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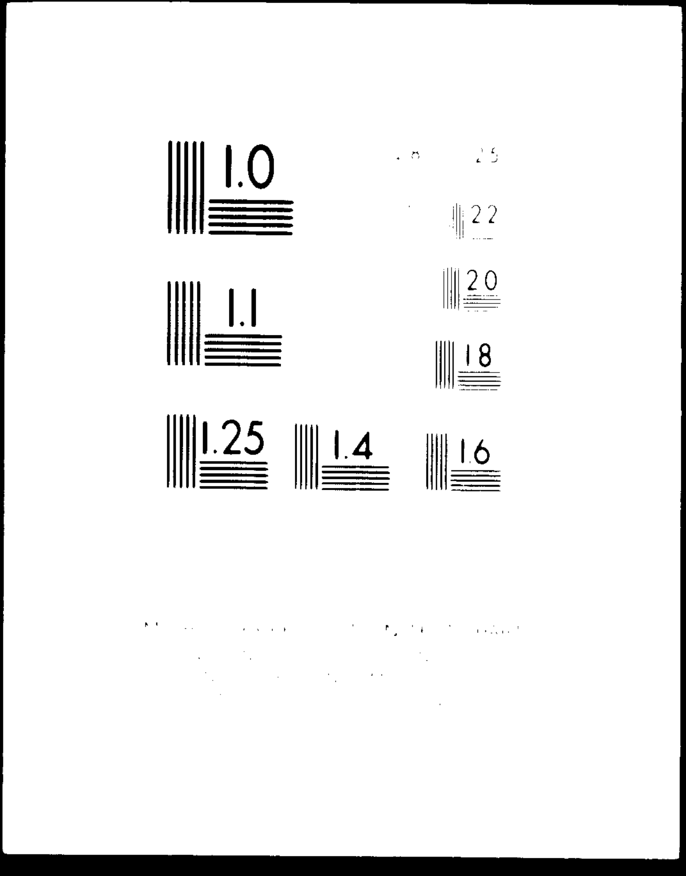

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Assistance Team to the
Asbestos-Cement Industry
in Syria

02371

Final Report

July 1970

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Asbestos-Cement Industry
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Final Report

submitted to

United Nations Industrial Development

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Attn. Chief Technical Equipment, Procurement

and Contracting Office

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S k e t c h

1. Introduction

According to the Contract concluded between the United Nations Industrial Development Organization in Vienna and Polservice in Warsaw for rendering the assistance to the Asbestos-Cement Industry in Syria a team composed of:

Mr. Wit Molenda B.Sc./Eng/ - Team Leader

and Mr. Zygmunt Krawczyk,

worked in Syria from 21.04.70 to 14.07.70.

The Team assisted the UNIDO in improving the production of asbestos-cement products at the Dummar Cement Complex, Syria, and in eliminating of existing shortcomings at the said complex. Existing shortcomings are in general the cause of bad quality of production and of low production capacity.

The Team made study on:

- raw materials used for production
- methods employed in sheets and pipes production
- work organization at the factory of asbestos-cement
- work organization in the laboratory
- work organization in mechanical and electrical shops
- handling of raw materials and finished products
- technical documentation and technological process
- methods of servicing the machines.

After making the above study the team was able to make conclusions an anomalies existing in organization and in the process of production.

On the power of these conclusions the way for elimination of existing shortcomings was outlined and the method for reaching adequate quality of production was indicated.

Finally the workers were trained in correct servicing and maintenance of machines. Proper methods of how to prepare the machines for production was also demonstrated.

2. Raw Materials

2.1. Cement

From the head of laboratory, Mr. Hassan Saka, a quantitative analysis of cement was received. According to this analysis the sample of cement tested on 29.03.70 contained:

SiO_2	-	21.41 %
Al_2O_3	-	6.53 %
Fe_2O_3	-	2.95 %
CaO	-	63.95 %
MgO	-	3.18
CaO, free	-	0.80 %
SO_3	-	1.69 %
Losses	-	0.28 %
Total:		100.79 %

Specific surface	2814 sq.cm/g
Sieve analysis /rest on sieve 4900/	10 %
Compressive strength after 3 days	218.3 kg/sq.cm.
Compressive strength after 7 days	345.0 kg/sq.cm.
Compressive strength after 28 days	480.0 kg/sq.cm.

Le Chatelier 5 mm

Beginning of setting after 1 hs 30 min

Specific water 23 %

Mineralogic analysis according to Bogues formula.

$C_3S = 4.07\ C - /7.60\ S + 6.72\ A + 1.43\ F + 2.85\ SO_3/ =$

$= 4.07 \cdot 63.95 - /7.60 \cdot 21.41 + 6.72 \cdot 6.53 +$

$+ 1.43 \cdot 2.95 + 2.85 \cdot 1.69/ = 44.64\ \%$

$C_2S = 2.87\ S - 0.754\ C_3S$

$C_2S = 2.87 \cdot 21.41 - 0.754 \cdot 44.64 = 27.79\ \%$

$C_3A = 2.65\ A - 1.69\ F = 2.65 \cdot 6.53 - 1.69 \cdot 2.95 =$

$= 12.31\ \%$

C = quantity of CaO in tested cement sample

A = quantity of Al_2O_3

F = quantity of Fe_2O_3

SO_3 = quantity of SO_3 in cement analysis.

On the basis of above analysis this cement does not meet, in our opinion, the requirements for asbestos-cement production and gives bad results both in quality and quantity of production.

Besides, entirely fresh cement is used for production while its temperature exceeds 70°C thus deteriorating the quality of prepared asbestos-cement mixture. Neither at the cement factory nor at the asbestos-cement factory a special cement silo for seasoning of cement is provided and the cement has to be seasoned for a minimum of two weeks.

It was discovered that for production of roofing corrugated sheets the cement of the same quality had been used as that for production of pipes.

2.1.1. Special Requirements for Cement

Special cement for production should contain:

/for production of sheets/

C_3S	-	55 ± 5 %
C_2S	-	20 %
C_3A	-	5 ± 2 %
CaO, free	-	0.5 % max
SO_3	-	1.5 - 3.5 %

The rest on sieve, 4900 mesh/sq.cm	- 10 % max
Le Chatelier	- 6 mm max
Temperature	- 40 - 50°C max

For production of pipes the contents of C_3S should be about 65 ± 5 %.

We explain in brief why these parameters are so important:

C_3S - /3 CaO · SiO_2/. This mineral isn't as durable as C_2S and therefore it quickly reacts with water while the compresive strength increases quickly.

As the practice indicates this mineral is very useful for our production but it lowers the production capacity at the cement factory and causes an increased consumption of coal /gas/ so that the optimum quantity of C_3S will be about 55 - 65 %.

It should be noted that production capacity and the density of obtained products increase in direct proportion to the quantity of C_3S.

C_2S = /2 CaO · SiO_2/. This mineral is very durable, its compressive strength increases slowly but constantly.

In production the finished product should be stored for a long time. Considering large storing areas wchich are necessary, increasing the quantity of this mineral isn't profitable. Therefore optimum quantity of C_2S would be about 20 - 30 %.

C_3A = /3 CaO · Al_2O_3/. This mineral binds with water very quickly.

It can be said that is starts to react with water right at forming the sheets or pipes. As a chemical compound is obtained wchich is unfavourable for production process. This collaidal compound covers the asbestos fibre surfaces causing other very useful parts of cement to glide to the water. The water gets dirty very quickly comtaminating both the felt and sieve cylinder. Thus the production capacity declines.

It can not be worked efficiently with dirty felt and sieve cylinder and therefore the quality of production also declines. We specially suggest to observe the production, and bending and density tests of finished products when the contents of C_3A will be higher than 12 %.

According to our opinion this component in local cement will be most influencing the quality and quantity of production.

Contents of C_3A in cement should be not higher than 5 $\pm$ 2 %.

Free CaO. In storing or during production calcium oxide reacts partialy with water and partially with carbon oxide bringing thus about an increase in volume. This increase in volume causes bursting of finished pipes or sheets and therefore the contents of free CaO is limited to 0.5 % max.

SO_3. This component regulates the setting. Besides, it reacts with C_3A thus bringing about an increase in volume and therefore it is dangerous to the finished product; the pipes or sheets may fall apart. The quantity of SO_3 is limited to 1.5 - 3.5 %.
Grinding of specific surface. The rest on the sieve, 4900 meshes/sq.cm, depends on grinding times in cement mills.

In our opinion it is unfounded to keep the grinding below 5 %.

In our practice we have observed that small grains of cement are passing through felt and sieve cylinder to the water, while the biggest grains fail to keep to the asbestos fibre and are very easily separated from asbestos cement mixture. A thick accumulation of sediment in pipelines and under the machine as well as in water recuperators can be observed and therefore the grinding is limited from 6 to 10 % /specific surface of cement about 3000 - 3500 sq.cm/g/.

Temperature of cement. According to our opinion the high temperature of cement is unfavourable for production. A slow drop of productions capacity as well as an increase of cement consumption can be observed when the temperature exceeds 40°C.

2.2. A s b e s t o s

In stores only 4 sorts of asbestos were available and therefore sort V or VI of asbestos had not been used for production.

Particularly the sheets, lacking asbestos of sort V or VI, are not elastic, cracking during bending if they don't contain adequate quantity of water /about 27 %/.

The knives cutting the sheets are getting blunt very quickly. Asbestos mixture used for production of sheets consists of :

Asbestos blue II	20 kg = 25 %
Asbestos amosite	20 kg = 25 %
Asbestos BL - 4D	40 kg = 50 %

Asbestos mixture used for production of pipes consists of:

Asbestos blue I	20 kg = about 22 %
Asbestos blue II	10 kg = about 11 %
Asbestos amosite	20 kg = about 22 %
Asbestos BL - 4D	40 kg = about 45 %

Asbestos mixture used for production of sheets as well as of the pipes is in our opinion of too good a quality. The proportion between chryzotile and amphiboll asbestos is wrong. This proportion at Dummar Asbestos Cement factory is equal to 50 : 50 for sheets, and 45 : 55 for pipes respectively.

In others countries this proportion is held:

for pipes Ø 50 - 200 mm	- 80 : 20
for pipes + 200 mm	- 70 : 30
for sheets	- 70 : 30

Middle East countries,

for pipes 50 - 200 mm dia.	-	80 : 20
+ 200 mm	-	70 : 30
for sheets	-	70 : 30 or 80 : 20

U S A,

for pipes	-	70 : 30

Far East countries,

for pipes 50 - 200 mm dia.	-	80 : 20
for pipes + 200 .mm	-	70 : 30
for sheets	-	78 : 22

The general formula for pressure pipes throughout the world is: Asbestos 15 % Cement 85 %

Asbestos Blend: 30 % asbestos blue I
10 % asbestos amosite
30 % asbestos group 4
30 % asbestos group 5

Similarly the general formula for corrugated sheets is:

Asbestos 12 % Cement 88 %

Asbestos Blend: 10 % asbestos blue I
10 % asbestos blue II
40 % asbestos group 4
30 % asbestos group 5
10 % asbestos group 6

or:

15 % asbestos blue II
10 % asbestos amosite
45 % asbestos group 4
20 % asbestos group 5
10 % asbestos group 6

For low pressure pipes /sewage pipes/ the same mix as for corrugated sheets is satisfactory.

The pipes for higher pressures and of larger diameters require fibre mixtures of higher quality.

2.3. Technological water

According to the analysis received from the head of laboratory, Dr Hassan Saka, 1 l of fresh water used for production purposes contains, after evaporation, about 0.465 g of sediment which is about 0.0465 % and therefore, in our opinion, the water of this quality is quite satisfactory for production of pipes and sheets.

Sediment contains about :

Al_2O_3	-	0.45 %
CaO	-	13.26 %
MgO	-	3.28 %
SO_3	-	7.99 %
Cl	-	0.085 %

and others

No organic impurities were observed.

Technological water for production of asbestos cement can not contain great quantity of clay or of organic matter. Such substance covers the surface of asbestos fibre and is present in the space between grains of cement and therefore the filtration, strength and capacity of production decline. The water can not contain more then 0.2 % of SO_3 and 1 % of NaCl or of $MgCl_2$. The temperature of water is of great significance for production quality and capacity. Hot water cleans better the felt and sieve cylinder.

Hot water reduces the viscosity of asbestos - cement mixture and accelerates hydratation process of cement, but it should be remembered that the water also dissolves some components of cement until the point of saturation is reached. Saturated water influences in a very high degree the stabilization of technological process as well as the consumption of raw materials. Optimum water temperature should not be lower than 30°C. Asbestos - cement mixture contains about 90 % of water and this is the reason why the quality of water is of so great an importance for production.

3. Production of Pipes

There is one asbestos-cement pipe plant and one asbestos-cement sheet plant at the factory. Both plants were made, supplied and installed by RCM - Torino - - Italy. The factory started its production in 1967. The pipe plant consists of:

A - Asbestos weighing plant /for pipes and sheets machine only one plant/

B - Cement silo "

C - Water recuperators "

D - Disintegrator "

E - Turbomixer "

F - Cement weighing plant "

G - Noria

H - Homogenizer

I - Pipe machine

K - Turboleser

L - Roller conveyor

M - Basins

N - Lathe for pipes

O - Testing press for pipes

P - Cutting machine

Q - Lathe for joints

R - Testing press for joints

Described will be now the production method with special attention paid to the anomalies in the methods of production and to the inexpedient handling of the machines resulting in poor quality of finished product.

3.1. Asbestos Weighing Plant

There is only one plant at the factory for preparation of asbestos cement mixture as well as only one pair of water recuperators. Since for the production of sheets a different production formula applies than that for production of pipes therefore the machine fo- production of sheets is idle when the pipe machine is working.

Asbestos weighing plant is operated by two workers. In our opinion one worker would be sufficient for operating this plant. There are 5 boxes in the weighing plant for 5 different kinds of asbestos. In each of the boxes 42 kg of one sort os asbestos can be weighing automatically. This quantity of asbestos according to the recipe can be altered as desired from 0 to 42 kg.

After weighing of a suitable quantity of asbestos from one box, the weighing plant of this box is stopped automatically.

If all sorts of required asbestos are weighed the entire plant is stopped after weighing. It is possible to put in motion two boxes in a sequence while the other start at the same time. Starting of weighing plant is controlled from the control panel /control desk/ while stopping occurs automatically. The entire plant is equiped with dust collector.

3.1.1. Anomalies in Weighing Plant Operation

According to the recipe for production of pipes as it was on 27.04.1970, one weigh of:

asbestos blue I	was	20 kg,	which is about	22 %
asbestos blue II	was	10 kg,	which is about	11 %
asbestos amosite	was	20 kg,	which is about	22 %
asbestos BL - 4D	was	40 kg,	which is about	45 %
The total	was	90 kg,	which is about	100 %

While making our observation of the plant we suspected that the composition of asbestos cement may be unsuitable and therefore we suggested checking of the weighing plant operation. During the first and second shifts the portions /weighed/ were counted, each portion 90 kg. At the same time the number of bags was counted, each bag 45.3 kg, which were poured into the weighing plant boxes. During the first shift 20 portions of asbestos mixture were prepared, giving a total of 1800 kg. However according to the data obtained from Mr. Cheltaui B. Sc. /Eng./ the quantities used were:

asbestos blue I, 7 bags, each bag 45.3 kg =
= 317.1 kg = 20 %

asbestos blue II, 4 bags each bag 45.3 kg =
= 181.2 kg = 11 %

asbestos amosite, 8 bags each bag 45.3 kg =
= 362.4 kg = 23 %

asbestos BL - 4D 16 bags each bag 45.3 kg =
= 724.8 kg = 46 %

Total : 35 bags each bag 45.3 kg =
= 1,585.5 kg = 100 %

During the second shift prepared were 14 portions of mixture, each portion 90 kg, giving a total of 1,260 kg.

used actually were:

asbestos blue I, 9 bags, each bag 45.3 kg =
= 407.7 kg = 25 %

asbestos blue II, 5 bags each bag 45.3 kg =
= 226.5 kg = 14 %

asbestos amosite, 5 bags each bag 45.3 kg =
= 226.5 kg = 14 %

asbestos BL - 4D 17 bags each bag 45.3 kg =
= 770.1 kg = 47 %

Total: 36 bags each bag 45.3 kg =
= 1,630.8 kg = 100 %

In consequence the above difference between automatic balance indication and the quantity of asbestos consumed in fact is too great. In our opinion the above balance is neither proportionate nor controlled. Mechanical friction can bring about the difference in consumption.

In order to receive suitable mixture we think it proper to control the balance and to compare the automatic balance indications with quantity of asbestos realy consumed to the production.

In our opinion the recipe for pipes is too rich /good/, what not always will take a good turn. The spet near asbestos weight plant isn't orderly, bags with asbestos mixed up. Empty asbestos bags one don't arranges, that is why above mentioned spot isn't orderly.

3.2. D i s i n t e g r a t o r

From the weight plant asbestos quantity has been weighed is fesded by means of a screw conveyor and pneumatic transport to the disintegrator, that sistematicly grinds the asbestos fibre. It is to notice that the grinding is of a great influance on wear of asbestos and cement as well as on quality and productions capacity. Disintegrator is equiped with dust separator.

3.2.1. A n o m a l i e s   i n   D i s i n t e g r a - t o r   O p e r a t i o n

The plant is completely closed, and we have no possibility to control its work. Dependently on sort of asbestos and its oppesing grad /oppening of asbes tos fibre/ the grinding time in disintegrator should be regulated.

For instance asbestos blue I should be grinded 10 minutes, asbestos BL - 4D 5 minutes only, but asbestos in sort V and VI can be used without grinding.

In this plant we haven't possibility to regulate the grinding times.

3.3. T u r b o m i x e r

Exactly grinded asbestos fibre is carried from disintegrator by means or pneumatic transporter to the turbomixer, containing a suitable quantity of water /about 1 cu.m/. In the first phase all sorts of asbestos arc mixed with water while the grinding process is continued. To this portion of asbestos mixture /90 kg/, suitable quantities of water /about 5 cup. m/ and cement /about 500 kg/ are added and mixing is continued. Correct proportions between asbestos: cement: and water should be kept 1 : 6 : 35 respectively.

In such a condition the procentages are:

asbestos	1 part	=	2.4 %
cement	6 parts	=	14.3 %
water	35 parts	=	83.3 %

This proportion is correct for cement of quality 500, but at the factory the cement of quality 350 is being used. In conformity with above mentioned proportions the concentration in turbomixer should be about 20 % /7 : 35/.

The concentration was controlled and found to be 16 %. As to the efficiency of disintegrators the progress of sedimentation of asbestos fibre is decisive and therefore this sedimentation was controlled in the first phase, when in the turbomixer there was only the asbestos mixture mixed with water. It proved to be about 100 %, and on this basis we think the disintegrator works good. The primary task of turbomixer is to prepare homogeneous asbestos cement mixture which is possible if the quantity of asbestos, cement and water measured automatically is for each portion the same. As far as we know the automatimation is working correctly but its operation should be subjected to checking. It also should be noted that water is taken from the second water recuperators /clean water/. The turbomixer is set in motion from a control panel and is connected with dust collector.

3.3.1. Anomalies in Turbomixer Operation

Concentration of asbestos-cement mixture in turbomixer is not controlled while the concentration of each portion of mixture should be the same. Besides, the concentration in found to be too low.

There is no possibility of controlling the asbestos fibre opening in disintegrator but this can be done in turbomixer, particularly in the first phase which is never done at the factory.

One portion of asbestos and cement is mixed in turbomixer for 60 to 100 sec. For preparation of a correct mixture all components should be mixed no less than for 3 - 4 minutes.

The water for the turbomixer is taken from second water recuperators /clean water/ which we consider to be wrong.

The water can be partially taken also from first water recuperators.

The cement contained in the water of the first recuperator is still having some bonding properties and therefore it should be re-used for the production cycle as soon as possible.

The operation of automatic valve which is metering the required quantity of water to the turbomixer is not being checked.

By preparation in the turbomixer of a densier mixture /but not too dense/ we had the possibility of using in the homogenizer of more water from the first water recuperator which is important for reduction of raw material consumption /asbestos and cement/.

3.4. Cement Weighing Plant

Direct from the cement factory the cement is supplied by special tank lorries to the cement silo in asbestos-cement factory. The silo is equipped with on air mixer and pneumatic pump for pumping the cement from silo to cement balance box. Cement silo has the capacity of about 160 t. When an adequate quantity of cement /500 kg for production of pipes or 560 kg for production of sheets/ is poured into the balance box the pneumatic pump stops automatically. The wought cement portion is fed to the turbomixer by means of worm conveyor. The cement weighing plant is completly enclosed and equipped with dust separator. This plant is controlled from the control panel. In our opinion the weighing plant works satisfactorily.

3.4.1. Anomalies in Weighing Plant Operation

In the asbestos cement factory the quantity of cement supplied to the silo with the above mentioned tank lorries is not being verified and therefore the true consumption can not be compared with indications of automatic balances.

In the cement silo the temperature of cement is not checked and in the local climatic condition the temperature of cement is of great importance for the quality of production. /The temperature of cement is too high/.

The accuracy of weighing is being not controlled.

3.5. Noria

Asbestos cement mixture prepared in turbomixer as well as scrap material of fresh production ground in turbolessr are pumped over to the noria.

The noria keeps asbestos cement mixture continuously in motion. According to our opinion this plant is working properly and its output is satisfactory.

3.5.1. Anomalies in Noria Operation

The concentration of asbestos-cement mixture is not being controlled and often it is very fluctuating /we controlled concentration for several times and we found it to fluctuate within 16 - 23 %/ particularly if the pipe machine operation is not correct and excessive quantity of production scrap materials is formed, which has to be ground and pumped over to the noria.

3.6. H o m o g e n i z e r

Asbestos cement mixture is pumped from noria to the homogenizer. To this mixture some water from the bottom of first water recuperatore is poured additionally in order to keep the concentration of asbestos cement mixture at a proper level /about 7 - 10 %/.

The concentration was controlled and found to be 7.9 %. This concentration seems to be satisfactory for production. The machine could operate continuously if replenished with the same mixture and this is reason why the concentration in homogenizer is so important and must be controlled.

The quantity of asbestos-cement mixture and its concentration is regulated with the aid of two automatic valves installed in water pipeline /from first water recuperatore to the homogenizer/ and in mixture pipeline /from noria to the homogeniser/. If the concentration in homogenizer is too low the valve in mixture pipeline is opened or the valve in water pipeline closed.

If on the other hand the concentration in homogeniser is too high the valve in mixture pipeline is closed or the valve in water pipeline opened. By closing or opening the valve meant is the decreasing or increasing of the clearance in valve.

The valves clearance can be adjusted by hand or mechanically, but depending on quantity of mixture in homogenizer they open or close automatically /completly/ and the clearance lets asbestos--cement mixture /or water/ through if the valve is opened.

In the homogenizer the mixture is ready for use. Mixture prepared by a centrifugal pump is pumped over to the sieve cylinder tank. Excess of mixture returns to the homogenizer.

3.6.1. Anomalies in Homogenizer Operation

The valves clearance in the mixture pipeline as well as in the water pipeline is sealed depending on the time of forming the pipes /for different pipes diameters the forming times are also different/ and in our opinion this regulation method is nor correct. Productions capacity does not depend entirely on mixture concentration. The quality of felt and sieve cylinder should be taken into account. It is proper when the concentration in homogenizer is constant and care should be taken to keep this concentration at a constant level. It is attainable if the quantity of asbestos, cement and water is correct, as well as when the concentration in turbomixer and noria is controlled.

The water used for production from the first water recuperator /dirty water/ has a great influance on consumption of raw materials /see point 3.3.1./. This water contains small particles of asbestos and cement possessing still bending properties and should be quickly reused for production /returned for production/.

3.7. Pipe Machine

The pipe machine is a fundamental plant for production of pipes. In our presence it worked only from 22.4.70 to 7.5.70. For the lack of a new felt the machine was put idle. We had the opportunity to see its work and to conclude on the anomalies in the performance of individual subassemblies as well as to rectify what could be done for improving its work. We think it proper to describe the work of individual subassemblies paying particular attention to the anomalies reflecting on quality and quantity of production. It seems to be worth to note that the pipe machine works without upper felts replaced by press roll. It has a provision for working with two sieve cylinder but it works with only one sieve cylinder.

This pipe machine produces 5 m long pipes of diameters ranging from 50 to 600 mm.

3.7.1. Sieve Cylinder Tank

The mixture from homogeniser is pumped and flows via four pipes to various spots of the sieve cylinder and therefore the concentration along the sieve cylinder tank can very. The four mixture fillers are separated from the tank with a partition.

The quantity of mixture in sieve cylinder tank is regulated by means of a diaphragm indicator and four automatic valves installated in four pipes introducing the mixture to the sieve cylinder tank. Rotational sieve cylinder should be carefully sealed within the stable sieve cylinder tank. The lowest part of the inner part of sieve cylinder is connected with an overflow so that the water can flow immediately out from inner part of sieve cylinder.

The surface of asbestos-cement mixture which is in sieve cylinder tank, but outside of sieve cylinder, is higher then in the inside of sieve cylinder and therefore the water /component of asbestos-cement mixture, about 90 %/ flows inside immediately through the sieve. A dense mixture is left on the surface of sieve cylinder which is to be transferred to the felt.

The difference between the surface of mixture outside the sieve cylinder and the surface of technological water which is inside is of a great importance for production capacity and for this reason the outlet from sieve cylinder tank must be always clean.

Concentration of technological water inside the sieve cylinder should not be higher than 1 to 1.5 %. Technological water flows from the sieve cylinder to the centrifugal pump and then it is pumped to the first water recuperators.

Sieve cylinder tank is equipped with an agitator for mixing asbestos-cement mixture. At the other end of this tank /oposite mixture inlet/ sometimes a thickening of mixture can be observed in various spots along the sieve cylinder which may be the reason why the pipes have irregular strength and density over their length. We think that at the full output the mixture was flowing to the sieve cylinder tank and settling at once on the sieve cylinder. The biggest /heaviest/ components of mixture could be found usually under the filler of mixture, this is the case if the mixture is not mixed or dilluted uniformly at once. We have checked the concentration of asbestos cement mixture in different spots of sieve cylinder tank as well as the concentration of technological water right under the outlet from the tank and the concentration in the sieve cylinder tank was found to be 4.0 - 4.7 - 4.2 %. In the technological water under the sieve cylinder tank the concentration was 1.2 %.

This concentration seems to be satisfactory for conditions of production in our country.

3.7.1.1. Anomalies in Sieve Cylinder Tank

Concentration of asbestos-cement mixture along the entire sieve cylinder tank should be equal. On the basis of results obtained it does'nt seem to be satisfactory.

The construction of partition fails to quarantee an equal separation of the mixture in the sieve cylinder tank and therefore the concentration is different in various spots.

The outlet of technological water from the sieve cylinder tank was exposed to partial clogging.

3.7.2. S i e v e   C y l i n d e r

The sieve cylinder is covered with a brazen net /sieve/, dimension of mesh 4 x 4 mm, and with a phosphor bronze net /238 meshes/sq.cm/.

Sieve cylinder should be smooth, clean and without cracks. Sieve cylinder quality is of a great importance for the quality of production and therefore its quality has to be good.

We have learned that the ends of asbestos-cement pipes are soft. To obviate this we propose that sieve cylinder should be painted at its ends with lacquer over the width of 2 - 4 cm.

The quality of sieve cylinder is satisfactory. Soldering of sieve cylinder as well as its sealing within the sieve cylinder tank seems to be also satisfactory.

3.7.2.1. A n o m a l i e s   i n   S i e v e   C y l i n d e r

As we have learned the pipe machine worked with an unsuitable sieve cylinder. The phosphor bronze net /sieve/ was damaged and its meshes clogged with hard sediment, and this is the reason why the elementary layer on the felt is of inequal thickness and thus the manufactured pipes lock an equal strength and density.

3.7.3. T h e   F e l t

The pipe machine is operating with felt imported from Italy or Austria. The felt, during operation in local condition, extends and must be sometimes cut lengthwise. There is no reserve felt in store. The felt works for about a month and however in our opinion its quality is satisfactory it must be cleaned what is of a great importance for the quality of production.

3.7.3.1. A n o m a l i e s i n F e l t

As we have learned the pipe machine operates with a felt that should be changed long ago. We think the felt is not settled over its width. It is not additionally reinforced on its edges. The felt was partialy clogged with hard sediment and some holes were found on its surface. It is impossible to obtain good production results with this felt. The felt is not being correctly cleaned.

3.7.4. S p r a y e r s

The most important task of sprayers is to clean exactly the sieve cylinder and the felt. The construction of sprayers is correct but there are no maintenance facilities for making them quickly clean and therefore we suggested changing of construction. A new sprayer was made in the mechanical shop according to our suggestion which proved to be better.

We have also made a special brush for cleaning. For sprayers the fresh water is used as well as the water from second water recuperators. In our opinion the water should be taken only from the top of the second water recuperators and its pressure should be not lower than 2 kg/sq.cm. If fresh water would be used a troublesome handling of excess of technological water would take place.

The sprayers must be frequently cleaned. Clean sprayers and correct pressure of water quarantee correct operation of felt and of sieve cylinder.

The sprayer which cleans the sieve cylinder causes dilution of asbestos-cement mixture in the sieve cylinder tank and this must be taken into consideration.

3.7.4.1. Anomalies in Sprayers Operation

Sprayers are not frequently cleaned this being the reason why the felt and sieve cylinder are so prone to clogging with sediment causing the quality of production to decline.

If not all the holes in the sprayer are clean neither the felt nor the sieve cylinder can be clean. In places where the holes ere stopped a belt of dirt can be observed and exactly in this places the pipe operation is not so strong as in others places.

3.7.5. Vacuum Boxes

The task of vacuum boxes is to decrease the humidity of elementary layers on the felt and to remove all small impurities from the felt. Vacuum boxes must be kept clean. The vacuum in vacuum box should be not higher than 200 mm Hg.

The vacuum pumps - water sealed, operate satisfactorily. Technological water from vacuum boxes is drained off beyond the factory premises while the water for sealing the pumps /fresh water/

flows from vacuum pumps under the pipe machine. Two pumps are working simultaneously with the machine. We checked the humidity of elementary layer and ahead of first vacuum box 73.7 % were read, ahead of second vacuum box - 56.7 % and behind the second vacuum box 53.0 % was registered.

3.7.5.1. Anomalies in Vacuum Boxes

Vacuum boxes are not frequently cleaned. Water from vacuum boxes should be re-used for production. It contains a part of raw materials in opposition to sealing water /vacuum pumps sealing water/ which can be drained off beyond the factory.

3.7.6. Calendering and Drawing the Pipes

The asbestos-cement pipe to be formed on a mandrel is transferred to calendering. Beforecalendering, between the mandrel and asbestos cement pipe, at its two ends, compressed air is introduced and then the calendering begins. The calendering rollers should be smooth and without cracks or other damage. The mandrel used in production of pipes is smooth. The calendered pipes are automatically transfered to the turnbucle. If the end of the pipe is hard and the calendering performed correctly the pipe should very easily slide from the mandrel. The asbestos cement pipe is transfered manually to the roll conveyor and the mandrel returns to another cycle of production.

3.7.6.1. Anomalies in Calendering and Drawing the Pipes

We have discovered small disturbance in automatic transfer system of the mandrel. We discussed this problem particularly with Mr. Fotti who is an engineer and designer.

We have also learned that the pipes do not slide so easily from the mandrel, the ends of pipes are deformed and therefore we think it would be proper to make, lengthwise of the mandrel, very fine incissions over all its surface.

The compressed our will thus penetrate between the pipes and the mandrel very easily. In this way the calendering operation will be improved and simplified.

The pipes are soft at their end which is inauspicious for drawing the pipes.

The pipe machine was never correctly prepared for production /used up felt as well as sieve cylinder met clogged, vacuum boxes, sprayers, water pipelines dirty, the water temperature low/ and therefore different hardness of pipes in various spots is observed. Compressed air is introduced only to the one end of pipes.

3.7.7. Turboleser

The task of turboleser is to grind fresh pipe scrap and breakage and return it to production. It is very important for the economy of raw materials. The fresh scrap should at once be returned to production. The turboleser operates continuously and its output is satisfactory. We controlled the concentration of the mixture and we found it to be 16 %. We have no objection to this concentration as well as to the work of turboleser. The water used for grinding is taken from the second water recuperators.

3.7.7.1. A n o m a l i e s

We observed that the scrap is not ground at once which should be done continuously. We have learned that sometimes the attendants are putting to the turboleser too much of the scrap stopping thus the pipeline and causing the turboleser to wark bad.

3.7.8. W a t e r   R e c u p e r a t o r s

There are two water recuperators at the factory, of 100 cu.m capacity. In our opinion it is sufficient for normal working of the machine but excessive quantities of fresh water are added in production and then allowed to flow from the water recuperator away. It should be noted that the hottest water flows from the water recuperator away which could be very profitable for production and specially for the local cement.

The temperature of water should not be lower than 30°C. All the water from under the machine /from sieve cylinder tank and from agitator sprayers/ is pumped over only to the first water recuperators.

Excess water flows from the first water recuperators to the second water recuperator. If the water circulation is correct thick sediment accumulates in the first water recuperated and to the second water recuperator flows almost clean water. If the water circulation is wrong a dirty water flows from the first to the second water recuperator and remaining sediment accumulates in the second water recuperator.

The water from the first water recuperator is used only for the homogeniser /from the bottom/ and water from the second water recuperator is used from sprayers /from the top/, for turboleser /from the middle of water depth in recuperators/, and for turbo-mixer /from the bottom of water recuperators/.

Excess water in the second water recuperator flows through the overflow and is led off beyond the factory. It is to be noted that the water which flows out from the water recuperator is the hottest because it flows out from the top of water recuperators. There is a steam heater provided in water recuperators. Deficient water is supplied by means of a fresh water line with the inlet float valve provided for regulation of water level in the water recuperator. In the bottom of each water recuperators an outlet valve is provided for drawing the water from recuperators when water recuperators are to be cleaned.

3.7.8.1. Anomalies in Water Recuperator

Temperature of water in the water recuperators is too low /about 25 °C/ and it is not checked.

If suitable temperature of water is to be kept in water recuperator the overflowing water must be limited and the water heated properly.

The technological water from the machine is pumped to the water recuperator by means of two centrifugal pumps. One of these pumps takes the water from the sieve cylinder tank while the second takes the water from agitator. In our opinion one pump would be quite sufficient.

To the water recuperators an excessive quantity of technological water is pumped which could be used directly for production.

For example: the water from agitator can be used for turboleser.

3.7.9. Roller Conveyor

The asbestos-cement pipe to be drawn from the mandrel - as said above - is transferred manually from a wooden table to the roller conveyor. The roller conveyor is about 50 m long. This conveyor in enclosed over the length of about 40 m.

This is the first seasoning chamber. In this chamber the temperature is about 60°C and humidity about 90 %.

The speed of roller conveyor can be regulated.

About 250 asbestos-cement pipes of diameters ranging from 50 to 200 mm, or 125 pipes of bigger diameters can be placed on this roller conveyor. For local conditions particularly for small diameters, this roller conveyor is too short. Cosidering the quality of cement, if the cement will be correct for the production, this length of roller conveyor will be sufficient. We presume that the pipes can be removed from the roller conveyor after 6 hours, but if the maximum production output is attained the roller conveyor will be too short.

When the roller conveyor moves the rollers rotate keeping fresh asbestos-cement pipes in rotation and guarding them against deformation /collapsing and flattening/.

There is a long table behind the roller conveyor where the seasoning time can be prolonged, but attention must be paid to that the pipes are taken from the roller conveyor uniformly.

On the table the pipes should be sometimes slowly rotated.

3.7.9.1. Anomalies in Roller Conveyor

During transportation of asbestos-cement pipes to the roller conveyor bending of pipes on the table was observed.

In the spots where the pipe is bent it can never attain suitable strength. The attendants and workers never pay attention to the work they are doing. Their work can be termed as sloppy.

The pipes fall from the table on the roller conveyor with a power causing flattening /deformation/ of pipes.

The deformed /flattened/ ends of pipes aren't being equalised, particularly these fresh pipes which are at the head of roller conveyor.

At the asbestos-cement factory there is not a sufficient quantity of special pins of suitable quality for pipes and therefore we have suggested that such pins should be provided. We have noticed that the rollers in the roller conveyor are incomplete which impairs the output of the conveyor.

3.7.10. The Basins

There are 10 basins at the factory of overall dimensions of about 9 x 6 x 5 m which is sufficient if maximum production capacity would be attained. After first seasoning the pipes are transferred from the long table to the basin by means of an overhead travelling crane. The pipes of small diameters are put on special pallets while pipes of larger diameters are transported with the crane by means of hooks which are hooked into the pipe at both its ends. The pipes are stapled in layers, pipe by pipe, from bottom to the top. After putting them in the basin the pipes are submerged in water. Each basin is provided with an outlet and an inlet of fresh water from water pipeline. The outlet and inlet is provided with a valve. The pipes are arranged according to the date of production as well as to the pipe diameters. After few days the water is drained and the pipes are transferred to the lathe.

3.7.10.1. Anomalies in Basins

Since the pipes are thicker in their middle than at their ends, they become bent after stapling some layers of them /particulary the pipes in the upper layers/.

We have learned that thie difference is not being corrected. The bent pipes buret on the lathe or on the testing press.

In the lowest layer /directly at bottom/ no required clearance /1 - 2 mm/ is left between the pipes. The pipe submerged in water changes very little but its volume changes remarkably. The pipes in the basins are not being arranged in parallel. The difference between the wall of the basin and pipes on the left and right hand side is sometimes about 5 - 7 cm. It is so because the pipes are bending.

The hooks used for transportation of pipes are too small in diameter in relation to the pipee diameter, and no cover platee are available of diameters.corresponding to pipes ineide diameters. Thie is the reason why the pipes often break at their ends.

We have often seen that the pipes are left in the basin without water. Considering that the climate in Syria is very dry the strength of pipes laeking sufficient content of water /moisture/ declines rapidly. The pipes are too dry. We have also seen that the workers are handling the pipes very roughly which is impermissible.

3.7.11. Lathe for Pipes

There is only single lathe for machining the pipes at the factory. With this lathe it is possible to turn 5 m long pipes of diameters ranging from 50 to 600 mm. The pipes seasoned in basin are put on a special pallet /small diameters/ and transported by means of an overhead travelling crane to the lathe. The pipes of big diameters are transported by means of the same overhead travelling crane after hitching the pipes on hooks. In front of the lathe the pipes stay on two sleped steel rails from which they are transported by hand directly to the lathe. Similar sloped steel rails are arranged behind the lathe. The pipe fixed in rotational jaws is being cut at its both ends and turned automatically. Machined pipe falls on two sloped stecl rails behind the lathe.

3.7.11.1. Anomalies in Operation of the Lathe for Pipes

The lathe jaws fixing the pipe break very often particularly by turning the pipes of diameters from 100 to 300 mm. In our opinion the shape of jaws is not proper, particularly for the pipes of such diameters.

The shape of cutting tool is wrong /great width and rake/. It is quite often that the lathe operator fixes the tool upside-down. We instructed them how to work the lathe properly. The workers never pay attention to proper shoving of pipes. Pipe strikes against pipe and often breaks.

The steel rail should have a rubber protection.

3.7.12. Testing Press for Pipes

From sloped steel rails the pipe is transferred directly to the testing press. The frame of this press can be adjusted so that pipes of different length can be tested.

Into the sealed pipe the water is pumped under suitable pressure and the pipe is tested according to the standard. The applied pressure of water depends on the class of the pipe. After testing the pipe falls on the above mentioned steel rail. Broken and burst pipes are cut into smaller sectors used for drain /canalization/ pipe production /flenged pipes/. The pipes withstanding the test are stamped and transported to the store.

3.7.12.1. Anomalies in Operating the Testing Press for Pipes

We did not discover any anomaly in its operation. However we have objooctions to the operators. They never pay attention to proper shoving and stapling the pipes. Pipe strikes against pipe. The workers should handle the pipes with greater care.

3.7.13. Cutting Machine and Lathe for Joints

For production of joints special pipes of thicker walls are used. These pipes are cut on a cutting machine into small pieces and transferred by hand to the lathe for machining the joints.

The cutting machine cuts at once two pieces. The piece is fixed by hand in rotational jaws of the lathe for machining the joints and machined automatically. Some of the joints are tested on the testing press for joints /in laboratory/.

3.7.13.1. Anomalies in Operating the Cutting Machine and the Lathe for Joints

Before cutting, the pipes are not checked and some of them being oval break when they are cut and therefore we suggested checking the pipes before they are cut. Oval pipes can be used for production of drain pipes.

To fix the joint in the jaws is very difficult and therefore we suggested that a limiter aill be installed under the jaws for simplifying this operation.

We were not able to see the testing press for joints working since it had been overhauled at that time.

4. Production of Sheets

As it was said above there is only one plant at the factory for production of sheets and one plant for production of pipes.

Both plants were made and supplied by R C M Torino - Italy.

The pipe and sheet machines have common plants for preparation of asbestos cement mixture which are described in items 3.1. to 3.4.

The plant for production of asbestos-cement roofing corrugated sheets is composed of :

A. Asbestos weighing plant	common plant
B. Cement silo	" "
C. Water recuperators	" "
D. Disintegrator	" "
E. Turbomixer	" "
F. Cement weighing plant	" "
G. Noria	
H. Homogenizer	
T. Sheet machine	
U. Stacking plant	
W. Seasoning chamber	
Z. Separating plant	

Now described will be the production method for sheets with special attention paid to the anomalies observed as well as to the erratic methods of production and machine operation reflecting on the quality and quantity of production.

All plants mentioned above in points A to F operate in production of sheets in the same way as the plants in production of pipes. For the production of sheets a different formula applies then for the production of pipes. It should be noted that having two production lines one line is stopped when other is working. Production output capacity is utilized only in 50 %. According to the formula following asbestos-cement mixture rations are used :

Asbestos blue II	20 kg = 25 %
Asbestos amosite	20 kg = 25 %
Asbestos BL - 4D	40 kg = 50 %
T o t a l :	80 kg = 100 %

To this portion of asbestos 560 kg of cement is added. We have learned that in turbomixer one portion of asbestos is mixed with cement for 60 to 100 sec.

Asbestos-cement mixture ratio used for production of sheets is too good, which is not always a welcome thing. For this production the asbestos of sort V or VI, should be used. The proportion between the asbestos and cement and water is as 1 : 7. There is no objection as to such a proportion.

The production line for sheets has its own noria and homogenizer working like the noria and homogenizer described for production of pipes /items 3.5.; 3.6./ and therefore description of their work is omitted. We checked the concentration of asbestos--cement mixture in the noria and in the homogenizer. The concentration in noria was found to be 15 % and in homogenizer 5.9 %.

At the time we have paid particularly attention to the circulation of technological water.

Operation anomalies of this plants are described above where the production of asbestos-cement pipes is depicted.

4.1. R o o f i n g   C o r r u g a t e d
S h e e t   M a c h i n e

This machine works with three sieve cylinder tanks, and is able to produce 3 sheets of dimensions of 1200 x 1285 x 6 mm, two sheets of optimum dimensions or one sheet of dimensions of 3660 x x 1285 x 6 mm.

The sheet machine is a fundamental plant for production of roofing corrugated sheets. During our stay at the factory it worked from 13.5.1970 till 6.7.70 and therefore we had no change to make a conclusive observation of its work and to discover the anomalies in the work of individual subassemblies as well as to rectify the defects in order to improve the production of sheets.

It appears to be proper to describe the production of sheets with particular attention paid to these subassemblies which are not described by the machine for production of pipes as well as to the defects which are reflecting on the quality and quantity of production.

The asbestos-cement mixture pumped from homogenizer flows via two pipes to various spots in the sieve cylinder tanks and therefore the concentration along each sieve cylinder tank can be different.

Two fillers of asbestos-cement mixture are separated from the tank by a partition. The sieve cylinder for production of sheets is shorter then that for production of pipes.

Similarly the sprayers, vacuum boxes and agitator are also shorter. The anomalies are the same as by pipe machine.

We checked the concentration in sieve cylinder tanks and it was found to be:

In the first sieve cylinder tank - 6.3 %
In the second sieve cylinder tank - 7.0 %
In the third sieve cylinder tank - 6.5 %

We also checked the concentration of technological water past the sieve cylinder tanks and it was found to be:

a/ Past the first sieve cylinder tank on the right hand side - 1.2 %
on the left hand side - 1.2 %

b/ Past the second sieve cylinder tank on the right hand side - 1.4 %
on the left hand side - 1.2 %

c/ Past the third sieve cylinder tank on the right hand side - 1.5 %
on the left hand side - 1.2 %

Working with this concentration an elementary layer 0.9 mm thick was obtained.

The test was repeated on 29.6.70 when the machine had been working correctly and into consideration the concentration was taken in sieve cylinder tanks on its left and right hand side.

It was found to be :

a/ In the first sieve cylinder tank on the right hand side - 4.1 %
on the left hand side - 4.3 %

b/ In the second sieve cylinder tank on the right hand side - 3.8 %

on the left hand side - 3.4 %

c/ In the third sieve cylinder tank on the right hand side - 3.8 %

on the left hand side - 3.8 %

The concentration in technological water past the sieve cylinder tanks was:

a/ Past the first cylinder tank on the

right hand side - 0.8 %

left hand side - 0.7 %

b/ Past the second sieve cylinder tank on the

right hand side - 0.7 %

left hand side - 0.5 %

c/ Past the third sieve cylinder tank on the

right hand side - 0.6 %

left hand side - 0.6 %

At this concentration the thickness of elementary layer was 0.61 mm. For local conditions we suggest the production of sheets of these parameters until special cement will be obtained /see point 2.1.1./ and about 300 steel corrugated moulds. We also checked the speed of the felt which is about 36 m/min.

4.1.1. Anomalies in Sheet Machine

The channels under the machine should be carefully cleaned. The technological water from the sheet machine is pumped with two centrifugal pumps to the water recuperators but we presume that one pump would be sufficient. This relates also to two vacuum pumps and two pressure water pumps for sprayers. Each pair of pumps should be connected by means of a piece of steel pipe with a valve and in this way only one pump can be used when the second is put idle. It is very important in case of a break-down of one of two pumps.

Such an arrangement relates particularly to the water pumps.

The design of the system of sprayers for sieve cylinder is not satisfactory.

The sprayers are of a crooked type and service attendants have not possibility for mechanical cleaning. On this occasion we should like to mention that the sprayers for agitator have been altered according to our suggestion and they are working satisfactorily.

The water for sealing vacuum pumps was mentioned when the pipe machine was described /see item 3.7.5./.

It should be noted that as soon as the machine operation was started at its /full/ maximum capacity all steel corrugated moulds were used for production after three hours. After this time the sheets could not be separated from steel corrugated moulds and production process had to be stopped.

In our opinion the formula applied for production of sheets is too good.

The store rooms are short of asbestos.

4.1.2. F o r m R o l l e r

The form roller is of a diameter of about 1240 mm. On its surface parallel to the axis of the roller a groove is provided for a steel cord for automatic or manual cutting /manual automatic cutting breaks/. In our presence fresh sheets were cut off from the form roller by hand. We suggested installation of an electromagnetic knife or for the sake of a trial the re-installation of the steel cord for automatic cutting. On that occasion we have demonstrated the way for fastening of the steel cord as well as the way of its stretching. It works till now.

The form roller can be pressed to the felt and transmission shaft. It is completly smoth. The elementary layer from the felt is transfered to the form roller automatically. If the thickness of asbestos cement layer on form roller reaches 6 mm, it is cut at once with the steel cord. After cutting, the steel cord is resting in the above mentioned groove. A special pointer indicates the thickness of sheet on form roller. The humidity of sheets leaving the form roller is 27 %.

4.1.2.1. A n o m a l i e s F o u n d i n F o r m R o l l e r

Sometimes we observed that the elementary layer fails to keep to the form roller, particularly if the sheet is cut by hand and therefore attention should be paid to pressing the sheets to the form roller and to the asbestos cement mixture.

Thickness of asbestos cement sheets cut from the form roller varies, particularly when cutting is effected by hand.

4.1.3. Cutting of Sheets

Fresh asbestos cement sheet cut from the form roller drops on the first band transposter which brings it to the second one. On the second band transporter the sheet is stopped and cut lengthwise by means of a rotary disk tool. Asbestos cement trimmings are collected by hand und transmitted to the turboleser for grinding.

4.1.3.1. Anomalies in Cutting

The sheets stop in their progress in various places for cutting them with tools. Stopping is actuated by hand from control table. In our monthly second report, point 4 - conclusions, we wrote about the knife /cutting tool/ and in our presence after few days, the second band transporter was cut across by the cutting tool. The guiding shoe for this knife /cutting tool/ should never go beyond the top surface of the band transporter.

The axle of rotary disk tool must be perpendicular to the transverse straightline motion /to the edge of cut/ and must touch the gap in the shoe. Cutting tools should be always kept sharp. In this way tearing of sheets will avoided.

4.1.4. Stacking Plant

After transverse cutting the asbestos cement sheets come to the third convergent transportes for corrugation. This transporter consists of a lower and an upper transporter. These two parts are moving at the same speed. Each of this transporters consists of a number of endless belts. The surface of belts coming into contact with sheets is of the shape of corrugated sheet. Since the transporters are convergent, the flat sheet is corrugated on its ends right at the front of this transporter.

Corrugated sheet is transferred to the fourth transposter. Between the third and fourth transporter the sheet is cut lengthwise by means of rotary disk tools /width of sheets/.

From the fourth transporter the sheet is transferred by means of a special vacuum box on to a truck and covered with a corrugated steel mould. This plant works automatically. On the truck 40 pes of sheets and moulds are stacked and the truck rolls to the first seasoning chamber.

Operation system of stacking plant is connected with an hydraulic system for automatic lifting and lowering of a special vacuum box /for transferring of sheets and steel corrugated moulds/ as well as for moving the trucks to the seasoning chamber.

The asbestos cement trimmings left on the fourth band transporter are transferred directly to the turboleser.

4.1.4.1. Anomalies observed in Stacking Plant

The sheets are not stopped automatically for cutting, stopping occurs in various places depending on the attention of attending personnel.

The rotary disk tool /knife/ is often blunt as well as its dressing is effected perfunctorily. The roller guides of all transporters are covered with asbestos cement waste, particularly on the fourth transporter.

The ends of sheets are catching on the housing of cutting toole thus impairing the quality of production. The site of the plant is dirty. The transition between the third and the fourth transporter is not rectilinear this being the reason why the sheets lose in strength.

4.1.5. Turboleser /differences with 3.7.7./

The differences between the turbolesers for the trimmings of pipes and sheets are following:

a/ Turboleser for grinding the trimmings of sheets is situated in a pit.

b/ Distance between the turboleser and the noria of sheet plant is greater then that of pipe plant.

c/ Pipeline between the turboleser and the noria of sheet plant is frequently clogging.

4.1.6. Seasoning Chamber

In this chamber 7 - 8 trucks remain at one time. In local conditions its capacity is not satisfactory for the production. The temperature inside the chamber is sometimes unsuitable. There is a water heating employed. When the maximum capacity of production will be attained the chamber capacity will not suffice.

4.1.6.1. Anomalies in Seasoning

The sheets stacked on truck past the seasoning chamber fail to generate an increase in temperature and therefore we presume that the cement reacts very slowly, failing to most the requirements.

4.1.7. Separating Plant

The separating plant works similarly to the stacking plant and an hydraulic system is also employed for automatic lifting and lowering of special vacuum boxes for transferring of sheets and steel corrugated moulds.

After first seasoning the truck with sheets and steel corrugated moulds is transported to the separating plant.

By means of two special vacuum boxes asbestos cement sheets are separated from corrugated steel moulds.

One vacuum box takes the asbestos-cement sheet and stacks it on the pallet, while the other vacuum box takes the steel corrugated mould and transfers it to the lubrication plant. At this plant upper and lower surfaces of steel corrugated mould is covered with mineral oil. Oiled moulds are stacked on the truck. The truck with oiled steel corrugated moulds returns to the stacking plant.

The sheets stacked on a pallet in 40 pcs stacks are transferred to the store.

4.1.7.1. Anomalies in Separating Plant

The quantity of steel corrugated moulds is insufficient for production purposes.

Special vacuum boxes, particularly these on the right hand side /transferring the moulds/ sometimes strike the roller transporter ahead of the lubrication plant. The gaskets of hydraulic release system were broken.

There is a shortage of pallets, the sheets are sometimes stacked on asbestos-cement pipes, on wooden blocks and therefore lower sheets break.

Frequently occuring defects in hydraulic system could be observed. We learned that the oil is not clean.

Asbestos-cement sheets stacked automatically on wooden blocks are not controlled and therefore the quality of stored sheets is unknown.

As it was mentioned above special vacuum box falls with an impact down on the pile of stacked asbestos cement sheets causing damage.

The workers are not trained for servicing the plant.

5. Stores

There are two stores at the asbestos-cement factory:

a/ Raw materials store

b/ Finished production store.

Below described is the work and the anomalies observed in these two stores.

5.1. R a w   M a t e r i a l s   S t o r e

The cement is supplied with special tank lorry directly from cement factory to the cement silo of the capacity of about 160 ton. The quantity of supplied cement is not checked. It is taken in store on the basis of the weight certificate issued by the cement factory. The cement is expended on the basis of production reports.

Existing supply of cement is never compared with card index.

There is also an asbestos store at the asbestos - cement factory which is under construction and not yet ready. The asbestos is partially kept in store in the plant hall and partially in the new store. The asbestos is taken in store on basis of a bill issued by the supplier of asbestos. The asbestos is supplied to the factory in road trucks /motor trucks/. Expenditure of asbestes fellows in conformity with the written order signed by the general manager of asbestos-cement factory. The storing area for asbestos will be satisfactory when new store will be ready.

5.1.1. A n o m a l i e s   i n   S t o r i n g

A cement silo is lacking at the factory especially for seasoning of cement and this is of utmost importance for the local cement. The quantity of cement as well as the quantity of asbestos taken in store and expended from the store is not controlled.

No inventary of raw materials in store as well as on the factory had ever been made during our stay and for this reason a comparison between the store supply of asbestos and the card index is impossible.

In the store the asbestos should be stacked separately, according to its sort /grade/.

On the floor of the store we saw that the sorts of asbestos had been scattered and mixed /so the asbestos in store near asbestos weighing plant/.

There is a lack in store of particularly sort /grade/ V and VI asbestos which is reflecting on the costs of production.

The floor of the store is dirty and in this case asbestos can be very easily mixed with small pieces of wood, rags, metal, paper and so on.

5.2. F i n i s h e d   P r o d u c t s   S t o r e

The controlled pipes - are transported to the store with a fork-lift, type Hyster, and admitted by store keeper. In the store room the pipes are stacked according to their dimensions. Asbestos cement joints are transported like the pipes to the store room and also admitted by store keeper.

The store keeper decides on the place for stacking. The same applies for asbestos cement joints.

Asbestos cement sheets stacked at the separating plant on wooden blocks /40 pieces in a pile/ are transported with the above mentioned fork lift - type Hyster - to the store. Their strength increases while storing. The storage takes place in the plant hall. Four of five piles are stacked one over another, so that the lower pile is under the load of all upper piles. Each sheet weighte about 20 - 25 kg and therefore the lowest sheet are under the load of all upper, sheets which is about 4,000 kG. In the bottom of each pile we found 3 - 4 sheets broken.

Finished producte /pipes, joints and sheets/ are expended on the basis of an order received from the office /sales office/.

The customers are taking finished producte aoetly with their own means of transport.

5.2.1. Anomalies in Storing

Handling of pipes and jointe from the factory to the store rooms ie improper. Instead of stacking the pipee by hand with care the fork of the fork lift is being pitched and the sheets are poured out. The pipee are striking against each other and their resistance /strength/ decreaees.

For information we should like to add that a pipe dropped from about 70 cm on the floor loees about 50 % of ite strength.

The floor of pipe storing room is dirty. There is a lot of caked pieces of pipes and joints an its surface. The surface of pipe storing room should be even and sweeped.

The ends of stacked pipes should never jut out from the pile. The sides of sheets should be equal. For the sake of a trial we have demonstrated to the workers the way of correct arranging of pipe piles. Such a pile looks altogether better.

While loaded on a lorry /truck/ the pipes are thrown and tossed without care instead of arranging them with caution.

There are many pipes as well as the sheets in store which have small nick and they could be sold as sort I after cutting them into pieces of different length. This shoul be taken into consideration.

As we mentioned above stacking of sheet piles for storing is improper. At the bottom of each pile few sheet are always broken.

We consider stacking of pipes on wooden blocks as not appropriate.

The sheets should be stacked on special /corrugated/ pallets.

6. Technical Documentation and Technological Control

At the factory they have only some commercial literature delivered by the machine manufacturers which only very roughly deals with the methods of how the pipe machine should be operated. No parameters whatever are available and therefore we were unable to check on the technology process.

There is neither technological program for production of sheets.

For production they depend on the data delivered by supplier of machinery /R C M Torino/. This data has to be frequently accommodated to local condition which requires time and technical experience.

Considering that :

a/ The factory works since few years /3 years/
b/ The workers very often change their work
c/ There is lack of experience,

the technological process with all its parameters and maintenance instruction must be worked out.

This technological process must be adjusted to local conditions. On the basis of this process there should be the possibility of checking the technological parameters and ascertaining on what is wrong with the production.

The worked out operating instruction should be displayed on the working place. All the workers should get acquainted with the instruction.

There is no section of technological control at the factory and its task is partially fulfilled by the laboratory and partially ba technical inspection of the factory. There is no schedule worked out for the laboratory nor for the technical inspection.

7. Work Organization in Asbestos Cement Factory

Work organization is of a great importance for the quality and quantity of production. In this part present work organization will be described taking into consideration the task to be fulfilled.

We have analysed present organization scheme with the Management and on basis of this analysis we decided that the organization of work at the factory is not correct.

One worker has to obey the orders of two superiors and sometimes he does not know to obey if the orders given to him happen to be different.

In conclusion we suggest certain changes is organizations scheme. Our suggestion does not include following sections :

a/ Administration

b/ Accountancy

c/ Supply and other non-technical sections

The organizations scheme No 2 explains in the best way present organization as well as the scheme No 3 explains the suggested changes in organization in the asbestos cement factory.

7.1. Reporting on Production

To the works organization in asbestos cement factory we also recon reporting on production. Correct reporting on productions keeps the Management constantly informed on the state of production. At present following reports are made:

7.1.1. Production of Pipes

Each of the foremen at the pipe machine makes a report for his shift with following data:

a/ Quantity of asbestos and cement used for production b/ Number of portions prepared in turbomixer /on basis of the formula/

c/ Quantity of crude pipes manufactured with the machine

d/ Quantity of pipes deposited to the basin

e/ Technological parameters

f/ Working time of machine

Each foreman of lathe and joints section prepares two reports. One report for lathe section and pressure testing machine in which he reports:

a/ Quantity of pipes taken from the basin

b/ Quantity of pipes which meet the requirements and quantity of rejected pipes

c/ Working time of machine.

The second for joints in which he takes into consideration:

a/ Quantity of pipes takes from the basin for modification

b/ Quantity of joints manufactured by the machine

c/ Quantity of joints passed for storing

d/ Quantity of scrap

e/ Working time of machine.

7.1.2. Production of Sheets

Because there is only plant at the factory for preparation of asbestos-cement mixture, therefore if the pipe machine works the sheet machine must be put idle. Similarly is with the reports for the machines /except section of joints/.

The shift foreman makes a report for sheet machine in which he takes into consideration:

a/ Quantity of asbestos-cement mixture portions prepared in turbomixer

b/ Quantity of asbestos and cement consumed in the manufacturing process /on basis of formula which is in force/

c/ Quantity of crude sheets manufactured with the machine

d/ Quantity of sheets passed for storing

e/ Quantity of scrap

f/ Working time of machine

On the basis of the above data submitted everyday by three shifts in the morning the secretary makes a daily report in three copies which is signed by the general manager of the factory.

First copy is sent to the general manager, the second to the technical manager and the third to the general manager of factory.

7.1.3. Anomalies in Reporting

Shift reports do not take into consideration the condition of raw materials /asbestos and cement/, at the beginning and at the end of shift.

The same shift reports do not take into consideration the condition of pipes in basin and on roller conveyor as well as the condition of sheets in seasoning chamber.

In each daily report distinctly underlined should be the consumption of raw materials as well as the quantity and quality of production from the beginning of the month /crude and finished production/.

7.2. Employment - Work Organization in Asbestos Cement Department

Directly at pipe machine employed are: /for three shifts/

a/ Asbestos balance	6 workers
b/ Control table /2 control tables/	6 "
c/ Aeration of pipes before calendering	6 "
d/ Calendering	3 "
e/ Turboleser	3 "
f/ Roller conveyor	9 "
g/ Overhead travelling crane	3 "
h/ Basin	6 "
i/ Pipe lathe	9 "
k/ Pipe testing press /with control table/	9 "
l/ Pipe handling from basin to the lathe and from the lathe to the store	9 "
m/ Cutting machine for joints	3 "
n/ Lathe for joints	3 "
o/ Testing press for joints	3 "
Total:	78 workers

When the pipe machine is idle and the sheet machine is working for three shifts, fallowing workers are employed:

a/ Asbestos balance	6 workers
b/ Control table /2 control tables/	6 "
c/ Cutting of fresh sheets	3 "
d/ Band transporter	9 "
e/ Stacking plant	3 "
f/ Turboleser	3 "
g/ Separator plant	12 "
T o t a l :	42 workers

Between pipe machine employment and sheet machine employment there is a difference of 36 workers who are employed with the turner section.

Besides of the above mentioned workers, at the factory employed are:

a/ Foreman of shift	3 workers
b/ Foreman of machine section	3 "
c/ Foreman of lathe section	3 "
d/ Fitter	3 "
e/ Lubricator	3 "
f/ Electrician	3 "
g/ Driver /for Hyster	3 "
h/ Handling of asbestos	2 "
i/ Drain pipes production	9 "
T o t a l :	32 workers

This employment will be altered when new asbestos-cement preparation plant will be finished /now under construction/.

7.2.1. Anomalies

We observed very great fluctuation of trained personnel employed in important working stations. Therefore we think advisable to put forward certain propositions.

One of workers employed at the asbestos weighing plant should be employed at the pipe or sheet machine. He should clean the sprayers and keep near the machine.

We also observed some workers who are able to work in several working stations.

It is very welcome for local comdidtions but another question is how efficient he is at these working stations ?

For the most part his efficiency is poor.

At the factory mostly young workers are employed. These young men are recruited after having been trained. It shoul be noted that learning time can not be shorter than 6 months. This problem has also a great influence on the quality of production.

7.3. Work Organization in Laboratory

The work of laboratory and results of research, particulary the research /control/ of technological process are of great importance for the quality of production.

For instance if the laboratory confirms that in the sieve cylinder tank of pipe machine /5 m long/ there is in different spots a different concentration of asbestos cement mixture then it can be expected that the pipes will also be soft in one spot and hard in another.

Technical supervision must at once control the condition of felt, sieve cylinder and valves conducting the asbestos cement mixture to the sieve cylinder tank.

We have instructed the workers how the concentration of asbestos cement mixture can quickly be defined.

In conclusion we shall put forward a suggestion what the laboratory task is. Present research which is made at the laboratory will now be described.

There are three workers at the laboratory - - head of laboratory and two workers - employed on the first shift only at following examinations for the production of pipes:

Finished product testing

a/ Longitudinal bending test

b/ Bursting test, and

c/ Transverse crushing test.

Production process control:

a/ Sedimentation past the sieve cylinder tank

b/ Humidity of the elementary layer ahead of the first vacuum box, ahead of the second vacuum box and past the second vacuum box

c/ Humidity of fresh pipes at their ends.

For finished sheets checked is only:

a/ Bending strength

For controlling the production process the laboratory investigates:

a/ Sedimentation past the sieve cylinder tank on its right and left hand side

b/ Humidity of elementary layers as above

c/ Humidity of fresh sheet past the form roller.

Besides, the laboratory controls the rubberr packing.

The laboratory has also the possibility for controlling the length of asbestos fibre by means of a Canadian sieve apparatus /shaking screen/ and Bauer Mc Net apparatus.

They are able to investigate new felt sieve cylinder nets. We should like to point out that the concentration past the sieve cylinder is check-ed at intervals of 5 - 10 and 15 minutes.

7.3.1. Anomalies in Organization

The laboratory works only during the first shift, on other shifts the technological process is not controlled.

There is no instruction whatever available at the laboratory on the methods of investigation.

The laboratory does not investigate:

a/ Concentration in turbomixer

b/ Concentration in noria

c/ Concentration in homogenizer

d/ Concentration in sieve cylinder tank /for pipes at 5 spots, for sheet in three spots, for each sieve cylinder tank/

e/ Concentration past the sieve cylinder tank on its left and right hand side f/ Concentration in turboleser

g/ Sedimentation of asbestos in turbomixer /before cement is added/

h/ Thickness of elementary layers /it is controlled at random/

i/ Temperature of technological water.

We think that the raw materials should be investigated and particularly:

a/ Sieve analysis of cement

b/Setting of cement

c/ Le Chattelier /Stability of volume/

d/ Phosphor-bronze net for sieve cylinder

e/ The felt

The parameters will be dealt with in the conclusion.

7.4. Work Organization in Mechanical and Electrical Shop

The most important tasks for mechanical and electrical shop are:

a/ Maintenance of plants continuously in operation

b/ Preparation of spare parts for machines

c/ Rectification of defects

d/ Fulfilling of overhauls and routine repairs

We have noticed that mechanical and electrical shop performs the work which should be effected by the plant service, for instance pipeline cleaning and machine cleaning. This work should be done by the fitter servicing the machine / one fitter is detached by the foreman on shift/.

At present at the mechanical shop employed are:

1.	Foreman of mechanical shop	1 worker
2.	Deliverer of tools	1 "
3.	Welder /gas and are welding/	2 workers
4.	Sieve cylinder soldering	2 "
5.	Turners	2 "
6.	Oil pumps maintenance	2 "
7.	Fitters	3 "
8.	Pipeline and water pumps maintenance	3 "
9.	Lubricator	1 worker
	T o t a l :	17 workers

At the electrical shop employed at present are:

1.	Foreman of electrical shop	1 worker
2.	Electrician	7 workers
	T o t a l :	8 workers

The workers of mechanical and electrical shops work satisfactorily though they have certain difficulties.

All workers of this two shops are instructed by the foremen of shops and by mechanic and electric engineers.

7.4.1. A n o m a l i e s

The workers of mechanical and electrical shop do not have fundamental tools as hammers, open-end spanners, box spanners, adjustable spanners, screw drivers, hack-saws and files.

No plan for major end routine repairs exists for these two shops and therefore there is e shortage of spare parts. For the lack of plan, preparation of sensible policy with spare perts is impossible.

At the esbestos cement fectory the work remains inbalanced. Servicing personell of machines does not know what belongs to the responsibility of mechanical shop and what operetions are left for handling by the workers under the supervision of the shift foreman.

We heve often seen the fitters cleaning the machine under the supervision of the foreman of mechenical shop.

7.5. Work Organization of Storing

At present in the storing section employed are:

a/ Foreman of storing	1 worker
b/ Deliverer of finished product	1 "
c/ Driver /for Hyster/	6 Workers
d/ Loading section	8 "
Total:	16 workers

The foreman of storing distributes the work among the workers and helps the deliverer. He also keeps the card file. The deliverer receives and gives away the finished product as well as the raw materials.

The driver is responsible for transport of finished products. Loading section is employed at loading and unloading of products and raw material as well as it is responsible for keeping store rooms tidy.

7.5.1. Anomalies in Organisation

The foreman of the stores directs the driver only on the first shift but the drivers work also on the second and third shift.

The supervising personell of the stores does not pay attention to correct arranging of pipes, or this attention is very casual.

8. Conclusions

In conclusion we want to bring forward important problems reflecting on quality and quantity od production. Many of these problems are known to the supervising personell but no attention is being paid in practice.to them and therefore we we should like, once more, to put some light on these questions.

We hope that such treatment, will turn out well for the factory and besides, we shall be happy that we have done our best.

8.1. Raw Materials

1. Local cement does not permit obtaining of the full capacity as well as of an adequate quality of production and therefore we propose to make

efforts towards acquaring of a special cement for asbestos-cement production of the followings parameters:

C_3S	55 ± 5 % /for pipes 65 ± 5 %/
C_2S	20 % min
C_3A	5 ± 2 %
CaO free	0.5 % max
SO_3	1.5 - 3.5 %
The rest /residue/ on sieve 4,900	10 %
Le Chatelier	6 mm max
Temperature	40 - 50

The head of cement laboratory working for the cement dealers is sure that such a cement can be obtained.

2. It is possible to decrease in local conditions the quantity of C_3A /the more the better/, to decrease the residue on sieve 4,900 to 8 % and to increase the quantity of C_3S as well as to increase the quantity of gypsum /$CaSO_4 \cdot 2 H_2O$/ to 2.5 %.
3. Because for the production of asbestos-cement a seasoned cement of stable properties should be used we should like to propose erection of 1 - 2 new cement silos of the capacity of 1000 - 1500 ton or fixing of 1 - 2 cement silos at the cement factory for the cement intended for production of asbestos cement.
4. At the laboratory of asbestos cement factory

we suggest that verified will be:

a/ Le Chatelier	6 mm
b/ Setting beginning	1 hs 30 min.
end	5 hs
c/ Sieve analysis, residue on sieve 4,900	8 %
d/ Temperature of cement	40 + 50°C

5. We suggest controlling of a new sort of asbestos to be supplied to the store. The laboratory is able to control the sedimentation and the length of asbestos fibre by means of Canadian sieve apparatus or the apparatus of Bauer Mc Nett.

6. We suggest controlling of the temperature of technological water in water recuperators. It should be not lower than 30°C.

7. We suggest building of a water basin of dimensions of 5.0 x 5.0 x 0.5 m for heating of the water on the roof near the water recuperator. Considering that the temperature in Syria, particularly in summertime is very high, we suppose that the sun would be able to heat the water inside the basin to the required temperature /see sketch No 4/.

8.2. Production of Pipes

8.2.1. Asbestos Cement Weighing Plant

8. The quantity of asbestos and cement taken from the stores should be chacked by the shift foreman.

Asbestos weighing plant.

9. Once a week the work of asbestos balance should be checked and the quantity of portion prepared in turbomixer compared with the quantity of asbestos used in fact for production.

10. The site near the asbestos weighing plant should be devided into three parts - each part for one shift - as well as the quantity or asbestos supplied should be divided among three shifts.

11. Each shift should make an account of asbestos consumption.

12. Empty asbestos bags should be tied in 10 pcs bundles and transfered to the store.

13. To avoid the confusion in asbestos on the floor /scattered on floor/ the place near the asbestos weighing plant should be kept clean.

14. The foreman of shift should account on the consumption of asbestos as well as cement according to true consumption.

15. The stock of asbestos near the asbestos weighing plant should be taken at least once a month.

8.2.2. T u r b o m i x e r

16. Sedimentation of asbestos fibre in turbomixer, particularly in the first phase /without cement/ as well as the concentration of asbestos cement mixture /in the second phase with cement/ should be controlled once a day. Sedimentation should be no less than 80 % and the concentration no higher than 20 %.

17. For the turbomixer it is necessary to take the water partially from the first water recuperators, particularly for mixing asbestos with cement /in second phase of work/.

For this purpose the turbomixer has to be connected with first water recuperator /by a pipeline/. /see sketch No 5/.

18. On the basis of obtained results the automatic valve metering the water for turbomixer as well as for the cement and asbestos weighing plant should be verified. Also verified should be the proportion between the asbestos cement and water. This proportion for pipes should be 1 : 6 : 35 and for sheets 1 : 7 : 35.

8.2.3. Cement Weighing Plant

19. Once a week the work of cement weighing plant should be checked.

8.2.4. Noria

20. Once per shift the concentration of asbestos cement mixture in the noria should be checked. It should be about 25 %.

8.2.5. Homogeniser

21. The concentration in homogenizer must be checked. It should be not higher than 10 %.

8.2.6. Sieve Cylinder Tank

22. We suggest that controlling of concentration in sieve cylinder tank should be made in 5 different places. In all these the concentration should be equal.

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23. On the basis of obtained results we propose installation behind the sieve cylinder of an agitator for equalization of concentration in these places.

24. According to the result obtained as to the concentration in the sieve cylinder tank the valves controlling the mixture should be adjusted and cleaned.

25. We suggest changing of the construction of partitions. Their shape must be worked out on the basis of obtained results.

26. The channel under the sieve cylinder tank for draining the water to the pump must be kept clean.

8.2.7. S i e v e C y l i n d e r

27. Partially clogged sieve cylinder must be cleaned or exchanged without delay. As we were able to learn this is very important for the quality of pipes particularly for pipes of different thickness.

28. The net used in sieve cylinder should be replaced /it is worn/. Working with this sieve increases the consumption of raw materials.

8.2.7.1. S p r a y e r s

29. We suggest that the shape of sprayers holes be altered according to our proposed pattern. Cleaning of sprayers will be much simpler /see sketch No 6/.

30. We suggest changing of the shape of sprayers for sieve cylinder. As mentioned above cleaning will be much easier /see sketch No 7/.

31. Attention should be paid for situating of sprayers particularly the sprayer in sieve cylinder. The water which is bouncing off the sieve cylinder should not wash the asbestos cement mixture out from the felt.

32. Sprayers must always be kept clean so that the spray is obtained from all the holes.

33. The pressure of water for sprayers should be no less than 2 kg/sq.cm.

8.2.8. F e l t

34. Attention should be paid to proper cleaning of the felt as well as to the operation of cleaning agitator.

35. The felt clogged with asbestos-cement sediment must be cleaned or replaced. This is as important for quality of production as it is the case with the sieve cylinder /pipes or sheets of different thickness/.

36. Each new felt should be examined /for 5.10 ± ± 0.05 m the number of mesh for 100 sq.cm should be about 600 - 650/.

37. We suggest strengthening of the edges of felt with double nylon thread so that the durability of felt will be increased.

8.2.9. Vacuum Boxes

38. The vacuum in vacuum boxes should be high enough for keeping the humidity of elementary layer before the mandrel not higher than 50 + 5 % /vacuum about 200 Hg/.

39. Technological water from vacuum boxes should be used for production purposes and therefore we suggest modification of water cirbulation from the vacuum boxes.

40. Vacuum boxes must be cleaned sistematically.

8.2.10. Calendering an Drawing

41. Before calendering compressed air must be introduced between the mandrel and asbestos cement pipe at both ends of the pipe.

42. The pipe should be calendered only with good calendering rollers. The calendering rollers should be without cracks and other damage. It should be smooth.

43. The slideway of the mandrel after calendering and before forming of pipes /slideway to the forming station/ should be free of cracks.

44. Along and over the surface of mandrel, incisions should be made for smoother extraction of pipes from the mandrel.

45. A micro-switch should be provided so that at the beginning the extraction will be very slow and then when the pipe moves the speed of extraction can be increased.

46. We suggest providing the ends of wooden table in front of roller conveyor with a piece of rubber belt or felt for dampening the fall of the fresh pipe from the table on the roller conveyor.

47. Bending of fresh pipes on the table in front of roller conveyor is impermissible.

8.2.11. W a t e r   R e c u p e r a t o r s

48. We suggest limiting the supply of fresh water for production particularly of water for sprayers and for turboleser.

49. The water for sealing the vacuum pumps /fresh/ can be led off to the sewer but the water from vacuum boxes should be re-used for production. It is just opposite at the present time.

50. We suggest to increase the tapping of water from water recuperators and particularly for sprayers, homogenizer, turbomixer and turboleser.

51. Technological water from the top of second water recuperator should never be led off. It is the hottest water.

52. The temperature of water in the water recuperator should not be less than 30°C.

8.2.12. T u r b o l e s e r

53. Fresh waste material should at once be re-used in production. It reflects on the consumption of raw materials.

54. For grinding of fresh waste of asbestos cement in turboleser only the water from water recuperator should be used.

55. The waste should be ground continuously in small portions to avoid the stopping of pipe line.

Roller conveyor and seasoning chamber.

56. To equalise flattening of pipes at the front of roller conveyor we suggest making 20 pins from wood or from asbestos-cement pipes, according to enclosed drawing No. 8. These pins should be put inside the fresh pipes at their ends right at the front of roller conveyor.

57. The rollers in roller conveyor are incomplete and must be supplemented.

58. The temperature in the seasoning chamber should be 42°C and humidity 95 %.

59. At present for currently used cement the conveyor is too short, particularly for pipes of small diameters and therefore we suggest lengthening of the conveyor.

60. The pipes taken from the roller conveyor should be handled with care as well as putting them on the table behind the roller conveyor should be smooth without buffeting and striking the pipes.

8.2.13. T h e   B a s i n s

61. The pipes on the table behind the roller conveyor should not be kept longer than for 1 day.

The pipes should at once be put into the basin and flooded with water.

62. In the first layer of pipes in the bottom of the basin a clearance of 2 mm between each pipe should be maintained. It is very important particularly for the pipes of small diameters /80 - 100 mm/.

63. We have learned that the pipes are more thin at their ends than in their middle and therefore we suggest placing on every fifth layer of these pipes of a belt of old felt /9 m long; 0.6 m wide/. In this way warping of pipe resulting from difference in thickness will be avoided.

64. The pipes in the basin should be arranged parallel. The clearance left at the right and left hand sides of the basin should be equal.

65. The pipes of small diameters should be transported to the basin and from it on a pallet having smooth surface.

66. The pipes of big diameters should be transported to and from the basin on hooks shaped as suggested /see sketch No 9/.

67. Considering local conditions the pipes in basins must be flooded with water /also technological water can be used/.

68. Striking of pipes against each other is impermissible. It is very important for all operations since the pipes lose their strength.

8.2.14. Lathe for Pipes

69. We propose to change the form of jaws, particularly for turning the pipes of diameters from 100 - 300 mm /see skotch No 10/.

70. The shape of lathe cutting tool should be suitable as well as proper should be its fixing. We have instructed the workers on this problem.

71. Steel rails of two sleped steel railings should have rubber protection.

8.2.15. Cutting Machine and Lathe for Joints

72. We suggest that all pipes will be checked before cutting paing special attention to the pipes which are oval.

73. The pipes which are found to be oval should be used for production of sewage pipes.

74. We suggest acquiring of a cutting machine for cutting above mentioned long pipes into pieces of 1-2-2.5-3-3.5-4 and 4.5 m in length. These pieces of sort I, can be used as drain pipes.

75. We suggest increasing of the length of limiter in the middle of lathe jaws for joints thus simplifying the fixing of joints in the lathe.

76. We suggest introduction of work on the principle of task rate for the cutting machine as well as for the lathe for joints. This should result in an increased output.

8.3. Production of Sheets

8.3.1. Turbomixer

77. To obtain uniform mixture of asbestos cement we propose, besides controlling of the weighing plants, to fix the mixing time in turbomixer for each asbestos and cement formula. We propose to fix this time at 8 minutes.

8.3.2. Water Circulation

78. We suggest connecting of each pair of pumps by means of a pipe provided with a valve. In this way the machine will be able to work even if one of these two pumps fails. This connection relates particularly to water pumps.

8.3.3. Sieve Cylinder Tanks

79. We suggest checking of sedimentation in each sieve cylinder in three various spots. Inside every single sieve cylinder tank the sedimentation should be equal; in the first sieve cylinder tank it should be about 8 - 10 %, in the second: 6 - 8 %, and in the third - about 4 - 6 %.

80. We also suggest controlling of the concentration in the water past the sieve cylinder tank on its left and right hand sides.
    It should be about 1 %.

81. The sieve cylinder tank as well as the felt and the outlet from the sieve cylinder tank must always be clean.

82. We suggest modification of the shape of sprayers for sheets machine as described in point 30 /see sketch No 7/.

8.3.4. F o r m   R o l l e r

83. We suggest to employ an electromagnetic knife or another automatic method /steel cord/ in place of currently employed method of cutting the sheets.

84. The humidity of a fresh sheet leaving the form roller should be about 27 % which is very important for the employed method of corrugating the sheets. This humidity can be partially regulated by adjusting the pressure between the form roller and transmission shaft.

8.3.5. C u t t i n g   o f   S h e e t s

85. For accurate stopping of the second band transporter in exactly the same place we suggest installation of a micro-switch.

86. To avoid cutting through the second band transporter as well as sliding of sheets on to the knife we propose to lengthen the guiding shoe for the knife to about 6 cm and withdraw the knife by about 4 cm transversely.

87. Attention should be paid to correct setting of knives - rotary disk tools /see item 4.1.3.1./.

88. For local conditions we propose to keep the thickness of elementary layer to no more than 0.6 - 0.7 mm; in this way the quality of sheets will be better.

8.3.6. S t a c k i n g   P l a n t

89. We suggest padding up of the space between the knife /rotary disk tool/ and its housing, in this way hitching of sheets will be avoided.

90. We suggest providing of a reliable device for taking the chips of fresh sheets at the head of the fourth transporter.

91. We suggest balancing of the transition between the third and fourth transporter.

92. We suggest installation of a metal sheet between the upper and lower part of the fourth transporter in similar way at it is made on the third transporter.

93. We suggest renewing the oil in hydraulic system every three months. The same oil could be used after filtration.

8.3.7. T u r b o l e s e r

94. To simplify the cleaning of the pipeline between turboleser and noria we suggest replacing of the steel pipeline with the rubber pipeline or to modify the position of pipeline according to our sketch No 11.

95. For the turboleser the water from water recuperators should be used or directly from the machine /sprayers water/. /see also point 54 and 55/.

8.3.8. S e p a r a t i n g   P l a n t -
- seasoning chamber

96. We suggest that in seasoning chamber the tempe-

rature is kept above 60°C and humidity about 90 - 95 %.

97. For the maximum production capacity we propose acquiring of about 300 pieces of steel corrugated moulds.

98. To avoid the damage of asbest both at the stacking plant as well as at the separating plant we propose to provide the vacuum box with a limiter so that steel corrugated mould can never be pressed by the vacuum box down to the roll lubricating plant. Steel corrugated moulds can fall on the roll from the height of 1 - 2 cm.

99. We propose that particular attention is paid to the retardation of vacuum box motion in its final part of motion. Its descent to the sheets /truck/ should be slow.

8.4. S t o r e s

100. The asbestos for production should be taken from the stores as it is taken at present time but its quantity should be checked.

101. The quantity of all materials taken for storing as well as dispensed must be checked.

102. Finished products must be stacked for storing with due care and handling of pipes requires special attention. /see item 5.2.1./.

103. Before transporting them for storing the sheets must be stacked on pallets /see sketch No 12/.

104. For storing the sheets should be stacked according to their sorts and to the date of their production. For local conditions they should be stapled on wooden blocks, no more then three sheets over another three.

105. A pile of sheets must be placed on the another horizontally. The pipes should be stacked by hand; they should never be tossed.

106. There are many sheet in storing with nicks. After cutting them they can be sold as sheets of sort I but of smaller dimensions and therefore we propose acquisition of a cutting machine for sheets.

107. Better attention should be paid to loading of pipes on the truck lorry.

108. The surface of store area should be kept tidy.

8.5. Technical Documentation

109. On the basis of standards in force we suggest working out of a correct technological process taking into consideration:

a/ the means for servicing the machines

b/ parameters of our report /I - II and final/

c/ local conditions

110. The worked out operation instruction for each operation should be made known to the workers and disployed for reference in suitable places at the factory.

8.6. W o r k   O r g a n i z a t i o n

111. We suggest realization of our proposition shown in rcheme No 3.

8.6.1. R e p o r t i n g   o n   P r o d u c t i o n

112. Besides of the data already illustrated in the course of our report we also propose taking into consideration the stock of:

a/ asbestos at the beginning and at the end of each shift

b/ cement at the beginning and at the end of each shift

c/ fresh sheets and pipes in seasoning chamber and in the basins.

113. We also suggest registering of working hours and idle hours as well as consumption of electrical power.

8.6.2. E m p l o y m e n t   a n d   R e s p o n s i b i l i t y   R a n g e

8.6.2.1. L a b o r a t o r y

114. The laboratory should employ 4 workers, two on the first shift and one worker on each other shift.

115. The laboratory should investigate all parameters according to the standards for finished product /see point 8/.

116. During production the laboratory should investigate following technological parameters:

a/ temperature in water recuperato, once per shift - 30°C minimum

b/ sedimentation of asbestos in turbomixer, once per shift - 80 % minimum

c/ concentration of asbestos cement mixture in:

turbomixer	once per shift	20 %
noria	" " "	20 ± 5 %
homogenizer	" " "	10 - 15 %
sieve cylinder tank once per shift, about		9 - 7 - 5 %
/in the middle in of each cylinder/		
or for pipes		8 - 10 %
water past the sieve cylinder, about		1 %

d/ humidity of elementary layers ahead of the vacuum box I = 70 %, II = 60 % and past the vacuum box II - about 50 %

e/ thickness of elementary layer - once per shift. This thickness should be 6 - 8 mm

f/ humidity of fresh sheets = 27 % and of pipes 20 - 25 %

g/ parameters in seasoning chamber: temperature about 60°C, humidity 90 - 95 %.

117. Raw materials should also be checked and particularly:

a/ cement:

sieve analysis /rest on sieve 4,900/	8 %
setting time, beginning	1 h 30 min.
end	5 h
Le Chatelier	6 mm
temperature	50°C max

b/ felt - mesh per 100 cu.cm = 25 x 26

c/ net - mesh per 1 sq.cm = 14 x 17 /see point 4/

8.6.2.2. Technological Control Division

118. Technological control division should employ 4 workers /2 on the first shift and one worker on each other shift/.

119. Technological control should examine:

a/ thickness, width and length of sheet as well as the thickness and diameter of pipes

b/ appearance of sheets and pipes

c/ correct operation of machines.

120. On the basis of results obtained from the laboratory the foreman of technical /technological/ control decides on shipping the finished product and settles the claims.

8.6.2.3. Mechanical shop

121. In our opinion the employment in the mechanical shop should be increased by 6 workers /for heating of water/ with 6 workers - assistants and 1 deputy foreman /see our II monthly report/.

122. Besides, the asbestos cement factory should employ:

Greaser	- 1 worker
Fitter	- 1 "
Electrician	- 1 "
Driver for Hyster	- 2 workers

123. The workers must be provided with fundamental tools /hammers, spanners, saws and files/.

124. A detailed plan for major and routine repairs must be worked out and the required spare parts must be considered.

125. Responsibility range for mechanical and electrical shop should be worked out with a plan for each foreman.

8.6.2.4. Human Factor

126. To reduce fluctuation of personel we suggest partial replacing of the men by women, particularly at working stations 2 - 3 - 6 - - 8 - 9 - 14 - 21 - 22 and: in laboratory - - 2 workers; in technical control division - - 3 workers; secretary - 1 worker; reporting office - 1 worker /see scheme of employment No 13/.

127. We suggest employing of workers who are leaving army after 1 year of service.

128. We propose to remunerate the management with premiums depending on production costs or on fulfilling the plan. Which of the above is more important is open for discussion.

129. Trained workers should be encouraged for staying with the factory.

130. A contest should be encouraged among the shifts for better production, and better output.

131. We suggest that the management of the factory be acquainted with production of asbestos cement in other countries /also in Poland/.

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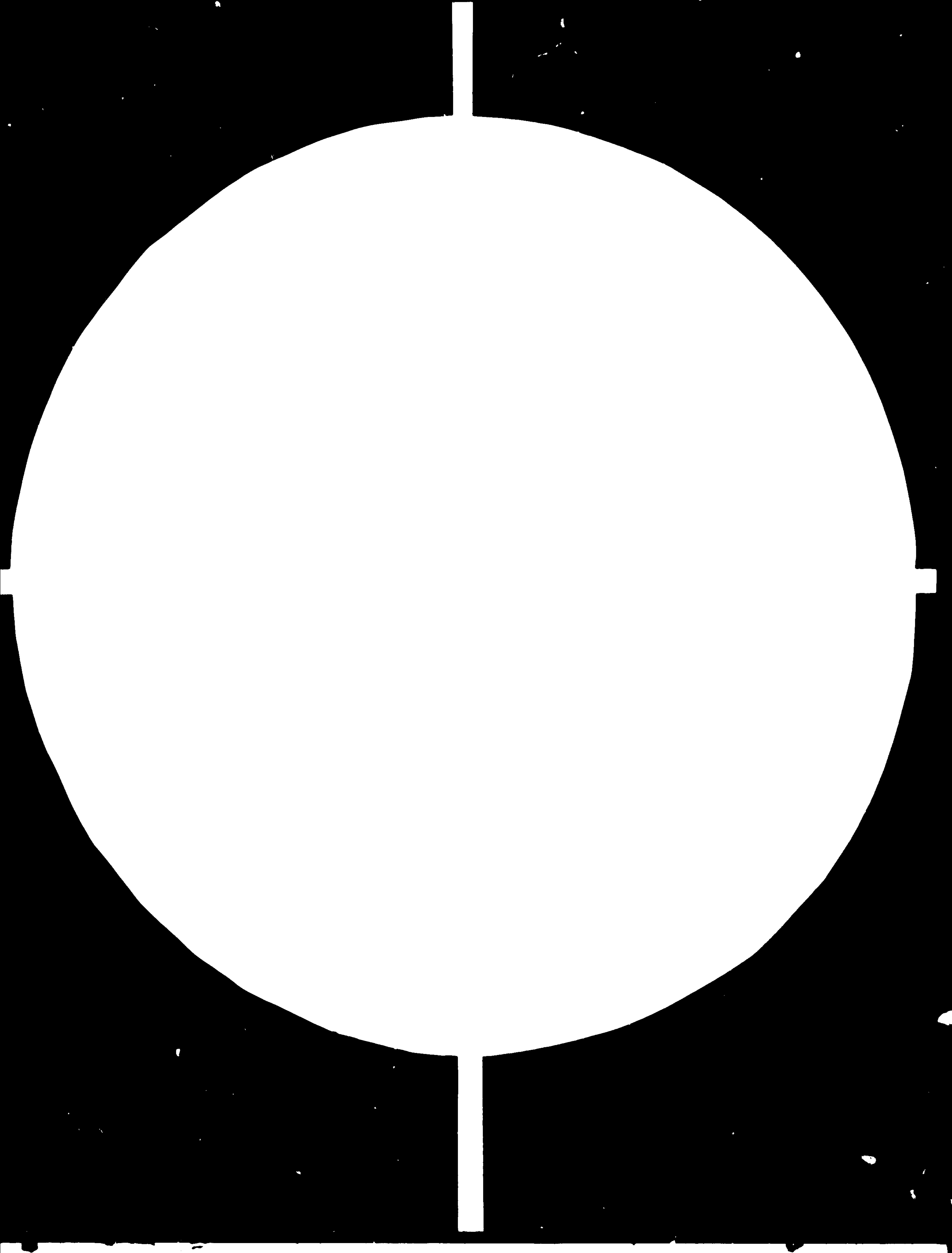
ILL 5.5+10



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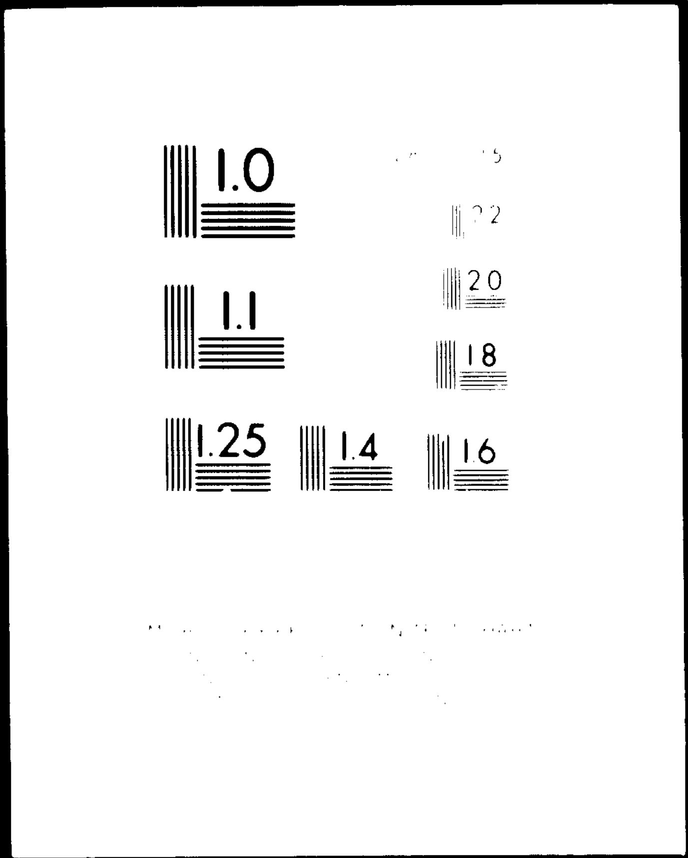


24x

F

Recapitulation

During our work in Syria we instructed the workers paying special attention to correct servicing of the machines.

Water circulation is nearly satisfactory. According to our suggestions following modifications were made:

1/ The shape of sprayers holes modified /conclusion pt No 29/.

2/ The design of sprayer for sheet machine modified /point 82/.

3/ The sprayer of sieve cylinder for sheets machine reshaped /point 31/.

4/ The sprayers and felt cleaned and kept in suitable condition /point 81/.

5/ The supply of fresh water reduced /pt 48/.

6/ The tapping of water from water recuperators increased /pt 50/.

7/ The method of cutting modified /pt 83/.

8/ The humidity of sheets corrected /point 84/.

9/ The micro-switch installed /point 85/.

10/ Pipeline position modified /point 94/.

From 15.6.70 we were engaged with instructing the workers how to prepare the machines for operation. The machines were prepared correctly but when the factory started production after few days there was no asbestos available for production and then the band transporter had been cut through and the production was stalled.

We are glad that the factory was able to exceed its production plan in 140 % /June 1970/.

Summarising, in our opinion, as the most important problems of the factory we conclude to be:

1/ the quality of cement

2/ water circulation

3/ concentration of asbestos-cement mixture

4/ purity of sieve cylinder and felt

5/ deficiency of steel corrugated mould.

We should like express our gratitude to all the persons who owing to their excelent cooperation made a significant contribution to implementation of our study. This is especially true of the officers of UNIDO Vienna - Mr M. Micillo and Boldyrev, UNIDO in Damaskus - Mr L. Fares, Mr M. Nigasi and Mr O. Chettani

The Team Leader

W. Molenda B. Sc. /Eng/

No. 1 Technological water circulation

1. Water recuperator I /dirty/
2. Water recuperator II /clean/
3. Water tank
4. Float valve /cut-off valve/
5. Overflow pipeline
6. Clean water pipeline for sprayers
7. Clean water pipeline for turboleser
8. Turbomixer
9. Noria
10. Homogenizer
11. Slide valve for dirty water
12. Slide valve for asbestos cement mixture
13. Sieve cylinder tank
14. Form roller

15 - 18. Water pumps

19. Exhauster
20. Vacuum pump
21. Dewatering pipe
22. Dewatering vacuum box
23. Water pump
24. Turboleser
25. Asbestos cement mixture pump
26. Fresh water pipeline

Modifications suggested

27. Modified pipe with outlet 20 cm below item No 6
28. Rubber pipeline to the turboleser
29. Separated pipe for feeding the turboleser
30. Pipeline from vacuum box to the machine /or to the water recuperator/

31. Fresh water pipeline from pump /sealing water/
32. Pipe connection between two pumps
33. Outlet valve
34. Technological water pumps connection

No 11 Sketch of turboleser with noria connection

Specification of existing installation

1. Noria
2. Turboleser
3. Pump
4. Mixture pipeline
5. Water suction pipe
6. Water suction pipe
7. Water pipeline /from water recuperator/
8. Fresh water pipeline
9. Platform

Modification proposed, alternative I

10. Rubber pipeline 60 mm dia
11. Rubber pipeline with steel pipe connection
12. Steel pipeline
13. Rubber pipe for fresh water
14. Rubber pipe for fresh water with valve

Alternative II

15. Rubber pipeline 80 mm dia
16. Steel pipeline 80 mm dia
17. Steel pipeline terminated with a through
18. Water gate /with througn and pipe leading to the channel/

No 13 Employment scheme

1. Asbestos balance service	2 workers
2. Control table	1 worker
3. Aeration of pipes before calendering	2 workers
4. Calendering	1 worker

5. Control table	1 worker
6. Turboleser	1 "
7. - 8. Conveyor	3 workers
9. Overhead travelling crane	1 worker
10. Basins	2 workers
11. - 12. Pipe lathe	3 "
13. Pipes testing press	2 "
14. Control table	1 worker
15. - 16. Pipes handling	3 workers
17 Cuttings machine	1 worker
18. Lathes for joints	1 "
19. Testing press for joints	1 "
20.Handling of asbestos	2 workers
21. Control table	1 worker
22. Cutting of fresh sheets	1 "
23. - 24. Band transporter	3 workers
25. Stacking plant	1 worker
26. Turboleser	1 "
27. Separating plant	4 workers

A - Asbestos-cement weighing plant

B - Cement silo

C - Water recuperators

D - Disintegrator

E - Turbomixer

F - Cement weighing plant

G - Noria

H - Homogenizer

I - Pipe machine

K - Turboleser

L - Roller conveyor

M - Basins

N - Lathe for pipes

O - Testing press for pipes

P - Cutting machine

Q - Lathe for joints

R - Testing press for joints

S - Storing

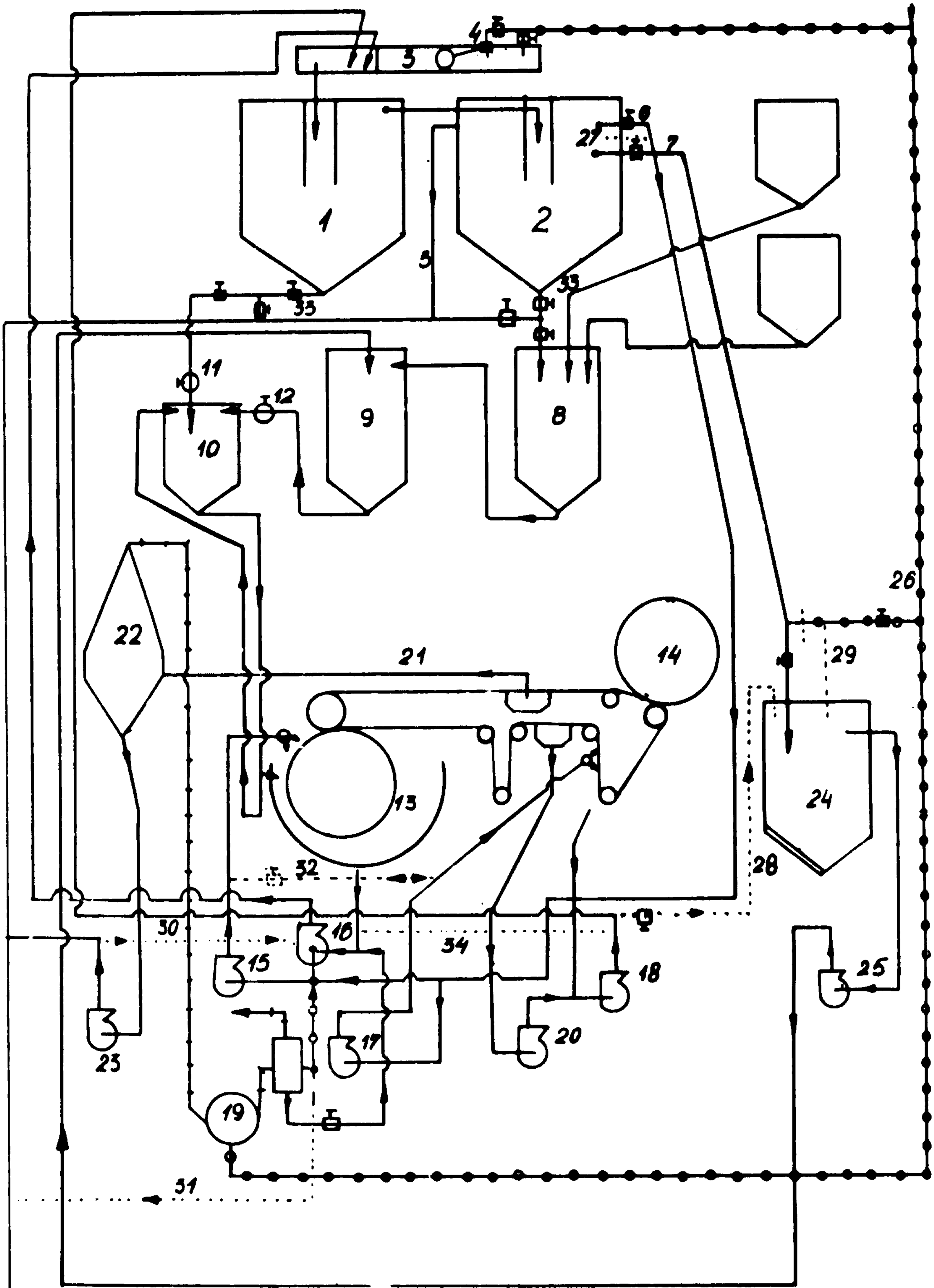
T - Sheet machine

U - Stacking plant

W - Seasoning chamber for sheets

Z - Separating plant

No 1. TECHNOLOGICAL WATER CIRCULATIONS SCHEME



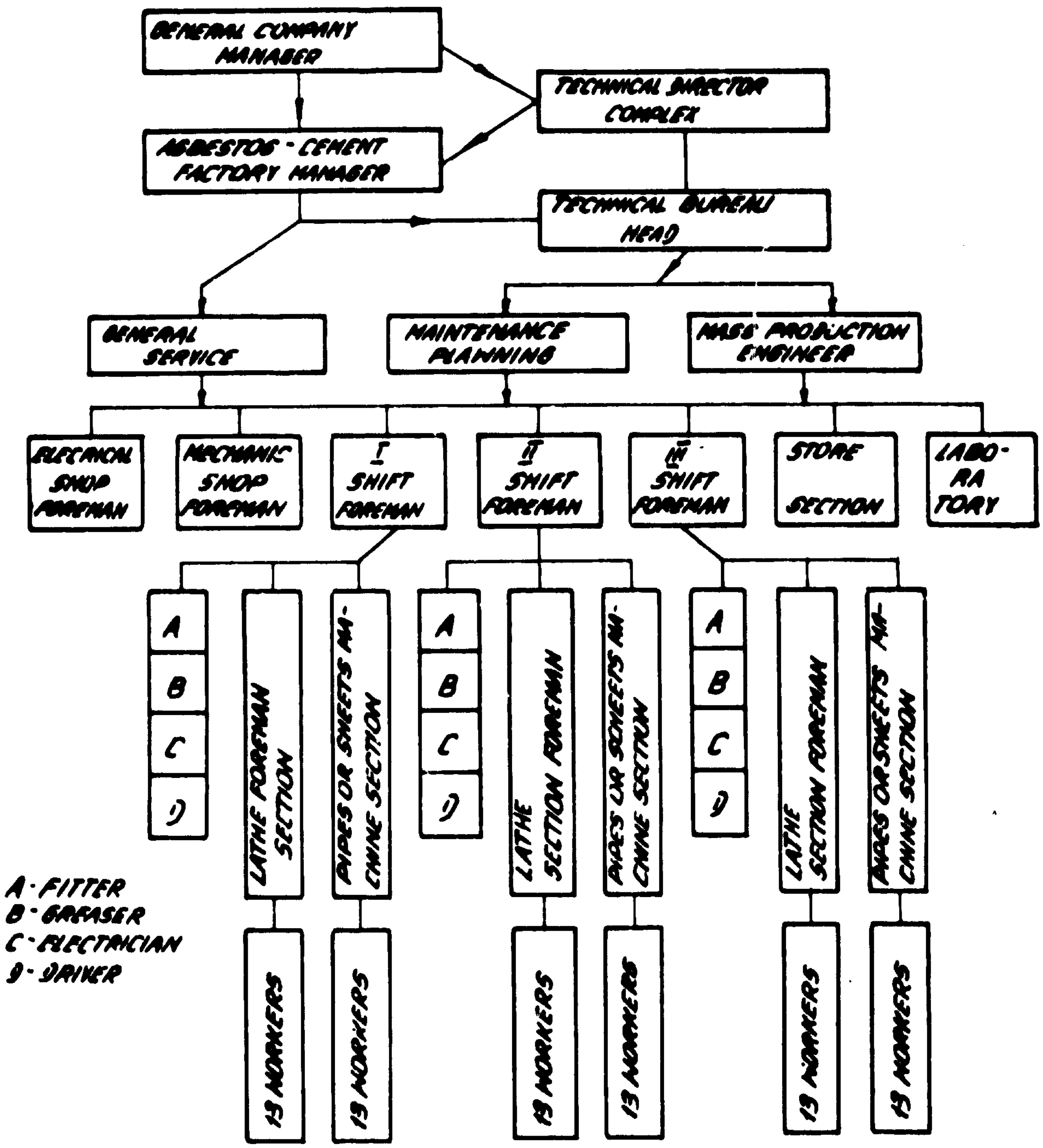
TECHNOLOGICAL WATER

AIR PIPE-LINE

FRESCH WATER PIPE-LINE

PROPOSED PIPELINE

No 2 ORGANIZATION SCHEME PRESENT



ELECTRICAL SHOP

1. FOREMAN
7. ELECTRICIAN

MECHANICAL SHOP

1. FOREMAN
1. DELIVERER OF TOOLS
2. WELDERS
2. SIEVE CYLINDER SOLD
2. TURNERS
2. OIL PUMP MAINT
3. FITTERS
3. WATER PUMPS MAINT GREASER

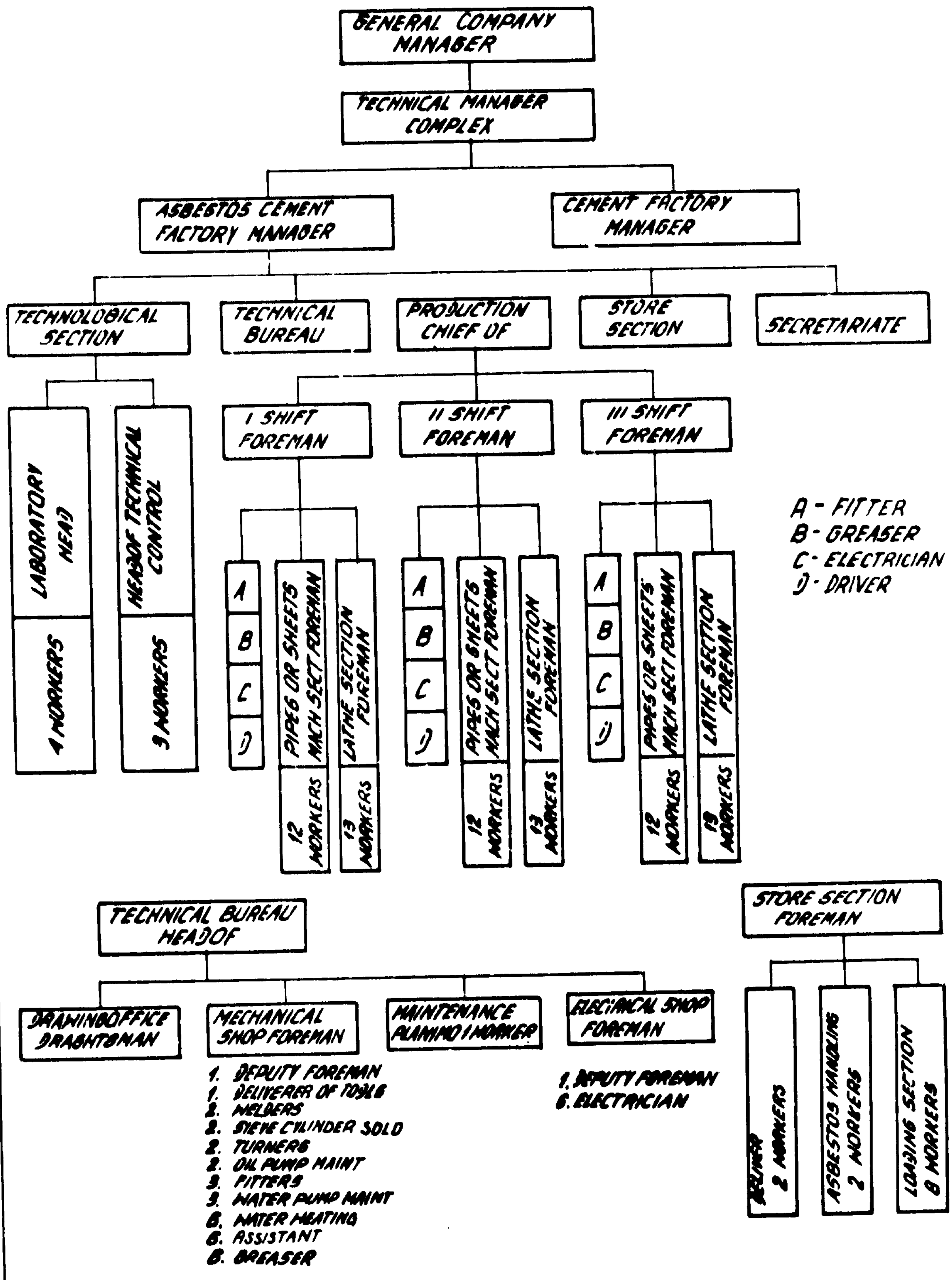
STORE SECTION

1. FOREMAN
1. DELIVER
8. DRIVER
8. LOADING SECTION

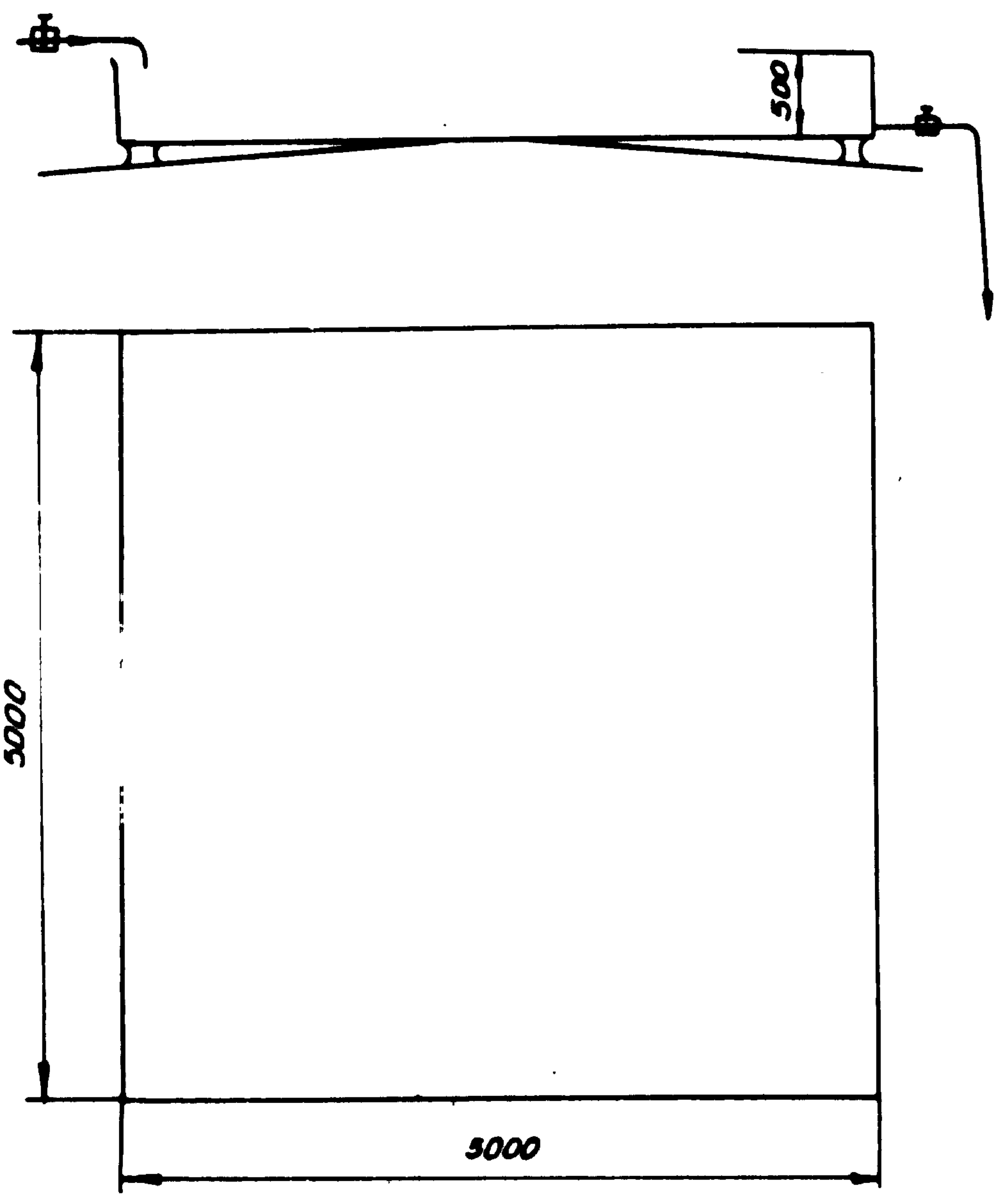
LABORATORY

1. FOREMAN
2. WORKERS

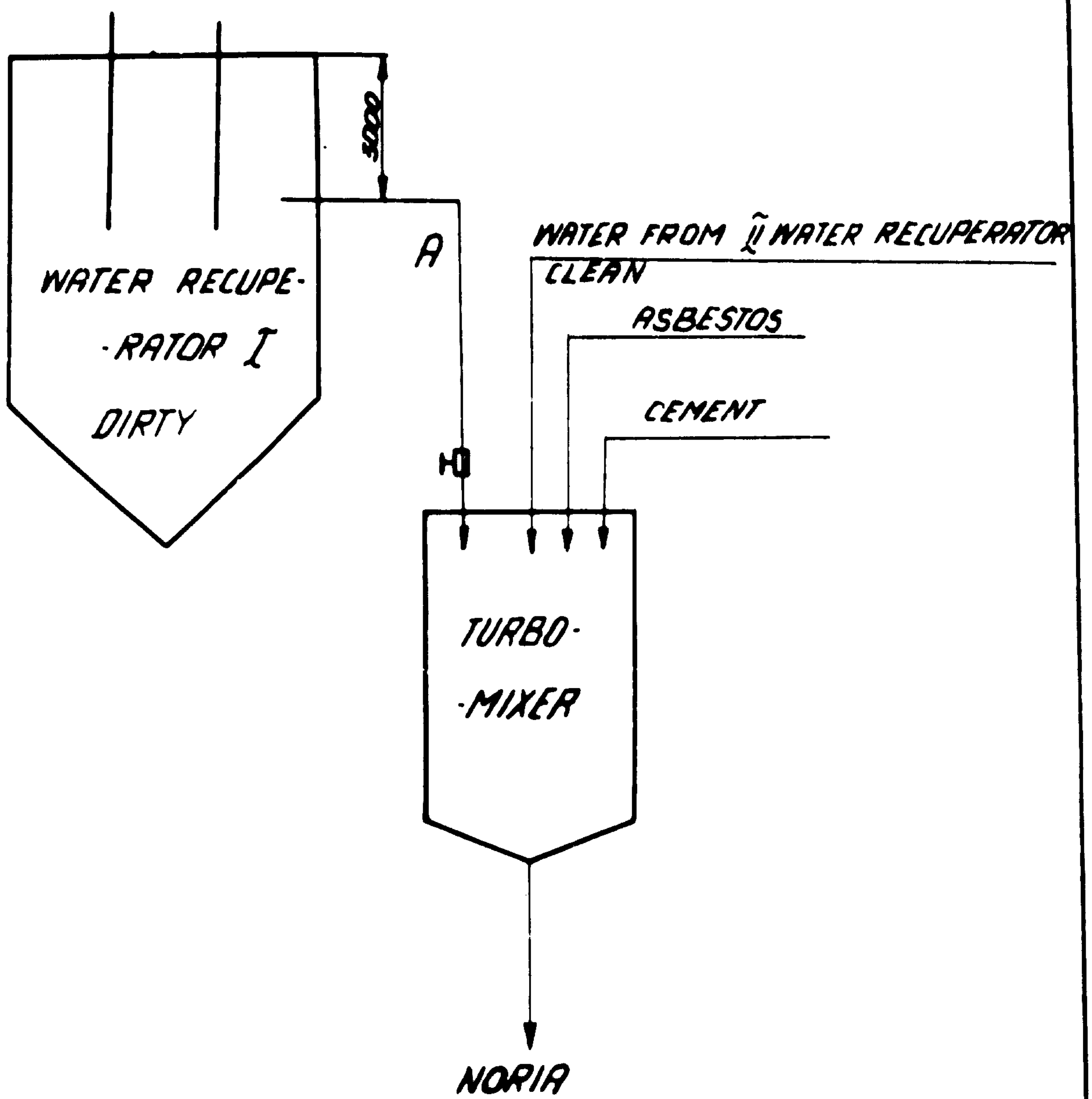
No 3 ORGANIZATION SCHEME PROPOSED



No 4. WATER BASIN SKETCH FOR NATURAL WATER HEATING



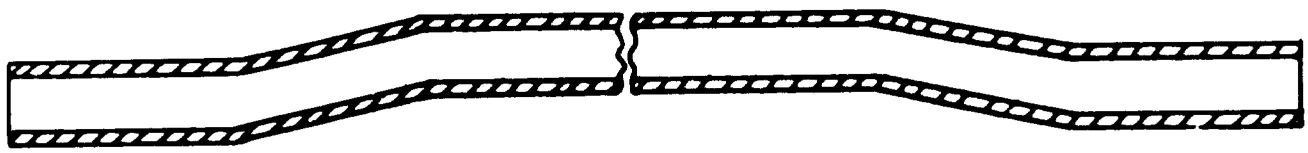
No. 5. SKETCH OF CONNECTION WATER RECUPERATOR-
-TURBOMIXER



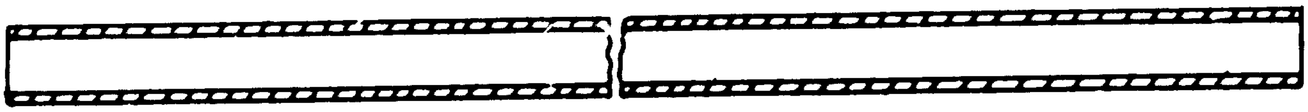
A - STEEL PIPELINE ∅ 80-100 WITH VALVE

No. 7 SKETCH OF SPRAYERS FOR SIEVE CYLINDER OF SHEETS MACHINE

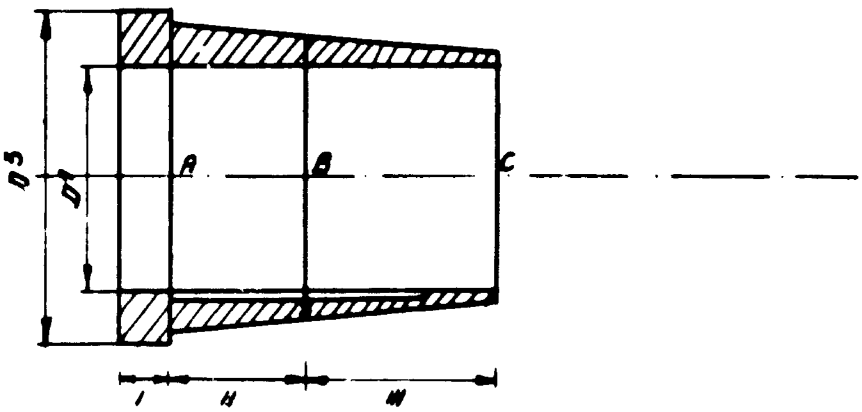
PRESENT



PROPOSED

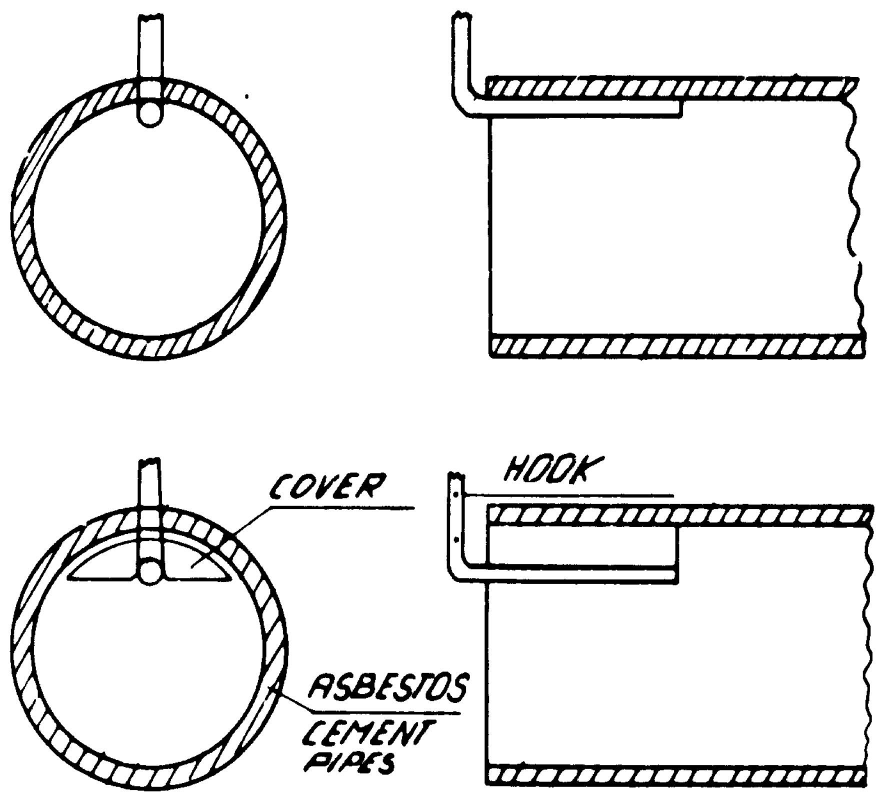


No 8 SKETCH OF PIN FOR PIPES



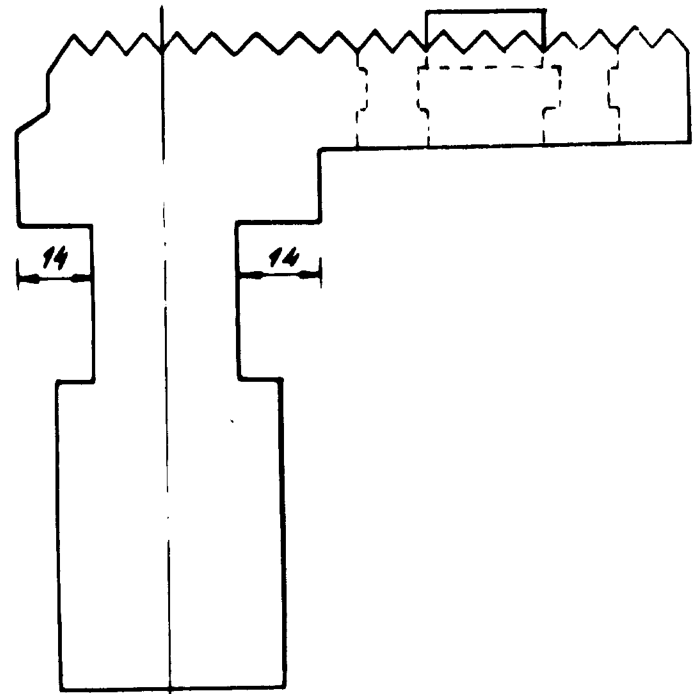
DIAMETER OF PIPES IN MM	DIAMETER OF PIN IN MM			LENGTH IN MM			QVANTITY			
	A	B	C	I	II	III		MATER.	D' IN MM	D3 IN MM
80	82	78	70	15	100	100	30	WOOD	-	-
100	102	98	90	15	100	100	30	a.c pipes or wood	DN 80	DE 102
125	127	123	115	15	100	100	30	-"-	101	136
150	152	148	135	15	100	100	30	-"-	121	156
200	202	198	185	15	100	100	30	-"-	171	206
250	252	248	235	20	145	145	20	-"-	225	262
300	302	297	265	20	145	145	20	-"-	247	308
350	352	347	320	20	145	145	20	-"-	305	368
400	402	397	360	20	145	145	20	-"-	343	404
500	503	497	460	20	145	145	10	-"-	441	498
600	603	597	565	20	145	145	10	-"-	549	616

No 9 SKETCH OF HOOK WITH COVER

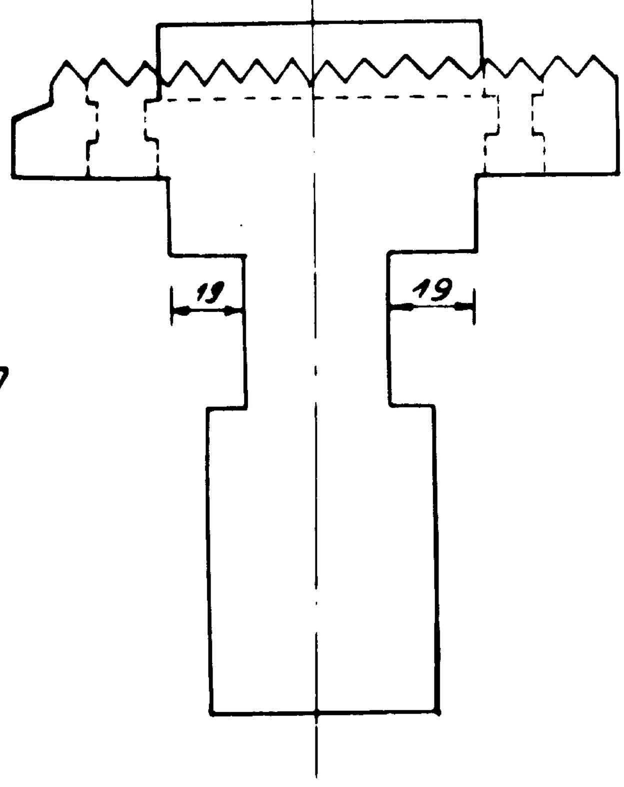


No 10. SKETCH OF JAW

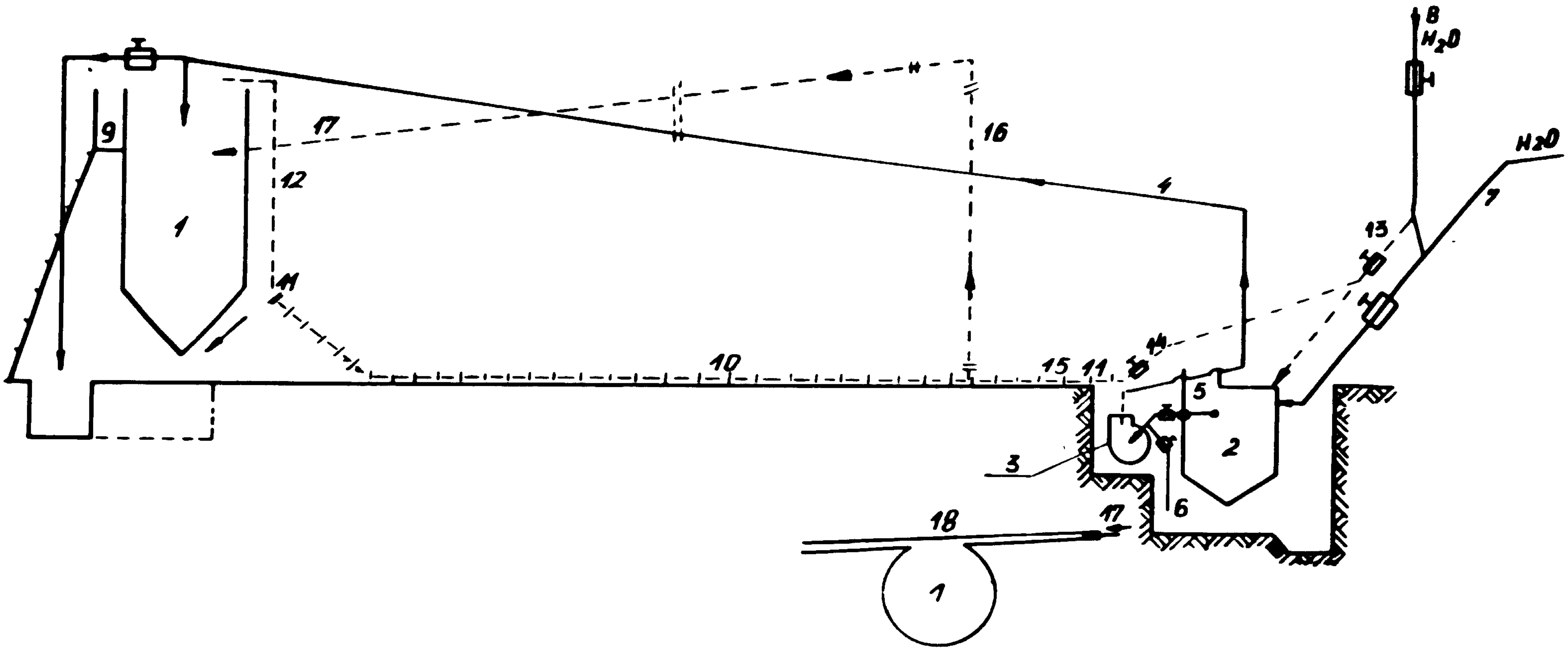
PRESENT



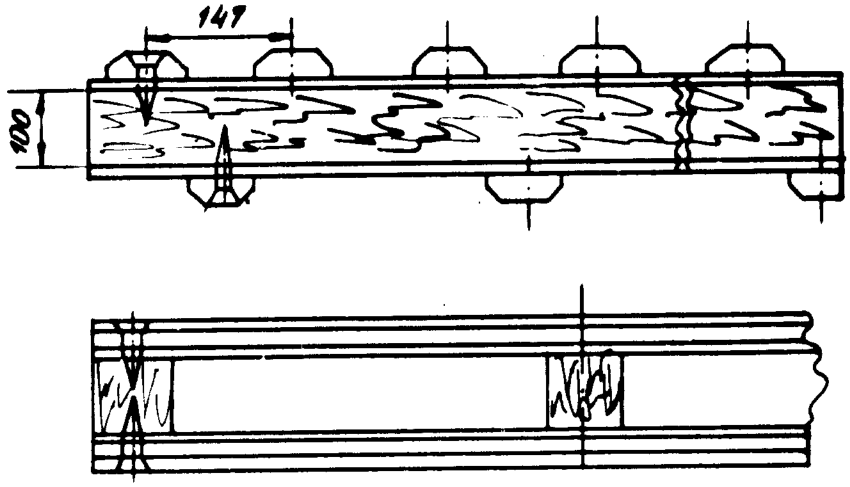
PROPOSED



No 11. SKETCH OF TURBOLESER WITH NORIA CONNECTION

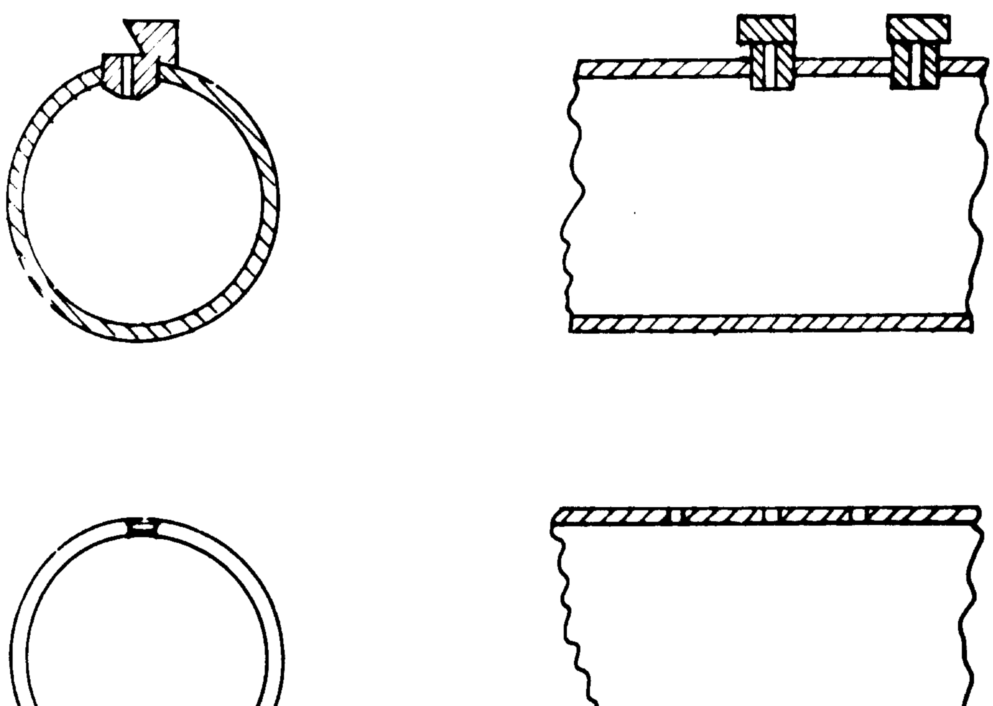


No 12 SKETCH OF PALLET

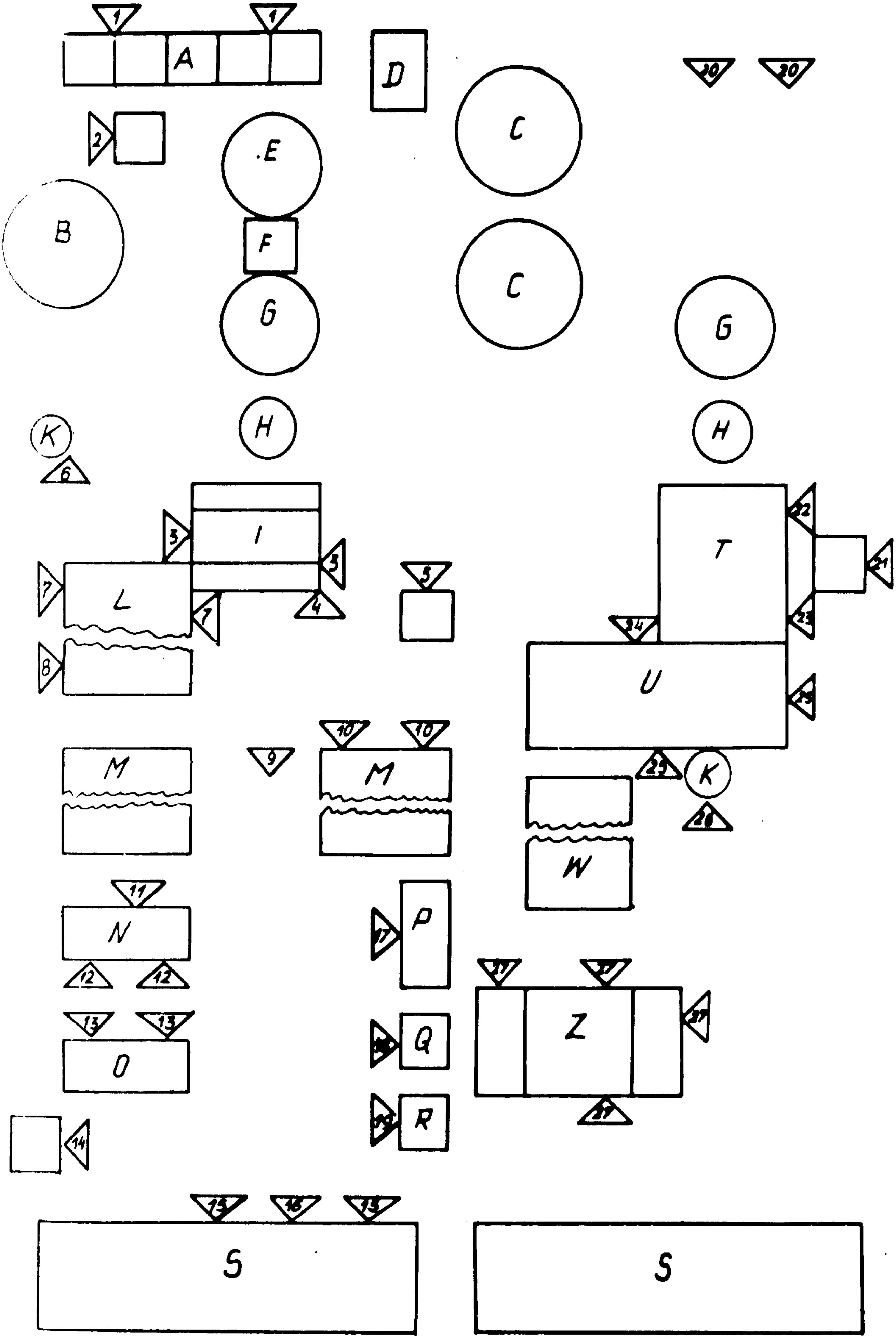


MATERIAL: WOOD

No 6 SKETCH OF SPRAYERS HOLE



No 13. EMPLOYMENT SCHEME



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