DESIGN

OF

A PRIVATE HOSPITAL AT HAMA

Epsm 25

D E S I G N

of

A P R I V A T E H O S P I T A L A T H A M A

for

SURGFPIE, INTERNAL MEDECINE and MATERNITY

by

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- 1946 - BSCE

C O N T E N T S

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OPERATING THEATER

I N T R O D U C T I O N

Individuals of community have to reach a parting of two ways in the course of their lives and one of two things must happen: either they follow the easiest way by living on the bouty of others and become social parazites or they face life with strong active will and well rigid heart which bring with them responsibilities that have for their object, the care and guardianship of the unfortunate and helpless members of their community. This noble feeling of responsibilities will always stimulate the good citizen to act and do his best, within his field of specialization, for the achievement and realization of his ideals and good principles.

In such a manner, members of a community try to raise its living standard, by improving its moral, economical and social conditions.

Unfortunately, the first necessity which an educated member can conceive in our society in " Hama " disctrict is the urgent need of a hospital to care for and cure the majority of diseases which are widely spread there.

Choice of the problem:-

Due to that increasing demand for a hospital equipped with modern installations, I have chosen this problem

to do my part in achieving the erection of such institutions. As for the selection of the three following medical units: surgerie, internal medecine and maternity which I have planned for, I should thank first my three cousin doctors : (Ali and Najib and Mamdouh Adi) who have drawn my attention to the practical point of view of these three medical units, and I should thank too those doctors of Beirut, especially doctor Khayat and Khairallah who have given me many good specific details of such units and many good practical ideas about the construction and management of hospitals in general.

Layout of the necessary steps followed in this selected. problem

I.- Collecting specification : To study a problem thoroughly one should first collect and read as much as he can of reference books dealing with his subject. Unfortunately my references were very limited. Consequently I have tried to be always in touch with doctors in order to get as much as possible of specifications concerning Hospitals.

2.- Studying the various arrangements with my professor, " Mr. Mannasseh ", I was able to facilitate, to a great deal, the difficulties which have obstructed my way to get the best and suitable solution of this problem. I would like

to sieze this opportunity and thank him for his good ideas and the effort he has offered to me.

3.- After getting the approval of my supervisor on the best suitable arrangement in the plans, I began to study my problem from the point of view of construction as well as from the point of view of architecture.

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PRIVATE HOSPITAL

" Outlines "

Due to that urgent necessity which I have mentioned before of having a good hospital furnished with modern scientific equipment for the treatment of diseases; my three cousin doctors in "Hama" have asked me to study and design a private hospital which can be built and afforded in the near future, with the following general outlines :

I - one building of two stories

2 - It should accommodate (40) beds

3 - It should have an out-patient clinic

4 - It should contain the following wards :

- a - surgerie
- b - Internal medecine
- c - Maternity

5 - Kitchen and laundry apartment.

6 - One elevator

7 - Provision for ~~hot~~-water heating system.

8 - Accomodation for one intern, staff and nurses.

General analysis .-

The private hospital of the day, in which all patients are expected to pay in full for the care they receive, is one of the most interesting public problems of the time. As the hospital is depending for its prosperity on the number of patients attracted, there will result a good competition in service and care. Because if the doctor is financially interested in the establishment, he is certain to be more interested in the proper care demanded and necessary for his patient; and even he may desire to supply his institution with the latest and best scientific methods in the treatment of diseases. Thus and in such a way we can be sure of progress and better order in our modern hospitals.

In a broad sense, we can consider this class of hospitals as new standards of the latest scientific methods in disease treatment and as the highest order of technical skill.

Let us now turn to the way I have investigated and studied the conditions and the specifications I have followed in planning my private hospital.

Planning of a hospital is probably more difficult than the planning of any other kind of a building under the best conditions, that is with unlimited land and unlimited funds; but when one of these two conditions is restricted, the problem becomes more complicated and depends to a large extent on the method of management and intended use.

It is impossible to lay down rules which can be followed and which will fit every doctor and every case. Every doctor has his own preferable arrangement, similarly each locality has its own proper case . Almost every architect or engineer is only too glad to have an intelligent criticism of his preliminary piece of work. But a failure in the proper workind out of a plan can easily be avoided if the directors and doctors would combine their views into a simple statement and discuss the various points with the architect and engineer where all of them can arrive to a mutual understanding and satisfactory arrangement.

Collecting the various doctor's opinions as well as the different specifications from the possible obtainable books and forums, I tried to coordinate and get the most preferable ideas which can be applied in a locality like Hama district. All of this has been done with the help, contribution and the supervision of my professor : "Mr. Manasseh" .

Character of the Hospital :-

After what we have known of the underlying spirit which stimulates the community to demand and build such institutions; we should consider the character of this demand and needed necessity. Every district or country has its own characteristics from the economical and financial point of view as well as from the medical point of view .

In general our district is an agricultural one where the majority of the people are in moderate circumstances with limited incomes. And our local conditions lead to a certain class of diseases which determine also the character of our hospital and its proposed medical units. The prevailing classes of diseases, which are now widely spread, are the micro-organisms of Malaria, Typhoid

and Pneumonia. And also by considering the increasing necessity of women to retire to a hospital for their maternity, we should include and provide a new ward for women in our plans.

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SMALL HOSPITAL ARCHITECTURE

" F O R W A R D "

In general the principles of hospital architecture apply to the small ones as well as to the large kind of institutions. The only difference between the two is simply that one contains more wards and units than the other.

Question of transportation of food, ventilation, light and heating are more considered in the larger ones.

Economy of arrangement is more considered in the small hospitals than in the large ones, because they may often use one unit for a great number of purposes.

Finally the general requirements and conditions of the hospitals make the style usually more or less classic.

T H E S I T E .-

In choosing a site, a pleasant prospect from the wards is desirable. An elevated or hilly site is naturally

more adaptable and suitable for a hospital than low plane ground. The elevation has the advantages of an airy condition of being wind swept, and having a good natural drainage. All of these advantages are of primary importance for a building as a hospital. Fortunately all of these conditions with beautiful natural surroundings have been provided by the owners before they asked me to stufy this problem.

PLANNING THE HOSPITAL .-

A plan of a hospital should be laid out with reasonably straight lines to permit observation, good illumination, ventilation and a proper interrelation between its parts.

Small hospitals according to what we have said, should contain the same units as large hospitals but of course in proportion to their sizes.For each apartment, such as male medical, female medical, maternity and surgical, I tried to make each one as far as possible self-contained, so as to keep the nurse close to her patients. But the operating apartment, has been planned for easy communication with every unit as well as with the elevator for easy transportation.

" S P E C I F I C A T I O N S "

THE AREA PER PATIENT .-

Specifications of modern hospitals limited the area per patient to this following table:

Table I

Kind of Room	Min. Sq.ft.of floor per person			Min.cubic ft. of air space per person		
	Adults	Chil - dren.	Babies	Adults	Chil - dren .	Babies
Private Rooms	90	75	55	900	675	500
Wards	80	65	45	800	600	400

With these specified areas per patient the doctors insist on the minimum distance between the centers of adjacent beds. Eight feet center to center of beds is fairly acceptable by most doctors. If we keep the eight feet between centers of beds we can get areas per patients more than the required in the above table. To satisfy also the cubic content of air per patient, the height of the room should be at least I2 feet .

For this hospital plan, I provided more than I2 feet for height : (3.80 meter), which give about II50 cubic feet of air with 96 sq.feet of area per patient.

G R O U N D F L O O R

WATER and DAMP-PROOFING OF GROUND FLOOR .-

Although the site of our building is on an elevated ground where natural drains are provided and are sufficient to take off the rains in winter, I raised the level of the ground floor half a meter to avoid dampness which may get in, especially in winter . But this is not sufficient because dampness on the interior surface of walls may be due to water which penetrates the wall by capillary action,without the actual flow of water under pressure. The remedy of this dampness caused by capillary action is to seal the pores by a coat of cement mortar on the inside surface of walls. By this simple method we can be sure of damp-proofing as well as water-proofing for our private institution.

ADMINISTRATION .-

There are two kinds of persons who may get in through the main entrance of the hospital: a visitor comes to see his relative or friend patient or a patient who has been examined

previously by the doctors in the clinic department and comes to enter the hospital. Before they can pass through the main entrance to the hall, they can get informations from the office. Then by permission, entering to the near-by waiting room where he or she can wait for his or her turn regardless of their being visitors or patients. If the patient is brought on the stretcher , they can get him to the emergency room on the right side of the main entrance where any preliminary operation, such as bleeding treatment can be done, or if the case is urgent, the patient may be placed at once in the elevator and taken to the operating theatre upstairs .

CLINIC ARRANGEMENT .-

With the idea of separating the clinic from the other hospital units, special out-patient apartment is arranged with its own main entrance. Beside the entrance an information desk is placed to provide the necessary information for the clients. The unit is made self-contained by the introduction of a pharmacy furnishing the required medecines.

An X - ray room is also designed to act as a resource for doctors in cases of difficult diagnosis which require thorough scientific examination and medical treatment.

SERVICE APARTMENT :-

This is established in a separated and isolated wing in order to get rid of smell and noise which have considerable effect upon the patients . On one side of that wing there is the kitchen and its auxilliaries with a small lift to communicate the kitchen with the upper story; and on the opposite side there are the washing, cleaning and ironing rooms with their sanitary fittings.

A provision is made for the permanent workers to dine and sleep in the same apartment near their work.

" F I R S T F L O O R "

ARRANGEMENT OF THE MEDICAL UNITS .-

Every medical unit should have its own requirements grouped together so that it would be easy for doctors and nurses to serve their patients without any delay or difficulty. The medical unit is composed of a ward with all the things

that add to the service of the patients -: Linen room , serving room or utility room for the handling of food, bath room, toilet room and medical cabinet, which can be set into the walls of the corridor just outside the ward or at some point in the walls of the ward itself. We have three kinds of medical units : Surgerie, Internal medecine and Maternity .

I.- Surgical Unit .-

As every medical unit is in need of a surgical one, a great deal of attention is given to its location. It should be near the elevator as well as to the other two medical units.

Operating theatre .- Of course the most important room in the surgical unit is the operating room. Privacy and complete quietness are essentiel elements in a well planned operating hall. As far as the instruments must be sterilized immediately before and sometimes during the operation, it would be better to have the necessary sterilizers next to the operating theatre, whereby doctors can get easily, in and out. Supplies are constantly called for, and therefore a supply room should be arranged in the nearest vicinity. This room

should not have a door in order to keep the instruments in a dry natural condition. Due to the psychological response of the patient in the operating hall, I have planned a special anesthesia room next to the operating room, as was suggested by the doctors.

It becomes more and more customary to make the plan of the modern operating hall in the shape of an ellipse with a dome ceiling to reflect the natural or artificial light on the operating table.Thus they can get an indirect light which is more preferable than the direct one. Another advantage, is that it will be easy and safe for visitors to attend the operation from a place in the ceiling itself prepared for this purpose.

Finally there ought to be in this unit a room for the surgeons to prepare themselves for the operation and rest after it is completed . Likewise a room should be provided for the nurses who are likely to become exhausted and tired. One of them may get sick while at work and will need a great deal of attention and rest.

2.- Internal medecine Unit .-

This unit has been prepared for the treatment of the non-infectious diseases, For example : Malaria, dysentry

typhoid, external jaundice and heart failure. They need nothing more than the general requirements of a hospital room , except in the case of malaria, which requires the use of mosquito-net over the bed, in addition to which, only some medical precaution is to be expected from the attending nurses.

3.- Maternity Unit .

The maternity unit and its equipment and details do not differ from other units in general, except that the private rooms are more comfortably furnished because the patients need much nursing and attention before delivery, after which she will need a cheerful surrounding, flowers, sunshine, bright colors and the company of a few intimate friends to share her pleasure happily .

D E T A I L S O F S T R U C T U R E

FOUNDATION .-

The type of foundation which is now used in our locality as a result of war, is the contineous rubble masonry with lime mortar, because rubble masonry is cheaper

than the reinforced concrete. In as much as lime is hygroscopic, an underground wall laid with lime mortar will always get moist during the whole year, therefore we should avoid its use; especially in hospital constructions where moisture and dampness should be absolutely avoided. Cement mortar in such cases is the best. We should not forget the capillary action which I have mentioned before.

WALLS :-

I.- Exterior walls : Generally speaking, in our locality, lime stone is the most suitable stone for exterior walls due to its stability, water-proofing qualities, ease of transport and extraction. They are to be white in color and dressed to an accepted degree which depends upon the owner taste. Cement mortar without lime should be used.

2.- Interior walls : I propose the use of bricks that agree with the specifications, although they may be a little more expensive than cement blocks. Another reason, for their use, in my opinion, is the easiness of their use as partition walls and as an insulation

for sound and dampness which is usually found in washing rooms, sterilizing rooms and boiler room.

FLOOR - CONSTRUCTION .-

The cheapest and best material for this type of construction is tile and reinforced concrete. In addition to this, they resist the transmission of sound which is a source of trouble in such a design, and at the same time tile is a good insulator for heat.

FLOOR - SURFACING .-

LINOLEUM : Linoleum has been found to be fairly satisfactory and accepted by doctors, when laid in the ordinary manner with the ordinary thickness, but when it is used in the heavy grade known as " battleship " linoleum and cemented to the foundation, it will be a very superior floor filling almost every one of the requisites of a perfect hospital floor. The foundation must be of the trowel-finished cement made about (8) millimeters in thickness. The material is laid on the floor loosely and allowed to expand, contract and accommodate itself to the new condition,and is then cemented solidly to the foundation with a glue or cement, and is weighted down with an innumerable iron weights and bags

of cement while the cement is setting.

After the work is completed, the floor is perfectly true, without any objectionable sound heard when somebody is walking on it.

In as much as the junctions between floors and walls are very tiresome in cleaning, they tried to curve linoleum covering upward to cover a part of the wall to a steel corner bead, forming the division between plastered wall and the floor linoleum, as shown in the next figure (1)

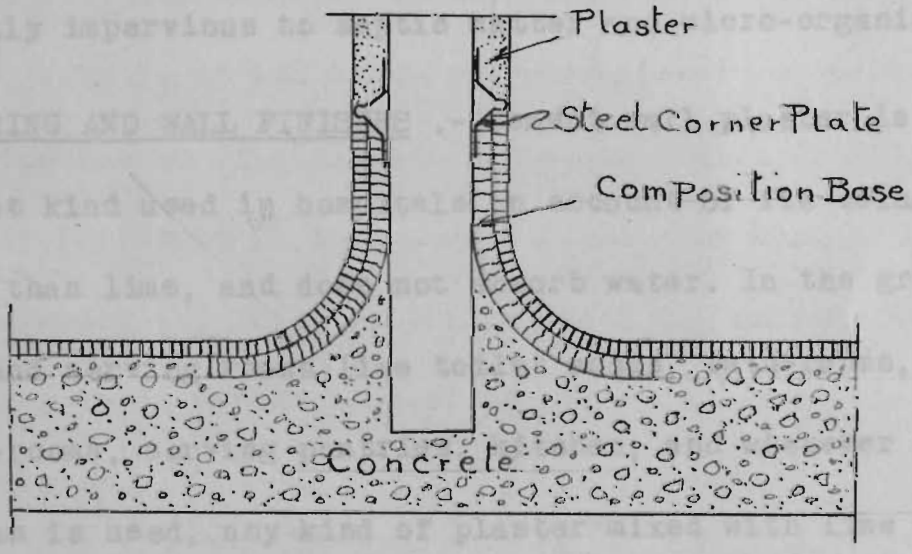

Fig. (1)

Steel corner plate between plaster of wall and composition base .

There is another kind of linoleum which is promising a substitute for "battleship ", called the

plastic linoleum. The only difference between them, is that the latter is mixed and made like any concrete at the time and place where it is to be used. It requires exceedingly careful troweling if it is to look well. Sometimes the surfacing of laboratory work-table is made of it. This has given excellent result.

COMPRESSED CORK .- One of the newest materials used for flooring is the compressed cork. It is elastic and noisless; but its chief disadvantage is the fact that it is not sufficiently impervious to septic matter and micro-organisms.

PLASTERING AND WALL FINISHES .- Cement wall plaster is the best kind used in hospitals on account of its being harder than lime, and does not absorb water. In the ground floor and serving rooms like toilet rooms, bath-rooms, operating-rooms, serving pantries, kitchen, and wherever water or steam is used, any kind of plaster mixed with lime should be avoided and only sand and cement should be used. Cement plaster well troweled with steel trowel, will result in a very hard, dense surface having a slight polish.

INTERIOR PAINTING .- All corridors, wards and private rooms are to be of deep cream color except the ceiling and a

IO inches frieze which will be white. The modern high-grade enamel paints, made of Damar varnish and pulvarized quartz or spar, are best suited for hospitals and should unquestionably be used throughout the operating apartment, dressing-rooms, bath-rooms, toilet-rooms and wherever steam or water is used considerably; and if the means will permit, such material should be used throughout the hospital.

STAIRS IN THE HOSPITAL .- The best material, used for stairs in hospitals, is polished marble. Although it is more expensive than ordinary stone or mosaic concrete, it is usually preferred because of its pleasing general outlook, pure white color and easiness of cleaning. As to the stairs; higher railing is preferred in such institutions. The minimum allowed elevation being (4) feet. In dealing with the outside stairs, lime stone, which stands weathering action and wear, is preferably chosen.

WINDOWS AND DOORS .- Windows and doors are of vital importance for ventilation and light in hospitals. Double sash-windows are the usual standard kind used. It has the advantage of accessibility for cleaning, and where a safety robe is used, the cleaner can stand on the outside of the window sill and wash the window while it is closed; another advantage is that it

does not open the entire opening of the window but only half.

Doors leading to verrandas are to be of such a form as to serve the purposes of a window and a door. The inside of the frame should be rebated for hinged insect screen for summer use.

WOOD WORK .- In as much as the wood should resist wear and abrasion; dense, close-grained and hard woods are the most desirable for hospital purposes. To avoid recesses and other places which are cleaned only by the expenditure of considerable labor, we use flush doors, that is, doors without panels, because they are the most successful type. But these doors are so severe in appearance that they have gloomy effect on patients, so some of the newer hospitals have reverted to the use of single panel doors. It is not necessary to do this, however, for the flush doors are veneered on built-up soft wood cores, and it is a simple matter, with veneering, to inlay a border line or lines making imaginary panels. This can be done with a comparatively small expense above the cost of a flush door.

SCREENS .- Insect screens should have the full size of the window openings, so that our double-sash windows may be opened at both the top and the bottom. A durable wire mesh is desirable; tinned wire, also termed " pearl wire " is durable but the bronze wire is the best.

P E R M A N E N T I N S T A L L A T I O N S

BOILER .-

The steam supply for hospitals is used for the heating system, for sterilizing, cooking purposes and for laundry equipment requirements and sometimes for generating motors. All of these uses, except the heating system, need steam of high temperature and consequently high pressure; so the high-pressure type of steel boiler is always useful in such cases. The introduction of generating electric units is a problem that is related to the cost of electric current as obtainable from outside sources such as a public electric company.

In general the piping system should extend as directly as possible to the various locations where there is need for it, and should be exposed wherever possible for inspection. The general layout requirements will include

a main from the boiler room; this branching to risers throughout the building, and these, in turn, having small branches running directly to their fixed positions. From these fixed positions return branches are carried to return risers and then to the return main, extending back to the boiler-room where it discharges the condensed steam into a hot-water collecting tank or to a boiler feed water heater.

HEATING .- The comfort of patients, and the work of the various activities of a hospital, depend upon the provided heating system.

Among the requirements for a satisfactory hospital heating system there must be considered the cleanliness, noislessness at all times, prompt and ready regulation through a considerable range of temperature, freedom from leakage, odors, with simplicity of operation and a good thorough design.

Hot-water systems are easily managed and serviceable in small institutions where the distances of pipe runs are short and permit satisfactory uniformity of operation throughout the building. But in long and large buildings, hot-water system has been improved by inserting a circulating

pump connected to the main supply-pipe in the power plant, so that the water is circulated rapidly, positively, and uniformly throughout the whole institution.

One advantage of this system (forced circulating hot-water) is that the water can be circulated at a positive uniform speed under all conditions, while the temperature of water can be varied to suit the varying demands for heat in accordance with the outside temperature changes. The temperature of the whole institution is then being controlled by a simple valve in the boiler-room and the control of temperature in any room can be regulated and adjusted by the individual radiator valve.

Referring to the details of construction, the radiators in hospitals should be of the simplest and plainnest type of design . And in order to permit a more rapid cleaning of the floor and to prevent the collection of dirt, radiators should have high standing legs.

The proper location of radiators in wards and in any other room should always receive a serious study and the services of an experienced designer is here required.

LIGHTING .- Patient's room, and wards in general, require the indirect-systems which are extensively used in hospitals. These systems use inverted lighting fixtures, which throw the light directly to the ceiling where by reflection, it is diffused throughout the room. Beside the indirect lighting, side-wall bracket lights are essential and must be used when doctors or nurses are working about the patient.

The most difficult problem of hospital-lighting is, no doubt, the lighting of the operating theatre. Modern incandescent lamps are approaching daylight color. To get more focal light they usually place, in front of the incandescent lamp, a lense to diverge the light to the dome ceiling shape which in turn reflects the light to a properly selected area in the operating room, where they usually put the operating table. When daylight illumination is fit for operation they let it enter through the large north window which receives an indrect sun light.

VENTILATION .- Ventilation in a hospital is a matter of primary necessity. Small hospitals are usually designed with little or no provision for ventilation. It is customary to make their ventilation depend upon the correct placing of windows and doors arrangement resulting in a sound and

hygenic air circulation. Thus, being the case, a careful and intelligent discussion of this problem need be considered :

a)- Kitchen ,- Fans are needed to extract the excess of hot air, The windows and doors, obviously, permit the entrance of new and fresh air resulting in a satisfactory condition.

b)- Laundry apartment,- Here the extraction of hot and moist air is more necessary. In this apartment, as in all others, the centrifugal fan should be employed where it becomes necessary to use duct work, either to control the source of air supply or to conduct it to any distance for outlet.

c)- Operating theatre,- A complete air conditioning system should be used with some form of efficient,antiseptic air filter. But, as it can not be afforded for, in our hospital, it is proposed that the use of the centrifugal fan with some simple air-washing device should be carried on.

REFRIGERATION .- In a locality where natural ice is cheap and easily obtained, there is no need for a refrigeration plan. But the designer must keep or provide a space for a

modern electrical refrigerating box. To reduce the expenses the floor of the refrigerating room, should be covered and isolated from the other rooms by a heat-insulating material, like compressed cork or wood fibers, as shown here with some details, in the following figure :

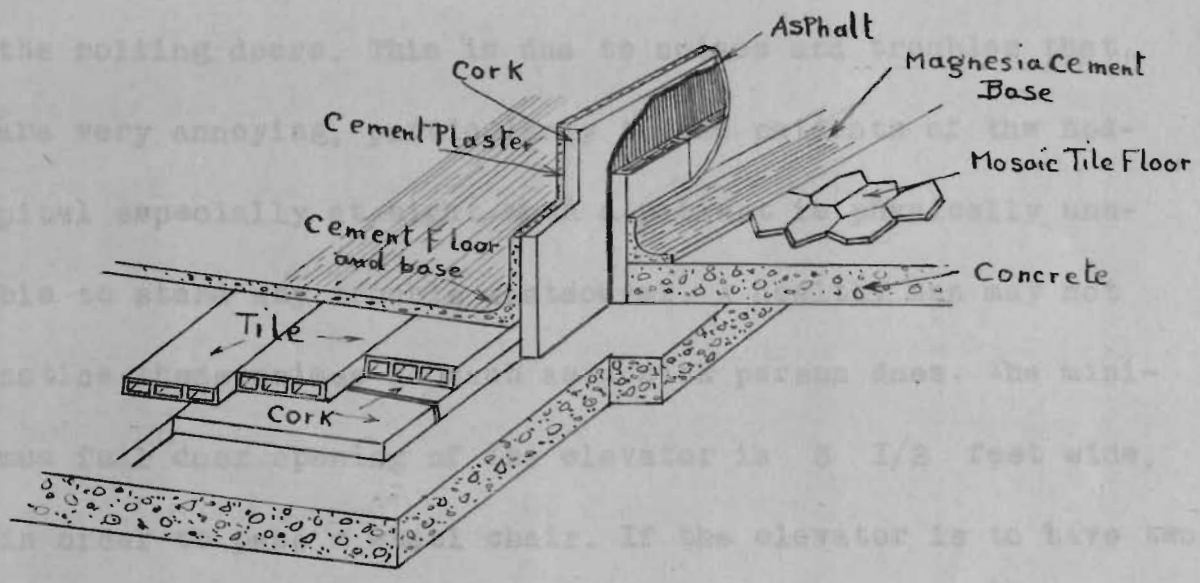

Fig. (2)

Insulating partition between refrigerator and main room .

ELEVATOR .- An elevator in modern hospitals is so badly needed that it becomes necessary to give an early and thorough study at the time when we are designing the plan of the building.

The proper location of the elevator influences greatly the efficiency of the hospital. Moderate speed is satisfactory, provided the elevator is large enough to accommodate a wheeled stretcher with attendants; doctors and nurses . A point that requires more attention is the fact that a good set of tracks and wheels is necessary for the rolling doors. This is due to noises and troubles that are very annoying, particularly to the patients of the hospital especially at night when a patient is physically unable to stand any trouble whatsoever. A healthy man may not notice these noises as much as a sick person does. The minimum full door opening of the elevator is 3 I/2 feet wide, in order to pass a wheel chair. If the elevator is to have two doors at right angles to each other, as our elevator does, the one that leads to the mortuary room must always be protected and under control.

A small service lift is installed to run between the main and the diet kitchen or other service rooms in the upper stories for food supply.

SEWERAGE .- As far as our hospital site is on an elevated piece of land, the sewerage system can easily be performed by converging each waste pipe from its own cess-pool to a

main which is approximately I5 feet higher than the municipality main.

APARTMENTS FOR PATIENTS

LOCATION OF THE PRIVATE ROOMS .-

It is desirable to have the private rooms in a separate pavilion, but this involves the difficulty of the increased distance between the medical units, and it is a matter which depends, mainly, upon the size of the hospital. The possibility of mixing the cases of patients and creating disorder is very much decreased if the private rooms are placed adjacent to each other in a small hospital.

DETAILS OF PRIVATE ROOMS .-

The minimum dimensions according to the specifications are: 9 x 9 feet per private room, and II x 9 feet if the room is to contain two beds. The door width is limited to 3 I/4 feet to allow the passage of the standard 3 feet hospital bed from one room to another. The general illumination of the room as was already mentioned, should be obtained by the use of an inverted reflector in the center of the ceiling. Every private room should have at least a wash-basin

supplying both hot and cold water. Adjacent to the bed at a height of 2 I/2 feet from the floor, there should be a portable table lamp.

The question of having a private closet for the patient's clothes, must have been already discussed among doctors, because they have different opinions. Some believe that a closet increases the number of corners and surfaces which require more labor in cleaning, others believe that the advantage of keeping the clothes in a good conditions should be given more weight if there is no fear of infection.

The edge of the bed should be about one foot from the wall so as to place the head of the patient in a zone of sufficient air circulation.

The window-sill is to be high enough to insure the safety of the patient as well as to restrict his view when he is in bed.

WARDS .- Rooms with two to six beds or more that are placed together are called wards. The patients can obtain a little more privacy by grouping them according to their social status , the disease from which they suffer, or their behavior.

Every ward should have its direct access to its toilet-room and bath-room.The arrangement of windows with

respect to beds in a ward, must be in such a manner as not to allow the placing of more than one bed between two windows.

The minimum distance between two beds 8 feet center to center should be increased in case there is a possibility of infection . According to specifications the ward height is limited to I2 feet in order not to have a volume less than the minimum allowed.

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C O N C L U S I O N

The design has been made in accordance with the specifications of hospitals, the requirements of the doctors who want to build it, and in a manner that the expenses can be afforded. Fortunately the land available was a corner lot. This has induced me to make the building having two main façades. Since we could not build on all the land due to financial difficulties, the hospital was designed an "L " shape building accommodating the specified number of beds which is only (40) .

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REFERENCE BOOKS

I - The Modern Hospital by Hornsby Schmidt.

2 - The Modern Hospital (a monthly journal devoted to the building,equipment and administration of hospitals, sanatoriums and allied institutions, and to their Medical, Surgical and Nursing Services) January I923 Vol. XX.

3 - L'Architecture d'Aujourd'hui N° 9, IO , Septembre I939).

4 - Hospital organization and management by : Stone, J.E.

5 - La construction des hopitaux modernes et leurs installations; by Schaerer, M.