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Operation

UPSHOT-KNOTHOLE

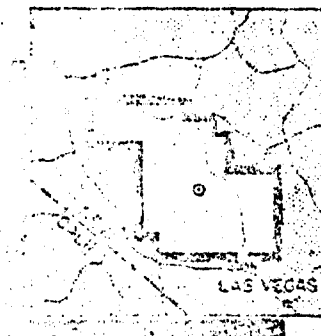
NEVADA PROVING GROUNDS

March - June 1953

Project 3.27

EFFECTS OF ATOMIC EXPLOSIONS ON FIELD
MEDICAL INSTALLATIONS EQUIPMENT

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21) Report on

OPERATION UPSHOT-KNOTHOLE

Project 3.27

6 EFFECTS OF ATOMIC EXPLOSIONS ON FIELD MEDICAL INSTALLATIONS EQUIPMENT.

~~REPORT TO THE TEST DIRECTOR~~

(10)

Edwin S. Chapman.

11

Feb 1954

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~~Medical Skills Service School~~

Brooke Army Medical Center
Fort Sam Houston
San Antonio, Texas

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ABSTRACT

The major objective of Project 3.27 was to determine the effects of an atomic explosion on field medical installations, equipment, and personnel as normally deployed in combat in support of the combined arms and services and to determine the degree of protection which is afforded by placing such installations in dug-in positions.

The procedures employed in meeting the objectives of the test encompassed the establishment of two types of composite field medical installations at varying distances from ground zero in both a standard aboveground position and in a dug-in position constructed in accordance with current Corps of Engineers doctrine.

Unit A, a composite battalion aid station and regimental collecting station was established in the standard squad tent authorized by T/O&E 8-7. This unit was erected at 4,163 ft and 9,000 ft from actual ground zero and contained all representative items of equipment authorized for those units.

Unit B, a composite division clearing station, mobile army surgical hospital, and evacuation hospital, was established at 4,163 ft, 9,000 ft, and 15,000 ft from actual ground zero. It was erected in the standard hospital sectional tent currently authorized for those units and contained all of the representative items of equipment normally found in those installations. Unit B was divided into four separate tents corresponding to a surgical tent; X-ray, dental, eye, maxillofacial, and ear, nose, and throat tent; a pharmacy and laboratory tent; and a ward tent.

Both Unit A and Unit B were established functionally and some of the equipment was operational at the time of the blast.

Results of the test were highly satisfactory and demonstrated casualty production and damage severe at the most forward site, moderate at the intermediate site, and mild-to-slight at the rearmost site.

A comparative analysis at each site indicates that 30 to 50 percent greater protection for personnel and approximately 20 percent greater protection for equipment is afforded by having these installations dug in. ^{c/o}

Utilizing equipment presently authorized to medical units in current Tables of Organization and Equipment, field medical installations above ground subjected to overpressures and thermal energies in excess of approximately 3 psi and 9 cal/cm² will be damaged to an extent which will preclude the performance of their mission for varying periods of time.

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Field medical installations in dug-in positions subjected to overpressures greater than 3 psi but less than 7 psi, and less than thermal energies of 15 cal/cm², may be considered as being capable of fulfilling 10 to 90 per cent of their mission, depending upon the alertness and ability of the surviving field unit personnel to successfully combat the primary and secondary fires following the attack and the distance the unit was located from ground zero.

Fires in any installation subjected to the effects of an atomic bombing will present a primary hazard. The hazard of fire will be greatly reduced if units will police the area of readily combustible material and store in protected shelters that combustible material which must be maintained close by.

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FOREWORD

This report is one of the reports presenting the results of the 78 projects participating in the Military Effects Tests Program of Operation UPSHOT-KNOTHOLE, which included 11 test detonations. For readers interested in other pertinent test information, reference is made to WT-782, Summary Report of the Technical Director, Military Effects Program. This summary report includes the following information of possible general interest.

- a. An over-all description of each detonation, including yield, height of burst, ground zero location, time of detonation, ambient atmospheric conditions at detonation, etc., for the 11 shots.
- b. Compilation and correlation of all project results on the basic measurements of blast and shock, thermal radiation, and nuclear radiation.
- c. Compilation and correlation of the various project results on weapons effects.
- d. A summary of each project, including objectives and results.
- e. A complete listing of all reports covering the Military Effects Tests Program.

PREFACE

The data presented in this report, it is believed, will provide a basis for planning and executing the provisions of medical service within the combat zone under conditions of atomic warfare. Together with target analyses of friendly areas, these data will enable the selection of locations and conditions of establishment of medical units within the combat zone in relation to such predetermined target areas as will permit the medical service to accomplish its mission and at the same time minimize the effects of a mass destruction weapon upon medical units within such areas. With this information—together with information as to ground zero, yield of weapon utilized, height of burst, terrain, climatic conditions, and other data available immediately or determinable within relatively short periods of time—reasonable estimates can be made as to the capability of medical units within target areas to carry out their mission in connection with area damage control and in support of the current military effort.

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CONFIDENTIAL

CHAPTER 1

OBJECTIVES AND EXPERIMENT DESIGN

1.1 OBJECTIVES

The major objective of Project 3.27 was to determine the effects of atomic explosions on field medical installations, thereby providing data:

1. Regarding the degree of protection which is afforded by placing field medical installations in a standard dug-in position.
2. Regarding those items of equipment of the Army Medical Service which are sensitive to the forces released by an atomic explosion.
3. For the determination of the hazards to both operating personnel and patients resulting from blast, thermal, and nuclear radiations.
4. Regarding the hazards to personnel and equipment resulting from fires occurring as a result of overloading of the electrical circuits and combustion of flammable products utilized within such installations.
5. Regarding the effects on items of equipment of the other technical services which are organic to medical units in the field.

1.2 EXPERIMENT DESIGN

1.2.1 Background

Project 3.27 was initiated as a result of the necessity for providing data with regard to the effects of an atomic explosion on field medical installations, personnel, and equipment of the Army Medical Service. These data are considered essential in planning for the field medical service support of forces as deployed in the field for combat.

1.2.2 General

In providing data for the attainment of the objectives outlined in para 1.1 above, two composite type units were placed at

varying distances from ground zero, 4,163 ft, 9,000 ft, and 15,000 ft, in both a standard aboveground position and in a dug-in position (Figs. 1.1 to 1.6). Location and orientation of subject units were determined in accordance with data available in current publications (TM 23-200). In order that maximum thermal and blast effects would be sustained, installations at all sites were oriented with the longitudinal axis at 90 degrees to ground zero. The locations were selected in order to incur slight to severe casualties and damage. Evaluations and estimations of effects on materiel were determined upon the basis of the usability and repairability of equipment following a blast within a theater of operations under conditions of war. Within the zone of interior damage to major items of equipment in excess of 50 per cent may not be economically repairable since the cost of repairs or restoration of equipment exceeds the initial cost of the item; in a theater of operations, however, where sources of procurement may be absent and the time lag in filling requisitions for new equipment may be in excess of six months, many items can be placed in an operational status even though damage to such items is in excess of 50 per cent. Therefore, the evaluation of equipment damage was conducted in such a manner as to determine the usability of all items of equipment within a theater of operations, regardless of the degree of damage sustained.*

1.2.3 Radiation

Gamma radiation was measured in both aboveground and below-ground installations by means of dosimeters and film badges. Data from Project 6.8a additionally were utilized for general determinations.

1.2.4 Photography

Motion-picture photography of the outside of the installations was made before, during, and after the blast. Photography during the blast included two of the established tents at each site, one above ground and one below ground, using Gun-sight Aiming Point (GSAP) cameras operating at 64 frames per second. Before-action still

*For the purpose of this report, damage has been subdivided into four categories: Category 1, no damage or only such damage as to leave the functionability of the item unimpaired; Category 2, damaged, but repairable within the unit in a minimal length of time and with materials available in the unit; Category 3, damaged to such an extent that repairs in a field depot would be required (such items could not be used within the unit); Category 4, damage sustained to such degree that major repair or rebuild in a base shop would be required. This category, also, could not be used within the unit (see para 2.3.1).

photography was made in each tent to establish position relationship of all major components within the tent. After-action still photography in the same positions was made to determine the disruption of these position relationships. Before- and after-action still photography was made of each individual functional setup within the various tents to determine the disruption of small items of equipment and to record the damage to each component. Project 3.27 personnel all participated in accomplishing the necessary photography.

1.2.5 Graphic Layouts

Graphic layouts were prepared for each tent with additional graphic layouts for each individual setup within the tent. These graphics were utilized in the establishment of each installation in order that, within the purview of equipment available, all installations would be as near alike as possible. After the blast these graphics were utilized by checking parties for determination of the extent of displacement and the degree of damage sustained by unevaluated items under damage criteria (see para 2.3.1).

1.2.6 Equipment Checks

All functional elements were tested operationally prior and subsequent to the blast. Medical equipment maintenance evaluation teams checked each major item of equipment evaluated before and after the blast in order to determine the degree and extent of damage incurred under damage criteria. Throughout all installations, gasoline-operated equipment contained gasoline which, however, was not ignited during the test. Anesthesia setups utilizing ether as an anesthetic had opened cans of ether stoppered with corks.

1.2.7 Casualty Production

Casualty production at each site was estimated through personal observations after the blast and through motion-picture photography during the blast. Casualty incidence was considered to be a result of burns from initial thermal radiation, of trauma from secondary missiles as a result of blast, of burns resulting from secondary fires, and of radiation injury resulting from nuclear radiation.

1.2.8 Blast and Thermal Measurements

Blast measurements and thermal radiation at the three locations were determined by Programs 1 and 8 of the Military Effects Group.

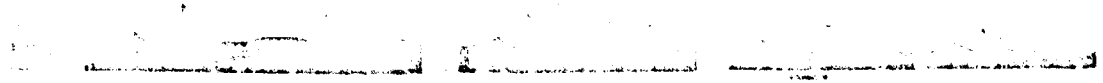


Fig. 1.1 Site 1, A^{*}, 4,163 ft from Ground Zero

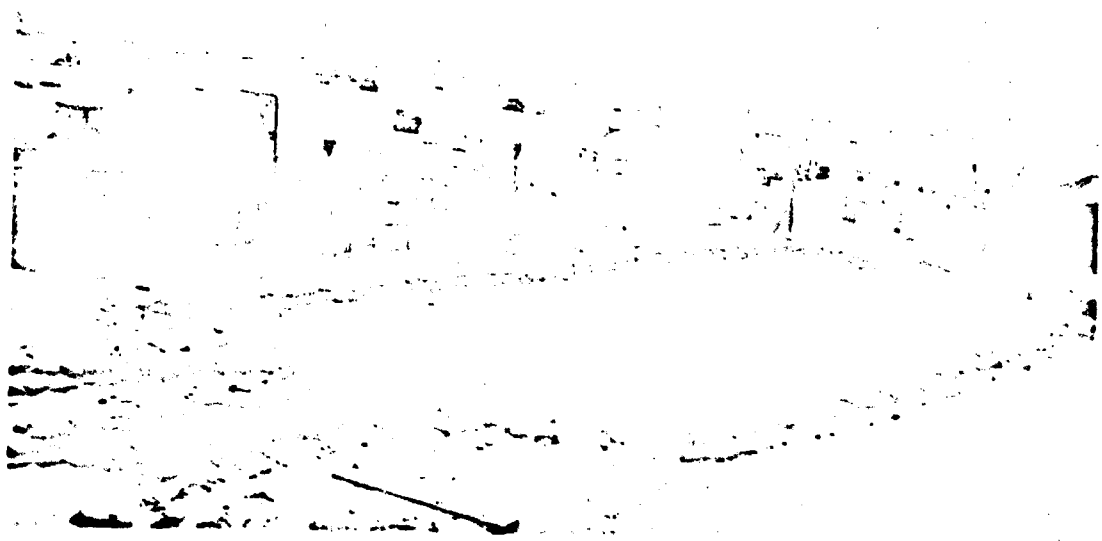


Fig. 1.2 Site 1, B^{**}, During Construction, 4,163 ft from Ground Zero

- * A: Above ground
- ** B: Below ground

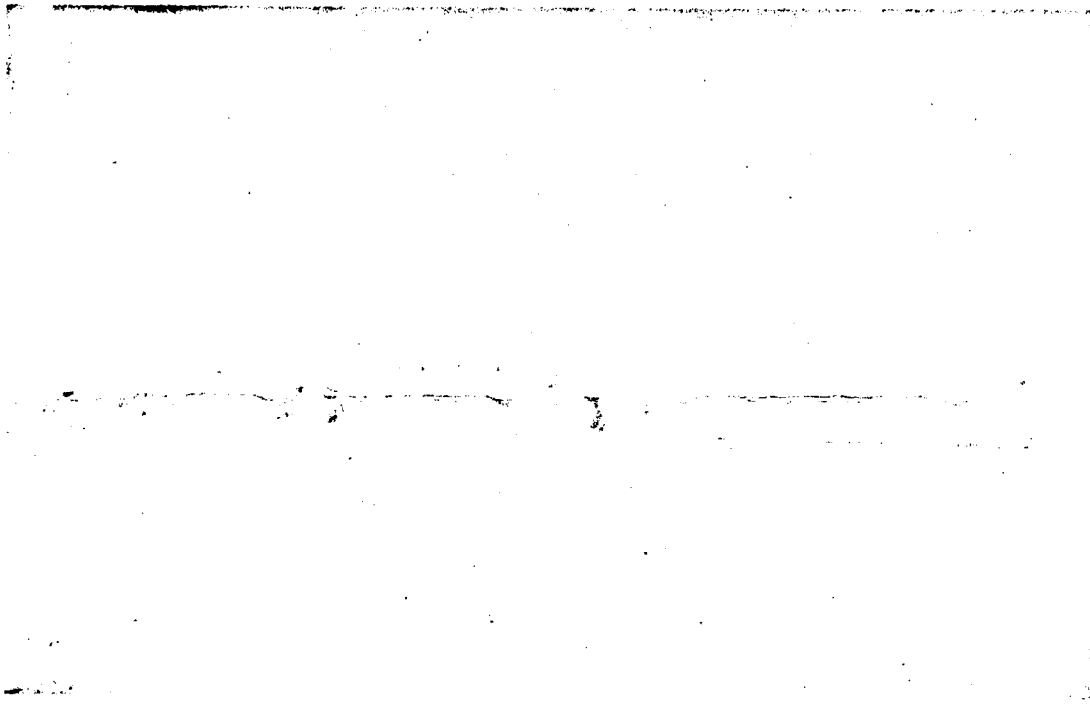


Fig. 1.3 Site 2, A, 9,000 ft from Ground Zero

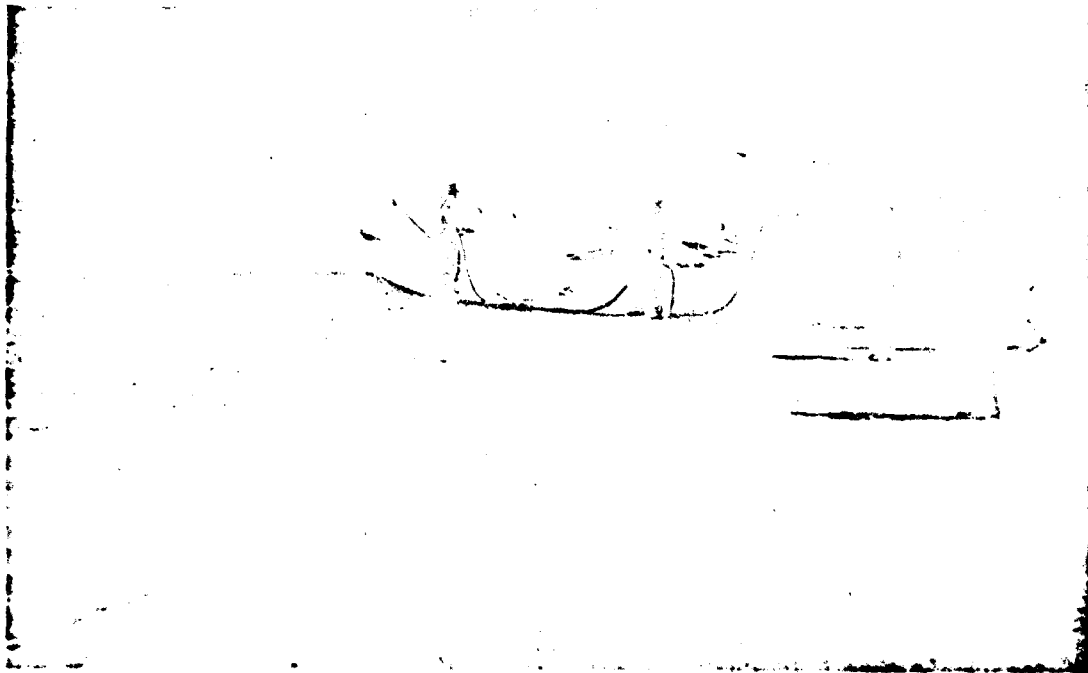


Fig. 1.4 Site 2, B, 9,000 ft from Ground Zero

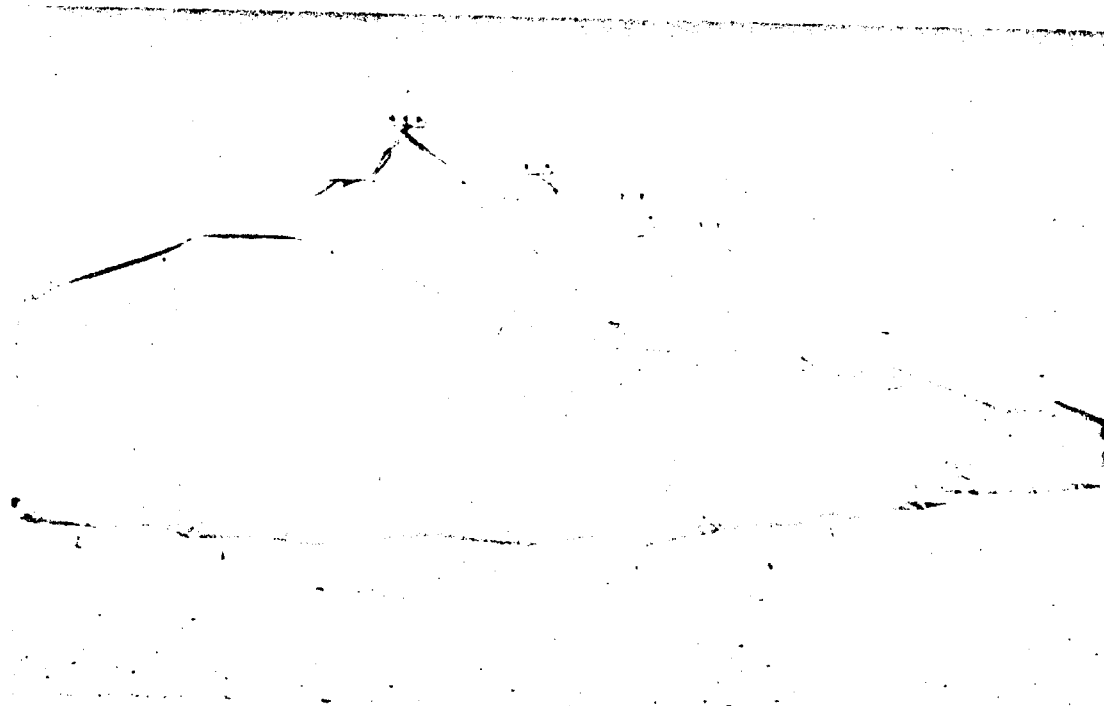


Fig. 1.5 Site 3, A, 15,000 ft from Ground Zero

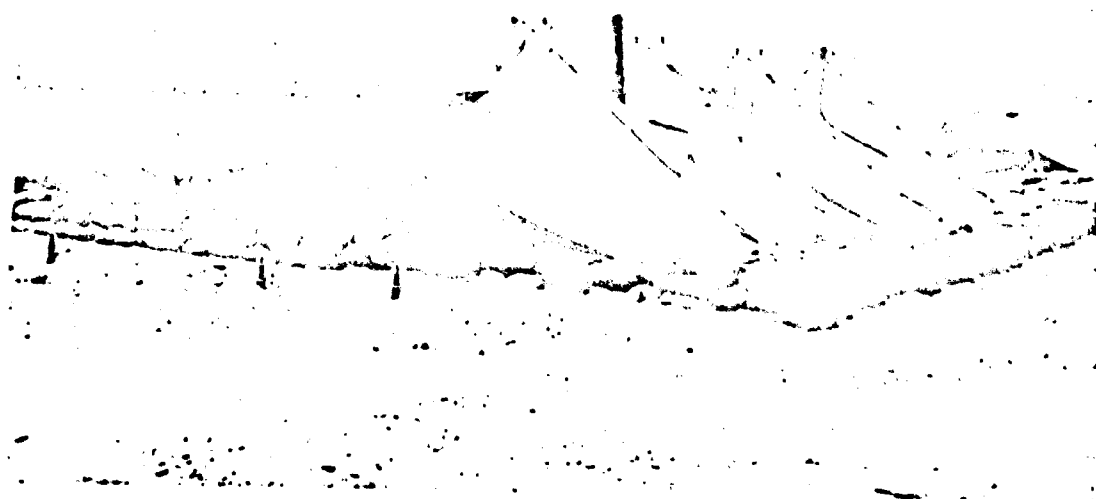


Fig. 1.6 Site 3, B, 15,000 ft from Ground Zero

1.2.9 Unit A

Unit A consisted of a composite battalion aid station and regimental collecting station erected in the currently authorized squad tent for these units. This installation was located at 4,163 ft and 9,000 ft from actual ground zero in both an above-ground and a dug-in position. Both installations were identical in the arrangement of equipment contained therein. Underground construction (Fig. 1.7) consisted of an excavation 34 ft 4 in. by 16 ft, and 4 ft 6 in. deep. This excavation was reinforced in one-half its length with sandbags, and in the remaining half by a 2-in. by 4-in. stake, chicken wire, and burlap retaining wall. The excavation was surrounded by a wall of sandbags 2 ft 6 in. by 2 ft 6 in., including the inclined entrance into the tent. During the blast, two ceiling lights and the field operating lamp were in operation.

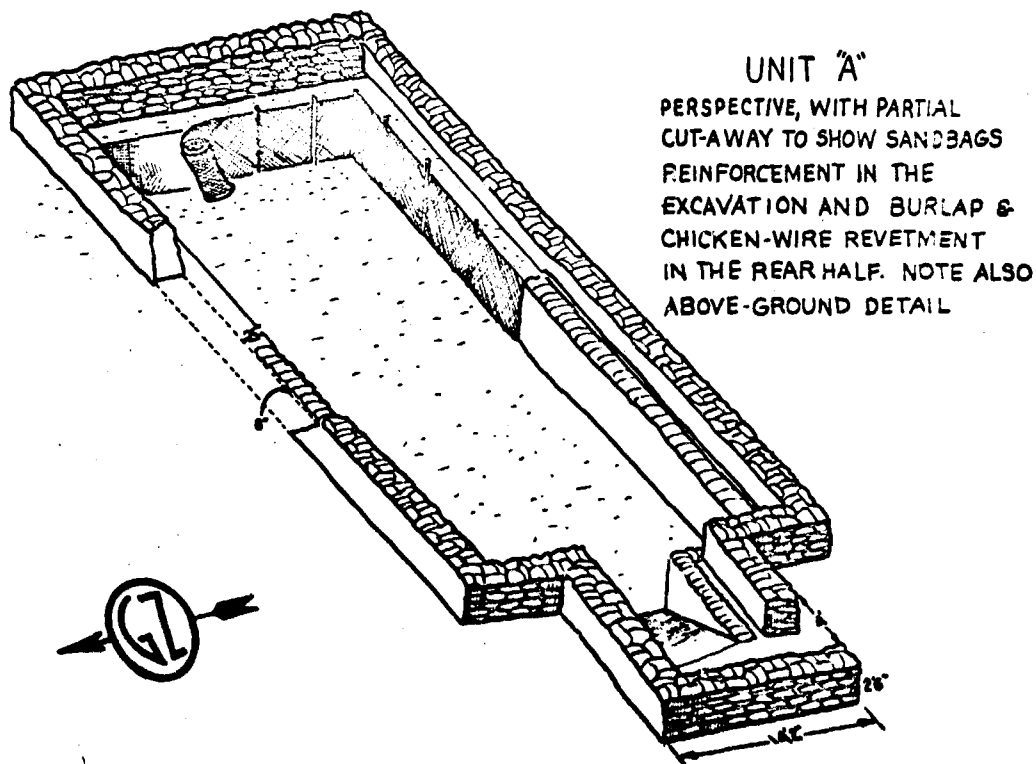


Fig. 1.7 Unit A Specifications

Figure 1.8 depicts schematically the arrangement of equipment and Figs. 1.9 to 1.16 show actual arrangement of equipment within Unit A.

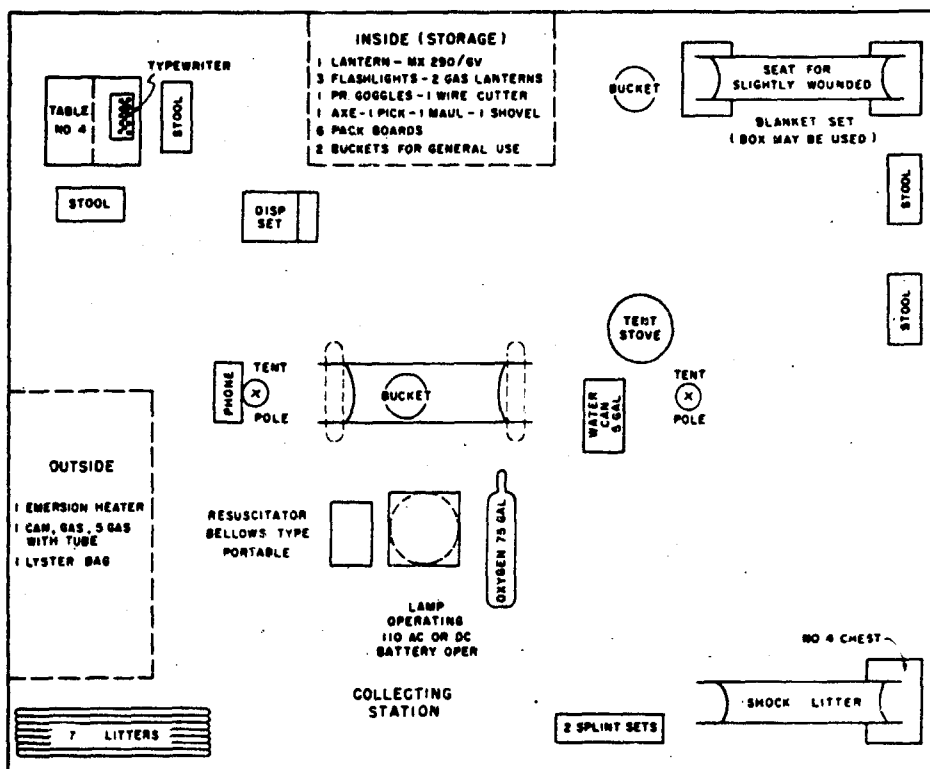


Fig. 1.8 Graphic Layout, Unit A

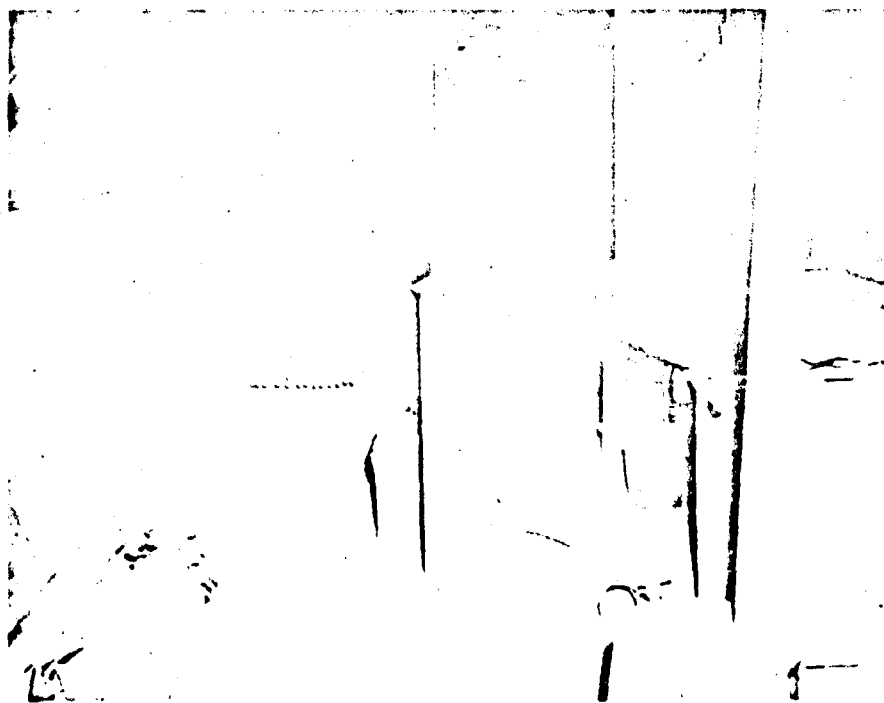


Fig. 1.9 Unit A, General, Interior, away from Ground Zero

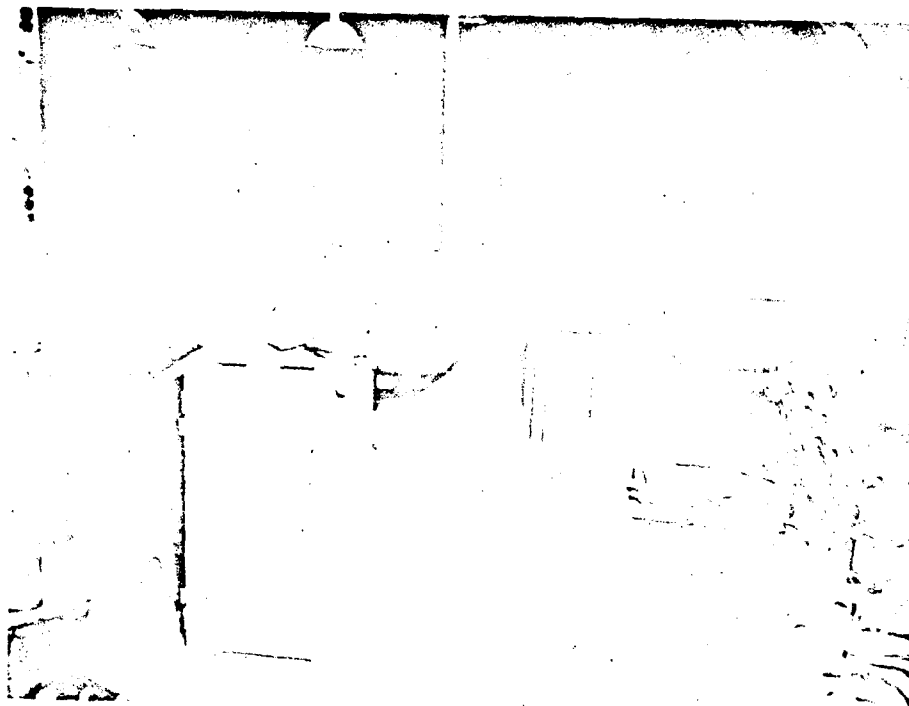


Fig. 1.10 Unit A, General, Interior,
toward Ground Zero

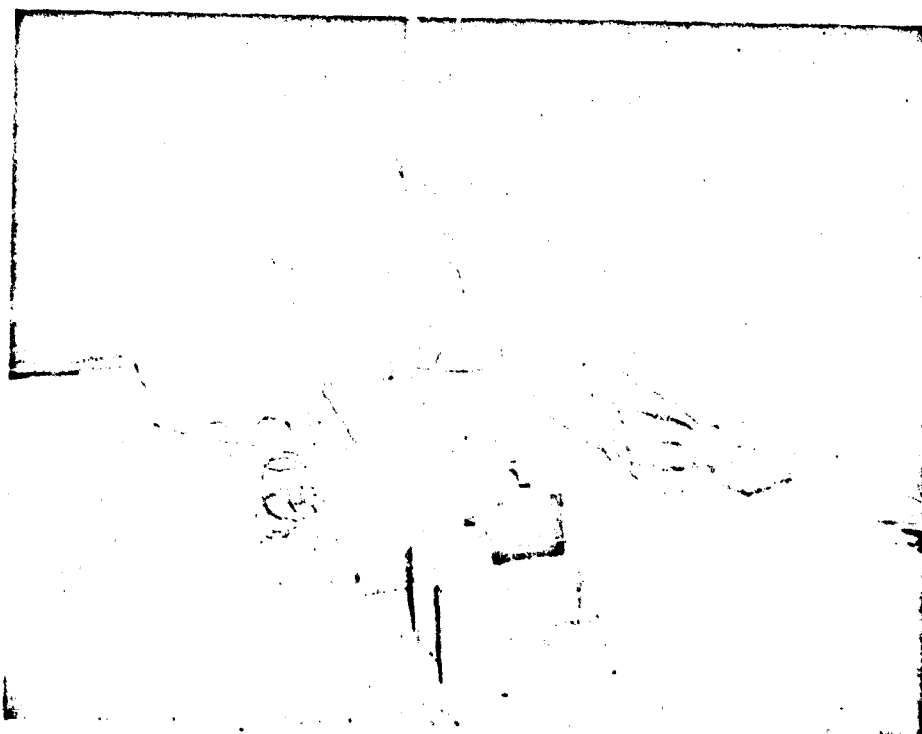


Fig. 1.11 Unit A, Oxygen and Splint Sets,
Operating Light, Resuscitator

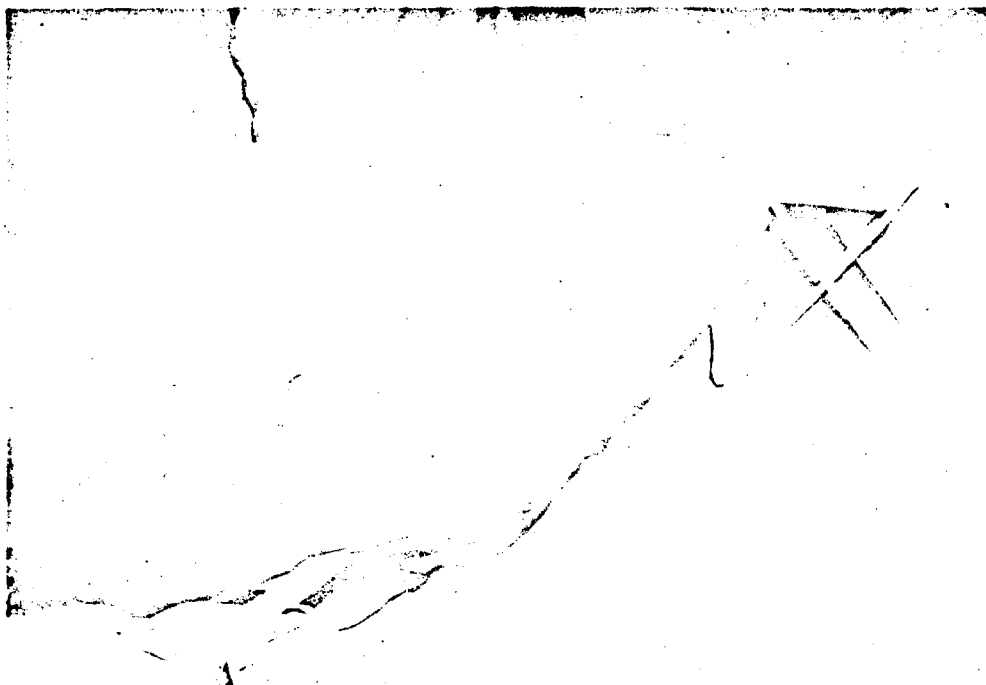


Fig. 1.12 Unit A, Casualty Evacuation Bag, Slightly Wounded Section

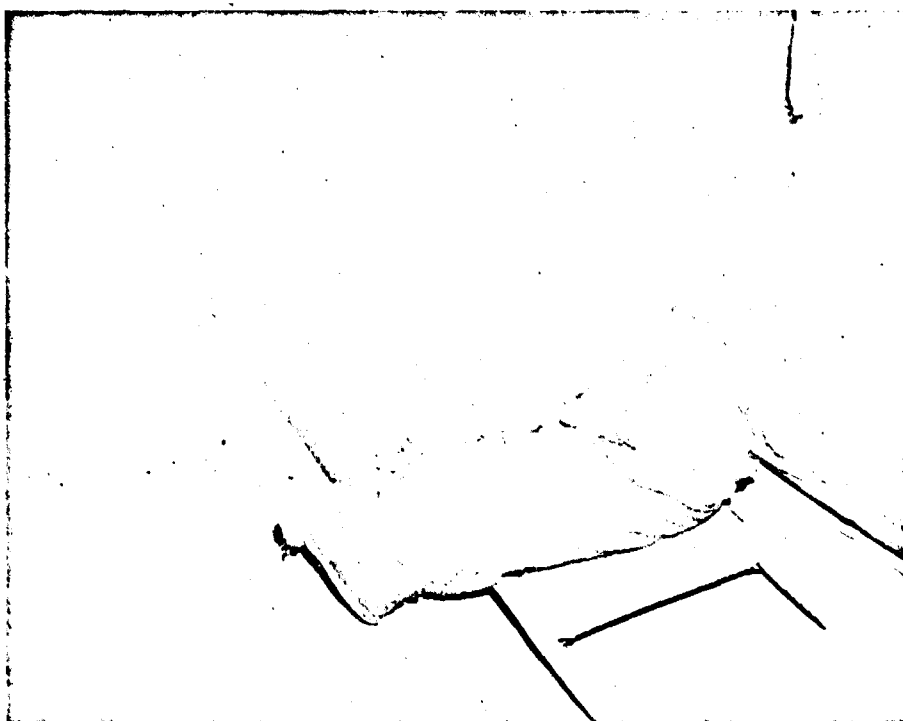


Fig. 1.13 Unit A, Casualty Evacuation Bag, Shock Position, Seriously Wounded Section

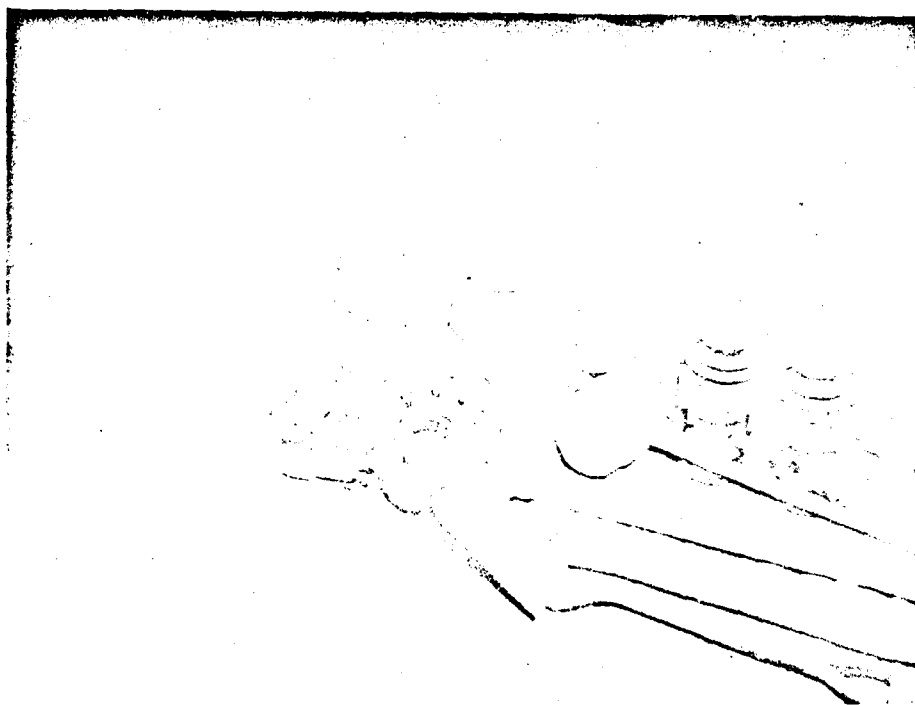


Fig. 1.14 Unit A, Supply Section

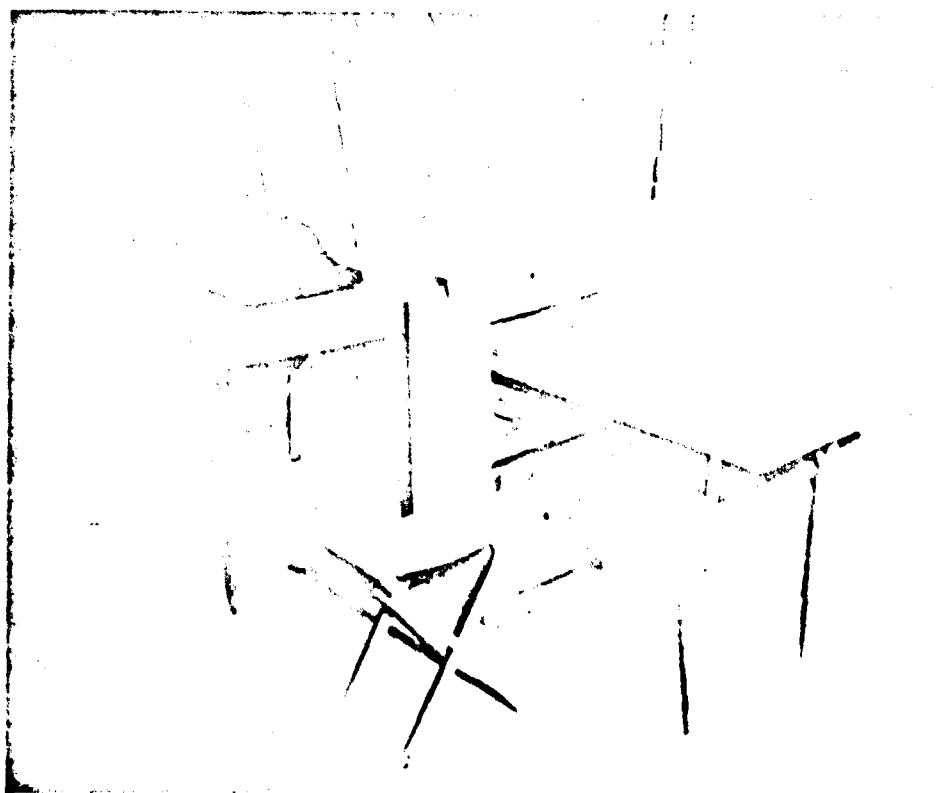


Fig. 1.15 Unit A, Records Section



Fig. 1.16 Unit A, Treatment Section

1.2.10 Unit B

Unit B consisted of a composite division clearing station, mobile army surgical hospital, and evacuation hospital. This unit was erected in hospital sectional tents which are currently authorized for these units. There were four such hospital sectional tents containing (1) a surgery; (2) an X-ray, dental, ear, nose, and throat, eye and maxillofacial sections; (3) a pharmacy and laboratory; and (4) a ward, respectively. These installations were placed at 4,163 ft, 9,000 ft, and 15,000 ft from actual ground zero in both an aboveground and in a dug-in position. The aboveground installations (Figs. 1.1, 1.3, 1.5) were arranged functionally. Below-ground installations (Figs. 1.2, 1.4, 1.6) also were arranged functionally so as to be identical with aboveground units. Below-ground construction (Fig. 1.17) consisted of four excavations 18 ft by 52 ft with a depth of 6 ft, each surrounded by an aboveground wall of sandbags to a height of 1 ft and a width of 2 ft 6 in. The interior of the excavation was supported in one-half its length by sandbagging and in the other half by a retaining wall composed of 2-in. by 4-in. stakes, chicken wire, and burlap. Because of the markedly unstable condition of the ground at Site 3 (15,000 ft) sandbagging was used throughout the excavations except in the surgical tent where the stake, chicken wire, and burlap retaining wall was employed. Instead of the usual 3-ft spread of the stakes, these were placed only 2 ft apart and the burlap was reinforced with tar paper. Inclines were placed at each end of the excavations and included in the aboveground sandbagging.

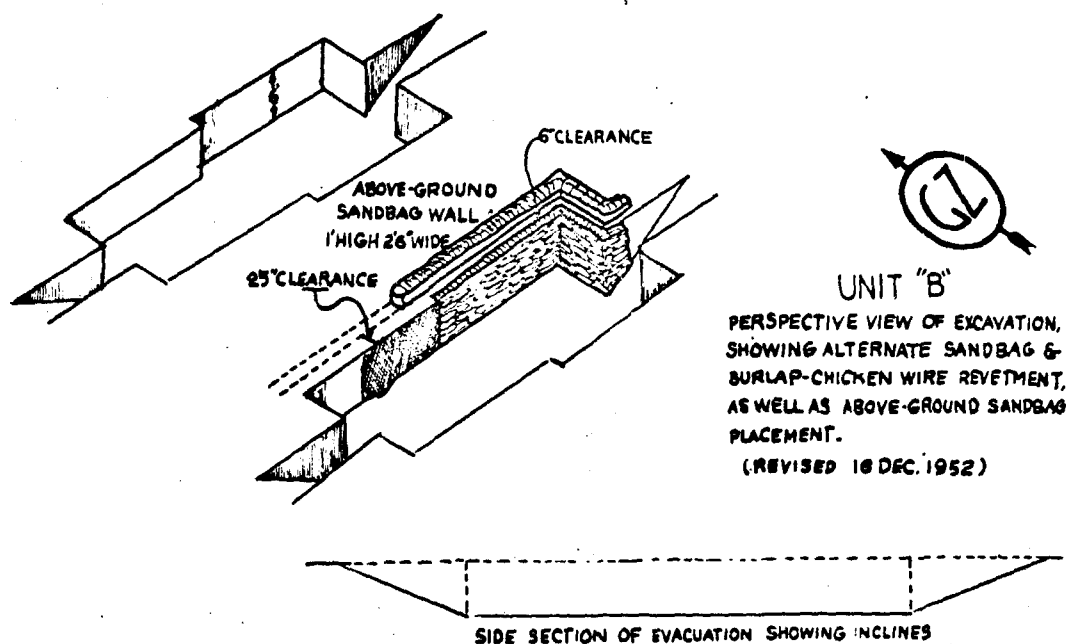


Fig. 1.17 Unit B Specifications

1.2.10.1 Surgical Tent

Figure 1.18 depicts schematically the arrangement of the major items of equipment contained within the surgical tent. The equipment was arranged functionally and consisted of surgical arrangements for the conduct of neurosurgical, thoracic, abdominal #1 and #2, genitourinary, and orthopedic procedures. Additionally, there were the supporting facilities necessary for operation, i.e., sterile and unsterile supplies, scrubbing facilities, sterilization equipment, anesthesia equipment and utilities, and cleanup equipment. Figures 1.19 to 1.40 show photographically the individual arrangement of the equipment. Some of the equipment was operational at the time of the blast. The functioning equipment consisted of three ceiling lights, two suction apparatuses, the electrosurgical unit, and six operating lights.

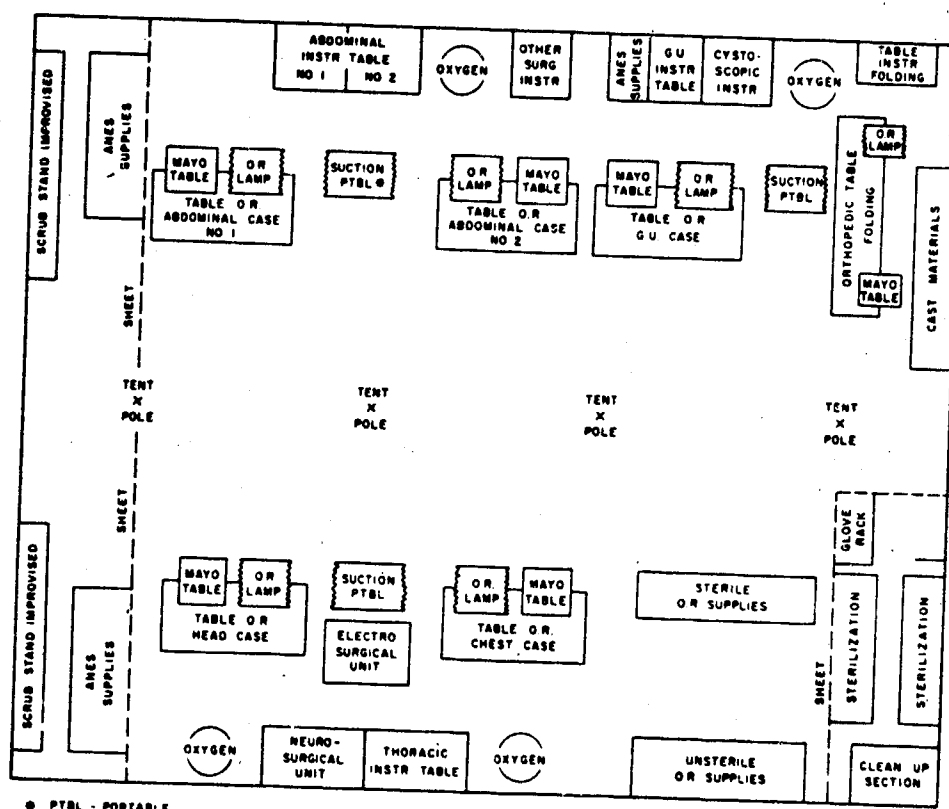


Fig. 1.18 Unit B, Surgical Tent, Graphic Layout, Ground Zero at Top (Not to Scale)

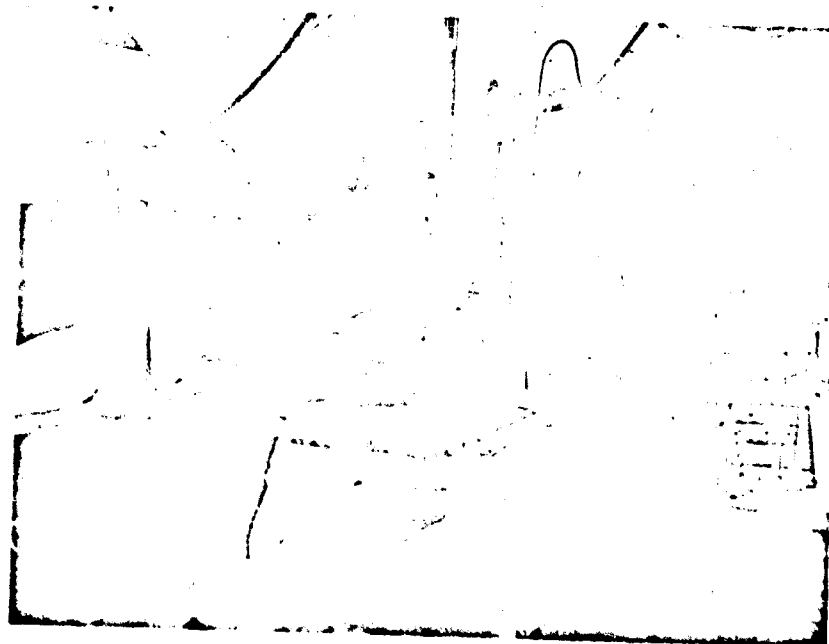


Fig. 1.19 Surgery, General View, Looking Obliquely toward Ground Zero

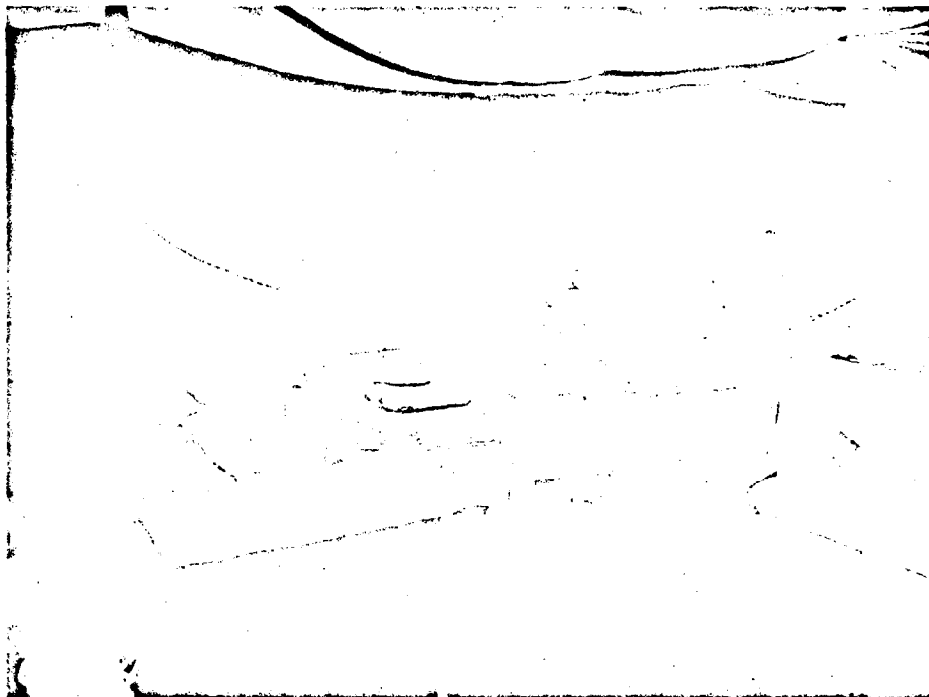


**Fig. 1.20 Surgery, Anesthesia Supplies to Left,
Reserve G. U. Table to Right**

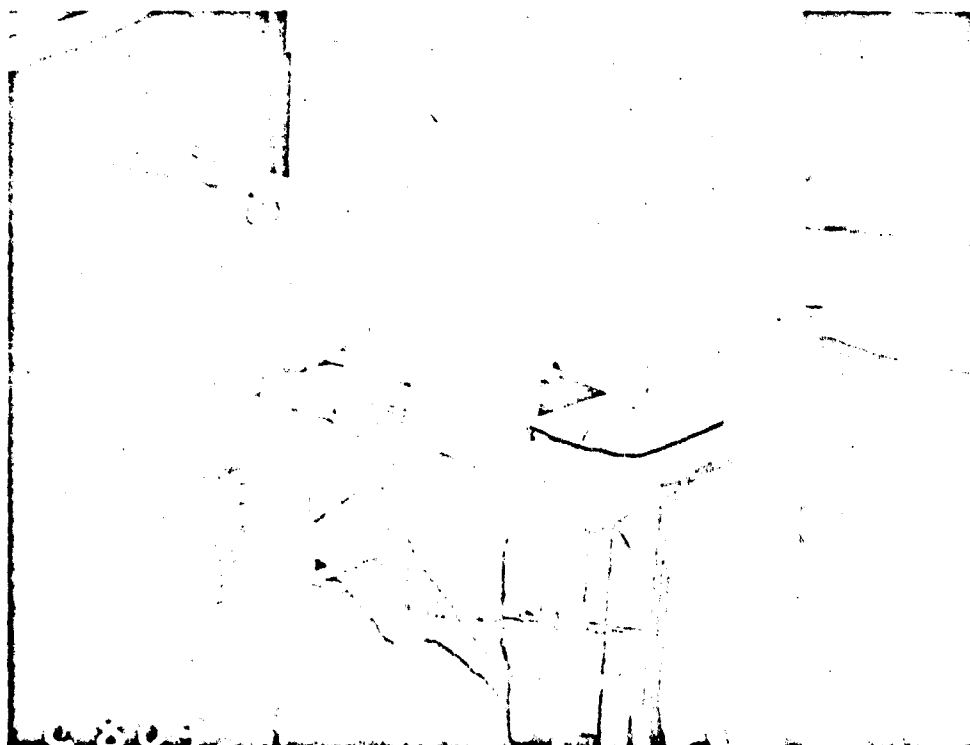


Fig. 1.21 Surgery, Anesthesia and Sterilizing Equipment

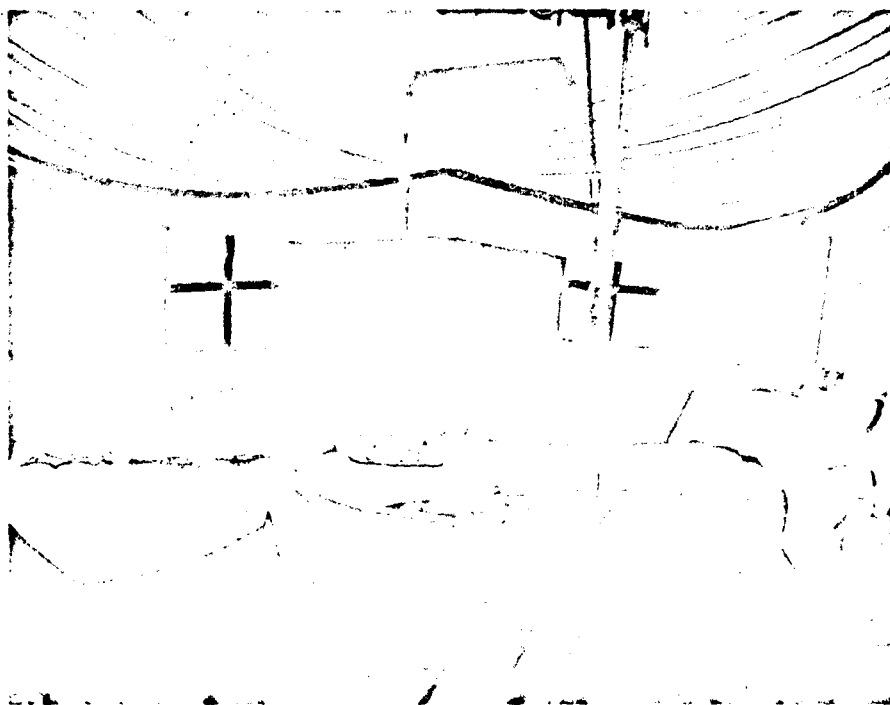


Fig. 1.22 Surgery, Neurosurgery

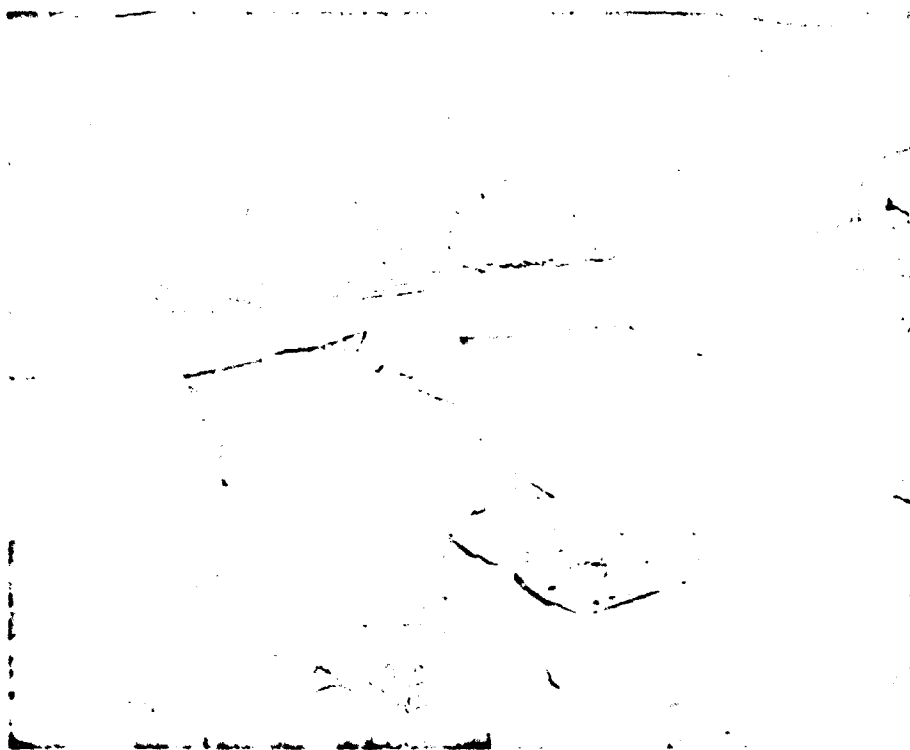


Fig. 1.23 Surgery, Chest and Neurosurgery Reserve Tables,
Left to Right, Anesthesia, Foreground

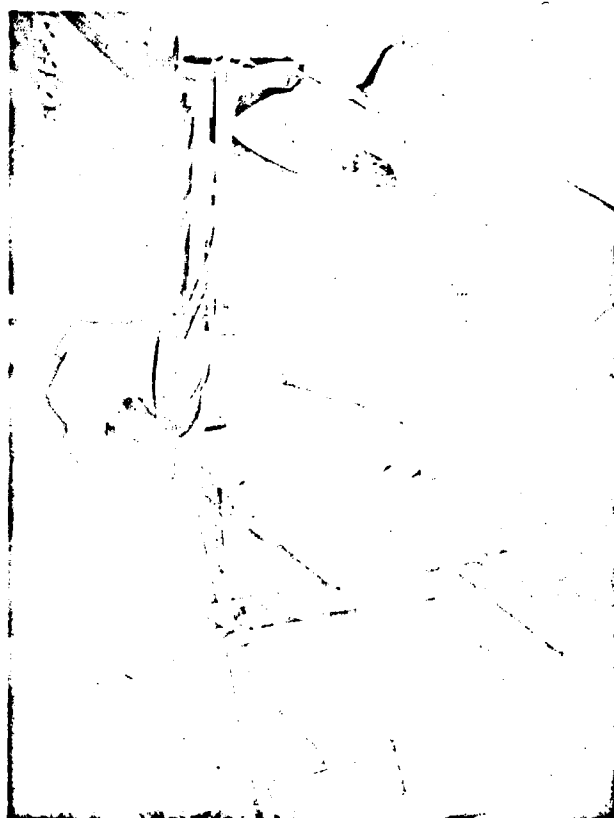


Fig. 1.24 Surgery, Thoracic Surgery

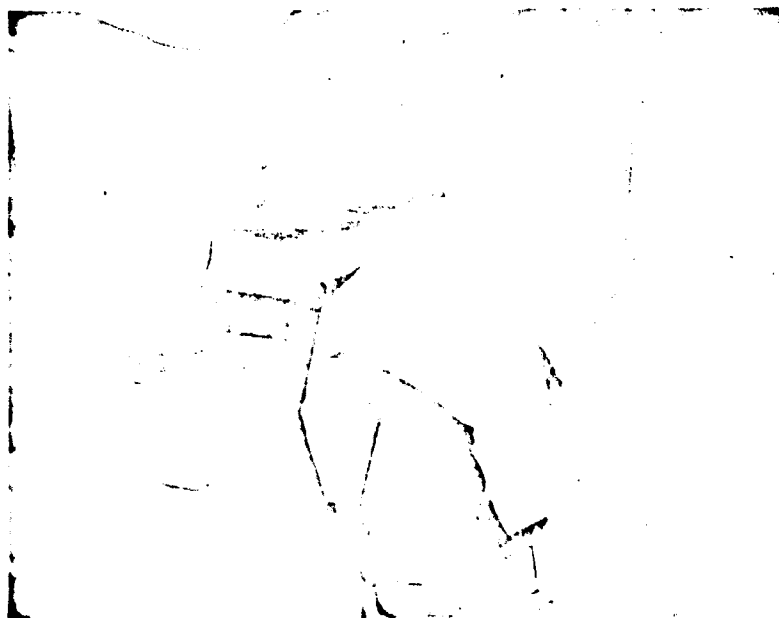


**Fig. 1.25 Surgery, Thoracic Surgery, Foreground -
Neurosurgery, Background**

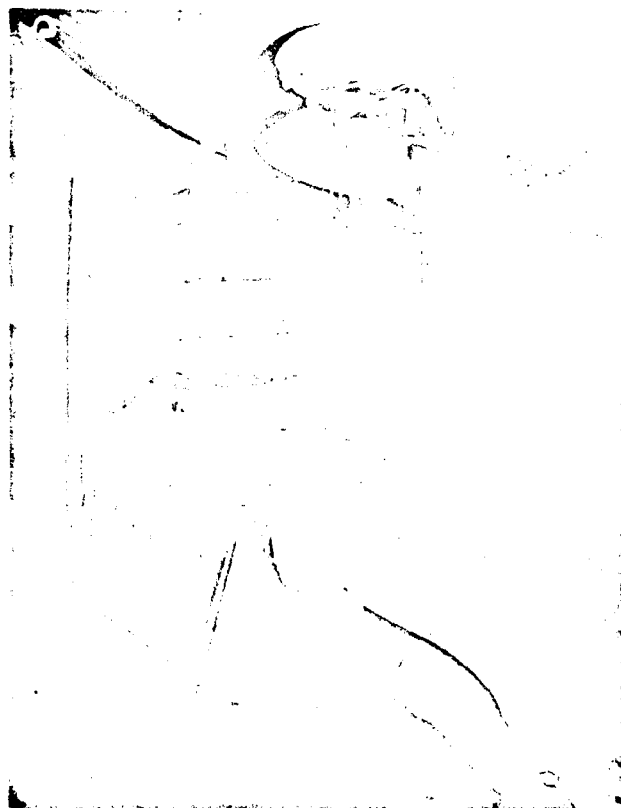


Fig. 1.26 Surgery, Abdominal Surgery #1

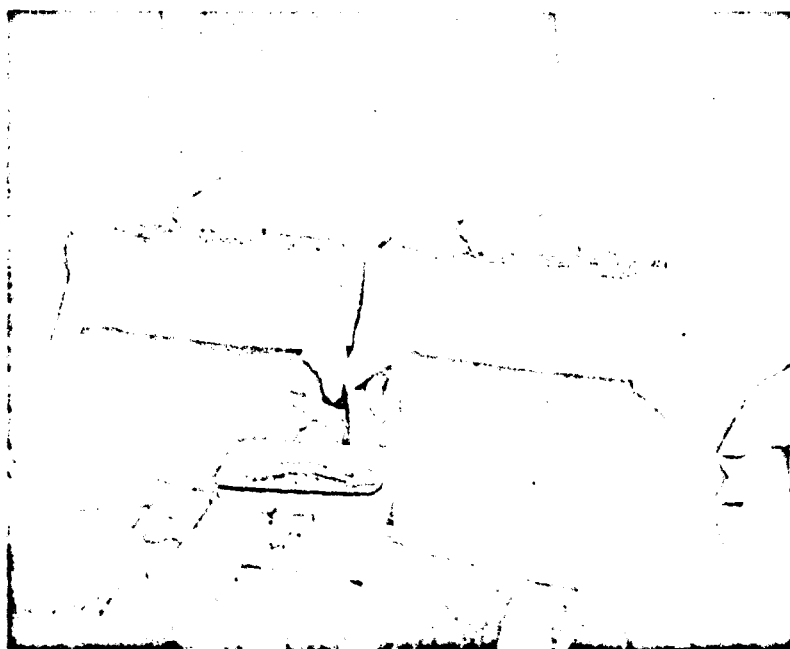


Fig. 1.27 Surgery, Abdominal Surgery, Reserve Tables
for #1 and #2, Left to Right



Fig. 1.28 Surgery, Abdominal Surgery, #2 Foreground, #1 Background



Fig. 1.29 Surgery, Other Surgical Instruments

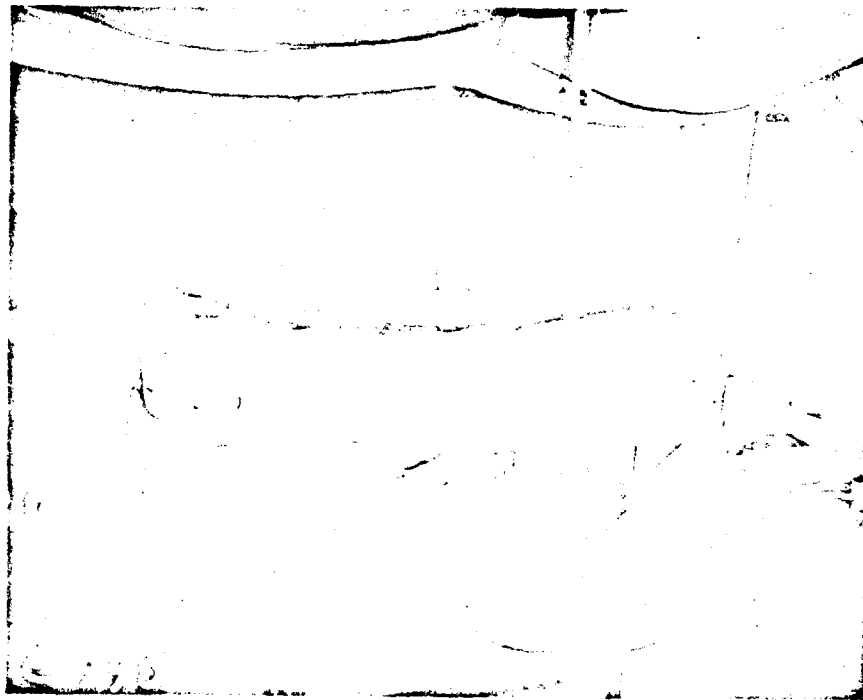


Fig. 1.30 Surgery, Abdominal Surgery #2

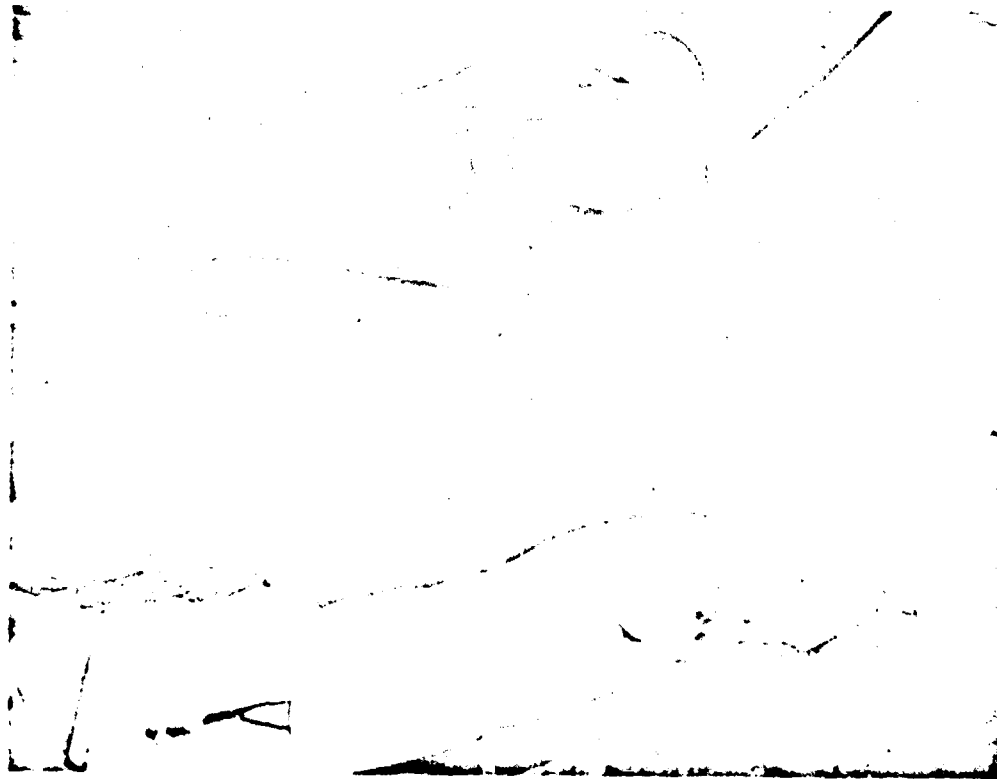


Fig. 1.31 Surgery, Genitourinary Surgery

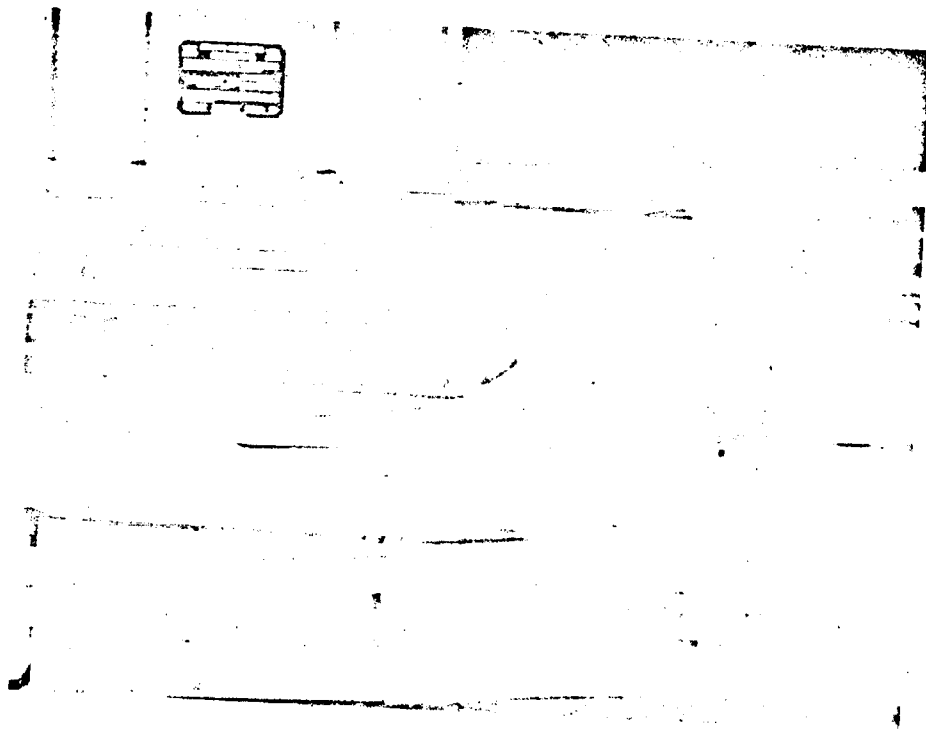


Fig. 1.32 Surgery, Genitourinary Surgery,
Cystoscopic Instruments

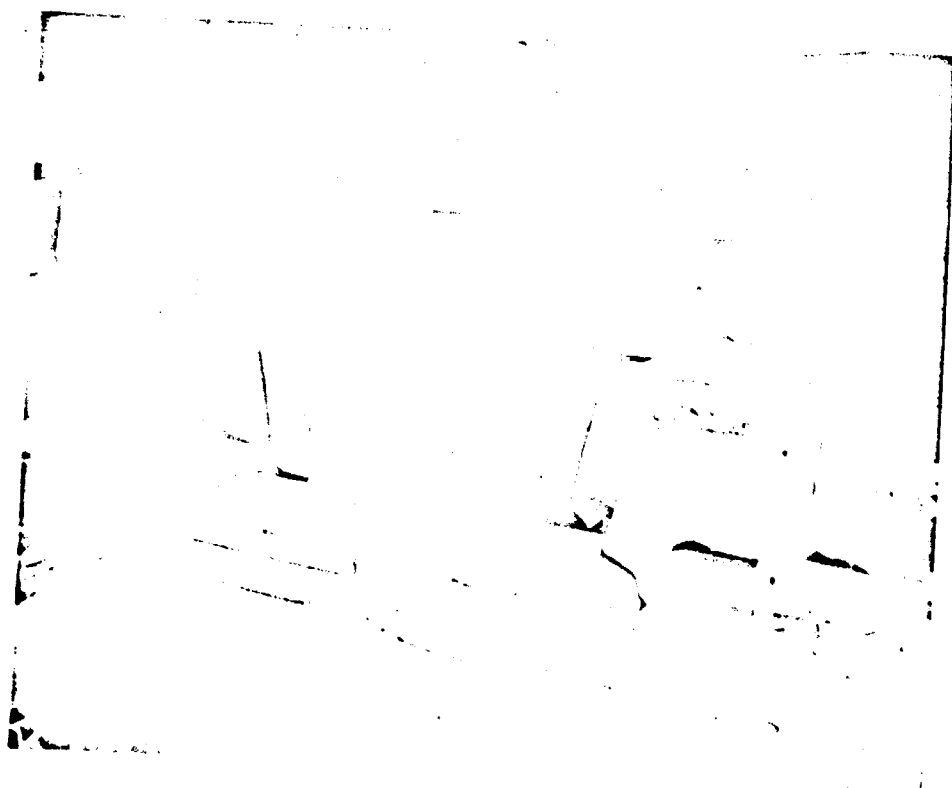


Fig. 1.33 Surgery, Orthopedic Surgery

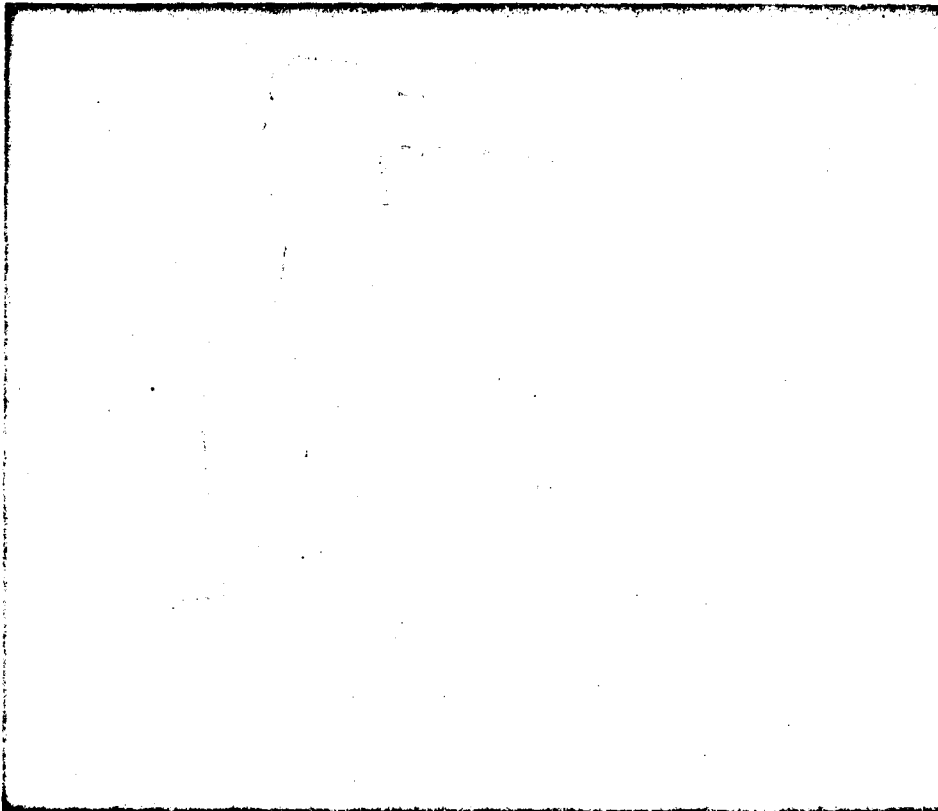


Fig. 1.33 Surgery, Scrubbing Facilities

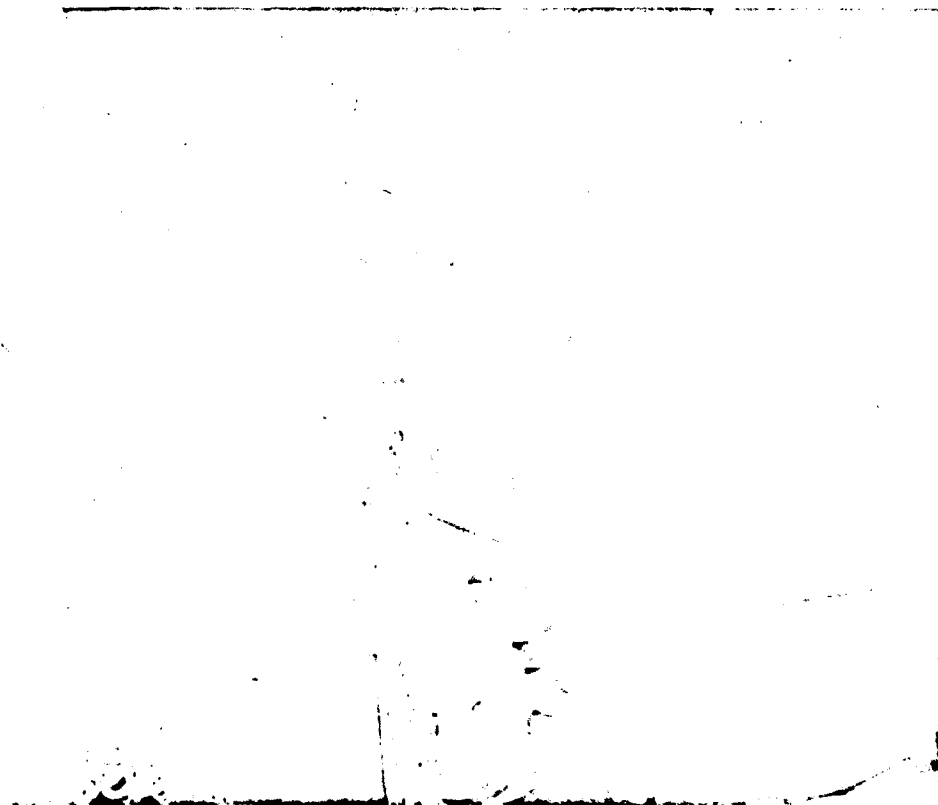


**Fig. 1.34 Surgery, Orthopedic Surgery, -
Mayo Table, Reserve Table, and
Plaster Table, Left to Right**

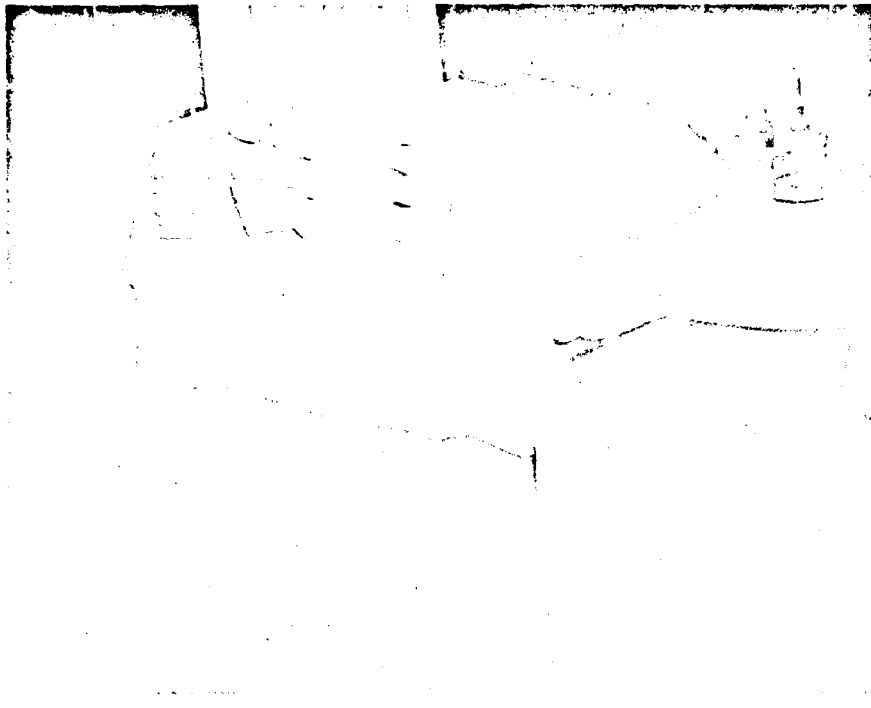


Fig. 1.36 Surgery, Sterile Supplies

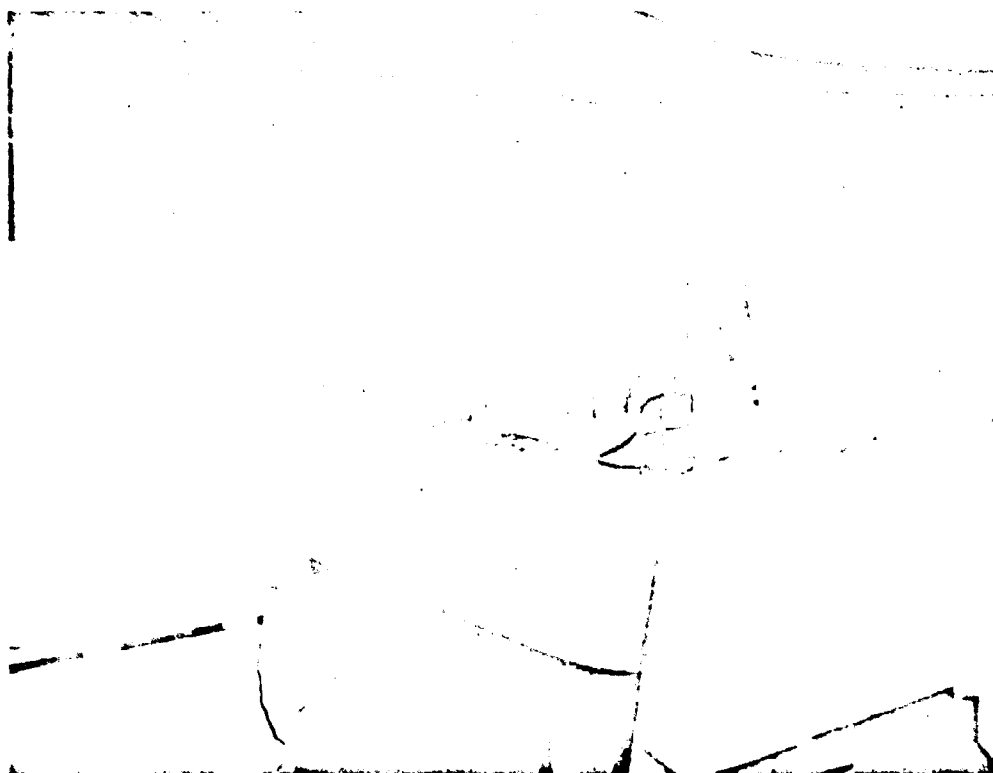


Fig. 1.37 Surgery, Unsterile Supplies

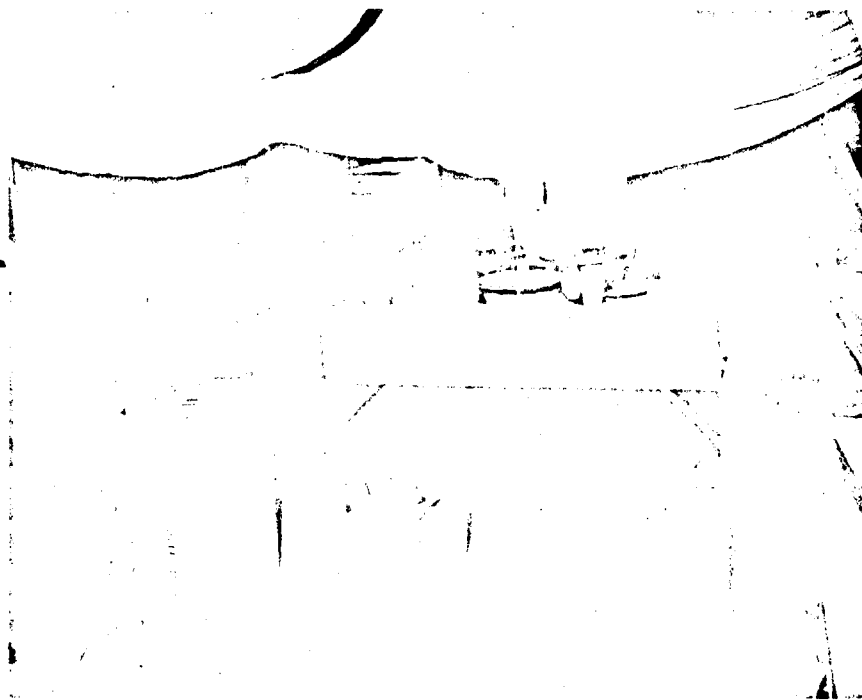


Fig. 1.38 Surgery, Utility and Cleanup Facilities

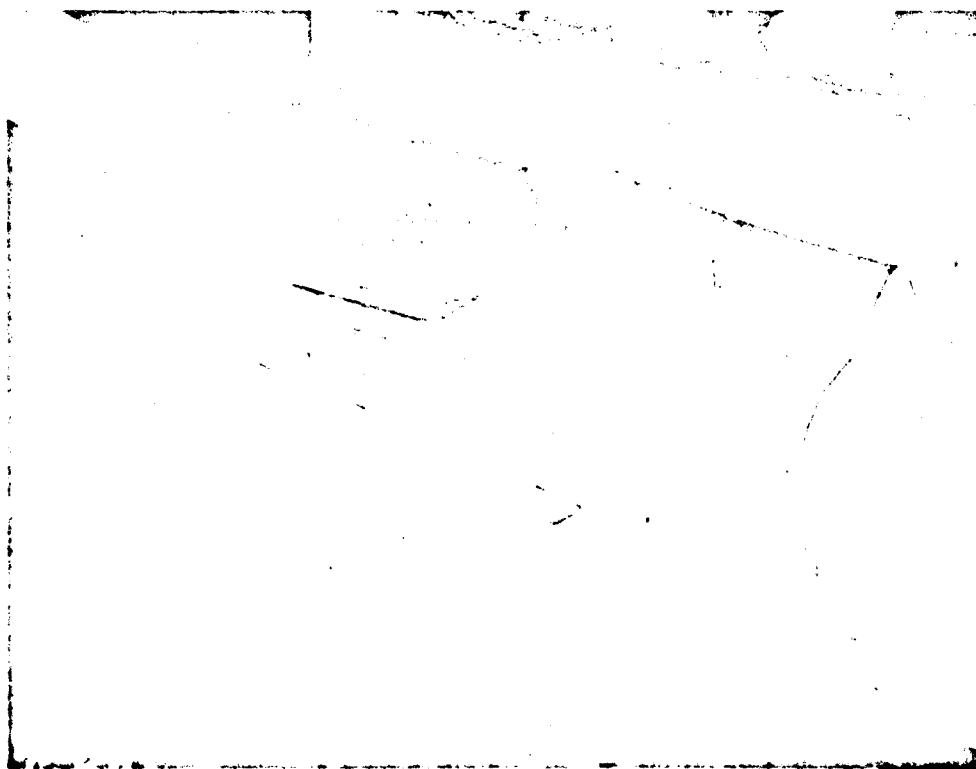


Fig. 1.39 Surgery, Anesthesia Setup and Suction Apparatus, Foreground

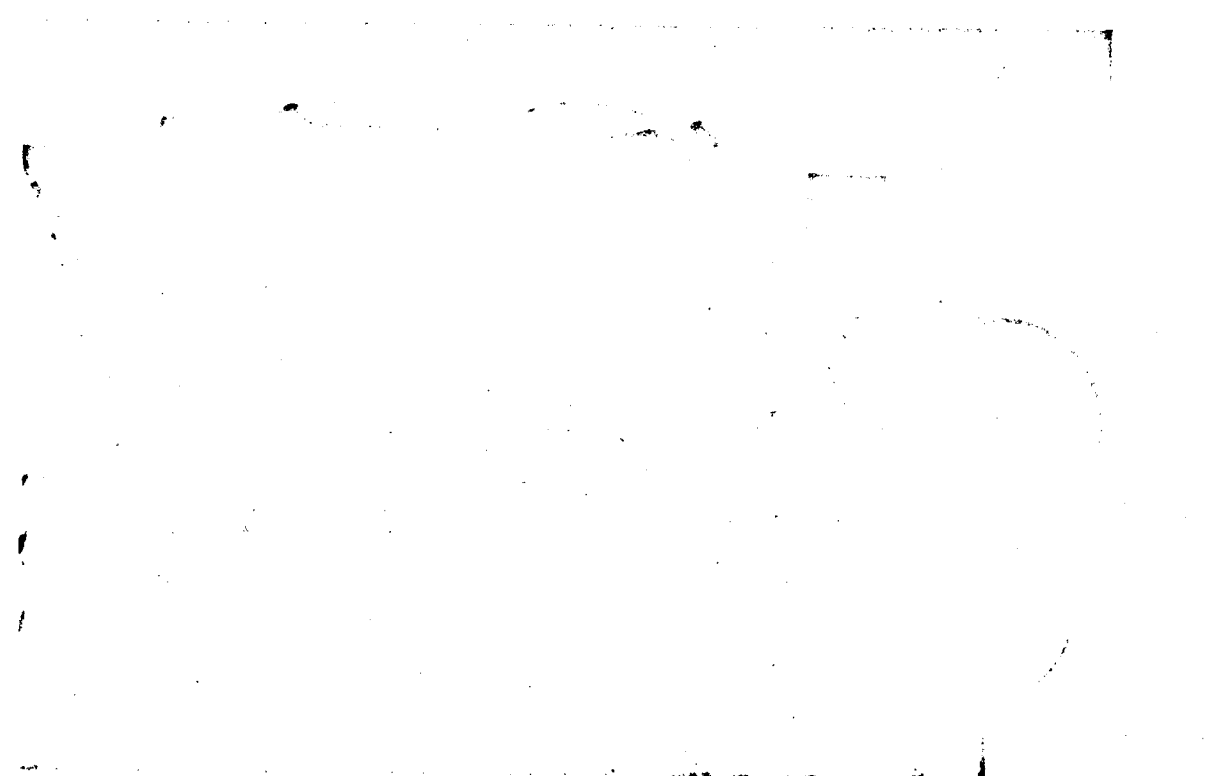


Fig. 1.40 Surgery, Electrosurgical Unit

1.2.10.2 X-ray Tent

The X-ray tent included clinic types of setup for eye, dental treatment, dental prosthetic, maxillofacial, and ear, nose, and throat procedures, as well as the X-ray equipment, which included a complete field darkroom, a 100 ma. X-ray with cassette changer, a 15 ma. X-ray, and a portable X-ray with all necessary equipment. All equipment was arranged functionally and was operable prior to the blast. During the blast, however, only certain equipment was in actual operation, i.e., two ceiling lights, 100 ma. X-ray, 15 ma. X-ray, portable X-ray, one Coakley lamp, two eye lamps, two chair lamps, two radiographic film illuminators, and two darkroom safety lamps. Figure 1.41 depicts schematically the arrangement of the major items of equipment within this tent. Figures 1.42 to 1.58 indicate photographically the items of equipment and their arrangement within the X-ray tent.

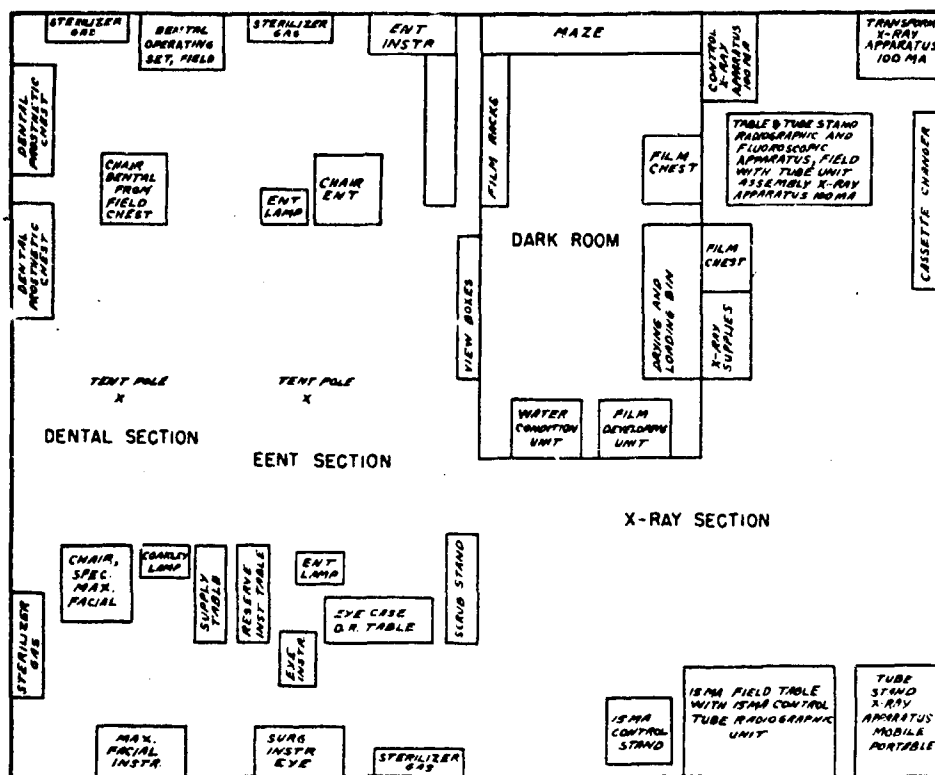


Fig. 1.41 X-ray Tent, Graphic Layout, Schematic (Not to Scale)

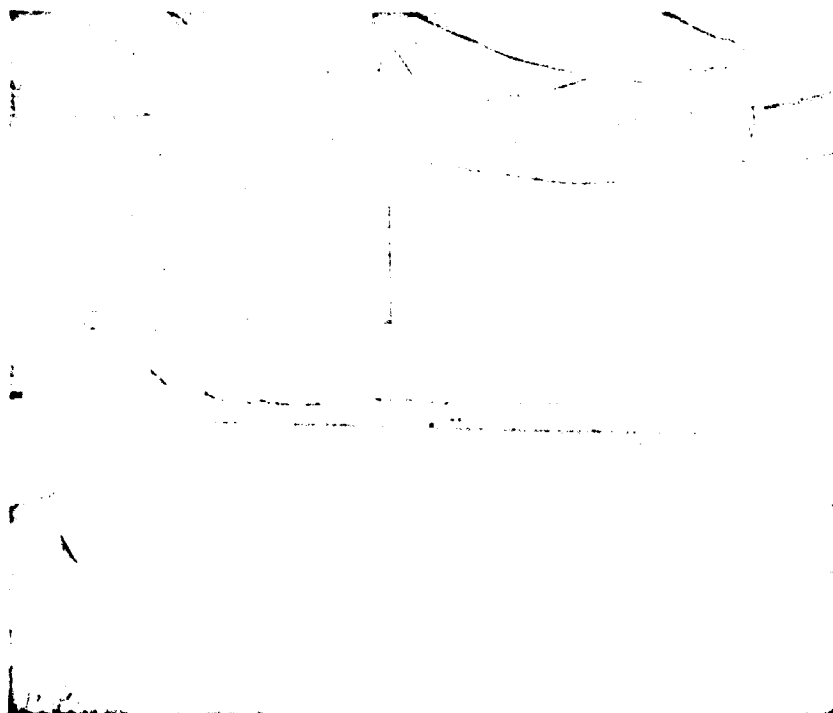


Fig. 1.42 X-ray Section, 100 ma. X-ray Unit

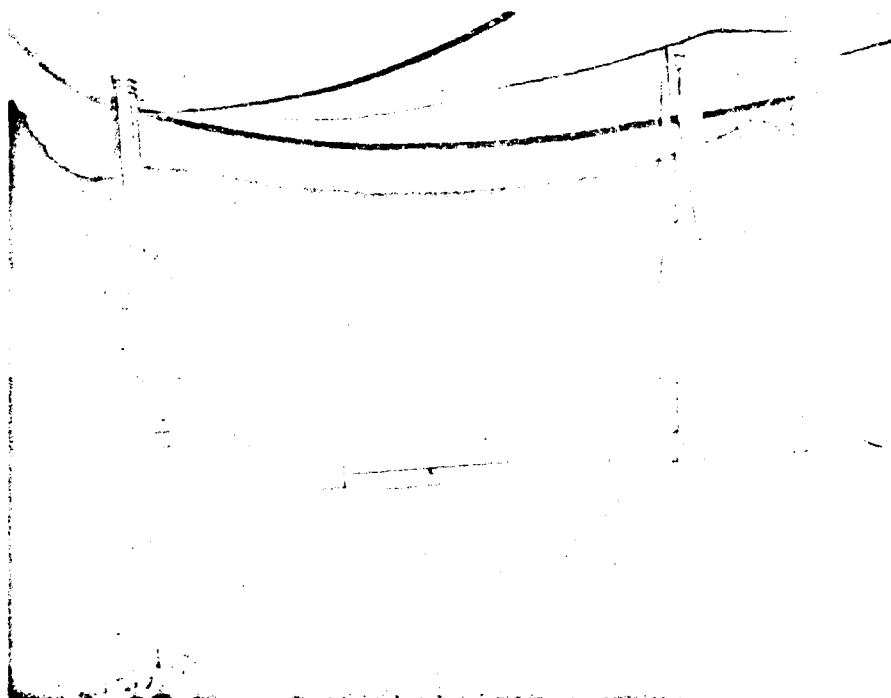


Fig. 1.43 X-ray Section, 15 ma. and Portable
X-ray Unit, Left to Right

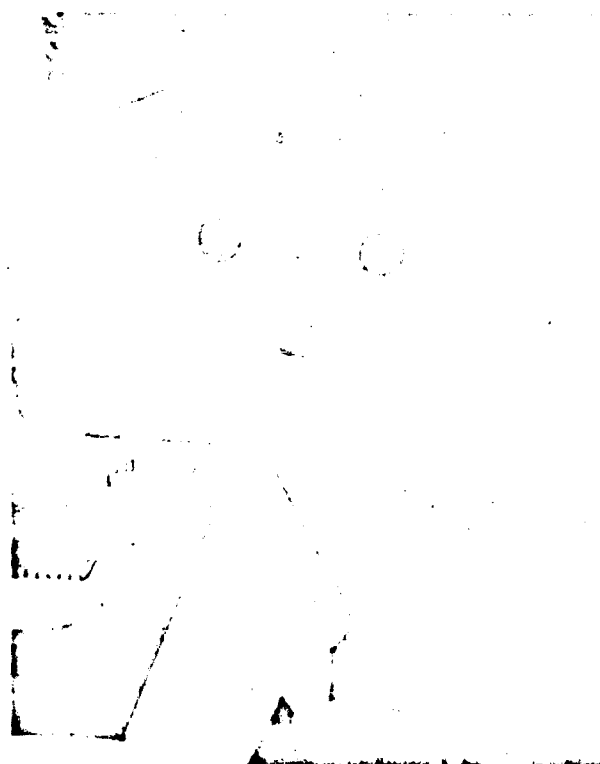


Fig. 1.44 X-ray Section, Control Panel, 100 ma. X-ray Unit

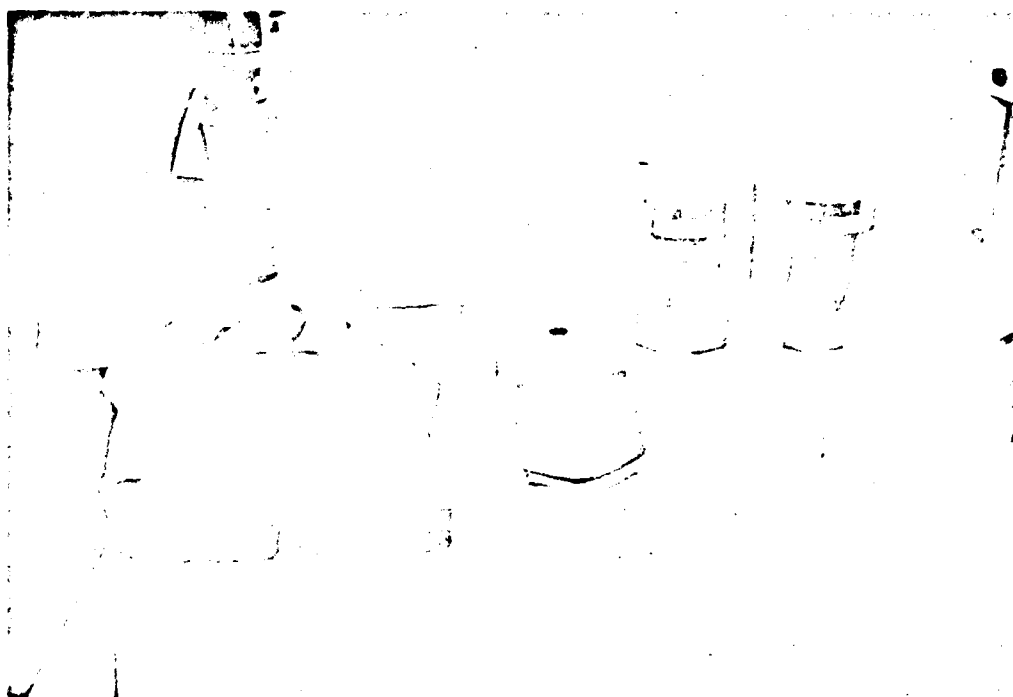


Fig. 1.45 X-ray Section, X-ray Supplier

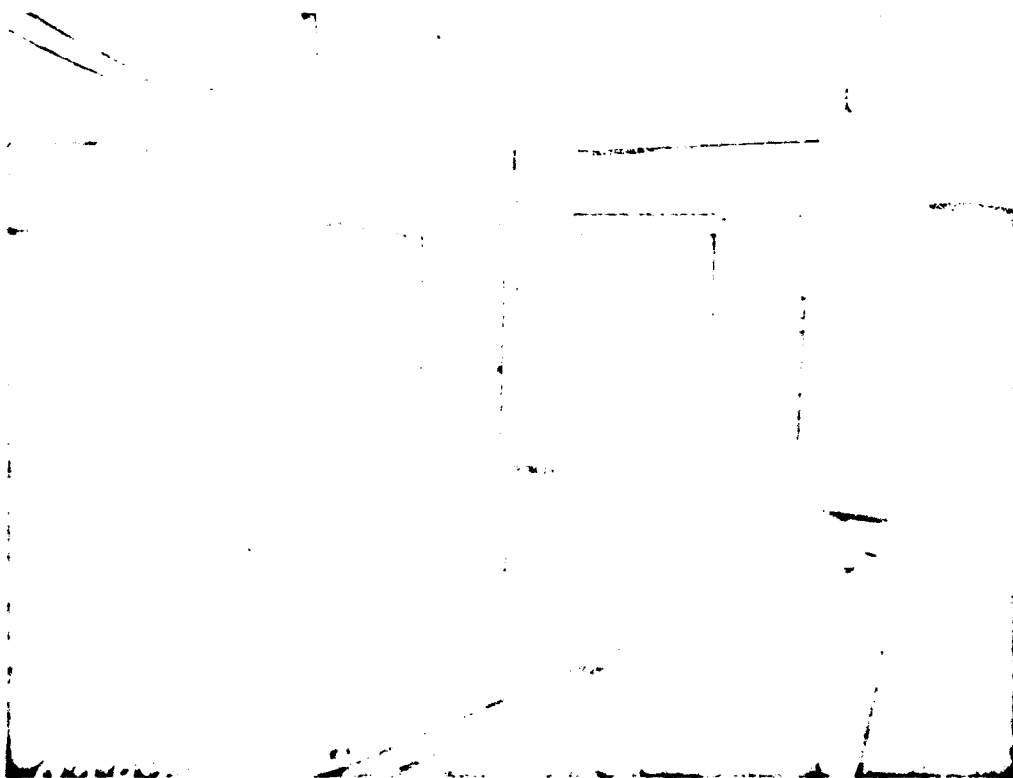


Fig. 1.46 X-ray Section, Cassette Changer and Transformer, 100 ma. Unit

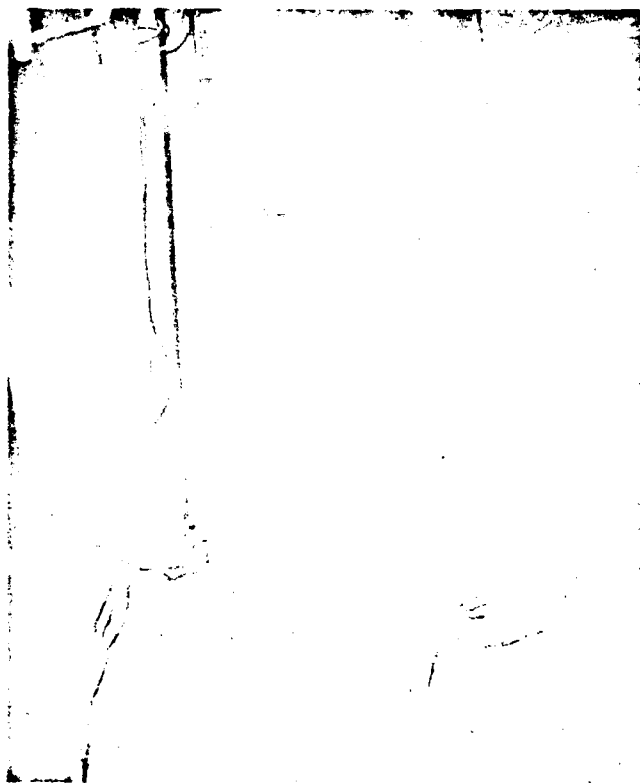


Fig. 1.47 X-ray Section, Control Unit, 15 ma. Unit

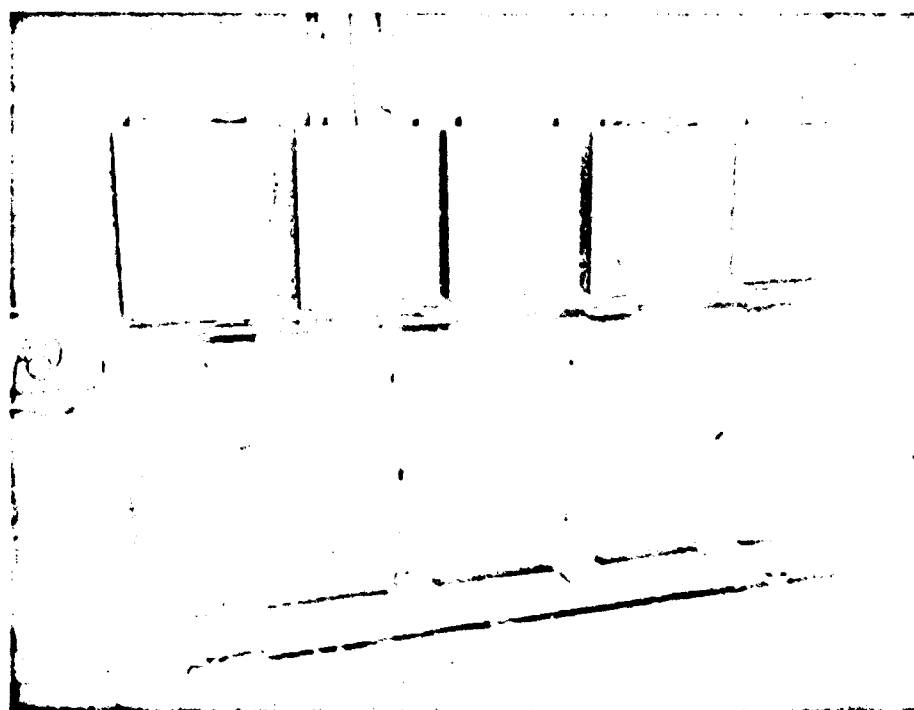


Fig. 1.48 X-ray Section, Radiographic Film Illuminators

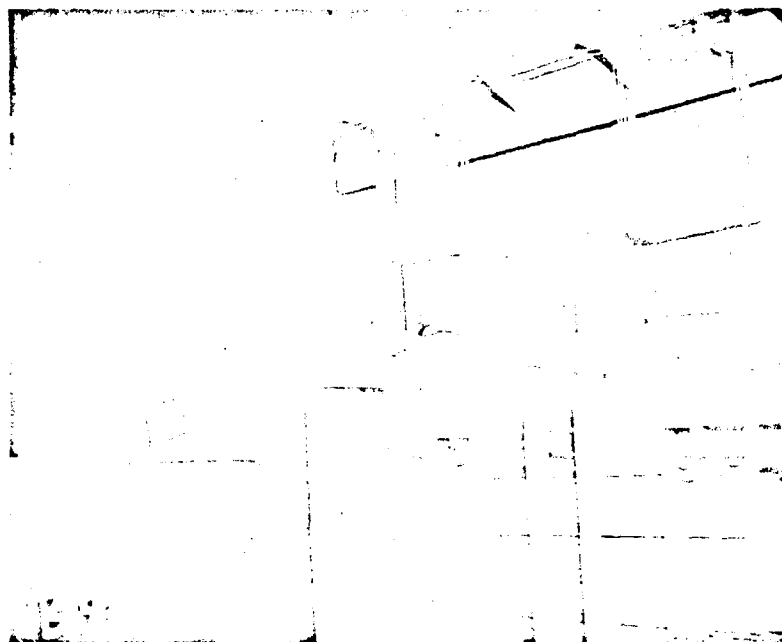


**Fig. 1.49 X-ray Darkroom, Polaroid Film Processing Unit,
Water Conditioning, and Improvised Film Racks**

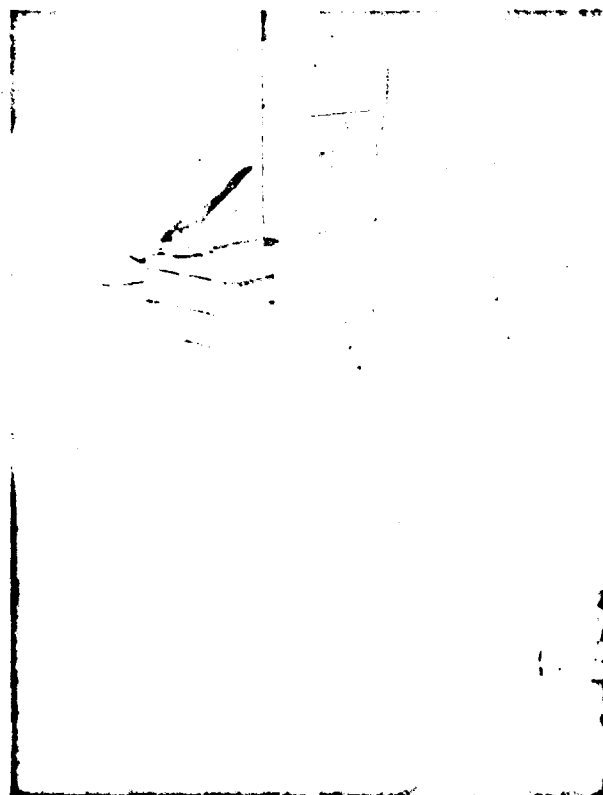


Fig. 1.50 X-ray Darkroom, Film Loading and Drying Bin

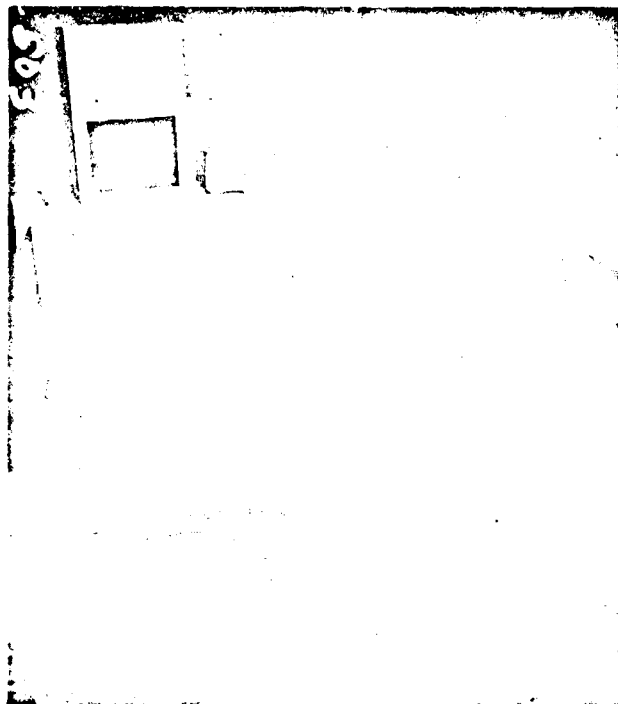


Fig. 1.51 X-ray Darkroom, Film Processing Unit, Developing Tanks on Left, Water Conditioning Unit on Right

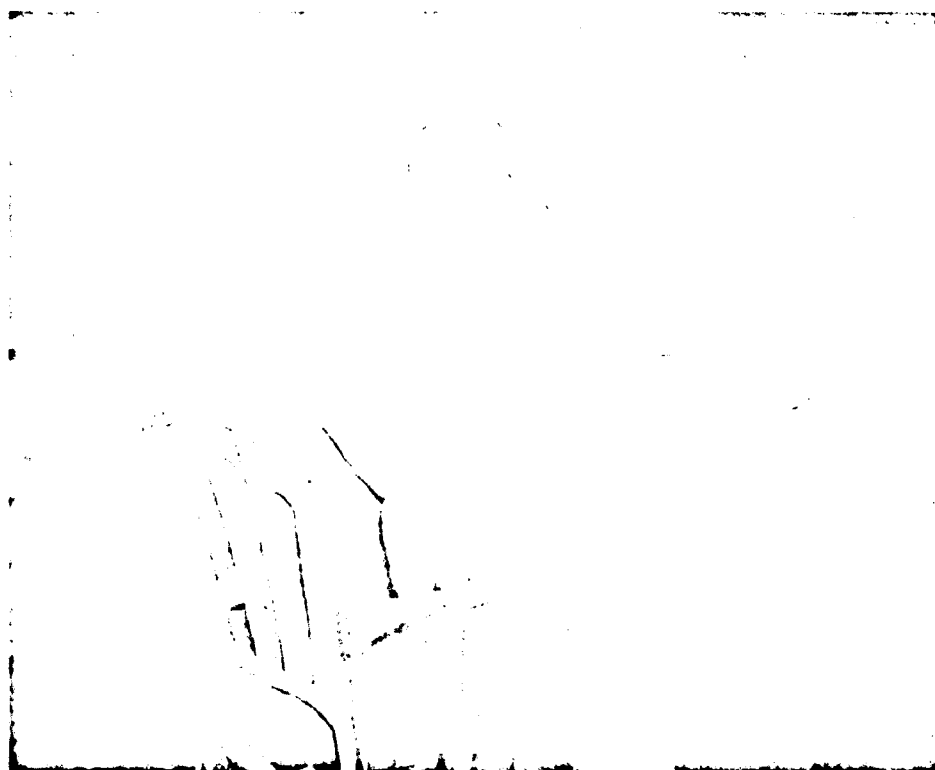


Fig. 1.52 Clinics Section, Maxillofacial Treatment

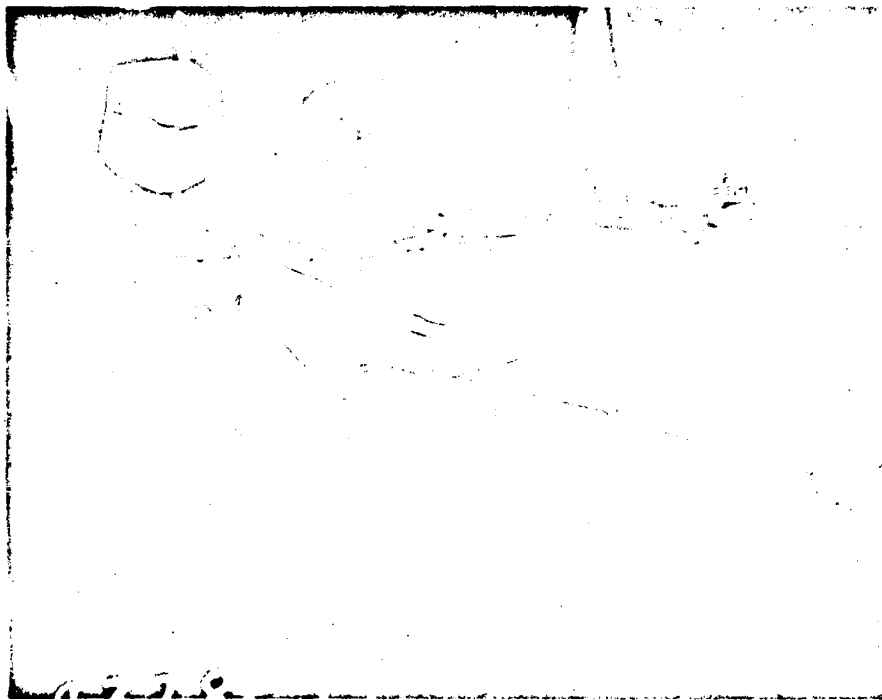


Fig. 1.53 Clinics Section, Ear, Nose, and Throat Treatment

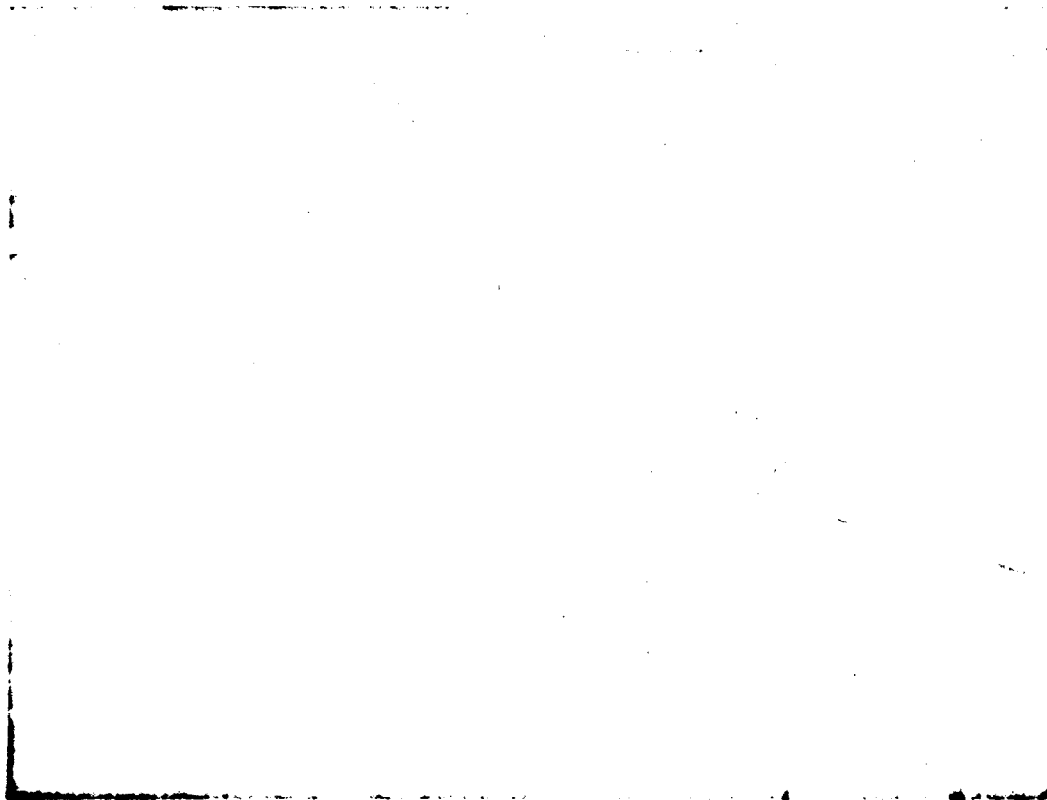


Fig. 1.54 Clinics Section, Eye Treatment

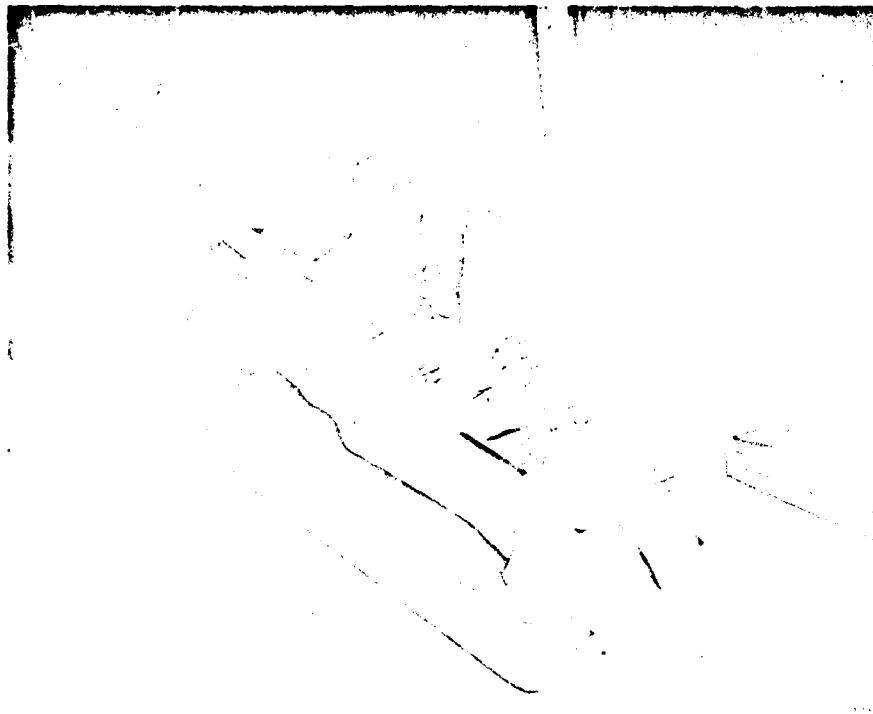


Fig. 1.55 Clinics Section, Eye Instruments (Additional)

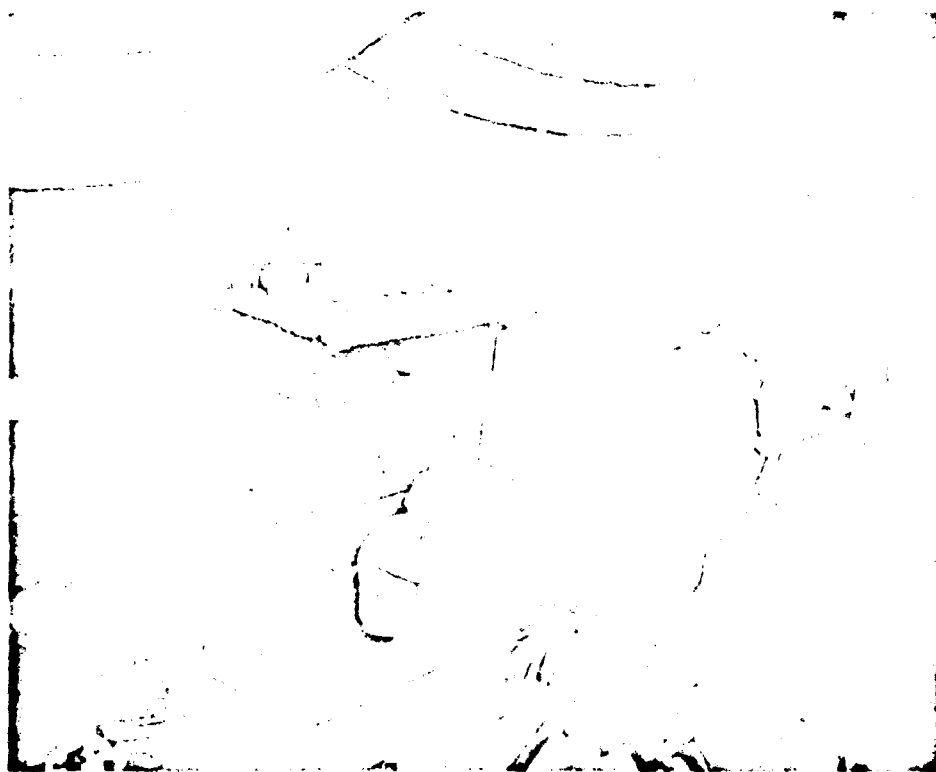


Fig. 1.56 Clinics Section, Dental Treatment

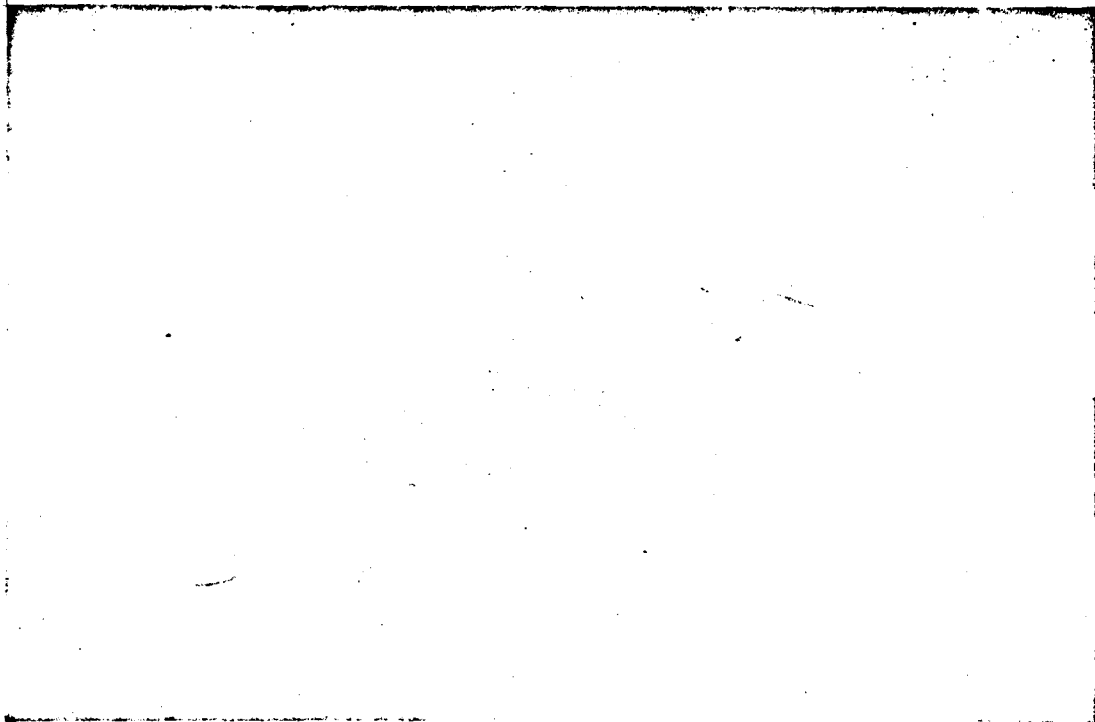


Fig. 1.57 Clinics Section, Dental Prosthetics

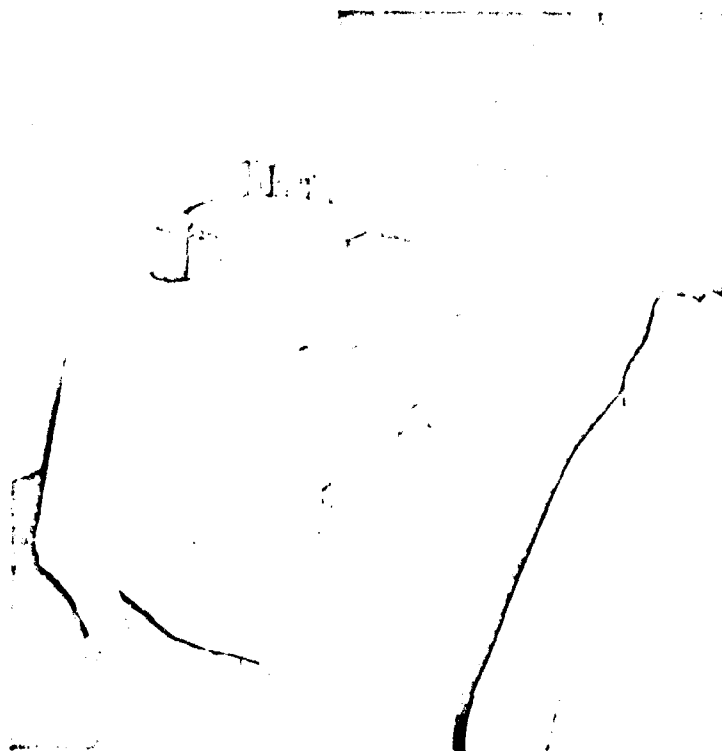


Fig. 1.58 Clinics Section, Scrub Facilities

1.2.10.3 Pharmacy and Laboratory Tent

This tent included the pharmaceutical supplies and the laboratory equipment and supplies necessary in the functioning of the hospital. Figure 1.59 depicts schematically the physical arrangements of major areas within this tent. Figures 1.60 to 1.74 show photographically the internal arrangement of equipment. All equipment was tested for operability prior to the test and was in operating condition. During the blast, three ceiling lights, three microscopic illuminators, one colorimeter, and one centrifuge were in actual operation. In both the pharmacy and the laboratory, the only materials outside of containers were those which would normally be outside under actual operating conditions. The remaining supplies were within such containers as would normally be improvised in the field. In this case these consisted of the boxes in which these supplies had been shipped from the depot.

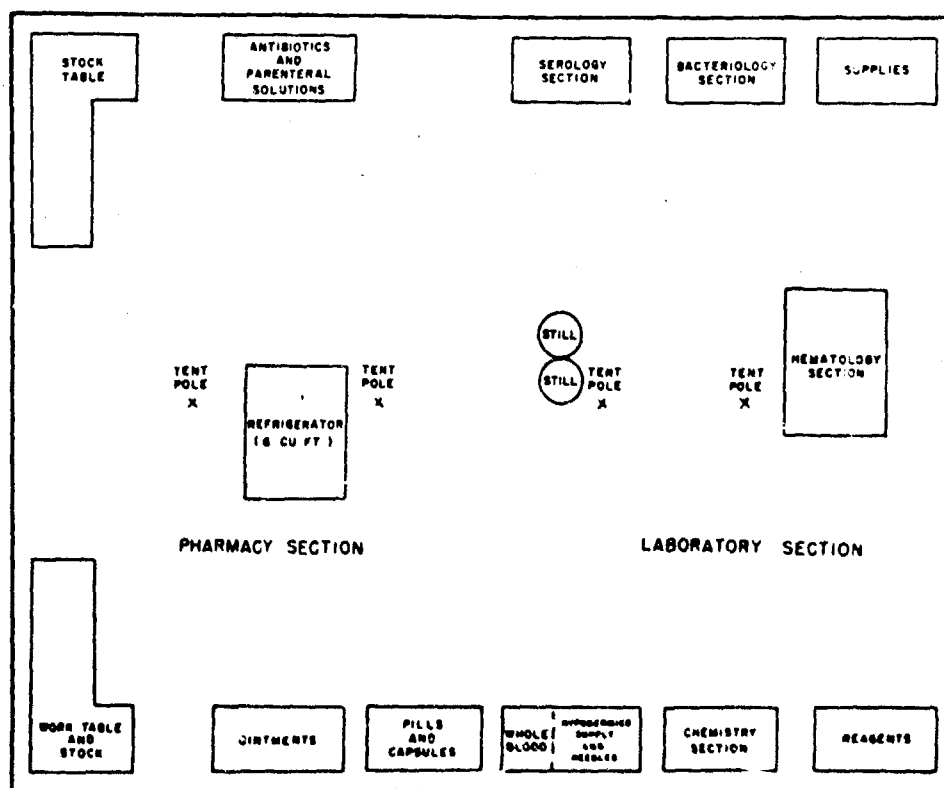


Fig. 1.59 Pharmacy and Laboratory Tent, Graphic Layout (Not to Scale)

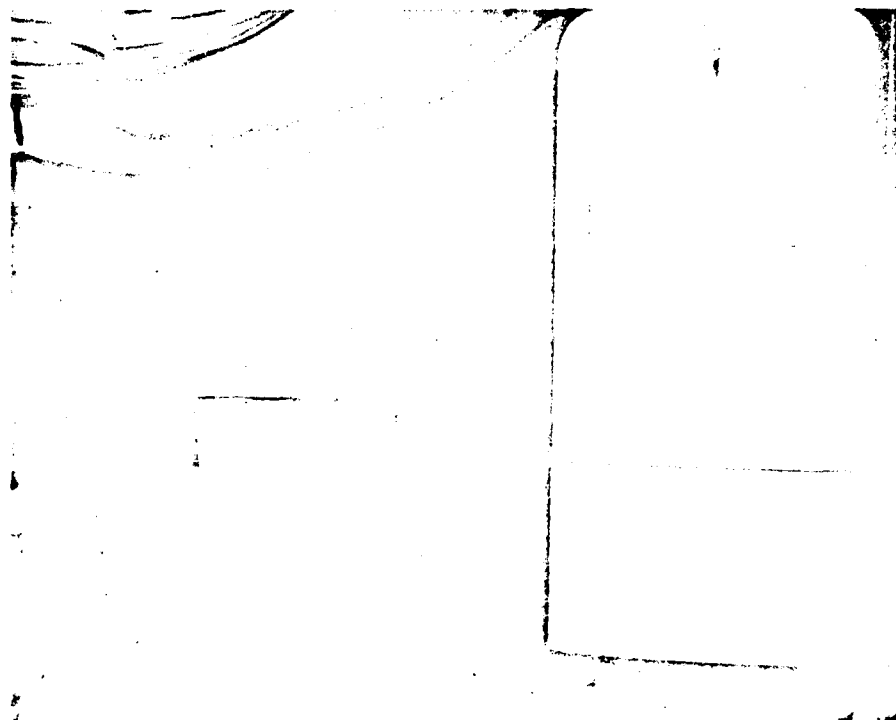


Fig. 1.60 Pharmacy and Laboratory, General Interior
toward Ground Zero

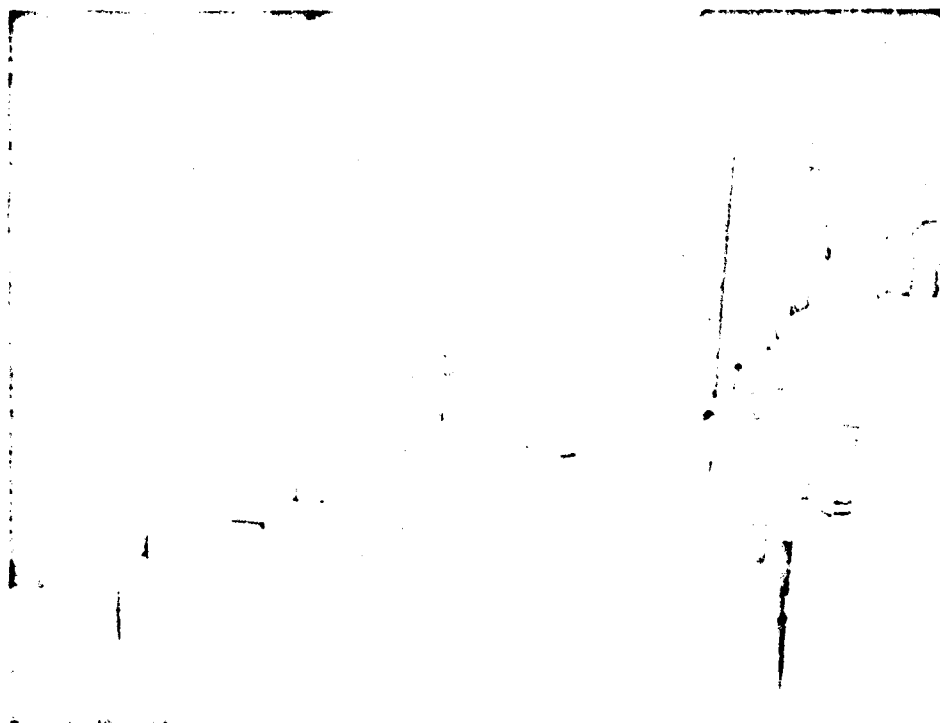


Fig. 1.61 Pharmacy and Laboratory, General Interior
away from Ground Zero

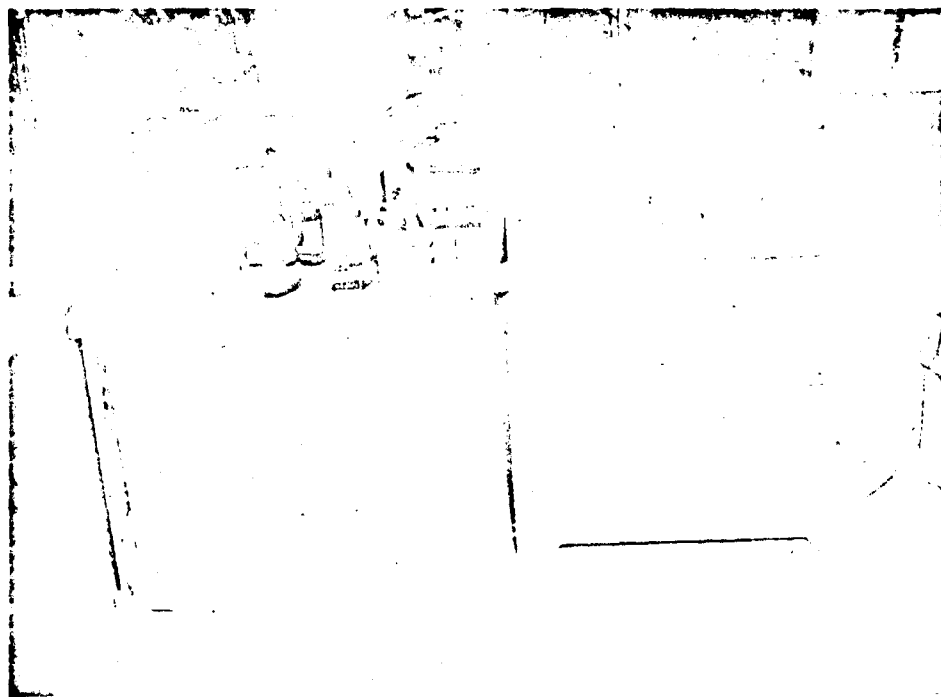


Fig. 1.62 Laboratory Section, Bacteriology

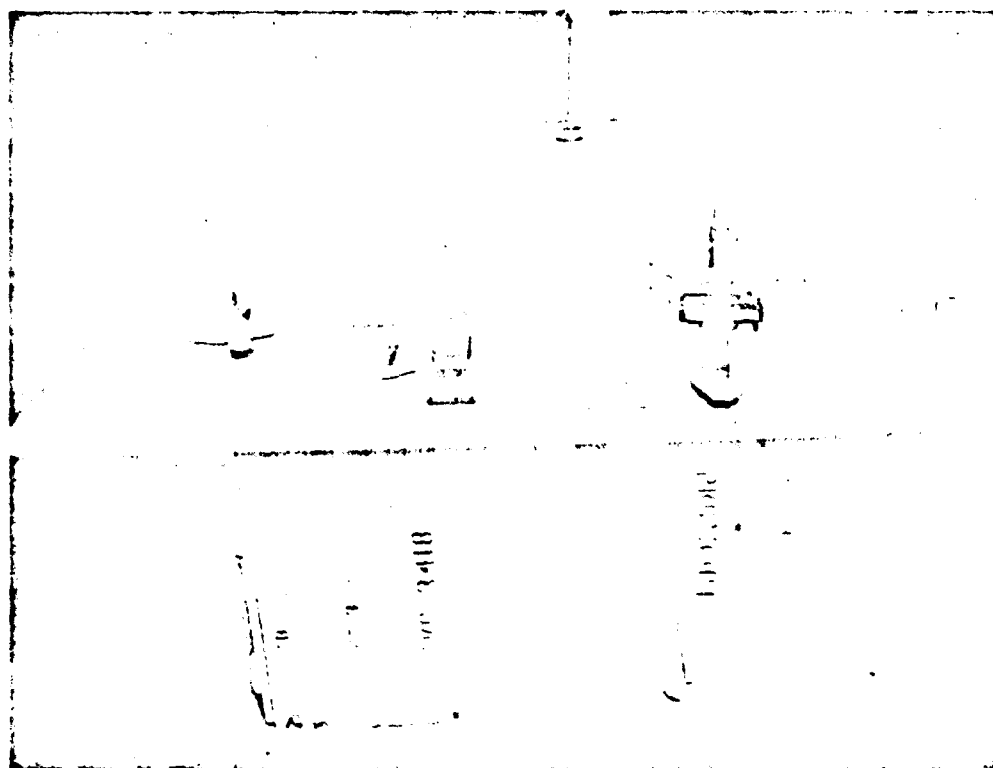


Fig. 1.63 Laboratory Section, Hematology

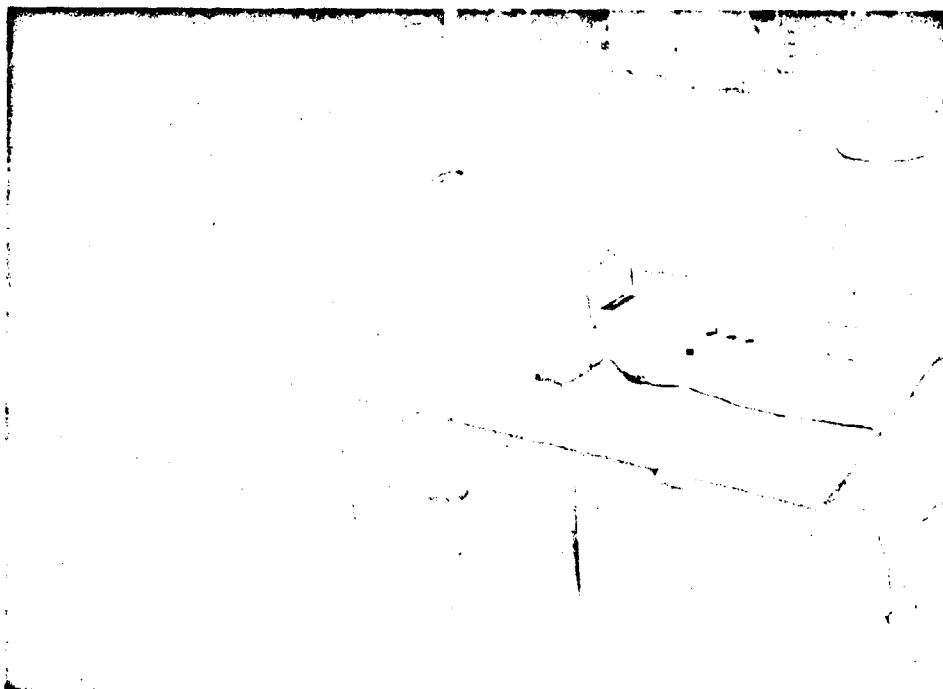


Fig. 1.64 Laboratory Section, Serology

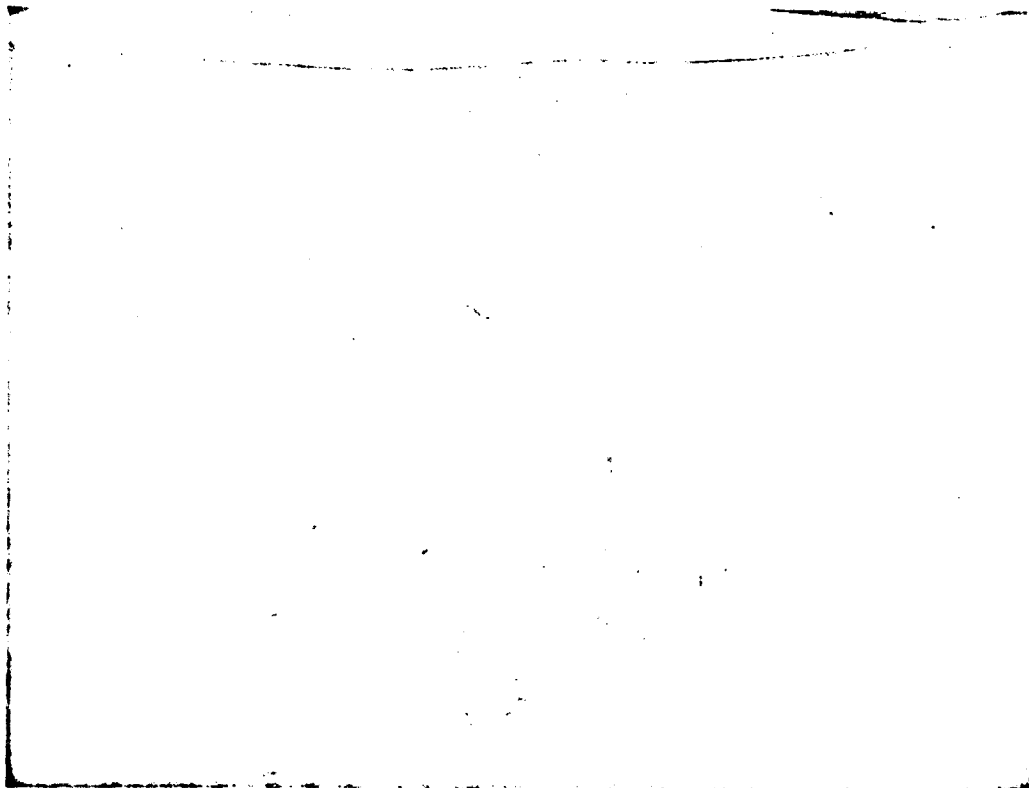


Fig. 1.65 Laboratory Section, Chemistry

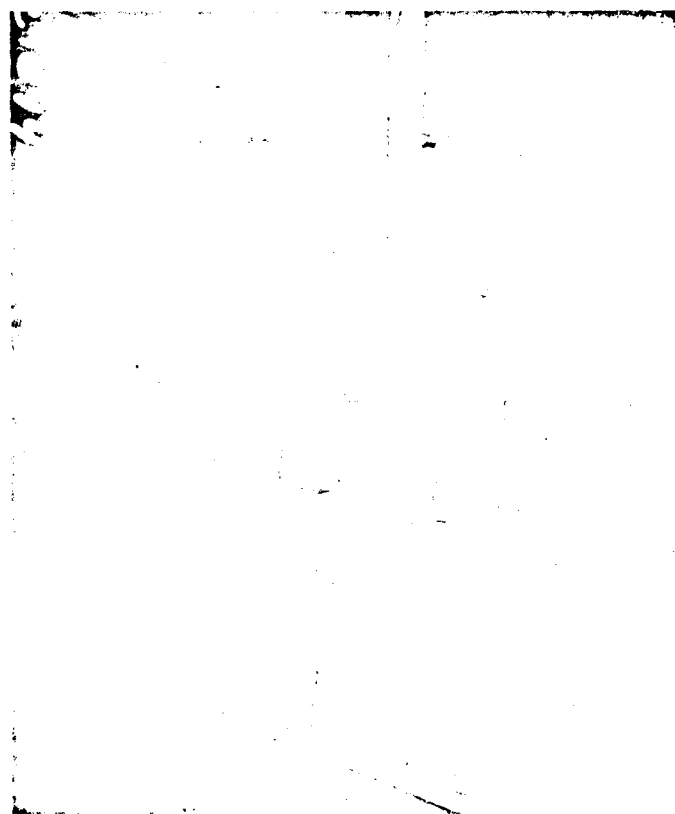


Fig. 1.66 Laboratory Section, Water Distillation Equipment

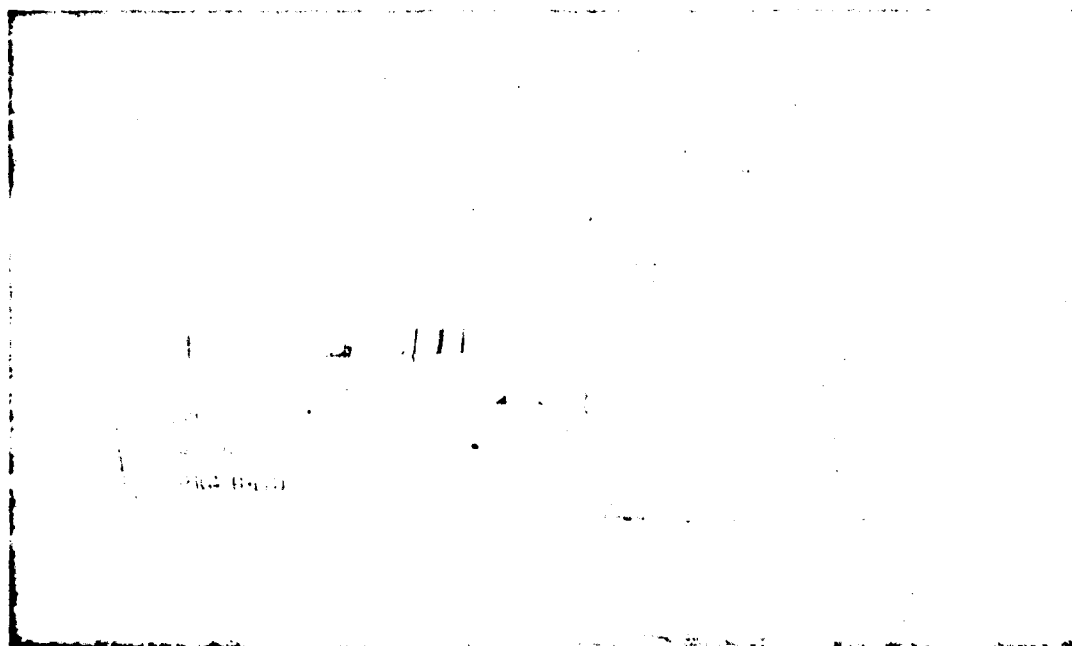


Fig. 1.67 Laboratory Section, Whole Blood Storage

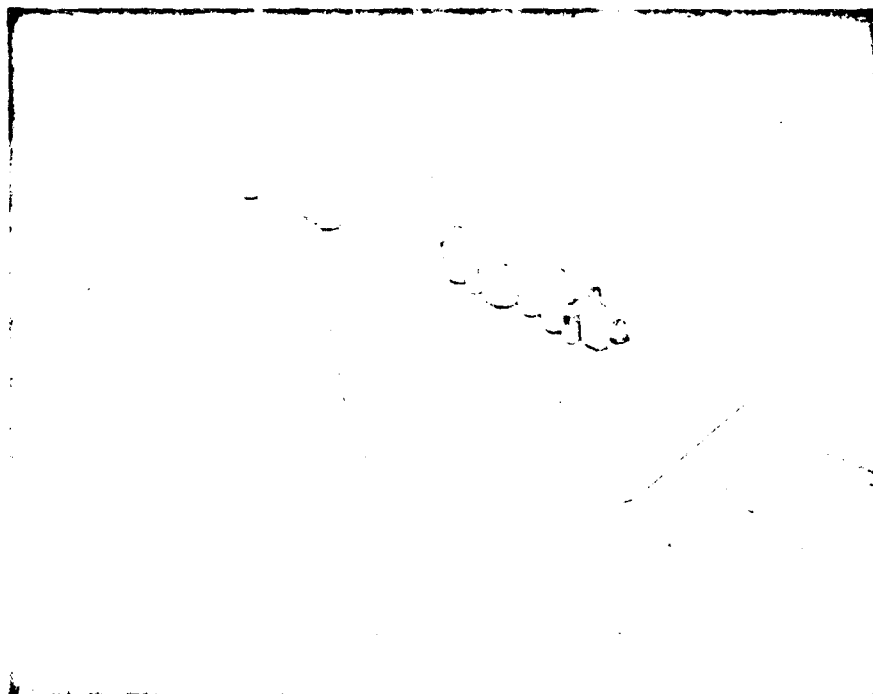


Fig. 1.68 Laboratory Section, Reagents



Fig. 1.69 Laboratory Section, General Supplies

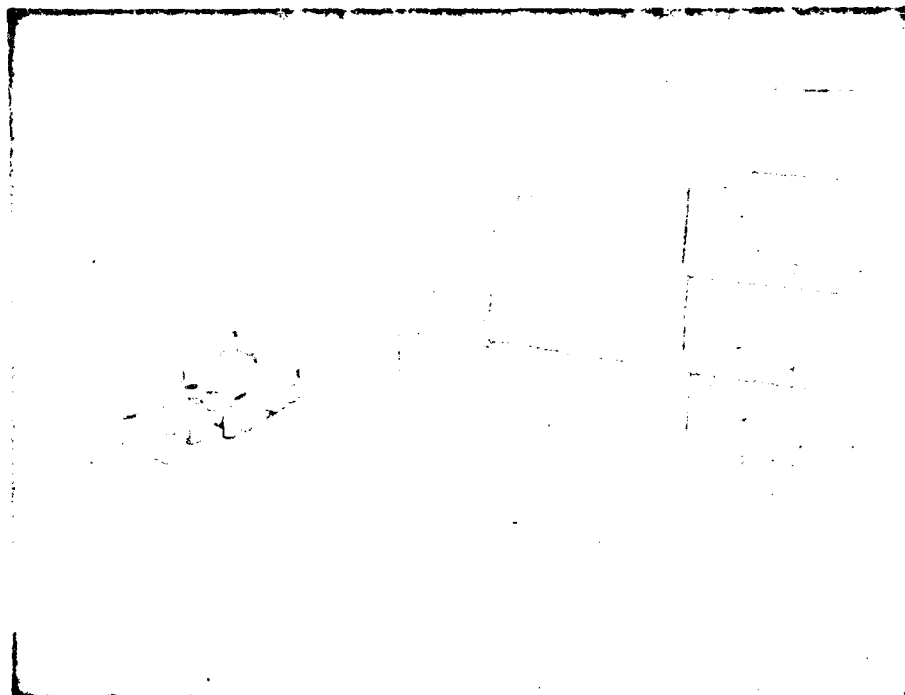


Fig. 1.70 Pharmacy Section, General Supplies

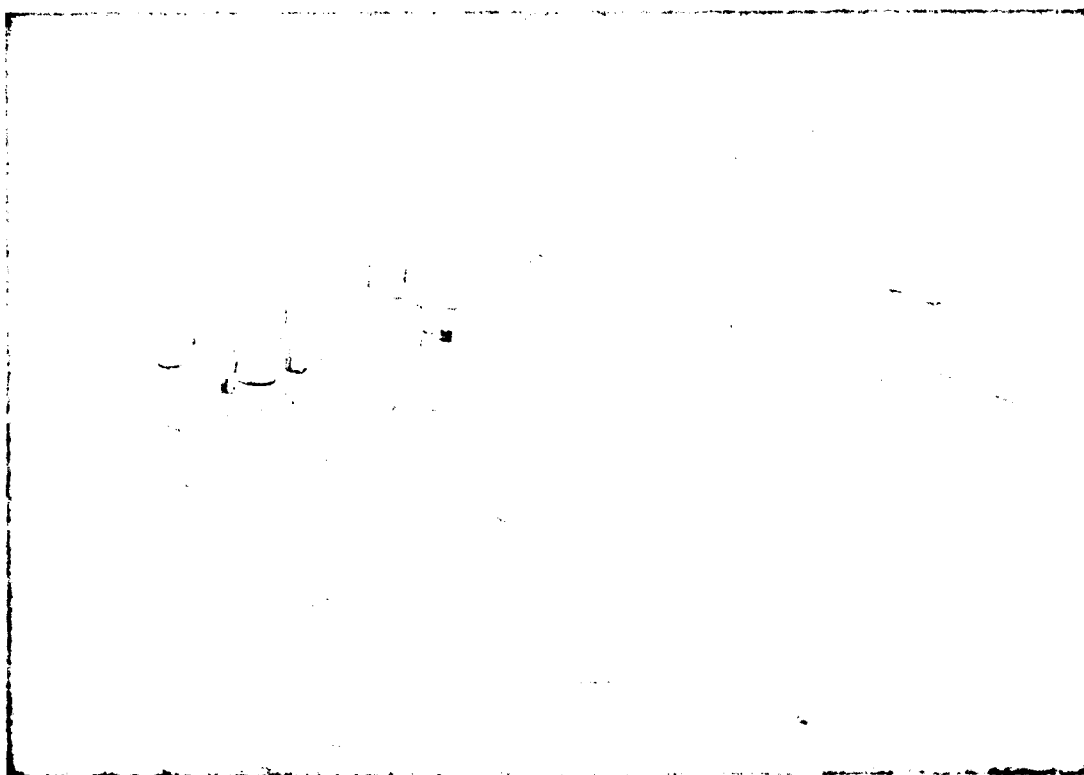


Fig. 1.71 Pharmacy Section, Work Table and Supplies

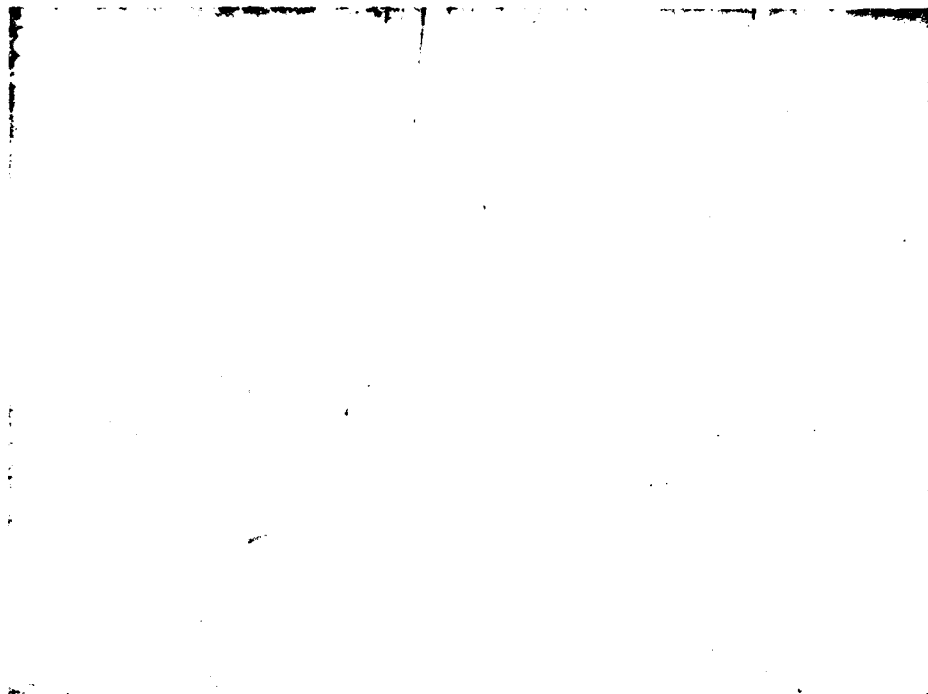


**Fig. 1.72 Pharmacy Section, Parenteral Solutions
and Antibiotics**

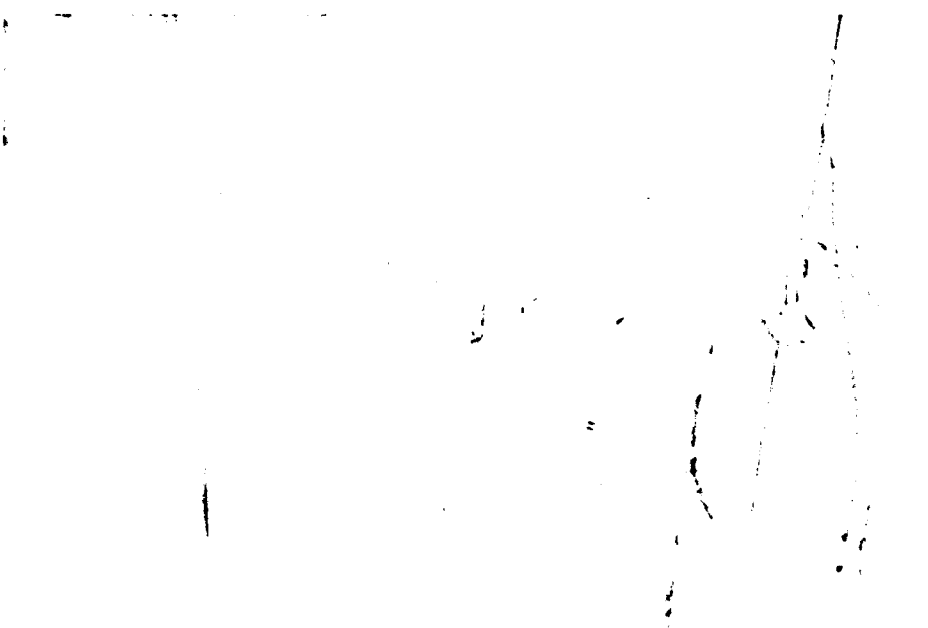


Fig. 1.73 Pharmacy Section, Ointments

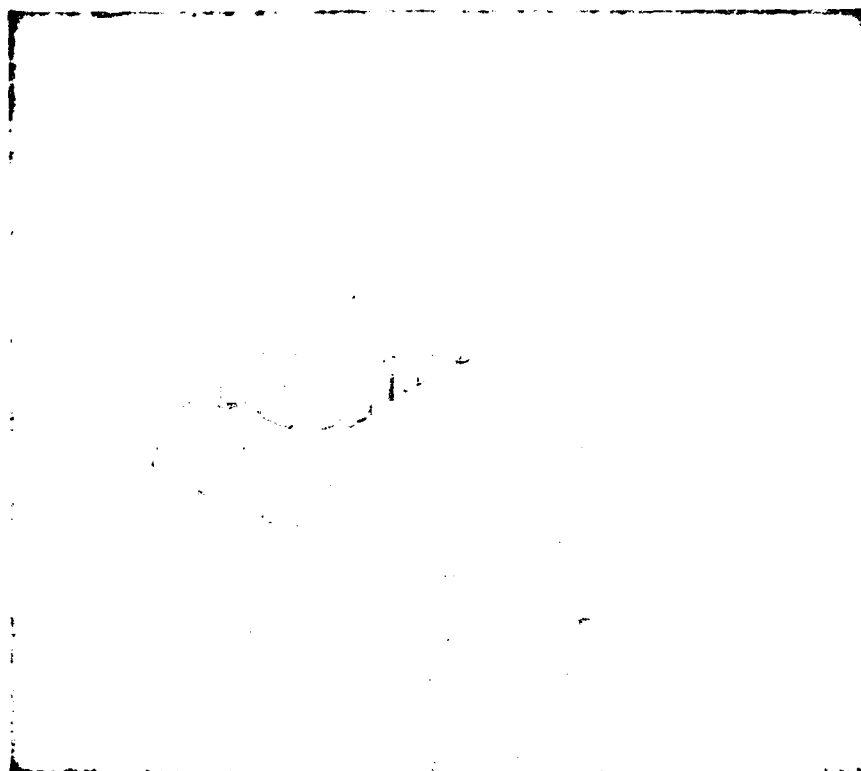


Fig. 1.74 Pharmacy Section, Pills and Capsules

1.2.10.4 Ward Tent

The ward was erected to provide space for 18 patients and contained all the equipment which might be found in an acute surgical ward under normal operating conditions. Figure 1.75 depicts schematically the arrangement of the ward. Figures 1.76 to 1.82 show photographically the actual arrangement.

1.2.11 Electrical Circuits

Electrical circuits were established in all installations to provide a source of power for the operation of electrical equipment and lights. This consisted of a Corps of Engineers electrical lighting equipment 15-kw set #5 for each installation. Circuits were established with dual outlets for supplying the aboveground and below-ground installations. There was no direct connection between the circuits in the two installations. Lines running from the generator, located centrally behind each site, were strung between the tents by means of a crossbar on each tentpole outside of the tent. One main line supplied all the tents in each of the aboveground and below-ground installations. Lead-ins from the main power lines entered each tent proximally at the junction of

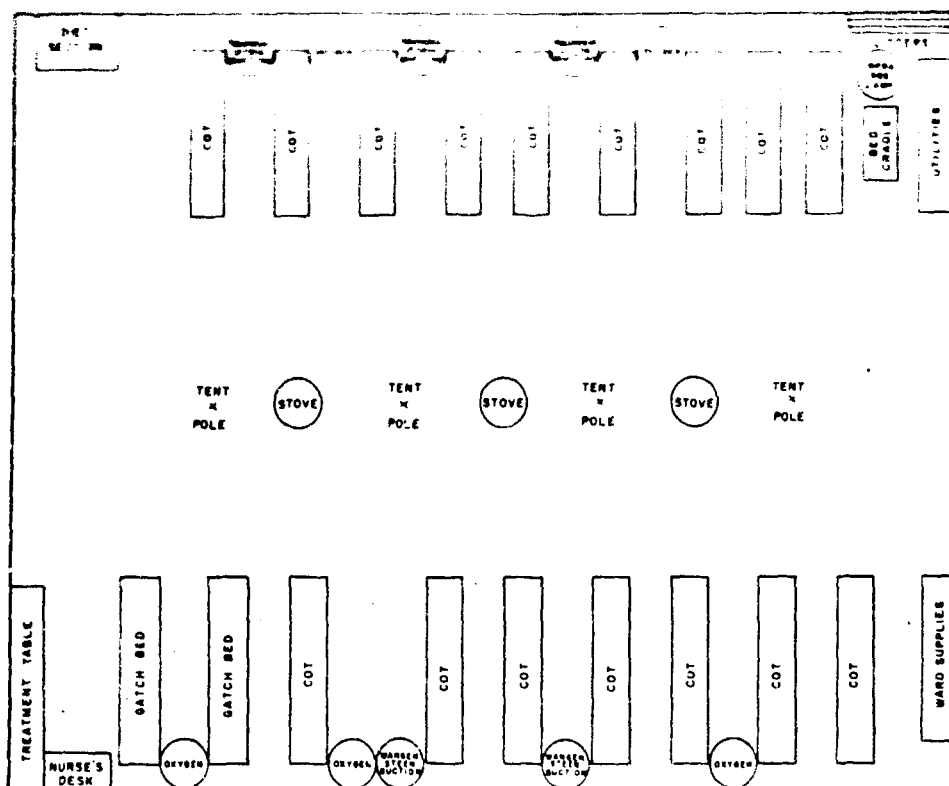


Fig. 1.75 Ward Tent, Graphic Layout, Schematic

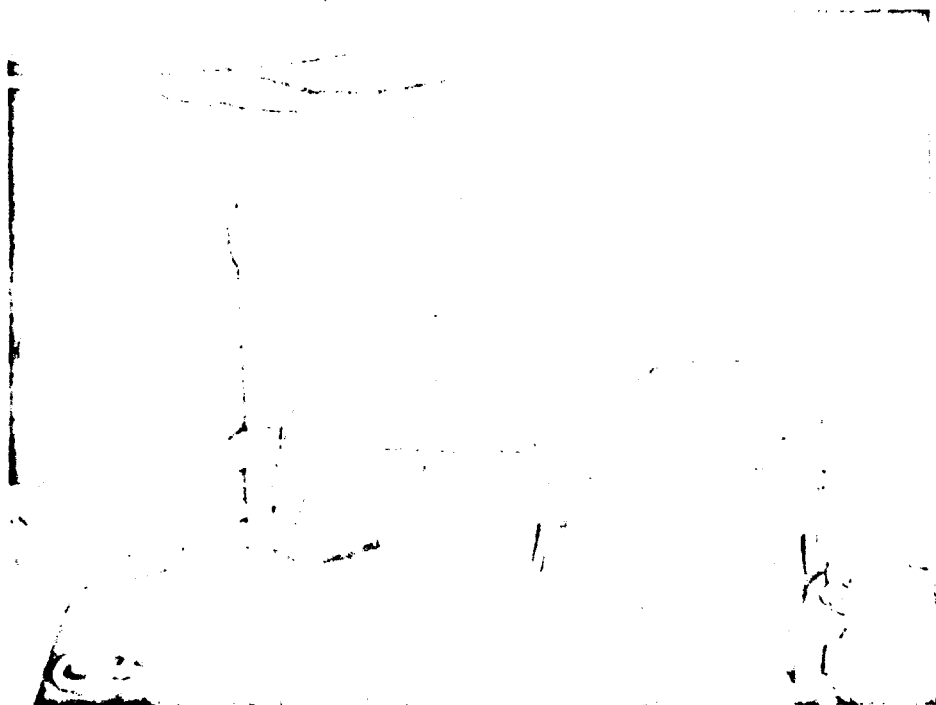


Fig. 1.76 Ward, General Interior toward Ground Zero

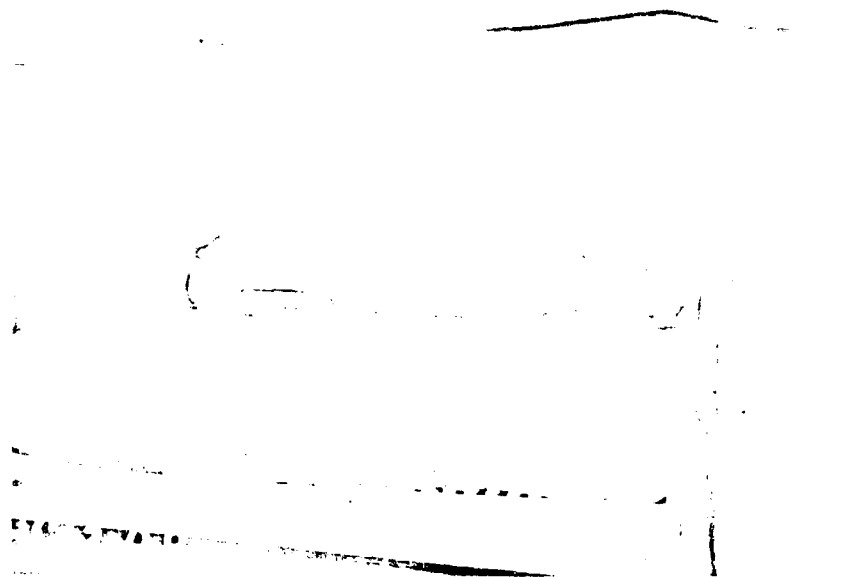


Fig. 1.77 Ward, Gatch Beds

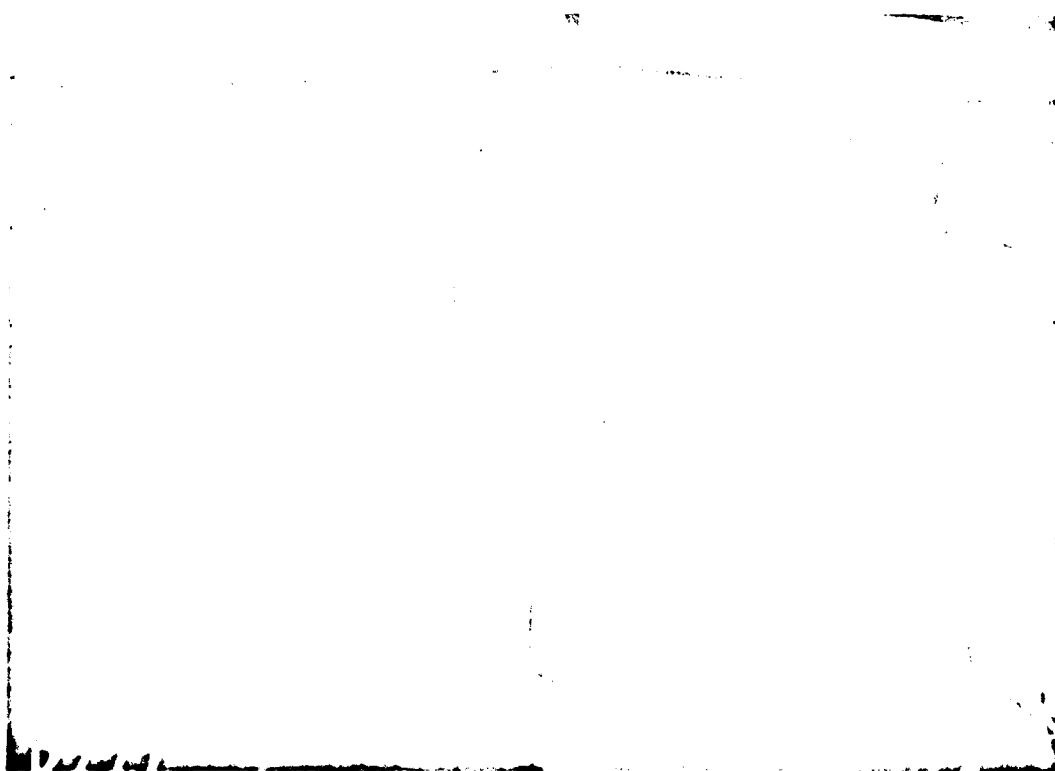


Fig. 1.78 Ward, Cots, Oxygen, and Wangenstein Suction

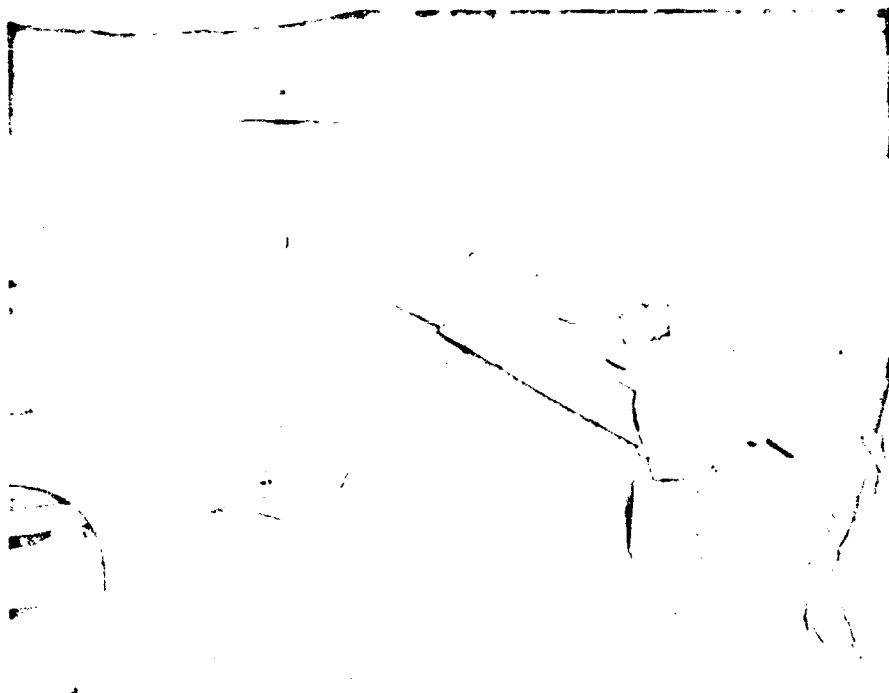


Fig. 1.79 Ward, Nurses' Desk, Telephone, and
Treatment Table

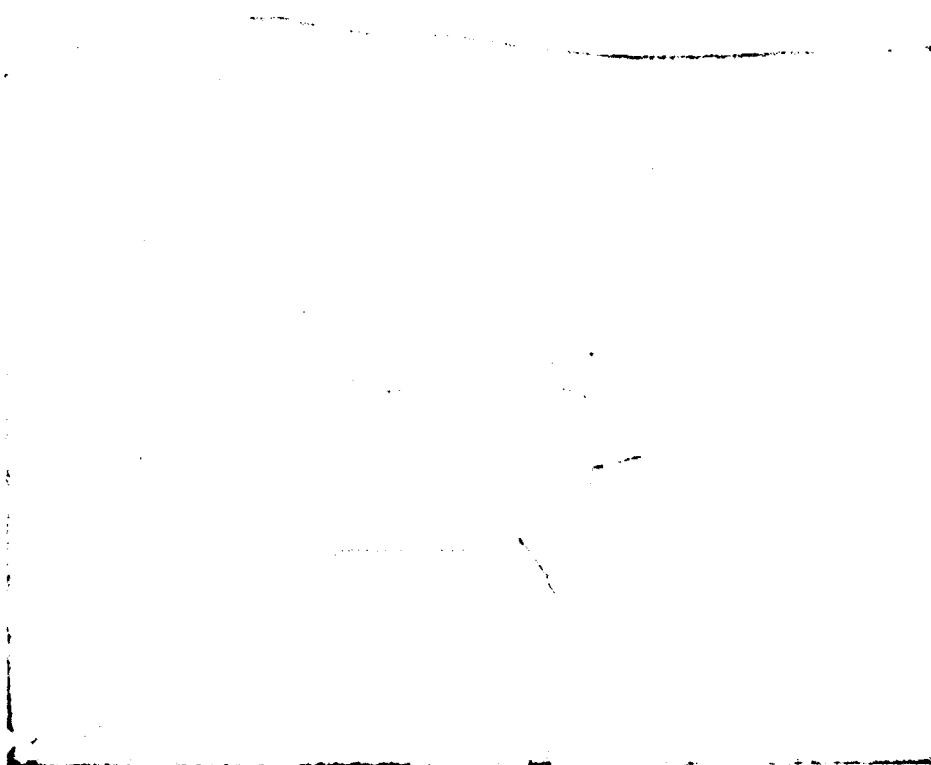


Fig. 1.80 Ward, Diet Preparation

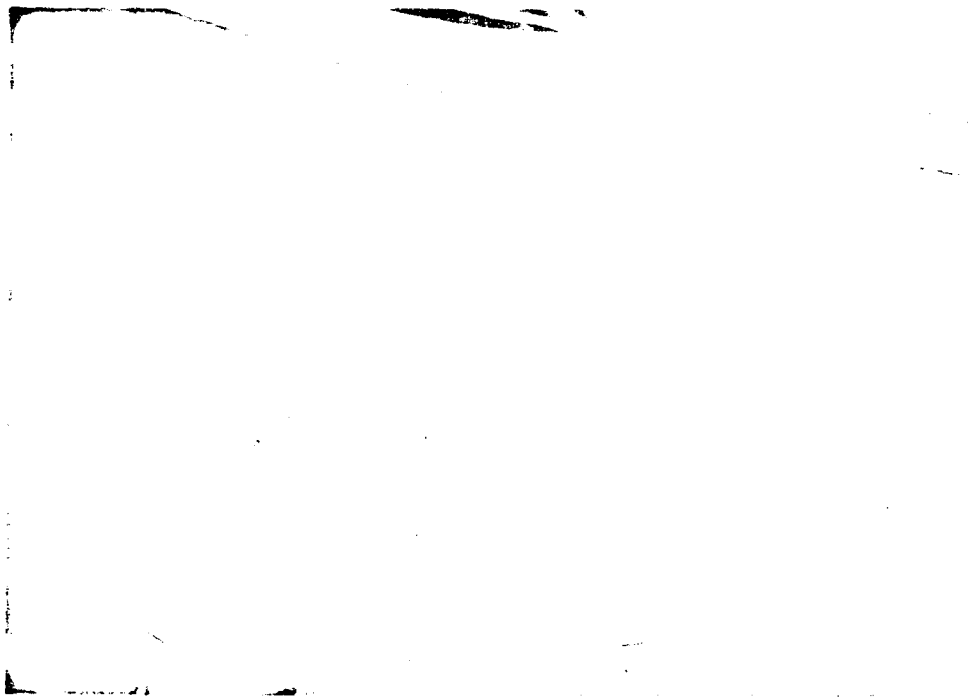


Fig. 1.81 Ward, Linen Supplies



Fig. 1.82 Ward, Utilities

the end section and midsection of the tent through the opening provided for the stovepipe outlet. A thermal-type (overload) circuit breaker was placed in the lead-in lines in each tent.. The main line within each tent was strung along crossbars on each center ventpole (Fig. 1.33). The main line was strung from the main tent line to appropriate side poles to provide outlets for the various electrical items of equipment (Figs. 1.35 to 1.39).

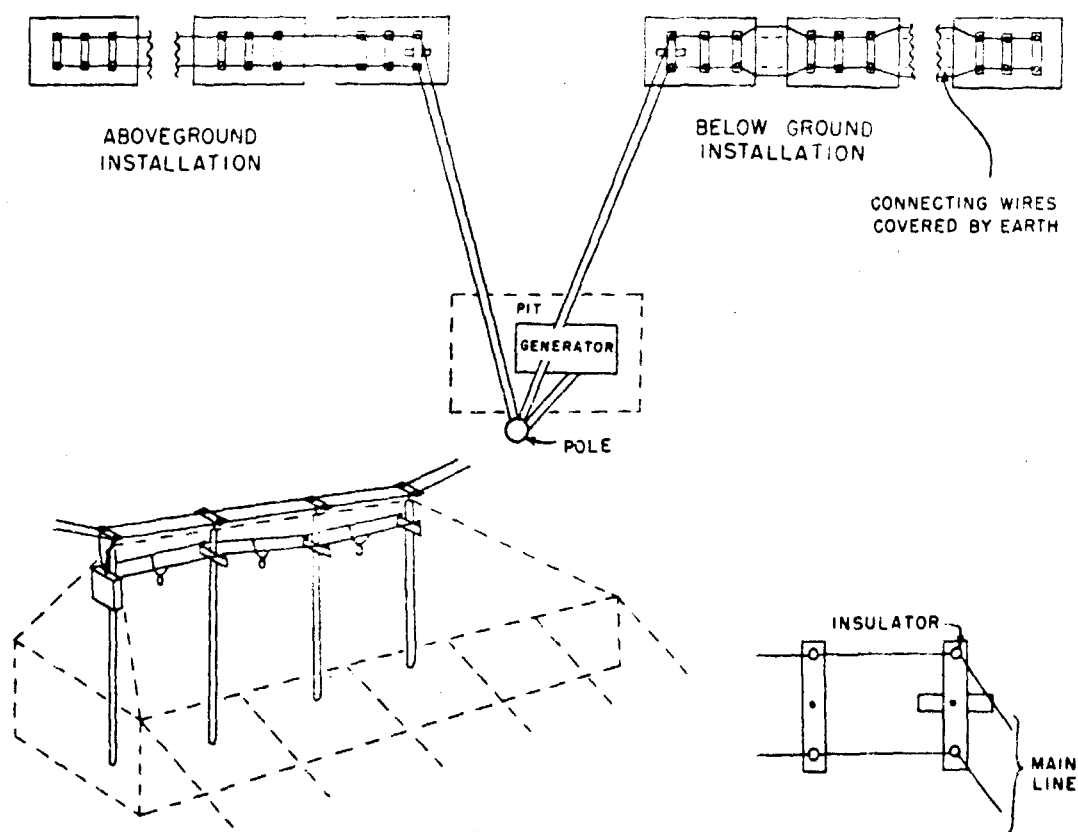


Fig. 1.83 Generator Pit and Main and Secondary Power Lines, Schematic

1.2.11.1 Generator

The generator was a 15-kw 3-phase 110-volt AC type. During the blast this generator was carrying about 100 amperes with the selected equipment in each tent in operation. It was in a dug-in position centrally located behind each site. Figure 1.84 shows the generator in position at Site 1. The positions of the generators at the other two sites were identical.

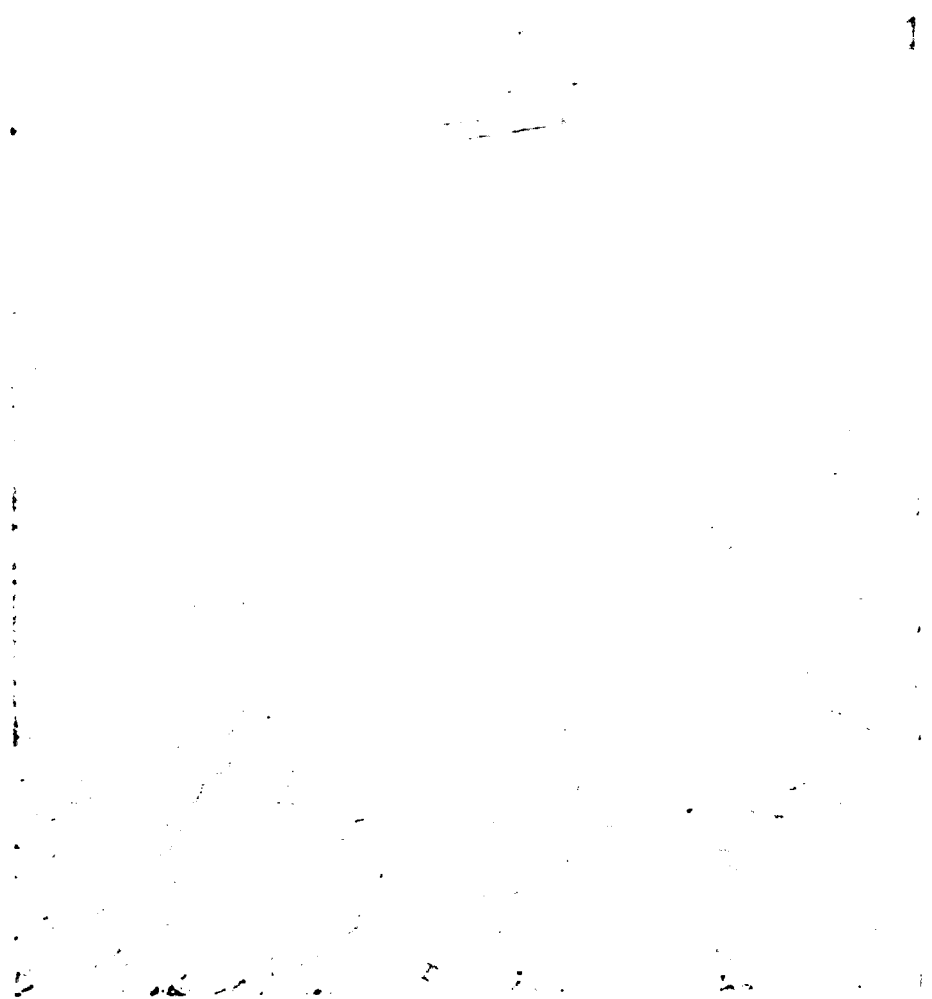


Fig. 1.84 Generator, Site 1

1.2.11.2 Surgery

The electrical circuits within the surgery were sufficient to provide a source of power for all electrically operated equipment as well as for the lights. Figure 1.85 is a diagram of the internal circuits within this tent.

1.2.11.3 X-ray and Clinics Tent

The interior circuits within the X-ray tent were sufficient to operate all X-ray equipment as well as to provide those necessary for the operation of the clinics. Because of the excessive load in operating the X-ray machines, thermal-type (overload) circuit breakers were placed in the circuits of both the 100 ma. and the 15 ma. X-ray machines as well as in the lead-in of the secondary of the tent itself. Figure 1.86 depicts the wiring diagram for the X-ray tent.

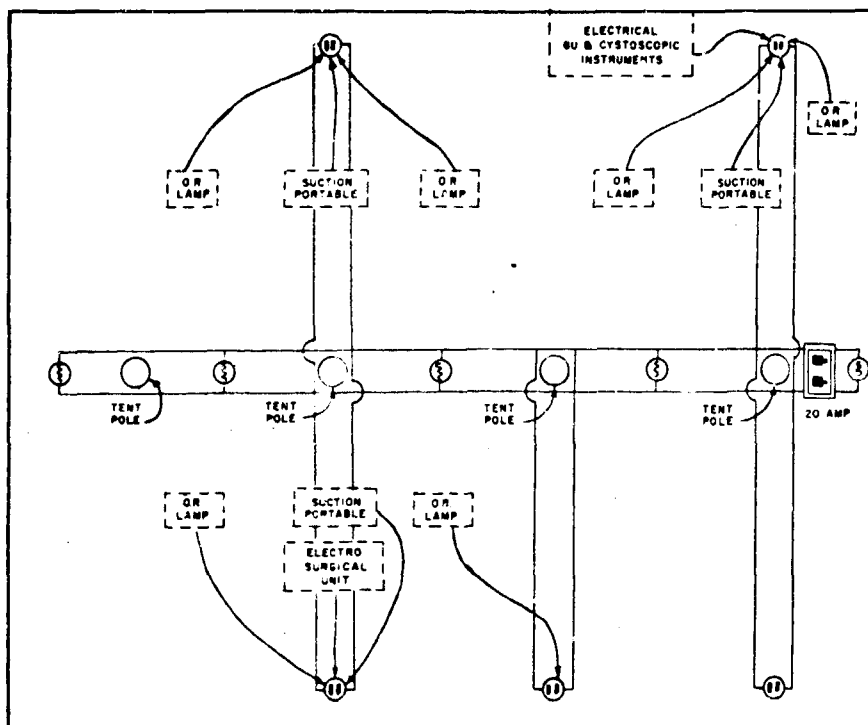


Fig. 1.85 Wiring Diagram, Surgical Tent

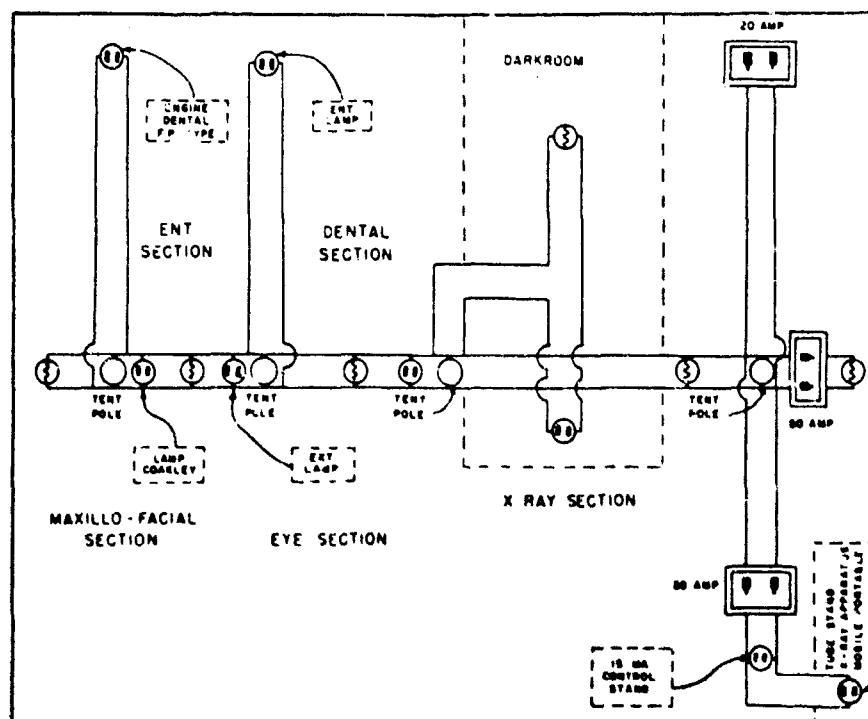


Fig. 1.86 Wiring Diagram, X-ray Tent

1.2.11.4 Pharmacy and Laboratory, Ward, and Unit A

The circuits within these tents were established in the same manner as were those for the surgical and X-ray tents. Only one thermal-type (overload) circuit breaker was utilized in each of these tents. Figures 1.87, 1.88, and 1.89 graphically depict the wiring circuits.

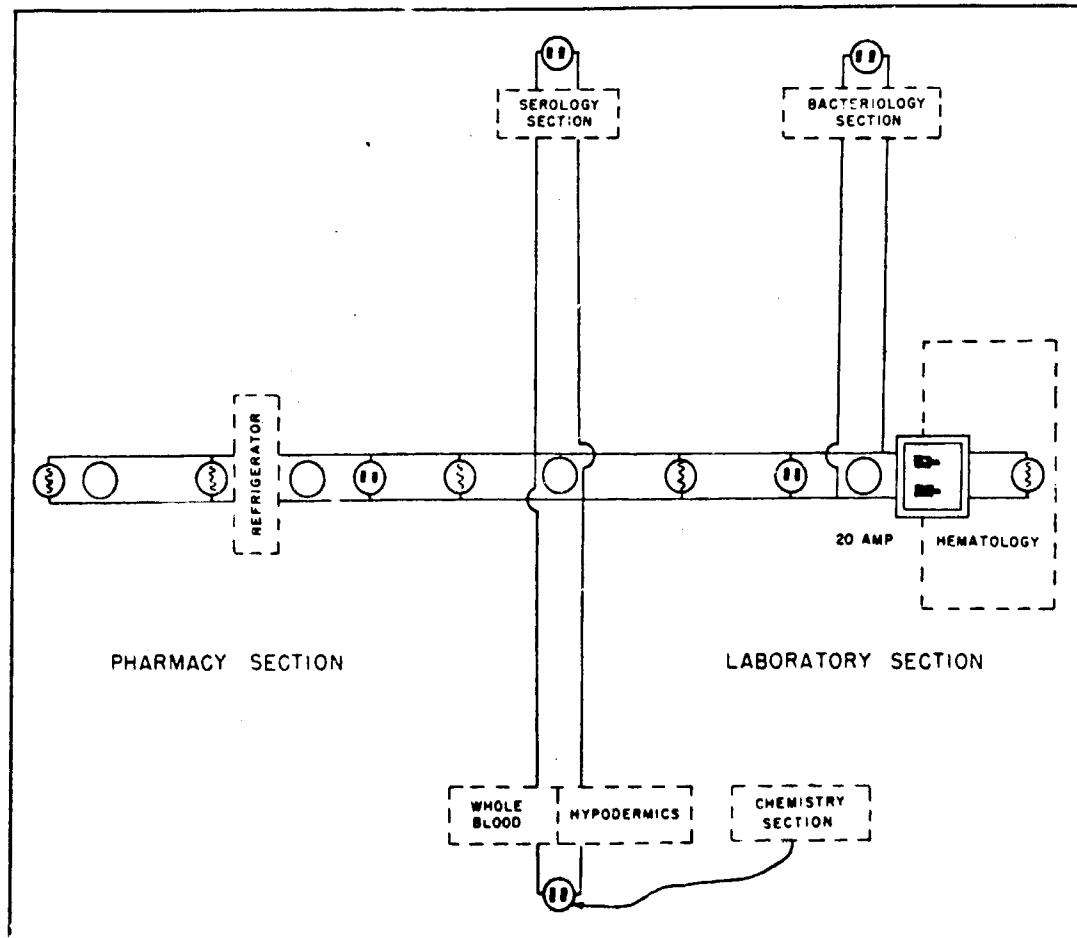


Fig. 1.87 Wiring Diagram, Pharmacy and Laboratory Tent

1.2.12 Tentage

Tentage utilized throughout all installations was the standard quartermaster tentage authorized in current Tables of Organization and Equipment and was erected in accordance with current doctrine. None of the tentage utilized in the tent was new; but it had been reconditioned in quartermaster depots prior to receipt at Nevada Proving Grounds.

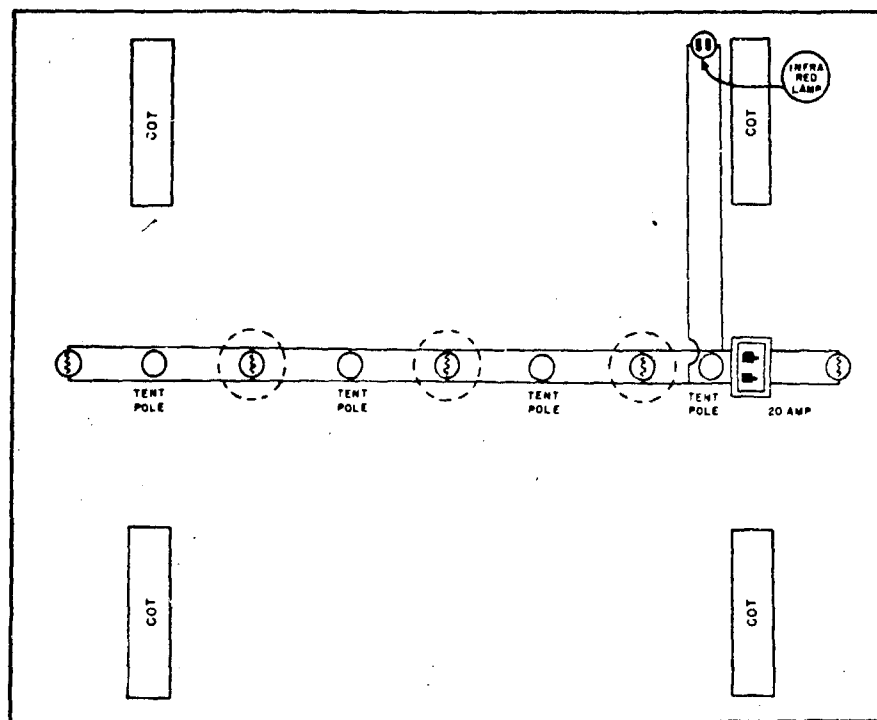


Fig. 1.88 Wiring Diagram, Ward Tent

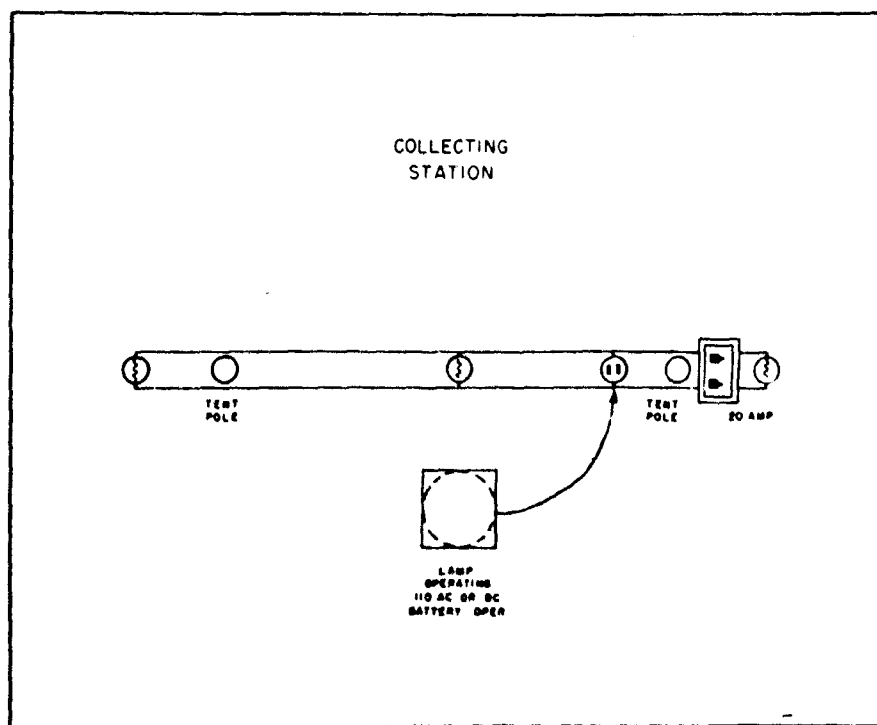


Fig. 1.89 Wiring Diagram, Unit A

1.2.12.1 Unit A

Unit A was erected in Tent, Fire-Resistant, Squad, M-1942 OD. This tent is fire resistant as well as mildew resistant. It is 16 ft wide, 32 ft 9 in. long, and 12 ft high at the ridgepole. Above ground it was erected as shown in Fig. 1.90. Below ground the side walls of the tent were staked down within the excavation. The eave-line ropes were inserted beneath the aboveground sandbagging and staked down in the standard manner.

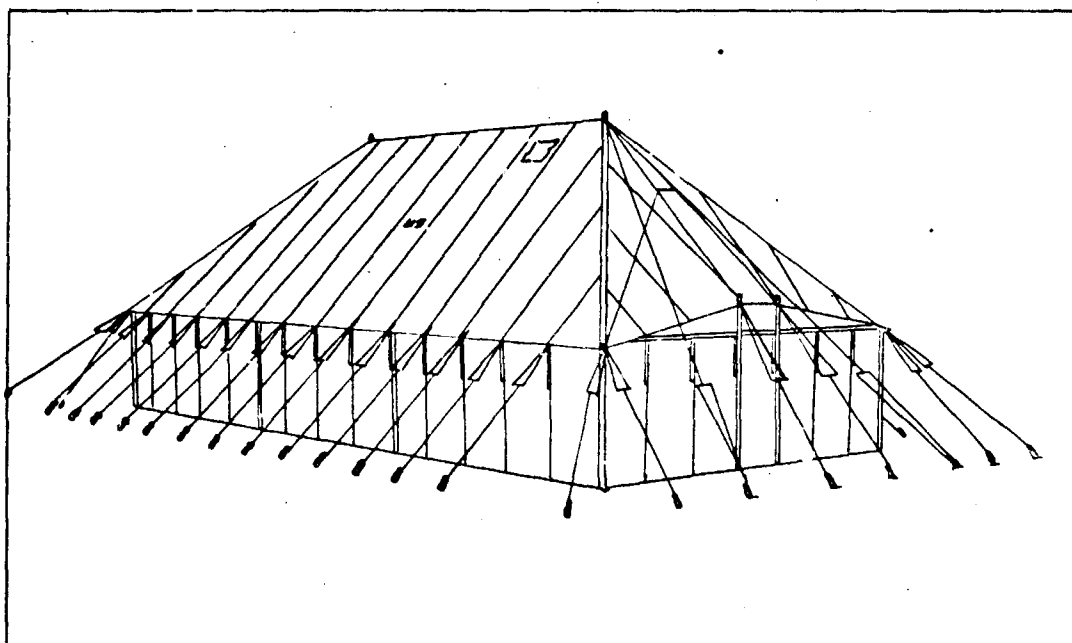


Fig. 1.90 Squad Tent for Unit A, Schematic

1.2.12.2 Unit B

Unit B was erected in the Tent, Fire-, Mildew-Resistant Sectional Hospital Tent. Each tent consisted of two end sections, three midsections, and two vestibules. These components were married by lacing as shown in Fig. 1.91. The dimensions were 18 ft by 53 ft by 12 ft. Length does not include vestibules. The tent was provided with a non-fire-resistant white tent liner which lined the tent from the eave-line to the peak. In erection, this tent

liner provided a dead space of approximately 12 inches between the tent and the liner. Above ground the tent was erected as shown in Fig. 1.91 and the plastic windows were incorporated therein. Below ground the side walls were staked down inside the excavation in the same manner as in Unit A. Eave-line ropes were inserted through the aboveground sandbagging and were staked down in the same manner as the below-ground Unit B. The vestibules were omitted from the below-ground installation. For further information regarding the standard tentage utilized, see Department of the Army FM 20-15.

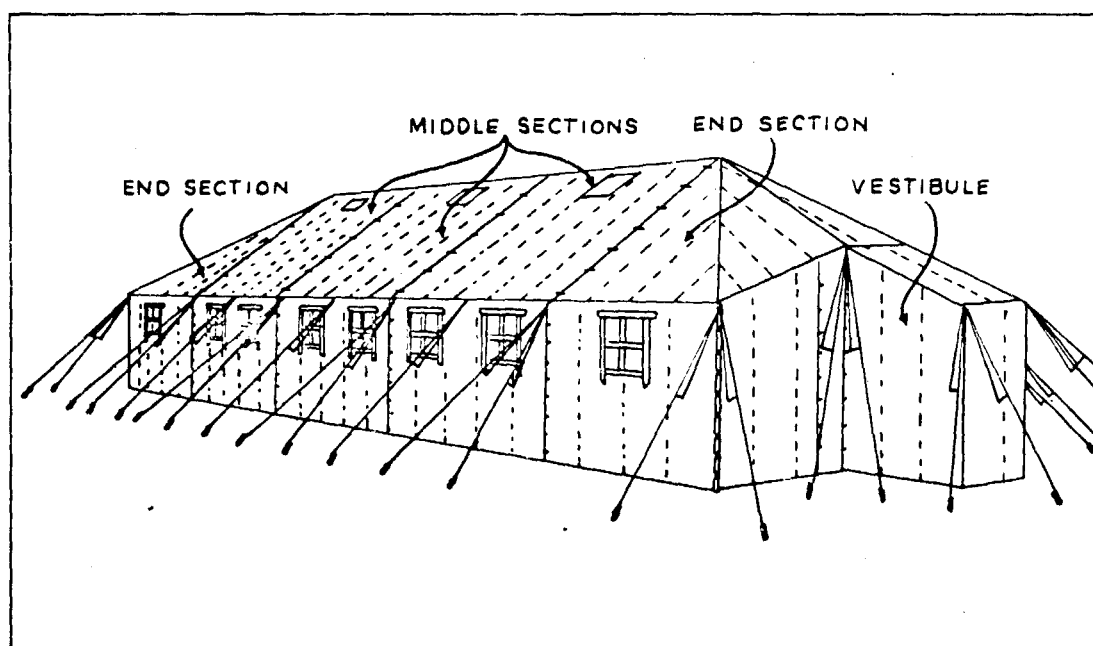


Fig. 1.91 Hospital Sectional Tent, Unit B, Schematic

CHAPTER 2

RESULTS AND OBSERVATIONS

2.1 GENERAL

Results of the test indicate that the experiment design was satisfactory to fulfill the objective as outlined in para 1.1. Damage occurring at Site 1, however, was in excess of that anticipated based upon the preliminary criteria utilized. A contributing factor may have been the target error, in which this site was 4,163 ft from actual ground zero instead of the planned 5,000 ft. It is doubtful if the difference of the pressure of 7.8 psi at 4,163 ft and the pressure of 6.3 psi at 5,000 ft would explain the excess of the actual over the anticipated damage at Site 1. This error was insignificant in modifying the conditions at Site 2 and Site 3. Table 2.1 shows the approximate overpressures, thermal radiation, and initial gamma radiation at the three sites.

It is felt that the over-all purpose of the experiment has been fulfilled in that more positive information was gathered with which to establish replacement factors for units, personnel, and/or equipment.

TABLE 2.1 Base Data On Blast, Thermal, and Gamma Radiation

Location	psi	Thermal (cal/cm ²)	Gamma (r)
Site 1 4,163 ft	7.8	38 - 40	700 - 800
Site 2 9,000 ft	2.7	8 - 9	2 - 3
Site 3 15,000 ft	1.0	1 - 2	>1

2.2 CASUALTY PRODUCTION

2.2.1 General

Under the conditions of the experiment, casualty production was estimated through personal observations after the blast and through motion picture photography during the blast, as well as by the effects of overpressures and thermal and gamma radiation from data available in TM 23-200. In these estimates, casualties were considered to be a result of burns from thermal radiation, trauma resulting from secondary missiles as a result of the blast, burns resulting from fires, and radiation injury resulting from the initial gamma radiation. Because of the inherent difficulties in arriving at specific conclusions with regard to casualty production under the conditions of the test—in which neither personnel nor animals were present—the estimates of casualties occurring at each site are subject to wide variations and can be considered as only approximations of the incidences which would occur under actual operating conditions in the field. Thermal radiation injury was estimated on the basis that under average normal operating conditions approximately 25 per cent of assigned personnel would be outside and away from any shielding and would, therefore, be subjected to the total thermal radiation. It is assumed that all such personnel would be clothed in standard uniforms. Casualties suffering trauma as a result of secondary missiles were estimated upon the basis of the degree of displacement of small, sharp, rigid items of equipment as well as injuries which would result from displaced heavier equipment such as X-ray machines, tentage, tentpoles, operating lamps, tables, etc. Estimates of burns resulting from fires were based upon the extent of such fires at each site. Radiation injury estimates were based upon the initial gamma radiation as measured by Project 6.8a and the readings obtained on film badges placed in each installation.

2.2.2 Site 1. 4,163 ft from Actual Ground Zero 7.8 psi, 38-40 cal/cm² Thermal, 700 - 800 Initial Gamma

2.2.2.1 Thermal Radiation Injuries

It is estimated that of the 25 per cent of personnel who were outside or unprotected by shielding, all would have suffered first, second, and third degree burns from thermal radiation. Clothing of such individuals would have been destroyed, which would have resulted in more extensive burning of the body surfaces of personnel so exposed. Although based primarily on thermal effects, extensive burns would have occurred; it is believed that these effects would be modified, since in many instances the blast wave would have extinguished the flaming of clothing. Materials from which standard uniforms are fabricated, however, would have continued

to smolder, thereby extending the areas of body surface which would have been burned seriously as a result of thermal radiation. Personnel who were shielded from thermal radiation, either within the tentage or by having the tentage or other structure interposed between them and the fireball, probably would not have suffered burns from thermal energy. It is believed that little variation would have occurred between aboveground and below-ground installations in respect to thermal radiation in the production of casualties.

2.2.2.2 Traumatic Injuries

Traumatic injuries to all personnel, whether in the above-ground or in the below-ground installations, would have been extensive. These injuries primarily would have consisted of perforating wounds, lacerations, contusions, and fractures involving practically all portions of the body. In the aboveground installations small, sharp, rigid instruments had initial velocities from the blast sufficient to traverse distances as great as 250 ft from their original location (Fig. 2.1). It may be safely assumed, it is believed, that this initial velocity was sufficient to cause severe lacerations in all parts of the body and, in the case of cutting instruments, sufficient



Fig. 2.1 Unit B, A, Scattering of Material (Site 1)

to result in penetrating wounds of the extremities as well as of the body cavities. Although it is considered that personnel in the below-ground installations would have suffered traumatic wounds to a lesser extent from the small items of equipment, considerable injury would have resulted from tentpole breakage with flying splinters, together with sudden disruption of larger items of equipment (Fig. 2.2). Conditions as found subsequent to the blast did not lend themselves to a comparative analysis of the incidences of trauma in the below-ground and aboveground installations.



Fig. 2.2 Unit B, B, Scattering of Material (Site 1)

2.2.2.3 Burns Resulting from Fires

Fires were widespread in both the aboveground and the below-ground locations. Burns resulting from these fires would have been extensive and of such a degree as to cause death in a large percentage of cases. Personnel in below-ground installations would have suffered to a greater extent since the fires resulting in the below-ground excavations, being in a confined area, burned much more intensely and for a longer period of time. Patients and other personnel injured and in shock, unable to extricate themselves from equipment and debris

below ground, would undoubtedly have died from burns. In the above-ground installations, fires were not so widespread, unquestionably because of the widespread disruption of combustible material. It is therefore considered that, on a comparative basis, fewer serious burns from secondary fires would have been encountered in the above-ground installation.

2.2.2.4 Radiation Injuries

All personnel in both aboveground and below-ground installations would have incurred radiation injury to some extent. The initial gamma radiation, 700 to 800 r, was sufficient to produce radiation sickness in all exposed personnel within 2 to 4 hours, with an anticipated mortality of 100 per cent (Table XXII, TM 23-200). Since only one of the six film badges from the aboveground installation was recovered unburned, and on development could not be read, it must be assumed that all personnel would have been subjected to the initial gamma radiation as determined by Project 6.8a. Radiation injuries in the below-ground installations would have been subject to wide variations, dependent upon the location of the individual concerned and the amount of shielding which was provided by the intervening earth. Here, also, only one of the six film badges was recovered: it showed a gamma flux of 165 r. With possible shielding and/or nonuniform dosage, as well as the limited range of the type of film badge utilized (maximum gamma dosage $\pm$ 165 r), a determination of casualty incidence in the below-ground installation based upon this one film badge cannot definitely be made. From the data available, however, it is assumed that all personnel would have suffered some degree of radiation injury.

2.2.2.5 Summary, Site 1

In summary, it is believed that the casualty incidence from all causes in medical installations of the types tested, subjected to the overpressure, thermal radiation, and gamma radiation as shown in Table 2.1, can safely be stated to have been $\pm$ 98 per cent in both the aboveground and below-ground installations. All personnel not within the installations nor shielded (about 25 per cent) at the time of the blast would have suffered severe burns from thermal radiation. Traumatic injuries would have occurred in all personnel in the immediate vicinity of either installation. These injuries would have varied from slight to severe, depending upon the location of the individual: those individuals in surgery, the X-ray, and the clinics making up the group of the more severely injured, with those in the pharmacy, laboratory, and the wards being affected to a lesser extent. Personnel outside of the installations would have suffered trauma to varying degrees, dependent upon their location with relation to the blast, the degree of their protection, and the units of the

installation itself. Burns from fires would have occurred in all personnel who were within the installation itself, sparing to a certain extent those located outside. These burns would have varied from first to third degree, involving from less than one-third to total body surface, again dependent upon the location of the individual. As with trauma, the more severe burns would have occurred in those personnel within the surgery, the X-ray, and the clinics where fires burned more intensely as a result of the explosive and flammable materials contained therein. This would have been universal in the aboveground installations, with wide variations in degree in those below ground. It is estimated that in both installations, in almost all instances, each casualty would have suffered from trauma, burns, and radiation injury. Casualty incidence would have approached 100 per cent; and, from a personnel aspect, both installations would have required 100 per cent replacement, and both installations could have been considered as incapable of performing any portion of their mission.

2.2.3 Site 2, 9,000 ft from Actual Ground Zero 2.7 psi,
8 - 9 cal/cm² Thermal, 2 - 3 r Initial Gamma

2.2.3.1 Thermal Radiation Injuries

Based upon the same criteria as for Site 1, i.e., 25 per cent of personnel outside and away from any shielding, it is estimated that burns from thermal radiation would have been minimal. In most cases these would have consisted of first to second degree burns of only those skin surfaces which were exposed to the thermal radiation. Clothing would not have been ignited but only scorched; therefore burns from ignited clothing would have been nonexistent. Personnel within the tentage or who were shielded would have been unaffected by the thermal radiation. Location in either aboveground or below-ground installation would present no significant differences in relation to thermal effects.

2.2.3.2 Traumatic Injuries

Traumatic injuries from secondary missiles sustained by personnel in the aboveground installation would have been confined to those personnel who were within the tents or immediately adjacent thereto (Fig. 2.3). Any personnel farther than 100 ft to the rear of the installation away from ground zero probably would have received only minor contusions, while those between ground zero and the installation probably would have been free of injury from these phenomena. Personnel within the tentage or immediately adjacent thereto would have suffered contusions, lacerations, penetrating wounds, and fractures. It is estimated, however, that these injuries would have been considerably less extensive here than at Site 1 and, in most

Fig. 2.3 Scattering of Materiel, A, (Site 2)

instances, would have been less incapacitating. As in Site 1, the more extensive and serious wounds would have occurred in personnel in the surgical and X-ray tents, while those within the pharmacy, the laboratory, and the ward tents would have been affected to a lesser degree. This latter group in most cases would have suffered only minor traumatic injuries. In the below-ground installation, (Fig. 2.4), trauma from secondary missiles is estimated to have been minimal. Lacerating and perforating wounds from sharp instruments would practically have been nonexistent, since in most cases the displacement of these items was a result of the overturning of tables, with individual items not having applied sufficient force to have them become missiles capable of inflicting more than minor traumatic wounds. The overturning of some heavy equipment and the breakage and displacement of tentpoles, however, would have resulted in the occurrence of contusions and fractures of varying degrees, from slight to incapacitating. Personnel outside of the installation, with the exception of those within only a few feet of a tent, would not have suffered injury from these phenomena. It is estimated that the incidence of traumatic injuries in the below-ground installation would have been 50 to 75 per cent less than that in the aboveground.

Fig. 2.4 Scattering of Materiel, B, (Site 2)

2.2.3.3 Burns Resulting from Fires

Burns occurring as a result of fire within the installations would have been minimal, since fire occurred in only two of the tents of the aboveground installation and in none of those below ground. The aboveground X-ray and surgical tents burned. Since this fire occurred after a period of about 10 minutes following the initial blast wave (para 2.3.10.2), it is believed that most of the personnel within that tent either would have been removed from the tent or have come outside under their own power. It is estimated, therefore, that burns from fire would have been minimal and of but a minor nature.

2.2.3.4 Radiation Injuries

The initial gamma radiation at Site 2 was so minimal that it could be disregarded as a source of casualty production irrespective of the location of the individual at the time of the blast.

2.2.3.5 Summary, Site 2

In summary, it is believed that casualty incidence from all causes in medical installations of the type tested, subjected to the overpressure, thermal radiation, and gamma radiation as shown in Table 2.1, can be estimated at between 10 to 25 per cent above ground

and from 5 to 10 per cent below ground. Burns from initial thermal radiation would have been restricted to exposed body surfaces and would have been of such a nature as not to have been incapacitating for the performance of normal duties. Traumatic injuries, in general, would have consisted of lacerations and contusions with a small number of penetrating and/or perforating wounds and fractures. The incidence of trauma would have been two to three times greater in the above-ground installation than in the below-ground. It is believed that in the aboveground installation the incidence of all types of trauma would have exceeded that of the same types in the below-ground. Moreover, it is estimated that in the below-ground installation contusions would have been the predominating type of injury with the occurrence of only a few lacerating, perforating, and/or penetrating wounds. Burns resulting from secondary causes would have occurred in only a few personnel in the aboveground installation and would have been of only first and second degree, while burns in personnel of the below-ground installation would have been nonexistent. Radiation injury can be disregarded as a source of casualty incidence. From a personnel aspect, it is estimated that the aboveground installation would have been 75 to 90 per cent capable of carrying out its mission, while the below-ground installation would have shown 90 to 95 per cent capability.

2.2.4 Site 3, 15,000 ft from Actual Ground Zero 1.0 psi,
1 - 2 cal/cm² Thermal, 1 r Initial Gamma

2.2.4.1 Thermal Radiation Injuries

As at the other two sites, injuries from the thermal radiation would have been restricted to personnel outside or away from shielding and would have been confined to exposed body surfaces. Burns would have been only first degree and not considered a source of casualty production.

2.2.4.2 Traumatic Injuries

Traumatic injuries would have comprised the total of all injuries occurring at Site 3 (Fig. 2.5). As at the other two sites, these would have been composed of lacerations and contusions with only an occasional penetrating or perforating injury. The only positive indication of a penetrating injury occurred in the below-ground ward where one of the main tentpoles broke and the weight of the upper segment was thrown into a cot: had the cot been occupied, this probably would have resulted in a severe injury (Fig. 2.6). Except in a few instances, all traumatic injuries are estimated to have been minor and nonincapacitating. Few traumatic injuries would have occurred in the below-ground installation. The differential protection afforded to personnel by the dug-in position at Site 3 is considered to have been so small as to be insignificant.



Fig. 2.5 Below-ground and Aboveground Installations (Site 3)

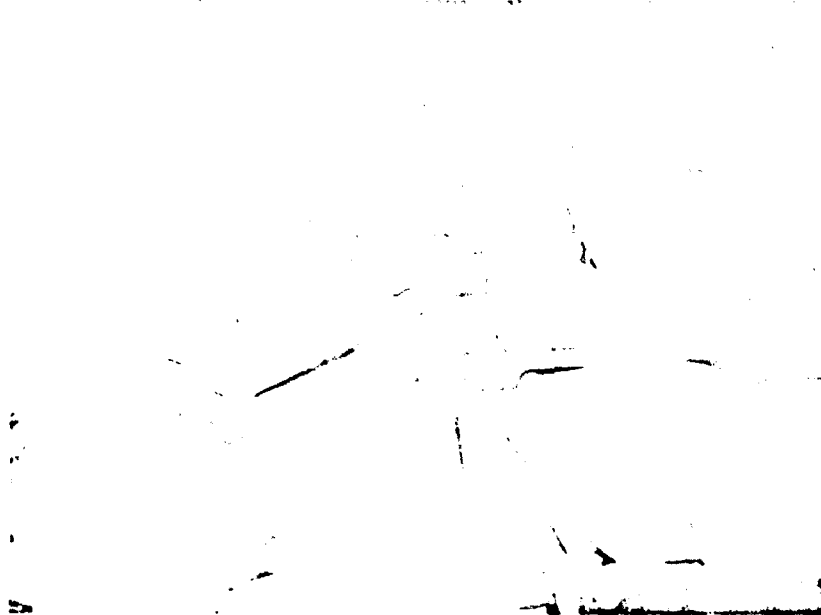


Fig. 2.6 Broken Tentpole Thrust into Cot, B, (Site 3)

2.2.4.3 Burns Resulting from Fires

Since no fires resulted in either installation, burns from fire would not have occurred.

2.2.4.4 Radiation Injuries

The initial gamma radiation was of such small intensity that it was not considered a source of casualty incidence.

2.2.4.5 Summary, Site 3

All casualties in both the aboveground and below-ground installations would have been within the traumatic group. In most instances they would have been minor and nonincapacitating. From a viewpoint of personnel, it is not considered feasible to draw any definite conclusions as to the degree of protection afforded by the dug-in positions at this distance from the blast, except that it is believed the incidence would have been lower below ground. In both installations it is estimated that casualty incidence would have been below 5 per cent and that both installations would have been 95 to 100 per cent capable of accomplishing their mission.

2.2.5 Residual Radiation

As was anticipated, residual radiation was of such small intensity at all sites that it could be disregarded as a hazard to operating personnel. Fifty minutes after the blast, residual radiation at all sites was less than 5 mr/hr.

2.3 EQUIPMENT

2.3.1 General

As it was not considered feasible to carefully examine and evaluate each item of equipment as to its serviceability within the space of time permissible for such examination, key items of equipment were selected and check lists for their evaluation were prepared prior to the test. Medical equipment maintenance personnel, organized as evaluation teams, evaluated the key items at the site both before and after the blast. These evaluations were based upon the criteria as to the degree of serviceability of each item within a theater of operations. Since, under active combat in theaters of operations with long supply lines, the replacement of items of destroyed equipment is very slow, evaluations were based upon criteria as to the serviceability of equipment within the theater subject even to repairs which within the United States would not be considered economical. This system of evaluation set up four categories of serviceability:

1. No damage, or only such damage as would leave the functionality of the item unimpaired.

2. Damaged, but repairable within the unit in a minimal length of time and with materials available within the unit.

3. Damaged to such an extent that repairs in a field depot would be required. (Such items could not be used within the unit.)

4. Damaged to such degree that major repair or rebuild in a base shop would be required. (Such items could not be used within the unit.)

A list of the items selected for evaluation is included in Appendix A. In general, selection was made of those items considered to be most sensitive to damage. Therefore, conclusions reached as to the degree of operability of any installation on the basis of the serviceability of the specific items evaluated would tend to be lower than might be expected under actual conditions. For example, although key items of X-ray might be unserviceable without major repairs and would preclude the installation from adequately treating certain types of cases, the installation could still perform those procedures in which the use of X-ray was not absolutely essential. As a result of shortages in supply, insufficient numbers of certain items were available to equip all six installations identically. Their number, however, was minimal. The total number of items evaluated at each site was:

	<u>Site 1</u>	<u>Site 2</u>	<u>Site 3</u>
Aboveground	137	130	128
Below-ground	134	128	130

All items not completely destroyed or declared as salvage at the Nevada Proving Grounds were further evaluated at the St. Louis and Louisville Medical Depots. Based upon the criteria as outlined above, depot evaluations closely correlated with those done in the field at the Nevada Proving Grounds.

2.3.2 Unit A

2.3.2.1 Site 1, Above Ground

The tent for Unit A, above ground (para 2.3.9 for damage of tentage) was completely destroyed. Material contained within this tent was scattered to 120 ft away from ground zero (Fig. 2.7) and about 25 ft toward ground zero (Fig. 2.8). Splint sets and one blanket set were destroyed by fire (Figs. 2.9 and 2.10). Of the evaluated items of equipment within Unit A, the resuscitator could not be found and was considered destroyed; the operating lamp was evaluated as being 85 per cent serviceable; the dispensary chest (Fig. 2.11) was intact and its contents were undamaged; the typewriter was considered as being serviceable after depot repairs. In general, from an equipment aspect, Unit A above ground could be considered as being only 50 per cent serviceable based upon both unevaluated and evaluated items.

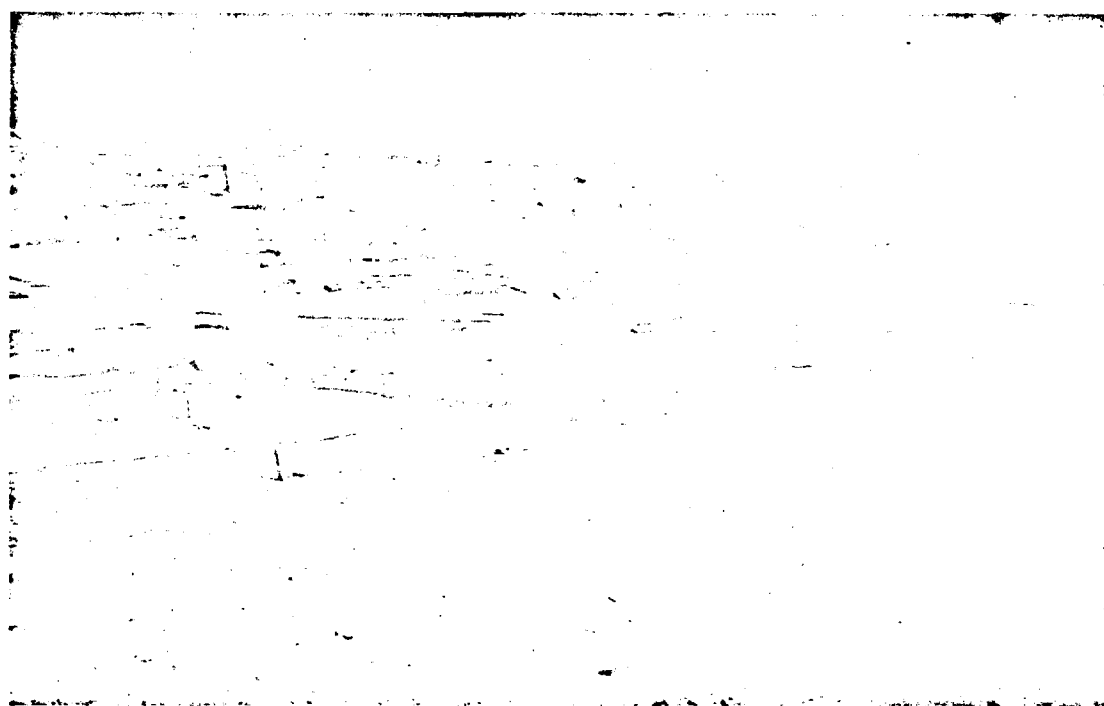


Fig. 2.7 Unit A, A, Scattering of Materiel away
from Ground Zero (Site 1)



Fig. 2.8 Unit A, A, Scattering of Materiel
toward Ground Zero (Site 1)

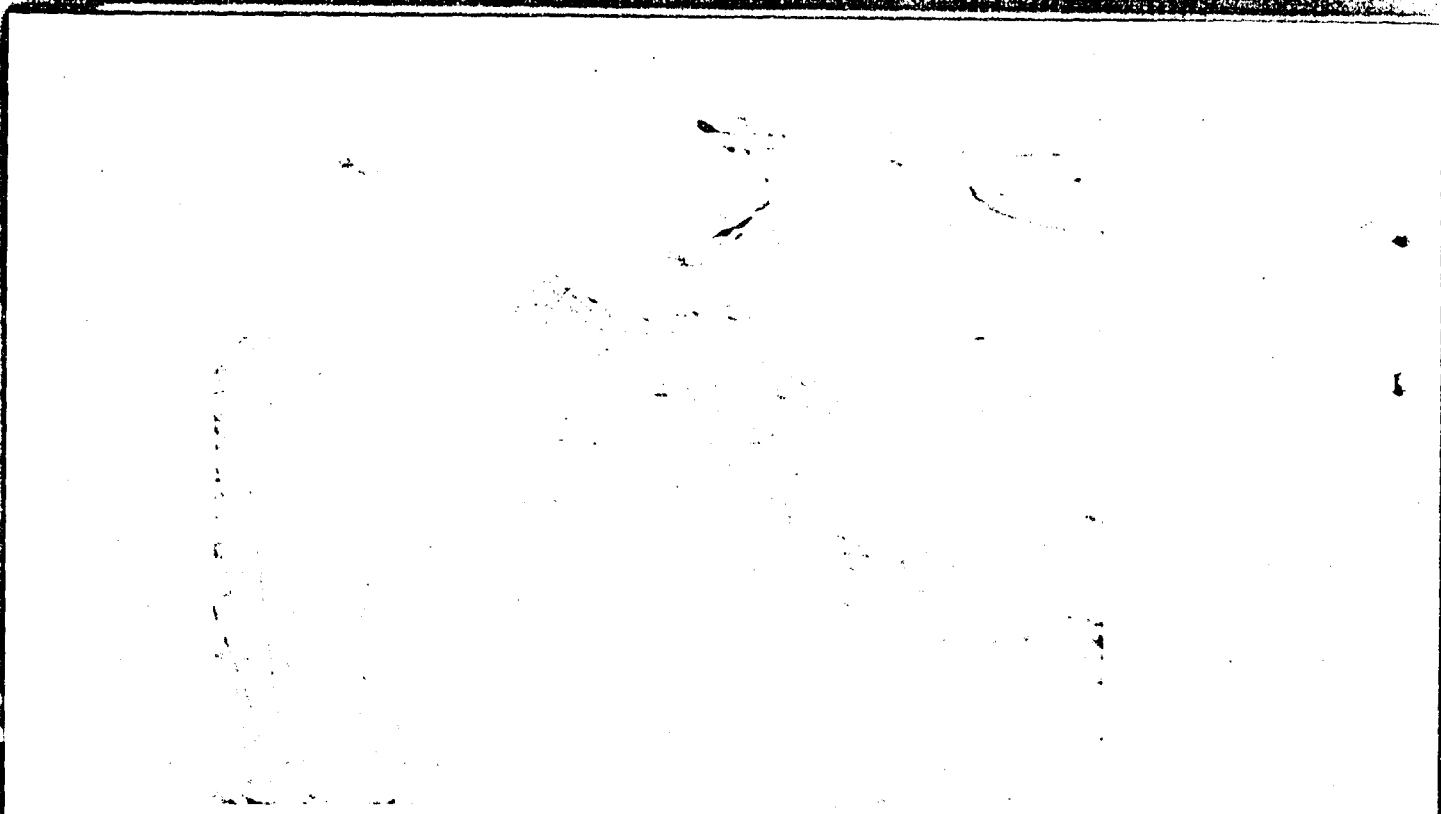


Fig. 2.9 Unit A, A, Splint Set Burned, 50% Serviceable,
Category 3 (Site 1)



Fig. 2.10 Unit A, A, Blanket Set Burned,
0% Serviceable (Site 1)

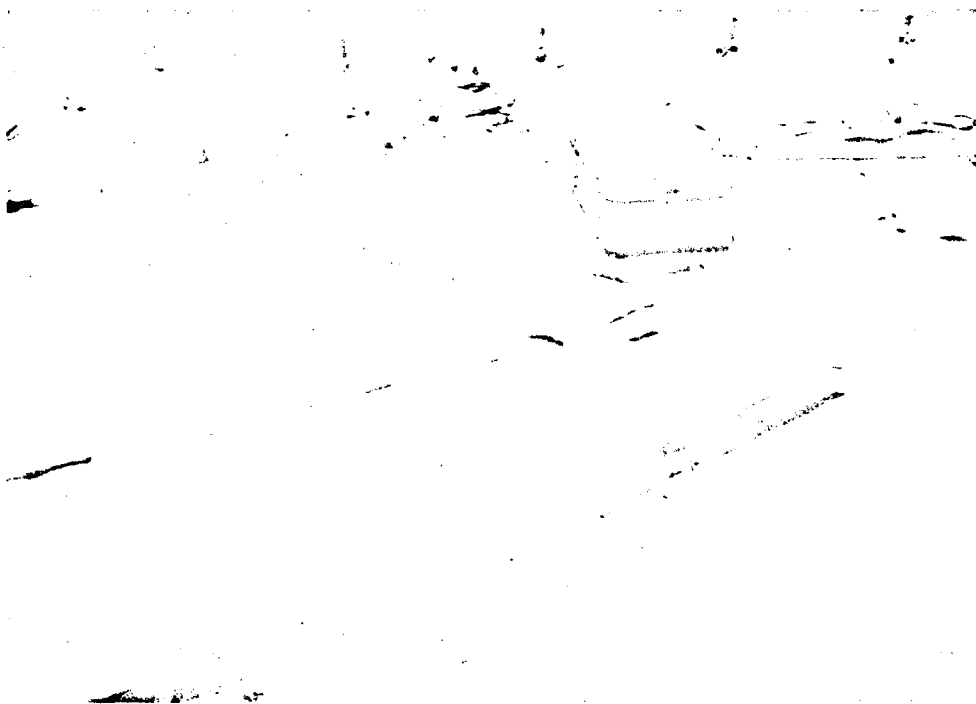


Fig. 2.11 Unit A, A, Dispensary Set, Background, Litter,
Foreground, 100% Serviceable, Category 1 (Site 1)

2.3.2.2 Site 1, Below Ground

As in the aboveground installation, the tent was destroyed. There was a general disruption of the equipment, although only a few light items were blown out of the excavation (Fig. 2.12). Fires within this installation were more widespread and all equipment showed some evidence of fire damage. The resuscitator could not be found; the operating lamp was 90 per cent serviceable in that only the male plug was missing and there were small holes in the reflector; and the typewriter was undamaged. Contents of the dispensary set were intact. Equipmentwise, the unit could have been considered about 25 per cent serviceable.

2.3.2.3 Site 2, Above Ground

At Site 2, above ground, the tent was blown down. There was little scattering of materiel and all equipment was either undamaged or repairable with only minor repairs (Figs. 2.13 and 2.14). On the basis of equipment, this unit could be considered 95 per cent serviceable.

2.3.2.4 Site 2, Below Ground

Below ground, the tentage was blown down but equipment was disrupted only to a minor extent. All equipment was undamaged or

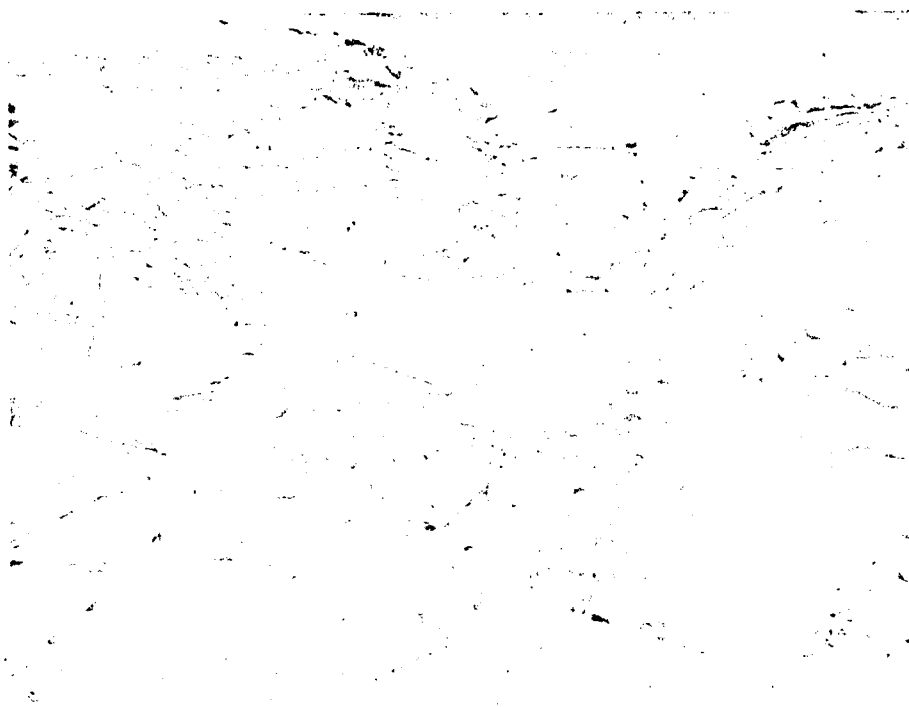


Fig. 2.12 Unit A, General View, B, (Site 1)



**Fig. 2.13 Unit A, A, Scattering of Materiel
toward Ground Zero (Site 2)**

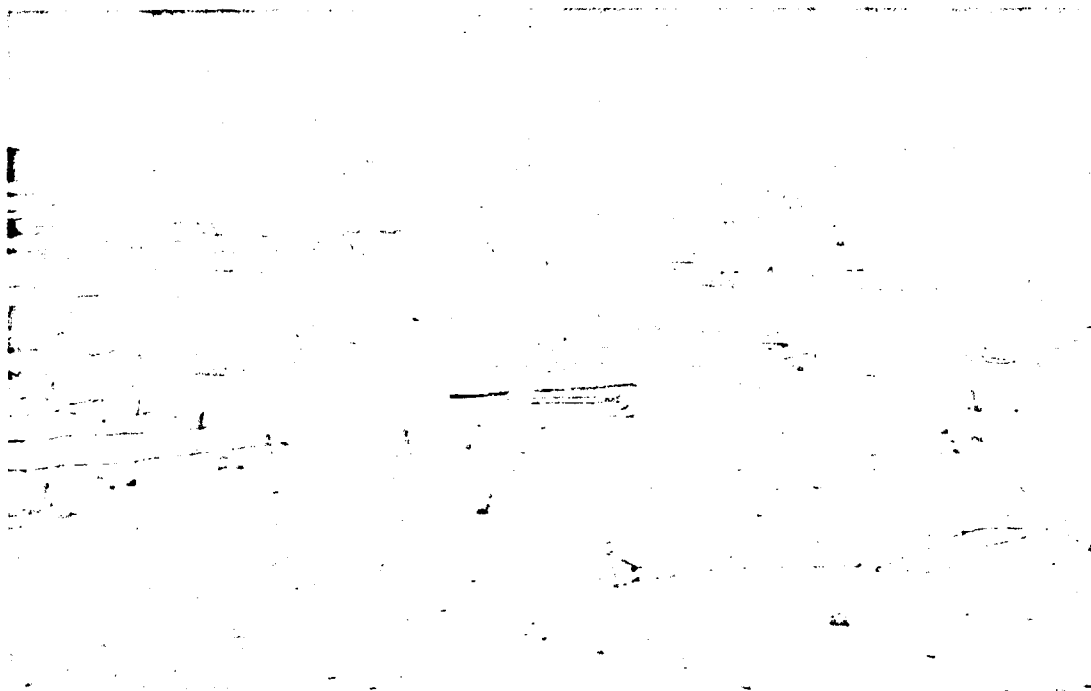


Fig. 2.14 Unit A, A, Scattering of Materiel
away from Ground Zero (Site 2)

damaged so slightly that it was still serviceable (Figs. 2.15 and 2.16). Equipmentwise, this unit was considered 100 per cent serviceable.

2.3.3. Unit B, 4,163 ft, Site 1, Above Ground

2.3.3.1 Surgical Tent

In the aboveground surgery, the tent was completely destroyed and the equipment was scattered a distance of 250 ft away from ground zero (Fig 2.17) and a distance of 100 ft toward ground zero (Fig. 2.18). Damage to individual items of equipment varied from minor damage to complete destruction. This damage was, primarily, a result of blast effects and fire (Figs. 2.19 and 2.20). Attempts to evaluate separately the damage from these two causes did not prove to be feasible. Column 1, Table B.1 shows the serviceability of each of the items of equipment evaluated within the surgery, regardless of where the item required repair under damage criteria. Examination of the smaller items of equipment, such as surgical instruments of a non-flammable material, indicated that some showed evidence of having been exposed to the fire but that in most cases they were serviceable immediately. Contents of chests, also of a nonflammable material, likewise were serviceable. Chests of an aluminum alloy with a

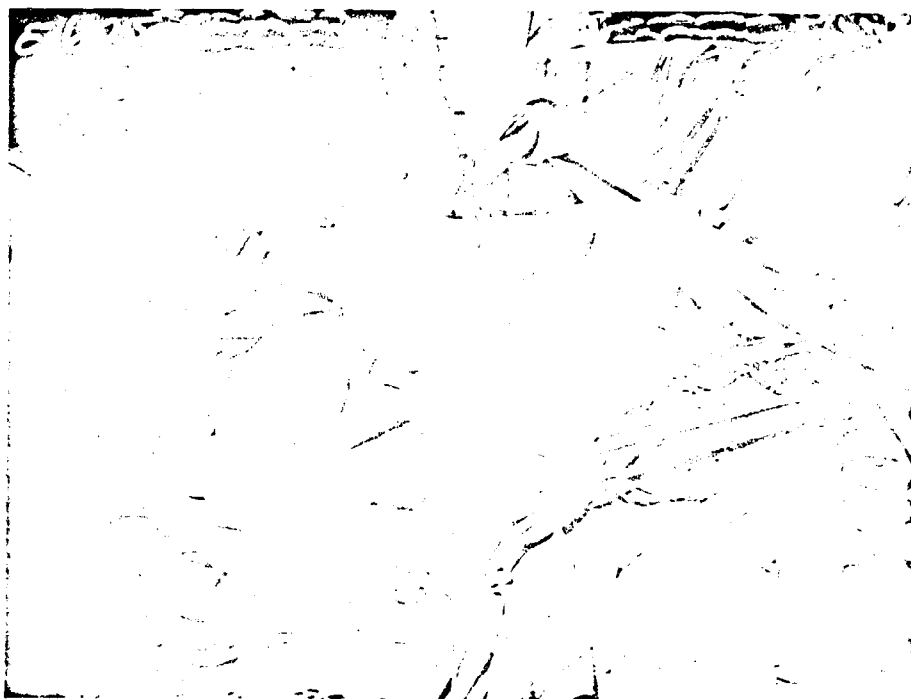


Fig. 2.15 Unit A, General View, B, toward Entrance
(Site 2)

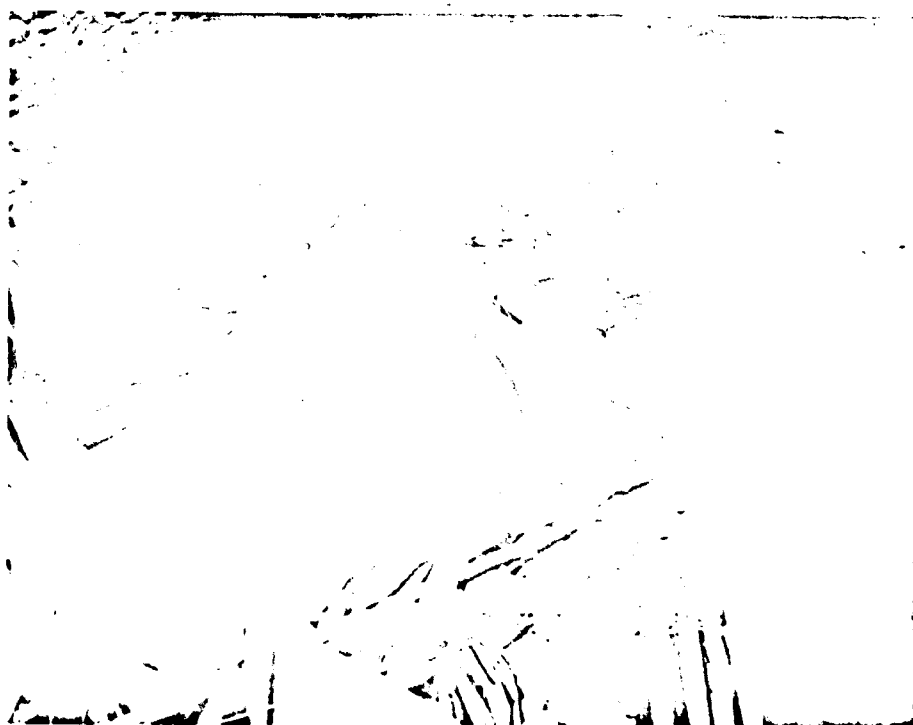


Fig. 2.16 Unit A, General View, B, away from Entrance
(Site 2)

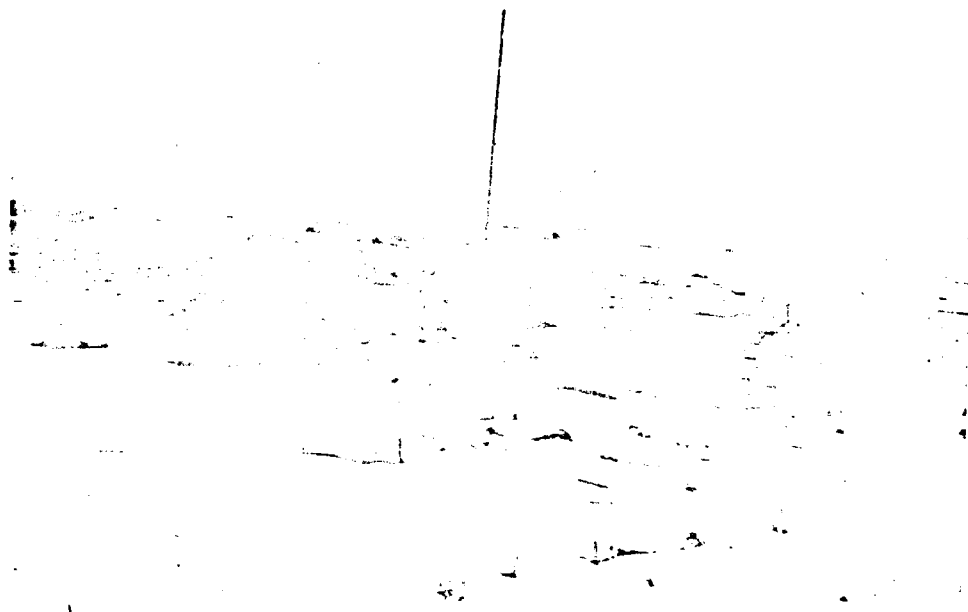


Fig. 2.17 Unit B, A, Scattering of Materiel away from Ground Zero (Site 1)



Fig. 2.18 Unit B, A, Scattering of Materiel toward Ground Zero (Site 1)

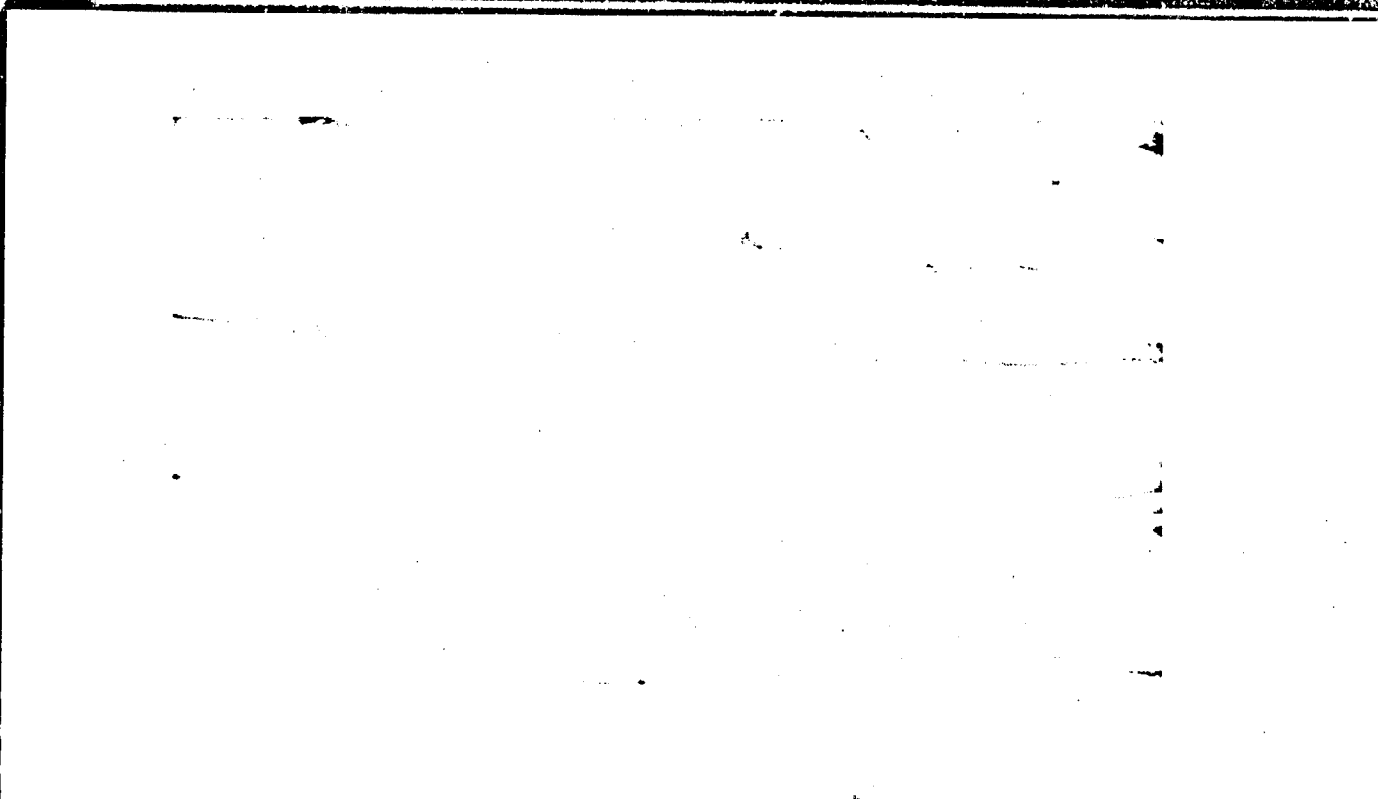


Fig. 2.19 Surgery, A, Lamp, Operating, Showing Results of Fire,
10% Serviceable, Category 4 (Unit B, Site 1)



Fig. 2.20 Surgery, A, Left, 2 Instrument Tables 90% and 95%
Serviceable, Category 1, Right, 2 Operating Lamps
10% and 10%, Category 4, Background, Operating
Table 50%, Category 2 (Unit B, Site 1)

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comparatively low melting point, exposed to fire, were fused and considered destroyed (Fig. 2.21). If composed of metal with a high melting point, contents of these chests were serviceable. Chests not exposed to fire (Fig. 2.22) showed evidence of blast effects in that lids could not be closed as a result of bending and distortion. Contents of these chests which were not of a fragile nature were undamaged (Fig. 2.22). All fragile items were broken regardless of whether they were within a chest or exposed. Items having parts composed of flammable materials were damaged to nonserviceability when they had been exposed to fire; such items, however, sustained only minor damage from blast effects. On a comparative basis, it was considered that the damage sustained by the unevaluated items of equipment was less than that sustained by the evaluated items. Based upon the items evaluated, the over-all arithmetical average of serviceability of the surgical tent was 70 per cent (Line 20A, Col 1, Table B.1). In accordance with criteria established in para 2.3.1, of the 48 items evaluated in the surgical tent, 34 were in category 1, 3 were in category 2, 4 were in category 3, and 7 were in category 4 (Line 20A, Col 1, Table B.5). Since items in categories 1 and 2 were either undamaged or readily repairable within the unit, 37 of 48 items were immediately serviceable within the unit. Thus, equipmentwise, based upon evaluated items the surgery would have been 77 per cent immediately serviceable but would have required 23 per cent replacement.



Fig. 2.21 Surgery, A, Aluminum Chest Exposed to Fire
(Unit B, Site 1)

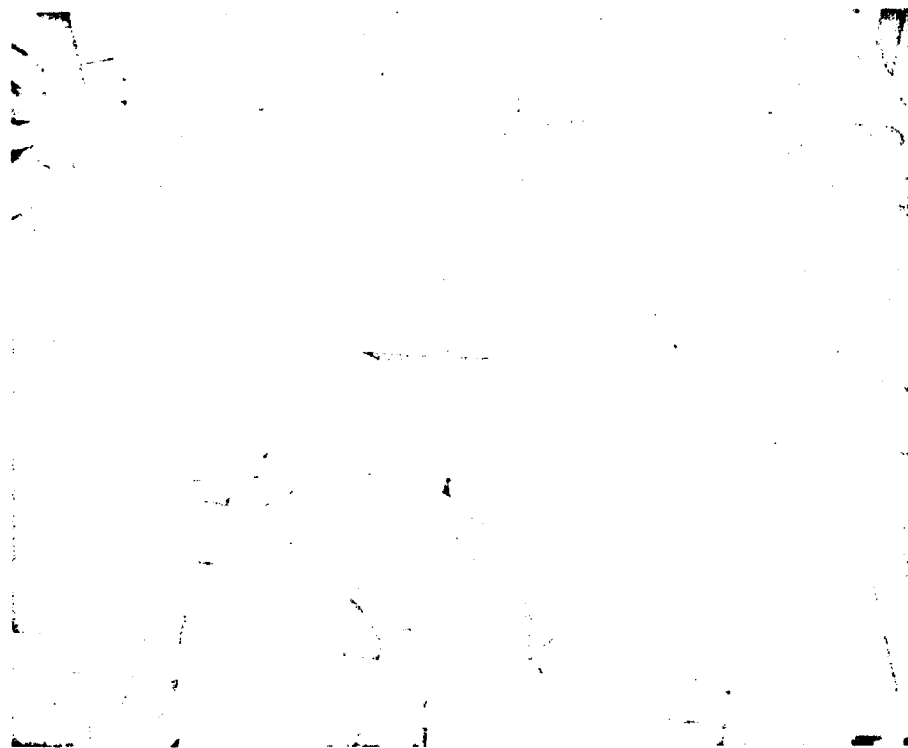


Fig. 2.22 Surgery, A, Contents of Chest Undamaged,
Distortion of Metal Chest (Unit B, Site 1)

2.3.3.2 X-ray Tent

In the aboveground X-ray, the tent was completely destroyed. Materiel of the X-ray section was scattered to a lesser extent than that of the surgery (Fig. 2.23), due, undoubtedly, to the heavier nature of the equipment. Materiel of the clinics--dental, ENT, eye, and maxillofacial--being smaller in nature than that in the X-ray section, was scattered to about the same degree as that of the surgery. The serviceability of individual items of equipment within the X-ray tent is given in Col 1, Table B.2. Figures 2.24 to 2.30 show some of the individual items of equipment within the X-ray section with their degree of serviceability and their category. Figures 2.31 to 2.33 show some of the individual items within the clinics, their degree of serviceability and their category. As in the surgical tent, smaller items of steel or of high melting-point alloys showed evidence of having been exposed to fire but in almost all cases were serviceable immediately. Fragile items in most instances were destroyed by either blast or fire. In the X-ray tent there was an over-all arithmetical average serviceability of evaluated items of 52 per cent (Line 30A, Col 1, Table B.2). In accordance with the damage criteria in para 2.3.1, there were 12 items in category 1, 6 in category 2, 7 in category 3, and 3 in category 4 within the X-ray section (Line 19A, Col 1, Table B.6); and 8 items in category 1, 2 in category 2, 0 in



Fig. 2.23 X-ray, A, toward Ground Zero - Small Degree of Scattering (Unit B, Site 1)

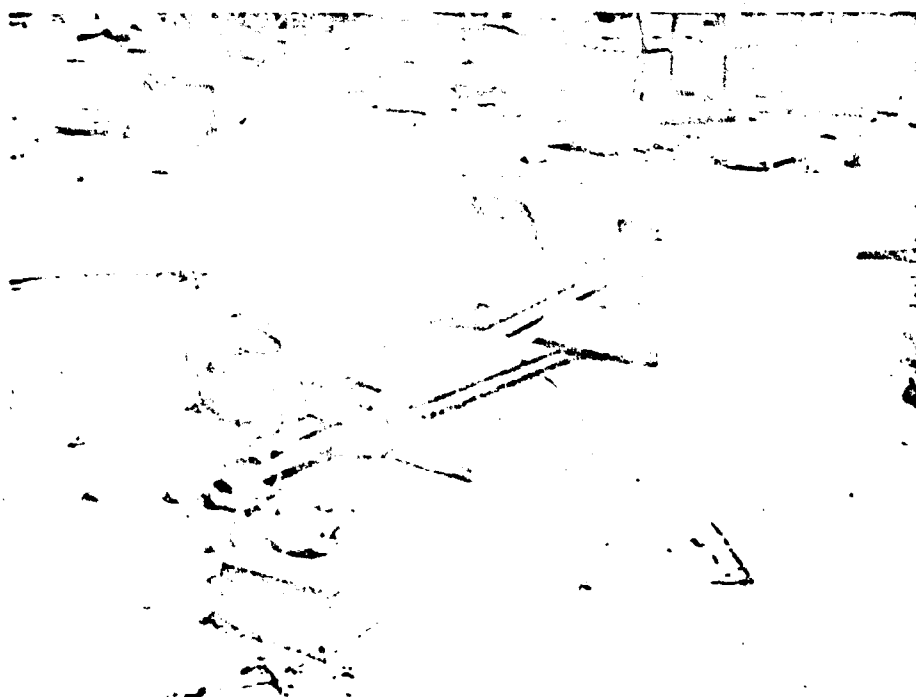


Fig. 2.24 X-ray, A, Portable X-ray, 90% Serviceable, Category 1 (Unit B, Site 1)

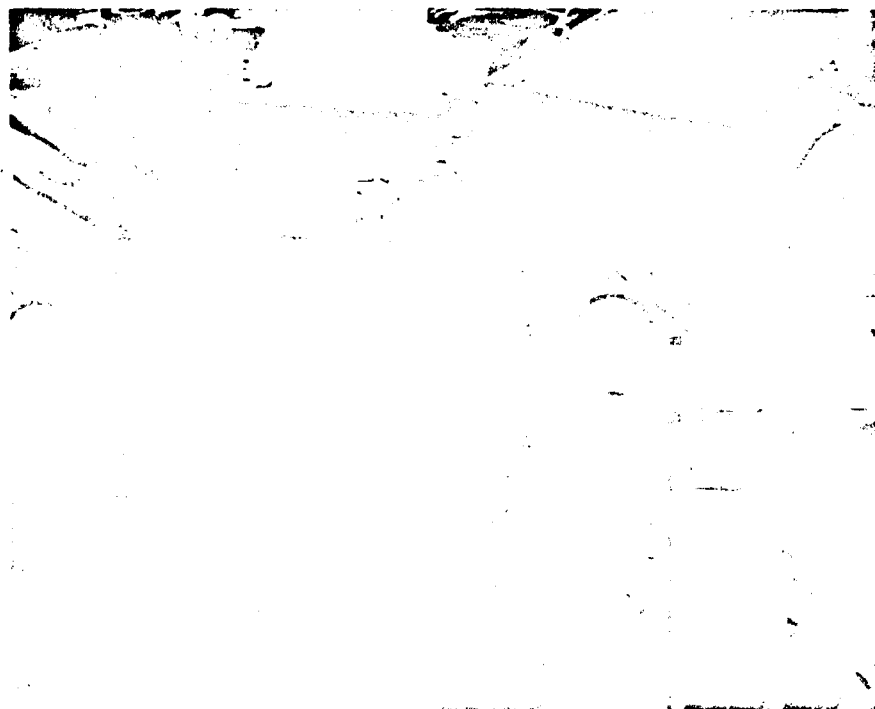


Fig. 2.25 X-ray, A, Cassette Changer, 80% Serviceable,
Category 1 (Unit B, Site 1)

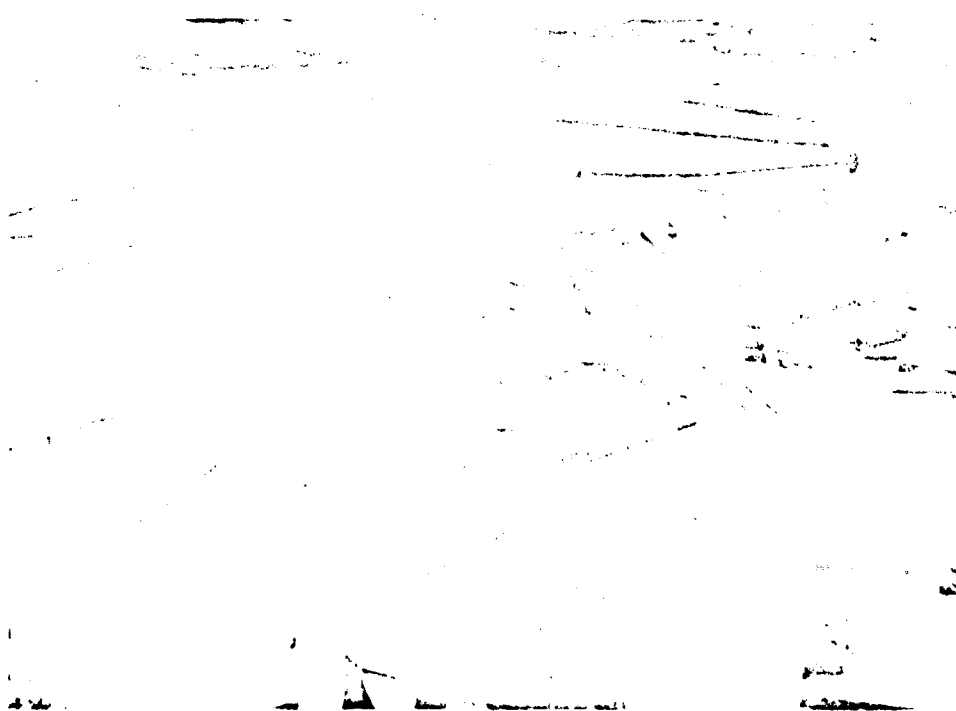


Fig. 2.26 X-ray, A, Control Panel, 100 ma. X-ray, 75%
Serviceable, Category 2 (Unit B, Site 1)

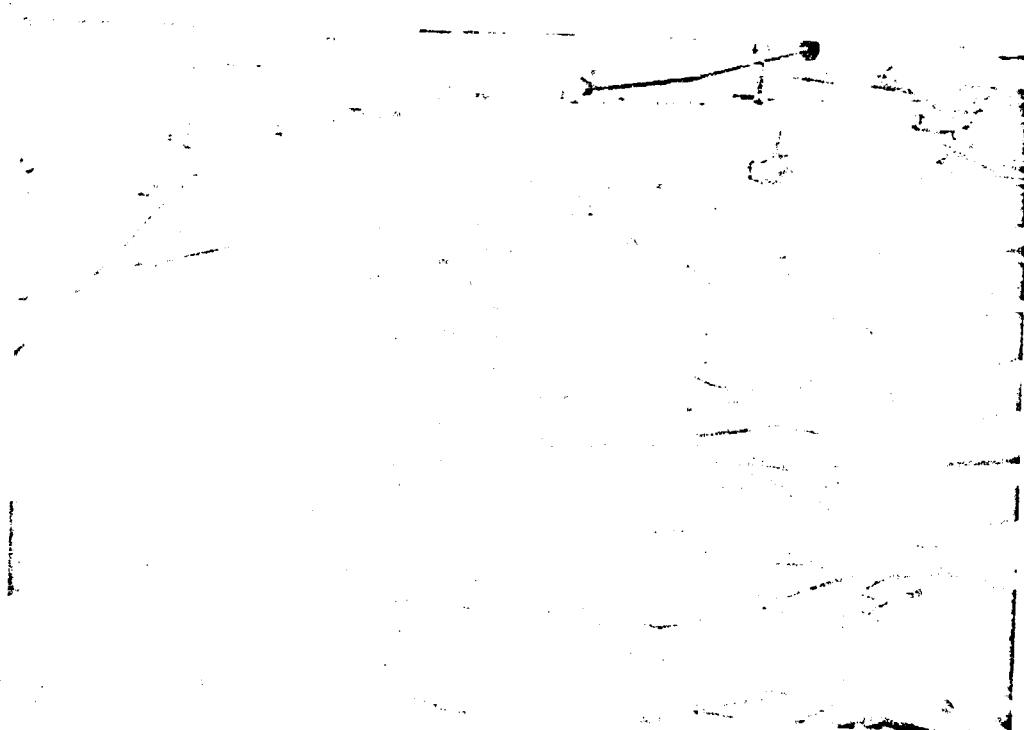


Fig. 2.27 X-ray, A, Transformer, 100% Serviceable,
Category 1 (Unit B, Site 1)

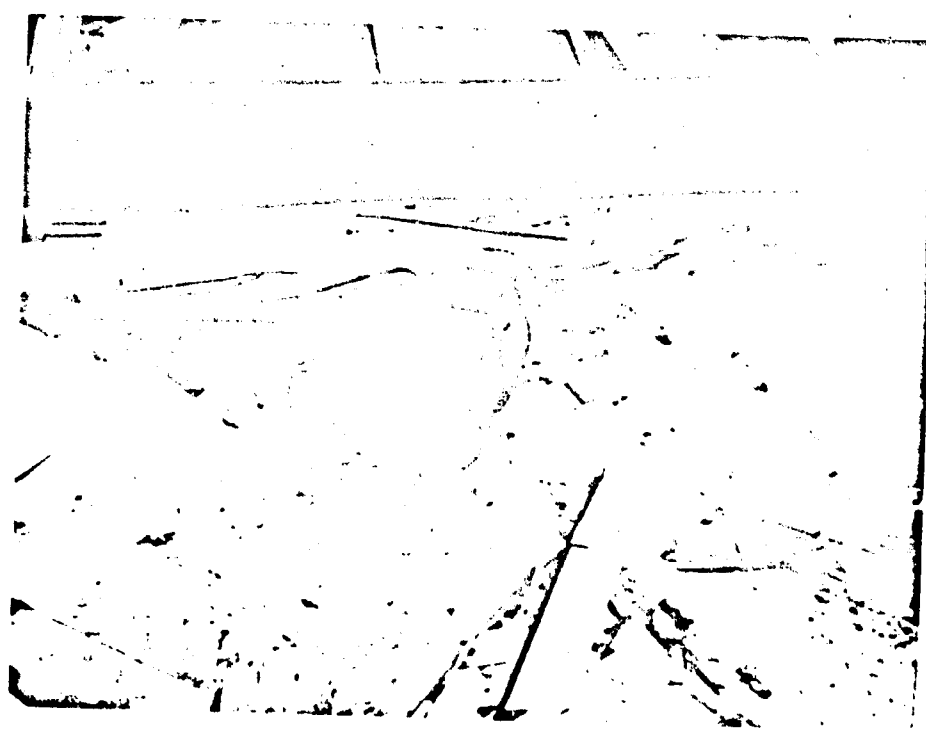


Fig. 2.28 X-ray, A, X-ray, 100 ma., 95% Serviceable,
Category 1 (Unit B, Site 1)

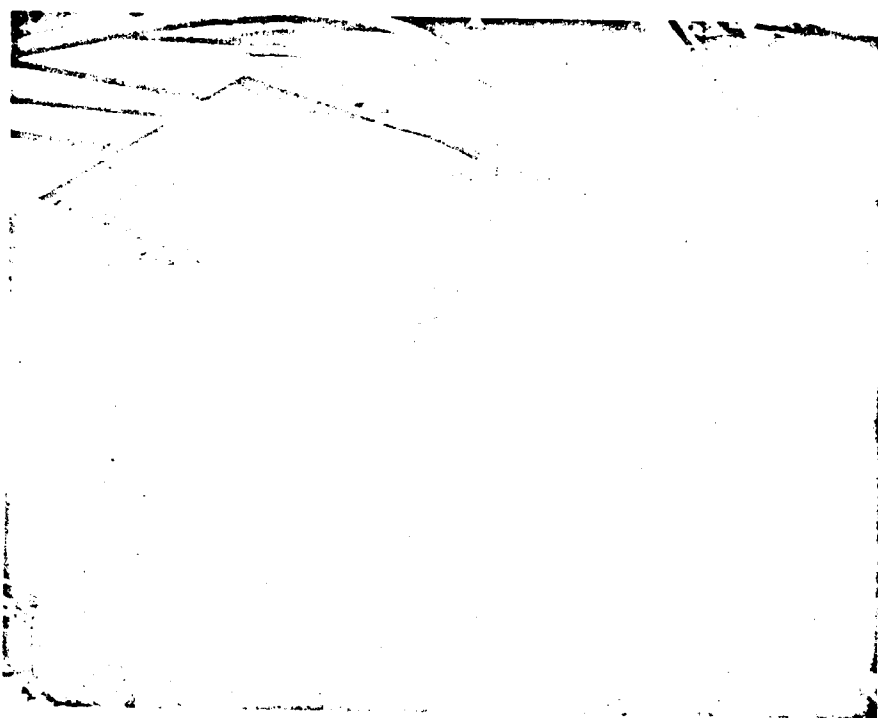


Fig. 2.29 X-ray, A, Water Conditioner, 97% Serviceable,
Category 1 (Unit B, Site 1)

Fig. 2.30 X-ray, A, Loading and Drying Bin, Left Background, 95%
Serviceable, Category 1, Developing Tank, Left
Foreground, 90% Serviceable, Category 1 (Unit B, Site 1)

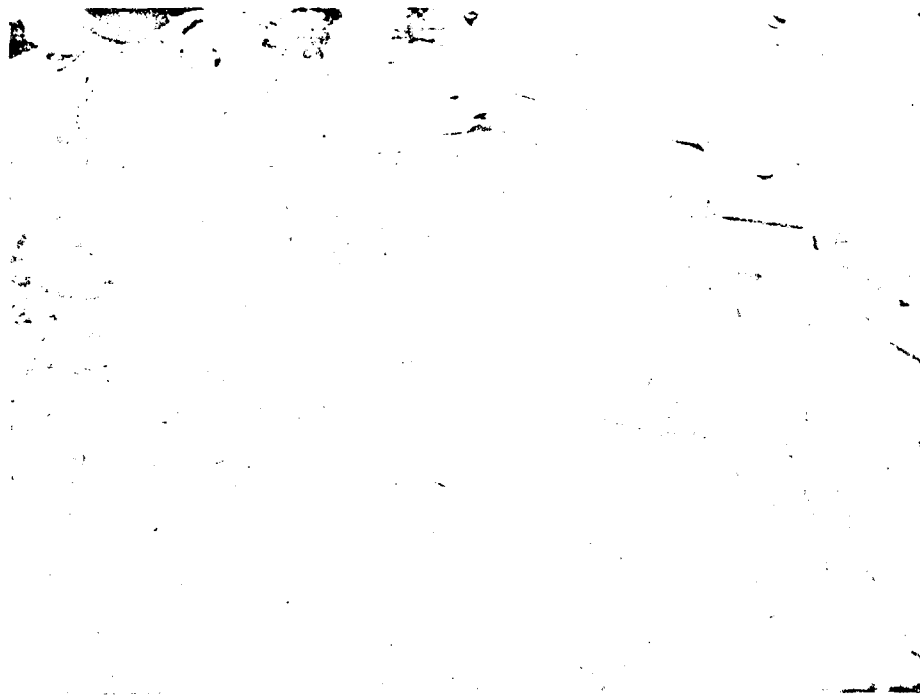


Fig. 2.31 Clinics, A, Dental Chair, 85% Serviceable, Category 1,
Dental Engine, Left 55% Serviceable, Category 1
(Unit B, Site 1)



Fig. 2.32 Clinics A, Specialist Chair, 70% Serviceable, Category 2,
Foreground, Instrument Table, Background, 100% Service-
able, Category 1 (Unit B, Site 1)



Fig. 2.33 Clinics, A, Chair, Specialist, 65% Serviceable,
Category 2 (Unit B, Site 1)

category 3, and 5 in category 4 within the clinics section (Line 12A, Col 1, Table B.7). Thus, 18 out of 28 items, or 64 per cent, were immediately serviceable within the X-ray section; and 10 out of 15, or 66 per cent, were immediately serviceable within the clinics section (Lines 2A and 3A, Col 1, Table B.11). Equipmentwise, therefore, the X-ray section was about 64 per cent serviceable, requiring 36 per cent replacement; and the clinics section was about 66 per cent serviceable, requiring 34 per cent replacement.

2.3.3.3 Pharmacy and Laboratory Tent

Above ground, as elsewhere, the tent was destroyed. Materiel exposed on tables was blown to about the same distances as was that from the surgical tent, i.e., 250 ft away from ground zero and 100 ft toward ground zero (Figs. 2.34 and 2.35). All exposed glassware was either broken by the blast or fused by the fires. Contents of closed boxes, if packed in such a manner as to provide protection against shock, sustained only slight damage. Normal packaging for overseas shipment, as performed at depots, afforded this protection (Fig. 2.36). Materials contained loosely in boxes, such as would be encountered under actual operation with working stocks, were completely destroyed (Fig. 2.37). When the wooden boxes contained either glass materials or flammable materials and were exposed to fire, both box and contents

were either fused or burned (Fig. 2.38). Of the unevaluated items of equipment it was estimated that less than 20 per cent were serviceable. Damage was higher than that of the evaluated items since a large proportion of the material was of a fragile nature. Column 1, Table B.3 shows the serviceability of each evaluated item. Figures 2.39 to 2.42 show some of the items evaluated with the degree of damage sustained. The over-all serviceability of evaluated items was 40 per cent (Line 14A, Col 1, Table B.3). In accordance with the damage criteria established in para 2.3.1, of the 19 items evaluated in the laboratory section, 8 were in category 1, 1 was in category 2, 5 were in category 3, and 5 were in category 4 (Line 12A, Col 1, Table B.9). Of the four items evaluated in the pharmacy section, there were none in category 1, none in category 2, 1 in category 3, and 3 in category 4. Therefore, since categories 1 and 2 were undamaged or were immediately serviceable, 9 out of 19, or 47 per cent, of the evaluated items in the laboratory section, and none, or 0 per cent, of those in the pharmacy section would be available for use. Based upon damage to equipment evaluated as well as unevaluated, the laboratory was considered to be 30 per cent serviceable and would have required 70 per cent replacement. The pharmacy was considered to be 5 per cent serviceable and would have required 95 per cent replacement.

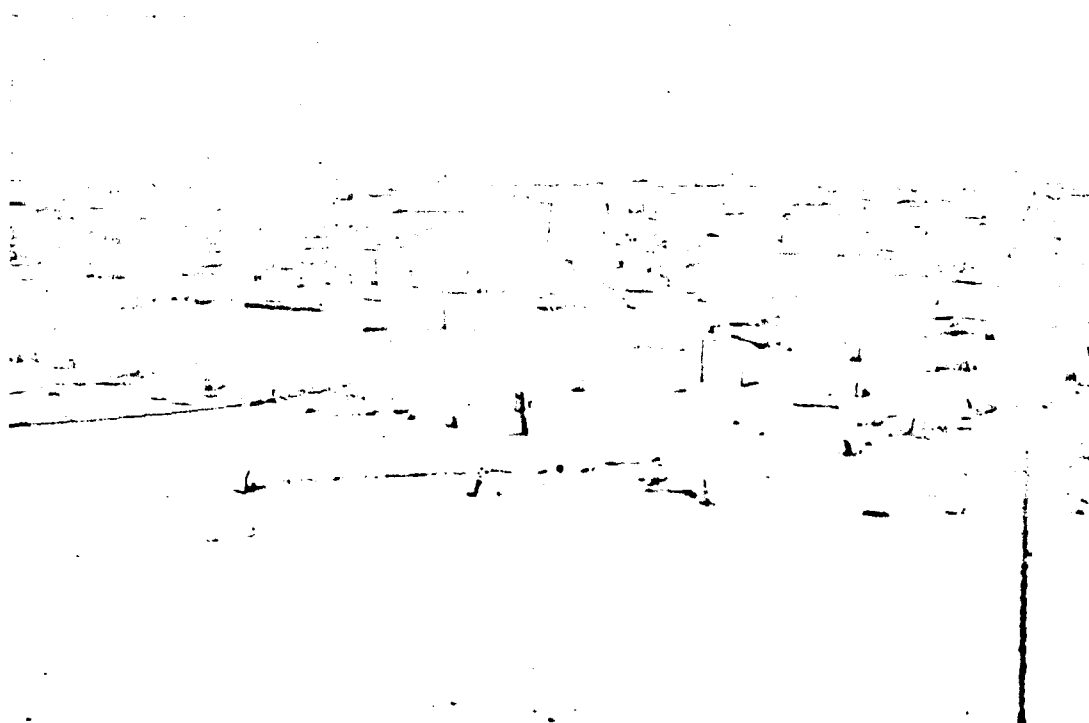


Fig. 2.34 Pharmacy and Laboratory, A, Scattering of Material
away from Ground Zero (Unit B, Site 1)

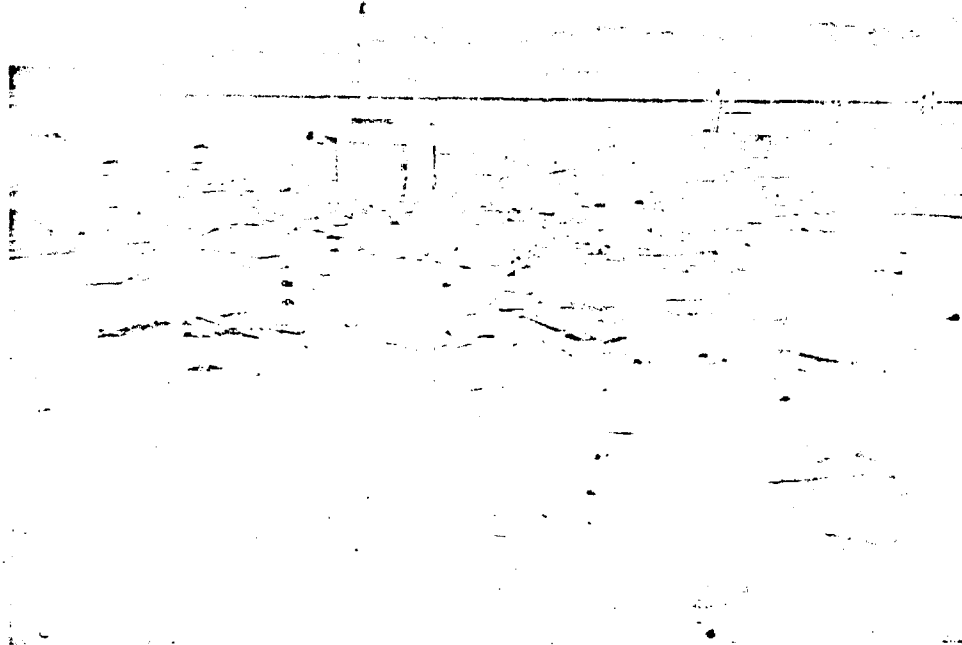


**Fig. 2.35 Pharmacy and Laboratory, A, Scattering of Materiel
toward Ground Zero (Unit B, Site 1)**

**Fig. 2.36 Pharmacy and Laboratory, A, Contents of Depot
Packaged Ether Undamaged (Unit B, Site 1)**



Fig. 2.37 Pharmacy and Laboratory, A, Destruction of Loosely Packed Items (Unit B, Site 1)



Fig. 2.38 Pharmacy and Laboratory, A, Fusion of Glassware as a Result of Fire (Unit B, Site 1)

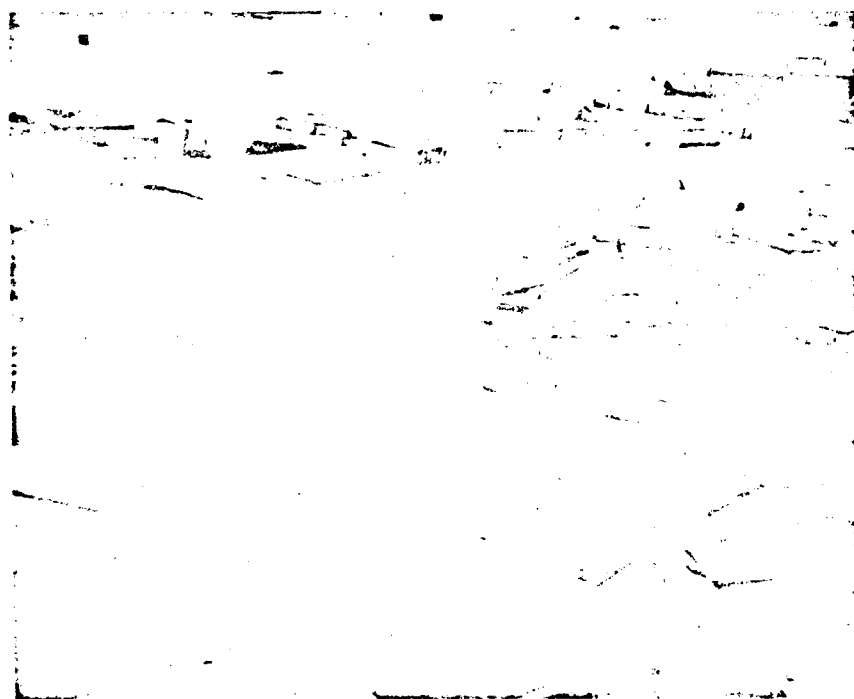


Fig. 2.39 Pharmacy and Laboratory, A, Incubator, Bacterial,
10% Serviceable, Category 4 (Unit B, Site 1)

Fig. 2.40 Pharmacy and Laboratory, A, Water Distillation
Apparatus, 15% and 20% Serviceable, Categories
1 and 3 (Unit B, Site 1)



Fig. 2.41 Pharmacy and Laboratory, A, Refrigerator,
10% Serviceable, Category 4 (Unit B, Site 1)



Fig. 2.42 Pharmacy and Laboratory, A, Microscope,
5% Serviceable, Category 4 (Unit B, Site 1)

2.3.3.4 Ward Tent

In the aboveground ward, as elsewhere, the tent was destroyed. Equipment was scattered at varying distances from 200 ft away from ground zero to 50 ft toward ground zero (Figs. 2.43 and 2.44). Examination of unevaluated items of equipment paralleled closely that within the X-ray and surgery. Since the largest portion of items contained within the ward was of a flammable nature, the effects of fire were more evident here than elsewhere. In many instances cots, mattresses, blankets, sheets, etc., were completely consumed. Conversely, the damage sustained from the blast was estimated to have been less here than in other tents--a result of this type equipment being of a less rigid nature hence not as sensitive to the effects of blast. Of the 16 cots in this tent, 6 were immediately serviceable. Of the two Gatch beds, one was usable immediately and the other after minor repairs (Fig. 2.45). Metallic objects in most instances were undamaged (Fig 2.46). Column 1, Table B.4 indicates the degree of serviceability of each item of equipment evaluated within the ward tent. Figures 2.47 to 2.49 indicate some items with their degree of serviceability. Based upon evaluated items of equipment there was an over-all average serviceability of 50 per cent

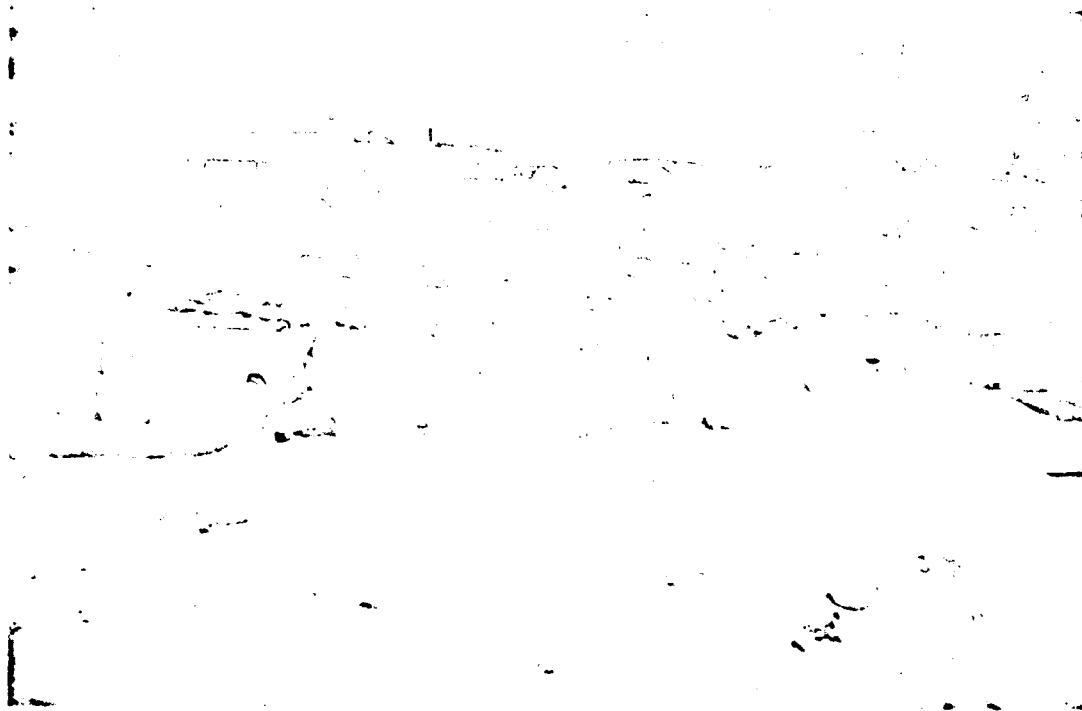


Fig. 2.43 Ward, A, Scattering of Materiel toward
Ground Zero (Unit B, Site 1)

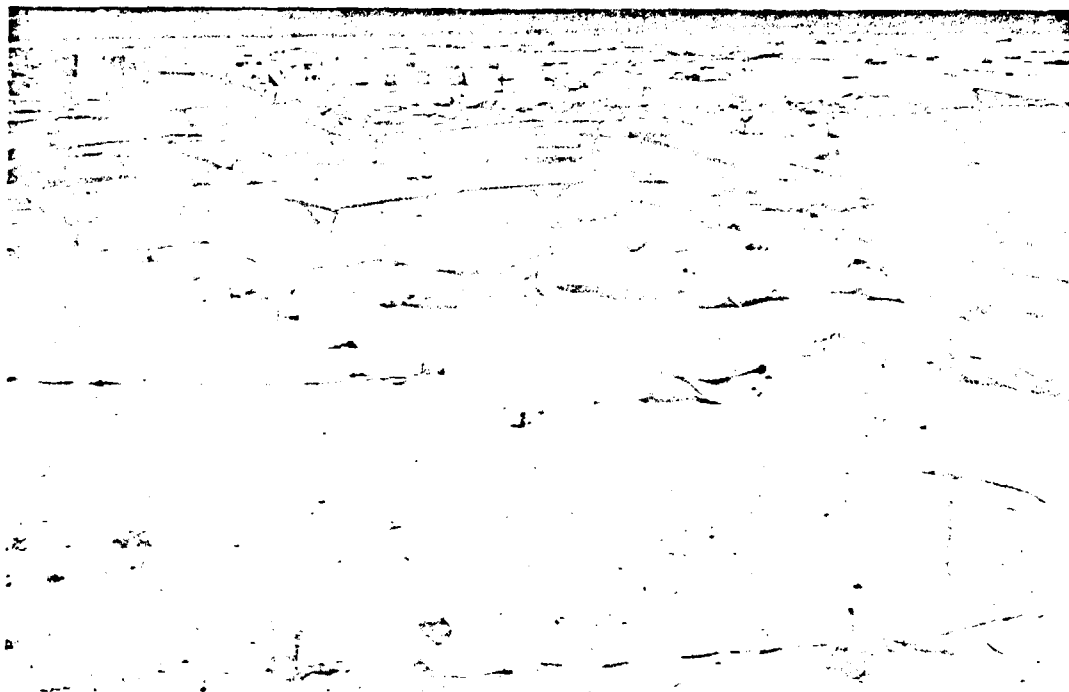


Fig. 2.44 Ward, A, Scattering of Materiel away
from Ground Zero (Unit B, Site 1)



Fig. 2.45 Ward, A, Gatch Beds, Left 90% Serviceable, Right
80% Serviceable, Categories 1 and 2 (Unit B, Site 1)

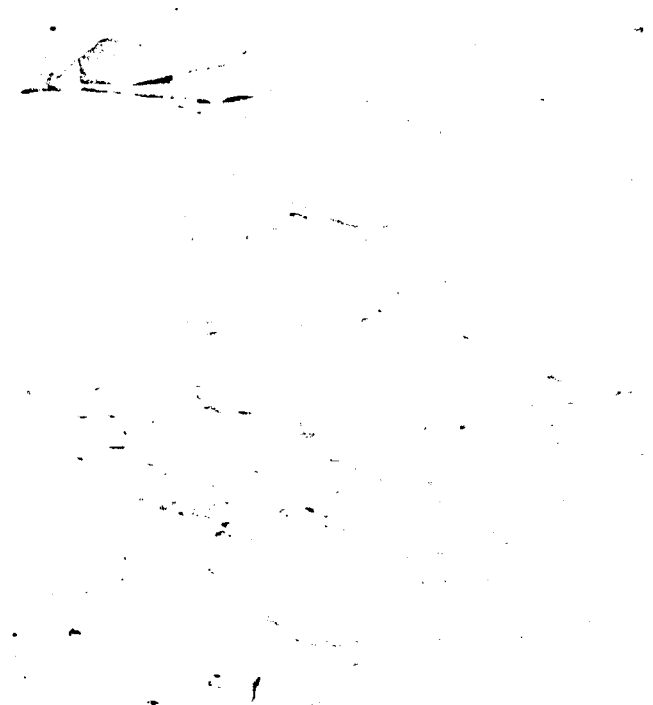


Fig. 2.46 Ward, A, Metallic Bedpan and Basin, 95%
Serviceable, Category 1 (Unit B, Site 1)

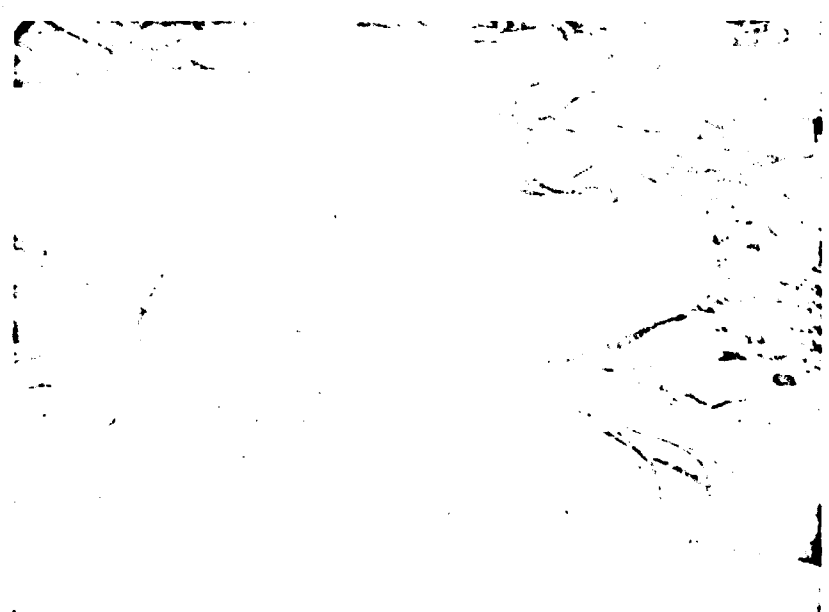


Fig. 2.47 Ward, A, Wagensteen Suctions, (3) 90%, 90%, and
90% Serviceable, All Category 1 (Unit B, Site 1)

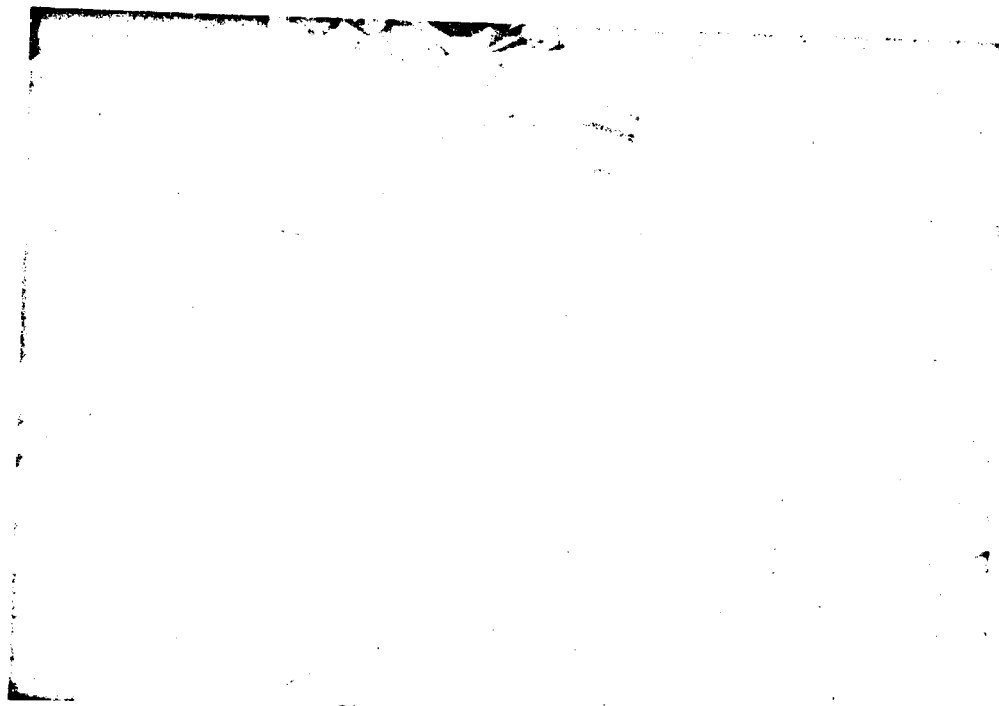


Fig. 2.48 Ward, A, Suction Apparatus, 40% Serviceable,
Category 1 (Unit B, Site 1)



Fig. 2.49 Ward, A, Infrared Lamp, 50% Serviceable,
Category 1 (Unit B, Site 1)

(Line 11A, Col 1, Table B.4). In accordance with the damage criteria in para 2.3.1, 14 items were in category 1, none in category 2, 3 in category 3, and 6 in category 4 (Line 11A, Col 1, Table B.10). Thus 14 out of 23, or 60 per cent, of the items were immediately serviceable within the unit (Line 6, Col 1, Table B.11). Therefore, based upon evaluated items, equipmentwise, the ward tent would have been 60 per cent serviceable and would have required 40 per cent replacement.

2.3.3.5 Over-all, Site 1, Above Ground

Of the evaluated items of equipment, out of a total of 137 items 88 were in categories 1 and 2. Thus, equipmentwise, this installation was 64 per cent serviceable and would have required 36 per cent replacement (Line 7A, Col 1, Table B.11).

2.3.4 Unit B, 4,163 ft, Site 1, Below Ground

2.3.4.1 Surgical Tent

In the below-ground surgery the tent was completely destroyed. There was little scattering of equipment either toward or away from ground zero. There was a general disruption of equipment, and fire damage was extensive (Figs. 2.50 and 2.51). It is estimated



Fig. 2.50 Surgery, B, General View Obliquely away from Ground Zero (Unit B, Site 1)

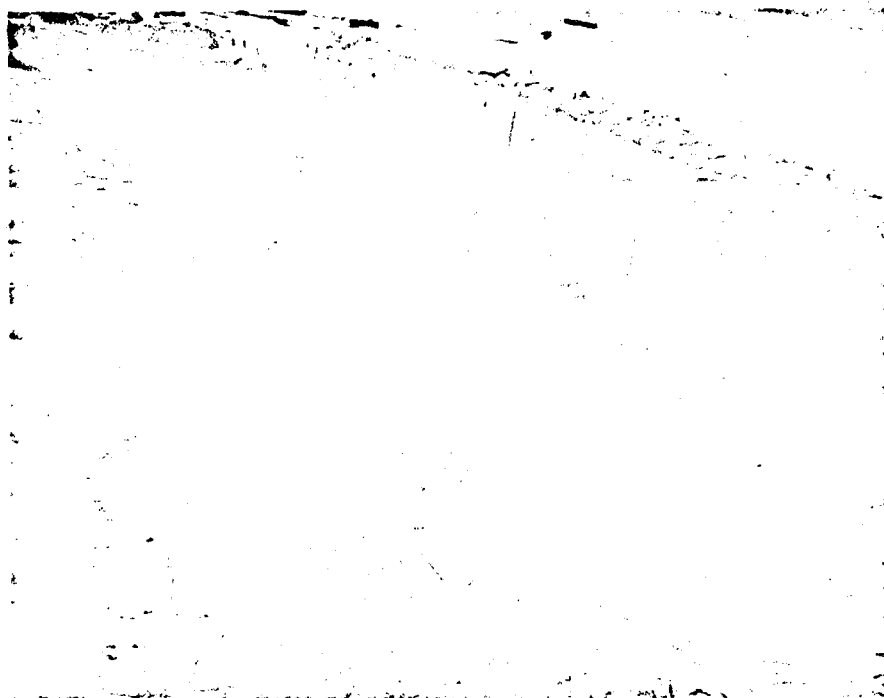


Fig. 2.51 Surgery, B, General View Obliquely toward Ground Zero (Unit B, Site 1)

that the fire damage to all equipment was more extensive here than it was in the aboveground installation, while blast damage was less extensive. Almost all equipment showed some effects of fire. Unevaluated items which were nonflammable or composed of metals with a high melting point were considered serviceable. As in the aboveground installation, the unevaluated items of equipment were damaged to a lesser extent than were the evaluated items. Column 1, Table B.1 indicates the degree of serviceability of each item regardless of where it would require repair under damage criteria. Figures 2.52 to 2.54 show some of the evaluated items with their degree of serviceability and their category under damage criteria as outlined in para 2.3.1. Chests not exposed to fire were undamaged, as were their contents (Figs. 2.51 to 2.54). Materials exposed on chests, if not of a fragile nature, were undamaged, while fragile items were destroyed or severely damaged. Based upon evaluated items only, there was an over-all arithmetical average of serviceability of 63 per cent (Line 20B, Col 1, Table B.1). It is estimated, however, that the largest portion of damage sustained was a result of fire rather than of blast effects. It is considered that the blast damage above ground exceeded that below ground, while the reverse was true of fire damage. The over-all arithmetical average of serviceability of evaluated items in the X-ray tent was 31 per cent. In accordance with damage criteria outlined in para 2.3.1, of the 48 items evaluated in the below-ground surgery, 34 were in category 1, 2 were in

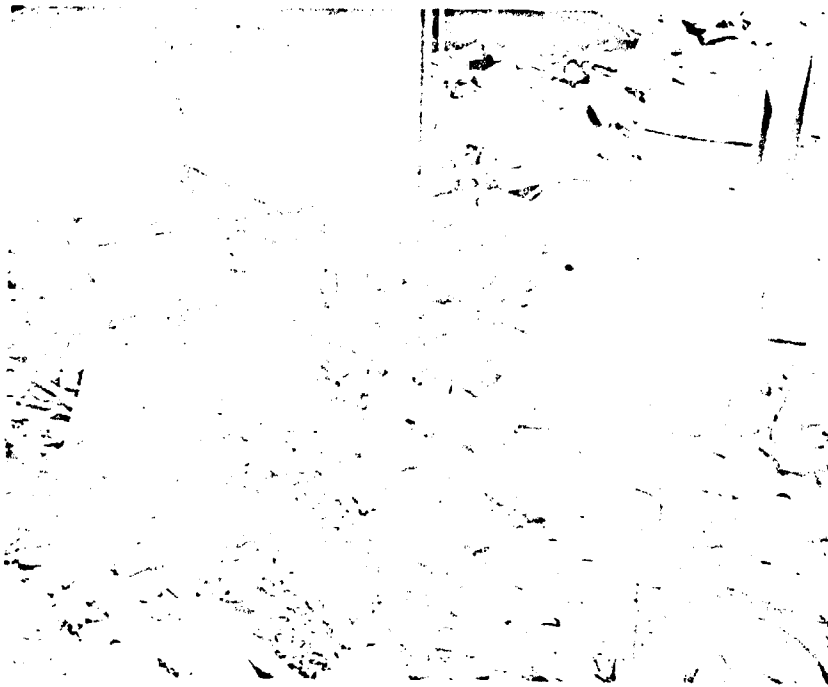


Fig. 2.52 Surgery, B, Orthopedic Table, 0% Serviceable,
Category 4 (Unit B, Site 1)



Fig. 2.53 Surgery, B, Operating Lamp, 10% Serviceable,
Category 4 (Unit B, Site 1)



Fig. 2.54 Surgery, B, Operating Table, Aluminum, Operating Lamp, Right, 50% Serviceable, Respectively, Category 1 (Both) (Unit B, Site 1)

category 2, 2 were in category 3, and 10 were in category 4 (Line 20B, Col 1, Table B.5). Thus, since categories 1 and 2 are considered as being undamaged or immediately repairable, 36 out of 48 items, or 75 per cent, were immediately usable within the unit. Therefore, equipmentwise, the below-ground surgery could be considered 75 per cent immediately serviceable but would require 25 per cent replacement.

2.3.4.2 X-ray Tent

In the below-ground X-ray the tent was destroyed. Unburned material had relatively the same position as it had prior to the blast (Figs. 2.55 and 2.56). Material of a flammable nature contained within this tent was in most cases destroyed by fire. With regard to unevaluated items of equipment, the situation was parallel to that in the aboveground installation; i.e., equipment composed of metals with a high melting point showed evidence of fire damage but was serviceable; while that with a low melting point, or of a flammable nature, was destroyed or severely damaged. As in the below-ground surgery, it is estimated that the greatest portion of damage sustained was a result of fire, with a minimum result of blast. Conversely, the degree of blast damage in the aboveground X-ray tent was greater than that below-ground. The serviceability of evaluated items within the X-ray tent is shown in Col 1, Table B.2. Figures 2.57 to 2.63 show



Fig. 2.55 L-ray, B, General View (Unit B, Site 1)

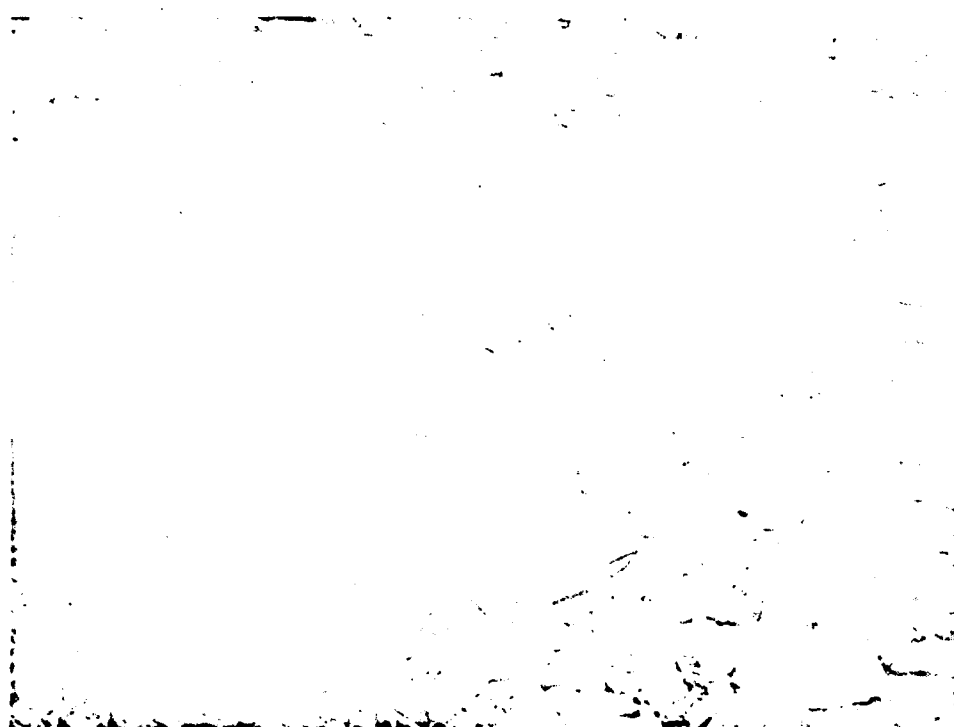


Fig. 2.56 Clinics Section, B, General View (Unit B, Site 1)

some of the items within the X-ray tent with their degree of serviceability and their category under damage criteria. There was an overall arithmetical average of serviceability within the X-ray tent of 31 per cent. In accordance with damage criteria in para 2.3.1, there were within the X-ray section 4 items in category 1, 7 in category 2, 0 in category 3, and 16 in category 4 (Line 19B, Col 1, Table B.6). Of the items in the clinics section, 7 were in category 1, 1 was in category 2, 3 were in category 3, and 5 were in category 4 (Line 12B, Col 1, Table B.7). Thus, 11 out of 27 items within the X-ray section and 8 out of 16 items in the clinics section were serviceable within the unit. Therefore, the X-ray section was considered 40 per cent serviceable and the clinics 50 per cent serviceable with 60 per cent and 50 per cent replacement required, respectively.

2.3.4.3 Pharmacy and Laboratory Tent

Below ground, as elsewhere, the tent was destroyed. Fires were widespread within the excavation, and practically all of the combustible material was consumed by fire. Cave-ins of the excavation were widespread as shown in Figs. 2.64 and 2.65. Such cave-ins covered material and boxes located around the side wall which, when uncovered, showed evidence of fire damage prior to such cave-ins (para 2.3.11, Construction). As in other below-ground installations, blast damage

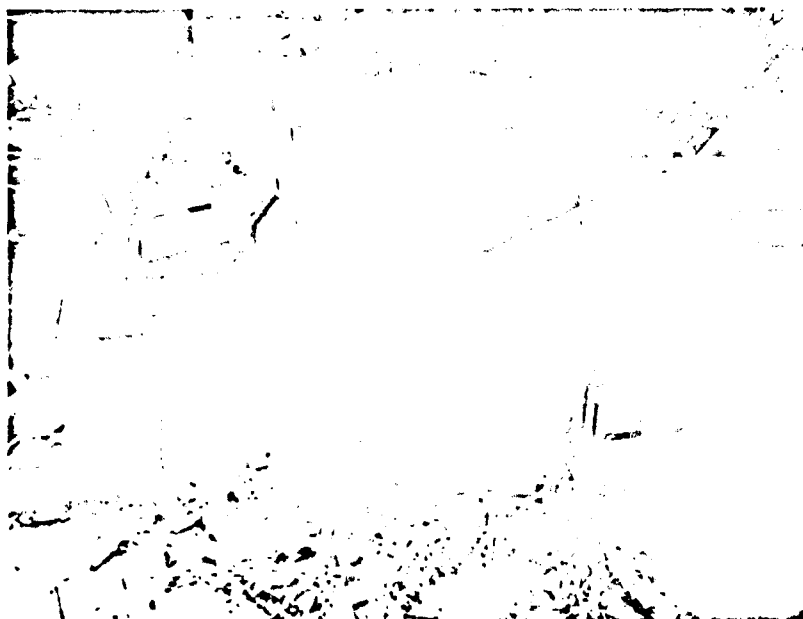


Fig. 2.57 X-ray Section, B, Loading and Drying Bin, 85% Serviceable, Category 1, Developing Tank, 15%, Category 2, Water Conditioner, 0%, Category 4 (Unit B, Site 1)

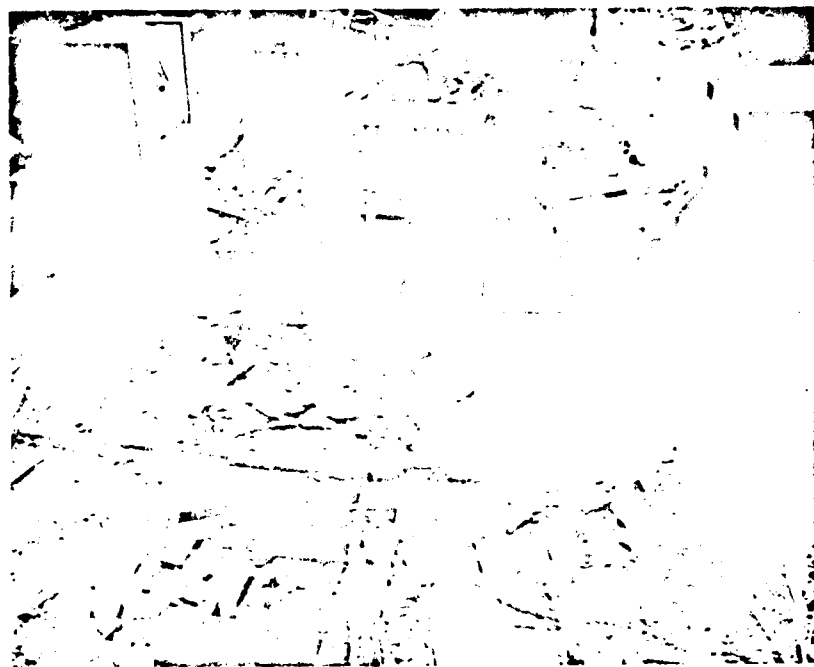


Fig. 2.58 X-ray Section, B, Control Panel, 100 ma.,
90% Serviceable, Category 2, Transformer,
90% Serviceable, Category 2, and X-ray,
100 ma., 0% Serviceable, Category 4 (Unit B, Site 1)



Fig. 2.59 X-ray Section, B, X-ray, 15 ma., 30% Serviceable,
Category 2 (Unit B, Site 1)



Fig. 2.60 X-ray Section, B, Control Unit, X-ray 15 ea.,
50% Serviceable, Category 4 (Unit B, Site 1)



Fig. 2.61 Clinics Section, B, Chair, Specialist,
80% Serviceable, Category 1, Lamp, Floor, Coakley,
90% Serviceable, Category 1 (Unit B, Site 1)



**Fig. 2.62 Clinics Section, B, Chair, Dental, 65% Serviceable,
Category 1, Engine, Dental, 0% Serviceable,
Category 4, Chair, Specialist, Background,
65% Serviceable, Category 1 (Unit B, Site 1)**



**Fig. 2.63 Clinics Section, B, Table, Operating,
80% Serviceable, Category 1 (Unit B, Site 1)**



**Fig. 2.64 Pharmacy and Laboratory, B, General View
toward Pharmacy Section (Unit B, Site 1)**

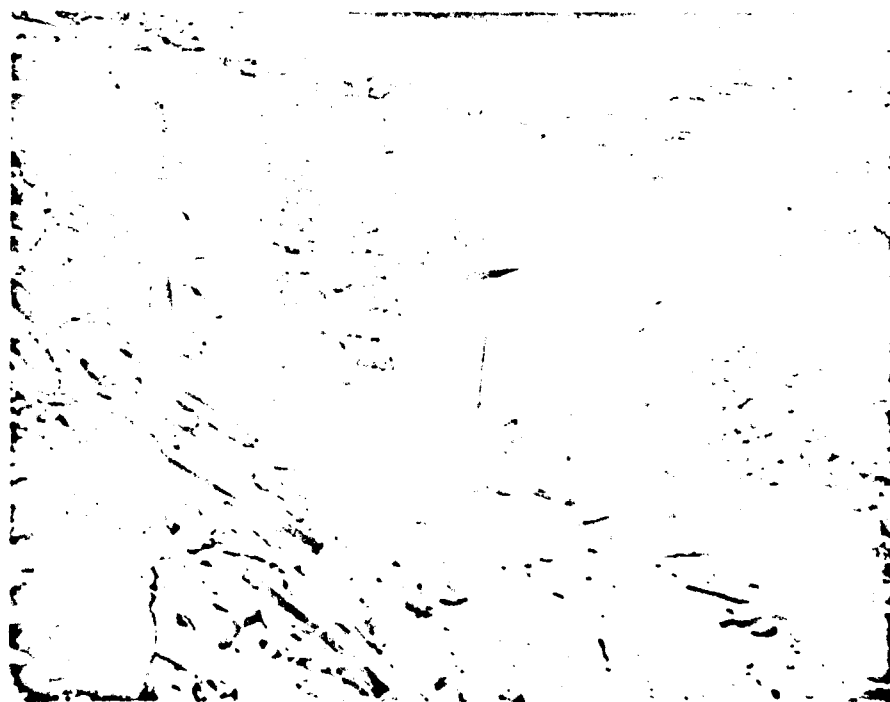


**Fig. 2.65 Pharmacy and Laboratory, B, General View
toward Laboratory Section (Unit B, Site 1)**

was considered to have been less extensive than in the aboveground installation, while fire damage was more extensive. If not consumed by fire, materials contained within boxes, regardless of whether loose or depot packed, were undamaged. This was equally true of both fragile and nonfragile items. Unlike those in the aboveground installation, it is estimated that unevaluated items of material sustained less extensive damage from blast effects than did the evaluated items. Fire effects on either of these two groups were dependent upon the location of the items, and both groups were considered as being equally affected. Column 1B, Table B.3 lists the items of equipment evaluated with their degree of serviceability. Figures 2.66 to 2.69 show some items with their degree of serviceability and category under damage criteria. There was an over-all arithmetical average of serviceability of evaluated items of 27 per cent (Line 14B, Col 1, Table B.3). In accordance with damage criteria (para 2.3.1) of evaluated items, there were within the laboratory 8 items in category 1, 0 in category 2, 3 in category 3, and 8 in category 4 (Line 12B, Col 1, Table B.9); and in the pharmacy all items were in category 4 (Line 4B, Col 1, Table B.8). Thus, 31 per cent of the laboratory section and none of the pharmacy were immediately serviceable and 69 per cent and 100 per cent replacement, respectively, would have been required.

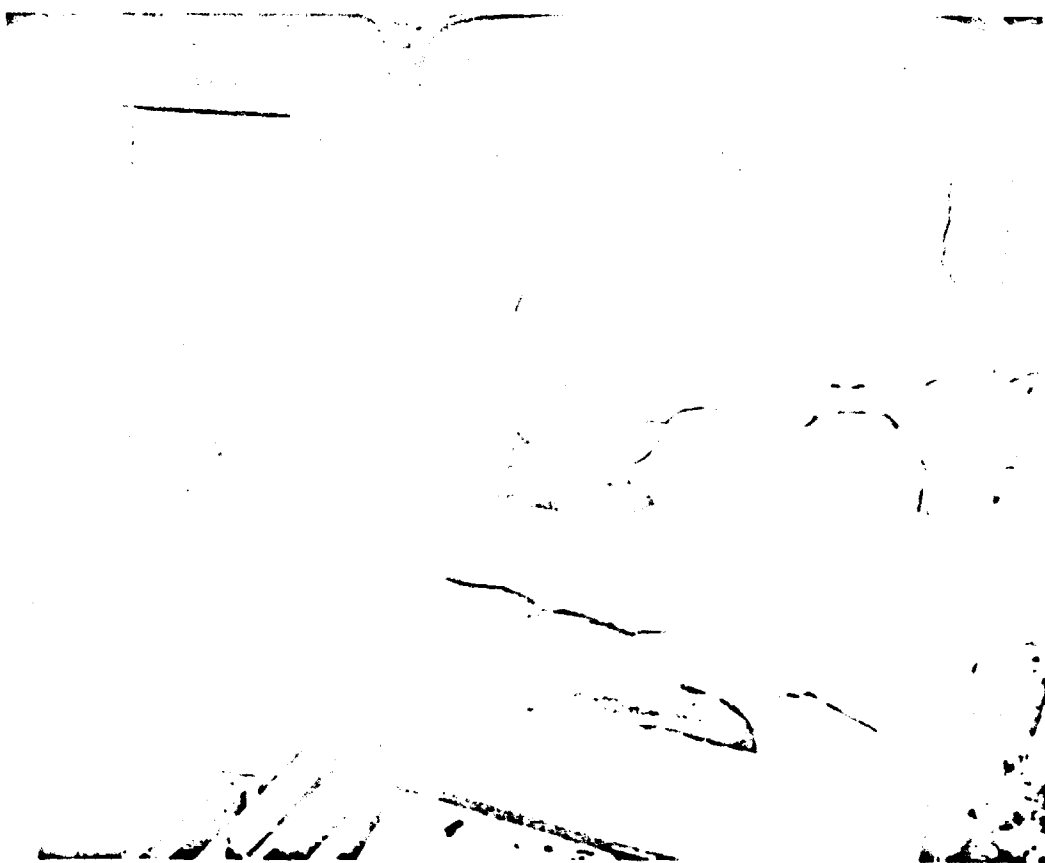


Fig. 2.66 Pharmacy and Laboratory, B, Refrigerator,
10% Serviceability, Category 4 (Unit B, Site 1)

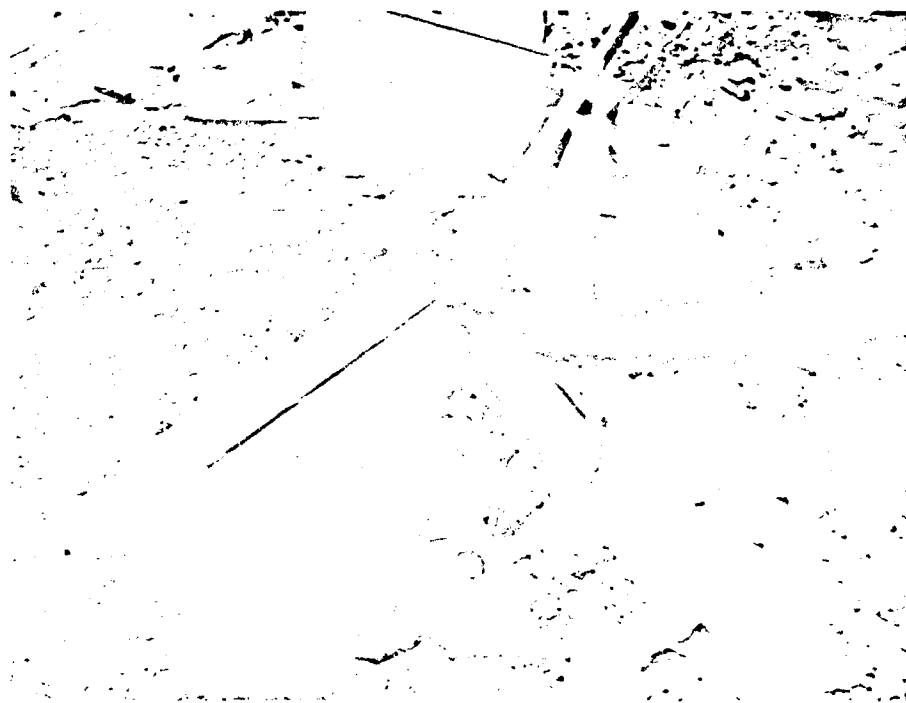


Fig. 2.67 Pharmacy and Laboratory, B, Water Distillation Apparatus,
30% Serviceable, Category 1 (Unit B, Site 1)



Fig. 2.68 Pharmacy and Laboratory, B, Blood Storage Case,
0% Serviceable, Category 4 (Unit B, Site 1)



Fig. 2.69 Pharmacy and Laboratory, Incubator,
10% Serviceable, Category 4 (Unit B, Site 1)

2.3.4.4 Ward Tent

As elsewhere at Site 1, the tent was destroyed. However, all equipment was still within the excavation. Examination of unevaluated items again showed extensive fire damage to items of a combustible nature. Cave-ins of the excavation were extensive (Fig. 2.70) and with a few exceptions materials, when extracted, showed evidence of fire damage. Only three of the cots were serviceable and the two Gatch beds could be used with minor repairs (Figs 2.70 and 2.71). The same situation existed in the ward tent as in the other below-ground tents, i.e., damage resulting from fire was more extensive than that which resulted from blast. Metallic items in most instances were serviceable (Fig. 2.72). Column 1, Table B.4 lists the evaluated items with their degree of serviceability. Figure 2.73 shows one item evaluated with its degree of serviceability and its damage category. The over-all arithmetical average of serviceability of evaluated items was 53 per cent (Line 11B, Col 1, Table B.4). In accordance with damage criteria of the evaluated items, 10 items were in category 1, 1 was in category 2, 5 were in category 3, and 4 were in category 4 (Line 11B, Col 1, Table B.10). Thus, 11 out of 20 items were undamaged or immediately serviceable; or, equipmentwise, the ward was 55 per cent serviceable and would have required 45 per cent replacement.



Fig. 2.70 Ward, B, General View (Unit B, Site 1)

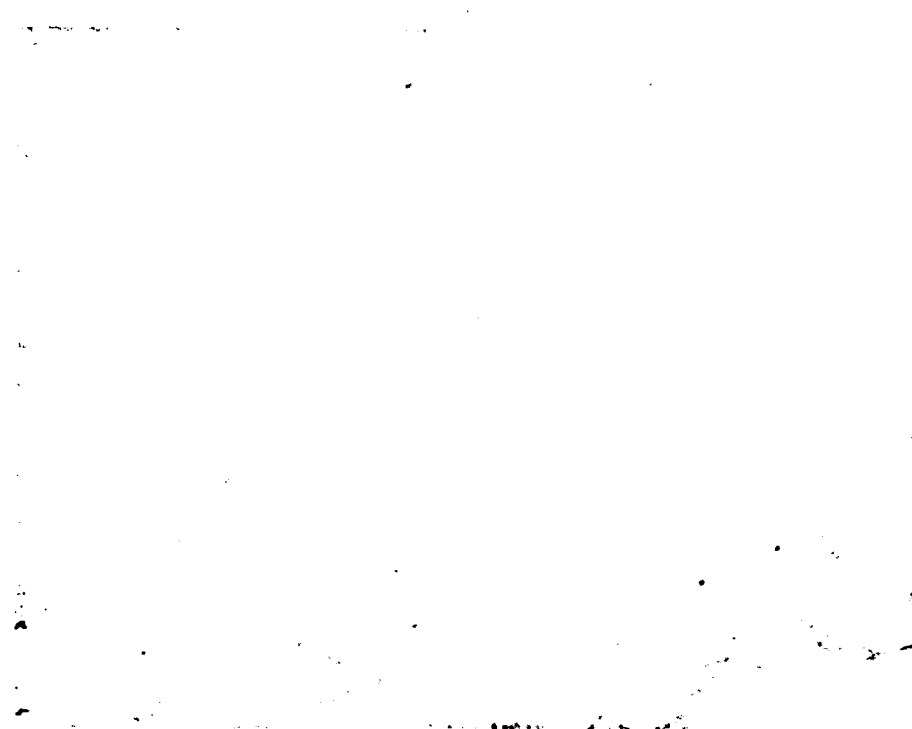


**Fig. 2.71 Ward, B, Catch Beds, 90% and 85% Serviceable,
Category 2 (Unit B, Site 1)**

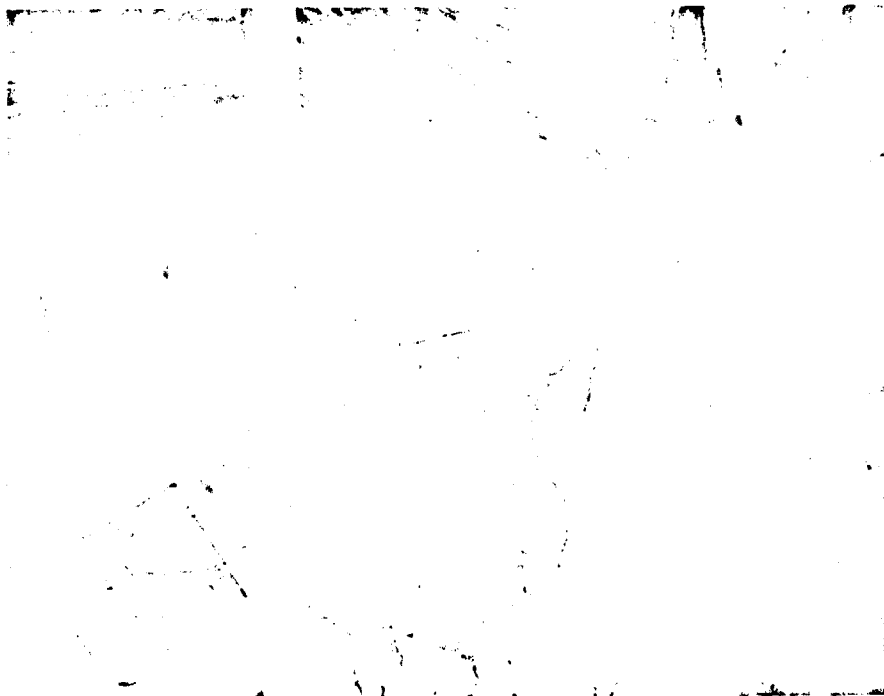


Fig. 2.72 Ward, B, Metallic Items Undamaged
(Unit B, Site 1)



Fig. 2.73 Ward, B, Gatch Beds, Category 2, Wangenstein
Suction, Background, 75% Serviceable, Category 2
(Unit B, Site 1)

2.3.4.5 Over-All, Site 1, Below Ground

Of the evaluated items of equipment in the below-ground installation, 74 out of 134 items were in categories 1 and 2. Thus, equipmentwise, this installation was 55 per cent serviceable and would have required 45 per cent replacement. It was estimated that the major portion of damage in the below-ground installation was a result of fire and was responsible for the increase of damage sustained in this installation when compared to the aboveground installation.

2.3.5 Unit B, 9,000 ft, Site 2, Above Ground

2.3.5.1 Surgical Tent

In the aboveground surgery the tent was blown down and destroyed by fire (Fig 2.74). Some small items were blown a maximum of 80 ft from their original location away from the blast but none were found toward ground zero. The large majority of the equipment, however, was found within the area occupied by the tent (Figs. 2.74 and 2.75). Damage sustained by all items of equipment varied from no damage to complete destruction. All items completely destroyed were a result of fire and blast. Items of a nonflammable material of high melting point showed effects of fire, but were serviceable. As at Site 1, unevaluated items were estimated to have sustained less extensive damage than did those in the evaluated group. Contents of chests in all cases were undamaged or the damage was so slight as to be insignificant. None of the aluminum chests showed evidence of fire damage. Fragile items were broken as a result of tables being overturned; nonfragile items, however, were undamaged. Column 2, Table B.1 indicates the degree of serviceability of all evaluated items within the surgical tent. The over-all average of serviceability of evaluated items was 68 per cent (Line 20, Col 2, Table B.1). The largest percentage of damage sustained was estimated to be a result of fire. Figures 2.76 to 2.79 show some items with their degree of serviceability and their category. In accordance with damage criteria outlined in para 2.3.1, of the items evaluated, 33 were in category 1, 3 were in category 2, 4 were in category 3, and 8 were in category 4 (Line 20A, Col 2, Table B.5). Thus, 36 out of 48 items were undamaged or immediately serviceable; or 75 per cent of all items were available for use. Therefore, the surgical tent was considered 75 per cent serviceable with a 25 per cent replacement requirement.

2.3.5.2 X-ray Tent

Here, as with the surgery, the tent was blown down and destroyed by fire. In most cases the material occupied its original location with the exception of a few small items within the clinics

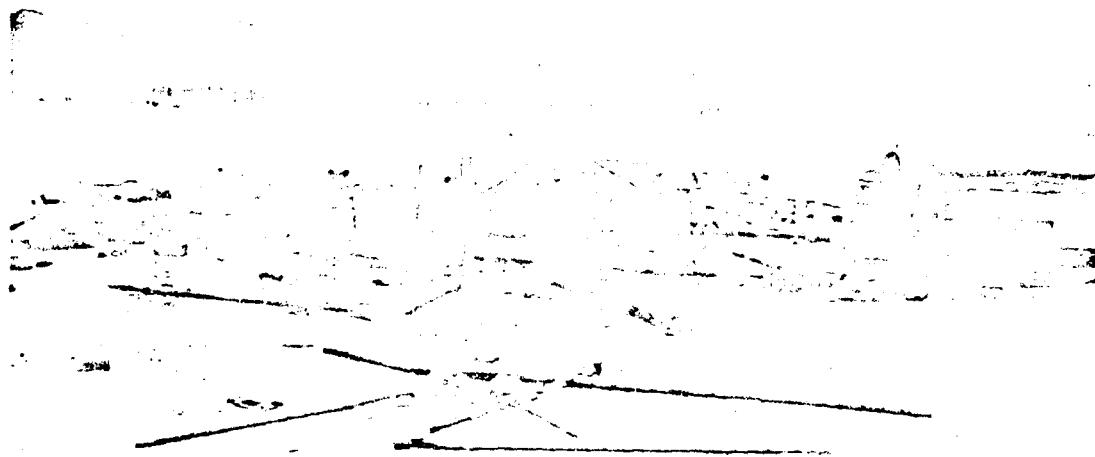


Fig. 2.74 Surgery, A, General View Obliquely
toward Ground Zero (Unit B, Site 2)



Fig. 2.75 Surgery, A, General View Obliquely away
from Ground Zero (Unit B, Site 2)

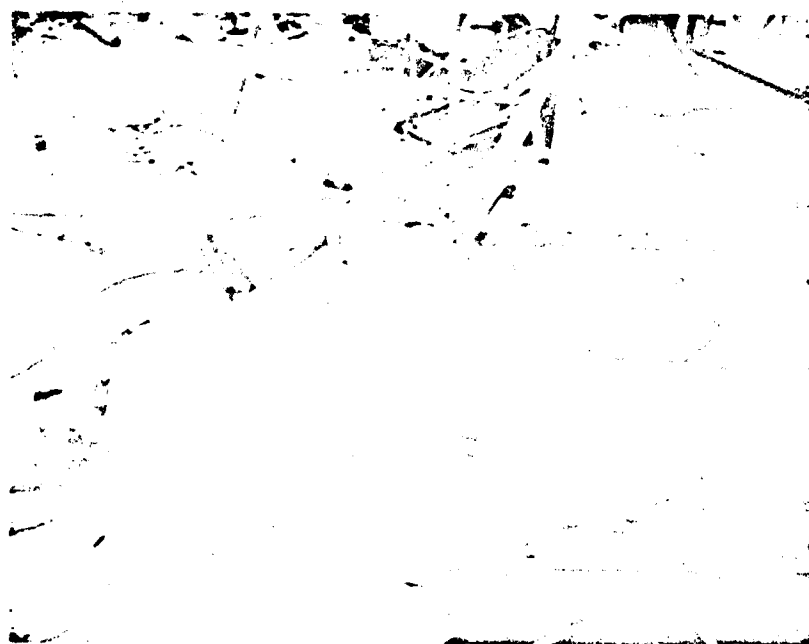


Fig. 2.76 Surgery, A, Operating Table, Aluminum,
40% Serviceable, Category 3 (Unit B, Site 2)

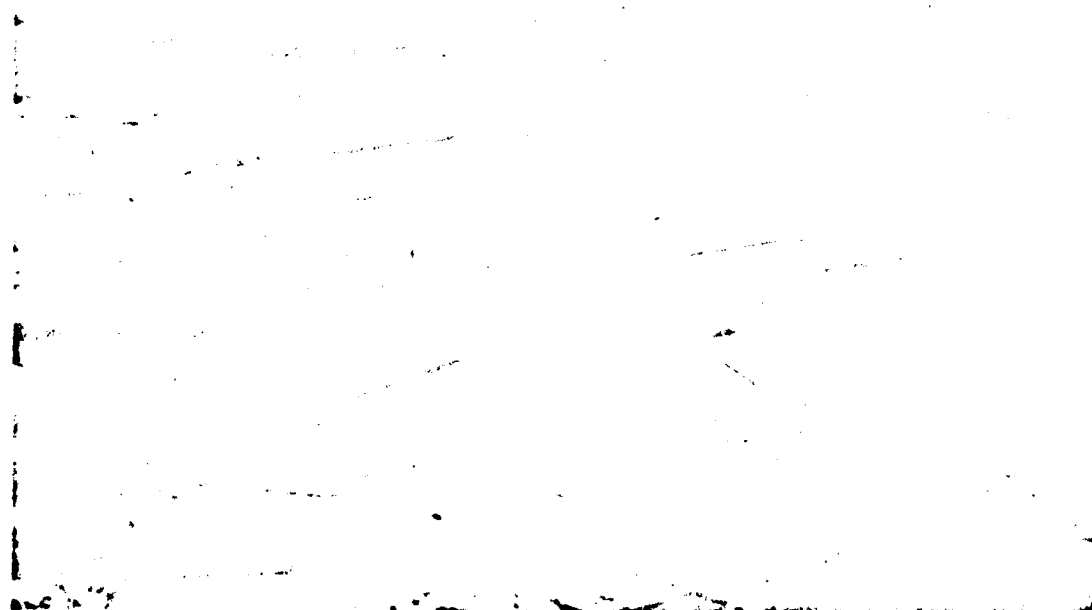


Fig. 2.77 Surgery, A, Instrument Stand, Foreground,
88% Serviceable, Category 1, Table, Operating,
Steel, Background, 90% Serviceable, Category 1
(Unit B, Site 2)

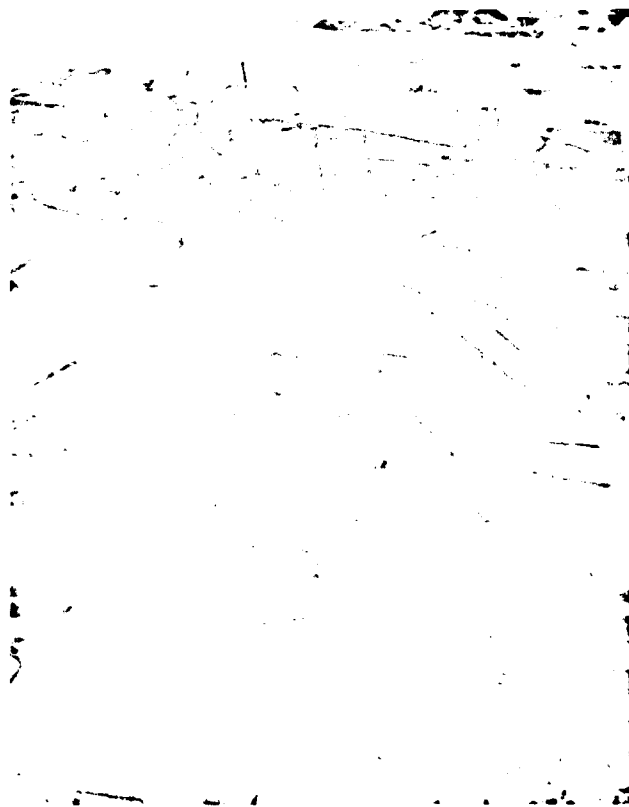


Fig. 2.78 Surgery, A, Table, Instrument (2), Center, 95% Serviceable,
Category 1, Lamp, Operating, 75% Serviceable, Category 2 (Unit B, Site 2)

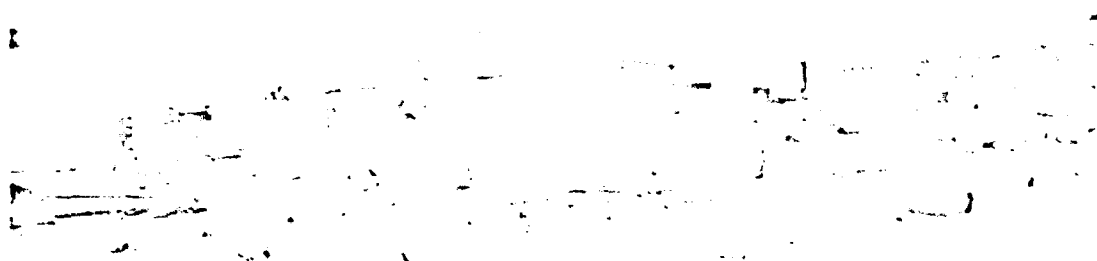


Fig. 2.79 X-ray, A, General View Obliquely Away
from Ground Zero (Unit B, Site 2)

section (Figs. 2.79 and 2.80). Fire was extensive and involved primarily the X-ray section, sparing some portions of the clinics section. The degree of serviceability of the items within the two sections is shown in Col 2, Table B.2. Figures 2.81 to 2.87 show some evaluated items within the X-ray tent with their degree of serviceability and their category. As in the surgical tent, it was estimated that the unevaluated items suffered less extensive damage than did the evaluated items. Items composed of materials with a high melting point showed effects of fire but were considered serviceable. Those of a fragile or flammable nature were destroyed from blast effects or from fire, respectively. The over-all arithmetical average of serviceability of evaluated items was 38 per cent (Line 30A, Col 2, Table B.2). In accordance with damage criteria (para 2.3.1), there were 9 items in category 1, 1 item in category 2, 4 items in category 3, and 12 items in category 4 within the X-ray section (Line 19A, Col 2, Table B.6); and within the clinics section there were 7 items in category 1, none in category 2, 3 items in category 3, and 6 items in category 4 (Line 12A, Col 2, Table B.7). Thus, 10 out of 26 items, or 38 per cent, were undamaged or immediately serviceable within the X-ray section and 7 out of 16, or 43 per cent, were undamaged or serviceable within the clinics



Fig. 2.80 X-ray, A, General View Obliquely
toward Ground Zero (Unit B, Site 2)

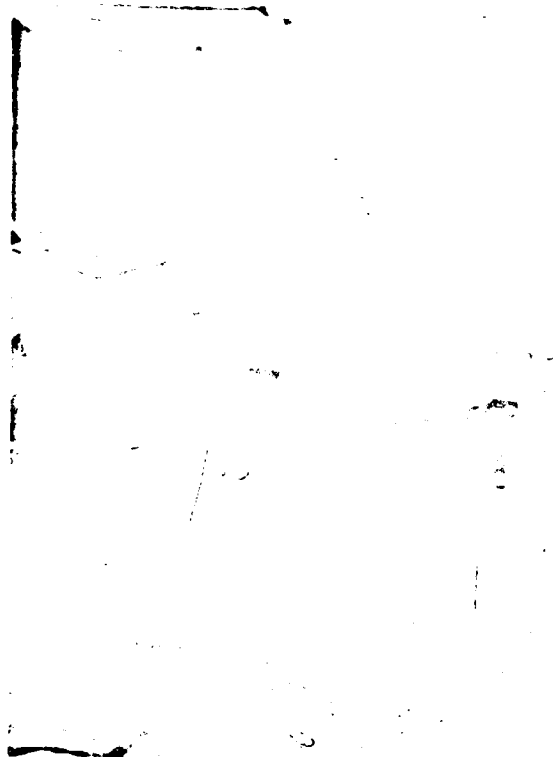


Fig. 2.81 X-ray, A, Control Unit 100 ma., Foreground, 80% Serviceable, Category 1, Loading Bin and Dryer, Background 70% Serviceable, Category 1 (Unit B, Site 2)

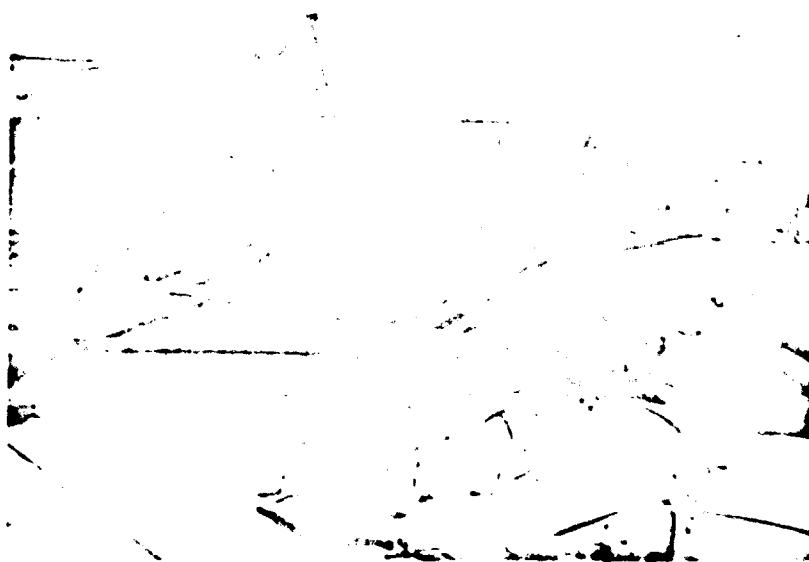


Fig. 2.82 X-ray, A, Portable 15 ma. X-ray, Background, 90% Serviceable, Category 1 (Unit B, Site 2)



Fig. 2.83 X-ray, A, Cassette Changer, Left Foreground,
90% Serviceable, Category 1 (Unit B, Site 2)



Fig. 2.84 X-ray, A, 100 ma. X-ray Table, Foreground,
50% Serviceable, Category 3, 15 ma. X-ray Tube,
Background, 50% Serviceable, Category 3
(Unit B, Site 2)

Fig. 2.85 Clinics Section, A, Table, Operating, Steel,
35% Serviceable, Category 1 (Unit B, Site 2)



Fig. 2.86 Clinics Section, Chair, Dental, 60% Serviceable,
Category 1 (Unit B, Site 2)



Fig. 2.87 Clinics Section, Chair, Specialist, 40% Serviceable, Category 4 (Unit B, Site 2)

section (Line 2A and 3A, Col 2, Table B.11). Therefore, the X-ray was considered as being 38 per cent serviceable and as requiring 62 per cent replacement; and the clinics as being 43 per cent serviceable, requiring 57 per cent replacement.

2.3.5.3 Pharmacy and Laboratory Tent

The tent containing the pharmacy and the laboratory was blown down. No fires occurred, however, so there was no damage as a result of that cause. All material contained within this tent occupied the area of the tent or immediately adjacent thereto (Figs. 2.88 and 2.89). All damage sustained, therefore, was a direct result of blast. As at Site 1, damage sustained by unevaluated items was estimated to have been greater to those items which were exposed or packed loosely in boxes than that sustained by evaluated items. Materials packed in boxes as for overseas shipment were undamaged (Figs. 2.90 and 2.91). Column 2, Table B.3 indicates the degree of serviceability of evaluated items. Figures 2.92 to 2.96 show some of these items with their degree of serviceability and their category. The over-all arithmetical average of serviceability of evaluated items was 76 per cent (Line 14A, Col 2, Table B.3). In accordance with damage criteria, there were 15 items in category 1, 0 in category 2, 3 in category 3, and 0 in category 4 within the laboratory (Line 12A, Col B, Table B.9); while 2 in category 1 and 2 in category 3 within



Fig. 2.88 Pharmacy and Laboratory, A, General View Obliquely
away from Ground Zero (Unit B, Site 2)

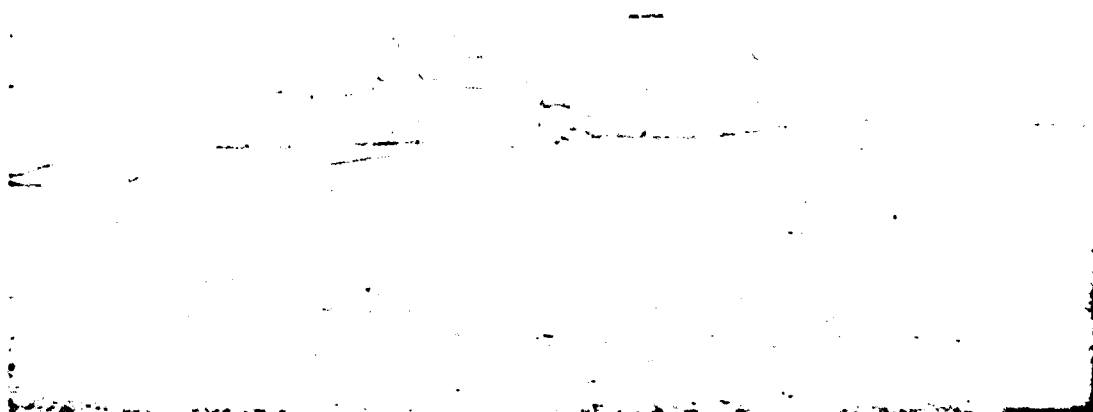


Fig. 2.89 Pharmacy and Laboratory, General View Obliquely
toward Ground Zero (Unit B, Site 2)

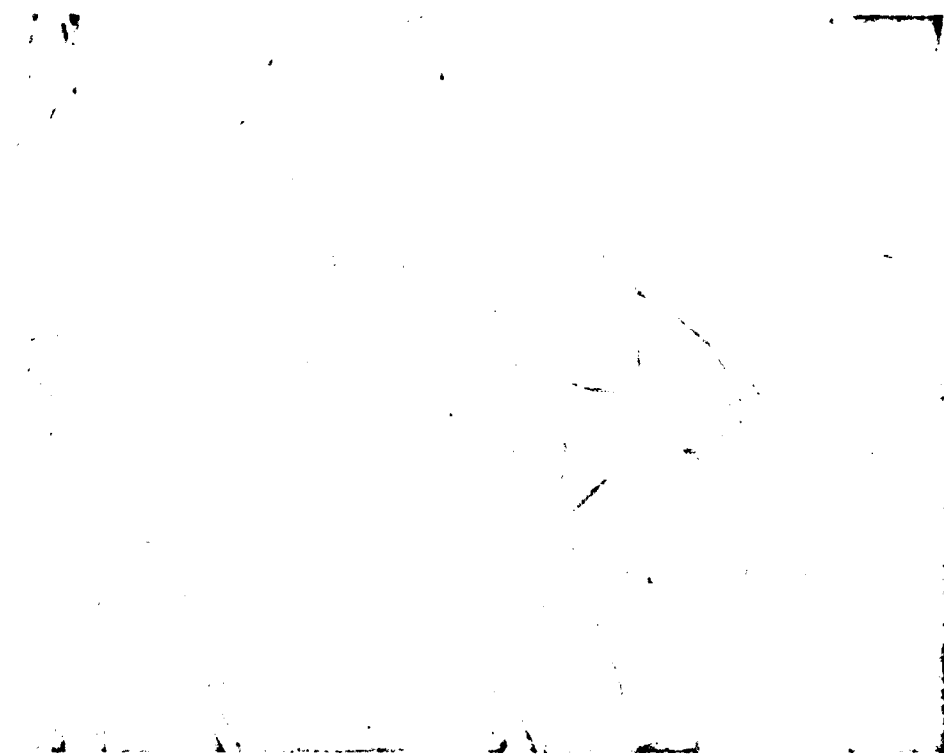


**Fig. 2.91 Pharmacy and Laboratory, A,
Contents of Boxes Left of
Center, Undamaged (Unit B,
Site 2)**



**Fig. 2.90 Pharmacy and Laboratory, A,
Items Packed Loosely, Damaged
(Unit B, Site 2)**

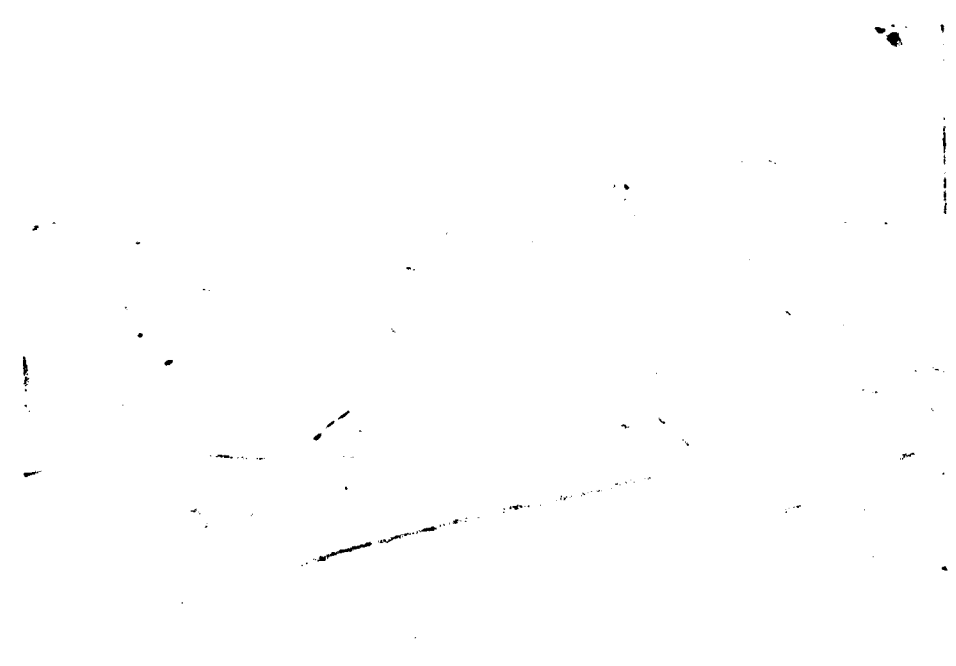


**Fig. 2.92 Pharmacy and Laboratory, A, Water Distillation
Apparatus, 60% Serviceable, Category 1 (Unit B, Site 2)**



**Fig. 2.93 Pharmacy and Laboratory, A, Incubator,
75% Serviceable, Category 3 (Unit B, Site 2)**



**Fig. 2.94 Pharmacy and Laboratory, A, Microscope,
65% Serviceable, Category 3 (Unit B, Site 2)**



**Fig. 2.95 Pharmacy and Laboratory, A, Refrigerator,
90% Serviceable, Category 1 (Unit B, Site 2)**

Fig. 2.96 Pharmacy and Laboratory, A, Prescription Balance,
80% Serviceable, Category 3 (Unit B, Site 2)

the pharmacy (Line 4A, Col 2, Table B.8) were undamaged or immediately serviceable. Thus, the laboratory was 83 per cent serviceable and would have required 27 per cent replacement (Line 4A, Col 2, Table B.11); and the pharmacy was 50 per cent serviceable and would have required 50 per cent replacement (Line 5A, Col 2, Table B.11).

2.3.5.4 Ward Tent

The ward tent was blown down and, since no fires occurred, all damage sustained was a result of blast. Materials contained within the tent occupied virtually the same area as the tentage (Figs. 2.97 and 2.98). Cots and beds were virtually undamaged or damaged so slightly as to be immediately serviceable. Other unevaluated items of equipment suffered damage in relationship to their fragility. Metal items and other nonfragile items were undamaged while the fragile items sustained varying degrees of damage (Figs. 2.99 and 2.100). Column 2, Table B.4 gives the degree of serviceability of evaluated items. There was an over-all arithmetical average of serviceability of evaluated items of 82 per cent (Line 11A, Col 2, Table B.4). In accordance with damage criteria, 16 were in category 1, and 2 were in category 3 (Line 11A, Col 2, Table B.10). Thus, 16 out of 18 items were undamaged, or serviceable. Therefore, the ward was 88 per cent serviceable and would have required 12 per cent replacement.

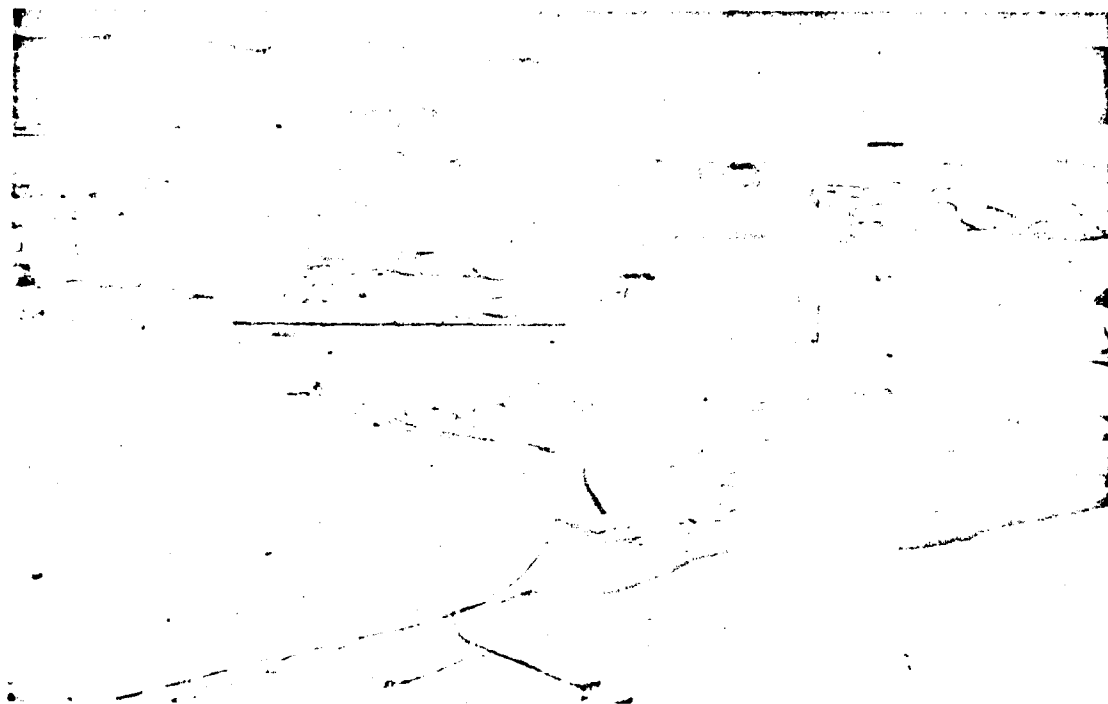


Fig. 2.97 Ward, A, General View Obliquely toward
Ground Zero (Unit B, Site 2)



Fig. 2.98 Ward, A, General View Obliquely away
from Ground Zero (Unit B, Site 2)

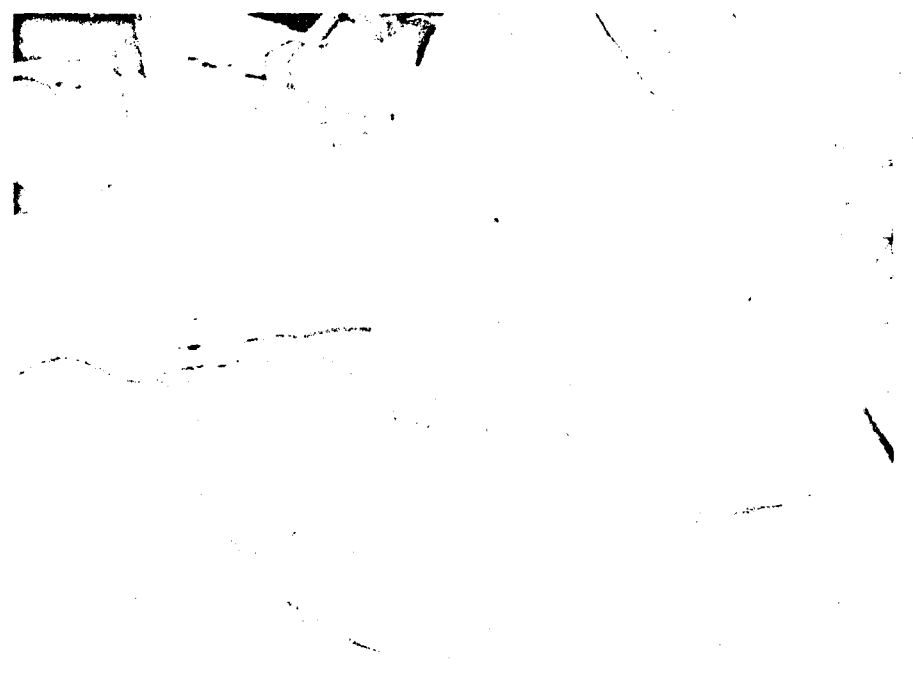


**Fig. 2.99 Ward, A, Fragile Items Showing Slight
to No Damage (Unit B, Site 2)**

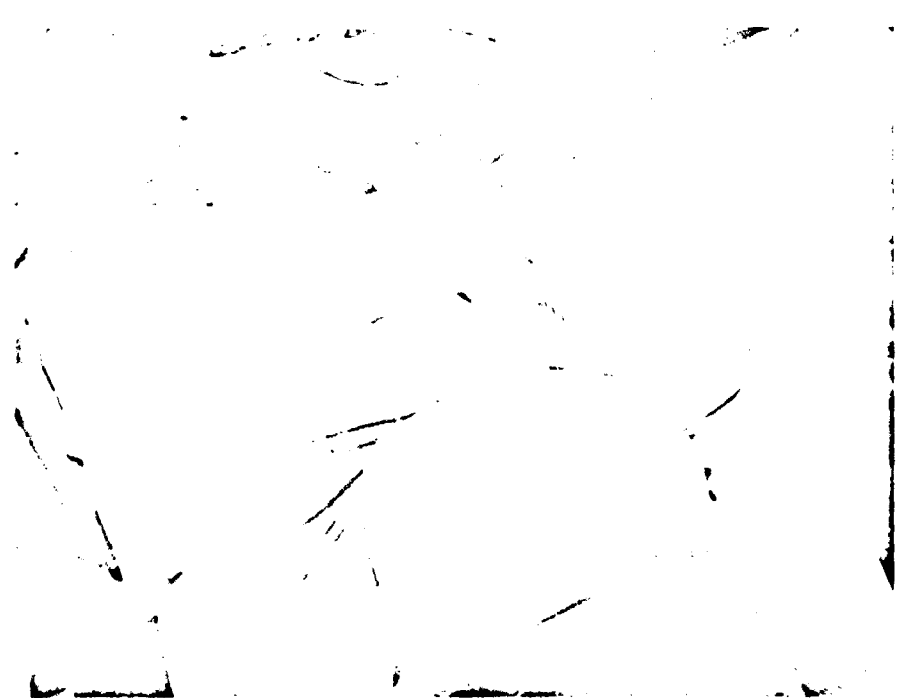


**Fig. 2.100 Ward, A, Nonfragile Items Showing
No Damage (Unit B, Site 2)**

2.3.5.5 Site 2, Over-all, Above Ground

Of the evaluated items of equipment in the aboveground installations, 86 out of 130 were in categories 1 and 2. Thus, equipmentwise, this installation was 66 per cent serviceable and would have required 34 per cent replacement (Line 7, Col 2, Table B.11). It is estimated that the greatest damage sustained was a result of fire rather than of blast. This factor, it is believed, accounts for the high rate of damage within this installation when compared to the below-ground installation and installations at the other sites.

2.3.6 Unit B, 9,000 ft. Site 2, Below Ground

2.3.6.1 Surgical Tent

The surgical tent was blown down but was still partially in the excavation (Figs. 2.101 and 2.102). Material within the tent was overturned and displaced away from ground zero. This was believed to have been a result of the side wall of the tent overturning tables and other equipment when blown from the excavation, rather than a direct result of blast. No fires occurred; all damage, therefore, was a result of blast. All items of equipment remained within the excavation.



Fig. 2.101 Surgery, B, General View from North
(Unit B, Site 2)

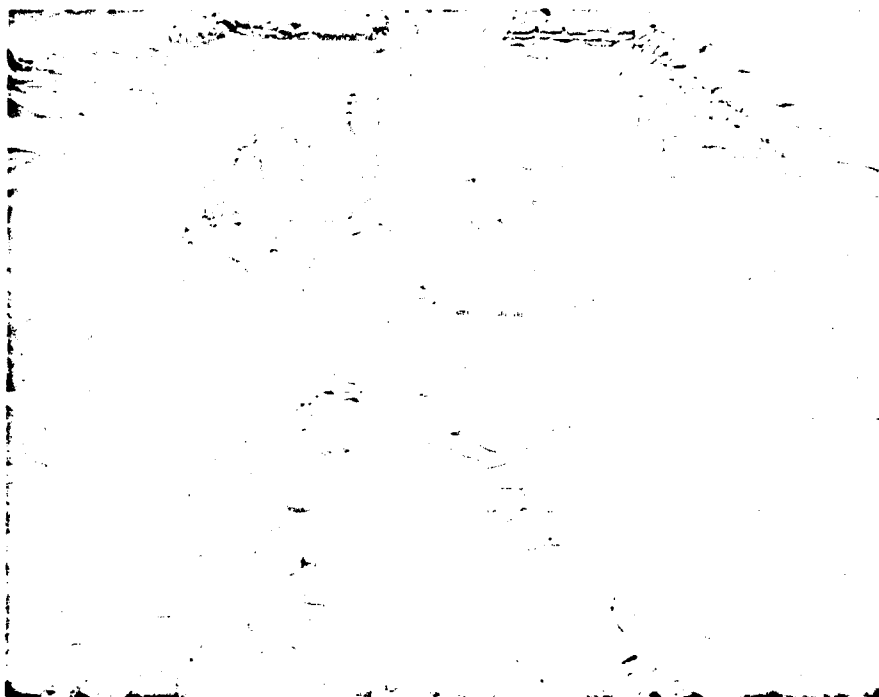


Fig. 2.102 Surgery, B, General View from South
(Unit B, Site 2)

All unevaluated items of equipment of a nonfragile nature were undamaged, while fragile items sustained varying degrees of damage. This damage varied from slight to complete destruction. Contents of all chests were intact and undamaged (Fig. 2.103). Column 2B, Table B.1 lists the evaluated items of equipment with their degree of serviceability. Figures 2.103 to 2.107 show some equipment with the degree of damage sustained. The over-all arithmetical average of serviceability of evaluated items was 98 per cent (Line 20, Col 2, Table B.1). In accordance with damage criteria, of the 48 evaluated items, 46 were in category 1, and 2 were in category 2 (Line 20B, Col 2, Table B.5). Thus, 100 per cent of the equipment was undamaged or immediately serviceable (Line 1B, Col 2, Table B.11).

2.3.6.2 X-ray Tent

The X-ray tent was partially blown down but was still within the excavation (Figs. 2.108 and 2.109). No fires occurred, all damage sustained being a result of blast. Only a few items of a fragile nature were destroyed. All nonfragile items were undamaged. Contents of all chests and boxes were intact. As in the surgical tent, equipment displaced was considered to be a result of the collapse of the tent rather than a direct result of blast. Figure 2.110 shows the X-ray section after removal of the tentage. Column 2, Table B.2 lists the evaluated items of equipment with the degree of

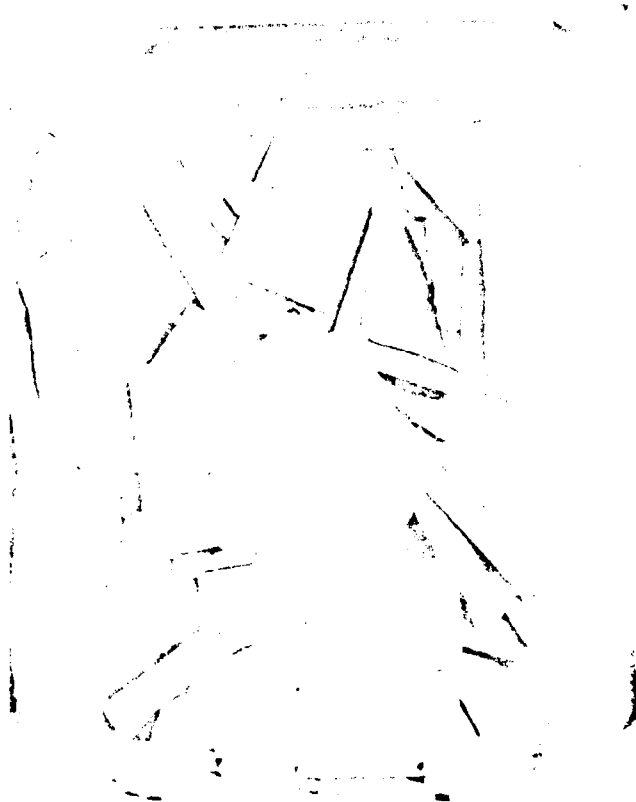


Fig. 2.103 Surgery, B, Contents of Chest Undamaged (Unit B, Site 2)



Fig. 2.104 Surgery, B, Operating Table, Steel, 100% Serviceable, Category 1 (Unit B, Site 2)

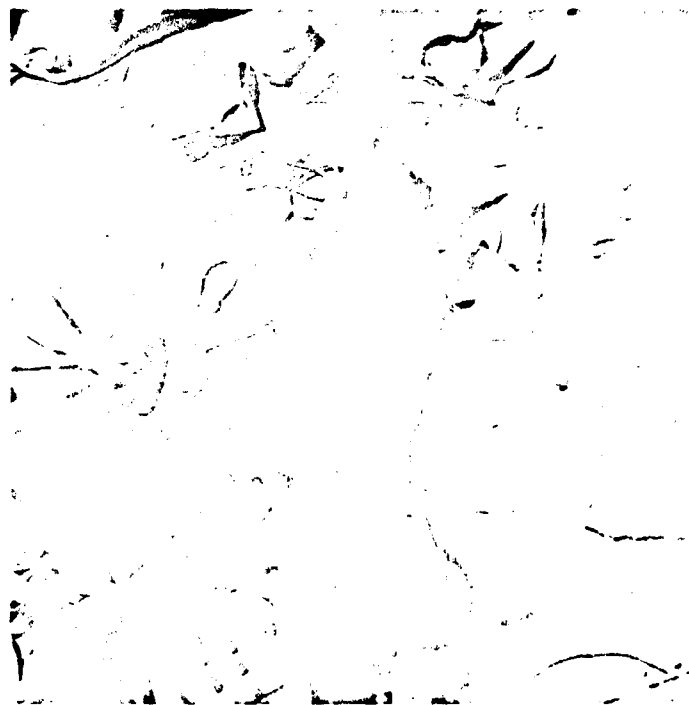


Fig. 2.105 Surgery, B, Operating Table, Aluminum,
100% Serviceable, Category 1 (Unit B, Site 2)

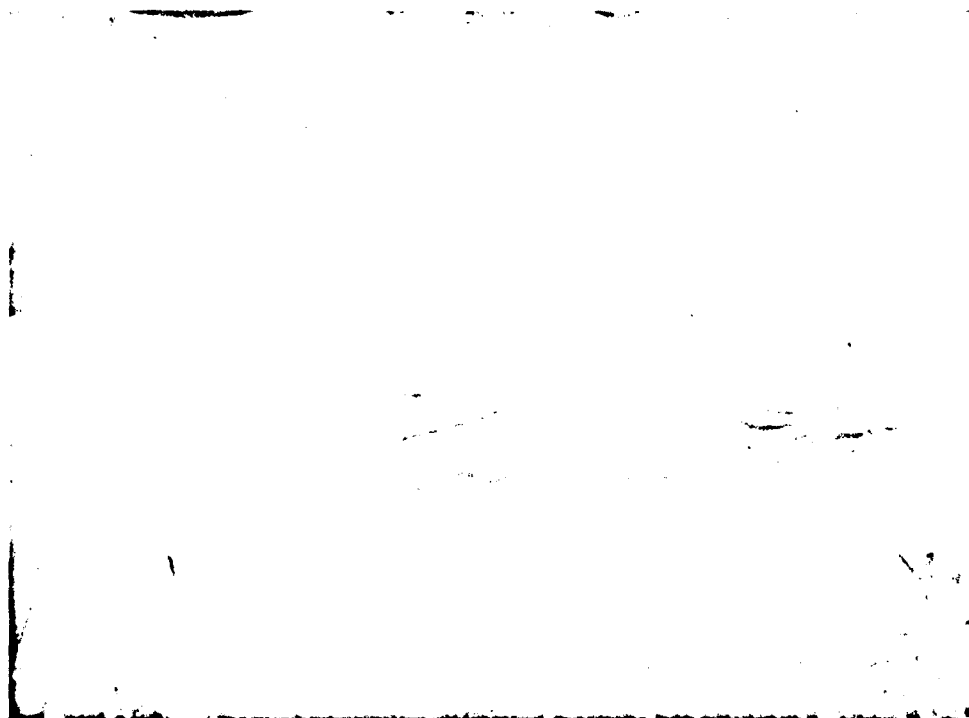


Fig. 2.106 Surgery, B, Instrument Tables with Instruments,
100% Serviceable, Category 1 (Unit B, Site 2)

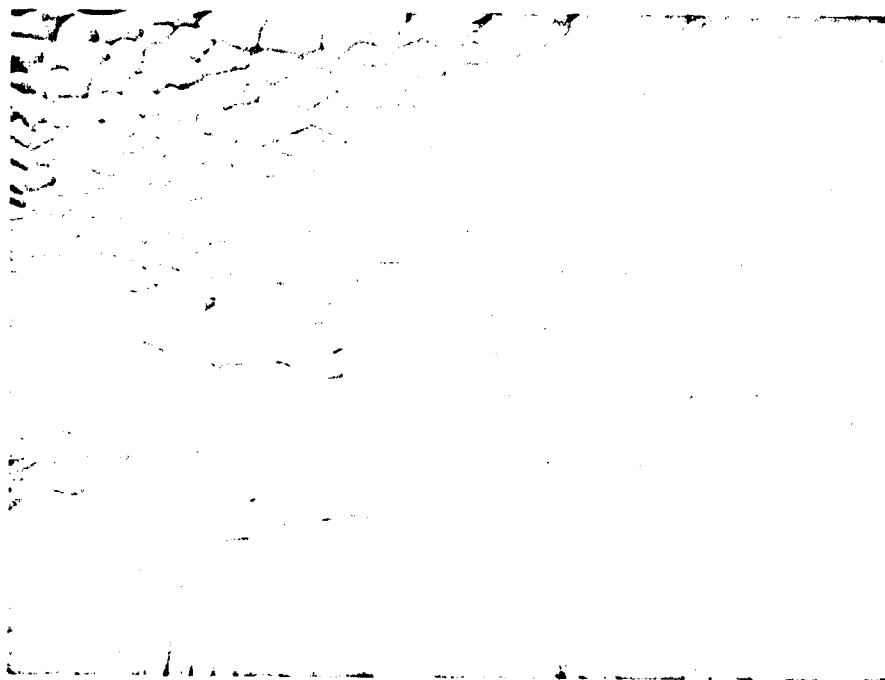


Fig. 2.107 Surgery, B, Table, Operating, Steel, 100% Serviceable,
Category 1, Unsterile Supplies Undamaged (Unit B, Site 2)

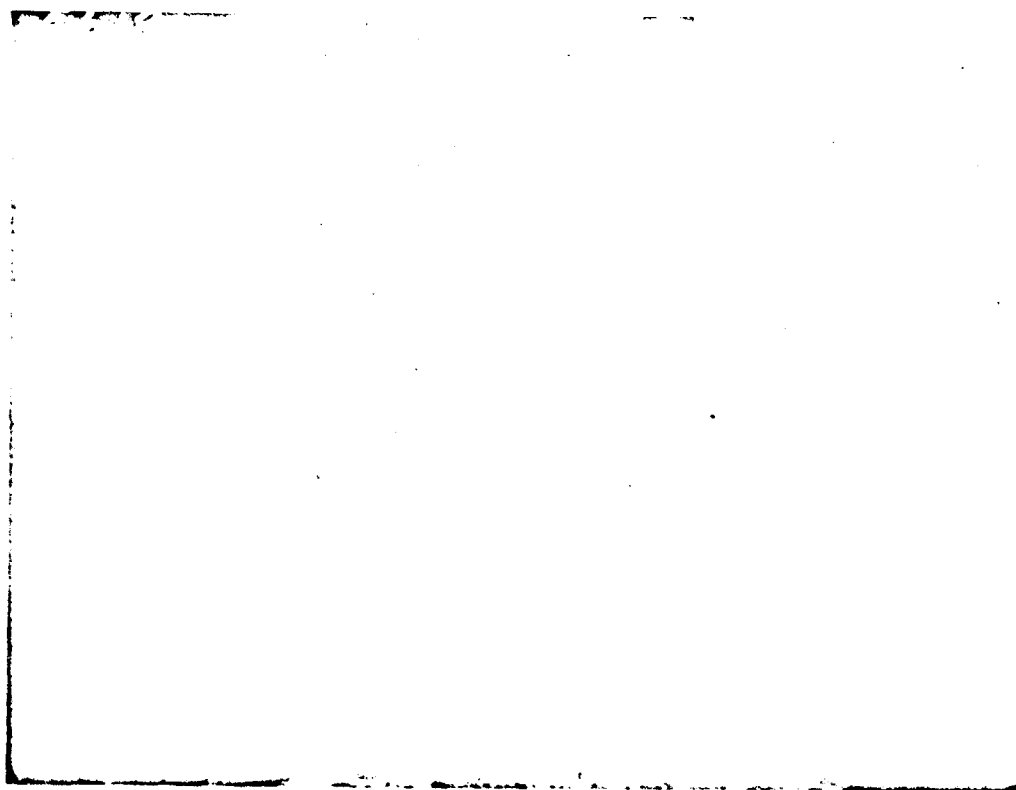


Fig. 2.108 X-ray, B, General View Looking South (Unit B, Site 2)

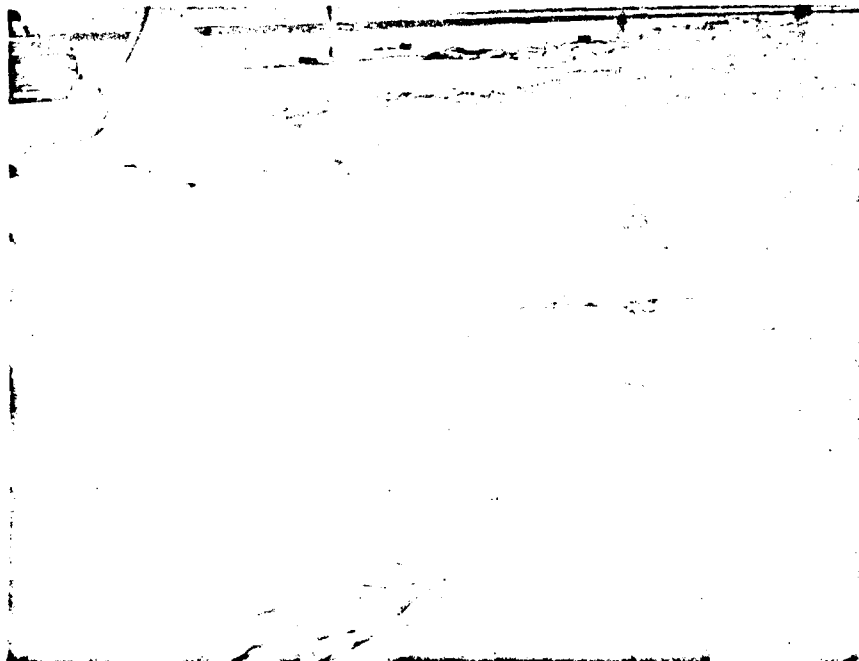


Fig. 2.109 X-ray, B, General View Looking North (Unit B, Site 2)



Fig. 2.110 X-ray, B, General View of X-ray Section
after Removal of Tentage (Unit B, Site 2)

serviceability. Figures 2.111 to 2.116 show some of the items within the X-ray tent and their degree of serviceability. The over-all average serviceability of evaluated items in the X-ray tent was 95 per cent (Line 30B, Col 2, Table B.2). In accordance with damage criteria, of the 26 items evaluated within the X-ray section, all were in category 1 (Line 19B, Col 2, Table B.6). Of the 16 items in the clinics section, 15 were in category 1, and 1 was in category 4 (Line 12B, Col 2, Table B.7). Thus, 100 per cent of the X-ray section (Line 2B, Col 2, Table B.11) and 93 per cent of the clinics section (Line 3B, Col 2, Table B.11) were immediately serviceable. Replacement of items in the X-ray tent would not have been required.

2.3.6.3 Pharmacy and Laboratory Tent

The tent was knocked down and partially blown out of the excavation (Figs. 2.117 and 2.118). There was little displacement of equipment. Fragile items which were thrown to the ground as a result of the overturning of boxes were damaged but in only a few instances were they destroyed (Fig. 2.119). Fragile items which had remained in their original position were undamaged (Fig. 2.120). All packaged items were intact. Column 2, Table B.3 shows the degree of serviceability of evaluated items. Figures 2.121 to 2.123 show some of these items with their degree of serviceability. The over-all arithmetical average of serviceability of evaluated items was 91 per cent (Line 14B, Col 2, Table B.3). In accordance with damage criteria, of the 18 items in the laboratory, 17 were in category 1, and 1 was in category 3 (Line 12B, Col 2, Table B.9). Of the 4 items in the pharmacy, all 4 were in category 1 (Line 4B, Col 2, Table B.8). Thus, the laboratory section was 94 per cent serviceable and would have required 6 per cent replacement. The pharmacy was 100 per cent serviceable (Lines 4B and 5B, Col 2, Table B.11). No replacements would have been required.

2.3.6.4 Ward Tent

The ward tent was knocked down and partially blown from the excavation--in this case toward ground zero (Figs. 2.124 and 2.125). All nonfragile items within the tent were intact. A few fragile items knocked to the ground were broken. Only one cot was displaced (Fig. 2.126). The only damage sustained by evaluated items was to three oxygen masks which were not repairable within the unit. Column 2, Table B.4 lists evaluated items of equipment with their degree of serviceability. The over-all arithmetical average of serviceability of the ward was 91 per cent. Thirteen out of 16 evaluated items, or 81 per cent, were in category 1 and immediately serviceable. Since the items that were not serviceable were all of one type (oxygen masks), the administration of oxygen by this method would have been the only ward function impaired.

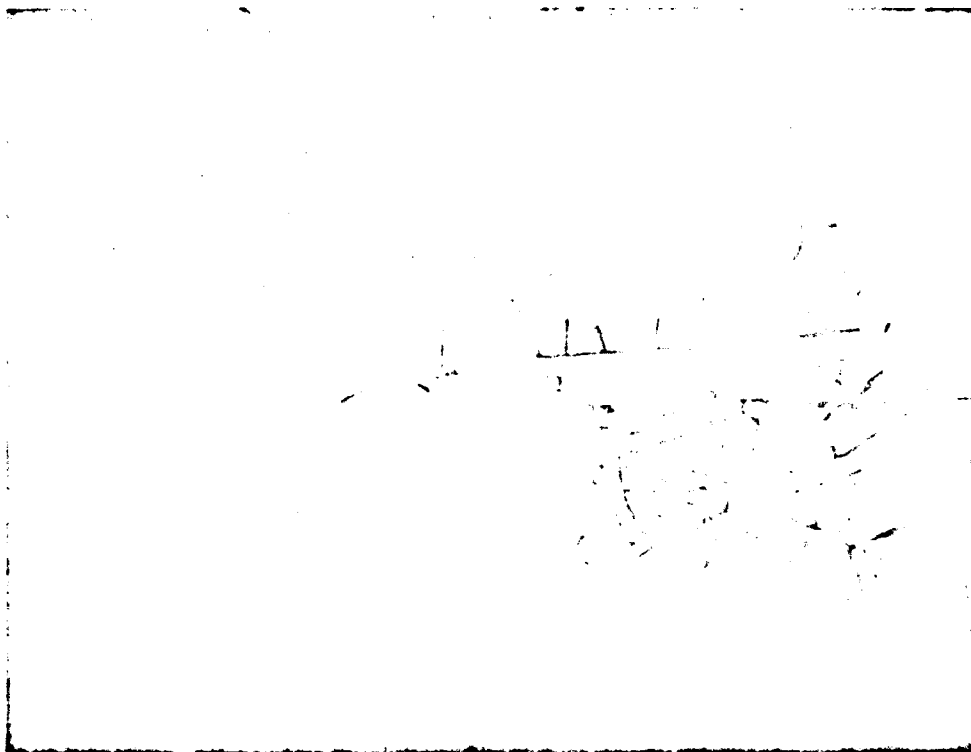


Fig. 2.111 X-ray, B, Transformer, 100 ma.,
100% Serviceable, Category 1
(Unit B, Site 2)

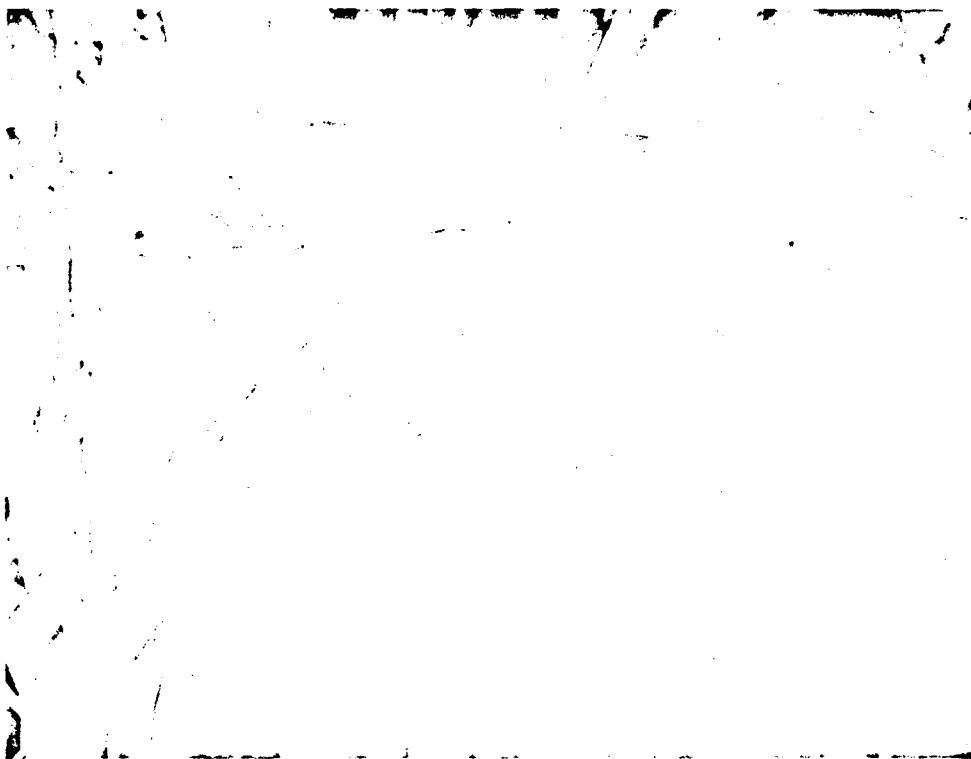


Fig. 2.112 X-ray, B, 15 ma. Portable
X-ray, 100% Serviceable,
Category 1 (Unit B, Site 2)

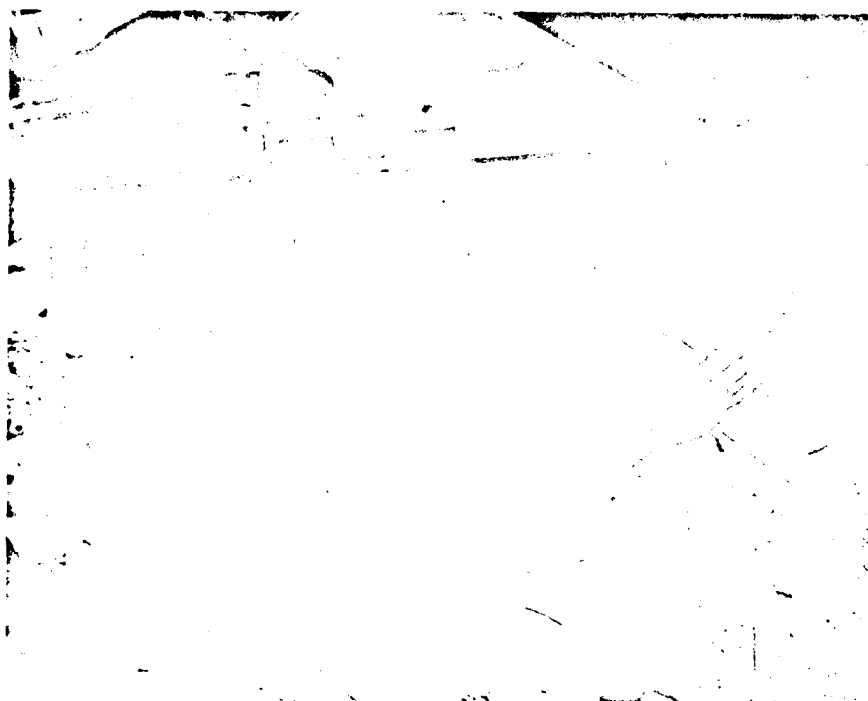


Fig. 2.113 X-ray, B, Cassette, Changer, 90% Serviceable,
Category 1 (Unit B, Site 2)



Fig. 2.114 X-ray, B, Darkroom Tent, 75% Serviceable,
Category 2, 15 na. X-ray, Right,
100% Serviceable, Category 1 (Unit B, Site 2)



Fig. 2.115 Clinics Section, B, Chair, Specialist,
95% Serviceable, Category 1 (Unit B, Site 2)

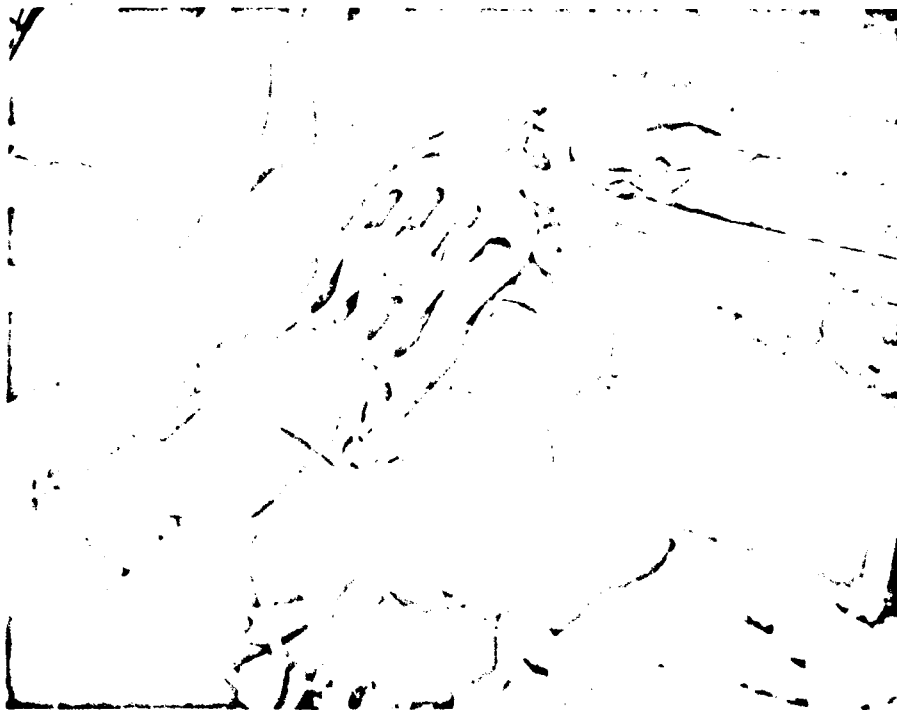


Fig. 2.116 Clinics, B, Chair, Specialist, 99% Serviceable,
Category 1 (Unit B, Site 2)

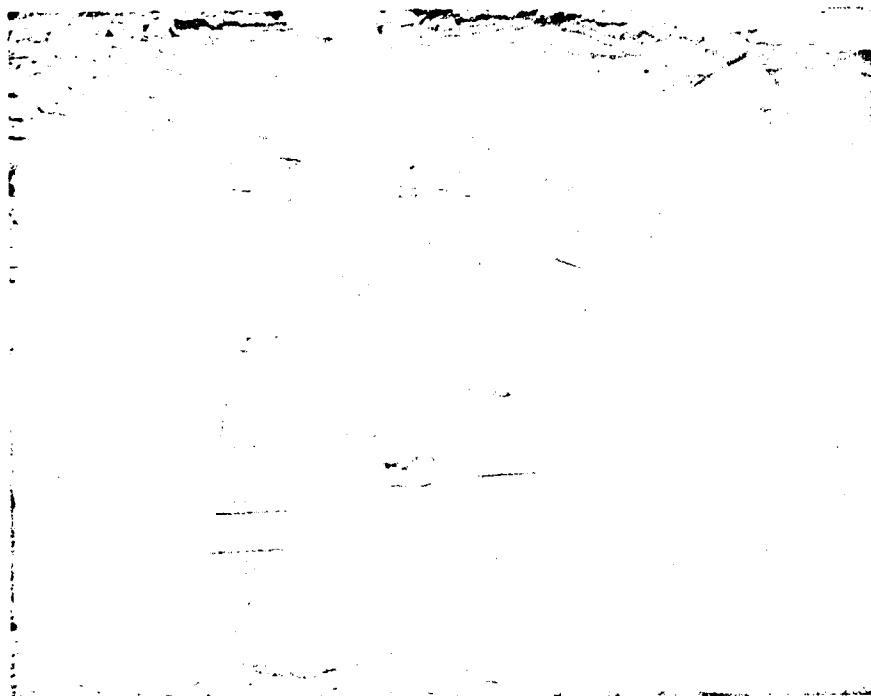


**Fig. 2.117 Pharmacy and Laboratory, B, General View
Looking South (Unit B, Site 2)**

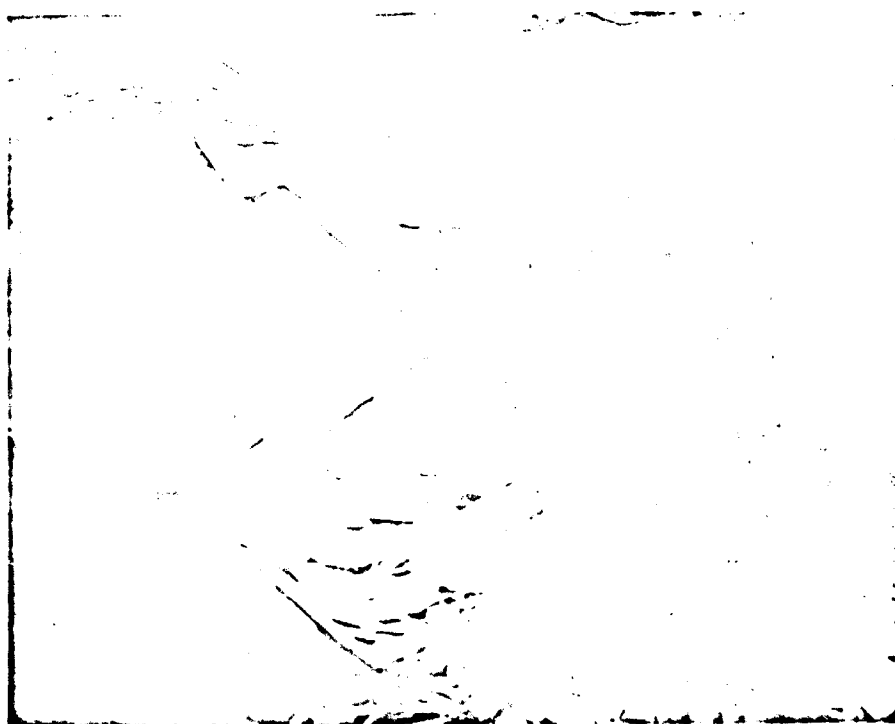


**Fig. 2.118 Pharmacy and Laboratory, B, General View
Looking North (Unit B, Site 2)**



**Fig. 2.119 Pharmacy and Laboratory, B, Bottled Items
from Overturned Table Showing Varying
Degrees of Damage (Unit B, Site 2)**

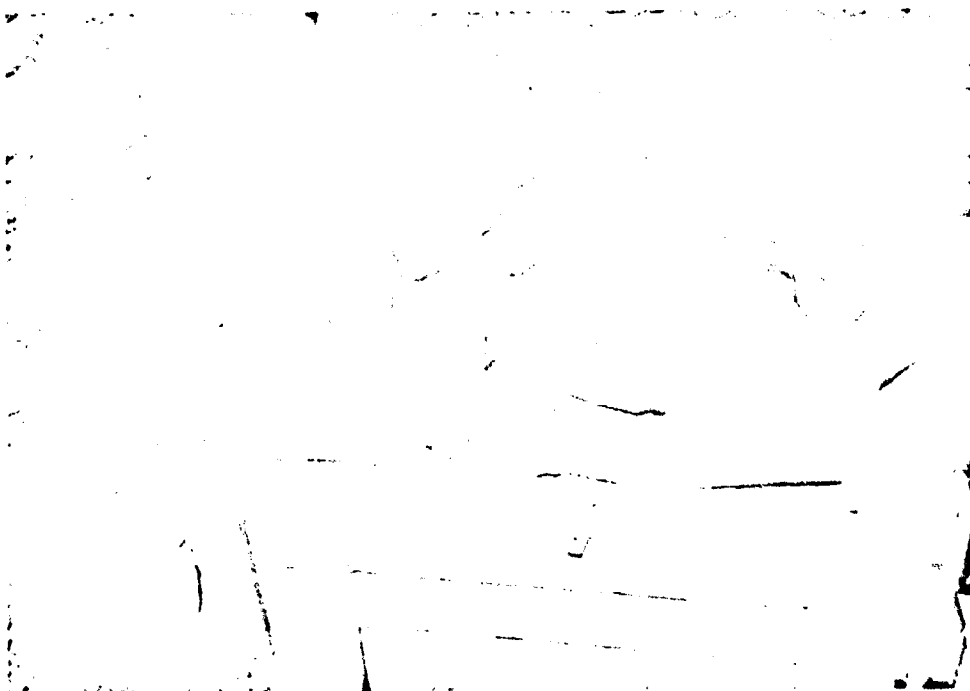


**Fig. 2.120 Pharmacy and Laboratory, B, Bottled Items,
Position Unchanged, No Damage (Unit B, Site 2)**

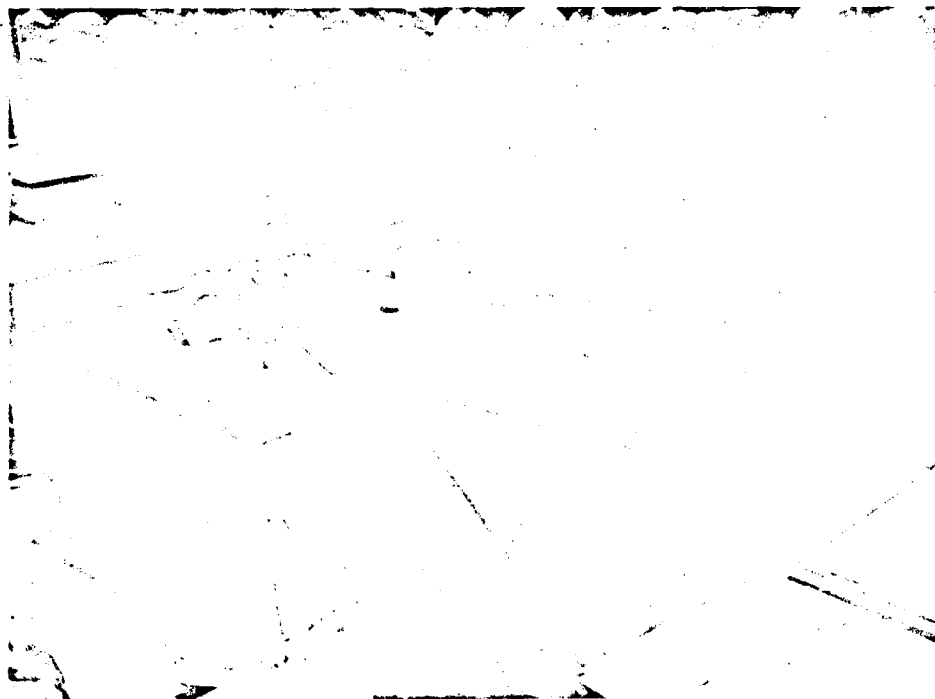


Fig. 2.121 Pharmacy and Laboratory, B, Incubator,
100% Serviceable, Category 1 (Unit B, Site 2)



Fig. 2.122 Pharmacy and Laboratory, B, Microscope,
90% Serviceable, Category 1 (Unit B, Site 2)

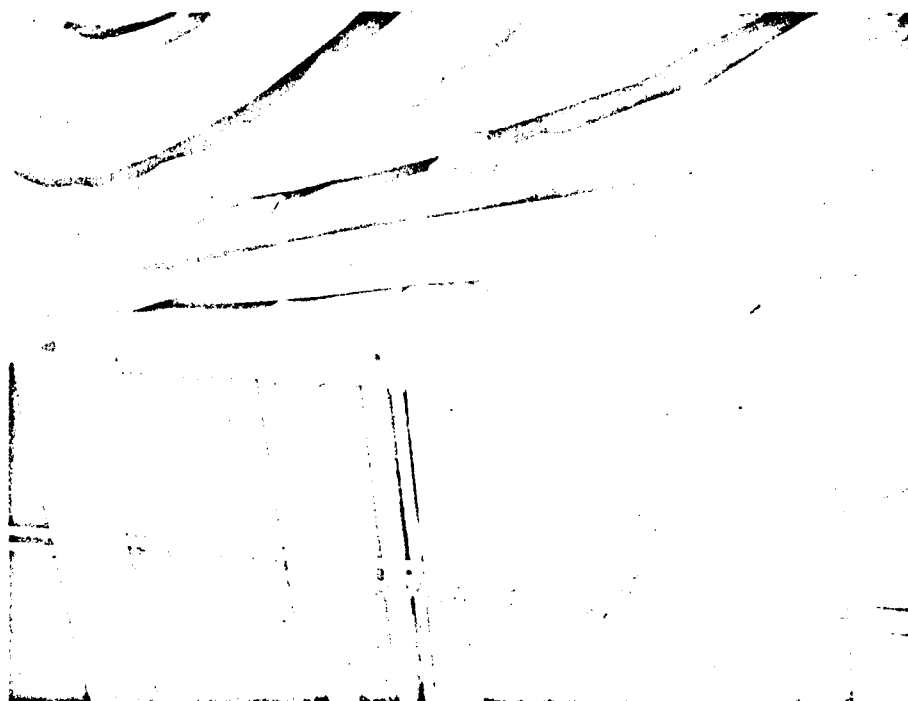


Fig. 2.123 Pharmacy and Laboratory, B, Refrigerator,
90% Serviceable, Category 1 (Unit B, Site 2)

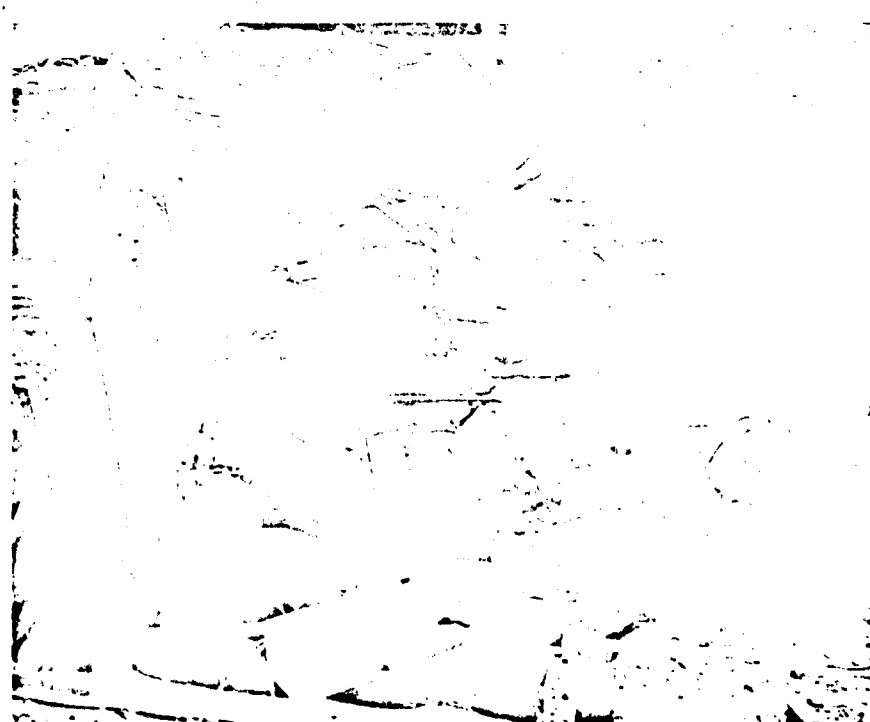


Fig. 2.124 Ward, B, General View Looking South
(Unit B, Site 2)



Fig. 2.125 Ward, B, General View Looking North
(Unit B, Site 2)

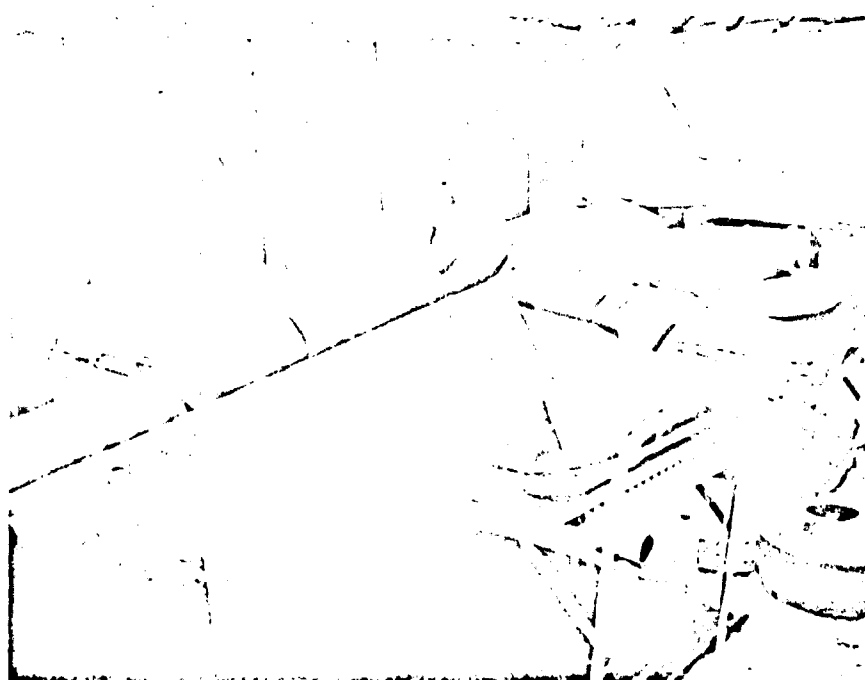


Fig. 2.126 Ward, B, Displacement of Cot
(Unit B, Site 2)

2.3.6.5 Site 2, Over-all, Below Ground

Of the evaluated items of equipment in the below-ground installation 123 out of 128 were in categories 1 and 2. Thus, equipmentwise, this installation was 96 per cent serviceable and would have required 4 per cent replacement (Line 7B, Col 2, Table B.11).

2.3.7 Unit B, 15,000 ft, Site 3, Above Ground

2.3.7.1 Surgical Tent

The surgical tent was partially knocked down (Figs. 2.127 and 2.128) and tables and lamps located on the ground zero side of the tent were knocked over (Figs. 2.129 and 2.130). Only a few fragile items on these tables were damaged. All nonfragile items, boxes, chests, and instruments were undamaged. All electrical equipment was in operation. Such damage as occurred was minor in nature and entirely the result of blast, since no fires occurred. Column 3, Table B.1 indicates the degree of serviceability of all evaluated items. Figures 2.131 to 2.133 show the conditions existent within the tent after removal of the tentage. It should be noted that a number of the operating and instrument tables were overturned during



Fig. 2.127 Surgery, A, General View of Side toward Ground Zero (Unit B, Site 3)



Fig. 2.128 Surgery, A, General View Looking South
on Ground Zero Side (Unit B, Site 3)



Fig. 2.129 Surgery, A, Overturning of Tables on
Ground Zero Side (Unit B, Site 3)

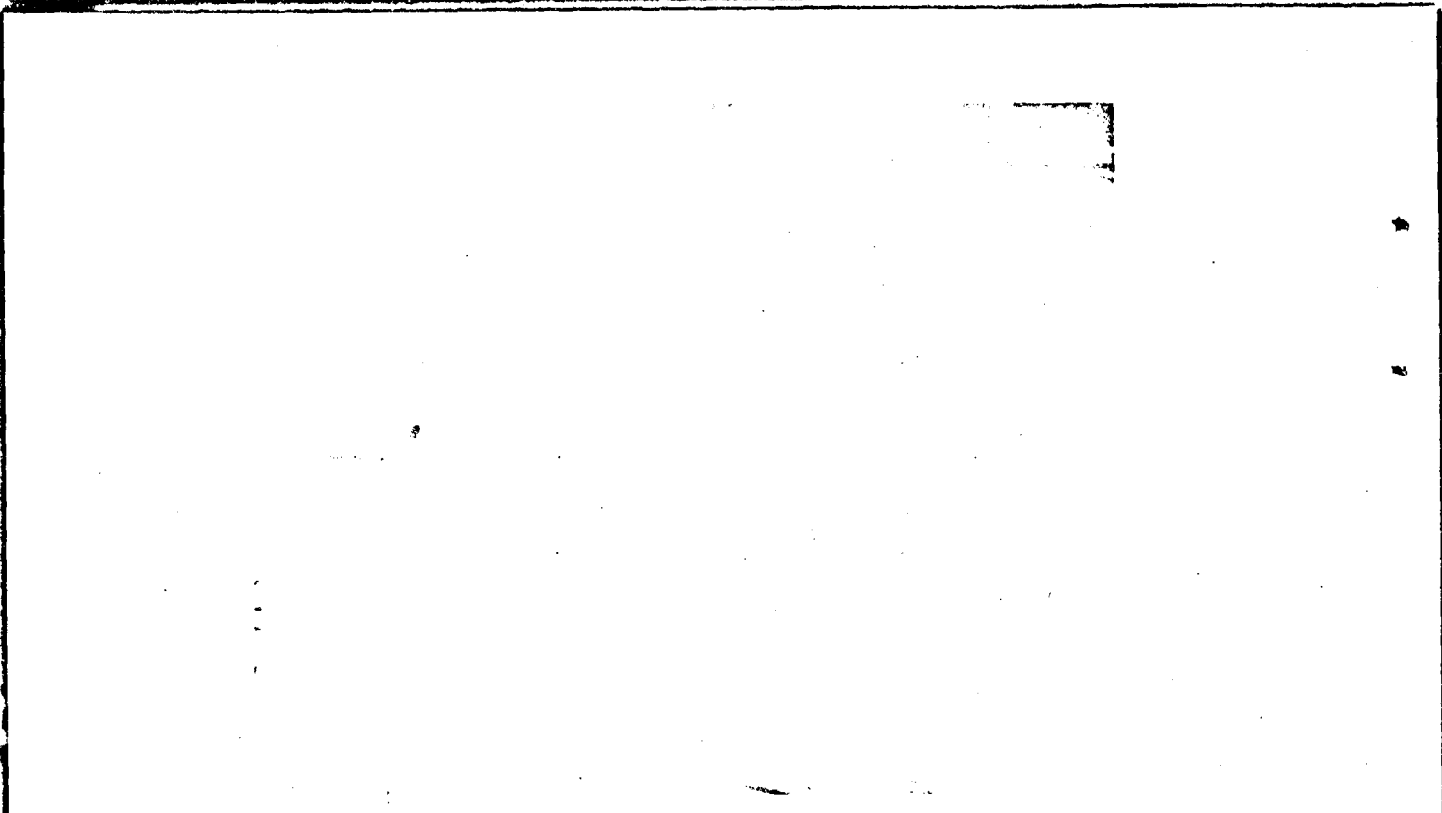


Fig 2.130 Surgery, A, Displacement of Items from Overturning
Tables on Ground Zero Side (Unit B, Site 3)

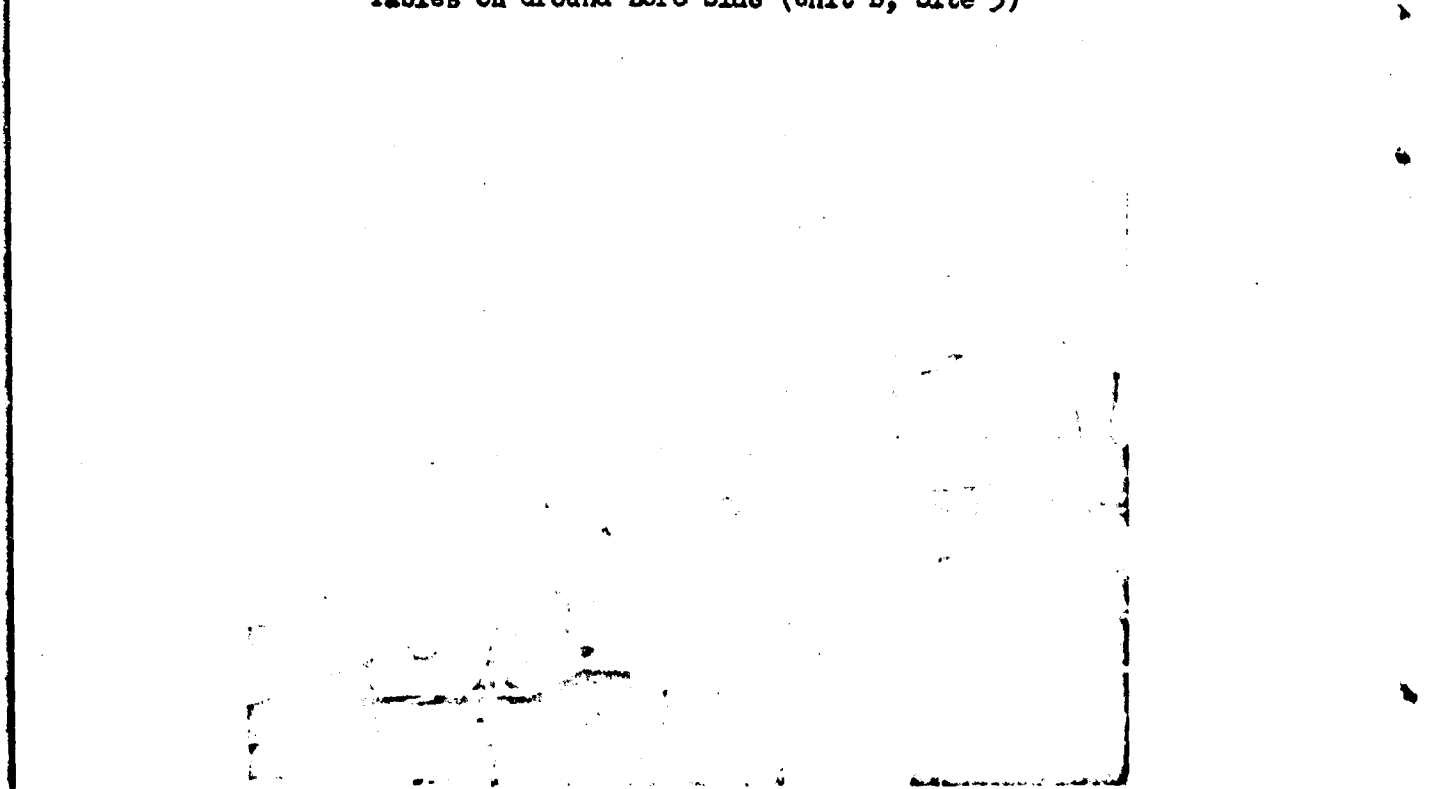


Fig. 2.131 Surgery, A, General View after Removal
of Tentage (Unit B, Site 3)

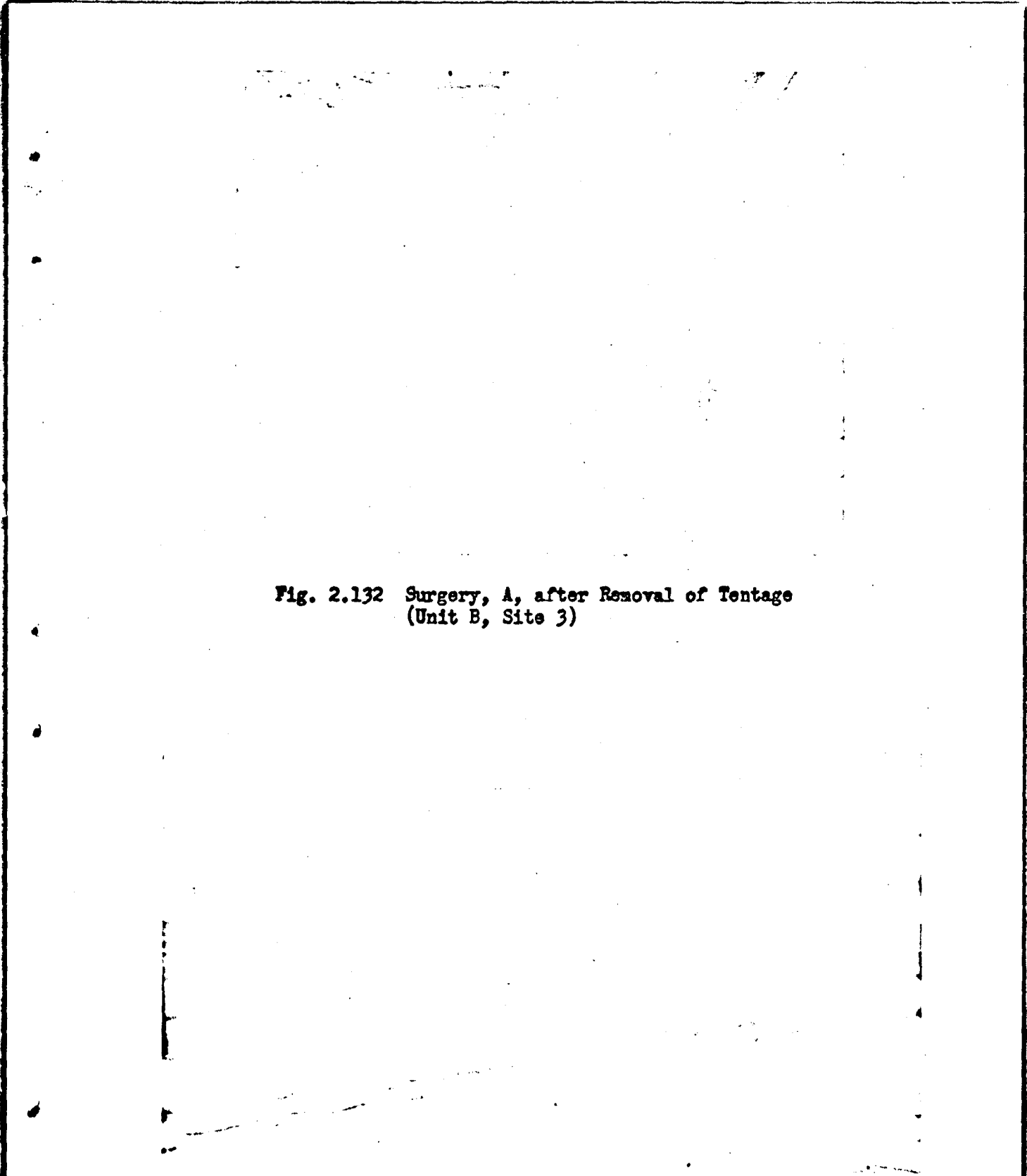


Fig. 2.132 Surgery, A, after Removal of Tentage
(Unit B, Site 3)

Fig. 2.133 Surgery, A, after Removal of Tentage
(Unit B, Site 3)

the removal of the tent. The over-all arithmetical average of serviceability of all items evaluated was 97 per cent (Line 20A, Col 3, Table B.1). All 48 evaluated items within the surgery were in category 1 (Line 20A, Col 3, Table B.5). Equipmentwise, the surgery was considered 100% serviceable.

2.3.7.2 X-ray Tent

As in the surgery, the tent was only partially blown down and some light equipment toward ground zero was overturned, damaging to a minor degree some fragile items (Figs. 2.134 and 2.135). All nonfragile items were either undamaged or damaged only slightly. Column 3, Table B.2 shows the degree of serviceability of all evaluated items of equipment. There was an over-all arithmetical average of serviceability of 98 per cent within the X-ray tent (Line 30A, Col 3, Table B.2). Figures 2.136 to 2.141 show the interior of the X-ray tent after removal of tentage, with contained items, their serviceability, and their category. In accordance with damage criteria, all 24 items in the X-ray section and all 16 items in the clinics section were in category 1 (Line 19A, Col 3, Table B.6 and Line 12A, Col 3, Table B.7). Thus, both X-ray and the clinics were 100 per cent undamaged, or immediately serviceable (Line 2A and 3A, Col 3, Table B.11).



Fig. 2.134 X-ray Tent, A, General View of Clinics
Section (Unit B, Site 3)



Fig. 2.135 X-ray Tent, A, Overturning of Equipment
within Clinics Section (Unit B, Site 3)

Fig. 2.136 X-ray, A, 15 ma. and Portable X-ray,
100% Serviceable, Category 1 (Unit B, Site 3)

Fig. 2.137 X-ray, A, 100 ma. X-ray, 100% Serviceability,
Category 1 (Unit B, Site 3)

Fig. 2.138 X-ray, A, Darkroom Tent, 90% Serviceable,
Category 2 (Unit B, Site 3)

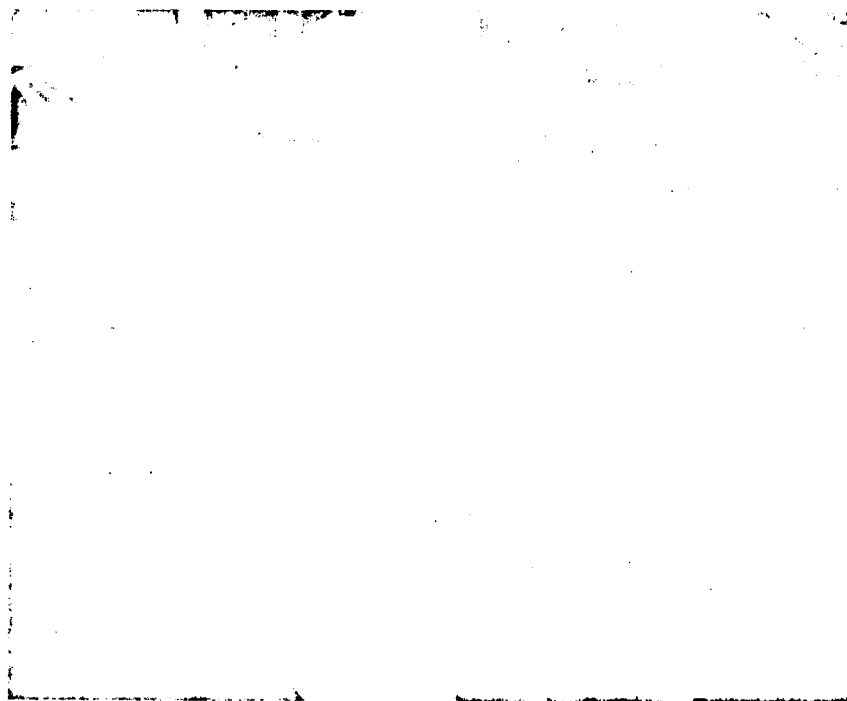


Fig. 2.139 X-ray, A, ENT, Specialist Chair, 100% Serviceable,
Category 1 (Unit B, Site 3)



Fig. 2.140 X-ray, A, Dental Chair, 100% Serviceable,
Category 1 (Unit B, Site 3)

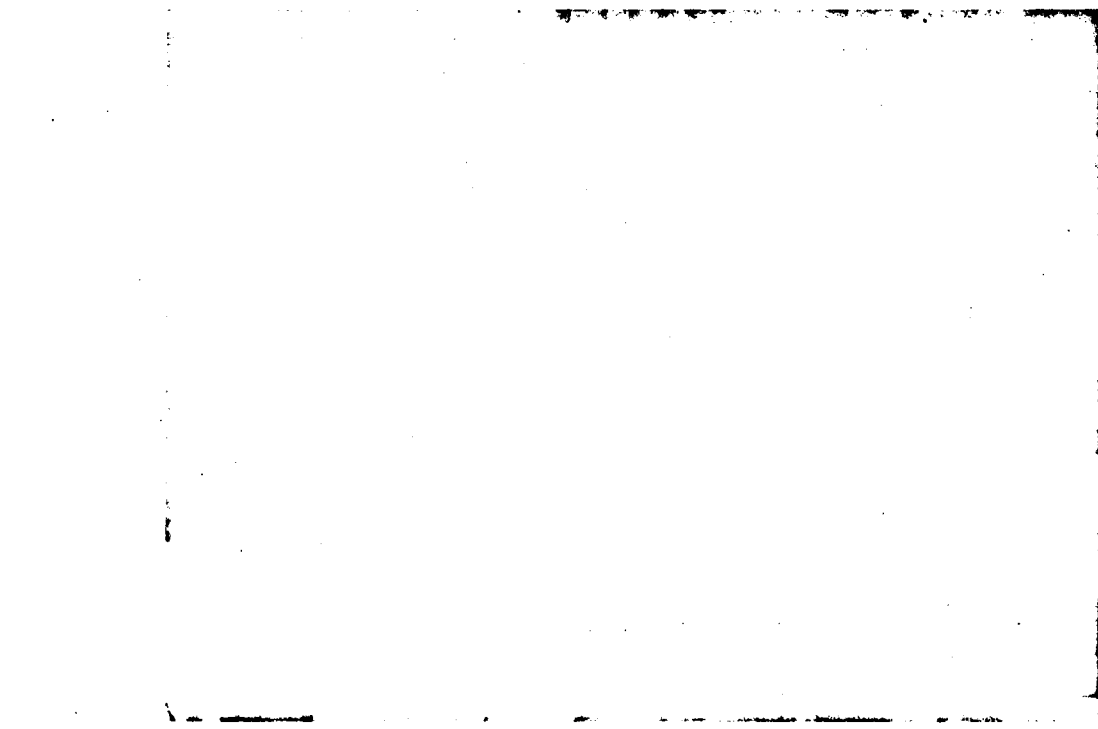


Fig. 2.141 X-ray, A, Chair, Specialist, Left 95% Serviceable,
Category 1, Table, Operating, Steel, Center,
100% Serviceable, Category 1 (Unit B, Site 3)

2.3.7.3 Pharmacy and Laboratory Tent

As in the X-ray and surgery, the tent was partially collapsed, knocking over tables next to the side walls (Figs. 2.142 and 2.143). Only a very few fragile items were broken as a result of the overturning of tables. Nonfragile items were either undamaged or damaged so slightly as to be immediately serviceable. Column 3, Table B.3 indicates the degree of serviceability of the evaluated items within the pharmacy and laboratory tent. Figures 2.144 to 2.148 show conditions within the pharmacy and laboratory after removal of tentage. There was an over-all arithmetical average of serviceability of evaluated items of 93 per cent (Line 14A, Col 3, Table B.3). In accordance with damage criteria, all 18 items of the laboratory section and all 4 items within the pharmacy were in category 1 (Line 12A, Col 3, Table B.9 and Line 4A, Col 3, Table B.8). Thus both the pharmacy and the laboratory were 100 per cent undamaged, or immediately serviceable (Line 5A and 4A, Col 3, Table B.11).

2.3.7.4 Ward Tent

The ward tent, as the tents elsewhere, was partially collapsed (Figs. 2.149 and 2.150). As in the other tents, the tables or upright items against the side wall of the tent were overturned.



**Fig. 2.142 Pharmacy and Laboratory, A, General View,
Pharmacy Section (Unit B, Site 3)**

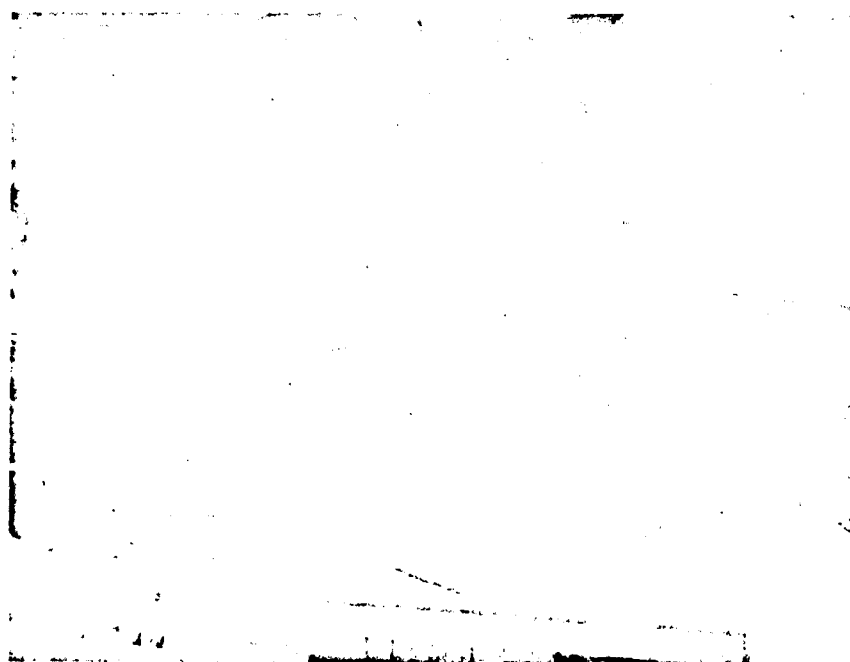


**Fig. 2.143 Pharmacy and Laboratory, A, General View, Laboratory
Section, Tentage Partially Removed (Unit B, Site 3)**



Fig. 2.144 Pharmacy and Laboratory, A, Colorimeter,
90% Serviceable, Category 1 (Unit B, Site 3)

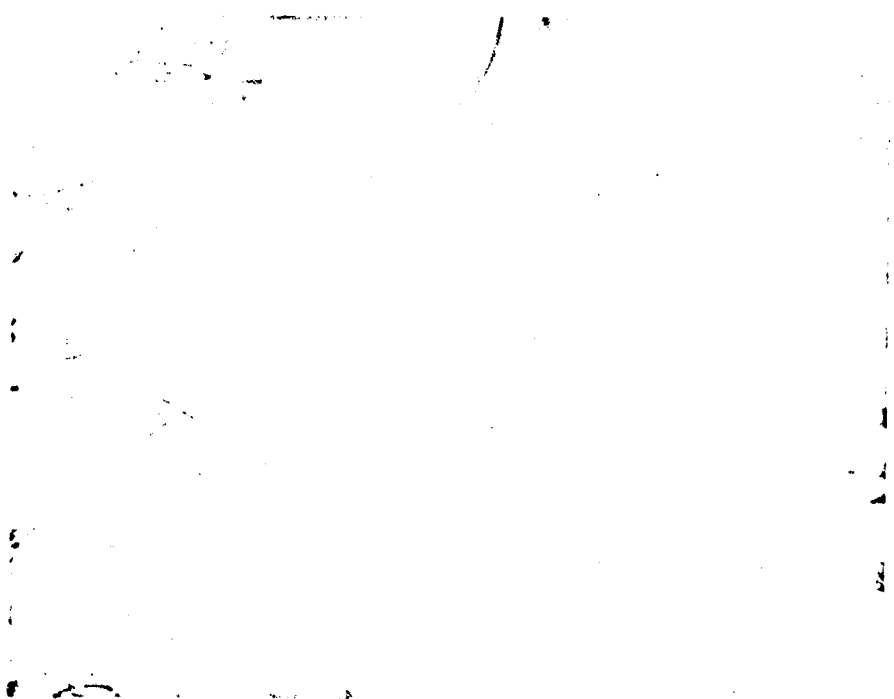


Fig. 2.145 Pharmacy and Laboratory, A, Incubator,
95% Serviceable, Category 1 (Unit B, Site 3)



Fig. 2.146 Pharmacy and Laboratory, A, Water Distillation Apparatus,
85% and 90% Serviceable, Category 1 (Unit B, Site 3)

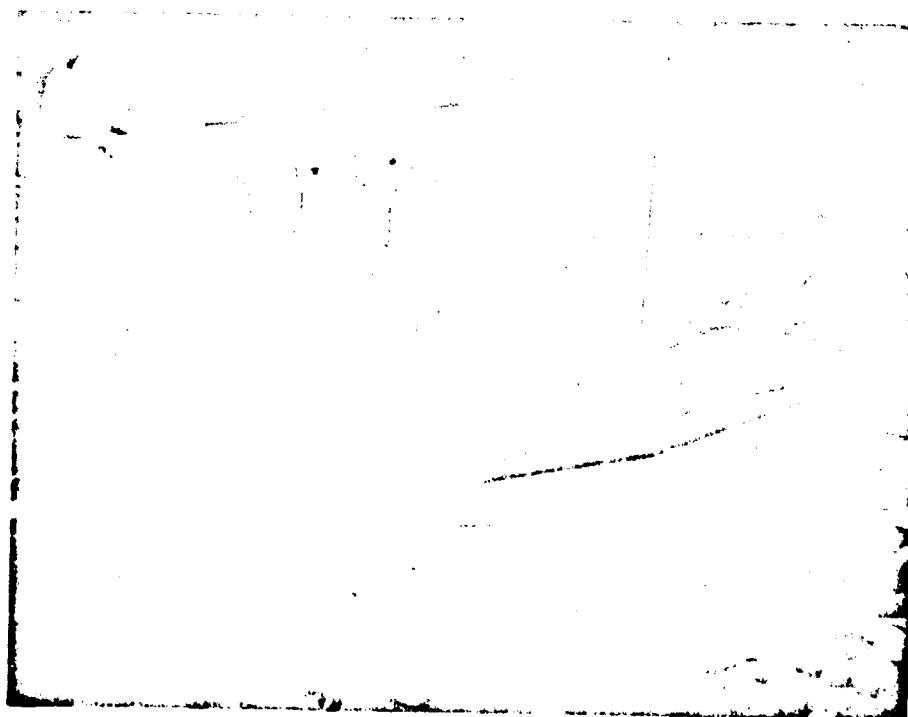


Fig. 2.147 Pharmacy and Laboratory, A, Refrigerator,
90% Serviceable, Category 1 (Unit B, Site 3)

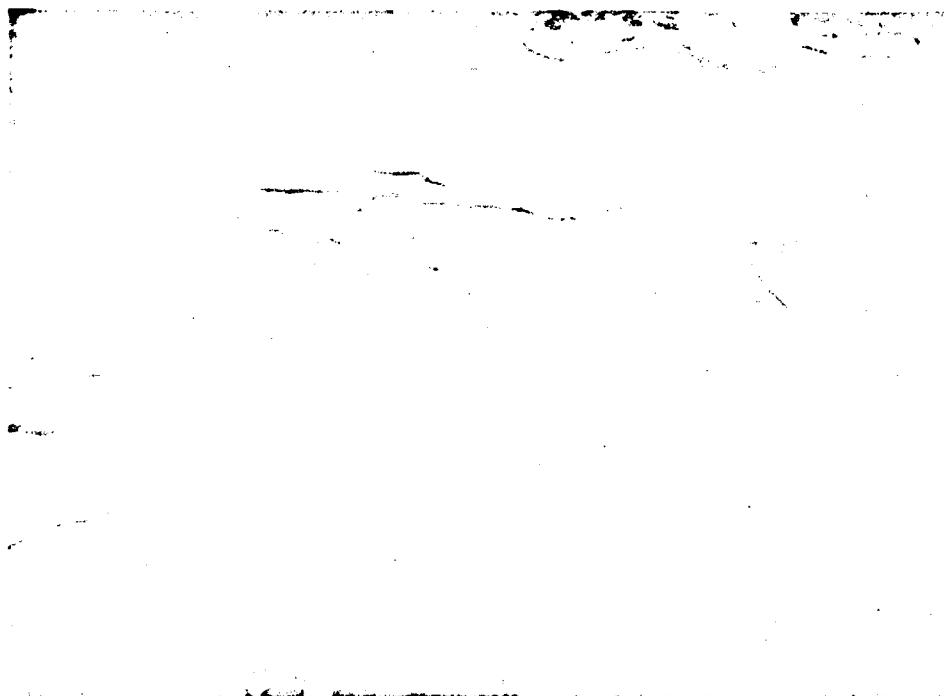


**Fig. 2.148 Pharmacy and Laboratory, A, Bottled Items,
Pharmacy Section Undamaged (Unit B, Site 3)**



**Fig. 2.149 Ward, A, General View from Ground Zero
Side (Unit B, Site 3)**



Fig. 2.150 Ward, A, General View South on Ground Zero Side (Unit B, Site 3)

Several (3) fragile items were broken. Nonfragile items were undamaged. All of the cots and beds were undamaged. Column 3, Table B.4 shows the degree of serviceability of all evaluated items. There was an over-all arithmetical average of serviceability of evaluated items of 99 per cent (Line 11A, Col 3, Table B.4). Figures 2.151 to 2.153 show the ward after removal of tentage. In accordance with damage criteria, 17 out of 18 evaluated items were in category 1 (Line 11A, Col 3, Table B.10). Thus, 94 per cent of the evaluated items were undamaged, or immediately serviceable (Line 6A, Col 3, Table B.11).

2.3.7.5 Site 3, Over-all, Above Ground

Of the evaluated items of equipment, 127 out of 128 were in categories 1 and 2 in the aboveground installation. Thus, equipment-wise, this installation was 99 per cent serviceable and would have required 1 per cent replacement (Line 7A, Col 3, Table B.11). As below ground, the items evaluated would not have prevented the unit from accomplishing its mission; and replacement of the destroyed items, both evaluated and unevaluated, could have been deferred.

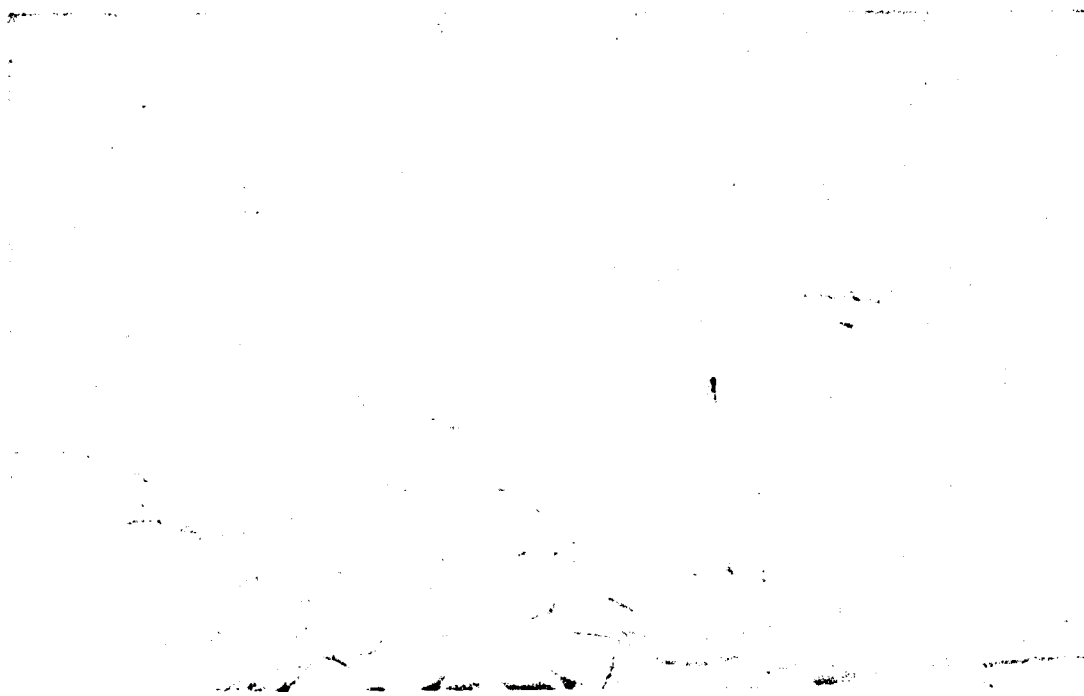


**Fig. 2.151 Ward, A, General View Looking North after
Removal of Tentage (Unit B, Site 3)**



**Fig. 2.152 Ward, A, Catch Beds Undamaged
(Unit B, Site 3)**

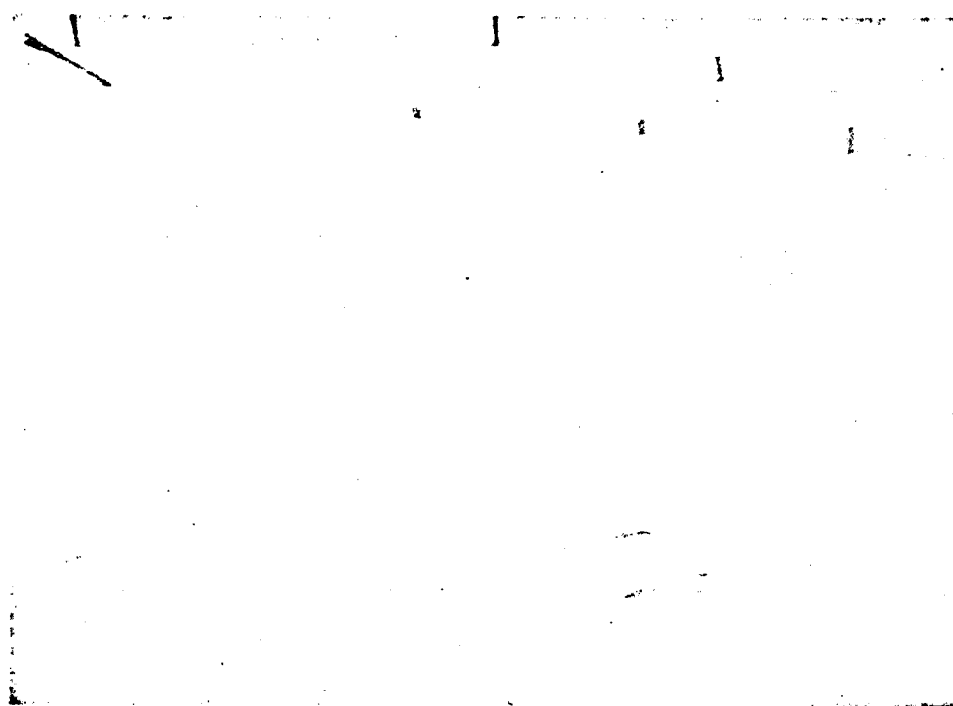


Fig. 2.153 Ward, A, Ward Linen Supplies, No Damage
(Unit B, Site 3)

2.3.8 Unit B, 15,000 ft. Site 3, Below Ground

2.3.8.1 Surgical Tent

The surgical tent remained standing, although 5 of the tentpoles were broken and the eave-line grommets were pulled out, allowing the sides of the tent to sag (Figs. 2.154 and 2.155). Some of the equipment was overturned but sustained little damage (Figs. 2.156 to 2.158). All electrical equipment was operating after the blast. No fires occurred. A few fragile items were broken but nonfragile equipment was undamaged and the relative relationship of the various sections of the surgery was undisturbed (Fig. 2.159). Column 3, Table B.1 shows the degree of serviceability of all evaluated items of equipment. The over-all arithmetical average of serviceability of evaluated items was 99 per cent. In accordance with damage criteria, all 48 items evaluated were in category 1 (Line 20B, Col 3, Table B.5). Thus, the surgery was considered 100 per cent undamaged, or immediately serviceable (Line 1B, Col 3, Table B.11).

2.3.8.2 X-ray Tent

The X-ray tent remained standing although, like the surgical tent, 2 tentpoles were broken and eave-line grommets were pulled out,

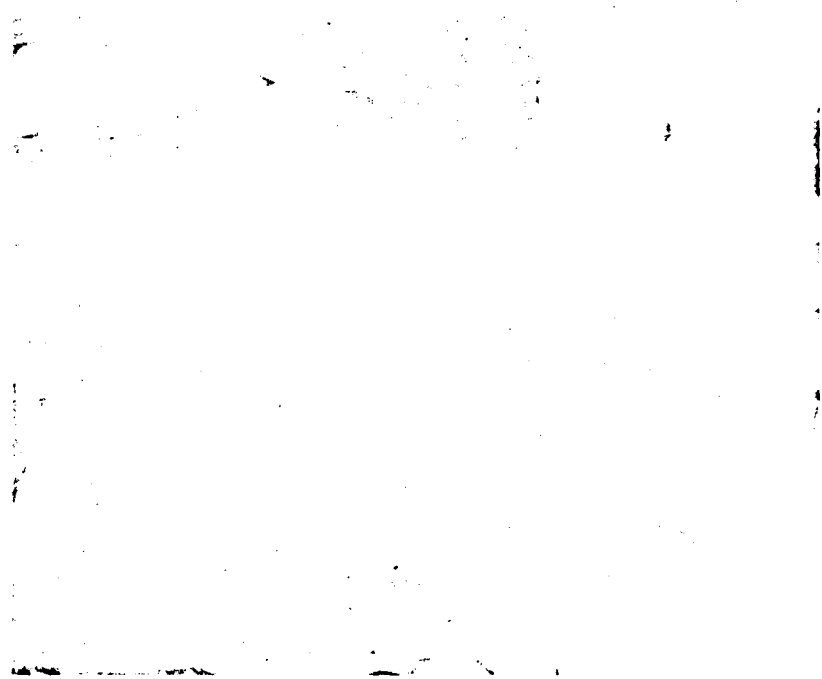


Fig. 2.154 Unit B, B, General View Looking South
(Site 3)

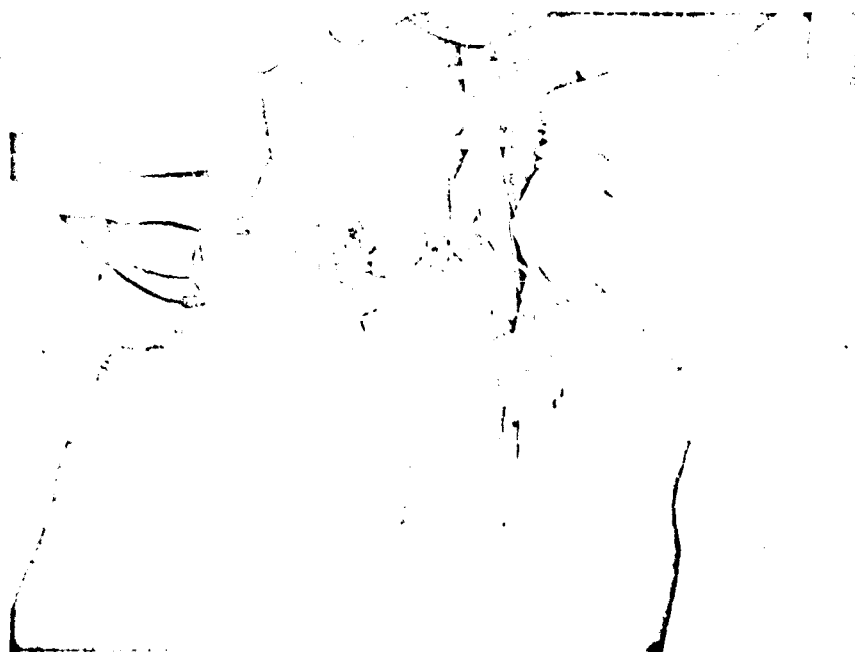


Fig. 2.155 Surgery, B, Center, Tentpole Broken, Electrical
Equipment Operating (Unit B, Site 3)

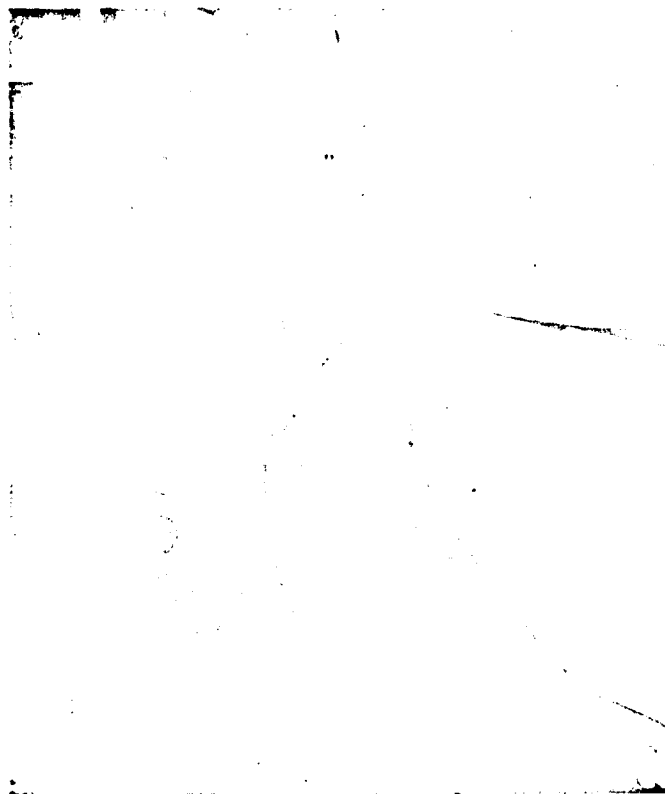


Fig. 2.156 Surgery, B, Operating Light Overturned but Functioning,
Sagging Tent Side Wall (Unit B, Site 3)

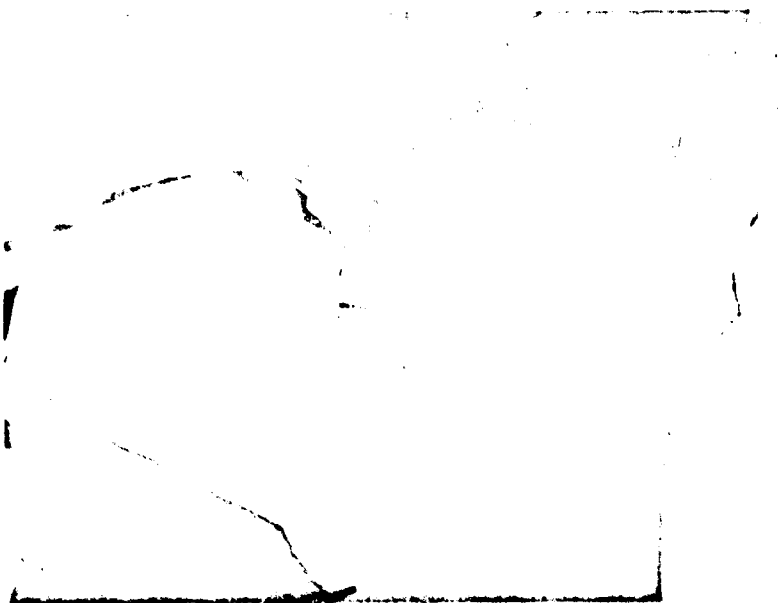


Fig. 2.157 Surgery, B, Instruments on Ground Result of Overturned
Tables, Sagging Tent Wall (Unit B, Site 3)

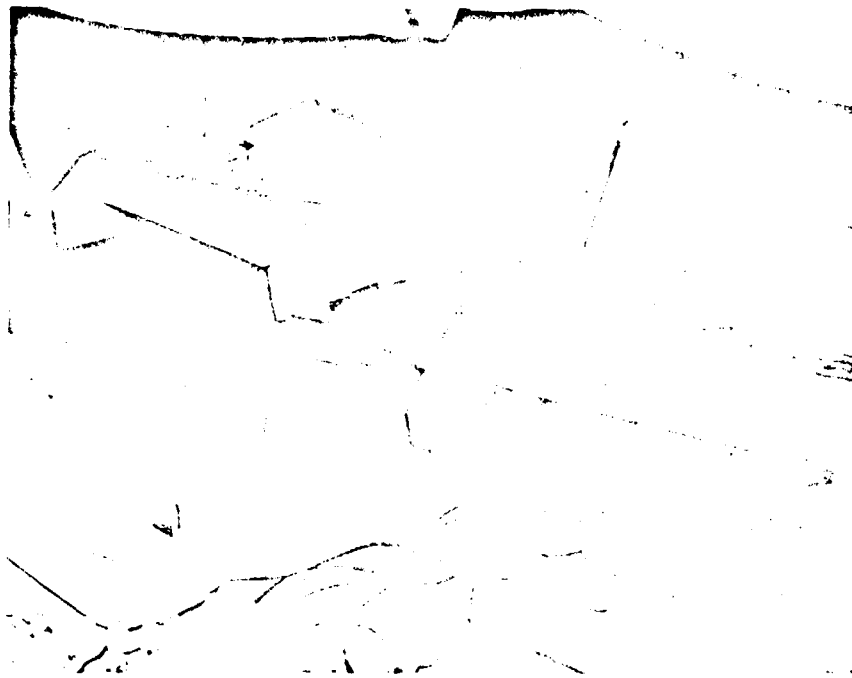


Fig. 2.158 Surgery, B, Instrument Tables away from
Ground Zero, Slight Displacement (Unit B, Site 3)

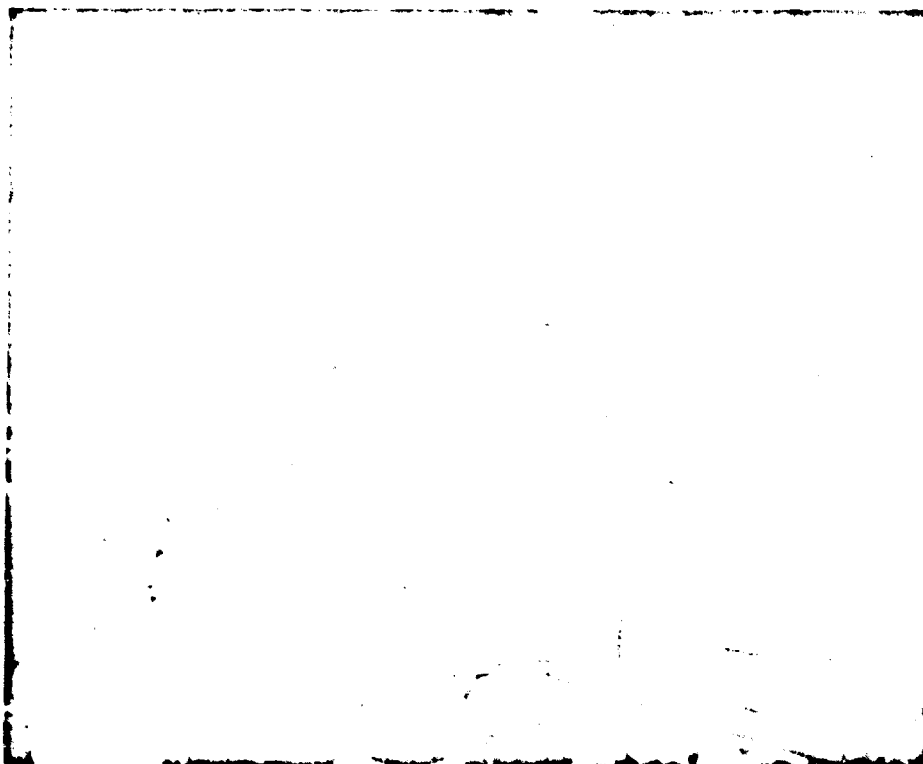


Fig. 2.159 Surgery, B. after Removal of Tentage (Unit B, Site 3)

allowing sides of the tent to sag (Fig. 2.160). Some tables were overturned and a few fragile items were broken (Fig. 2.161). Non-fragile equipment was undamaged. After removal of tentage, established relationships of the various sections was undisturbed (Figs. 2.162 to 2.166). No fires occurred and all electrical circuits were in operation after the blast. Column 3, Table B.2 lists the evaluated items of equipment with their degree of serviceability. The over-all arithmetical average of serviceability of the X-ray tent approached 100 per cent (Line 30B, Col 3, Table B.2). In accordance with damage criteria, all 26 items of the X-ray section and all 16 items in the clinics section were in category 1 (Line 19B, Col 3, Table B.6 and Line 12B, Col 3, Table B.7). Thus, both the X-ray and the clinics section were considered 100 per cent undamaged, or immediately serviceable (Lines 2B and 3B, Col 3, Table B.11).

2.3.8.3 Pharmacy and Laboratory Tent

The tent remained upright, although a few side poles had been displaced and five of them were broken, overturning some of the equipment and breaking a few fragile items (Figs. 2.167 and 2.168). All nonfragile equipment was either undamaged or damaged only slightly. The established relationship of the various sections was undisturbed (Figs. 2.169 to 2.172). Column 3, Table B.3 lists the evaluated items

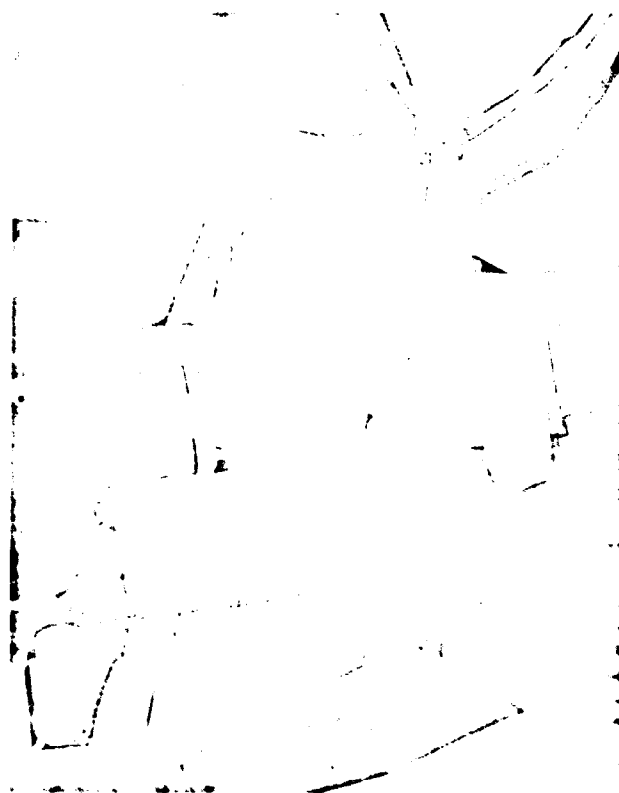


Fig. 2.160 X-ray, B, Sagging of Tentage on Side toward Ground Zero (Unit B, Site 3)

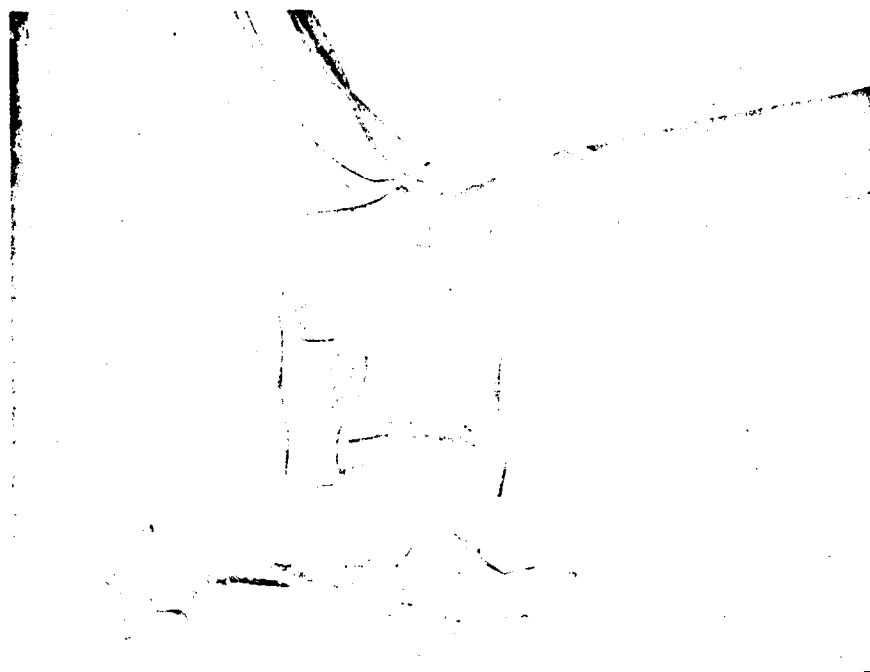


Fig. 2.161 X-ray, B, Overturning of ENT Table,
Minimal Damage (Unit B, Site 3)



Fig. 2.162 X-ray, B, Eye and Maxillofacial Sections away
from Ground Zero, No Damage (Unit B, Site 3)

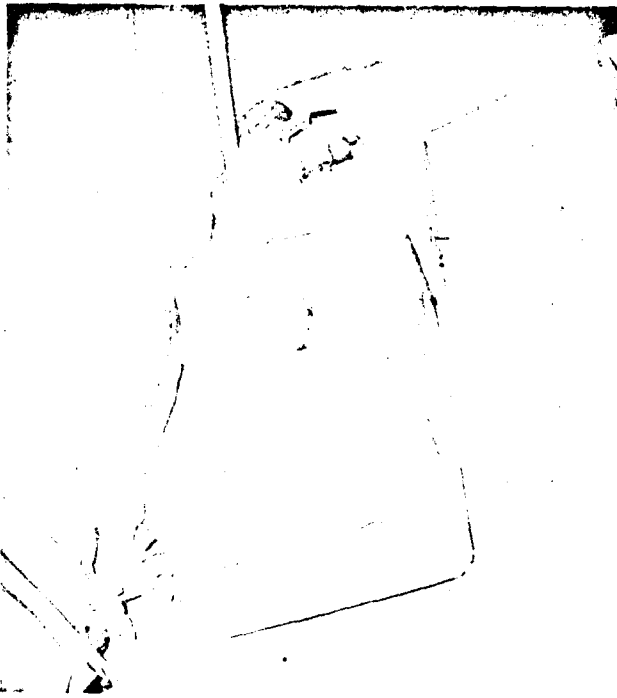


Fig. 2.163 X-ray, B, Dental Prosthetics, No Damage
(Unit B, Site 3)

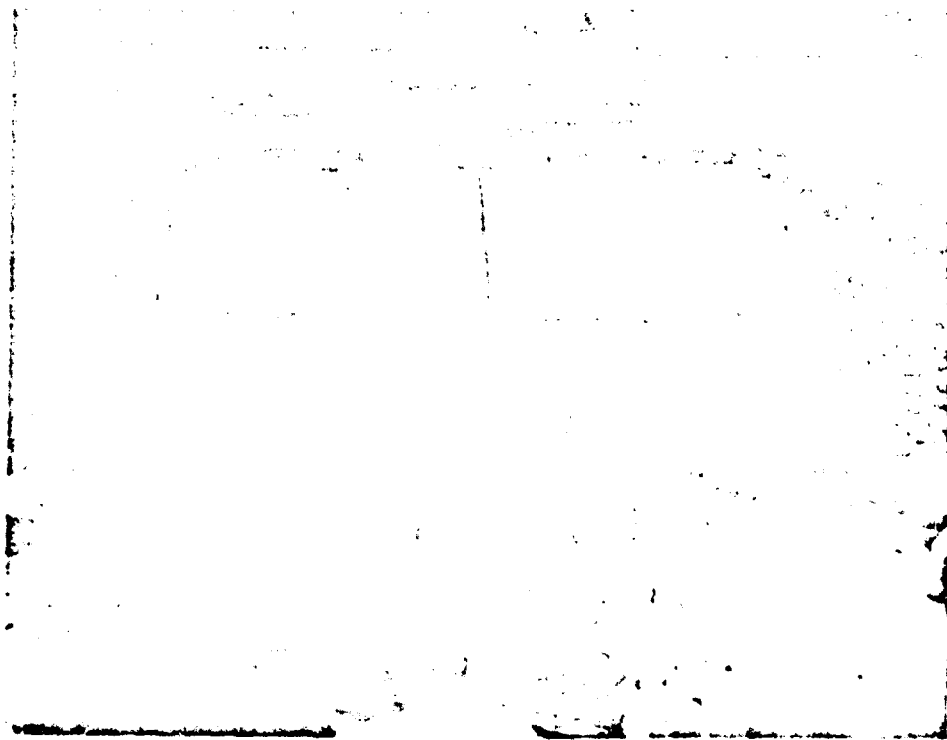


Fig. 2.164 X-ray, B, X-ray Section, No Damage (Unit B, Site 3)

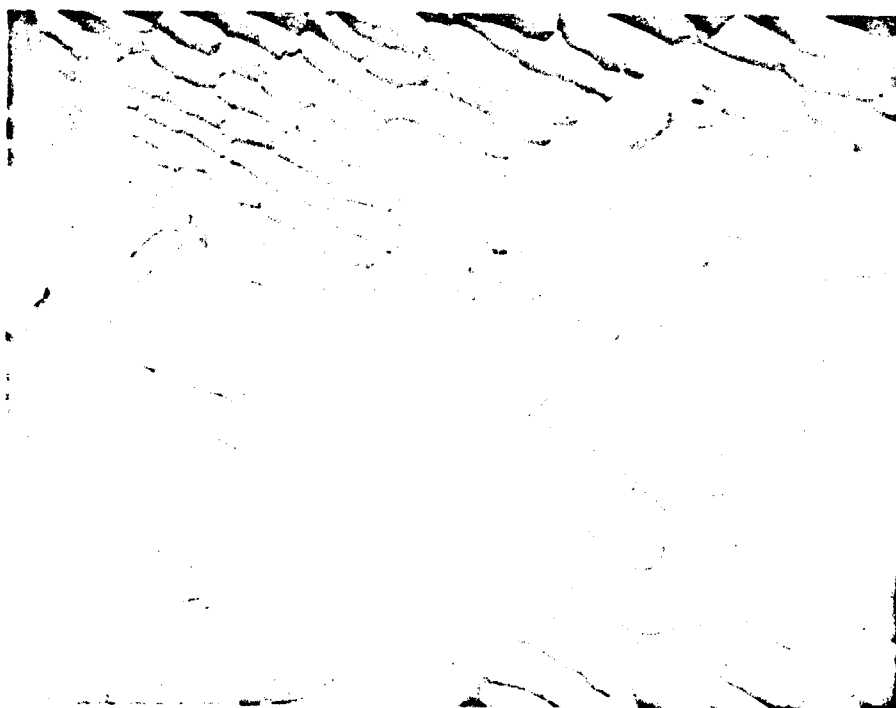


Fig. 2.165 X-ray, B, Transformer and Cassette Changer,
No Damage (Unit B, Site 3)

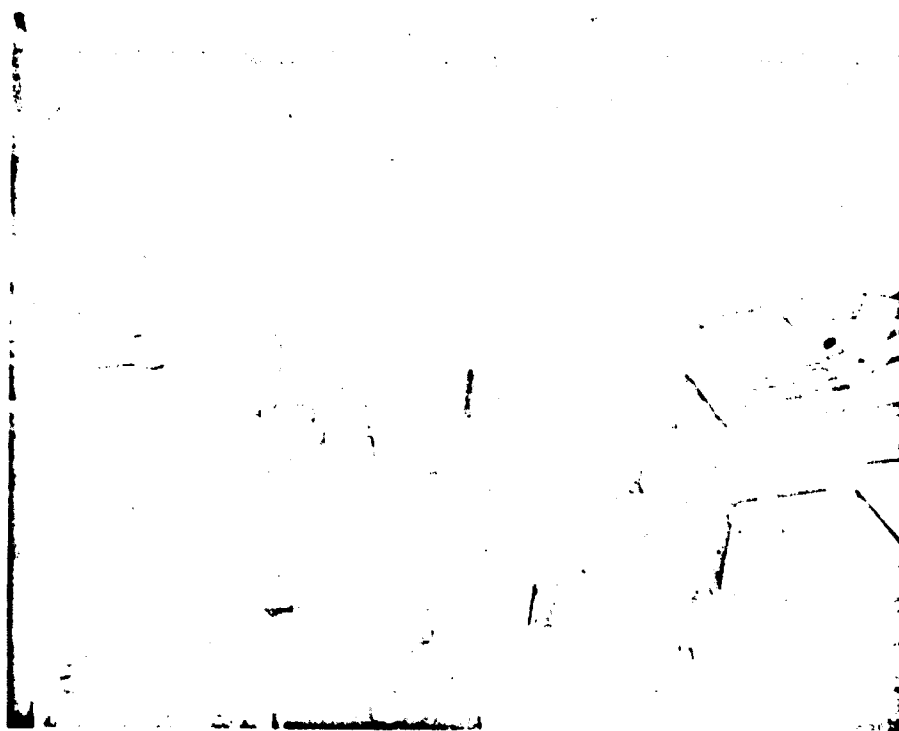


Fig. 2.166 X-ray, B, 15 ma. X-ray, No Damage (Unit B, Site 3)

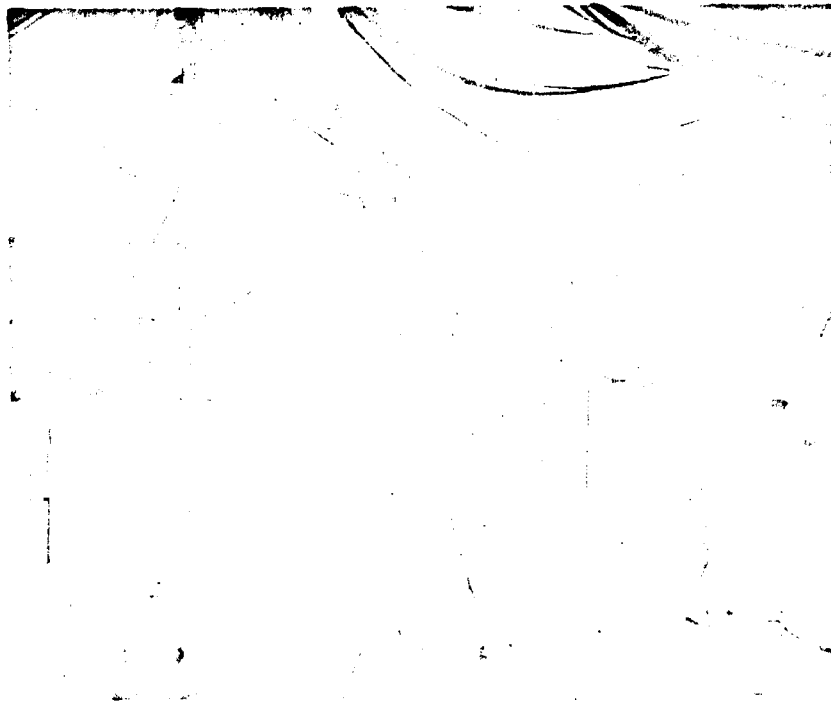


Fig. 2.167 Pharmacy and Laboratory, B, General View of
Laboratory Section, Slight Damage (Unit B, Site 3)

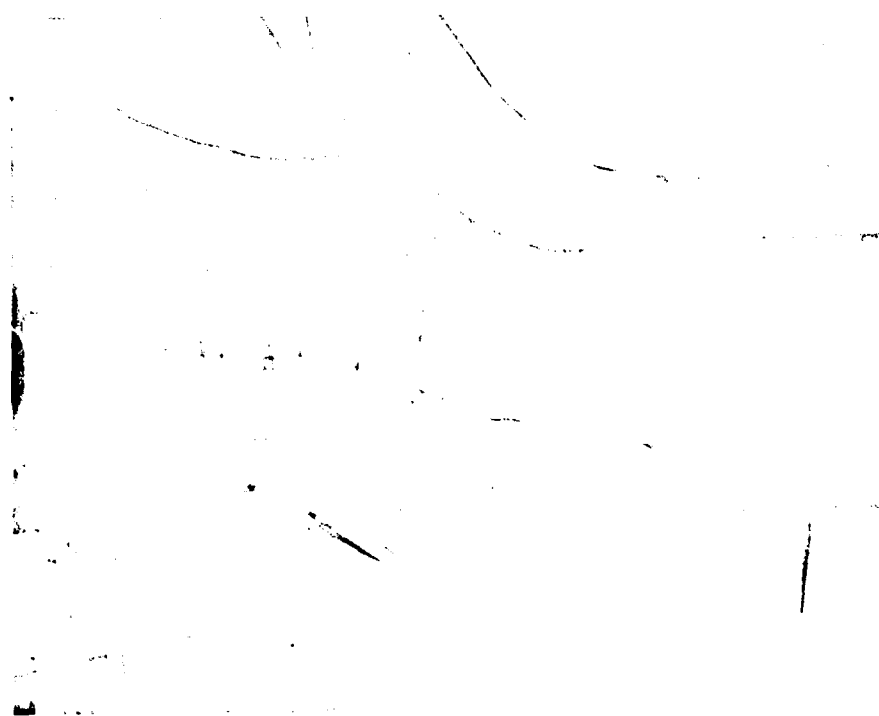


Fig. 2.168 Pharmacy and Laboratory, B, Pharmacy Section,
No Damage (Unit B, Site 3)

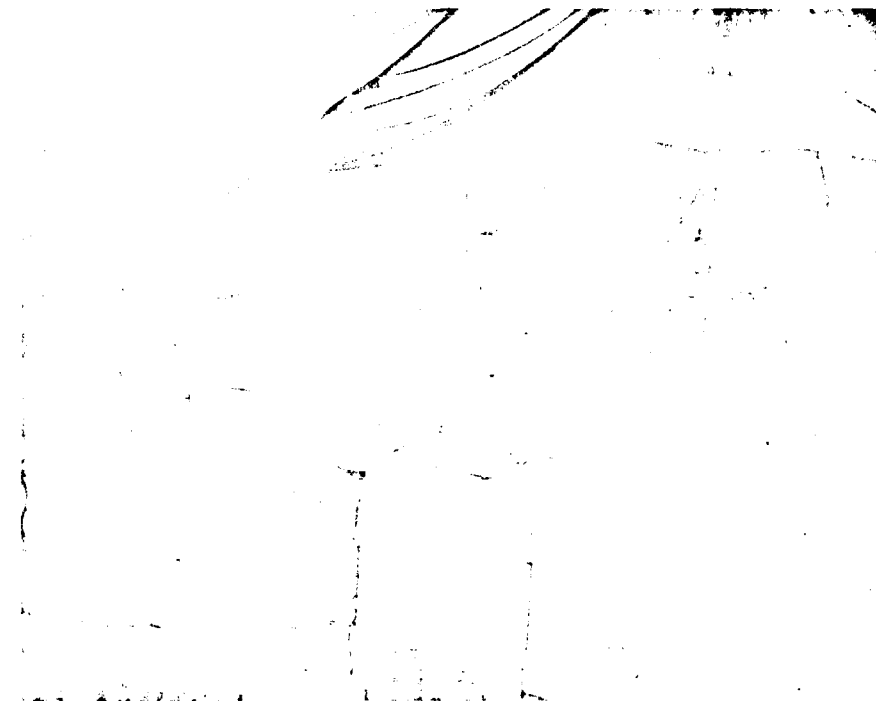


**Fig. 2.169 Pharmacy and Laboratory, B, Laboratory Section,
Slight Damage (Unit B, Site 3)**

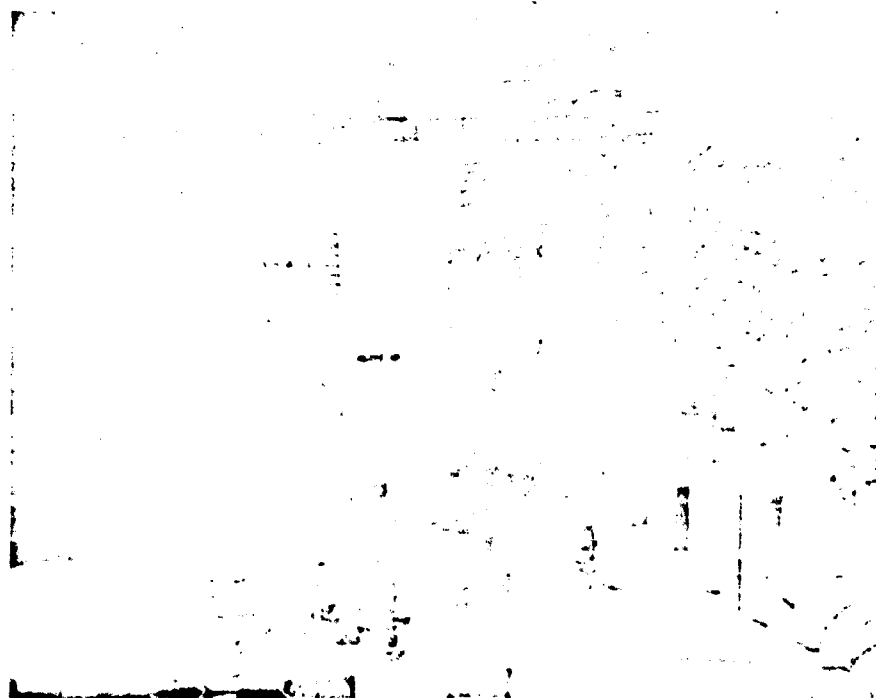


**Fig. 2.170 Pharmacy and Laboratory, B, General View Looking
North after Removal of Tentage (Unit B, Site 3)**

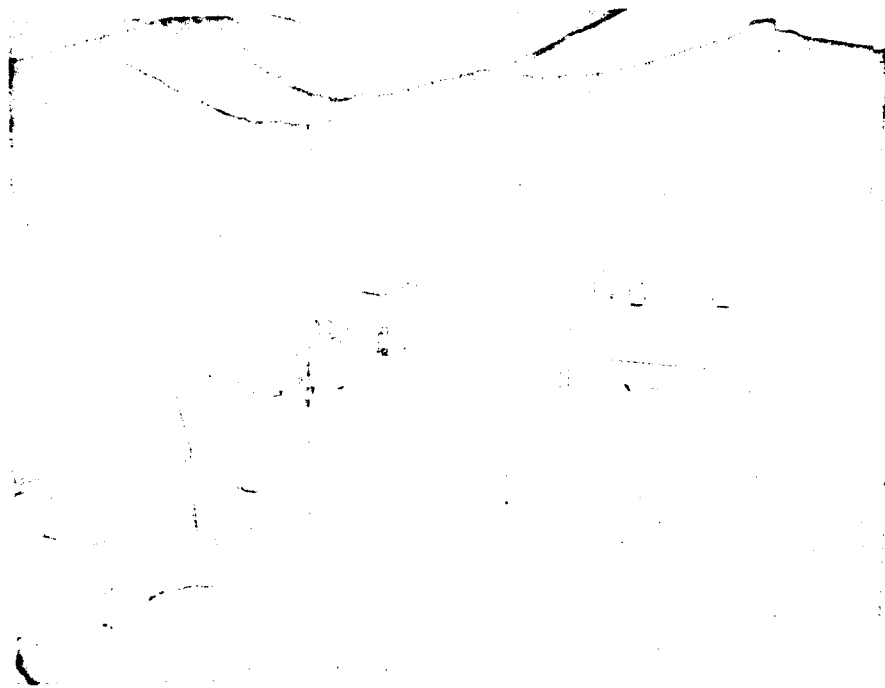


**Fig. 2.171 Pharmacy and Laboratory, B, Pharmacy Section,
No Damage (Unit B, Site 3)**

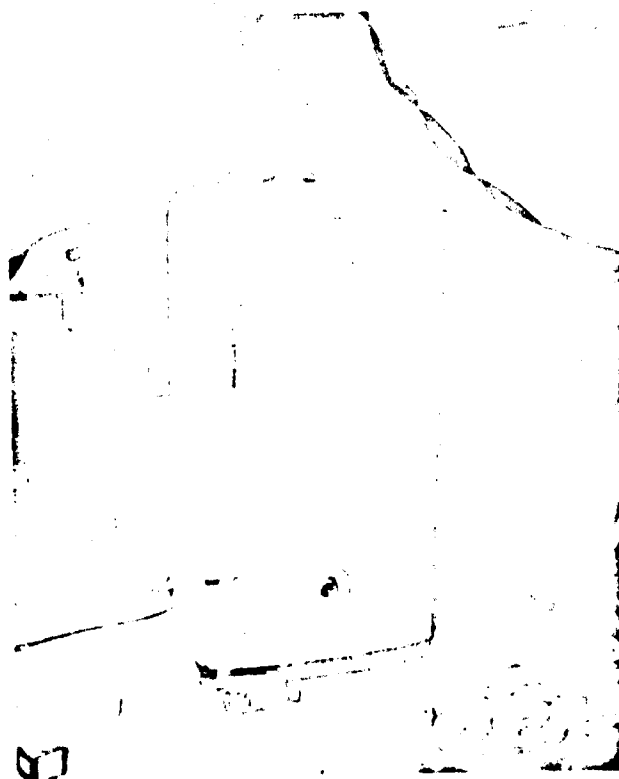


**Fig. 2.172 Pharmacy and Laboratory, B, Refrigerator,
No Damage (Unit B, Site 3)**

of equipment with their degree of serviceability. There was an over-all arithmetical average of serviceability of evaluated items of 97 per cent. In accordance with damage criteria all of the 18 items in the laboratory section and all of the 4 items in the pharmacy were in category 1 (Line 12B, Col 3, Table B.9 and Line 4B, Col 3, Table B.8). Thus, the laboratory and pharmacy were considered 100 per cent undamaged, or immediately serviceable (Line 4B and 5B, Col 3, Table B.11).

2.3.8.4 Ward Tent

The ward tent remained standing. One of the center poles was broken (Fig 2.6), three side poles were broken, and eave-line grommets were pulled out, permitting the side walls to sag (Figs. 2.173 and 2.174). No fires occurred. Established relationships within the ward tent were undisturbed (Figs. 2.175 and 2.176). Only a few fragile items were broken as a result of their being thrown to the ground from overturning tables. Nonfragile equipment was undamaged. Column 3, Table B.4 lists the evaluated items of equipment with their degree of serviceability. The over-all arithmetical average of serviceability within the ward tent approached 100 per cent (Line 11B, Col 3, Table B.4). In accordance with damage criteria,



Fig. 2.173 Ward, B, Sagging of Tentage on Ground
Zero Side (Unit B, Site 3)

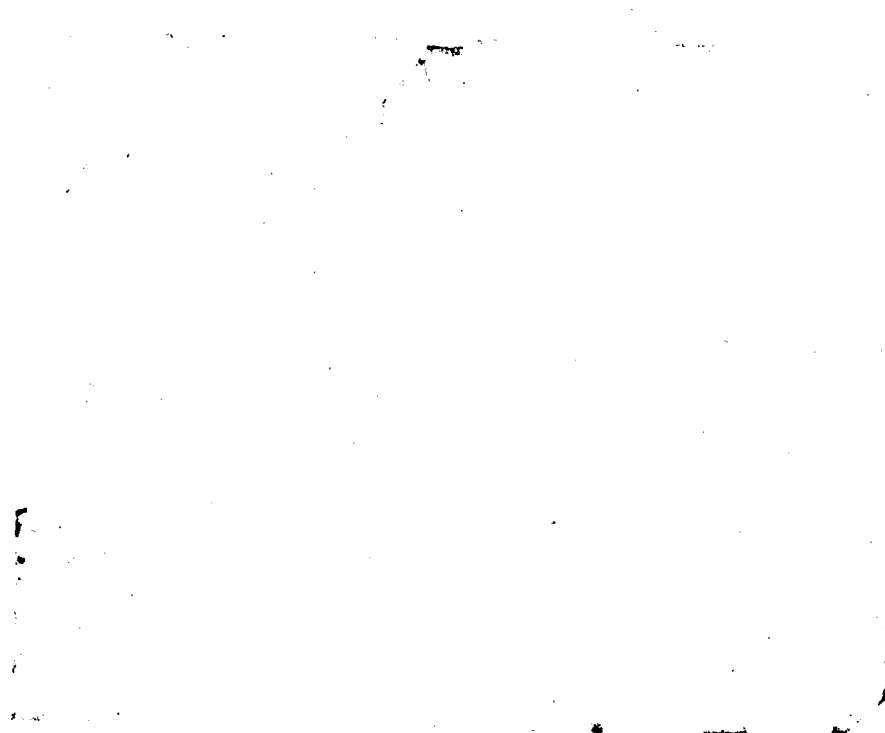


Fig. 2.174 Ward, B, General View, Sagging of
Tentage (Unit B, Site 3)

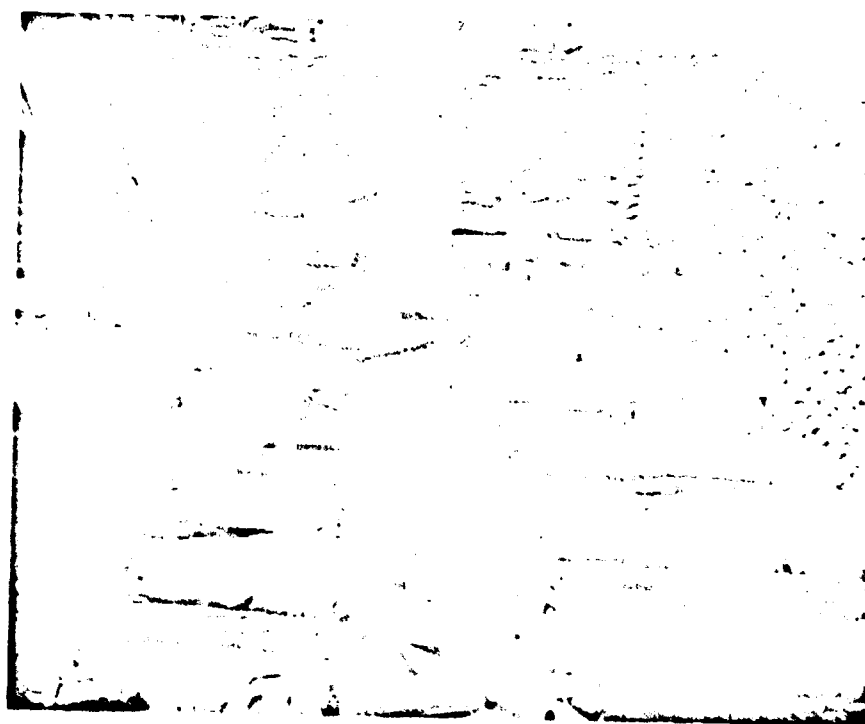


Fig. 2.175 Ward, B, General View Looking North after
Removal of Tentage (Unit B, Site 3)

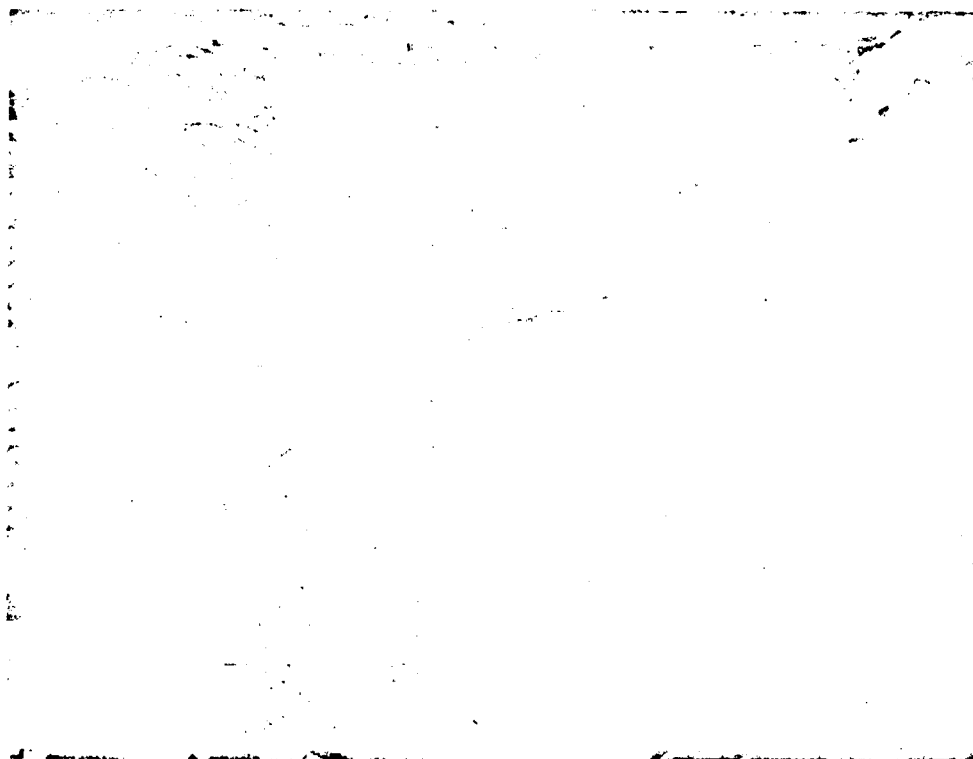


Fig. 2.176 Ward, B, General View Looking South after
Removal of Tentage (Unit B, Site 3)

17 items were in category 1, and 1 item was in category 3 (Line 11B, Col 3, Table B.10). Thus, the below-ground ward was considered to be 94 per cent undamaged, or immediately serviceable (Line 6B, Col 3, Table B.11).

2.3.8.5 Site 3. Over-all, Below Ground

Of the evaluated items in the below-ground installation, 129 out of 130 were in categories 1 and 2 (Line 7B, Col 3, Table B.11). Thus, the below-ground installation was considered as approaching 100 per cent serviceability, requiring only a minimum of replacement of both evaluated and unevaluated items, which could be accomplished on a deferred basis.

2.3.9 Tentage

2.3.9.1 Site 1. Above Ground

At Site 1, above ground, the tentage was completely destroyed. The portions of tentage found showed evidence of initial thermal radiation, but they were not completely burned. Blast motion-picture photography showed an instantaneous smoking of the tentage, but no flaming could be discerned. Figures 2.177 and 2.178 show some

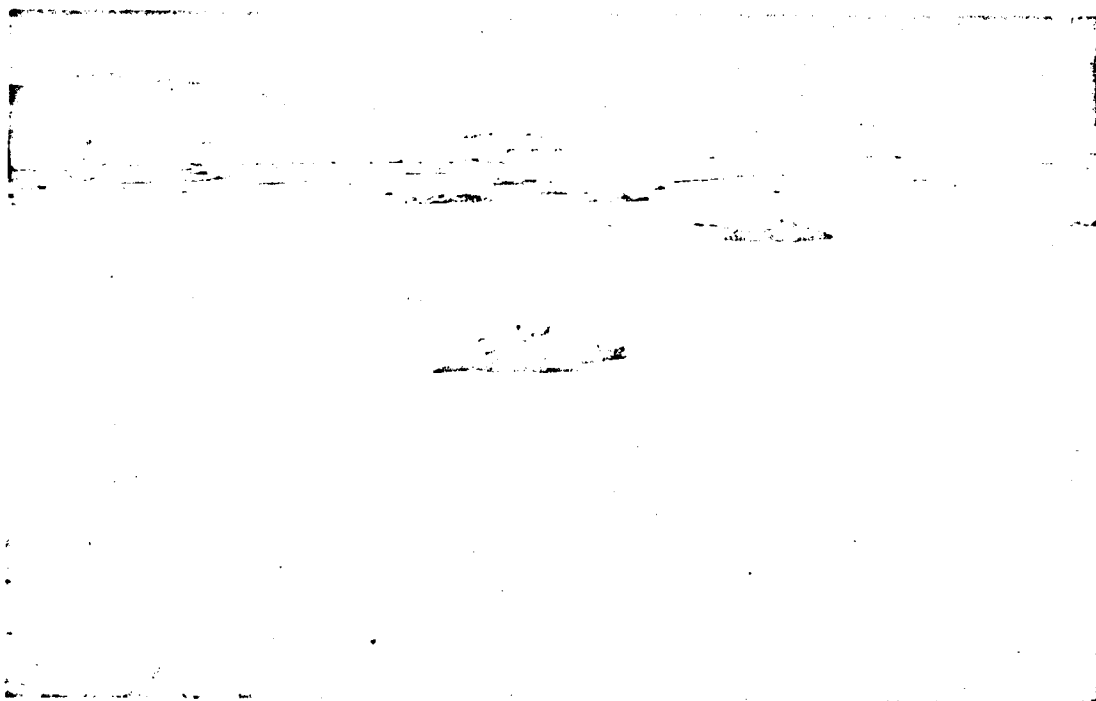


Fig. 2.177 Unit B, A, Remnants of Canvas from Tentage (Site 1)



Fig. 2.178 Unit B, A, Remnants of Canvas from Tentage (Site 1)

of the remnants of canvas. Eave-line tent ropes on the blast side showed evidence of scorching, but in all cases they were broken at the grommet. All grommets were pulled from the wall of the tent at the foot stops. All tent pegs were intact in the ground. On the side away from the blast, eave-line ropes had been lifted off the pegs and were intact on the fragments of canvas found. Only 3 of the 133 tent-poles were unbroken. Table 2.2 lists the component parts of the tent under damage criteria. Site 1, above ground, would have required 100 per cent replacement under damage criteria.

2.3.9.2 Site 1, Below Ground

Below-ground tentage was completely destroyed. Condition of below-ground tentage was identical with that of the aboveground, except that all eave-line ropes were broken, regardless of their orientation to the blast. Figure 2.179 shows fragments of below-ground tentage. Table 2.3 indicates the status of component tentage under damage criteria. One hundred per cent replacement would have been required.

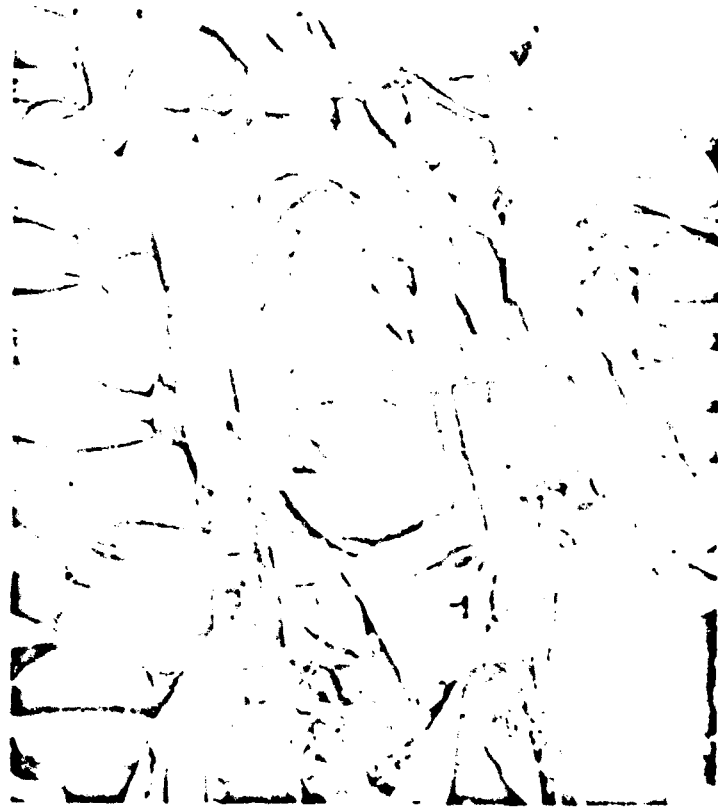


Fig. 2.179 Unit B, D, Remnants of Tentage (Site 1)

TABLE 2.2 - Tentage Evaluation, Site 1, 4,163 ft, Above Ground

I t e m	On Hand Prior to Blast	1*	2	3	4	De- stroyed
Tent, Sectional, End Sections, 1 and 2	8					8
Tent, Sectional, Middle Sections	12					12
Liner, Tent, Sectional, Middle and End Sections	20					20
Vestibule, Tent, Sectional	8					8
Tent, Fire-resistant, Squad, M-1942	1					1
Pins, Tent, 16"	330	294				36
Pins, Tent, 24"	226	203				23
Poles, Tent, Upright, 6'2"	92					92
Poles, Tent, Upright, 8'3"	16					16
Poles, Tent, Upright, 12'3"	16					16
Poles, Tent, Upright, 4'9"	8	3				5
Poles, Tent, Ridge, 17'	1					1
Lines, Tent (Eave, Assorted)	210		171			39

TABLE 2.3 - Tentage Evaluation, Site 1, 4,163 ft, Below Ground

I t e m	On Hand Prior to Blast	1*	2	3	4	De- stroyed
Tent, Sectional, End Sections, 1 and 2	8					8
Tent, Sectional, Middle Sections	12					12
Liner, Tent, Sectional, Middle and End Sections	20					20
Vestibule, Tent, Sectional	None used					
Tent, Fire-resistant, Squad, M-1942	1					1
Pins, Tent, 16"	330	330				
Pins, Tent, 24"	226	226				
Poles, Tent, Upright, 6'2"	92	16				76
Poles, Tent, Upright, 8'3"	16					16
Poles, Tent, Upright, 12'3"	16					16
Poles, Tent, Upright, 4'9"	8	5				3
Poles, Tent, Ridge, 17'	1					1
Lines, Tent (Eave, Assorted)	210	210				

*1 Immediate Use; 2 Field Repair; 3 Depot Repair (TOPNS);

4 Major Repair or Salvage.

2.3.9.3 Site 2, Above Ground

Aboveground tentage of the surgery and X-ray was completely destroyed by fire. The remaining tentage was damaged seriously, but some of it could have been repaired. By consolidation, it is estimated that one tent could have been erected from what remained of the entire aboveground installation. Table 2.4 lists components of tentage under damage criteria. This installation was considered 25 per cent serviceable and would have required 75 per cent replacement.

2.3.9.4 Site 2, Below Ground

Below ground, the tentage sustained moderate damage, but all was considered repairable under field conditions. It was estimated that three of the four tents could have been erected within half a day. Figure 2.180 shows some of the tentage of the below-ground installation. Table 2.5 shows component items of tentage under damage criteria.



Fig. 2.180 X-ray, Aboveground Tentage,
Category 2 (Unit B, Site 2)

TABLE 2.4 - Tentage Evaluation, Site 2, 9,000 ft, Above Ground

I t e m	On Hand Prior to Blast	1*	2	3	4	De- stroyed
Tent, Sectional, End Sections, 1 and 2	8		2		6	
Tent, Sectional, Middle Sections	12		3		9	
Liner, Tent, Sectional, Middle and End Sections	20					20
Vestibule, Tent, Sectional	8					8
Tent, Fire-resistant, Squad, M-1942	1		1			
Pins, Tent, 16"	330	227				103
Pins, Tent, 24"	226	134				92
Poles, Tent, Upright, 6'2"	92	25				67
Poles, Tent, Upright, 8'3"	16	2				14
Poles, Tent, Upright, 12'3"	16	4				12
Poles, Tent, Upright, 4'9"	8	4				4
Poles, Tent, Ridge, 17'	1					1
Lines, Tent (Eave, Assorted)	210	129	35			46

TABLE 2.5 - Tentage Evaluation, Site 2, 9,000 ft, Below Ground

I t e m	On Hand Prior to Blast	1*	2	3	4	De- stroyed
Tent, Sectional, End Sections, 1 and 2	8		8			
Tent, Sectional, Middle Sections	12		12			
Liner, Tent, Sectional, Middle and End Sections	20					20
Vestibule, Tent, Sectional	None used					
Tent, Fire-resistant, Squad, M-1942	1		1			
Pins, Tent, 16"	330	330				
Pins, Tent, 24"	226	226				
Poles, Tent, Upright, 6'2"	92	77				15
Poles, Tent, Upright, 8'3"	16	15				1
Poles, Tent, Upright, 12'3"	16	5	4			7
Poles, Tent, Upright, 4'9"	8	8				
Poles, Tent, Ridge, 17'	1					1
Lines, Tent, (Eave, Assorted)	210		210			

- *1 Immediate Use; 2 Field Repair; 3 Depot Repair (TOPNS);
4 Major Repair or Salvage.

2.3.9.5 Site 3, Above Ground

All of the tentage at Site 3, above ground, was field repairable. Damage sustained consisted of tears in the side walls toward the blast and broken eave-line ropes (Figs. 2.181 and 2.182). It is estimated that all tents could have been placed in serviceable condition within 2 hours. Table 2.6 shows the component items of tentage in accordance with damage criteria.

2.3.9.6 Site 3, Below Ground

Damage sustained in the below-ground installation was minimal and was confined almost exclusively to broken tentpoles. Except for a few minor tears, all canvas was intact. Tents with unbroken poles could have been restored within 1 hour while those with broken poles would have required a somewhat longer time. Table 2.7 lists components of tentage in accordance with damage criteria.

Fig. 2.181 Ward, A, Tear in Tentage,
Category 2 (Unit B, Site 3)

TABLE 2.6 - Tentage Evaluation, Site 3, 15,000 ft, Above Ground

I t e m	On Hand Prior to Blast	1*	2	3	4	De- stroyed
Tent, Sectional, End Sections, 1 and 2	8		8			
Tent, Sectional, Middle Sections	12		12			
Liner, Tent, Sectional, Middle and End Sections	20		20			
Vestibule, Tent, Sectional	8		8			
Tent, Fire-resistant, Squad, M-1942	None used					
Pins, Tent, 16"	288	288				
Pins, Tent, 24"	184	184				
Poles, Tent, Upright, 6'2"	88	85				3
Poles, Tent, Upright, 8'3"	16	14				2
Poles, Tent, Upright, 12'3"	16	16				
Poles, Tent, Upright, 4'9"	None used					
Poles, Tent, Ridge, 17'	None used					
Lines, Tent (Eave, Assorted)	184	116	68			

TABLE 2.7 - Tentage Evaluation, Site 3, 15,000 ft, Below Ground

I t e m	On Hand Prior to Blast	1*	2	3	4	De- stroyed
Tent, Sectional, End Sections, 1 and 2	8		8			
Tent, Sectional, Middle Sections	12		12			
Liner, Tent, Sectional, Middle and End Sections	20	20				
Vestibule, Tent, Sectional	None used					
Tent, Fire-Resistant, Squad, M-1942	None used					
Pins, Tent, 16"	288	288				
Pins, Tent, 24"	184	184				
Poles, Tent, Upright, 6'2"	88	77				11
Poles, Tent, Upright, 8'3"	16	13				3
Poles, Tent, Upright, 12'3"	16	13				3
Poles, Tent, Upright, 4'9"	None used					
Poles, Tent, Ridge, 17'	None used					
Lines, Tent (Eave, Assorted)	184	92	92			

- *1 Immediate Use; 2 Field Repair; 3 Depot Repair (TOPNS);
4 Major Repair or Salvage.



Fig. 2.182 Surgery, A, Tear in Tentage,
Category 2 (Unit B, Site 3)

2.3.10 Electrical Circuits

2.3.10.1 Site 1. 4,163 ft

The generator at Site 1 was found to be still running subsequent to the blast. The circuit breaker on the generator, however, was open, permitting no flow of current to the output side. After a careful check it was determined that the only apparent damage sustained by the generator was to the side panels which were slightly bent as a result of the blast; and the paint on the ground zero was discolored as a result of the initial thermal energy (Fig. 2.183). The entire wiring system, including the main circuits and the subsidiary circuits, was disrupted and, in many instances, burned (Fig. 2.184). Only a small portion of the wire could have been utilized. All circuit breakers in every tent were open (Fig. 2.185). Although the damage sustained by the generator was so slight that it would have been immediately serviceable, the complete wiring system would have required 100 per cent replacement.

2.3.10.2 Site 2. 9,000 ft

The generator at Site 2 was found to be still running subsequent to the blast. The main circuit breaker at the generator was open. There was no apparent damage from the blast or from initial thermal radiation. The main circuit extending from the generator to



Fig. 2.183 Site 1, Generator, 100% Serviceable, Category 1



Fig. 2.184 Site 1, Remnants of Main Wiring Circuit from Generator



Fig. 2.185 Site 1, B, Open Circuit Breakers

the aboveground installation was intact. The main line in the surgical and X-ray tents, however, as well as the subsidiary circuits within these tents, was completely destroyed by fire. The main line and subsidiary circuits extending from the termination of the X-ray tent through the aboveground pharmacy and laboratory, ward, and Unit A tent, as well as the entire main line and subsidiary circuits of the below-ground installation, were intact. All circuit breakers, both above and below ground, were open but were otherwise undamaged with the exception of those burned within the aboveground surgery and X-ray. It is believed that the fires occurring in the aboveground installation resulted from flammable vapors, such as gasoline and ether, being ignited from short circuits occurring within the surgery and X-ray tents as a result of the blast. This belief is based upon the fact that for a minimum of 10 minutes subsequent to the blast there was no evidence of fire at Site 2 from the observation point. After the clearing of the dust cloud from Site 2 there was no evidence of fire until $\pm$ 5 minutes thereafter, when black smoke began to rise from the installation. This smoke was believed to be of such type that it could result only from the burning of a rubberized product or crude petroleum. Since none of the latter was present in the installation, the only source could have been the rubberized tent of the darkroom in the X-ray section. Motion-picture photography during the blast failed to definitely corroborate the cause of the fire. It is believed,

however, that the absence of fire in the other tents of the above- and below-ground installations further supports the assumption of the secondary nature of that fire. It is estimated that 50 per cent of aboveground circuits and 100 per cent of the below-ground circuits could have been restored in a minimum length of time.

2.3.10.9 Site 3, 15,000 ft

The generator at Site 3 was found to be operating subsequent to the blast. The circuit breaker was closed on the generator as well as in each tent. All energized equipment was still functioning and all circuits were intact. There was no apparent damage to the generator and the entire electrical system was considered to be 100 per cent operational.

2.3.11 Construction

The comparative value of the two types of construction utilized in the test in sustaining the forces of an atomic explosion could not be definitely determined. At Site 1, neither type adequately retained the walls of the excavations. In most instances, however, this failure was believed to have been a result of the fires which occurred within these excavations rather than of the forces released from the explosion itself. The sandbagged portion of the excavations (Fig. 2.186) caved in as a result of the sandbags being burned, thereby releasing their contents and destroying their retaining qualities. The stake and chicken wire supported portions were affected in a similar manner. The stakes, being constructed of wood, were consumed by fire, which permitted the then unsupported chicken wire and burlap to collapse (Fig. 2.187). In addition, some of the stakes were broken directly as a result of blast effects. While many of the retaining wires on the stakes had been torn loose from the top of the stakes, the number was insufficient to result in a complete collapse of the retaining walls (Fig. 2.188).

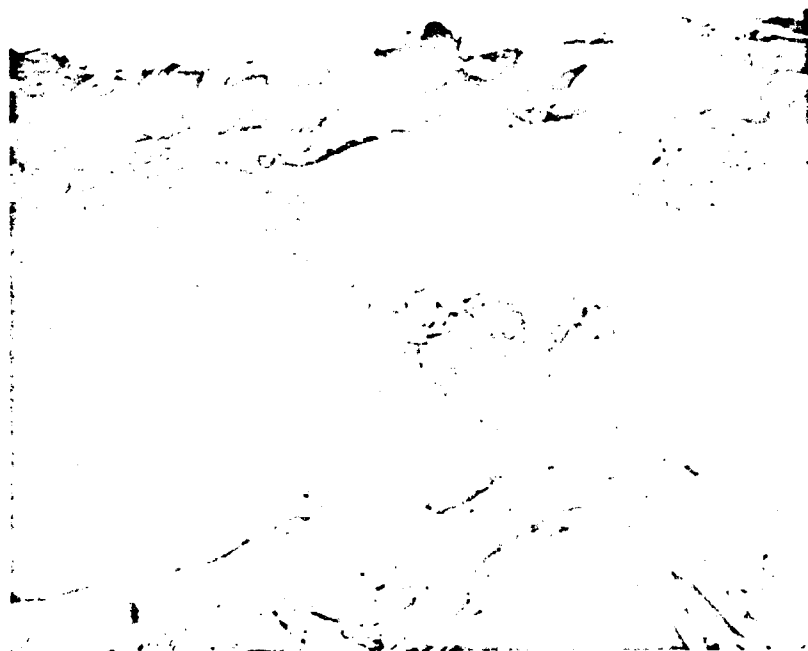


Fig. 2.186 Site 1, Sandbagging Showing Effects of Fire,
Impairing Retaining Characteristics



Fig. 2.187 Site 1, Stake and Chicken Wire and Burlap Showing
Effects of Fire and Breakage of Wooden Stake,
Impairing Retaining Characteristics

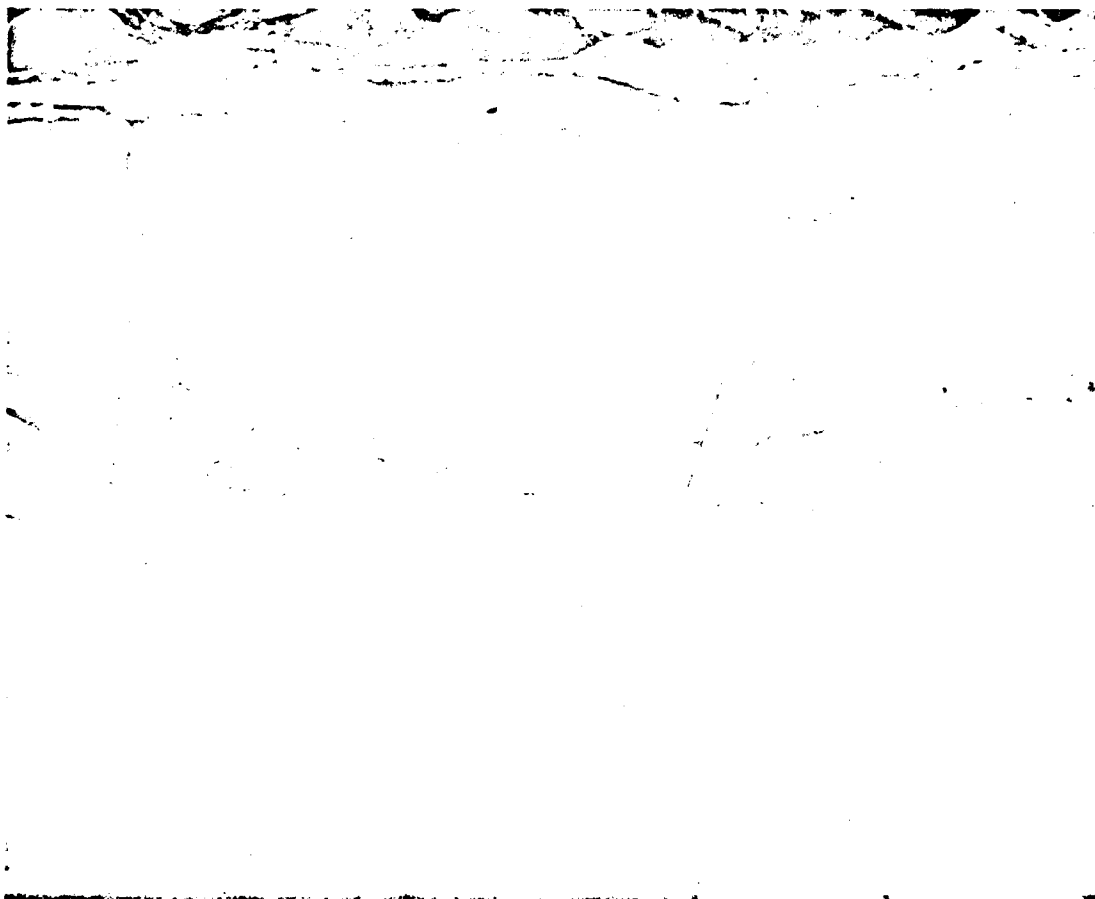


Fig. 2.188 Site 1, Stake Intact but Retaining Wire
Torn Loose from Stake

CHAPTER 3

DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

3.1 DISCUSSION

3.1.1 Casualties

In evaluating the effects sustained by personnel--both patient and operating--in field medical installations functionally established, considerable conjecture had to be undertaken since many of the factors involved in casualty production do not lend themselves to precise scientific methods of evaluation. In the determination of the effects of thermal and nuclear radiations, criteria established in TM 23-200 were utilized. Since the human body is able to withstand overpressures, per se, in excess of those occurring at the three sites, casualty production from the blast phenomena in most cases was attributed to the effects of the contents of the installations becoming secondary missiles. The possibility of the human body itself acting as a missile was considered but was more difficult to evaluate. The types of injury sustained were determined by the mass, configuration, and degree of displacement of entire items or of fragments thereof. Burns resulting from fires have been estimated upon the occurrence, extent, and time of occurrence of fires, and the injuries sustained by personnel as a result of phenomena occurring prior to the fires, i.e., personnel being incapacitated in numbers and extent which would preclude their either moving or being removed from burning areas.

3.1.2 Material and Equipment

The method utilized in the evaluation of damage to equipment has been outlined in paras 1.2.6 and 2.3.1. The reciprocal of the percentage of damage sustained, i.e., the per cent of serviceability, has been utilized in this report since the damage, per se, is not considered to be the primary consideration. In the event of the utilization of mass destruction weapons, the medical service is confronted with the problem of mass casualties: therefore, the degree of serviceability or the ability of medical service installations to provide expeditious and adequate medical care to such casualties is of primary

importance. The degree of damage sustained by any item or by an installation, therefore, becomes secondary, and the utilization of an item immediately or after minor repairs is the primary and immediate concern of the medical service. Likewise, the ability of any installation to care for casualties (even on a limited scale) is of paramount importance. In view of the foregoing, the per cent of serviceability and the utilization of the four categories of serviceability have been employed in lieu of the damage criteria of mild, moderate, and severe, as outlined in TM 23-200.

3.1.3 Installation Operability

Serviceability percentages of installations represent an estimate of the total effects on personnel and equipment. Conclusions reached are subject to considerable variations, and predictions extrapolated to conditions other than those existent at the test site have not been attempted. Neither have attempts been made to determine in what field any installation would have been limited in the detailed care and treatment of patients. In the evaluation of equipment in accordance with damage criteria, however, the placement of certain items in category 2, for example, would be a result of replacing a destroyed component of that item from a like item in a lower category ("cannibalization"), while, if each like item were considered separately and not as a source of component replacement, both items might fall into categories which could not be utilized within the units.

3.1.4 Fires

The critical ignition energy for the tentage used was 25 cal/cm². Except for a litter and a water can which were placed outside the ward tent of each area for kindling and missile comparison, the remainder of the area was scrupulously policed of all combustible materials likely to be seen by the fire ball. Timed technical photography at Site 1 demonstrated no flaming, but a cloud formation which resembled smoke was seen; Site 2 and Site 3 showed no evidence of flaming or smoke. At Sites 1 and 2, fires occurred which, to a certain degree, masked the effects of the atomic phenomena, per se. Attempts were made on evaluation of equipment to differentiate between damage resulting from the primary effects of the bomb and that resulting from fires; such differentiation, however, did not prove feasible. At Site 1 there was a 64 per cent serviceability above ground; while below ground there was 55 per cent, or approximately 10 per cent greater serviceability above ground. At Site 2 there was 66 per cent serviceability above, with 96 below, or 30 per cent greater serviceability below ground. It is believed that at Site 1, below ground, the equipment remaining within a confined area and thereby being subjected to more extensive fires, was a factor responsible for the decrease in serviceability in the below-ground installation. At Site 2, where fires occurred only in the aboveground installations, the conditions

were reversed; and the increase of serviceability below ground, over that which might be anticipated, was a result of the failure of the occurrence of fires in that installation. Therefore, in the absence of fires, the degree of protection afforded to equipment by dug-in installations is probably intermediate between the two situations, or approximately 20 per cent greater for a below-ground than for an aboveground establishment.

3.2 CONCLUSIONS

1. Under the established conditions of the test the results of Project 3.27 were highly satisfactory and, together with other information, will provide data which can be utilized in the fulfillment of the objectives outlined in para 1.1 with regard to the effects on field medical installations.

2. Within the respective overpressure and thermal energy readings of 7.8 - 1.0 psi and 40 - cal/cm², and in the absence of fires, from a comparative analysis of the protection afforded by placing field medical installations in dug-in positions (rather than placing them above ground) it is estimated that the casualty incidence for personnel is reduced 40 to 50 per cent, and the equipment damage is reduced by 20 per cent.

3. A field medical installation above ground, established under current doctrine and with current equipment, subjected to overpressures and thermal energies in excess of 3.0 psi and 9 cal/cm², respectively, may be damaged to such an extent that it would not be able to carry out its complete mission during the required period for area damage control operations, and requirements for eventual operation will more nearly, approximate 100 per cent replacement of personnel and equipment--the closer the conditions approach those of 7.0 psi and 40 cal/cm².

4. In the absence of fires, a field medical installation in a standard dug-in position subjected to overpressures in excess of 3.0 psi but less than 7.0 psi may be considered as capable of partially (90 to 10 per cent) fulfilling its mission during the period of area damage control operations.

5. An installation, either above or below ground, subjected to less than 3.0 psi and 9 cal/cm² may be considered as capable of performing its missions wholly or in part. In the former situation, this capability is estimated to be 70 to 100 per cent and in the latter 90 to 100 per cent.

6. The occurrence of fires in a field medical installation subjected to less than 7.0 psi and $\pm$ 15 cal/cm² will be a primary hazard to both personnel and equipment and, if uncontrolled, will result in such installation becoming incapable of performing its mission.

7. Casualty incidence in an installation subjected to overpressures of 7.0 psi and greater will approach 100 per cent. At pressures lower than 7.0 psi and greater than 2.0 psi and less than 15 cal/cm², injuries will be composed of traumatic wounds and thermal

burns, both from thermal radiation and from fires. It is estimated that in an operating installation 75 per cent to 90 per cent of all casualties will be traumatic in nature, the remaining 10 to 20 per cent being thermal or a combination of injuries.

8. Under conditions of the effects of an air burst weapon, residual radiation may be disregarded as a hazard at distances from ground zero at which other phenomena, blast, thermal, and initial nuclear radiation effects would not have resulted in totally incapacitating a field medical unit to perform its mission.

3.3 RECOMMENDATIONS

With current equipment, and established in accordance with current doctrine for field medical installations, it is considered that the data obtained in Project 3.27 are adequate to meet the objectives of the test; and no further full-scale tests are recommended at the present time.

It is further considered that tests on a smaller scale are desirable to substantiate and expand on the data obtained in Project 3.27.

It is recommended that, with the advent and authorization of newer type shelters and equipment for field medical installations, further non-fullscale testing be conducted for the purpose of determining weapons effects on such equipment.

APPENDIX A

EQUIPMENT LISTS

COMPLETE EQUIPMENT LIST

3-109-100 Bone Set, Extension and Traction, Wire Type, M-2:
3-186-840 Transformer, Cautery, Medium, 110 volt, 60 cycle, AC:
3-238-800 Cystoscope, Double Catheterizing, Brown-Buerger, 16 Fr:
3-268-875 Drainage and Suction Apparatus, Wangenstein Type, Portable:
3-275-600 Electrosurgical Unit, Portable, 110-220 volt, 60 cycle, AC:
3-425-200 Inhalator, Mask Type, Oxygen Therapy Apparatus:
3-457-400 Lamp, Floor Stand, Coakley, 110 volt, AC-DC:
3-467-200 Magnet, Eye, Lancaster, Small, 110 volt, AC-DC:
3-540-200 Otoscope, Electric:
3-540-800 Otoscope and Ophthalmoscope Set, Electric:
3-579-500 Proctosigmoidoscope, Electric, Distal Lighting, Pneumatic Type:
3-579-600 Proctosigmoidoscope, Electric, Proximal Lighting, Pneumatic Type:
3-713-100 Sphygmomanometer, Aneroid:
3-713-200 Sphygmomanometer, Mercurial:
3-752-750 Suction Apparatus, Portable, 110 volt, 60 cycle, AC:
4-017-195 Balance, Harvard Trip, Double Beam:
4-018-400 Balance, Prescription, 120 Gm. Capacity:
4-030-420 Bath, Water, Serological, 110 volt, AC-DC:
4-102-820 Burner, Alcohol, Barthel Type:
4-129-450 Centrifuge, Small, 110 volt, AC-DC:
4-185-225 Colorimeter, Duboscq, Inclined:
4-287-065 Illuminator, Microscope, Substage, Daylight, 110 volt, AC-DC:
4-288-620 Incubator, Bacteriological, Medium, 110-220 volt, AC-DC:
4-315-000 Microscope, Monocular:
4-389-600 Rotating Apparatus, Slide, 110 volt, AC-DC:
4-404-832 Still, Water, Electrically Heated, 1 gal., 110-220 volt, AC-DC:
5-143-250 Chair, Dental Operating, Folding, Field:
5-253-750 Engine, Dental, Foot Pedal Type:
5-389-195 Lathe, Dental Laboratory, Heavy Duty, 110 volt, 60 cycle AC:
6-011-700 Cassette Changer, 110 volt, 60 cycle, AC:
6-012-124 Ghost, X-ray Film, Lead Lined, Empty:
6-013-680 Control Unit and Transformer, X-ray Apparatus, 15 MA, 110-220 volt, 50-60 cycle, AC:
6-014-280 Dryer and Loading Bin Combination, Radiographic, Field, 110 volt, 60 cycle, AC:
6-039-525 Illuminator, Dental Film, 110 volt, AC-DC:

6-040-000 Illuminator, Radiographic Film, Fluorescent, 110 volt,
 60 cycle, AC:
 6-109-800 Mixer, Fluids, 110 volt, AC-DC:
 6-124-310 Processing Machine, Radiographic Paper and Developer
 Packet, 110 volt, 60 cycle, AC:
 6-124-725 Cable Assembly and Radiographic Cone Set, X-ray Apparatus,
 Field:
 6-124-755 Control, X-ray Apparatus, 100 MA, 110-220 volt, 60 cycle, AC:
 6-124-775 Transformer, X-ray Apparatus, 100 MA, 110-220 volt, 60
 cycle, AC:
 6-124-795 Tube Unit Assembly, X-ray Apparatus, Rotating Anode, 100 MA:
 6-127-775 Safelight, Bench or Wall, X-ray Filter:
 6-127-825 Safelight, Coiling, X-ray Filter:
 6-158-100 Table and Tube Stand, Radiographic and Fluoroscopic
 Apparatus, Field:
 6-167-678 Tank, Radiographic Film Processing, Field:
 6-169-250 Tube Stand, X-ray Apparatus, Mobile-Portable:
 6-290-000 Water Conditioning Unit, Radiographic Darkroom, Field,
 110 volt, 60 cycle, AC:
 7-046-010 Chair, Specialist, with Adjustable Lamp:
 7-066-275 Lamp, Operating, Eye, Portable, 110 volt, 60 cycle, AC:
 7-066-325 Lamp, Operating, Field, Portable, 110-220 volt, AC-DC or
 Battery:
 7-081-590 Stand, Instrument, Adjustable, CRM:
 7-084-490 Sterilizer, Dressing and Utensil, Fuel Heated, 16 by 36
 inches, M-2:
 7-084-712 Sterilizer, Instrument, Boiling Type, Fuel Heated, CRM,
 9-3/4 by 3-3/4 by 2-3/8 inches, M-2:
 7-084-735 Sterilizer, Instrument, Boiling Type, Fuel Heated, CRM,
 18 by 10 by 9 inches:
 7-085-352 Heater, Sterilizer, 110-220 volt, AC-DC:
 7-085-400 Stove, Gasoline, 5,000 B. T. U., One Burner:
 7-085-455 Stove, Gasoline, Two Burner, with Metal Case:
 7-093-975 Table, Instrument, Folding, 33 by 18 inches:
 7-098-150 Table, Operating, Folding:
 7-098-175 Table, Operating, Folding, M-2:
 7-099-400 Table, Orthopedic, Portable:
 7-124-100 Lamp, Infra-Red, Incandescent Type, 500 watt, 110 volt,
 AC-DC:
 26-R-228-20 Refrigerator, Mechanically Cooled:
 26-T-160 Table, Camp, Folding, Wood, 36 by 24 inches:

APPENDIX B

EXPLANATORY NOTES B.1 to B.4

TABLES B.1 to B.10

INTRODUCTION

B.1 Of the items exposed in this experiment, certain major items of medical equipment were evaluated by medical equipment maintenance personnel in order to determine the extent of serviceability of each such item before and after the test. The number of items at each location was:

	<u>Site 1</u>	<u>Site 2</u>	<u>Site 3</u>
Above ground	137	130	120
Below ground	134	128	130

B.2 To present gross evaluation data, Tables B.1 through B.10 exhibit each item, its location during experiment, and its percentage of serviceability after experiment. Detailed statistical studies might be conducted from these tables and from the supporting evaluation records on file. Such is not the intent here. Rather, the detailed records have been consolidated into grouped tables, and only such statistics extracted as have been desired for purposes of general discussion. It was considered to be of interest to reduce the tables to arithmetical means, compute standard deviations, and evaluate medians for the items at each location. Since in this report no distinction has been made between "primary" and "secondary" fires, the indication of any effects on items as a result of secondary fires would not be practicable.

B.3 Tables B.1, B.2, B.3, and B.4 are summarizations of the individual sheets used by maintenance technicians in evaluating each item following the test. In several instances, items were not available, and improvised substitutions were used and are so indicated in the tables. In other instances, sufficient items were neither available nor improvised and these are indicated by the word "None" to explain differences in numbers of items at each location.

This collation of the results of the individual evaluation sheets presents considerable basic data required to interpret and support the text.

B.4 Tables B.5, B.6, B.7, B.8, B.9, and B.10 depict the results of placing each evaluated item at each location into the proper category of serviceability represented by the status of 1. immediate usability, 2. repairable for use by operating unit, 3. repairable only at maintenance shop level, or 4. requiring rebuilding or complete salvage.

Such assignment of categories portrays realistically the actual serviceability of each item and of the installation as a unit, equipmentwise.

**TABIE B.1 - Percentage of Serviceability of Each Item
of Equipment in Surgical Tent**

A Above Ground
B Below Ground

Line No.	Catalog No.	Item	Column 1 Site 1 (4,163 ft)	Column 2 Site 2 (9,000 ft)	Column 3 Site 3 (25,000 ft)
1	3-109-100	Bone Set, Extension and Traction, Wire, Type, M-2	A 100 B 0	0	100
2	3-186-840	Transformer, Cautey, Medium, 110 volt, 60 cycle, AC:	A 0 B 0	100	100
3	3-238-800	Cystoscope, Double Catheterizing, Brown-Buegger, 16 Fr:	A 100 B 0	100	100
4	3-275-600	Electrosurgical Unit, Portable, 110-220 volt, 60 cycle, AC:	A 95 B 95	95	100
5	3-540-200	Otoscope, Electric:	A 0 B 0	0	100
6	3-540-800	Otoscope & Ophthalmoscope Set, Electric:	A 0 B 0	0	100
7	3-579-500	Proctosigmoidoscope, Electric, Distal Lighting, Pneumatic Type:	A None B None	0	100
8	3-579-600	Proctosigmoidoscope, Electric, Proximal Lighting Pneumatic Type:	A None B None	None	None
9	3-713-100	Sphygmomanometer, Aneroid:	A 100 100 100 B 100	0 0 100	100 100 100
10	3-713-200	Sphygmomanometer, Mercurial:	A 50 B 0	100 100 100	100 100 100
11	3-752-750	Suction Apparatus, Portable, 100 volt, 60 cycle, AC:	A 85 85 100 B 0 50 75	95 95 95	100 100 100
12	7-066-325	Lamp, Operating, Field, Portable, 110-220 volt, AC-DC or Battery:	A 40 10 50 B 0 50 10	75 70 40	80 80 80
			A 40 10 80 B 75 60 70	100 85 80	70 100 100
				95 60 75	100 100 100

TABLE B.1 (Concl'd.)

A Above Ground
B Below Ground

Line No.	Catalog No.	Item	Column 1 Site 1 (4,163 ft)	Column 2 Site 2 (9,000 ft)	Column 3 Site 3 (15,000 ft)
13	7-081-590	Stand, Instrument, Adjustable, CRM:	A 40 90 80 80 85 100 B 0 90 80 80 80 100 A 100 B 90	90 80 85 85 80 85 100 100 100 100 100 100 100 100	100 100 100 100 100 100 100 100 100 100 100 100 100 100
14	7-084-490	Sterilizer, Dressing and Utensil, Fuel Heated, 16 by 36 inches, M-2:	A 100 85 50 100 80 B 80 100 85 50 100	100 100 60 100 50 100 100 100 100 100	100 100 100 100 100 100 100 100 100 100
15	7-084-735	Sterilizer, Instrument, Boiling Type, Fuel Heated, CRM, 18 by 10 by 9 inches:	A 90 90 90 95 85 90 90 80 85* 90*	95 95 85 90 90 85 100 85 90 90	100 100 100 100 100 100 100 100 100 100
16	7-093-975	Table, Instrument, Folding, 33 by 18 inches:	A 90 90 90 95 85 90 90 80 85* 90*	95 95 85 90 90 85 100 85 90 90	100 100 100 100 100 100 100 100 100 100
17	7-098-150	Table, Operating, Folding:	A 85 90 90 85 50 90 A 30 50 B 50 90	90 90 85 100 100 100 100 100 100 100	100 100 100 100 100 100 100 100 100 100
18	7-098-175	Table, Operating, Folding, M-2:	A 85 90 90 85 50 90 A 30 50 B 50 90	90 90 85 100 100 100 100 100 100 100	100 100 100 100 100 100 100 100 100 100
19	7-099-400	Table, Orthopedic, Portable:	A 0 B 90	None None	None None
20		Average Per Cent Above Ground	A 70 B 63	63	97
		Average Per Cent Below Ground		58	99

*For improvised table, arbitrary estimate of serviceability is assumed.

TABLE B.2 - Percentage of Serviceability of Each Item of
Equipment in X-ray and Clinics Tent

A Above Ground
B Below Ground

Line No.	Catalog No.	Item	Column 1 Site 1 (4,163 ft)	Column 2 Site 2 (9,000 ft)	Column 3 Site 3 (15,000 ft)
1	3-457-400	Lamp, Floor Stand, Coakley, 110 volt, AC-DC:	A 10 B 90	15 100	100 100
2	3-467-200	Magnet, Eye, Lancoaster, Small, 110 volt, AC-DC:	A 0 B 90	20 100	100 100
3	4-287-065	Illuminator, Microscope, Substage, Daylight, 110 volt, AC-DC:	A None B 0	0 0	95 95
4	5-143-250	Chair, Dental Operating, Folding, Field:	A 85 B 65	60 100	100 100
5	5-253-750	Engine, Dental, Foot Pedal Type:	A 55 B 0	60 60	90 100
6	5-389-195	Lathe, Dental Laboratory, Heavy Duty, 110 volt, 60 cycle, AC:	A 100 B 95	100 100	100 100
7	6-011-700	Cassette Changer, 110 volt, 60 cycle, AC:	A 80 B 85	90 50	100 100
8	6-012-124	Chest, X-ray Film, Lead Lined, Empty:	A 85 85 B 0 0	100 None 100 None	100 None 100 None
9	6-013-680	Control Unit and Transformer, X-ray Apparatus, 15 MA, 110-220 volt, 50-60 cycle, AC:	A 50 50 B 50 50	90 50 100 95	100 100 100 100
10	6-014-280	Dryer and Loading Bin Combination, Radiographic, Field, 110 volt, 60 cycle, AC:	A 95 B 85	70 100	100 100
11	6-039-525	Illuminator, Dental Film, 110 volt, AC-DC:	A 10 B 0	5 100	100 100

TABLE B.2 (Cont'd.)

A Above Ground
B Below Ground

Line No.	Catalog No.	Item	Column 1 Site 1 (4,163 ft)	Column 2 Site 2 (9,000 ft)	Column 3 Site 3 (15,000 ft)
12	6-040-000	Illuminator, Radiographic Film, Fluorescent, 110 volt, 60 cycle, AC:	A 45 0 0 45 0 45 75	0 45 0 0 0 0 None	100 98 98 98 100 None None
13	6-109-800	Mixer, Fluids, 110 volt, AC-DC:	B 5 10 0 0 0 0 None	100 100 100 100 100 100 None	100 100 100 100 100 100 None
14	6-124-310	Processing Machine, Radiographic Paper and Developer Packet, 110 volt, 60 cycle, AC:	A 90 B 0	0 100 100	100 99 100
15	6-124-725	Cable, Assembly and Radiographic Comp. Set, X-ray Apparatus, Field:	A 0 B 0	0 100 100	100 100 100
16	6-124-755	Control, X-ray Apparatus, 100 MA, 110-220 volt, 60 cycle, AC:	A 75 B 90	80 95 100	90 100 100
17	6-124-775	Transformer, X-ray Apparatus, 100 MA, 110-220 volt, 60 cycle, AC:	A 100 B 90	100 100 100	95 90 100
18	6-124-795	Tube Unit Assembly, X-ray Apparatus, Rotating Anode, 100 MA:	A 95 B 0	50 100 100	100 100 100
19	6-127-775	Safelight, Bench or Wall, X-ray Filter:	A 45 0 B 20 0	55 0 100 100 100	100 90 100 100 100
20	6-127-825	Safelight, Ceiling, X-ray Filter:	A 0 B 0	0 100 100	90 100 100
21	6-158-100	Table and Tube Stand, Radiographic and Fluoroscopic Apparatus, Field:	A 30 20 B 30 35	30 20 100 90 100	100 95 100 100 100

TABLE B.2 (Concl'd.)

A Above Ground
B Below Ground

Line No.	Catalog No.	Item	Column 1 Site 1 (4,163 ft)	Column 2 Site 2 (9,000 ft)	Column 3 Site 3 (15,000 ft)
22	6-167-678	Tank, Radiographic Film Processing, Field:	A 90 B 15	75 100	100 100
23	6-169-250	Tube Stand, X-ray Apparatus, Mobile-Portable:	A 90 B 95	90 100	100 100
24	6-290-000	Water Conditioning Unit, Radiographic Darkroom, Field, 110 volt, 60 cycle, AC:	A 97 B 0	35 100	100 100
25	7-046-010	Chair, Specialist, with Adjustable Lamp:	A 70 B 65	65 95	65 98
26	7-066-275	Lamp, Operating, Eye, Portable, 110 volt, 60 cycle, AC:	A 0 B 10	0 85	0 85
27	7-084-712	Sterilizer, Instrument, Boiling Type, Fuel Heated, CRM, 9-3/4 by 3-3/4 by 2-3/8 inches, M-2:	A 0 B 0	30 95	100 100
28	7-084-735	Sterilizer, Instrument, Boiling Type, Fuel Heated, CRM, 18 by 10 by 9 inches:	A 100 B 25	100 25	100 100
29	7-098-175	Table, Operating, Folding, M-2:	A 35 B 80	35 100	100 100
30		Average Per Cent Above Ground Average Per Cent Below Ground	A 52 B 31	38 95	98 94

TABLE B.3 - Percentage of Serviceability of Each Item of Equipment in Pharmacy and Laboratory Tent

A Above Ground
B Below Ground

Line No.	Catalog No.	Item	Column 1 Site 1 (4,163 ft)	Column 2 Site 2 (9,000 ft)	Column 3 Site 3 (15,000 ft)
1	4-017-195	Balance, Harvard Trip, Double Beam:	A 90 B 10	40	95
2	4-018-400	Balance, Prescription, 120 Gm. Capacity:	A 0 0 B 0 0	50 80 90 90	90 95 100 100
3	4-030-420	Bath, Water, Serological, 110 volt, AC-DC:	A 85 B 10	None None	None None
4	4-102-820	Burner, Alcohol, Barthel Type:	A 0 95 0 B 10 10 10	90 65 85 100 100 100	100 100 100 100 100 100
5	4-129-450	Centrifuge, Small, 110 volt, AC-DC:	A 25 90 B 20 20	80 70 100 100	80 95 100 100
6	4-185-225	Colorimeter, Duboscq, Inclined:	A 0 B 85	90 90	90 100
7	4-287-065	Lamp, Microscopic, Substage, Daylight, 110 volt, AC-DC:	A 50 75 75 B 90 80 0	80 85 85 90 90 90	100 95 95 95 95 95
8	4-288-620	Incubator, Bacteriological, Medium, 110-220 volt, AC-DC:	A 10 B 10	75 90	95 95
9	4-315-000	Microscope, Monocular:	A 70 90 5 B 85 75 0	65 85 90 90 75 90	90 90 95 95 90 100
10	4-389-600	Rotating Apparatus, Slide, 110 volt, AC-DC:	A 35 B 10	65 95	90 80
11	4-404-832	Still, Water, Electrically Heated, 1 gal., 110-220 volt, AC-DC:	A 15 20 B 30 30	70 60 80 85	90 85 100 90
12	7-085-455	Stove, Gasoline, Two Burner, with Metal Case:	A 70 20 B 0 0	80 95 80 95	80 100 100 100
13	26-R-228-20	Refrigerator, Mechanically Cooled:	A 10 B 10	90 90	90 100
14		Average Per Cent Above Ground Average Per Cent Below Ground	A 40 B 27	76 91	93 97

TABLE B.4 - Percentage of Serviceability of Each Item
of Equipment in Ward Tent

A Above Ground
B Below Ground

Line No.	Catalog No. Item	Column 1 Site 1 (4,163 ft.)	Column 2 Site 2 (9,000 ft.)	Column 3 Site 3 (15,000 ft.)
1	3-268-075 Drainage and Suction Apparatus, Wangensteen Type, Portable:	A 90 90 90 B 90 90 85	90 90 90 92 95 95	100 100 100 100 100 100
2	3-425-200 Inhalator, Mask Type, Oxygen Therapy Apparatus:	A 75 90 50 85 80 75 55 70 45 80	95 95 90 95 95 95 85 85 85 40	100 100 100 100 100 100 85 90 100 100
3	3-713-200 Sphygmomanometer, Mercurial:	A 80 B 0	0 90	100 100
4	3-752-750 Suction Apparatus, Portable, 110 volt, 60 cycle, AC:	A 40 B 75	None None	100 100
5	7-084-712 Sterilizer, Instrument, Boiling Type, Fuel Heated, CRM, 9-3/4 by 3-3/4 by 2-3/8 inches, M-2:	A 20 B 60	100 90	None None
6	7-084-735 Sterilizer, Instrument, Boiling Type, Fuel Heated, CRM, 18 by 10 by 9 inches:	A 0 B 90	90 90	100 100
7	7-085-352 Heater, Sterilizer, 110-220 volt, AC-DC:	A None B 0	None None	None None
8	7-085-400 Stove, Gasoline, 5,000 B.T.U., One Burner:	A 90 90 B 90 90	100 100 100 100	100 100 100 100
9	7-124-100 Lamp, Infra-Red, Incandescent Type, 500 watt, 110 volt, AC-DC:	A 50 B 45	40 85	100 100
10	26-T-160 Table, Camp, Folding, Wood, 36 by 24 inches:	A 0 0 0 0 0 0 0 0 0	95 100 None NoneNoneNone NoneNone	100 100 None NoneNoneNone 100 100
11	Average Per Cent Above Ground Average Per Cent Below Ground	A 50 B 53	82 91	99 99

TABLE B.5 - Serviceability of Each Item of Equipment
by Damage Criteria in Surgical Section

Line No.	Catalog No.	Item	Column 1 4,163 ft Site				Column 2 9,000 ft Site				Column 3 15,000 ft Site					
			1*	2	3	4	1	2	3	4	1	2	3	4		
1	3-109-100	Bone Set, Extension and Traction, Wire Type, M-2:	A	1	0	0	0	0	0	0	0	1	1	0	0	0
2	3-186-840	Transformer, Cautery, Medium, 110 volt, 60 cycle, AC:	B	0	0	0	1	1	0	0	0	0	1	0	0	0
3	3-238-800	Cystoscope, Double Catheterizing, Brown-Burger, 16 Fr:	A	0	0	0	1	1	0	0	0	0	1	0	0	0
4	3-275-600	Electrosurgical Unit, Portable, 110-220 volt, 60 cycle, AC:	B	0	0	0	1	1	0	0	0	0	1	0	0	0
5	3-540-200	Otoscope, Electric:	A	0	0	0	1	0	0	0	1	1	0	0	0	0
6	3-540-800	Otoscope and Ophthalmoscope Set, Electric:	B	0	0	0	1	1	0	0	0	0	1	0	0	0
7	3-579-500	Proctosigmoidoscopy, Electric, Distal Lighting, Pneumatic Type:	A	0	0	0	1	0	0	0	1	1	0	0	0	0
8	3-579-600	Proctosigmoidoscopy, Electric, Proximal Lighting, Pneumatic Type:	B	0	0	0	1	1	0	0	0	0	1	0	0	0
9	3-713-100	Sphygmomanometer, Aneroid:	A	None	None	None	None	None	None	None	None	None	None	None	None	None
			B	None	None	None	None	None	None	None	None	None	None	None	None	None
10	3-713-200	Sphygmomanometer, Mercorial:	A	4	0	0	0	1	0	0	3	4	0	0	0	0
			B	1	0	1	2	4	0	0	0	4	0	0	0	0
11	3-752-750	Suction Apparatus, Portable, 110 volt, 60 cycle, AC:	A	0	0	0	1	0	0	0	1	1	0	0	0	0
			B	0	0	0	1	1	0	0	0	1	0	0	0	0
			A	2	1	0	0	3	0	0	0	3	0	0	0	0
			B	1	0	1	1	3	0	0	0	3	0	0	0	0

*1 Immediate Use; 2 Field Repair; 3 Depot Repair (TOPNS); 4 Major Repair or Salvage.

CONFIDENTIAL - RESTRICTED DATA

TABLE B.5 (Concl'd.)

Line No.	Catalog No.	Item	Column 1 /,163 ft Site				Column 2 9,000 ft Site				Column 3 15,000 ft Site			
			1	2	3	4	1	2	3	4	1	2	3	4
12	7-066-325	Lamp, Operating, Field, Portable, 110-220 volt, AC-DC or Battery:	A	1	0	3	2	3	1	2	0	6	0	0
			B	5	0	0	1	4	2	0	0	6	0	0
13	7-081-590	Stand, Instrument, Adjustable, CRM:	A	5	0	1	0	6	0	0	0	6	0	0
			B	6	0	0	0	6	0	0	0	6	0	0
14	7-084-490	Sterilizer, Dressing and Utensil, Fuel Heated, 16 by 36 inches, M-2:	A	1	0	0	0	1	0	0	0	1	0	0
			B	1	0	0	0	1	0	0	0	1	0	0
15	7-084-735	Sterilizer, Instrument, Boiling Type, Fuel Heated, CRM, 18 by 10 by 9 inches:	A	4	1	0	0	3	2	0	0	5	0	0
			B	4	1	0	0	5	0	0	0	5	0	0
16	7-093-975	Table, Instrument, Folding, 33 by 18 inches:	A	10*	0	0	0	10	0	0	0	10	0	0
			B	10	0	0	0	10	0	0	0	10	0	0
17	7-098-150	Table, Operating, Folding:	A	3	0	0	0	3	0	0	0	3	0	0
			B	3	0	0	0	3	0	0	0	3	0	0
18	7-098-175	Table, Operating, Folding, M-2:	A	1	1	0	0	0	0	2	0	2	0	0
			B	1	1	0	0	2	0	0	0	2	0	0
19	7-099-400	Table, Orthopedic, Portable:	A	0	0	0	1	None	None	None	None	None	None	None
			B	1	0	0	0	None	None	None	None	None	None	None
20		Total Above Ground	A	34	3	4	7	33	3	4	8	48	0	0
		Total Below Ground	B	34	2	2	10	46	2	0	0	48	0	0

*For two improvised tables, arbitrary estimate of serviceability is assumed.

TABLE B.6 - Serviceability of Each Item of Equipment
by Damage Criteria in X-ray Section

A Above Ground
B Below Ground

Line No.	Catalog No.	Item	Column 1 4,163 ft Site				Column 2 9,000 ft Site				Column 3 15,000 ft Site			
			1*	2	3	4	1	2	3	4	1	2	3	4
1	6-011-700	Cassette Changer, 110 volt, 60 cycle, AC:	A	1	0	0	0	1	0	0	0	None		
			B	1	0	0	0	1	0	0	0	1	0	0
2	6-012-124	Chest, X-ray Film, Lead Linod, Empty:	A	2	0	0	0	1	0	0	0	1	0	0
			B	0	0	0	2	1	0	0	0	1	0	0
3	6-013-680	Control Unit and Transformer, X-ray Apparatus, 15 MA, 110-220 volt, 50-60 cycle, AC:	A	0	0	2	0	1	0	1	0	2	0	0
			B	1	0	0	1	2	0	0	0	2	0	0
4	6-014-280	Dryer and Loading Bin Combination, Radiographic, Field, 110 volt, 60 cycle, AC:	A	1	0	0	0	1	0	0	0	1	0	0
			B	1	0	0	0	1	0	0	0	1	0	0
5	6-039-525	Illuminator, Dental Film, 110 volt, AC-DC:	A	0	1	0	0	0	0	0	1	1	0	0
			B	0	0	0	1	1	0	0	0	1	0	0
6	6-040-000	Illuminator, Radiographic Film, Fluorescent, 110 volt, 60 cycle, AC:	A	1	2	4	0	0	0	1	5	5	0	0
			B	0	0	0	6	6	0	0	0	6	0	0
7	6-109-800	Mixer, Fluids, 110 volt, AC-DC:	A	0	0	1	0	1	0	0	0	1	0	0
			B	0	0	0	1	1	0	0	0	1	0	0
8	6-124-310	Processing Machine, Radiographic Paper and Developer Packet, 110 volt, 60 cycle, AC:	A	1	0	0	0	0	0	0	1	1	0	0
			B	0	0	0	1	1	0	0	0	1	0	0
9	6-124-725	Cable Assembly and Radiographic Cone Set, X-ray Apparatus, Field:	A	0	0	0	1	0	0	0	1	1	0	0
			B	0	0	0	1	1	0	0	0	1	0	0
10	6-124-755	Control, X-ray Apparatus, 100 MA, 110-220 volt, 60 cycle, AC:	A	0	1	0	0	1	0	0	0	1	0	0
			B	0	1	0	0	1	0	0	0	1	0	0

*1 Immediate Use; 2 Field Repair; 3 Depot Repair (TOPNS); 4 Major Repair or Salvage.

A Above Ground
B Below Ground

TABLE B.6 (Cont'd.)

Line No.	Catalog No.	Item	Column 1 4,163 ft Site				Column 2 9,000 ft Site				Column 3 15,000 ft Site			
			1	2	3	4	1	2	3	4	1	2	3	4
11	6-124-775	Transformer, X-ray Apparatus, 100 MA, 110-220 volt, 60 cycle, AC:	A	1	0	0	0	1	0	0	0	1	0	0
			B	0	1	0	0	1	0	0	0	1	0	0
12	6-124-795	Tube Unit Assembly, X-ray Apparatus, Rotating Anode, 100 MA:	A	1	0	0	0	0	0	1	0	1	0	0
			B	0	0	0	1	1	0	0	0	1	0	0
13	6-127-775	Safelight, Bench or Wall, X-ray Filter:	A	1	0	0	1	1	0	0	1	2	0	0
			B	0	2	0	0	2	0	0	0	2	0	0
14	6-127-825	Safelight, Ceiling, X-ray, Filter:	A	0	0	0	1	0	0	0	1	1	0	0
			B	0	0	0	1	1	0	0	0	1	0	0
15	6-158-100	Table and Tube Stand, Radiographic and Fluoroscopic Apparatus, Field:	A	0	2	0	0	0	0	1	1	2	0	0
			B	0	2	0	0	2	0	0	0	2	0	0
16	6-167-678	Tank, Radiographic Film Processing, Field:	A	1	0	0	0	0	1	0	0	1	0	0
			B	0	1	0	0	1	0	0	0	1	0	0
17	6-169-250	Tube Stand, X-ray Apparatus, Mobile-Portable:	A	1	0	0	0	1	0	0	0	1	0	0
			B	1	0	0	0	1	0	0	0	1	0	0
18	6-290-000	Water Conditioning Unit, Radiographic Darkroom, Field, 110 volt, 60 cycle, AC:	A	1	0	0	0	0	0	0	1	1	0	0
			B	0	0	0	1	1	0	0	0	1	0	0
19		Total Above Ground	A	12	6	7	3	9	1	4	12	24	0	0
		Total Below Ground	B	4	7	0	16	26	0	0	0	26	0	0

TABLE B.7 - Serviceability of Each Item of Equipment
by Damage Criteria in Clinics Section

A Above Ground
B Below Ground

Line No.	Catalog No.	Item	Column 1 4,163 ft Site				Column 2 9,000 ft Site				Column 3 15,000 ft Site			
			1*	2	3	4	1	2	3	4	1	2	3	4
1	3-457-400	Lamp, Floor Stand, Coakley, 110 volt, AC-DC:	A	0	0	0	1	0	0	0	1	1	0	0
2	3-467-200	Magnet, Eye, Lancaster, Small, 110 volt, AC-DC:	A	0	0	0	1	0	0	0	1	1	0	0
3	4-287-065	Illuminator, Microscope, Substage, Daylight, 110 volt, AC-DC:	A	0	0	0	0	0	0	0	1	1	0	0
4	5-143-250	Chair, Dental Operating, Folding, Field:	B	0	0	0	1	0	0	0	1	1	0	0
5	5-253-750	Engine, Dental, Foot Pedal Type:	A	1	0	0	0	1	0	0	0	1	0	0
6	5-389-195	Lathe, Dental Laboratory, Heavy Duty, 110 volt, 60 cycle, AC:	B	1	0	0	0	1	0	0	0	1	0	0
7	7-046-010	Chair, Specialist, with Adjustable Lamp:	A	0	2	0	0	1	0	0	1	2	0	0
8	7-066-275	Lamp, Operating, Eye, Portable, 110 volt, 60 cycle, AC:	A	0	0	0	2	0	0	0	2	2	0	0
9	7-084-712	Sterilizer, Instrument, Boiling Type, Fuel Heated, CRM, 9-3/4 by 3-3/4 by 2-3/8 inches, M-2:	B	0	0	0	1	1	0	0	0	1	0	0
10	7-084-735	Sterilizer, Instrument, Boiling Type, Fuel Heated, CRM, 18 by 10 by 9 inches:	A	4	0	0	0	2	0	2	0	4	0	0
11	7-098-175	Table, Operating, Folding, M-2:	B	0	1	3	0	4	0	0	0	4	0	0
12		Total Above Ground	A	1	0	0	0	1	0	0	0	1	0	0
		Total Below Ground	B	1	0	0	0	1	0	0	0	1	0	0
			A	8	2	0	5	7	0	3	6	16	0	0
			B	7	1	3	5	15	0	0	1	16	0	0

*Immediate Use; 2 Field Repair; 3 Depot Repair (TOPNS); 4 Major Repair or Salvage.

TABLE B.8 - Serviceability of Each Item of Equipment
by Damage Criteria in Pharmacy Section

A Above Ground
B Below Ground

Line No.	Catalog No.	Item	Column 1 4,163 ft Site				Column 2 9,000 ft Site				Column 3 15,000 ft Site			
			1*	2	3	4	1	2	3	4	1	2	3	4
1	4-018-400	Balance, Prescription, 120 Gm.Capacity:	A	0	0	0	2	0	0	2	0	0	0	0
			B	0	0	0	2	2	0	0	0	0	0	0
2	7-085-455	Stove, Gasoline, Two Burner, with Metal Case:	A	0	0	1	0	1	0	0	0	1	0	0
			B	0	0	0	1	1	0	0	0	1	0	0
3	26-R-228-20	Refrigerator, Mechanically Cooled:	A	0	0	0	1	1	0	0	0	1	0	0
			B	0	0	0	1	1	0	0	0	1	0	0
4		Total Above Ground	A	0	0	1	3	2	0	2	0	4	0	0
		Total Above Ground	B	0	0	0	4	4	0	0	0	4	0	0

*1 Immediate Use; 2 Field Repair; 3 Depot Repair (TOPNS); 4 Major Repair or Salvage.

TABLE B.9 - Serviceability of Each Item of Equipment
by Damage Criteria in Laboratory Section

A Above Ground
B Below Ground

Line No.	Catalog No.	Item	Column 1 4,163 ft Site 1* 2 3 4				Column 2 9,000 ft Site 1 2 3 4				Column 3 15,000 ft Site 1 2 3 4								
1	4-017-195	Balance, Harvard Trip, Double Beam:	A	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	
			B	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	
2	4-030-420	Bath, Water, Serological, 110 volt, AC-DC:	A	1	0	0	0	0	0	None	None	None	None	None	None	None	None	None	
			B	0	0	0	1	0	0	None	None	None	None	None	None	None	None	None	
3	4-102-820	Burner, Alcohol, Barthel Type:	A	1	0	0	0	0	3	3	0	0	0	0	3	0	0	0	
			B	0	0	0	3	3	0	0	0	0	0	3	0	0	0	0	
4	4-129-450	Centrifuge, Small, 110 volt, AC-DC:	A	1	0	1	0	2	0	0	0	2	0	0	0	2	0	0	0
			B	1	0	1	0	2	0	0	0	2	0	0	0	2	0	0	0
5	4-184-225	Colorimeter, Duboscq, Inclined:	A	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0
			B	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0
6	4-287-065	Lamp, Microscope, Substage, Daylight, 110 volt, AC-DC:	A	2	0	1	0	3	0	0	0	3	0	0	0	3	0	0	0
			B	2	0	0	1	3	0	0	0	3	0	0	0	3	0	0	0
7	4-288-620	Incubator, Bacteriological, Medium, 110-220 volt, AC-DC:	A	0	0	0	1	0	0	1	0	0	1	0	1	1	0	0	0
			B	0	0	0	1	1	0	0	0	1	0	0	0	1	0	0	0
8	4-315-000	Microscope, Monocular:	A	1	0	1	1	2	0	1	0	2	0	1	0	3	0	0	0
			B	1	0	1	1	2	0	1	0	2	0	1	0	3	0	0	0
9	4-389-600	Rotating Apparatus, Slide, 110 volt, AC-DC:	A	0	0	1	0	1	0	0	0	1	0	0	0	1	0	0	0
			B	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0
10	4-404-832	Still, Water, Electrically Heated, 1 gal., 110-220 volt, AC-DC:	A	1	0	1	0	2	0	0	0	2	0	0	0	2	0	0	0
			B	2	0	0	0	2	0	0	0	2	0	0	0	2	0	0	0
11	7-085-455	Stove, Gasoline, Two Burner, with Metal Case:	A	0	1	0	0	1	0	0	0	1	0	0	0	1	0	0	0
			B	0	0	0	1	1	0	0	0	1	0	0	0	1	0	0	0
12		Total Above Ground	A	8	1	5	5	15	0	3	0	15	0	3	0	18	0	0	0
		Total Below Ground	B	8	0	3	8	17	0	1	0	17	0	1	0	18	0	0	0

*1 Immediate Use; 2 Field Repair; 3 Depot Repair (TOPNS); 4 Major Repair or Salvage.

TABLE B.9 - Serviceability of Each Item of Equipment
by Damage Criteria in Laboratory Section

A Above Ground
B Below Ground

Line No.	Catalog No.	Item	Column 1 4,163 ft Site				Column 2 9,000 ft Site				Column 3 15,000 ft Site			
			1*	2	3	4	1	2	3	4	1	2	3	4
1	4-017-195	Balance, Harvard Trip, Double Beam:	A	1	0	0	0	0	0	1	0	0	0	0
			B	0	0	1	0	1	0	0	1	0	0	0
2	4-030-420	Bath, Water, Serological, 110 volt, AC-DC:	A	1	0	0	0	1	None	None	None	None	None	None
			B	0	0	0	1	None	None	None	None	None	None	None
3	4-102-820	Burner, Alcohol, Barthel Type:	A	1	0	0	0	3	0	0	0	0	0	0
			B	0	0	0	3	3	0	0	0	0	0	0
4	4-129-450	Centrifuge, Small, 110 volt, AC-DC:	A	1	0	1	0	2	0	0	0	0	0	0
			B	1	0	1	0	2	0	0	0	0	0	0
5	4-185-225	Colorimeter, Dubosq, Inclined:	A	0	0	0	0	1	0	0	0	0	0	0
			B	1	0	0	0	1	0	0	0	0	0	0
6	4-287-065	Lamp, Microscope, Substage, Daylight, 110 volt, AC-DC:	A	2	0	1	0	3	0	0	0	0	0	0
			B	2	0	0	1	3	0	0	0	0	0	0
7	4-288-620	Incubator, Bacteriological, Medium, 110-220 volt, AC-DC:	A	0	0	0	1	0	0	1	0	0	0	0
			B	0	0	0	1	1	0	0	0	0	0	0
8	4-315-000	Microscope, Monocular:	A	1	0	1	1	2	0	1	0	3	0	0
			B	1	0	1	1	2	0	1	0	3	0	0
9	4-389-600	Rotating Apparatus, Slide, 110 volt, AC-DC:	A	0	0	1	0	1	0	0	0	1	0	0
			B	1	0	0	0	1	0	0	0	1	0	0
10	4-404-832	Still, Water, Electrically Heated, 1 gal., 110-220 volt, AC-DC:	A	1	0	1	0	2	0	0	0	2	0	0
			B	2	0	0	0	2	0	0	0	2	0	0
11	7-085-455	Stove, Gasoline, Two Burner, with Metal Case:	A	0	1	0	0	1	0	0	0	1	0	0
			B	0	0	0	1	1	0	0	0	1	0	0
12		Total Above Ground	A	8	1	5	5	15	0	3	0	18	0	0
		Total Below Ground	B	8	0	3	8	17	0	1	0	18	0	0

*1 Immediate Use; 2 Field Repair; 3 Depot Repair (TOPNS); 4 Major Repair or Salvage.

TABLE B.10 - Serviceability of Each Item of Equipment
by Damage Criteria in Ward Section

Line No.	Catalog No.	Item	Column 1 4,163 ft Site	Column 2 9,000 ft Site	Column 3 15,000 ft Site
1	3-268-875	Drainage and Suction Apparatus, Wangersteen Type, Portable	A 6 0 0 0 B 4 1 1 0	1 2 3 4 6 0 0 0 6 0 0 0	1 2 3 4 6 0 0 0 6 0 0 0
2	3-425-200	Inhalator, Mask Type, Oxygen Therapy Apparatus	A 2 0 2 0 B 1 0 3 0	2 0 2 0 1 0 3 0	3 0 1 0 3 0 1 0
3	3-724-200	Sphygmomanometer, Mercurial:	A 1 0 0 0 B 0 0 0 1	1 0 0 0 1 0 0 0	1 0 0 0 1 0 0 0
4	3-752-750	Suction Apparatus, Portable, 110 volt, 60 cycle, AC:	A 1 0 0 0 B 1 0 0 0	None None	1 0 0 0 1 0 0 0
5	7-084-712	Sterilizer, Instrument, Boiling Type, Fuel Heated, CRM, 9-3/4 by 3-3/4 by 2-3/8 inches, M-2:	A 0 0 1 0 B 0 0 1 0	1 0 0 0 1 0 0 0	None None
6	7-084-735	Sterilizer, Instrument, Boiling Type, Fuel Heated, CRM, 18 by 10 by 9 inches:	A 1 0 0 0 B 1 0 0 0	1 0 0 0 1 0 0 0	1 0 0 0 1 0 0 0
7	7-085-352	Heater, Sterilizer, 110-220 volt, AC-DC:	A None B 0 0 0 1	None None	None None
8	7-085-400	Stove, Gasoline, 5,000 B.T.U., One Burner:	A 2 0 0 0 B 2 0 0 0	2 0 0 0 2 0 0 0	2 0 0 0 2 0 0 0
9	7-124-100	Lamp, Infra-Red, Incandescent Type, 500 watt, 110 volt, AC-DC:	A 0 0 0 6 B 1 0 0 0	2 0 0 0 1 0 0 0	2 0 0 0 1 0 0 0
10	26-T-160	Table, Camp, Folding, Wood, 36 by 24 inches:	A 0 0 0 6 B 0 0 0 2	2 0 0 0 None	2 0 0 0 2 0 0 0
11		Total Above Ground	A 17 0 3 6 B 10 1 5 4	16 0 2 0 13 0 3 0	17 0 1 0 17 0 1 0

*1 Immediate Use; 2 Field Repair; 3 Depot Repair (TOPNE); 4 Major Repair or Salvage.

UNCLASSIFIED

ITEMS OMITTED AT SITE 1

Items	Above Ground	Below Ground
3-579-500 Proctosigmoidoscope, Electric, Distal Lighting, Pneumatic Type:	x	x
3-579-600 Proctosigmoidoscope, Electric, Proximal Lighting, Pneumatic Type:	x	x
4-287-065 Illuminator, Microscope, Substage, Daylight, 110 volt, AC-DC:	x	
7-085-352 Heater, Sterilizer, 110-220 volt, AC-DC:	x	

ITEMS OMITTED AT SITE 2

3-579-600 Proctosigmoidoscope, Electric, Proximal Lighting, Pneumatic Type:	x	x
3-752-750 Suction apparatus, Portable, 110 volt, 60 cycle, AC:	x	x
4-030-420 Bath, Water, Serological, 110 volt, AC-DC:	x	x
7-085-352 Heater, Sterilizer, 110-220 volt, AC-DC:	x	x
7-099-400 Table, Orthopedic, Portable:	x	x
26-T-160 Table, Camp, Folding, Wood, 36 by 24 inches:		x

ITEMS OMITTED AT SITE 3

3-579-500 Proctosigmoidoscope, Electric, Distal Lighting, Pneumatic Type:		x
3-579-600 Proctosigmoidoscope, Electric, Proximal Lighting, Pneumatic Type:	x	
4-030-420 Bath, Water, Serological, 110 volt, AC-DC:	x	
6-011-700 Cassette Changer, 110 volt, 60 cycle, AC:	x	
7-085-352 Heating, Sterilizer, 110-220 volt, AC-DC:	x	x
7-099-400 Table, Orthopedic, Portable:	x	x

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