or room-units. The elements are carried by transport conveyers to the site where they are assembled within some hours. Transport proceeds normally along good roads assembled of large-sized polysand elements.

Building of houses is similar to the manufacture of motor cars with the exception of the assembling conveyer which is shifted to the building site. Doubtlessly, the industrialization of polysand building will decreases the cost of and man-power needed for housing constructions as many times as industrialization of car production once decreased the cost of motor car and expenditure of man-power for its manufacture. Then dwellings and flats will be in such an abundance that everybody may choose the one he likes best. Towns will have always plenty of vacant flats in all districts, consequently one may choose a flat according to taste and needs. Making posible for each citizen of the world to get a sheltering roof above his head, is the first great mission of the new building materials.-

Half a century ago there were a lot of people who, during their lifetime, had not ventured farther from home than some tens of kilometres. Not that they did not want to, but because of having no possibilities for that. The revolution in the production of vehicles had not taken place as yet. There are many people nowadays, who have lived their whole life in the same flat or room. Not that they were fond of living cooped up like moles in their burrows but because not everybody has the possibility which once the Russian tsar had, who owned palaces in Petersbourgh, in the Crimea and in the Caucasus. There are still many employees in many countries getting either average or low pay, who skimp and spend some 15-20 years of their life to build a small house for themselves. Building of one's own house is still so difficult and so expensive that many people are bound to it all their life long. The only consolation to the unfortunate is the hope that his children's life would not be so hard as his, if once the house is ready.

The revolution in [illegible] gave a possibility to all people to travel and see the world. The revolution in building will [illegible] to live where they please. [illegible] - This is the second great [illegible] building materials.

An immense [illegible] experimental work and designing must be [illegible] the cost of a suitable shelter for the 20th century people.

The problem is vast. - It is evident that the single small building enterprises and firms in the countries are not able to solve this problem at adequate rate. There is the opinion that this problem should be solved in a concentrated way organized by UNIDO and by state authorities analogically to the problems of atomic energy and rocket technics. It goes without saying that necessary expenses on solving this problem are tens of times lower than those on atomic energy and rocket technics. The expenses on it should be within the means of small states like Finland or Austria. However, the spent capital may return ten- and hundredfolds very soon, contrary to expenses in rocket and atomic technics, where finding of economical justification for capitals being spent required an immense amount of fantasy, foreseeing of far future.

The fact that the described new building materials are the cheapest and the most promising building materials of the highest quality, guarantees a full success for this great work.

The good it does to mankind is colossal.

A car is not needed by everybody, yet everybody needs a sheltering roof. [illegible] people in the world lack a proper flat. According to [illegible] supplied by the UNO the world population is to be 4 milliards in 1970 instead of the present 3 1/2 milliards, and about [illegible] milliards in [illegible], assuming 4 persons per flat it will be necessary to build in the period to 19[illegible] some 120 million more flats; and in the following 20 years another 50 million! - By that time the majority of already existing flats are to be substituted by new ones. And how many people in the world [illegible]!

[illegible]

The 3 requirements for [illegible] methods for producing building materials, [illegible] to enable any country and any area to [illegible] by means of local raw materials and available labour have been ful-filled by the technics and processes presented hereby.

The building material [illegible]LYSA[illegible] [illegible] by direct conversion of ordinary sand, [illegible], [illegible], [illegible] a special process, [illegible] does not represent only a mixture of the [illegible] raw materials, [illegible] a completely new material with [illegible] than all conventional materials [illegible].

Special characteristics and properties are:

POLYSA[illegible] has the [illegible] compressive strength than concrete but [illegible] specific weight.
Depending on the [illegible] envisaged the finished articles [illegible] can be varied with a view to their physical and constructional [illegible] so that maximum economy can be [illegible] specific weight between 400 - [illegible]000 kg/m³ can be [illegible]. Also different compressive strength and any other requirement such as insulation against heat and sound etc. [illegible] considered. - Thus the material can be adapted in the factory to the constructional requirements and for any [illegible] the material can be produced, i.e. specific weight, compressive strength, insulating properties and abrasion resistance can be fixed and obtained as desired. Therefore it is not necessary to produce all prefabricated parts from one [illegible] with concrete, and then adapt these parts to [illegible] [illegible]tion

or other additional [illegible] (see the uncomfortable concrete houses with [illegible] disadvantages such as sensitiveness to noise, [illegible] mildew, insufficient insu[illegible] living, impossi[illegible] etc).

[illegible] automatic and can [illegible] can be built [illegible] supporting and [illegible] concrete skeleton is required - [illegible] other [illegible] can be produced.

The [illegible] a POLYSAND [illegible] can be compared to the costs of modern and efficient concrete works, the difference [illegible] concrete works do not produce the cement [illegible] have to buy it and can [illegible] really on local raw materials.

The prefabricated parts can also be produced in colour or with any surface [illegible]; they can be produced with or without reinforcement, their size is merely limited by transport problems.

At present [illegible] besides POLYSAND can be applied so universally, has [illegible] excellent [illegible] and is as economic [illegible].

Polysand [illegible] by cold setting can be employed for any finished [illegible] made out of asbestos cement, natural or artificial stone, [illegible] or [illegible], e.g. sheets, [illegible], floors, staircases, building elements [illegible] and moulded parts such as [illegible], tubes etc.

As a rule, POLYSAND is made out of sand; however, other locally available raw materials or industrial waste and mineral or non mineral [illegible].

[illegible] manufacture of POLYSAND can be [illegible] production is also possible in [illegible] developed regions without risking the high [illegible] investment required for the manufacture of POLYSAND is but a fraction of the cost for the processing of asbestos cement. Neither presses nor grinding or polishing devices are required and the space required for a production line is low so that it can be joined to an existing production.

Polysand pipes can be produced from local sand too, and can also be manufactured in [illegible] the production of pipes so far was impossible [illegible] lack of raw materials and qualified labour.

Polysand products can be given any colour or combination of colours; moreover they are resistant to weather and aggressive materials as well as to corrosion. Polysand materials are [illegible] more solid and of better durability than concrete and asbestos-cement materials.

The polysand building materials, the application of which is to find in the application field of asbestos cement, no expensive and large machinery and equipment are required.

To produce POLYSAND all kinds of [illegible] only sand, clay, ash, slag, lime and water or unsaturated polyester resin as raw materials (also industrial waste) while cement or asbestos fibres are not necessary.

The production [illegible]

The first step [illegible] the erection of a plant to produce sheets, [illegible], [illegible], [illegible], roof tiles and plates, etc. with [illegible] equipment (see page 47 - 52). [illegible] the possibility [illegible] POLYSAND building materials in a short time in their countries.

The cheap raw materials, [illegible] requirements as well as the economic method of [illegible] production result now in a material [illegible] not only combine the advantages of [illegible] in addition has far superior qualities and is less expensive, i.e. POLYSAND!

The technique of new building materials [illegible] is therefore capable of solving any problem of construction and of the manufacture of building materials in [illegible] of the world [illegible] and successfully. - [illegible] industriali-zation [illegible]! - - -

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