THE UNIVERSITY (A.B.U.) CLINIC EXTENSION

A THESIS SUBMITTED TO THE DEPARTMENT OF ARCHITECTURE

FACULTY OF ENVIRONMENTAL DESIGN,

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IN ARCHITECTURE.

BY

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DEDICATED TO

DAD, MAY HIS SOUL REST IN

PERFECT PEACE.

INTRODUCTION.

A most common occurrence in urban architecture is renovation and extension of existing structures. Very rarely do conditions permit complete the demolition of structures.

Sometimes this renovative approach fails. A times it wins architectural acclaims. Whatever way it presents itself, it is an area which is agreed to be a most difficult one.

The practicality of this problem is a major motivation to me.

The wish to not only to contribute to improving the health of mankind, but further investigating why hospital architects cannot keep pace with the medical scientist is another moving force.

How does an existing hospital respond to a drastic scientific development? For instance, if there is some improvement in X - Ray development that produces portable X-Ray units, what use will the space now being used for the X-Ray be? How much expense will it involve before the hospital management adjust to this development?

The choice of this topic presents an even more serious limitation. It is a peculiarity to itself. In the first place there is the limitation if the existing structure and the site. Secondly the surrounding structures; all the elements affecting the site are present e.g. the students hostel.

Thirdly, the services, it is meant to render; not being specialist, nor a general hospital, but requiring highly skilled manpower.

These problems and the constraints within which one has to operate must be appreciated.

I approach this problem not from only one conceptual perspective but infact from three angles. I will tag the three conceptual appraeches simply.

1. Phylosophicall approach.
2. Analytical "
3. Renovative "

I will briefly touch each concept.

1. In 1935 Sir Owan Williams proposed the family clinic in London. This clinic was in operation between 1935 and 1941. It was Sir Owan William's idea that illness or sickness could be more easily cured if handled from the grassroot. The grassroot here was the family. "Psychotherapy involving the whole family present on consultation eases tension and removes doubt" maintained Dr. Owens.

He proposed what he called "periodic overhauls" and provided social amenities for the families both young and old. The form not only took care of the ill but provided **recreation,** therefore tailing the health of the society. The complexity and combersomeness of this concept do not only constitute a problem here but it is impossible in a society where people do not see their doctors until they become critically ill. Moreso, it could only work in a small and homogenors community. It is obviously impossible for a doctor who has to see a hundred patients in three hours to operate a family based clinic.

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Consequently any phylosophical concept is bound to meet with unsurmountable problems.

An analytical concept involves exhaustive analysis of the existing system taking into consideration the social, history, demography, site, the existing structures as well as the administration on of the present system and, therefrom,, suggesting an ideal workable system. Analysis is purely an accademic exercise involving not necessarily any structural suggestion. Though this is an academic exercise, it must be borne in mind that it is a design thesis.

3. RENOVATIVE conceptual process involves purely adding new things after making a list of corrigenda.

In an academic exercise, of this nature, a combination of two or more concepts will be more easily applicable and in fact more workable.

I have adopted a method of analysis designed to guide me in my decisions about the future utilization of the existing building to be followed by modernization of certain parts and to justify which aspects need modernization. This will enable me know how much space will be needed.

As with most expansion problems, there are many other questions relating to the stated issue:

What are the existing space deficiencies.

What are the space needs for expanded programme?

What is the best directions for growth?

How much more land is needed?

Can existing equipment be contined in use?

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Would it be better to move to a new location?

How can the clinic operate during expansion?

What will it cost?

Before these questions could be answered, the essential facts about the existing physical plan was ascertained,, including the amount of land, the age and size of the buildings, the adequancy of plan arrangemnt, and of fine and safety provisions.

The tools for evaluations were not easily available, however, but had to be panisistakingly obtained through the Estate Department, a number of consultants and other staffs at different choices and a number of other university authorities. Information obtained include:

- A site plan or land use map in the campus.
- Scale floor plans of buildings
- The existing use of space by departments
- Ages of buildings
- Condition of buildings by inspection
- Opinion on functioning or departments
- Criteria for evaluation
- Fire and safety reports

After assembling this information, it was possible to start on the evaluation.

A survey of the community needs and long-range plan having established programmes and, to some extent, the expansion potentials; also some elementary schematic planning done, and, it is being expected that more and more planning and evaluation of equipment will follow this study of salvage possibilities if it is to be bought.

A thesis programme is more than just solving design problems. It Involves, as it were, probing into architecture, sicences, engineering, sociology or even the arts; carrying out an experiment and trying to integrate or add something to the development of mankind. To quote Dr. Albert Ikoun "A thesis without an experiment or investigation might as well be called a project."

An experiment does not have to be positive as it is well known, but it if logically carried out, it is a success.

My investigation in this study carried me into the realms of solar energy. How much if this raw energy abounds around us! But apart from a few uses, like drying out clothes, foods and other necessaries that need little or no effort of our own this energy is a nuisance to us.

But even in the temperate regions where there is not more than one-third of what we have in the tropics, attempts have been made and are being made to harness this energy.

It is not an easy task harvesting this energy, since it is as diffused as it is large. It involves highly scientific methods to obtain a reasonable success. This, most certainly explains why we have also been left behind. But a future awaits us in this field. And I am hoping that our scientists will soon develop a method of tapping, concentrating and converting this raw energy

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into physical energies for human consumption. This is certainly going to change our aesthetics. Our architects have to react to this development.

I am reacting to this, by assuming that we have already achieved some degree of development.

My investigation is, as it relates to hospital planning, in the tropics. I hope this utopian thought has made this work a thesis.

S Y N O P S I S.

This programme was approached by defining the problems. To enable me handle the problem definition fairly well, two metaphores were used :-

1. Social architecture.
2. Physical architecture.

SOCIAL ARCHITECTURE.

The design of hospitals is a most delicate one. It does not only deal with a large number of people but it deals with that section of the populace who are most sensitive to environmental condition, who are least resistant to unpleasant environment.

In proposing the design, therefore, the users Needs are of paramount importance. Therefore, the users' reactions and responses were found and, by projection their needs were also listed. It is from here that possible solutions and suggestions are made.

The clinic does not affect the patients, the doctors, nurses and other paramedicals and those working thereunder. Only, but affects even the passers-by and those working and/or living around. All these were taken into account the inconveniences the users, as well as the administration, suffer as a result of locating departments on different sites was borne. It will require less expenditure and manpower if the clinic serves under one roof. Working on an uptimum size the satelitès have been brought in and essentials have been added having determined the users need.

11. The physical architecture

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11. The physical architecture

This affects mainly, the site. A decision had to be made on whether to choose a new site or work on the existing site. On first hand it appeared as if the existing site was rather tight, but since the campus planning authorities have designated that space; it's the architect's responsibility to meet up with the challenge.

The Topography, the encompassing roads, as well as the surrounding buildings were a physical problem to handle. The existing structures is a most important physical problem.

To enhance a careful inspection of the hospital's physical plant and a review of the existing space use, a long-range plan was done.

1. They include Estimation of the community needs and resources.
2. Preparation of a functional programme for the hospital.
3. Analysis of existing floor areas
4. Calculation of deficiensies in size.
5. Evaluation of existing buildings
6. Determination of site potentials
7. Preparation of the long range plan in stages
8. Determination of building replacement
9. Preparation of architectural programme and schematic plans
10. Preparation of detailed design development bids.
11. Preparation of construction documents and taking of Other problems were also thought about incase this work is over considered for construction
12. Remove selected vacated buildings
13. Complete site work and equipment

14. Occupy the expanded clinic .

The objective of this long-range plan was to establish a programme for expansion of the clinic to meet the community, needs and to provide for the expanding services of its immediate staff. The functional programme and the suggested scheme are prerequisites for the detailed architectural programmes developed if actual constructions are to be authorised. The long - range plan would aid in coordinating interim alterations and uitility extensions and would serve as a guide for land use. The report includes among other things, the following:

1. A functional analysis of existing buildings and review of programme elements, departmental space allocations, and general circulation.
2. A physical survey of existing buildings relating to materials, methods of construction, code compliance, structure, and condition and capacity of mechanical and electrical systems.
3. A projection of departmental space requirements in three stages each self-sufficient in as much as functionally possible.
4. Schematic plans of buildings, additions and alternations, showing the general flow patterns of goods and persons.
5. A programme for the necessary expansion for the mechanical and electrical facilities
6. A site - development study, showing land utilization, parking requirements and recommendations for land use patterns.

.../...

7. A programme on the solar energy theory and subsequent conversion into useful heat energy for human consumption.

This, therefore, is the brief of the work done during the carrying out of the programme.

A brief history of the university is traced and, after which a careful analysis of the existing system is looked into. New concepts and new proposals are also suggested.

ACKNOWLEDGEMENT.

My most profound gratitude to my brother, Mr. Ajayi Ikubehinje, for his moral, material and financial support all the time; my mother, for her patience; Prof. E.A. Adeyemi for stepping in the last minute and making this work what it is; Dr. Albert Ikomi for giving me a sense of direction in this profession; Mr. O. Solanke for his professional advice and encouragement; my studio mates (Samuel Kana, Asabugu Rufus, Oswande Shonekan, Bunmi Asami, Biodun Imana, Tonye Braide and Kola Olusola) for the obvious positive contributions they all made to this thesis; my American friends, Mr. R.G. Lortscher and his family, for stepping into my life at a most crucial time; and to all my friends and well - wishers whose names there is no enough space here to mention but who took no less important part in making this work and life what is now for me.

Above all, thanks to the Almighty.

ADEDOTUN ADEKUNLE ≤ THOMAS

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CHAPTER ONE.

BRIEF HISTORY OF ABU.

1.1 The University was named after the late Alhaji Sir Ahmadu Bello (1910–1966), Sardauna of Sokoto and the premier of the then Northern Nigeria. Sir Ahmadu Bello was the first chancellor of the University and performed the opening ceremony on October 4 1962.

Today the University embraces a large number of faculties, institutes, a Division of Agricultural and Livestock services Trainig, Colleges and other units. These institutions have spread from the main campus at Samaru to many parts of the Northern States. The university opened with just over 400 students in October 1962 from the day when the first 400 students registered, the watch-ward was expansion it was expected that there would be 1,200 and 1,500 undergraduates by 1968 and that ultimately the whole student population would reach 4,000 to 5,000. By 1968, however, there were already 1,600 undergraduates in Zaria and 243 in Kano.

There are now on its different campuses more than 20 times the number of students originally registered in the university 18 years ago.

The University has had the inevitable problems of rapid development; and national events, such as the 1966 crisis and the war period affected progress in some measure. Nevertheless, the original university planners and the Northern States at large have something to be proud of today.

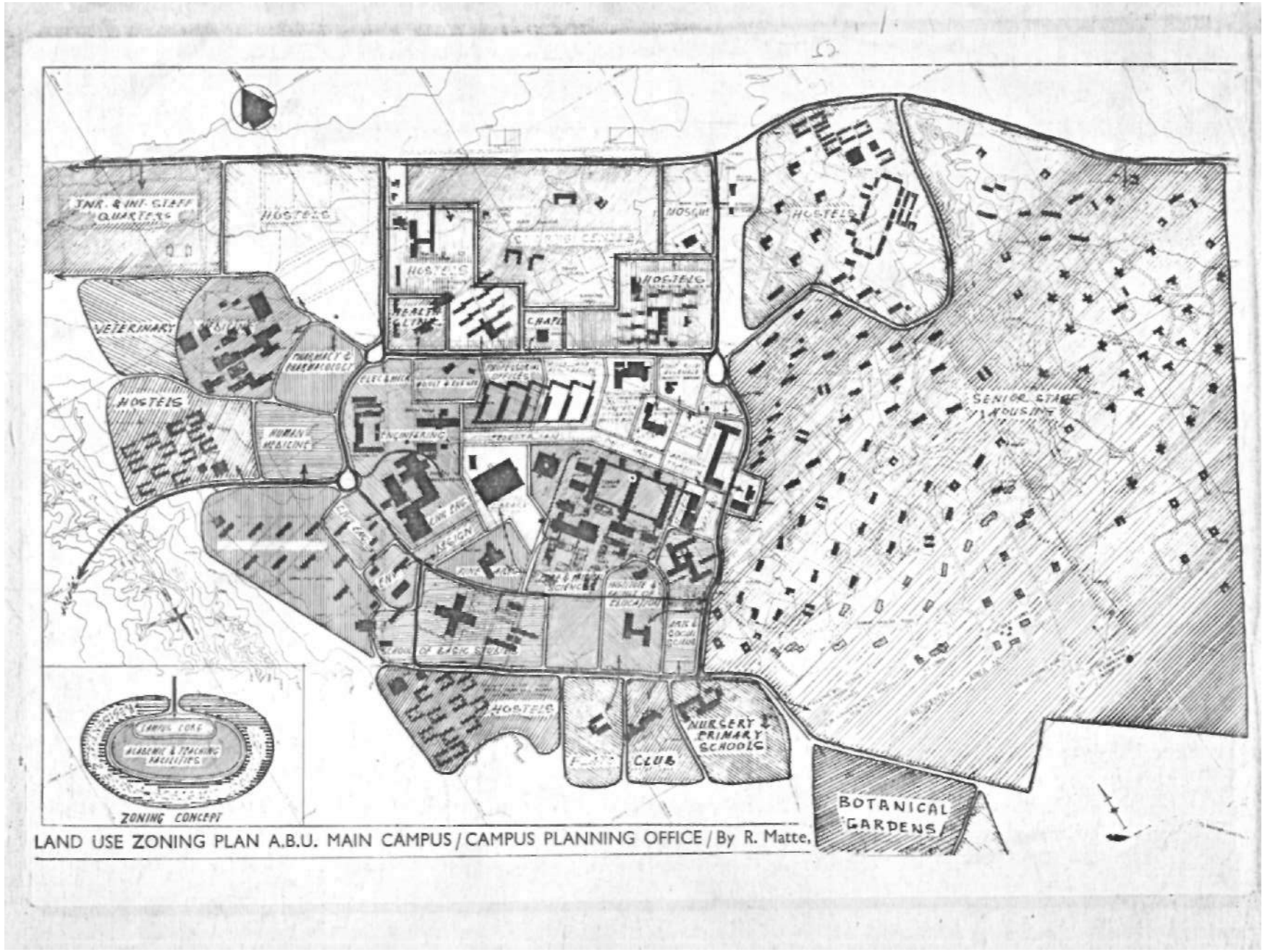
Since its inception in 1962 Ahmadu Bello University has developed at a remarkable pace. From the initial student population of 400 in 1962, it now has responsibility for just under 7,500 students on the main campus.

The 1964 calender lists 257 senior staff; there are now just under 2,000 senior staff.

There are about 8,000 intermidiate and Junior staff.

The actual limit cannot rightly be predicted, but for the purpose of this work an uptimum size is being suggested. A student population of 10,000 is estimated. And a senior staff population of 5,000 is suggested while that of the intermediate and junior staff is to be 10,000. Both staff and their families will give an estimated figure of 90,000 (5,000 x 6 + 10 = 600). The total students, and staff and their families will give a population of about this 100,000.

This figure is expected to be reached in 1985. See figure 1.



LAND USE ZONING PLAN A.B.U. MAIN CAMPUS / CAMPUS PLANNING OFFICE / By R. Matte,

CHAPTER TWO.

2.1 THE UNIVERSITY HEALTH SERVICES.

The University provides free medical services to all its students staff and their families.

Evidently the unprecedented growth of the university has overstreched the university health services.

Each institute and college has its own clinic but for the purpose of this work we are going to limit the health services to the main campus and its immediate surrounding institute.

The clinic is a whole Department having its own Director. It is captioned 'The University Health Services'

As I have already mentioned, the university Health services have been overstreched over the years such that they have been forced to decentralise in order to cope with the teeming population.

The main clinic, the Sick Bay occupies a very strategic position; lying to the west of the students' hostel, Umar Suleiman Hall, and bounded by the road heading to the North Gate and the Amina Way. It is the heart of the campus and easily reached from any part of the campus. It's greatest asset is accessibility. However, there are now other wings :

1. Observation ward
2. Health Office
3. Dental Clinic
4. The IAR Clinic.

.../...

The Health office takes charge of the university environmental condition and Preventive Health. There is also part of the administration there, it is located on the opposite side of the Sick Bay lying along Amina Way to the West of the Sick Bay. The Dental clinic is located within the administrative part of the Umar Suleiman Hall, a students Hostel.

The IAR clinic was meant to take care of the intermediate and Junior staff of the institute of Agricultural Research. It is located within one of the intermediate and Junior staff quarters in Samaru.

The observation ward is located within the Umar Suleiman Hall.

All these segments are expected to be brought under the same complex when eventually the university clinic takes its final shape.

It is this final structure I am proposing.

At present the clinic serves about 60,000 people.

Below is the attendance records for two years.

		1976/77	1977/78
-	Students	11,600	18,520
-	Senior Staff & their families	8,800	10,230
-	Intermediate and Junior staff and their families.	23,900	27,830

The uptimum attendance is expected to be as follows :

		1985/....
-	Students	30,000
	Senior Staff + families	30,000
	Intermediate & Junior Staff and families	60,000.

CHAPTER THREE.

ANALYSIS OF THE PRESENT CLINIC ; PHYSICAL.

3.1 The clinic which is orientated along North - West South - East direction lies on a gently sloping land readily accesseble from the Amina Way. It consists mainly of two wings; the old clinic and the circular wing; which was an extension designed in 1975 by Mr. Gn zick of the Department of architecture in conjunction with the project office. The public car park is on the Amina Way entrance and there the public entrance is located. There is also a service access where the service vehicles ambulances, and Refuse Disposal trucks are parked. Here also the workers car park is located. It is approached from the North Gate Road via the Umar Suleiman Dining Hall.

The surface architecture of the complex can be called massing or plastic, being a combination of "lines" and "plains."

The 'old clinic' has a plain surface towards the main entrance being carefully curved to act both as sun and wind -shaders as well as give a pleasant aesthetics. The North-West elevation, however, describes a line surface. It is a combination of horizontal and vertical lines.

The architect was free to choose his line of architecture because he was not under any serious constraints as the site was a virgin land not having any surrounding structures.

The designer of the circular section was, however, under several constraints. There was the existing structure itself. The Umar Suleiman Hall describing a plain surface architecture. There, also was the 'round-about' of the roads meeting directly to the North-West of the site.

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The Round-about appealed most to the architect; that, perhaps, explains why he chose the circle. He, however, made his surface all line. The structure describes vertical lines.

There is also the water tank on the Eastern part of the clinic that is a combination of two independent semi-circular plain surfaces. On the whole the aesthetics of the clinic is one of the most interesting on the campus.

3.2 SOCIAL.

As already mentioned, the clinic can be divided into two parts - 'the old clinic' and the circular one (the 1975 addition that came into use in 1978?). Their operation can also be divided into two.
The circular being used as the intermediate and junior staff clinic and the old wing serving the senior staff and the students. Each has its consultation, waiting, treatment, dispensary and records units. But the old wing houses the pathology division as well as the drug stores.

3.2.1 WAITING, CONSULTATION, EXAMINATION.

The clinic, as it is known, serves three groups of people, namely; students, senior staff and the intermediate and junior staff. It also has three major waiting areas each approached from the public parking area.

The intermediate and junior staff waiting area is at the centre of the building and all other divisions are arranged around in a circular manner.

The students' and senior staff's waiting areas, on the other hand are located on either side of the records and dispensary units, but they are flushed by

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a short passage that also serves as a small waiting area specially for consultation. At the other end there is also a long concrete slab that serves as seats for waiting in the treatment and pathology area.

A patient arrives at the clinic via the waiting zone where he calls the attention of the records clerks who sort his record file out. During normal consultation hours, a patient may indicate which doctor or nurse among those on duty he prefers to see.

The consultation rooms are lined over looking the waiting areas in both clinics. A patient, after examination goes for treatment.

3.2.2 TREATMENT, DISPENSARY, RECORDS.

On leaving the consultation room (in the case of senior staff and students), the patient will travel to the treatment room on the North-Eastern end of the building just before, the pathology; or in the alternative goes near the main entrance (students and staff in each case) where the dispensary hachets are located to collect his drugs.

The records are collected from each doctor or nurse back to the records office.

It will be observed that there is a clear margin between the upper section of the community on one hand, and the intermediate and junior cadre on the other.

Also the patient's freedom to choose his doctor during normal business should be noted.

.../...

3.2.3 DIAGNOSTIC SERVICES.

As I have mentioned earlier, the pathology section is located in the Old Wing being on the North-eastern part. It is a small unit that carries out skeletal clinical pathological diagnosis, there in the sick bay. If more accurate results are needed it is referred to the general hospital.

3.2.4 DENTAL CLINIC

The dental clinic is located in a tight space within the administration's office of the Ur Sheman Hall. It has a most busy schedule. It is not unusual to have to wait for three months before seeing the dentist.

3.2.5 ANTE-NATAL CLINIC

The present services rendered are only ante-natal; and they are rendered for only the first seven months of the pregnancy. There is a weekly clinic service to the mothers-to-be. After the seventh month, by which delivery is now close, they are refered to the general hospital for maternity care. As at now, there is no post-natal service being rendered

3.2.6 FAMILY PLANNING CLINIC

There is a family planning clinic for couples. The clinic operates on a fortnight basis. Couples have to book for the appointment a headof time.

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3.2.7 PUBLIC HEALTH SERVICE.

The operation of this unit can be classified into two, namely: Environmental Health unit, and preventive medicine.

As it has already been mentioned, the public health unit is situated on a different site for lack of space. The environmental health unit employs more than 70 attendants. The fruction of this unit is to keep the campus in a good, neat and habitable condition.

It, therefore, removes and dispose of all refuse; it keeps a watchful eye on the liquid wastes in the community be spraying disinfectants to all public toilets and in the students' hostels it also calls the attention of the Estate department to any malfunction in the waste and soil water drainage system. As there is no central sewerage system in the community unpleasant odours might be prevailent but for this unit.

The preventive medicine takes charge of innoculation and immunization of the populace against any inpending epidemics. It also has and ambulance service that refers patients to the general hospital if the situation calls for that.

3.2.8 THE IAR CLINIC.

The Institute of Agricultural Research (IAR) clinic is located in Samaru. In principle, it is supposed to serve the Intermediate and Junior staff of the institute of Agricultural Research.

During normal working hours a doctor is sent there to handle cases. But, perhaps, because of its proximity to the people it's meant to serve,

a few nurses are posted there, and are resident within the quarters.

But it is observed that of some of these people prefer to register in the sick bay to receiving treatment close to them. There is a psychological belief that they receive better treatment in the sick bay.

But in reality this is only an extension of the sick bay.

CHAPTER FOUR.

THE CONCEPTUAL APPROACH.

4.1 As already dealt with in the introduction, with proper attention to time it is possible to enter the problem of expansion at almost any point and to move forward effectively.

Planning for expansion is done in two major phases: First, the long-range plan; and second, the immediate improvements referred to as stage 1. Their differences lie in breadth and depth. The long - range plan is broad in scope, extended in time but relatively shallow. The immediate improvements the stage 1, are more limited in scope, worked out in depth, and capable of being carried out at once. Each phase contributes to the process of modernization and expansion. The long - range plan provides a comprehensive guide to the directions for growth. The stage 1 improvements take care of processing needs. Together they offer direction and accomplishment.

But since this is purely an academic exercise, a combination of the two phases will be most appropriate. There are a few factors to consider in developing a concept.

The questions that one needs to answer, among others are;

. Is there need for this expansion by the community? What are the functional programme of the present system? Are there deficiencies in the programme? How much more space, in terms of floor areas is needed ? What is the condition of the buildings by evaluation? What are the potentials of the site? How much replacement will be required?

.../...

How much addition will be needed? What new development is made? When these questions are answered then a concept can be developed that will give a workable scheme.

In the earlier part of this work it was indicated that the population explosion over the years has made the expansion of the Health services division long overdue. This is further emphasised by the scattered and often duplicated departments of the division. Suffice it to mention that there is a colossal waste of money and manpower.

The programme of the present clinic has been explained. Its deficiencies can be understood when we look closely into the constraints within which it operates.

In formulating a detailed architectural programme for a building that will last for fifty years or more numerous areas of uncertainty are encountered. For example in programming hospital beds there may be a desire to include beds for epidemic patients. The uncertainty arises over the likelihood of the length of stay, and how many beds can be justified.

What is the best size of a constultation room? Or what is the best size of unit for the future patterns of nursing care? Such questions introduce uncertanities in the programming process. If they are put off until later they tend to generate major changes which can be quite costly. In the face of such uncertainties the planning results cannot be expected to follow a standard, but they can be flexible enough to provide for the contingencies described.

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The uncertainities of the programme need not prevent beneficial expansion, but it is a fact of hospital planning that much of the capital improvement programme is an academic gamble. The task of the planner is to assess the needs and evaluate the risks implied by the uncertainties, then to decide upon a programme and proceed with the plans.

This is what I have done. The whole attempt, therefore, has been to assess the existing departments noting their deficiencies and suggesting a development or replacement. A new whole of services, which hopefully, with flexibility can operate for fifty years or more, assuming of, course the uptimum size of the community population.

INTERACTIONS.

4.2 In an exercise of this nature, the different interests affecting the overall plan is an important aspect. For the plan evaluation relates to its total appearance, inside and out , and the attendant psychological effect of that appearance upon the users of the building. Quite aside from the structural condition of a building or its functional value there is a point at which even a well-built hospital becomes so old - fashioned working as to call for replacement or modernization. A favourable human response to a building involves far more than satisfactory materials, a good mechanical plant and a workable arrangement. The factors of aesthetics and psychological effects are clearly felt by the users of a building, much more than the condition of structure and functional arrangement.

Throughout the expansion and modernization process the planner should keep in mind that a real need in almost every existing hospital is to bring order and beauty into a conglomeration of unrelated and often ugly elements, externally and internally.

But the subject of the total effect of environment on the users is much broader than a consideration of beauty alone. It embrace other subjective responses which are variously called comfort, convenience, repose or excitement, scale and confusion. The factors which produce such subjective responses are numerous but can be categorized generally as follows :-

.../..

- Visual form:

  Size, scale, sculptural qualities, texture, shape, colour and apparent significance or dominance.

- Atmosphere:

  temperature, humidity, aircontent

  air movement, ionization, and pressure.

- Light:

  colour, intensity, movement, and relation to form.

- Sound: both intentional and incidental

- Aesthetic composition.

With so many variables it is understandable that there can be no formula to assure human acceptance, of a design. But from categories mentioned above much can be learnt about human response to environment. What an architect should do is to keep a threshold of human acceptance and strive to design above this threshold. On deciding the factors affecting human response, the aesthetic evaluation should be included with other findings of economics, scheme, and potentials

4.2.1 OBSOLESCENCE AND DEPRECIATION.

On determining which parts of the buildings should stay and which should be removed, there is the problem of establishing which part is obsolescent and which has depreciated. Obsolescence and depreciation are not the same. Obsolescence has to do with being out-of-date. It relates to programme elements, to the size and arrangement of rooms, to materials

.../..

and finishes, to appearance, to equipment of all kinds, to details of all construction, to location of department within the complex, and so on.

Depreciation relates to the extent of wear and deterioration of materials and strucutre, of mechanical and electrical systems, and of equipment. Of the two obsolescence is the greater force for replacement and modernization of buildings. It is a common thing to find well-maintined hospitals practically as good as new except that they are out-of-date. The factors indicating obsolescence are harder to establish than those of depreciation; one needs great care; though when established they are more powerful.

CHAPTER FIVE.

ANALYSIS OF "NEW" FOR THE "OLD"

5.1 After much consultations with all the users of the clinic, and after in-depth research into all factors affecting the University Health services, it was discovered that though the building has been well-maintained and could stand any structure on the campus aesthically, it is growing far out-of-date. It will have been much easier to remove all the buildings and propose a new one but the challenge that an architect often faces is a compelling factor for keeping the strucuture intact.

However, a lot of internal re-organisation has been done and the expansion also added.

5.2.1 DIAGNOSTIC SERVICES.

It has already been mentioned earlier that the diagnostic services rendered are limited to skeletal clinical pathology. Understandably this clinic was designed to handle just a few patients at the time when the institute was yet to be a university. But this is grossly inadequate for a university, and of the capacity of Ahmadu Bello University.

By the university regulations, the health requirements require that any member of this community should undergo a thorough medical examination on becoming so. The results of such tests should be kept for record purposes and to help the clinic in their diagnosis processes. But it is noted, however, that the clinic's functions have been limited to treating patients. They have been unable to follow up their patients or in fact keep adequate records.

.../...

Development in diagnostic services, is making medical services more scientific and consequently easier. A modern hospital cannot overlook diagnostic services.

Among the most serious uncertainty in the design of hospital are the developme in this area. For example, the present X-Ray services may become obsolecent in a few years time, if X-Ray development is suddenly reduced to portable units. An attempt must be made therefore for obsolescence.

It is in the consideration of this that I have designated the existing strucuture (except the circular part), with an addition for diagnostic services.

X-RAY UNIT AND PATHOLOGY DEPARTMENT.

The North-Eastern end which at present is being used as treatment and pathology has been converted to the purpose of diagnostic X-Ray. This unit with all its technical requirements being taken care of shares the same waiting area with the pathology department. They also share the same records clerk for records and film filing units. One of the existing waiting areas, the students' waiting area has been renovated for pathology services.

5.2.2 DENTAL CLINIC.

The Southern end of the circular area of the complex links with the existing building at one of the consultation rooms where it is suggested that it will flush with the diagnostic units with its waiting area.

The reason, of course, being that Dentistry is a departmental that makes extensive use of X-Ray services. In a big hospital it is recommended that the Dental clinic have its own Radiographic unit.

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5.2.4 RECORDS, DISPENSARY, TREATMENT.

The Records office for this unit are both located at the centre of the circle; facing the main waiting areas with circular hatchets and counters, behind each records office is a small waiting area for the consultation units. The dispensary of each is located next to this unit. The treatment unit for each is located facing the main waiting areas. Each can be easily reached from either within the house or from the courtyard.

The consultants and their nurses and all staff can move or circulate freely without the waiting patients seeing them.

The waiting area reached from the main entrance can out-flow into the main entrance pavement. It is also a consideration to obsolescence.

5.2.4 DRUGSTORES PHARMACY.

The North-Western wing of the complex is designed to be assessed from the North-Gate Road and it is designed mainly as a specialist unit.

It is at the link of this unit with the pair of circles and facing the internal courtyard,, that the drugstores and pharmacy departments are located. The service-yard as the name indicates is meant to be used for staff circulattion and bring in or out all hospitals needs. It is understandable therefore, that they are so located. The drug stores are separated into two, dry store and cold store. The cold store is meant to keep low temperature materials (like alcohols). The pharmacist office is next to it. The pharmacy unit mixes the medicine and sends for distribution. Also provision is made for quality tests of the drugs made from the faculty of pharmacy of the university.

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5.2.6 EMERGENCY UNIT.

This unit is located linking the existing circle with the other wing of the existing unit. It is approximately where the toilets are existing now. It is approached from the courtyard where ambulance can drive in and move or bring patients.

5.2.7 PUBLIC HEALTH.

As it was mentioned before, the public health unit is a most important one. It does not only stand as a watchdog of the environmental sanitation and general health of the university but it handles preventive medicine. In addition to carrying out this function and to further enhance its successful operation, this unit has been given prominence. Among the working of its new laboraties is the epidemiology laboratory.

There are three major epidemics in this part of the country: Cholera; Cerebrospinal menegitis, (CSM) Thypoid fever. At any time of the year there is either one of these three. Cholera comes during the rains; cerebrospinal menegitis comes during the hot season and thypoid fever comes in-between.

The laboratory is therefore, designed to handle these cases as they come, it means that it must switch its services. There is also an epidemiologist office attached to it.

5.2.8 FAMILY CLINIC.

This unit is planned to operate under three categories:

(a) Family Planning clinic

(b) Ante-natal and post-natal clinic

(c) Family counselling clinic.

On the north-eastern part of the new wing is located this clinic, I have already mentioned that most parts of this wing is specialist in nature. This clinic operates on appointment basis. Facing the entrance lobby is the reception and the appointment counter where appointments are booked and checked.

The family planning clinic is designed with uncertainty. Depending upon the laws of the nation regarding pregnancy or abortion, family planning clinic may legally take care of unmarried patients. However, it is designed with the hope that only married couple may attend.

Like the present situation the Ante-natal clinic is not expected to handle deliveries (except emergencies). But it goes beyond this by having a post -natal services.

The psychiatrist who are located in the family counselling clinic area are meant to handle family problems. The rate of broken marriages in our society today makes the sociologists believe that it is a phonomenon that can be categorised as a disease.

However, the psychiatrists care in fact, supposed to handle all emotional problems.

. . . . .

5.2.9 LECTURE ROOMS.

Linking the family clinic and the public health is the public enlightenment department. This consists mainly of a very spacious lecture room designed to accommodate about 150 people at a seating.

5.2.10 ADMINISTRATIVE WING.

It was mentioned at the beginning of this write-up that the university Health Service' is a whole department in the university, like say, the Estate Department. It therefore, means that they will have their own director, secretary, administrative staff and clerks. The northern wing of the circular are encompassing the service yard is designed as the administrative block. It links the new northern wing at the lobby and opens to the courtyard.. It can therefore be approached from the two specialcar parks - staff car park and north-eastern car park.

It is approached through the reception of this wing.

5.2.12 TOILETS, CIRCULATION.

The toilets can be rightly categorised as staff and public.

Every part of the clinic is designed with a detailed consideration.

Since this clinic deals with a large crowd, both staff and patients toilets are a most important aspect. It should be noted that the toilets are located as carefully as possible taking into consideration ventilation.

CIRCULATION.

Circulation could be subdivided into external and internal.

The external circulation does not destroy the present one but rather emphasises it.

.../ ..

The main reason is that the areas being used as parking are most appropriate or could in fact be useless for other purposes. The staff car park on the eastern part of the complex is next to the students cafetaria and only serves as a buffer between the kitchen and the clinic. It is through this and coming from the North-gate road that the staff exit and energency road cone, the energency road is separated from the parking by a flower-barrier. This road passes under the observation ward to the energency unit. The service yard is paved all over and serves to ease staff movement from one department to the other within the complex.

While some of the entrances on the old wing are still maintained for easy accessibility, the main entrance is now approached from the western wing by pedestrains. By pavement facilities people can easily approach from the public car park.

The internal circulation is made easy by straight corridors linking the two axes to their circular ends. From the waiting area of the diagnostic unit one is linked to that of the dental clinic. And there is a short passage that leads to consultation units.

There also, is a small passage through the emergency linking the central courtyard to the consultation area for easy staff movements.

On the whole, one can say that the internal circulation under the limitation of hospital requirements, is satisfactory.

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5.2.12 OBSERVATION WARDS.

This is an area where uncertainty is encountered. The research look indicated that about 35 beds are needed. This will include a nursing unit, kitchen and it will cater for the disabled and epidemic and other contageous diseases victims. But the uncertainty arises over the likelihood of these beds being actually used, or the probable length of stay.

Under such circumstances the architect makes use of his experiences or others experience. This is what I have done. I have suggested about eight be[illegible] unit for the observation ward.

It is located completing the circular are encompassing the service yard. It is raised above ground such that vehicles can pass underneath to the service yard. It is structurally independent.
The advantage of this location, apart from its aesthetics satisfaction, is that it can be removed or extended horizontally or vertically as need may require.

5.3.1 ANALYSIS OF THIS CONCEPT.

I have discussed the conceptual constraints extensively. What I want to discuss briefly are a few major aspect of the decision making.

At the beginning of the discourse I mentioned that during normal working hours, patients indicate the doctors they want to see. While this may have the advantage of creating a cordial doctor - patient relationship, it creates an unfavourable atmosphere when some doctors have a busy schedule and another has a relatively light one.

A school of thought in the United States propanded a theory called Queing Theory.

The que-ing Theory requires the patient in the out-patient waiting room for instance, to form a single file. They go to meet the doctors that are next available. This theory removes frustration of a patient waiting to see a particular doctor/who has apparently refused to "release" a patient. It also makes consultation by appointment much easier.

This theory has already been tried in banks and such public places dealing with ques. It has proved successful.

This is what I am proposing here. A relatively few number of doctors can handle a large number of patients this way.

Interactions has also been mentioned. Human responses is the most easily [illegible] responses.

But in actuality there are other kinds of responses that go to make a design acceptable on a given site for a given purpose.

They could be categorised as follows :

(a) Person - to - environment.

(b) Person - to - person

(c) Environment - to - environment.

In all the three above a great number of shared interests must be satisfied, namely, shared acceptance, shared belonging, shared constraints, shared experience, shared discourse, shared appreciation, shared confidence, and shared trust.

By the time all of the above are satisfied a workable programme is evolved.

5.3.2. OTHER CONSIDERATIONS.

Having taken care of the topography and geology of the site, the climatic condition is another important factor.

A most prominent climatic condition is the cold, dry and dusty north-east wind (Harmattan) blowing for more than three months in a year. This explain the vertical wind shading devices of the North - east wing of the complex.

Also very important is the aesthics responses of the surrounding buildings. The most important ones being Umar Suleiman Hall. The aesthics of the new structure must complement these. The north - western elevations and the South - eastern elevations are linear surfaces (horizontal and vertical) The North-eastern and south-western elevations describe plain surfaces.

A strong constraint in this work is the aesthetics of the existing structure. The new structures must "marry" this old one.
The existing sick bay can be described as a plastic structure, being a combination of "plain" and "lines" surfaces.

The circular structure and the north-western elevation are "lines" while the rest elevation a "plain" it could be said that the plain surfaces are sandioaned between the lines.

For my design to be successful the new complex must look whole.
I have solved this by aligning the plain surfaces on one side and the lines on the other. The couple of circles are to be plain surfaces.

.../12..

All the North-eastern elevations and the south- eastern elevation of the existing structure are also to describe plain surfaces. The North - western elevation of the new wing and the western elevation of the arc are to describe lines (vertical and horizontal).

The water tower is to maintain its plain surface nature to be complemented by the high roofs of the solar energy systems.

CHAPTER SIX.

GROSS - FLOOR - AREA ANALYSIS.

6.1 The gross - floor - area analysis was calculated as the total floor area used by each department in comparison with empirical standards as a measure of its adequacy. The gross - floor - area analysis of the existing structure is tabulated to compare the new ones which are within limitations close to be empirical standards.

6.2.1 Space Allocations of the Old Structure.

The space allocations of the existing structure are as follows:

Total ara 770m^2.

The area before the 1975 extension 392.8m^2 .

It consisted of

	Space	No.	Area.
(a)	Consultation Rooms	6	93.06
(b)	Treatment Rooms	2	28.18
(c)	Pathology Section		24.99
(d)	Dispensary Rooms		12.81
(e)	Drug Store	1	20.23
(f)	Records	1	20.23
(g)	Waiting Rooms	2	96.34
(h)	Passage/Circulation		87.74

6.2.2 Expansion added another space of 370.19m^2 to the existing one and the space allocations was as follows.

(a)	Consultations	3	52.95
(b)	Treatment	2	35.3
(c)	Dispensary	1	17.65
(d)	Store	1	17.65

	Space	No.	Area.
(e)	Records	1	14.86
(f)	Waiting	1	74.32
(g)	Passage		84.54
(h)	Rest Room	1	17.65
(i)	Amin. (Clerks)		14.40
(j)	Toilets	3	40.88

6.2.3 Total Space Allocations.

		No.	Area
(a)	Consultation Rooms	9	93.01
(b)	Treatment Rooms	4	63.48
(c)	Pathology Section		24.99
(d)	Dispensary Rooms	2	30.46
(e)	Stores	2	37.88
(f)	Records	2	35.09
(g)	Waiting Rooms	3	170.66
(h)	Pasage/Circulation		172.28
(i)	Rest Room	1	17.65
(j)	Admin. (Clerks)	1	17.65
(k)	Toilets	3	40.88

NEW SPACE ALLOCATIONS.

6.2.4

DIAGNOSTIC SERVICES.

Processing Room	28.8 (m^2)
X-Ray Room/Theatre	54.4
Radiography	10.4
New Films Store	11.2
Changing Rooms	28.52
Radiologist	22.28
Records	84.6
Pathology Lab.	43.2
Pathologist	22.88
Technicians	14.08
Passage/Waiting/ Lobby =	107.8 + 79.04 + 14.8 701.64 + 25.2

DENTAL CLINIC

Changing Room	12
Theatre	27
Stores	4.8
Technicians	4.8
Recovery Room	15
Dentist/Doctor	15
Toilets	10.61

Staff Ammenities

Common Room/Rest Room	37.44

Emergency

Minor oporation Room	37.2
Troatment/First Aid Room	22.8
Doctor-on-duty	12.0

"Out-Patient Department"

	No.	Area
Consultation (15.2)	6	93
Treatment	2	38.5
Examination Room	2	30
Dispensary	2	51.1
Toilets	2	56
Records	2	41.6
Waiting/Passage/ Lobby		440

Pharmacy:

Pharmacy (mixing mainly)	1	36.8
Stores (Cold)	1	13.6
Stores (Dry)	1	25.3
Pharmacist	1	12.8

Public Health Department:

Epidomology laboratories		29.3
Epidomologist		14.0
Display Unit		9.1
Reception/Appointment		12.1
Lectures		46.8
Toilets		32.
Offices		96
Waiting/Lobby/Passage		162

Family Clinic:

	No.	Area.
Records	1	12
Treatment		36
Midwife		16
Psychiatrist (Doctor)		24
Waiting/Passage/Lobby		52

Isolation Wards:

Bed Units (Wards)	4	36
Toilets		8.1
Passage/Lobby		44.1

Administrative Section:

General Office	23
Administrative Officers	12
Secretary	16
Director	22
Toilets	16
Passage	40

Out-Door Space:

Service Yard	700
Car Park (Public)	40
Staff Services	16.

CHAPTER SEVEN.

SERVICES.

7.1 ENERGY CONCEPT.

The physical architecture of the new society will require the utilization of sophisticated technologies of the present to bridge the gap of history to the styles of the past, when climate reigned supreme.

Solar tempered homes have existed since Neolithic times, when people crawled from their caves, rubbed the darkness from their eyes, and piled or pounded together their first structures. Any shelter, no matter how flimsy, can capture sunlight in its skin and transfer some absorbed heat inside. It can also provide protection from undersirable solar radiation. / such moderation of climate is the essence of shelter.

Early cultures were adept at using the sun to temper their indoor climates. They chose designs, materials, and orientations that exploited this powerful energy source. But the penetration of solar heat through walls and roofs provided adequate warmth only in the holdest climates. For centuries people in colder regions have had to bundle up or huddle around fires to keep warm in winter, and people in hot regions have had to hide under cover to escape from the agressive solar radiation in hot season.

The use of transparent substances to enhance solar heat gains is a comparatively recent occurrence. With the advent of plate glass in the present century has come the possibility of heating a shelter mainly with the sun. Experienonters were groping in this direction late in the 1930's, when 'solar houses" began to appear. In 1939, the first flat - plate solar collectors were used to heat a house in cambridge massachusettes. Even more sophisticated technology for trapping sunlight and transforing and converting the heat insde have been tried since then.

The diversity of engineering and architectural styles evolved in this search are difficult to summarised in a few pages, but suffice it to say that researches are still going on and solar energy may be man's greatest and cheapest source.

7.2. The amount of solar radiation received on any portion of the earth at a given time depends on the location and the season. This radiation generally reduces with increasing latitude. That is to say that as one goes towards the north or south of the equator the amount of solar radiation reduces. Also in the high latitudes (above 30°), solar radiation is minimum in winter and maximum in summer. But around the equator it is nearly constant.

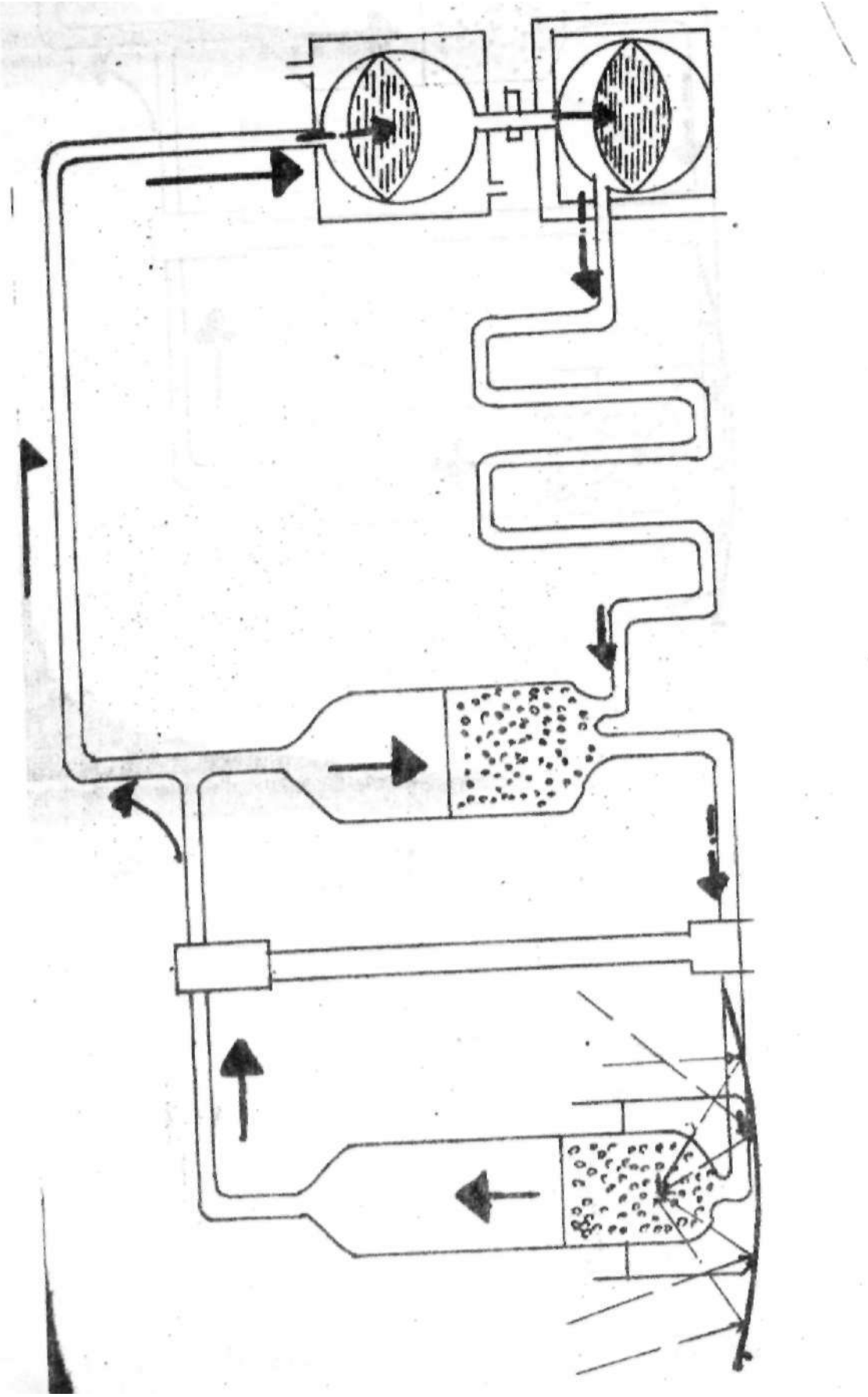
The solar radiation is received in two ways : 1. Direct solar Radiation, 2. Diffused radiation. The direct radiation is that one received and stricking the surface of the earth. The diffused one is that one that is lost in the earth atmosphere.

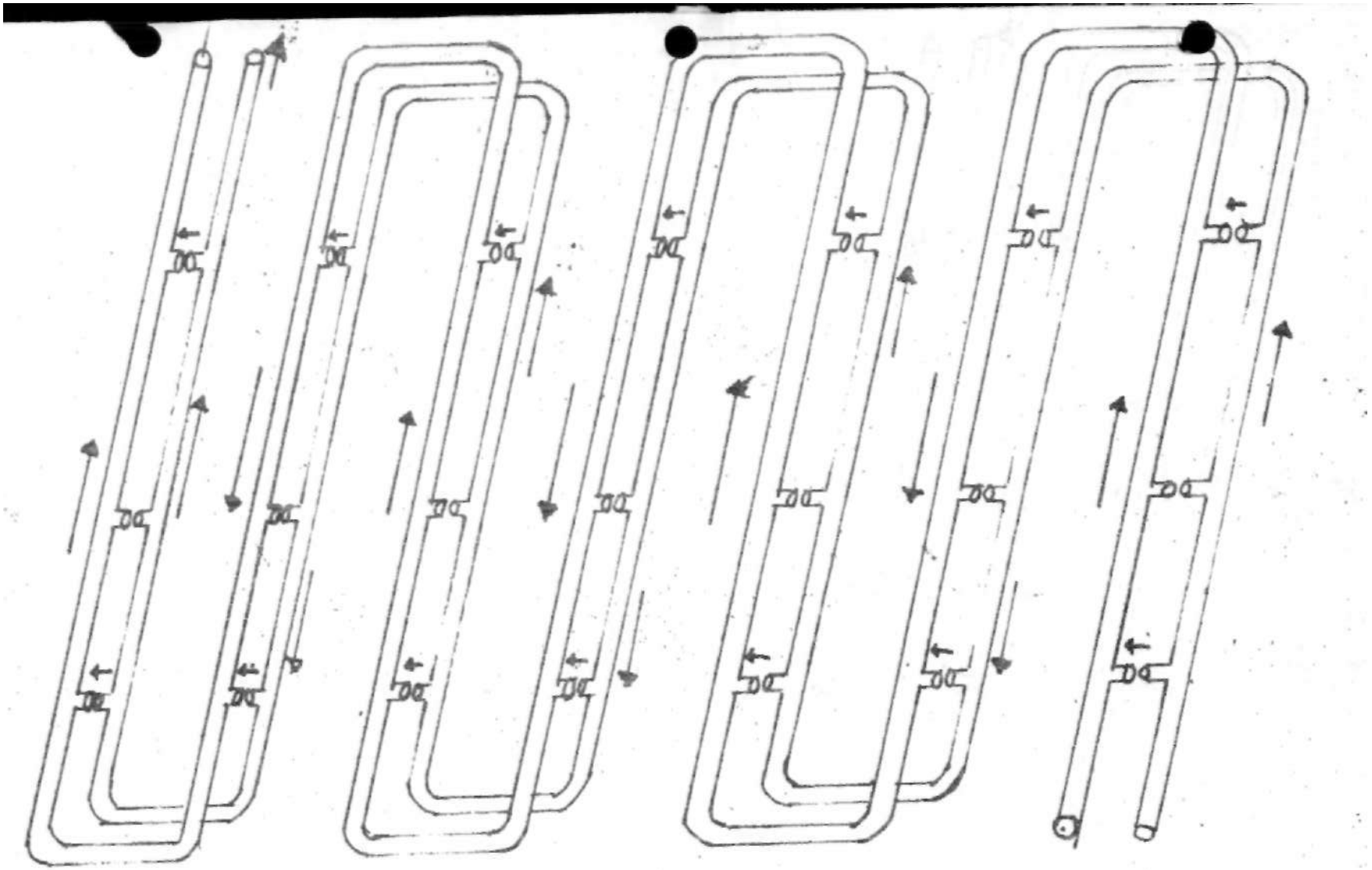
Zaria is located on latitude $11^{0}N$ of the equator and on the altitude of 67 m. It lies within the region of the world where solar radiation is between 2000 and 2250 Kwh/m^2 in a year. This means that solar energy is cheaply available in Zaria and, although diffused, with improved technology, it could be a cheap source of energy.

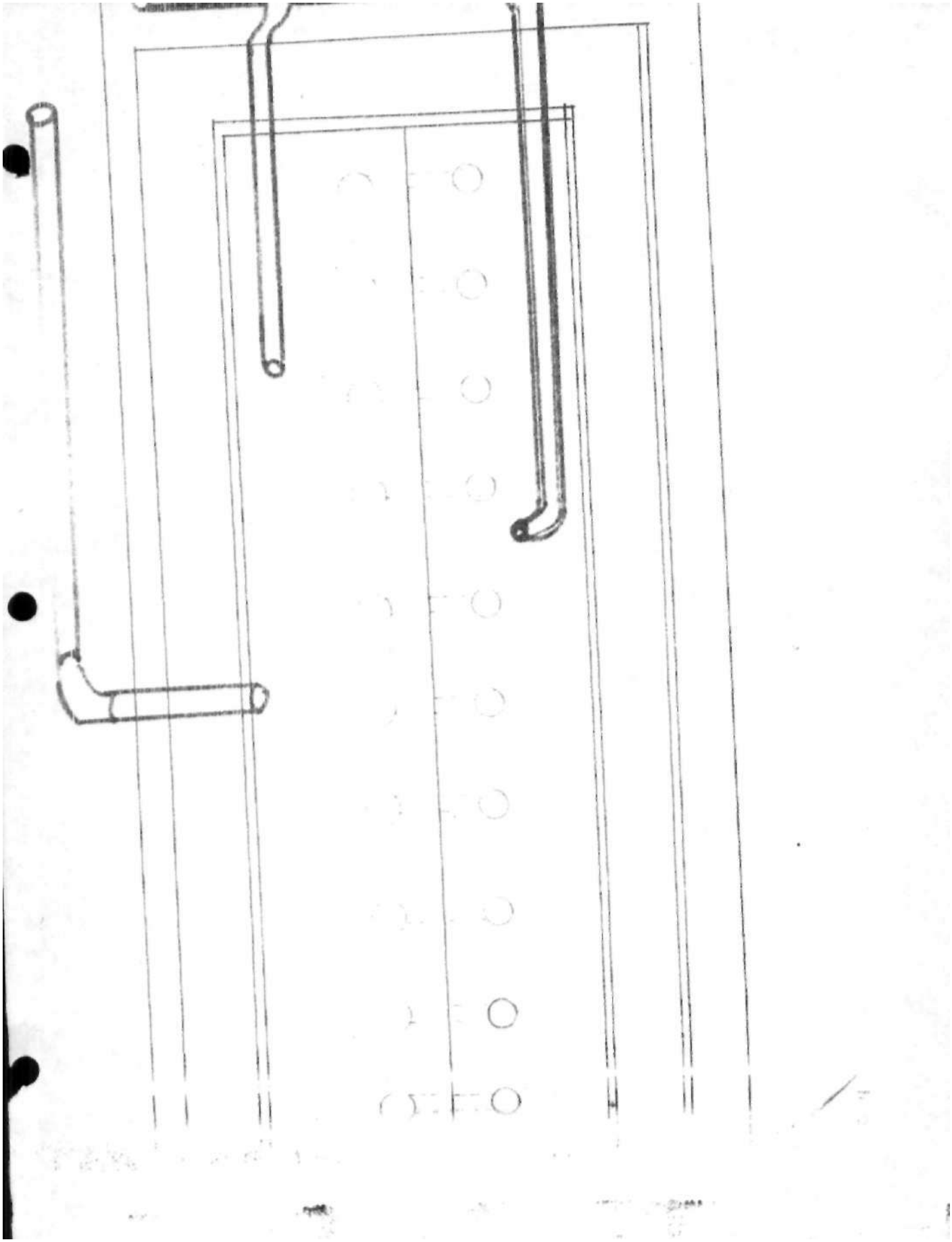
This is why I am proposing its use in my clinic.

7.3. COLLECTORS OF SOLAR RADIATION.

Solar collectors are conveniently classified as flat - plate collectors and focussing collectors. The flat - plate collectors are usually stationary inclined normally to the direction of the radiation; the focusing collectors are usually turned throughout the day to follow the sun. The flat plates collectors are generally cheaper and they absorb heat from the diffuse solar radiation as well as from the direct radiation and operate on bright or cloudy days. The focusing collectors can use only the direct radiation but can provide much higher temperatures.







In both types the receiving surface should be as black as possible, to absorb over 95 percent of the radiation and reflect only a negligible amount.

I am proposing the use of flat - plate collectors.

For maximum efficiency the collector - plates should be inclined at an angle $(N+13)^{\circ}$ where N is the lattitude of the position. In the case of Zaria N is 11° and therefore, the inclination is at most 24° to the horizontal. This explains the angle of the roofs and also the orientation.

7.4. HEATING AND COOLING PROCESSES.

Using the heat of the sun to operate refrigeration equipment and for heating are not new, method novel methods and systems are opening up possibilities.

The solar heating system is a simple process then needs little explaining. But briefly, the liquid being passed in the tubes in the collector plates (Fig.) collect the heat and it is passed round the house for use by means of pumps and other stoppers. The cooling or sun - powered air conditions, however is a little more complicated. But by use of such volites like ammonia the system is made operative. see fig.

The ammonia solutions gains heat of vaporization at A and its goes through pipes to B and C where moves as gas at room temperature (by aid of heat exchanger 1) . At C it is compressed to liquid at constent pressure. It is released into the pipes at D to become gas by ganning heat of vaporization this heat gains is from the room and by a piping system it is returned to A. (by aid of heat exchanger 2).

By technological manipulation the heat gained at D is utilized as airconditioning.

By using a more advanced technology, the process at A can be made to take place in the hot water tank of the collector plates. By this means air-conditioning is obtained in the clinic as well as using the hot water to supply the clinic. (see gis.

. . . .

The advantage of this system is that there is an autonitic control systems such that there is less cooling during the ..ut cold weather (Harmattan) and more hot water and vice versa.

This must be seen as an experiment and a thought - ahead.

There are still many obstacles blocking the widespread vie of the sun's energy for heating and cooling.

The include financial constraints, the lack of good equipment, construction problems, building code restrictions, and legal difficulties.

Most of these problems are non - technical in nature, having to do with solar energy's impact upon and acceptance by society as a whole. Wherever a new building method bursts upon the scene, financial institutions and the building trades are understandably very conservative until that method has proved itself.

But with the cost of fuel rising in the world, the rapid development of this vastly neglected power source is imminent.

CONCLUSION.

A final section of this write up is the future.

There is a veil of mystery between the present and the future which not only conceals tomorrow's happenings but clothes than with enchantment. Our curiosity is aroused and our apprehension too.

For architects and others who must look ahead when they design, there is a mixture of experience and anticipation in every expension programme. He needs, and very neu much too, encouragement and guidance to be derived from the sincere reactions to the design solutions proposed.

His design should pass the musler of full understanding by those who are knowledgeable and be developed and modified until that understanding includes acceptance.

An understanding of conceptual planning is most desirable. Its relation to the whole project is truly one of integration, and its objective is unification. The architect takes all the details of the programme, the engineering requirements, the limitations of site and budget, and the direction for growth and puts them into a whole design seeking unity and beauty, as well as [illegible] functional adequacy. Other professionals may help the architect achieve this, but he must take the lead in the effort. Creative efforts start with individual but must be translated into universally understandable terms to become effective.

Another aspect relates to the assumptions regarding continued use of existing buildings. Usually there is failure to re-examine the future use for certain buildings (pitfalls).

Such assumptions, properly made early in the planning, should not be frozen and should be reviewed if they later appear as real barrtors to an effective scheme. In modernization and expansion there are so many variables that the effect should be made to reduce them by making numerous assumption before commencing schematic findings to see whether a different assumption might permit a different and possibly better scheme.

All long-range plans seek to forsee both needs and potentials for the years to come. The effort is to anticipate both the kind and the quantity of future needs. A look to the future not only sharpens the focus on the immediate need but it provides a working contingency against the unforseeable, both in allowing for various directions of growth and in leaving room for variations in their scope. It is suggested that there be a review of these possibilities in nine general categories :

(1) pattern of care for bed patients

(2) pattern of anbulant - patient care

(3) supporting diagnostic and the rapertic services

(4) servics of supply

(5) control of physical environment

(6) The place of machine

(7) Tapping natural raw energy

(8) communications

(9) The organic hospital.

All of the above cannot be discussed, but it must be mentioned briefly that the architect must think along, and sometimes ahead of scientific development.

There are, for example, many fascinating conjectures as to the form of the hospital of the future.

Where such conjectures concern themselves with structure, they suggest varrations which look like a tree, a tent or an inverted pyramid. (see figs..) where control of atmospheric environment is the concern, the form may become a sphere above- ground, a cave, a pulsating tent or a tank underwater. (figs.....)

Where communications and control become paramount, the form approaches that of a ship's engine room or a bank varlt. Where tapping of sun's energy is the concern, they take the look of flat slabs or even saucers.

Although such ideas do not always constitute wholly realistic solutions to the problems of hospital design, they are stimulating. The numerous techniques described in this script can be considered as efforts to overcome the rigid constrictions of existing hospital facilities and even more, to avoid repeating them in planning for the future. Today, flexibility is a goal towards which planning constantly strives; tomorrow will see a far greater realization of this goal than is now thought possible.

BIBLIOGRAPHY

Principles of Hospital Design
- High Gainsborough
John Gainsborough

Hospital Modernization and Expansion
- Todd Wheeler.

Hospital Planning Requirements
- Guy Aldis.

The Future of Main Campus (A. B. U.)
(Prolininary Report (1977)
- Stan Kawkaw.

(A. B. U.) - Digst of Statistics Vol.I.

Hospital Management
- Colins Grant.

Dinensionally Co-ordinated British Hospitals for the
- World (1964) Loxlay Printers Limited.

Plan and Section Drawing
- Thomas C. Wang.

Hospital Architecture and Beyond
- Isadore Rosenfield.

Architectural Presentation Technics
- Willian Wilson Atkin.

Radiation Protection (RICRP)
- Perganon Press.

The Hospital Building
- American Institute of Architects.

Architectural Technology
- Oberneyer.

Solar Enery and Building
- S. V. Szokolocy.

Direct Use of the sun's Energy
- Farrington Daniel.

The solar House Book
- Bruce Anderson
- Michael Rionden.