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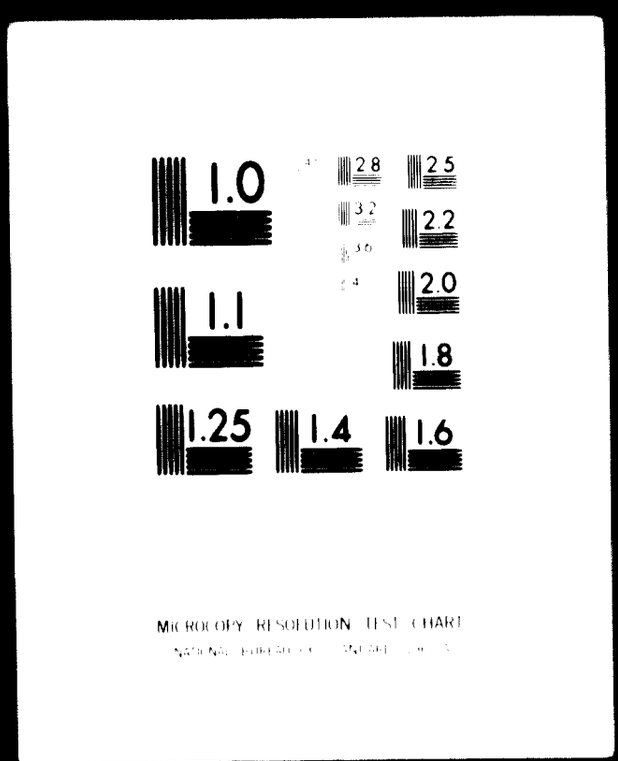

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ISLATIN ENTERPRISES LTD.
TEL AVIV
ISRAEL

LA SOCIETE DES CONSERVERIES DU MALI

(SOCOMA)

BY

P. WEINSTEIN
O. MANOR

SEPTEMBER 1971

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CONTENTS

1 INTRODUCTION

The present report concerns the execution of project no. 70/948 of UNIDO carried out on the basis of the agreement signed by UNIDO and the ISLATIN company, Israel. The object of this assignment was to study, examine and present the necessary recommendations concerning the processing methods of SOCOMA (Société des Conserveries du Mali), owned by the government of Mali. This factory was constructed in 1963 by the government of Mali at Baguinda, about 35 km from Bamako, for the processing of 1,300 tons of fresh tomatoes into tomato concentrate and for about 400 tons of [illegible] and other fruit annually.

Till now this entreprise has not operated on a profitable basis nor has it reached 50% of the envisaged production capacity.

In previous years, studies were executed for this entreprise (Ref. 3) in which different recommendations for improvements of the conditions were made, but till now nothing has changed and the entreprise continues to work at loss.

We found this entreprise to be in a very bad state as far as the management and technology are concerned and also as regards the lack of equipment and quality control.

In other similar cases, we would have suggested closing the entreprise and stopping all activity. We did not come to this conclusion in the case of the SOCOMA for two reasons :

a) Mali is an agricultural country and each agricultural development should be followed by the establishment of a transformation industry for the agricultural products. The SOCOMA Company, in spite of its serious losses and its bad condition, is the first transformation industry of Mali, and might be, in the future, the starting point for the development of other transformation industries.

b) In the entreprise there exists a team which has, over the last few years, gained experience in management and technology. This experience, although not perfect, is by no means negligible, and this team is willing to attempt to make this entreprise viable. In our opinion this team should be encouraged and helped.

For this reason it seems to us that while closing the factory might solve certain immediate problems such as lack of finance this action will very probable delay, in a considerable way, the development of transformation industries in Mali. On the other hand this factory cannot be left in its present state.

Essential extra equipment, technology and management capacity are required without delay for the plant. If these elements can be furnished, this entreprise may come viable.

The lack of sufficient quantities of tomatoes for processing during recent years has encouraged the management of this factory to develop other products that might be processed in the future in the same plant and sold on the local markets and for export. This initiative did not succeed because of the lack of adequate machines and equipment and the lack of the necessary technology. For these reasons the factory could not reach an adequate level of quality, nor cover the productions costs or earning a profit.

In this phase, there is no problem in marketing the factory's finished products as it cannot satisfy the demand. The basic problems are to increase output, improve quality, and as a consequence reach the plant's break even point.

The factory has begun to develop new products with its own means. In our opinion, there exist also other development possibilities, but these are beyond the power of the factory to carry out. A collaboration should therefore be envisaged with centralized institutions, national or intergouvernmental, having the know-how, the capacity and the equipment for the needed research concerning the utilization of the raw materials available in this part of the world. In our opinion fruit, vegetables and roots might be found in this region that can be processed industrially, either by adaptation and development of traditional transformation methods or by applying new production methods and products such as are used in developed countries with a high standard of living.

Consumers in European countries are willing to pay for imported exotic food products.

As a result of our observations on the spot, we believe that a serious effort on the part of the concerned parties together, with a relatively low investment will have a good chance of success. For this reason, we shall proceed in this report with the analysis of the elements which we found and shall also recommend ways of obtaining successful results.

This report is devoted principally to the directorate of SOCOMA and for this reason a part of this report is written in the form of instructions for different activities. Our recommendations are divided in two categories : the first one for measures which might be executed immediately (if it is decided to continue the existence of the entreprise) and the second one which might be executed at a later stage. These recommendations are concerned with the problem of how to :

1) increase the factory's production
2) improve quality
3) secure uniformity
4) avoid losses
5) reduce products cost

Knowing the particularly difficult situation of the entreprise and the Malien government, we have indicated in our recommendations only the minimal needs for leading the entreprise to satisfactory functioning.

In the following parts of this report a general analysis will be made of the different departments and services and the different products and production methods.

Based on this analysis, recommendations will be made concerning the improvements in equipment, production and managements methods. A final summary will complete the report.

2. GENERAL CONSIDERATIONS

2.1. In 1963, the Government of Mali established a factory having a production capacity of 2 tons of tomatoes per hour for a yearly transformation of 1,200 tons of tomatoes. This factory was also designed for the transformation of 400 tons of mangos into concentrate. The factory was planned and constructed by a Yugoslav organization which has continued, till the present date to supervise production with technical personnel.

The factory is owned by the Malien government and its management is carried on under the regis of the Ministry for Labour and Industry.

The head office of the compeny and the main stores are situated in Bamako where the menaging director of this company also resides.

The heed office is mainly concerned with marketing, management, accounting, purchase of materials and contracts with external bodies.

The fectory was erected in Baguinda, at about 35 km from the capital Bamako and its menegement has been entrusted to the Deputy-Director of the company who is in practice the responsible director for production operations and all other services of the factory. This compeny was named SOCOMA (Société des Conserveries du Mali).

2.2. In the planning end construction of the plant, it seems that the difficult and complicated problems concerning the supply of tomatoes to en industrial entreprise, were not correctly evaluated. A farm situated near the fectory, contracted to supply fruit for the processing. Since the factory exists, the farm did not succeed to supply the tomatoes to the factory in an uniform and regular way and in quantity and quality necessary for production.

The low agricultural production yields and the bad quality of the fruit caused big losses to this farm and to the factory. As a result the farm was detached from the SOCOMA company but this dit not bring about any improvement.

2.3. In addition to tomato concentrate the factory processed mangoes, tamarind fruits (Tamarindua Indica) and guavas in light drinks, concentrates, nectars and syrups (see annex No. 1).

2.4. For all products processed by the factory, the envisaged production capacity was not reached, the quality is very bad and the percentage of losses is very high.

3. METHODS OF EXECUTION OF THE STUDY

This study was carried out in two steps.

3.1. Step No. 1 : Study of the situation at the place of work and analysis of the facts and details of the plant's situation. This work was carried out by Mr. P. Weinstein, over a period of one month; in the context of this work, observations concerning the daily operations of the entreprise were carried out, supplemented questioning responsible personnel of different levels, inquiries of other persons and institutions connected with the entreprise and by the examination of calculations, statistics etc ..., at the offices of the company (see annex No. 2).

The work carried out on the spot enabled establishing the actual situation in relation to the following principal factors :

- utilization of the machinery and equipment
- utilization of manpower
- utilization of raw materials
- efficiency of the services (stores, maintenance and quality control, water quality, electricity, etc...)
- improvement of the quality

3.2. Step No. 2 : This step was carried out at ISLATIN Office in Tel Aviv with the participation of Engineer O. Manor. The data gathered in Mali were studied, analysed and summarized in the form of recommendations given in the present report. This part was carried out in consultation with Dr. J. ORSHAN.

3.3. Various difficulties were encountered in carrying out the work in Mali :

3.3.1. The work was carried out during the second half of June and the first half of July 1971. At this season, no transformation of fresh fruit is done (see annex No. 3). The principal activity of this factory, the transformation of tomatoes could not be studied, so that the facts were gathered by enquiries and written information. However the machinery and equipment was examined at the factors.

3.3.2. During the period of the survey, the principal activity was centralized in the production of light drinks, of dried tamarind fruits and the concentration of mango and guava pastes. In fact during this period, the factory was practically paralysed because of a breakdown of the sole automatic can filling and closing machine.

3.3.3. During the entire visit, only 2 complete working days were realized and in all the remaining time the personnel was busy in repairing the can closing machine. The bad state of the filling and closing machine, (which in our opinion cannot be repaired and used) is the major cause of the inefficiency of the factory. Such machines are the heart of a canning plant and should be replaced.

3.3.4. The director of the laboratory responsible for the quality control and the development of new products was in Yugoslavia in a training course and, because of that, it was very difficult to obtain the necessary information concerning methods of quality control, as well as details concerning the experience gained in development of new products.

3.3.5. Because of the bad state of the factory during recent years and the number of foreign experts who have already visited this entreprise in the past, a certain lack of confidence appears, in our view, among the plant, leading personnel towards the foreign experts. One can hear often "another report for the drawer but we shall not have anything for closing our cans". This approach can be understood but did not facilitate our task in preparing the present report.

4. THE FACTORY

4.1. The factory is situated in the city of Baguinda at about 35 km from Bamako. The region is an agricultural region and a great part of the land can be irrigated with water reaching this region from the Niger river. The buildings are constructed with concrete blocks covered with external and internal plaster, the roof is of corrugated asbestos sheets, the floor is made of reinforced concrete. A fence surround the factory site.

4.2. The factory is composed of various buildings (see annexed plans) :

a) Principal buildings comprising :

1) principal production hall
2) empty can store
3) can manufacturing hall
4) finished products store and bottle filling
5)
6) sheds
7)
8) offices

b) Laboratory and hygiene services building (9)

c) Water pumping and water treatment center (10)

d) Building for maintenance services etc (11) (mechanical workshop, steam boiler, spare parts store, electric power generators).

4.3. Four principal production systems exist in the factory :

a) a fabrication line for empty cans

b) a production line for tomato concentrate

c) the filling and closing system

d) the auxiliary materials systems

4.3.1. The line for the fabrication of empty cans

The line comprises equipment for the fabrication of empty cans from tin plate. The machines are all of German origin (Carges Hamer). The models of the machines are very old but in good conditions which enable them still to operate efficiently In all machines certain parts should be replaced, the problem of spare parts will be considered later in the chapter dealing with the factory's maintenance.

It should be noted that the two machines producing can are making the seal by the "overlap" method, which is an old method now considered not good enough. We should indicate that cans of this type are not allowed to be imported to the United States of America.

We do not recommend at this stage to change the existing methods because the present system permits the production of 800 cans in 8 working hours, a capacity sufficient for the near future.

Six different sizes of cans (from 100 gr to 5 kg) are manufactured at the factory, the tin plate is imported from France.

4.3.2. The system for the production of concentrate (see annex No. 6)

This system comprises a complete classical chain of machines, of Yugoslavian make, designed for the transformation of 2 tons of tomatoes per hour. This fabrication is entirely satisfactory to the factory's management. This system comprises of the folfowing units :

- a soaking and washing machine with turbulent water under pressure
- a roller conveyor belt for the sorting operations carried out by workers placed on both sides
- a crusher
- seed separating machine

- juice filtration system operating in 3 stages with filtering sieves of different mesh sizes (1 mm, 0,8 mm, 0,4 mm)
- a tank for reception of the juice, placed below floor level
- a piston pump for the delivery of juice to the heat exchanger
- a heat exchanger, of pipes type, having an automatic heat control system
- a two stage evaporator

4.3.3. The can filling and closing system

This system is composed of the following elements :

a) a tank of 500 liters

b) a two stage heat exchanger, of pipes type, having an automatic control system for maintaining the temperature and an automatic 3 way valve for the return of the non-pasteurized materials.

c) a can filling machine, of piston type, for filling high density products in cans up to 1 kg.

d) a can filling machine for gravity filling of liquid products in cans up to 1 kg. This machine is of "Bucheti" make.

e) a hand operation filling machine for cans above 1 kg, composed of 2 tanks and a 3 way valve.

f) an automatic can sealing machine, of "Bucheti" make, operating in conjunction with the filling machine indicated in paragraph d) above.

g) a semi-automatic can sealing machine operating with cans of 1 to 5 kg.

The machines indicated in d) e) and f) are very old and out of date and cannot be used. For this reason, it is not possible to oparate at this factory in a regular way. The state of these machines is the main reason for the considerable deteriorations appearing in the final products.

The preservation of foodstuffs by heat treatment is based on its packaging in the can while hot and absolutely hermetic sealing. With the sealing machine existing in the factory the hermetic sealing of the cans cannot be secured.

4.3.4. The auxiliary equipment system

This system is composed of the following elements :

a) a pulping machine for mangos with a capacity of 500 kg per hour

b) 2 tanks, each of 500 liters

c) 2 aerators for the aeration of dense products

d) 3 cooking pans, each of 500 liters, double jacketed (for steam heating), equipped with a mixer having an anchor form

e) 1 cooking pan of 50 liters

f) 2 autoclaves

g) a heating and cooling tank for cans

This system is not designated for particular products. With certain machines the tomato concentrate production line may allow, in different seasons, the processing of other products. With the initiative of the factory's responsible personnel, various other products have been developed in addition to those which were envisaged in the original planning.

5. THE SERVICES

5.1. The electric power station

Three electro generators each of 120 KVA are installed in the factory, 360 KVA in all; one of the generators is under repair in Yugoslavia for the last year and has not been delivered because of financial problems. The inatalled capacity of the motor power of the factory is 250 KVA; at peak-load hours the need does not exceed 180 KVA.

The existing electrical power station is therefore sufficient for the factory's needs and there ie still a certain reserve for additional development on condition that the repair of the unit indicated above will be rapidly completed.

The director of this station is at present a Yugoslav technician who is also the electrician in charge of the whole plant; in two months he will complete his work and an effort must be made within this time, to complete the training of two Malien technicians capable of keeping this station functioning.

5.2. The water supply

The entrepriae has two principal eources for the supply of water to the factory :

a) an open channel which leade the Niger river water by gravitation
b) a local well, drilled in the last year by the factory, in order to supply the necessary water to the factory during the dry season in which the water level of the Niger river is low and the water does not arrive in sufficient quantity at the plant. At present there is a regular supply of water to the factory.

The water price is relatively low, about 0,5 US cent per m^3.

At this cost there is no need to install a recovery and recirculation installations for water.

5.2.1. There are 2 water systems in the factory :

A system used for industrial purposes, cleaning, fire fighting, etc... This water is pumped directly.

The second system, used for the production, with filtration through active carbon and sand with the addition of chlorine.

The chlorination is done in a primitive way by dropping a chlorine solution into the water current and there is no certainty about the resulting concentration of chlorine in the water. Even more, the chlorine concentration control in the water is not regular and the exceeding amounts of chlorine in the water cause the corrosion of the equipment and rusting of the cans of the products. There is also the danger of chlorine penetration into the final products. Insufficiency of chlorine in the water cannot guard the microbial infection which might spoil the products by water penetration into the cans during the cooling phase.

5.2.2. We recommend that all water, with the exception of the water added to the products, will contain free chlorine in quantity of 4 to 7 PPM and the installation of a precise chlorination apparatus with a very strict control system for the chlorine content in the water. The control should be effected at least once a day under the supervision of the director of the laboratory.

5.3. Removal of the draining water and wastes

5.3.1. In the working hall, two water draining channels, covered by a removable screened cover, are installed, allowing the cleaning of this hall. The drained water is led by a channel to the site's fence, and there, by an open channel, to the fields. This drained water forms a swamp and in spite of the high surface evaporation, during the tomato processing season, constitute a source for the incubation of mosquitoes and flies near the factory.

There is also another danger that the waste water might penetrate by infiltration into the water well of the factory and pollute it.

5.3.2. We recommend at this stage :

a) Fix a place for collecting the drained water under the form of a small lake to be situated at a distance of at least 1 km far from the factory's fence and to pump the waste water to this lagune with the addition of gas-oil pulverization to avoid the incubation of flies and mosquitoes.

b) Establish a "modus operandum" for the examination of the quality of the water arriving at the factory. This examination could be done in the factory's laboratory with the aid of the health services of Bamako.

5.3.3. The removal and treatment of the factory's wastes is still not organized. The wastes and the rejected materials resulting from the production are placed in different places in the fields around the factory.

We recommend to establish a fixed place for the wastes, under permanent control and to apply, suitable materials, to prevent the breeding of flies and mosquitoes.

The responsible person to control the execution of this operation should be the plant's director.

5.4. Steam

The factory has a steam boiler having a heating surface of $75m^2$. Peanut busks, available in big quantities in Mali, replace fuel oil as heating material. Under local conditions, steam production does not exceed 20 kg/m^2 which correspond to 1,500 kg per hour. This quantity is sufficient to cover needs at the peak-load hours and leaves a certain reserve for further development. The water to be used in the steam boiler is not hard and therefore no water treatment is needed for the water fed to the steam generators.

5.5. The maintenance services

There is in the factory a mechanical repair workshop which contains a laths, shaping machine, drilling machine, electrical saw and all other tools necessary for routine maintenance. A Yugoslav technician directs this installation but will leave in 5 months; he has trained a certain number of Malien mechanics who gained sufficient experience that will permit them to continue by themselves.

The more complicated repair works are trusted to external workshops which can execute the necessary mechanical work.

5.5.1. The most distressing problem of the factory is the problem of spare parts. The total lack of spare parts (we shall return later of to this problem while discussing the production quality) directly or indirectly influences all the factory's activities. The machines and installations are in a very bad state (lack of spare parts or lack of technological knowledge and experience).

The quality of the products, the efficiency of the work and the coefficient of utilization of the machines and equipment suffer because of the lack of spare parts.

95% of the necessary spare parts must be imported and it is difficult to establish if failure to do so is due to financial or administrative reasons.

5.5.2. In our view, this situation cannot continue; a sufficient stock of spare parts should be secure for all departments of the factory, depending on the need for these parts and their delivery time. An annual budget should be put at the disposal of the factory's director for the purchase of the spare parts and he should be given all facilities to secure the purchase of these parts.We attach very great importance to this problem.

5.6. Laboratory

The laboratory is well equipped, the equipment is good with the exception units which are unusable because of the lack of spare parts; for example the measuring instruments for pH are not functioning for some years because of the lack of an electrode.

As we have indicated we did not meet the director of the laboratory and our general impression is that the laboratory is not active in the execution of the quality control, we shall return to this point in the chapter dealing with quality control.

The lack of an apparatus for the control of the vaccum in the cans in particular must be emphasized.

6. MARKETING PROBLEMS

6.1. At this stage, the entreprise has no marketing problems, on the contrary this entreprise cannot supply all the demand. The factory's products (see annex No. 1) are made from local fruit. These products were tradionally manufactured for immediate consumption without preservation. The same thing is to be found also in the neighbouring countries. The factory has not, in this case, difficulties to introduce new products but only the introduction of products already known, more easy for use but more expensive than the home-made products. With the increasing standard of living the consumption of these products will increase while appearing in convenient packaging and preserved in the form of canned products

6.2. Tomato concentrate is a product consumed by the urban and rural population.

The utilization of tomato pulp is traditional and serves as a basis for the preparation of sauces to be added to rice, meat, fish, etc... which are the principal foods of Mali. Cans of tomato pulp, from local production or import, can be found in shops or stalls along the roads and in most villages of Mali. It is evident that consumption in in the cities is more developed.

The increase in the consumption of tomato concentrate in the villages is bigger than in the city because of the more rapid increase in the standard of living in the villages in comparison to the cities.

Mali consumed in the last year between 800 to 1,000 tons of tomato concentrate (data furnished by the direction of the company) of which 100 tons were of local production.

The increase in the consumption of tomato concentrate in recent yeare was about 10% per year and, according to the factory diractor'a opinion, there is a poeaibility of eelling up to 600 tone of tomato concentrate per year, of a concentration of 20° Brix, in different packaging. This quantity corresponds to about 4,500 tons of freeh tomatoes. It should be noted that the factory, in the baet caee, cannot process more than 1,200 tons of fresh tomatoee during the season, and becauee of that, there is no problem of marketing for the actual production of the concentrate. The actual problem ie to increase the production with tha existing meana to tha planned level.

6.2.1. The neighbouring West African countries import big quantitiea tomato concentrata (Conseil de l'Entente and Ghana). The importation of theae products increases by 10 to 11% per year. In Senegal for example, the importation has increased by 16% per year. All theaa countries have conetructed during recent years factoriee for the production of tomato concentrate but all these entrepriees have serious production difficultiee and are far from being able to meet the demand (ref. 1-2). It follows therefore that there existe also a potentiality for exporting to neighbouring countrias, provided that quality end prices will be competitive.

6.3. <u>The Tamarind drinks</u> produced in the factory have been well received and are to the taete of the local population. For theae products, the factory also does not reach production of quantitiee to cover the demand. According to the factory'e director, it is poeaible to eell about 2 millions cans of different sizes per year.

From this fruit the tamarind eyrup (70° Brix) was fabricated and packed in bottles, of which 130,000 were sold each year. We suppose (and this supposition ahould be carefully examined) that tha tamarind drinka will be recaived in the neighbouring. If the transportation coet are high it will not be profitable to export the prepared drinks and it will be poeible to produce the tamarindconcentrate, with the existing production means, and to export the concentrate.

6.4. The juice of Mango prepared by the factory has not been well received on the local market and therefore only limited quantities can be marketed.

There are possibilities to export mango concentrate in cans of 5 kg to the USSR and, at present, there is an option for 1,000 tons of mango concentrate to be supplied immediately to the USSR but the factory cannot accept this order having difficulties to produce the required quality.

6.5. Nectar of guava About 100 tons per year can be sold on the local market, France ordered guava pulp in 5 k cans but the factory cannot produce it.

6.6. From the preceding data, it follows that the factory has no marketing problems but those of increasing production and improving quality. The solution to be found for these problems should also reduce the cost of production for each production unit.

7. THE PRODUCTS AND THE PRODUCTION METHODS

7.1. Tomato concentrate

Growing tomatoes is the main problem of the factory as the existing cultivation of tomato cannot supply the quantities needed for the production according to the existing production capacity.

Three principal sources exist for the supply of tomatoes to the factory :

a) A governmental farm situated near the factory which, in previous years, was owned by the factory. This farm should have been the main supplier of tomatoes to the factory and should have served also as a pilot farm for training farmers in growing methods. Till now this programme was without success. Although this farm has a big concentrated area of land with the possibilities of irrigation, the application of advanced growing methods did not succeed and the yields obtained on most of the land arrived only to 7 tons per hectare in comparison to 40/50 tons per hectare obtainable in Mediterranean countries. With such low yields it was not possible for the farm to continue to produce tomatoes for the industry at a price of 20 Malien Francs per kg, corresponding to about 36.3 US $ per ton.

On experimental plots of this farm, yields of 25 tons per hectare have been obtained, which prove that the yields can be improved by applying correct growing methods.

b) Individual farmers which grow tomatoes in the vicinity of the factory by the traditional methods, on small land spots, reach even lower yields and prefer to sell their produce on the local market, as fresh fruits, for which they receive a much higher price comparing to the price paid by the factory.

c) The tomato growing region at Douliba, about 100 km from the factory - The farmers of this region are connected to the factory supply contracts and the factory supplies them with the seeds. These supply agreements are not secure as tomato growing in this region is of a secondary importance and because of the low yields. The farmers' revenue is considerably lower than the revenue obtained from growing corn and rice which are more accepted by the farmers.

7.1.2. The region around the factory is a vast plot land that can be artificially irrigated by inundation or by furrows deriving from central channel that leads the water of the Niger river to this region. The soil is a clay loam which forms a crust when dry. This land has been cultivated for years in a primitive way without any controlled growing cycle and without the utilization of fertilizers and it might be supposed that it is a very poor land. The climatic conditions (see annex No. 4) are suitable for tomato growing from the standpoint of rainfall and temperature (ref. No. 2-3). Following the inquiry of Mr Brown of the company SONETAC of Dakar (This company owns a factory for tomato concentrate at St Louis). It was found that under similar climatic conditions and advanced growing methods (fertilizers, growing cycles, anti-parasitic measures) they have succeeded in reaching a yield of 30 to 40 tons of tomatoes per hectare in comparison to the 6 to 7 tons produced by the local peasants of the same region with primitive growing methods.

There is no doubt that, in the vicinity of Baguinda, as well as in other regions of Mali a yield of 30 to 40 tons per hectare (ref. 1-2-3) can be reached and change altogether the production conditions in the factory. The factory has not succeeded in attaining more than 50% of the envisaged production capacity because of the lack of tomatoes.

In our view the principal problem of tomato concentrate fabrication is not on the factory side but on the agricultural side, the choice of suitable varieties for the industrial production, the application of modern growing methods and the fight against parasites and deseases will help to solve the problems.

7.1.3 We recommend than an experienced agronomist specialized in tomato growing for the industry will be sent to the farm of Baguinda for at least 2 cultivation seasons, with the assurance that the Malien government will supply the farm with all the means that will enable the development of the farm as the main supplier of tomatoes to the factory in quality and price convenient to the farm and the factory. This farm can be transformedinto a pilot farm for training the peasants of all the region We know that the peasants in all parts of the world are very conservative and, for this reason, only positive results will be able to persuade them to pass gradually to more modern growing means with a higher revenue. This procedure is a long term but should be started immediately Already for the coming season, it should be planned to the farm a surface of 50 hectares, so that with correct growing methods and the help of an experienced agronomist the farm might supply about 1,000 tons of tomatoes to the factory

7.1.4. Supply of tomatoes from the field to the factory

It should be noted that during the tomato season it is very hot (see annex 3-5). The picking of the fruit, its transportation and storage are very important factors influencing the quality of the products which are produced. With the present practice, the picking of the tomatoes is done in small baskets. These small baskets are emptied into bigger baskets, carried on the head, and emptied later on the ground in bulk. The tomato remain in the sun, far from the factory, for many hours until the transporting truck arrives to take them.

The truck brings empty boxes into which the tomatoes are put and these boxes are loaded on the truck and transported to the factory over a distance of about 100 km of bad road at a temperature which reaches about 50°C inside the truck.

In the region nearer the factory the peasant load the tomatoes in bulk, without boxes, in small carts in which the tomatoes are transported to the factory.

All these methods are bad and unacceptable. The factory should undertake the supply of a sufficient quantity of boxes necessary for the production of a minimum cycle of 24 hours. The workers who pick the tomatoes in the fields should place the tomatoes directly in the boxes in which they are to be delivered. The tomatoes should be sent more rapidly for the processing in the factory. We were not present during the working season but, according to the description received on the spot, the fruit which arrives at the factory is a very bad quality and in poor condition.

Many tomatoes are bruised and rotting appears on the surface. It should also be noted that, with the present method of collection and transportation a great part of the juice of the tomatoes is lost during the transportation, storage and washing operations causing considerable losses to the factory. The lack of statistical data at the factory did not enable the evaluation of the losses and the amount of fruit used for the production of one unit of the finished products.

We recognize the problem of theftsof the empty boxes from the factory (an empty box is valuable material in great demand in Mali), however a way should be found to organize and secure the factory against these thefts.

7.1.5. The production method for tomato concentrate

As already indicated in paragraph 3.3.2. there exists in the factory an installation for the production of tomato concentrate based upon the classical method, permitting the transformation of 2 tons of tomatoes per hour.

Our recommendations are to make some changes in this system:

a) To add a roller conveyor before the washing machine (see annex No. 6) of a length of 1.5 m that will permit the placing of 2 workers on each side to sort the fruit before it enters the washing machine, to remove rotten fruit before it comes in contact with the washing water and thus to avoid contamination.

We suspect that, with the present procedure, the pollution of the water in which the fruit is damped and the heat damages it by infection rather than washes it.

b) Eliminate the tank in which the juice is gathered after crushing (this tank is placed at present below the floor level) and put in its place 2 tanks of 1,000 liters each above the floor level (see annex No. 6); it is evident that it is possible to use the existing tanks and place them above the floor level and add another two tanks.

Two reasons exist for this recommendation :

- The first is that the tanks which are placed below the floor level cannot be cleaned conveniently because of the lack of a drainage system and, for this reason, organic materials will always remain at the bottom of the tanks which will start to ferment and will infect the produce.
- Secondly, it is always convenient to work with two tanks so that each time a tank is emptied it will be possible to work with the other one and wash the emptied tank thoroughly with water and steam.

Under present conditions, it is impossible to wash the tank during working time.

In order to execute these changes the washing machine should be elevated to such a height that will permit the juice resulting from the crushing to flow by gravity into the tank or to be pumped in by a positive pump.

The same solution is recommended also for the filtration machine and the tanks which follow this operation.

The tomato concentrate produced till now in the factory was of a defective red colour in comparison to the colour of the imported concentrate. The one reason for this bad colour was the quality of the tomatoes and this problem is connected with the cultivation of the tomatoes. The solution is to pay more attention to the correct sorting of the tomatoes and eliminate from the transformation the tomatoes which are not completely red.

It is probable that, in the actual conditions, some years should be taken in consideration until a satisfactory quality of tomatoes may be reached. For this reason it should be arranged that the Minister of Health will authoriss the addition of an artificial colorant of a vegetable origin in limited quantities in order to allow this factory to compete with the imported products.

7.2. Products of Tamarind (Tamarindus Indica)

7.2.1. The tamarind tree is growing wild in vast areas of Mali and its fruit, having a similar form to a bean, is collected when dry. This fruit was used for generations by the population of Mali for the preparation of popular drinks.

In the SOCOMA factory, the juice of this fruit is fabricated in industrial form in 2 types of products : a diluted juice with the addition of sugar, ready for drinking, packed in metalic cans and a syrup of tamarind which is an extract of this fruit with the addition of sugar up to 65° Brix, which is packed in bottles. This syrup is diluted with water or gasified water for the preparation of drinks.

7.2.2. Under the existing method, a quantity of about 100 kg of dry tamarind (in blocks) is introduced into a 600 liters tank and water is introduced to cover the fruit.

After a delay of time, not defined (from 2 hours till over night), the liquid, which has extracted a part of the soluble materials, is removed into a vat placed at the lower part of the tank.

The vat is covered with a piece of cloth for the filtration of the liquid and as a result a solution of 8 to 18° Brix is obtained. This procedure is repeated several times with fresh water until reaching a concentration of 2° Brix.

The remaining solid part of the fruit is thrown aways after finishing the extraction. After each extraction a separate portion of juice is prepared by the addition of water and sugar. This addition is made following predetermined tables in order to secure a constant ratio between the soluble extract from the fruit and the added sugar.

7.2.3. There are many defects in this procedura, which ara :

a) The diffsrent extractions of the same fruit ara not of aquel quality; it is evident that the firet axtrections are batter, not only from the standpoint of tha concentration of the soluble products but elso from tha point of view of ths aroma and the retio between the components to the total quantity of the solubls matsriels. It follows therefors that all extrects of the same fruits should be mixed in ordar to obtain the final products to secure the uniformity of thesa products.

b) In the sxisting method of axtraction no more than 60 to 70% of ths soluble materiels presant in the fruit can be extracted. The reason for prevsnting ths axtraction by mixing and by crushing of the fruit is the difficulty to separate the fibers, the saeds end the euspended solid materials (the final products should be claar).

An experiment mada in tha leboratory by Mr. P. Weinstsin has shown a possibility of improving fruit utilisation (by 30%). The fruit is soeked in warm weter at 60°C for one hour while being intensively mixed. This warm mixture was pressed by hand through e seiva of 1 mm mesh to sepe-rate the fibers end the seeds: the resulting solution wes centrifuged by means of e leboretory centrifuga for 2 minutas st a speed of 4,000 RPM.

As a result a totally clear solution of a concentration of 20° Brix with a yield of 30% higher, comparing the conventional yields, was obtained.

As a result of this experiment, we recommend the adopting of different processing methods comprising the soaking of the dried fruit, after crushing, for one hour in warm water (60°C) with intensive mixing. The ratio between dry fruit and and water should be experimentally established in order to secure the best yields. This mixture will be passed through a finishing paddle machine having a filtering seive of 1 mm for the separation of the fibers and the seeds.

The resulting solution will be passed through an industrial centrifuge, having a capacity of 1,000 to 2,000 liters/hour, for the separation of the suspended solids with this system a continuous production may take place (instead of the batch method) and the final products will be of a better quality and yields.

From this fruit, the concentrate of tamarind may also be prepared by the utilization of the same concentrators used for the tomatoes already existing in the factory. It is possible to concentrate clear solution up to 70° Brix. This concentrate might be exported to the neighbouring countries for the production of tamarind juice by dilution of the concentrate for the preparation of drinks. In order to introduce the above mentioned recommended method a pulping machine and a centrifuge should be added.

7.3. Fabrication of products of mango

7.3.1. Mango trees grow in the traditional way in different regions of Mali and their fruit is eaten by the population. In recent years, these fruits in the form of fresh fruit were exported to Europe.

We could not find information on the growing and picking of these fruits and the possibilities concerning their export as fresh fruit. It should be noted that such export is always associated with a considerable amount of fresh fruit, not fit for export, but suitable for industrial transformation.

Different varieties of mango are grown in Mali, a systematic and precise examination of the properties of these fruits and their adaptation to industrial transformation should be made for quality and yields.

7.3.2. The mangoes arrive at the factory in baskets and not in boxes. The fruit is washed and sorted in the same installation as the tomatoes and crushed in a special pulping machine constructed in Yugoslavia for these fruits. The capacity of production of the pulping machine, which is the bottleneck of this system is about 1,500 kg per hour. The obtained yield in pulp having a concentration of 14 to 18° Brix is 70 to 75% of the fresh fruit.

The pulp is passed through two finishing machines of the tomato transformation system (diameters of the seives is 1 mm and 0,8 mm) and pasteurized at a temperature of 70 to 75°C. The warm products are concentrated, by using the tomato juice concentrators, to 28° Brix.

The concentrate is filled while hot into 5 kg cans and serves for the preparation of beverages by dilution with water and the addition of sugar and citric acid.

The greatest difficulty in the processing of the fruit is the deterioration observed in the finished products to which we shall refer in the following chapter dealing with the "pasteurization, filling and closing the cans".

In the products deriving from mangoes, the price of the fruit is a very important factor and, for this reason, means should be found to increase the yield from the fresh fruit. One possibility which seems to us interesting, is to warm the fruit before crushing.

7.4. Products from guava

7.4.1. The guava grows in Mali in unknown quantities and at the factory a drink, in the form of a nectar, of very good quality is produced. Despite of the fact that this drink is not popular with the local population, we thing that there is place for marketing this product in the European countries as well as in the local markets.

7.4.2. The fruit is washed and sorted with the same washing and sorting system used for the tomatoes. The cleaned fruit is cooked in the existing cooking pans with the addition of citric acid. Further filtration, with the use of the two tomato finishing machines, is done. The pulp is pasteurised and poured into 5 kg cans to be stored during the year for the preparation of canned drinks.

7.5. Pasteurisation, filling, closing, sterilisation and cooling

7.5.1. We shall refer in this chapter to the method and not to a certain product, since this method is utilised for all the products fabricated in the plant.

In our view, thie pert of the factory hae e dominant influence on the defects appeering in the final producte end we ehould like to give to this chepter an importance of the firet degree.

7.5.2. The factory euffers seriouesly from the deterioration of the finished products which is much greater then ehould be in thie industry. It was very difficult to ue to obtein preciee dete, either because they do not exist, or becauee they were not presented.

The management of the factory informed ue thet, lately theee deterioration did not exceed 2%, e fact which ehould not ceuse much trouble. But while examining the eituetion in the etorege places for the final products and on the baeis of the teetimony of different persons at the factory and outeide the factory, we had the impression that the percentage of the deterioratione ie situated between 20 to 30%. If thie were eo, such a situation would place in doubt the existence of the factory unleee meane were found to overcome these difficultiee in the near future.

The deterioration are found in all products. The higheet percentage is in the concentrated producte euch ee, for example, the concentrate of tomatoes, of mangoeeand the pulpe of guave; less important is the deterioretion in the drinks.

All the deterioration we examined were identified, with certainty, as elcoholic fermentetion. Thie deterioration ie expressed by the formation of gee in the cen which blows end explodes cane in the bulk store or etack, drope over other cans and causes rusting and holee in them, caueing a deterioration in chain. This deterioration doee not appear in defined patterns but is distributed over the whole production.

7.5.3. Four basic factors may include such deterioretion, each is separately sufficient but they may appear together. These factors are :

a) An excessive bacterial infection of ths raw materials at the starting point or of the equipment which the conventional heat trsetment is not sufficient to control.

b) In sufficient heat treatment or heat trsatment no uniformaly distributed over all the process of production; as to the temperature or the duration of heating or both.

c) A faulty closing of the can in which the product was packsd.

d) Infection of the cooling water for the final product.

In our view there are mistakes in production in the four factors mentioned above. In the factory no serious method exists for ths control of standards nscessary in the industry. These omissions result, on the one hand from lack of technological knowsdge and on the other because of the leck of controlling instruments on their bad state (spare parts, bad maintenance, etc...). The lack of sufficient appreciation of the importance of the precision required in the execution of the production operations and the influence of this precision on the results concerning the quality of ths finished products are also factors to be considered.

The explanation given at the factory thst the climatic conditions of Mali causes deterioration is without foundation and only prevents the persons responsible from seeking the true reasons.

7.5.4. The problems concerning the primary infection heve been already discussed in the preceding chepters end, for this reason, they will be only briefly indicated :

a) Before entry into the production lines the bruised end deteriorated fruits should be removed in order to avoid the contact of this fruit with healthy fruit and prevent the contamination of the equipment.

An additional sorting conveyor should be edded before the beginning of the weshing operation and plece workere for the dry sorting of ell types of fruit transformed in the plent.

b) Each 8 hours the work should be stopped for washing the equipment in use and each 24 hours the work should be stopped for 2 hours for a complete cleening of all perte of the equipment coming in contect with the product. Thie cleaning must be done firstly with cold water to remove the large particles of dirt, later with hot weter and steam under pressure end finally with cold water conteining 4 to 7 PPM of frse chlorine.

c) A simple chlorinator should be instelled above the pumps which will secure in e permanent wey the presence of free chlorine in the washing syetem and will prevent the development of migro-organisms.

d) For eneuring the work in this eystem, the factory ehould buy e steam gun having a long connecting pipe thet will permit weshing the working room and with which boiling water under pressure, with the eddition of caustic soda or other type of detergent.

e) The containers in which the finished products are stored (cans or bottles) are washed at present in a bath of static water. This water after a certain time becomes dirty and causes serious contamination. These containers should be washed with hot water before being filled and, for this reason, a burning water washing system for cans and bottles should be introduced before the filling operation.

f) The production hall should be well cleaned, the walls, floors and the draining channels, during all working hours. The rotten and fermented materials and all other wastes should be eliminated immediately. The working places should be sterilized with a chlorine solution to be applied to the surfaces and equipment which was in contact with the product. The preparation of fermenting materials, for the production of alcohol in the factory, should be stopped immediately. These operations encoureges the development of micro-organism cultures which are dispersed in the factory.

7.5.5. The heat treatment before filling and closing the cans, the temperature degree and the duration of heating will principally depend of two main factors :

a) the degree of the initial infection

b) the degree of acidity of the product (pH), the greatest in the acidity of the product, (lower pH value) the less severe should be the heat treatment and vice verse.

It is possible to recommend that for all products having a pH value up to 3,6 a temperature of 85 to 87°C will be sufficient. For all products where the pH varies between 3,6 and 3,9 the pasteurisation should be carried out at 95 to 98°C leaving the product at this temperature for 2 seconds (this might be achieved by the utilization of a convenient passage between the pasteurizer and the filling machine).

With a pH over 4,2 the pasteurisation should be done in the closed cans in an autocleve under pressure, at a temperature of at least 120°C.

In the examination of the pH made in Israel with a concentrate of mangos and with guaves pulps of the SOCOMA (because of the lack of spare parts for the pH meter at the factory it was not possible to examine the pH on the spot).We found a pH of 3,8 to 3,9 in all the products therefore one should not be suprised that deteriorations are found. The acidity degree may be corrected by the addition of an acid in cases where the product permits. In all cases the can should be turned over immediately after closing to secure the pasteurisation of the cover.

It is very important to esteblish that the minimum temperature will be observed in a constant and permanent way. It is sufficient that the temperature of the product will be lowered for some minutes in order to have a deterioration in the cans filled at this temperature. For this, firstly the control instruments, which are out of use, should be in working order and, the most important thing, they should be used.

The actual system in which the temperature is determined by the touch of the hand is not acceptable and does not insure against deterioration (no thermometer is functioning in the factory); the valve (Flow Diversion Valve), insuring the automatic return to the storage tank of the products which have not been correctly treated by heat, should be repaired.

In all cases whenever there is a breakdown and stoppage in the production, the cans on the way to the closing machines should be emptied because of the cooling of the product in these cans.

In the factory there exists another type of deterioration of the products, but for some reason, it is not considered as deterioration or is completely ignored. Among the cans which we have examined in the store of the finished products we didn't find cans having a vaccum in the can. The vaccum in the cans is vital for the storage duration of the products, in particular under the climatic conditions of Mali.

The presence of air in the cans causes oxidation of the tin covering the plate and later the oxidation of the steel of the plate itself. The corrosion, in time causes the perforation of the can and the dripping of the products. The attacked tin and iron are dissolved in the products and might become dangerous from the point of view of poisoning if their concentration becomes high enough.

To secure the presence of a vaccum in the cans, attention should be paid to filling the cans at a regular and correct speed at a temperature not lower than 80°C at the moment of closing the can. An apparatus for vaccum measuring in the cans is not available in the plant and should be purchased.

7.5.6. <u>The method for closing the cans</u>

The juice filling machine and the closing existing in the plant are not in working order and these machines should be immediately replaced as they cannot ensure the correct filling and closing.

Also, after changing the machines, their correct adjustment should be secured by the periodical examination, each hour, of the closing heads.

In the factory there is an instruction manual in Yugoslav explaining precisely the correct adjustment methods. At the factory there are persons who understand Yugoslav, the machine instruction manual should be therefore utilized to put the machines in order by exactly following the instructions. In order to secure the satisfactory results a special micrometer, for measuring the quality of the closing, should be purchased.

7.5.7. Cooling of the cans after closing

At present, after closing the cans are placed in baskets which are introduced into basins for the sterilization and cooling. If the factory decides to follow the recommendations of this report, there will not be a need for a complementary sterilization of the products, with the exception of the tomato concentrate, and it appears that it will be possible to cool all other products after closing the cans.

It is recommended to install a conveyor belt for the cans that will enable their transportation while turning on their axis and even to spray them with water while in movement.

Because of the big number of cans sizes, we do not recommend, at this stage, to install special cooling equipment and it might be possible to continue to cool the cans in the cooling baths, but it should be ensured that the cooling water will contain 4 to 5 PPM of free chlorine. It is desirable to wash the cooled cans, after finishing the cooling, with water not containing free chlorine in order to eliminate the chlorine residues and avoid corrosion.

8. QUALITY CONTROL

8.1. The concept of quality control in the accepted sense in the industry does not exist in the SOCOMA factory and should be introduced as soon as possible. It has been already stated that the factory's laboratory has suitable equipment but, in great part, no in a working state because of the lack of spare parts. The director of the laboratory was not present at the time of the visit and our impression is that this laboratory does not execute the current work of quality control. In our view the missing parts of the equipment which prevent the laboratory's functioning should be completed immediately. More electrode couples for the pH meter, 2 or 3 vaccum measuring apparatus, an apparatus for examining the quality of the can closing and a mixer (type blender) should be purchased.

8.2. All fruit arriving at the factory should be examined for its principal properties. The examination should be made by taking a representative separate sample of each delivery and of each supplier and variety; the results should be recorded in a reception register for raw materials. These examinations are very important for the following reasons :

a) To secure the reception of fruit suitable for production.

b) To know in advance the expected results after the traneformation and, in many cases, to adapt the production method to the availeble raw materials.

c) For gathering systematic information on the properties of fruit canning from different growing regione, different varieties and for the possibility in the future to chooee the varietiee and cultivation regions which give the best reeults.

For the tomatoes, for example, a sample of the delivery should be teken and weighed. Afterwards the tomatoee can be eorted by hand operation, seperating the red and well ripen tomatoee from the green and yellow tomatoes ae well as damaged (bruised) and rotton onee.

Each group should be weighed separately in order to establish the percentage of each type of product. With time, the collected information will enable the establishment of quality standards for the reception of fruit.

From the red and ripe tomatoes of good quality, selected for the production, the juice should be pressed and examined for :

- The degree of acidity in pH
- The content in soluble solids in degree Brix
- The percentage of the acidity
- The colour

d) For the guavas and mangos, besides the problem of the colour, the procedure will be same as described above.

e) For the tamarinds, the extraction should be done in the leboretory and the percentage of the soluble products that can be obtained from dry tamarind as well as the percentage of the acidity and pH, should be defined.

f) In annex No. 5, attached hereto, a formula for the examination of the quality of the fruit delivered to the factory, is presented.

8.3. Quality control

8.3.1. Each two hours, at least, a person from the laboratory should pass along the production line and examine:

- the quality of the products used for the production
- the delivery speed of the fruit
- the temperature at the different heating points
- the temperature of filling cans
- the filling height
- the quality of closing the cans

- an orgenoleptic examination of the products (colour, eppearance, taste, etc...)
- the cooling temperature
- the general state of cleanliness of the working hall and the equipment

All these data should be indicated in the register of the factory with the indication of the checking hour.

In all cases of non conformity with the working standerds of the laboratory, the man in charge of work and the director of the factory should be immediately notified.

8.3.2. From each batch of the final products, ready for filling in the cans, samples should be taken to the laboratory and only after the approval by the laboratory the filling of the cans will proceed. For each product the parameters that should be examined should be fixed. For example for the tomato concentrate the following parameters should be estebliehed :

- The colour
- The viscosity
- The degree Brix
- The acidity
- The pH

The results of the examinations should be indicated in the register and in cases where these results do not correspond to the standards, the laboratory should stop the filling operation and give the necessary instructions for the improvement of this batch (addition of acids, sugar, etc...) or to treat this portion again or to destroy it if it is not worth treating.

Each batch should have a number and this number should be engraved on the cover of the corresponding cans. In the factory a lid engraving machine is available, but not utilized. The indication of the batch number on the lid will permit checking of the final products before and after their delivery.

From each batch two cans should be brought to the laboratory for 10 days examination before authorizing the sale of this batch.

These instructions are very important in order to produce products of good quality, uniformity in quality and to avoid losses.

These instructions are essential and should be carried out during the work and implemented in accordance with local conditions.

9. COST OF PRODUCTION

According to the element of the cost of production which we received for the ready-to-drink beverages and, in reference only to the direct costs of production, comprising the cost of the fruit, the packaging, the work and the additional ingredients added to the final product, the following results are obtained :

- The fruit constitues between 3.3 to 4.7% of the direct coste of the final products
- the packaging, 62.4 to 81%
- the addition of suger and acid, 9.5 to 18.7%
- the labour, 4.6 to 5.9%.

For the tomato concentrate the results are different :

- the fruit constitutes 60% of the direct coste
- the packaging, 38% and
- the work, 2.4%.

From these figures we conclude that the efforte to reduce the production costs should be concentrated on the following factors :

- reduce the cost of the packaging materials
- make better use of the fruite
- increase productivity to reduce the number of hours of work and the relative overhead expenses per production unit.

The labour is not an important fector in the total cost and according to the informations given by reeponsible personnel of the factory, the high cost of the packaging materiale derives principally from the taxes imposed on the raw materiale for the manufacturing of cans, cartons and labels.

It should therefore be recommended to the government of Mali to reduce the import taxes on the auxiliary products necessary for this industry for a period of atleast a few years until the factory completes its running-in period.

Another possibility will be to make efforts to export the factory's products and to refund to the factory the part paid as import taxes.

10. THE UTILIZATION OF BOTTLES INSTEAD OF CANS OF TINNED PLATE

10.1. Because of the important fector of the packaging matariels in the total coat of tha products, we find it necessary to indicete the poesibility of replacing tha tin plated cans by glass bottles for the baveragas from tamarind, guava and mango for tha local market.

In eddition to the desira to economise on the coat of packaging there is another edvantaga in packaging thasa producta in bottles, specially undar Mali climatic conditions. Evan undar the best vaccum conditione, in the cans, undar Mali climatic conditions with e temperatura of 40°C in summer, tha procass of tha etteck on tha tinnad iron plate is rapid; this influences much the lifa duration of the product, its taste and its quality. In glass containers thia problem does not axist.

10.1.1. In Bamako different entreprisas supply carbonated bevaragas in glass bottlas. We judged that an examination of the conditions in thesa factoriea would be justified and we visited the "SOMALIBRA" factory, which is the biggest in Bamako.

This factory used aach bottle atleast 8 times. A bottle having a content corresponding to e 500 gr can, will cost tha factory about 80 to 90 F. Malien while the cost of the can is 25 F. Malien.

If a bottle can ba utilized 8 times, the coat of its utilization varias between 8 to 12 F Malien. At first sight this rasult seems very intaresting and, in our opinion, this point should be examined in greatar depth.

In Ghana there is e bottles factory and it might result that this factory can supply the bottles at e better price than that indicatad above for bottles imported from Belgium.

If this recommendation is approved, we suggest the establishment of a line for filling the bottles in addition to the line for filling the cans of tinned plate. This line will have a production capacity of 3,000 bottles per hour and will be able to work with bottles from 200 cc up to 1 liter and will be composed of the following equipment :

- a machine for washing bottles
- a semi-automatic machine for filling bottles
- a semi-automatic machine for closing bottles
- a conveyor for cooling bottles
- a semi-automatic machine for labelling, if the bottles cannot be printed.

There is no need to construct a special building for this installation which might be installed in the finished products store.

We presume that if the recommendations made in this report are executed we may expect that damage in the final products will be obviated and that there will be no need for a "quarantine" period, as it is called to-day by the factory's personnel, which serves at present as an intermediate storage for the finished products before being send to the stores of Bamako.

11. CONCLUSIONS

11.1. In this chapter we summarize our recommendations contained in preceding chepters. In spite of the lack of success of the entreprise during its years of existence and in spite of its bad condition from the stand point of the technological and financial organisation, we recommend that efforts be made to enable this entreprise to achieve efficient operation to improve its products, reduce the cost of production, increase its production capacity and, as a consequence, also its profitability.

11.2. The factory's problems might be summarized under three headings :

a) lack of essential production means

b) lack of experience and tradition in the management of industriel operations and the lack of sufficient technological know-how

c) lack of ability to implement, in the daily routines, the technological principles which are known to the factory's personnel.

11.2.1. The production means which are missing, in their order of importance and that should be purchased (see annex No. 6) are :

a) A can filling and closing machine should be purchased immediately if the production operation are to continue in the factory. If the packing in bottles is to be done, there will be no need for a new filling machine.

b) Secure a sufficient stock of spare parts to permit the functioning of all the existing equipment in a correct way. This remark is particularly directed to the entire can manufacturing system, the general production system and the laboratory.

c) Purchase of a steam gun, chlorinator, a washing machine for the empty cans and equipment necessary to secure the hygienic conditions in the factory.

d) Install two tanks in each place where juices are to be etored and install a conveyor for sorting dry tomatoee before reaching the waehing machine.

e) Purchase of a centrifuge and a pulping machine for changing the production method of tamarind.

f) Install the necessary facilities and equipment for the removal of the drainage water and wastee.

11.3. We recommend engaging :

a) An experienced agronomiet for the cultivation of tomatoes at the government farm, for a period of atleast 2 yeare. Thie agronomist will be employed principally as an instructor.

b) An expert in management of a canning plant for fruit and other food products for a period of atleaet 2 yeare, in order to work in the factory. This expert should be also experienced in organieation and food technology and in particular for fruit and vegetables. This expert should be given all the necessary executive power in order to enable him to introduce modern working methode and to instruct the factory's personnel.

11.4. We recommend collaboration with an institut for food technology that might supervise the activity of thie factory and give technological help to solve the problems of the Malien entreprise.

Research work might also be directed to the development of new products.

11.5. We recommend that preciee instructione for the daily routine ehould be prepared and printed for the pereonnel of the factory and that they be carried out as soon as poesible as aleo the instructions and the recommendatione presented in this report concerning different production methods and proceduree.

11.6. In our opinion it could be very important to find a formula for friendly collaboration between SOCOMA and an entreprise which has already succeeded in one of the developing countries.

The more advanced entreprise might help the Malien entreprise by supplying the experience and know-how. On the other hand, this entreprise might eventually receive raw materials from Mali in order to diversify its production as well as to collaborate in the introduction of new products in its home market.

12. ANNEXES

Annex No. 1

LIST OF PRODUCTS PROCESSED BY SOCOMA

Product	Packaging
Tomato concentrate	1 kg
" "	500 gr
" "	110 gr
Tamarind juice	500 gr
" "	200 gr
" syrup	650 cl(bottles)
Mango juice	1 kg
" "	200 gr
" concentrate	5 kg
" paste	5 kg
Guava juice	500 gr
" "	200 gr

Annexe No. 2

LIST OF PERSONS AND INSTITUTS INTERROGATED DURING THE STUDY

1. Mr. Brown - SETEMAC Jean Company, Dakar
2. Mrs. Basse - Director of the Institute for Food Technology, Dakar
3. Mr. Furia - Institute for Food Technology, Dakar
4. Mr. Dumont - UNDP Permanent Representative, Bamako
5. Mr. Droesch - UNIDO expert
6. Mr. BONEU - I.L.O. expert
7. Mr. Dramone Traoré - Deputy Director of the State Entreprise, Bamako
8. Mr. Kader Traoré - Director of the State Entreprise, Bamako
9. Mr. Kirilov - I.L.O. Bamako
10. Mr. Roy - Ministry of Health, Bamako
11. - The Meteorological Service, Bamako
12. Somali Beu - Factory for the manufacturing of gasified beverages, Bamako,
13. - The State Agricultural Farm at Baguinda.

Annexe No. 3

MONTHLY DISTRIBUTION OF MANUFACTURE OF DIFFERENT PRODUCTS AT SOCOMA

Months	Tomatoes	Tamarinds	Mangoes	Guavas
January				
February	x			
March	x			
April	x	x	x	
May		x	x	
June		x	x	
July		x		x
August		x		x
September		x		x
October		x		
November		x		
December		x		

Annexe No. 4

CLIMATIC CONDITIONS OF BAGUINDA

(Ref: Meteorological station, Remako)

Months	Mean Temperatures		Average rainfall	
	Minimum	Maximum	mm	raining days
January	12.7	37.5	-	-
February	14.7	40.3	0.4	0.1
March	19.0	41.8	10.8	1.4
April	19.0	42.5	8.5	2.0
May	21.6	42.8	40.0	4.9
June	19.5	39.5	141.1	10.7
July	19.2	36.7	239.4	13.8
August	20.4	33.7	296.2	16.6
September	19.8	35.6	204.3	15.3
October	16.0	37.6	50.5	5.7
November	11.9	37.3	5.5	0.4
December	11.9	37.4	2.6	0.2

The average rainfall for the last 10 years was 999,2 mm on 71 raining days.

Annex No. 5

FORMULA FOR THE CONTROL OF FRUIT DELIVERED TO THE FACTORY

Date .....

No.	Name of supplier	Origin	Variety	Quantity supplied (tons)	% non acceptable			Degree Brix	Acidity %	pH
					colour	rotten	Total			

Annex No. 6

LIST AND PRICE OF EQUIPMENT NECESSARY FOR THE FACTORY

(The prices are estimated in US dollars F.O.B. European port)

	Price in US $
1. Filling machine for juice in cans, by gravity	----
2. Can closing machine	6,000
3. Steam gun for cleaning the equipment	350
4. 3 stainless steel tanks with mixers having an anchor form	3,000
5. Conveyor (dry) for sorting tomatoes	1,500
6. Centrifuge	7,000
7. Finishing machine	3,500
8. Chlorinator	
9. Empty bottle washing installation	
10. 2 instruments for vaccum measuring	
11. An instrument for measuring the sealing of the cans	
12. Bottle filling installation (capacity of 3,000 bottles per hour)	
12.1. Bottle washing machine	6,000
12.2. Machine to control the washing	300
12.3. Semi-automatic filling machine	5,000
12.4. Bottle closing machine	3,000
12.5. Cooling conveyor	2,500
12.6. Transportation system by conveyors	2,500
12.7. Labelling machine (semi-automatic)	5,000
12.8. Intermediaire table	500
12.9. Two reservoirs	2,000
12.10 Sanitary pump	600
12.11 Pasteurizer	5,000

About 20% should be added to the price of the machines for the installation and connection with the electrical, water, air and steam installations.

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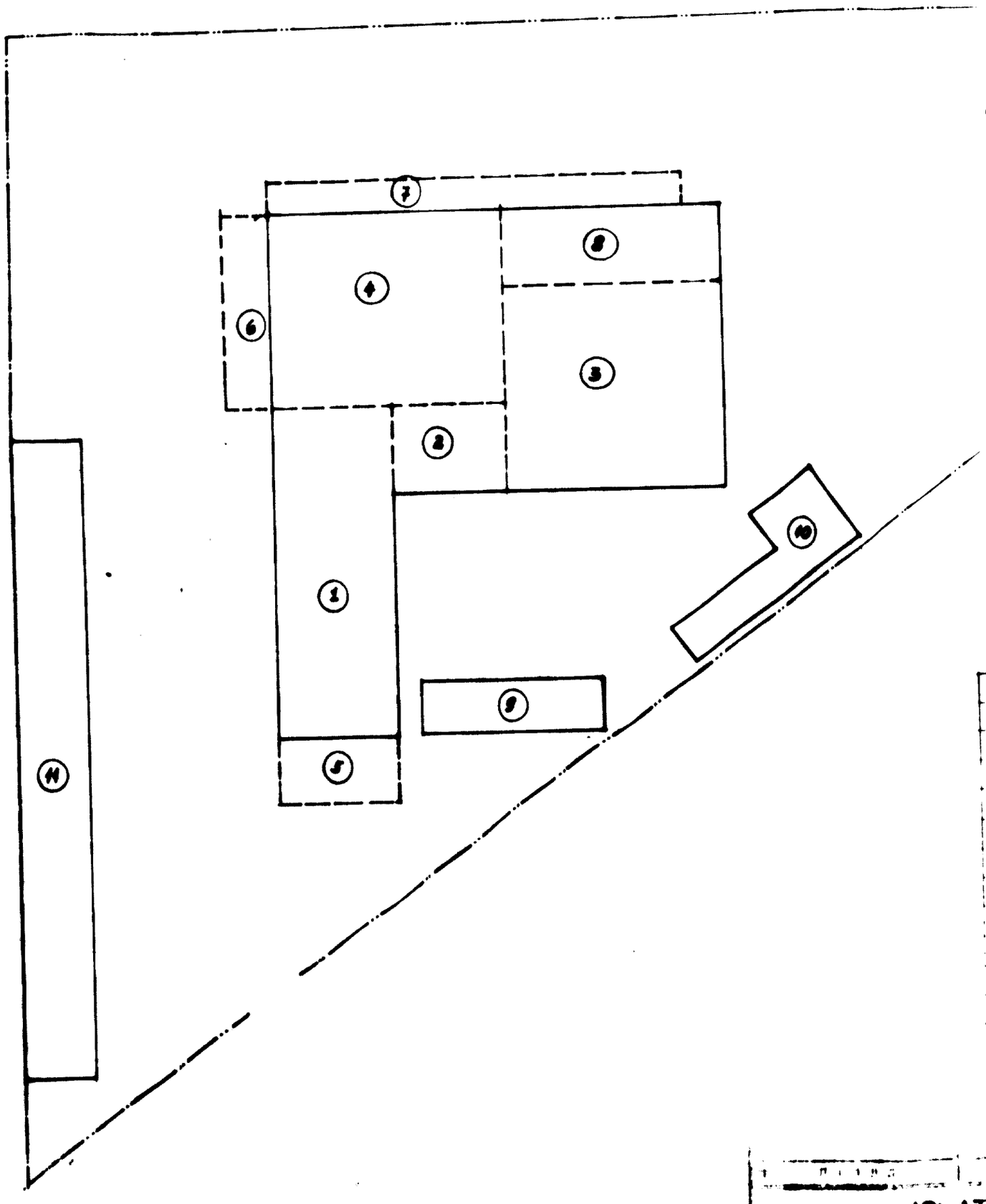
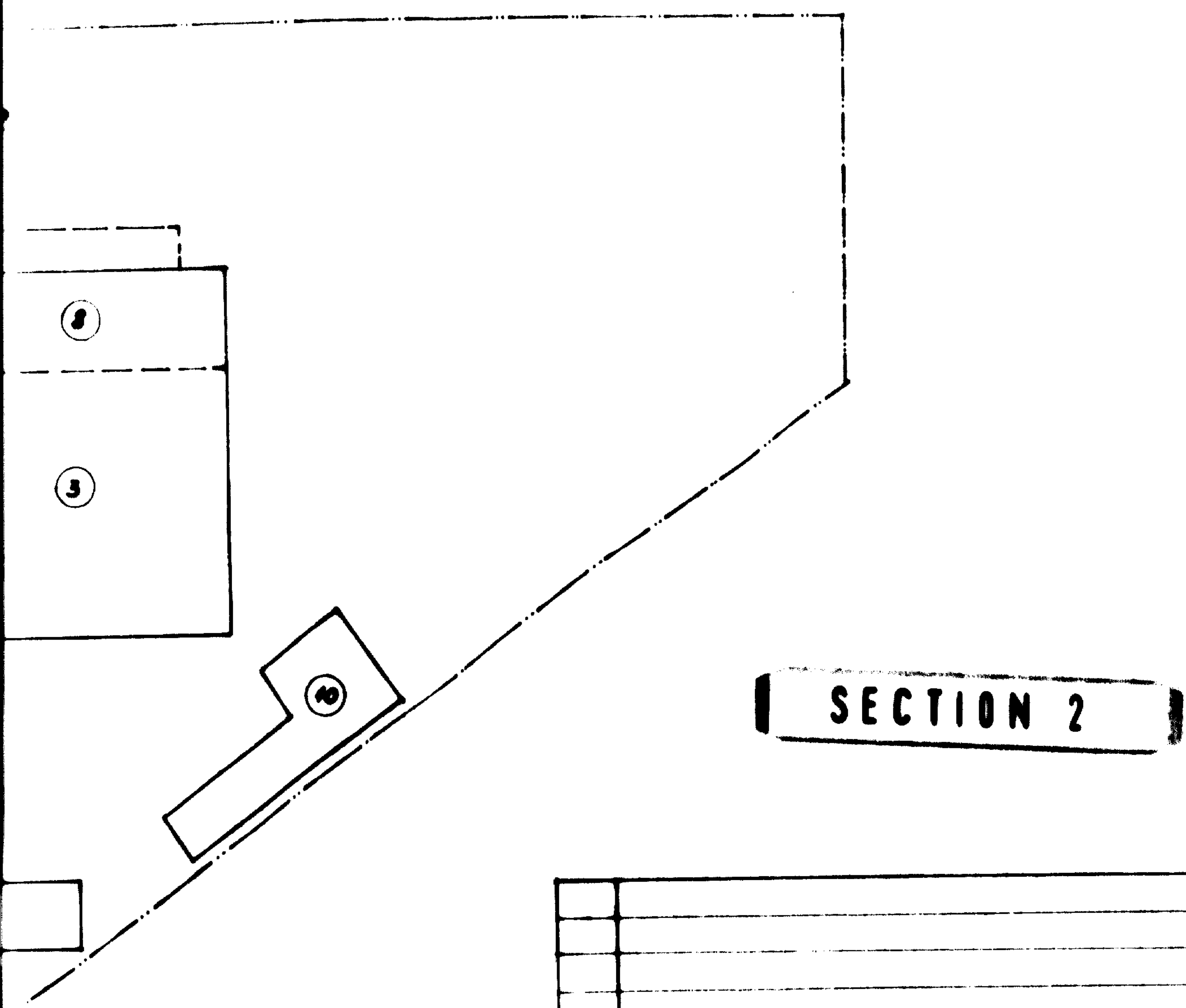


SECTION 1

ISLAT

SCALE 1:800 D.P.



11	Plant Utilities
10	Water Treatment Installation
9	Laboratory
8	Offices
7	Shed
6	Shed
5	Shed
4	Bottling Room
3	Can Manufacturing Room
2	Empty Can Storage
1	Processing Room

ISLATIN - TEL AVIV - ISRAEL

SOCOMA PLANT — BAGUINDA

Scale 1:800

Plant Area

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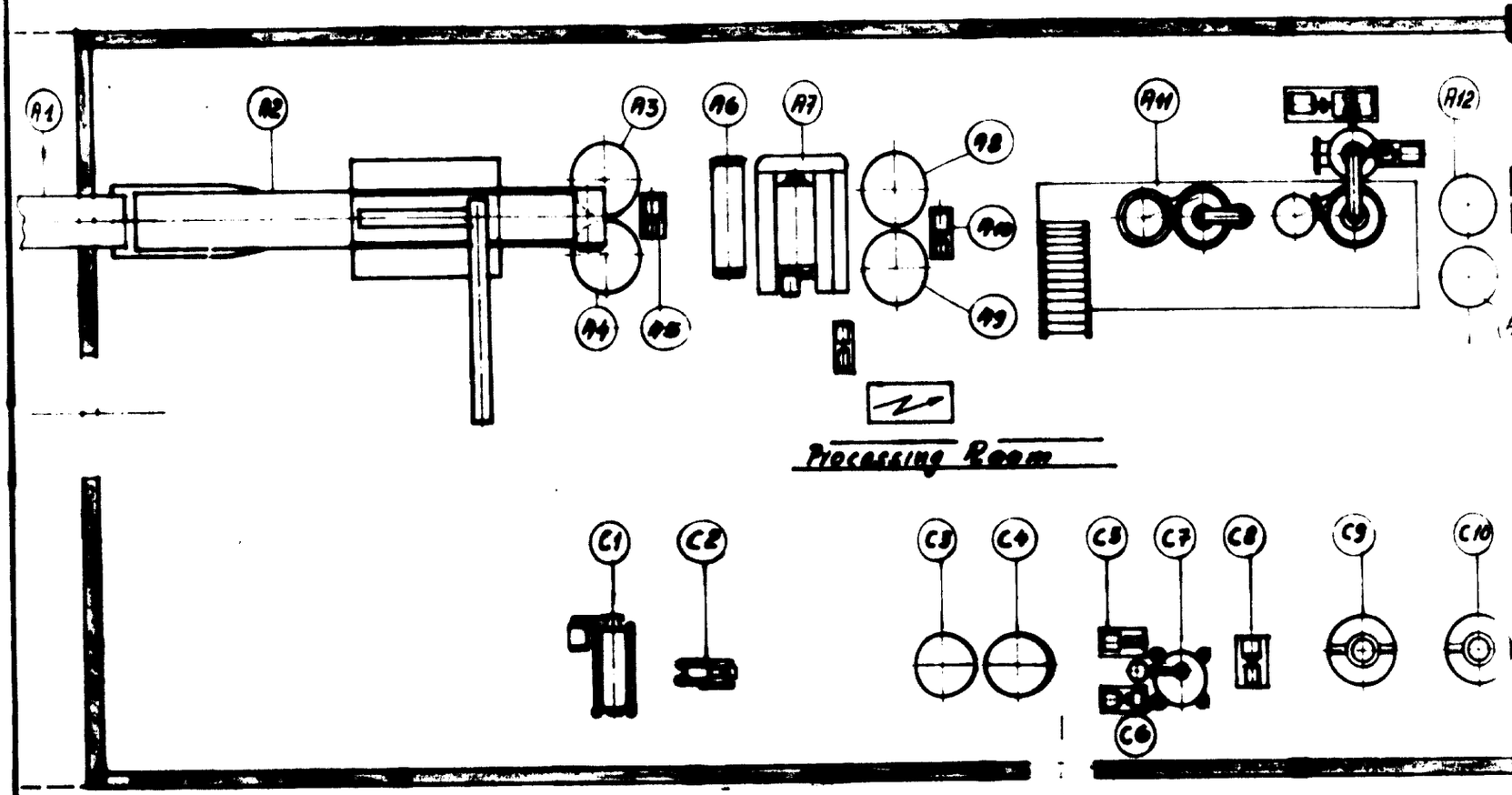
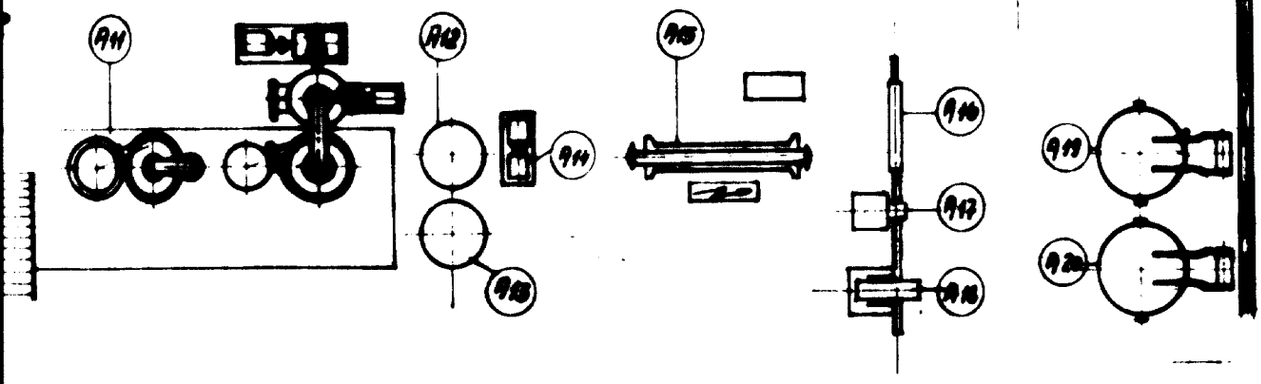
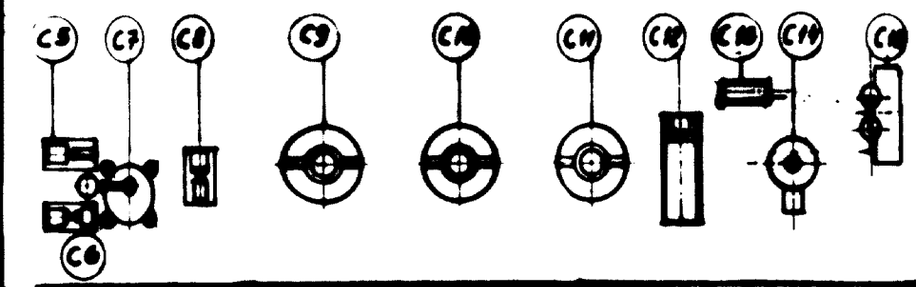
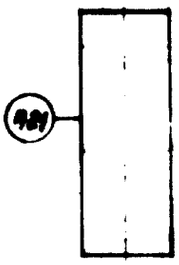


SECTION 1

		C 15	Filling Table
		C 14	Centrifuge
		C 13	Pump
		C 12	Paddle Finisher
		C 11	Cooking Pan
		C 10	Cooking Pan
		C 9	Cooking Pan
A 21	Cooling Tank	C 8	Pump
A 20	Autoclave	C 7	Deaerator
A 19	Autoclave	C 6	Pump
A 18	Can Steamer	C 5	Pump
A 17	Can Filler	C 4	Tank
A 16	Can Washer	C 3	Tank
A 15	Pasteurizer	C 2	Pump
A 14	Pump	C 1	Pulper
A 13	Tank		
A 12	Tank		
A 11	Evaporator	B 12	Pasteurizer
A 10	Pump	B 11	Pump





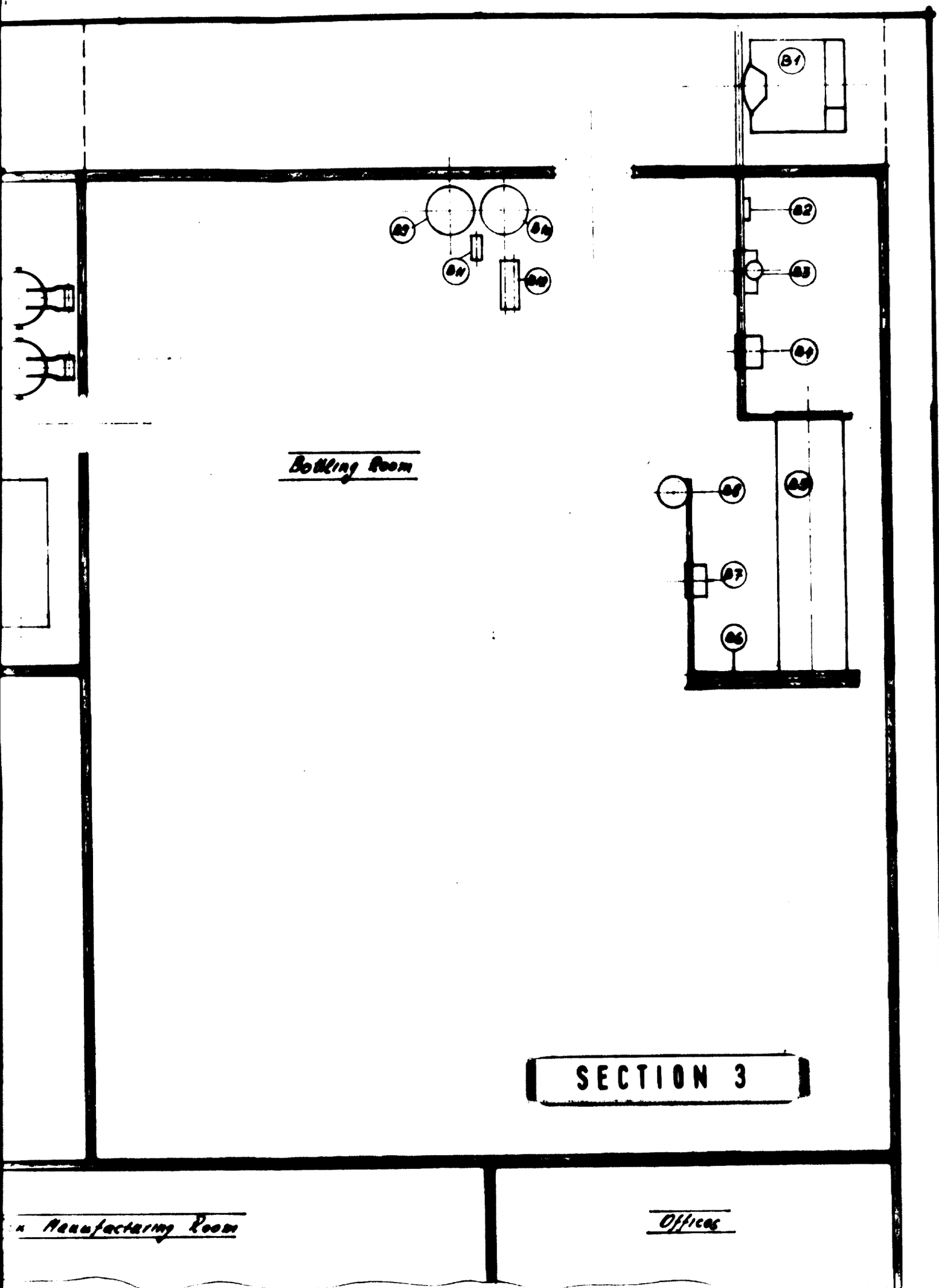


Bottl

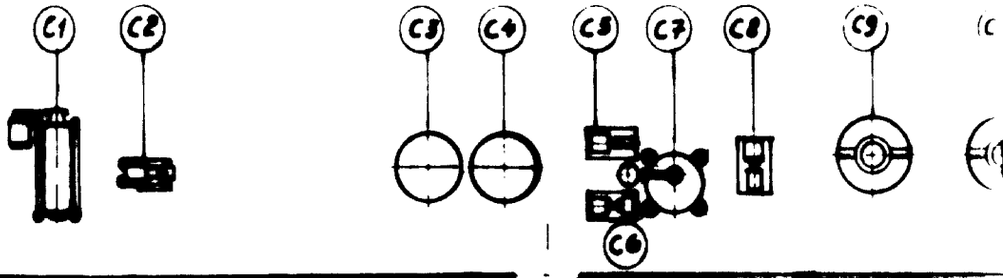
Empty can storage

SECTION 2

Can Manufacturing Room

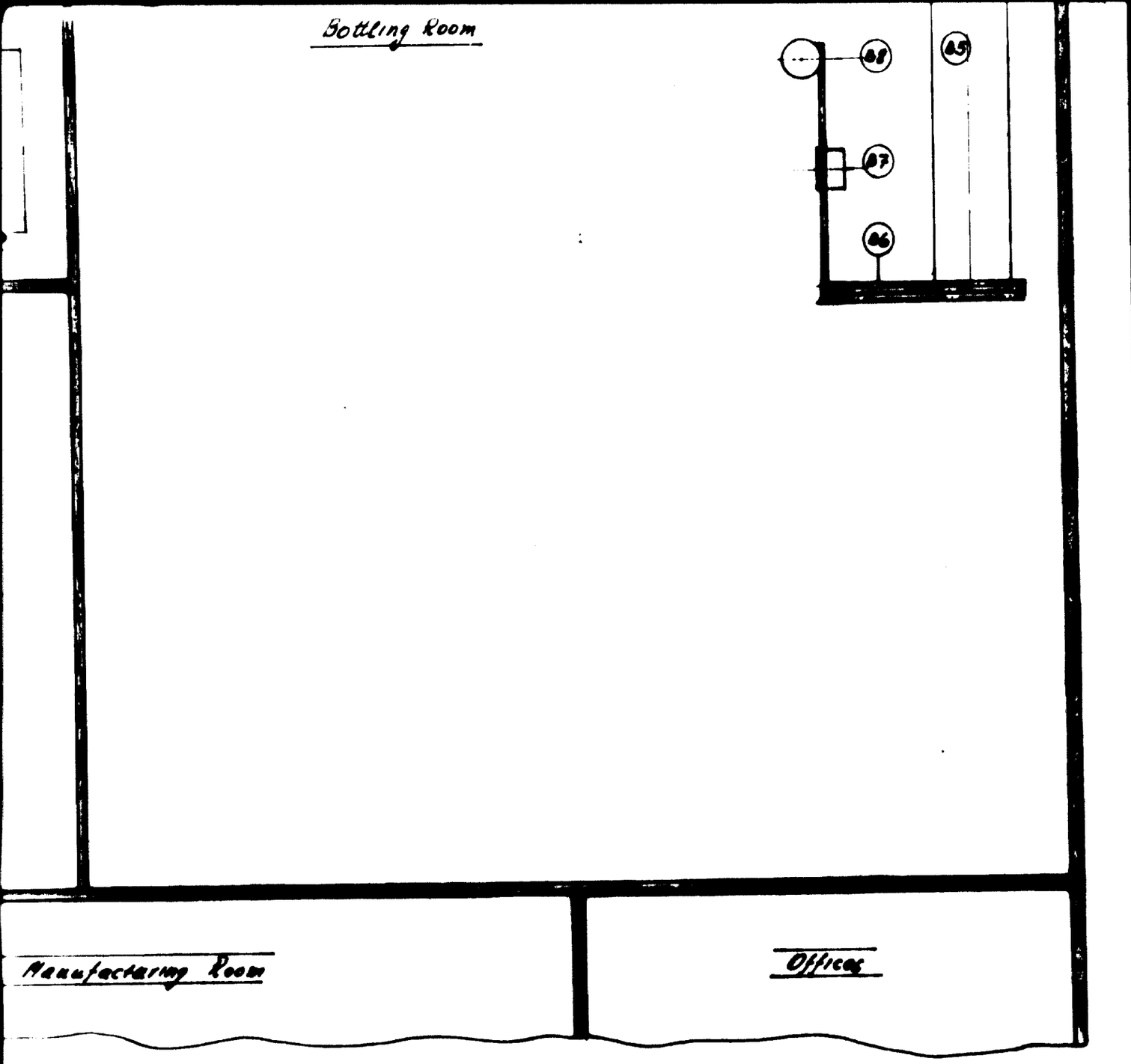

B1
B2
B3
B4
B5
B6
B7
B8
B9
B10
Bottling Room
SECTION 3
Manufacturing Room
Offices

Processing Room



		C 15	Filling Table
		C 14	Centrifuge
		C 13	Pump
		C 12	Paddle Flanker
		C 11	Cooking Pan
		C 10	Cooking Pan
		C 9	Cooking Pan
A 21	Cooling Tank	C 8	Pump
A 20	Autoclave	C 7	Deaerator
A 19	Autoclave	C 6	Pump
A 18	Can Seamer	C 5	Pump
A 17	Can Filler	C 4	Tank
A 16	Can Washer	C 3	Tank
A 15	Pasteurizer	C 2	Pump
A 14	Pump	C 1	Pulper
A 13	Tank		
A 12	Tank		
A 11	Evaporator	B 12	Pasteurizer
A 10	Pump	B 11	Pump
A 9	Tank	B 10	Blending Tank
A 8	Tank	B 9	Blending Tank
A 7	Pulping Unit	B 8	Accumulation Table
A 6	Preheater	B 7	Labeller
A 5	Pump	B 6	Exit Conveyor
A 4	Tank	B 5	Bottle Cooler
A 3	Tank	B 4	Bottle Capper
A 2	Washer, Sorter, Crusher	B 3	Bottle Filler
A 1	Feed and Inspection Belt	B 2	Inspection Stand
		B 1	Bottle Washer

SECTION 4



SECTION 5

ISLATIN-TEL AVIV-ISRAEL

Socoma Plant — Baguinda

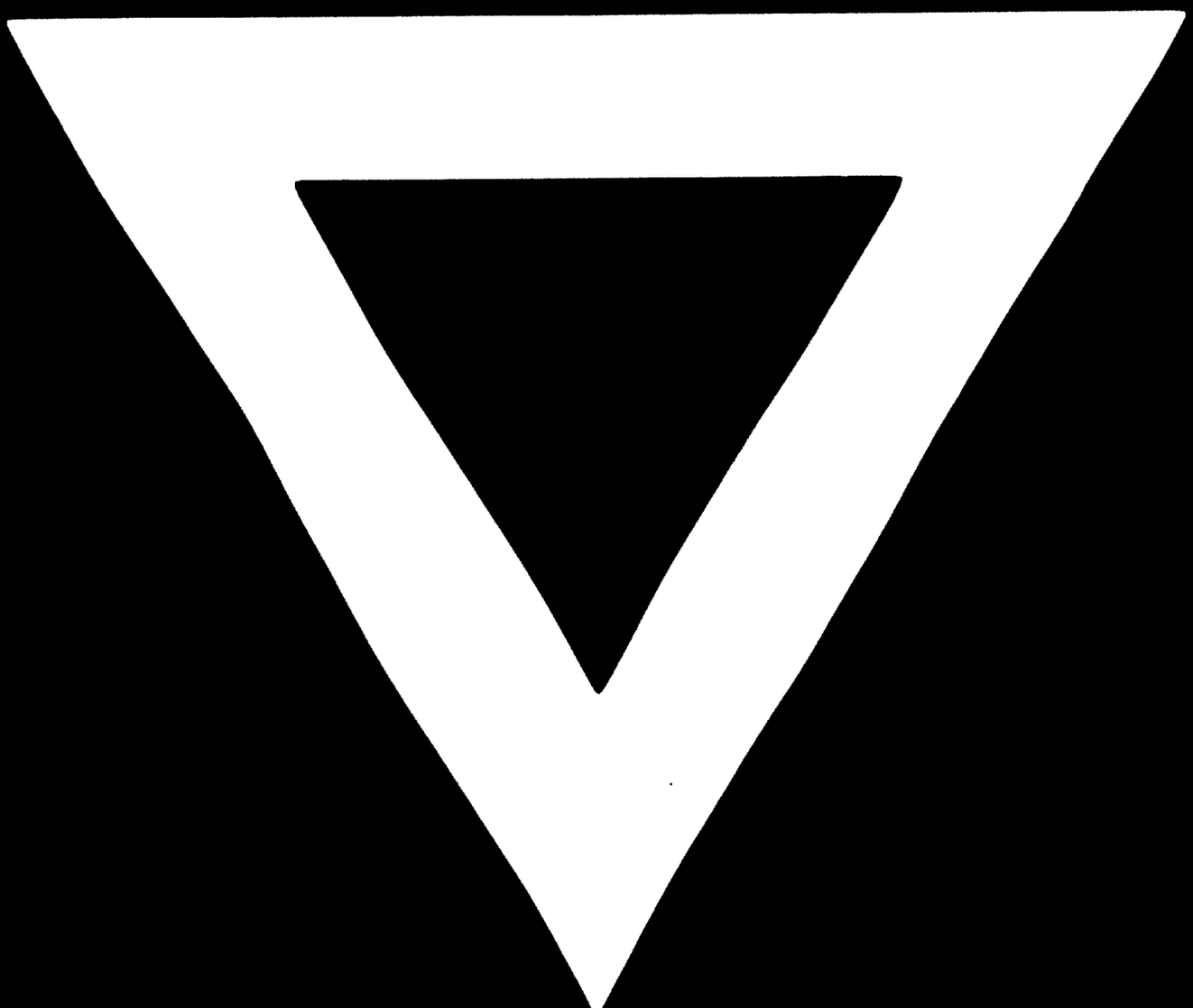
1:100

Recommended Plant Layout

by J.D. Moser

2827/2

C-369



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