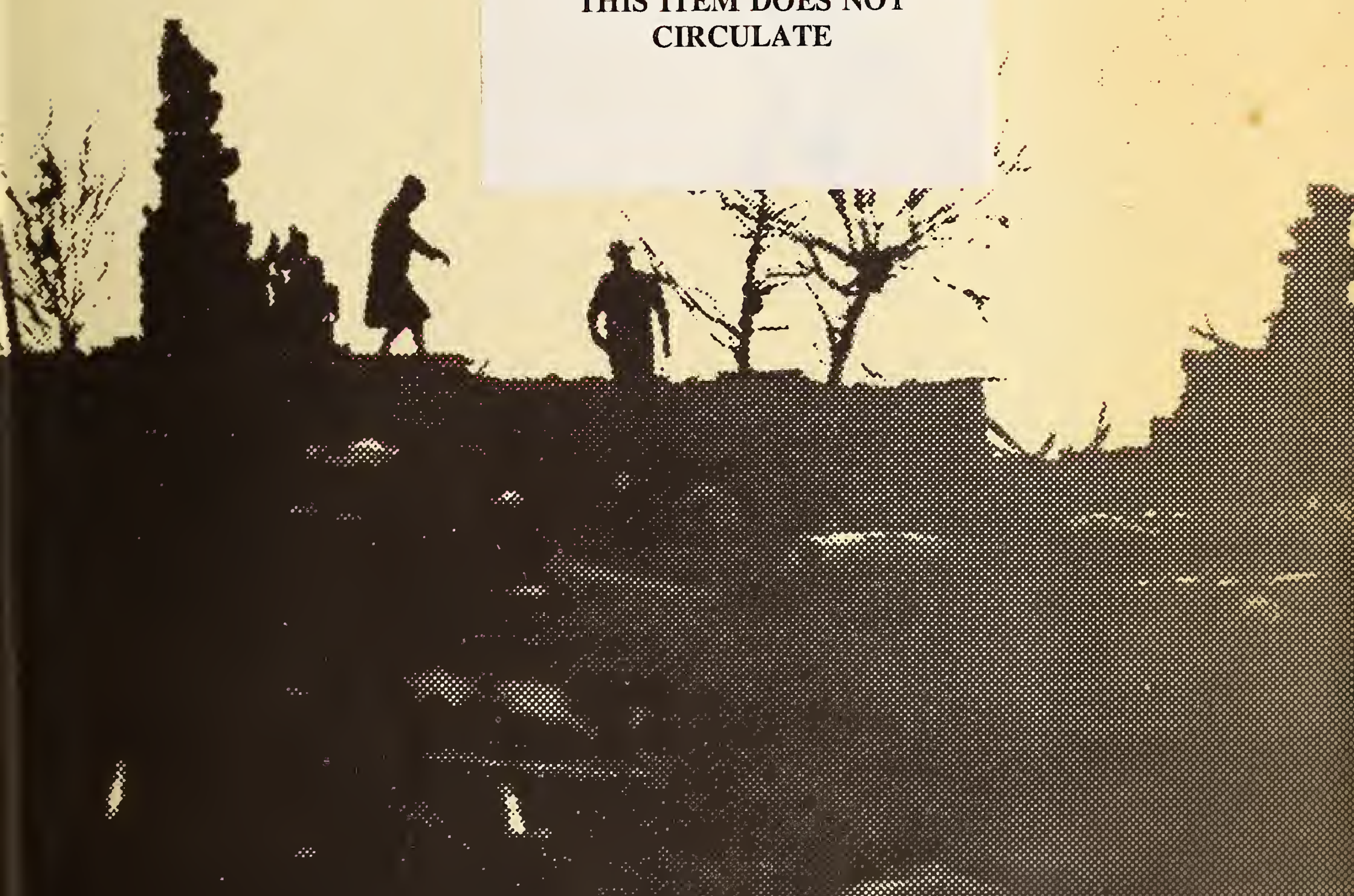
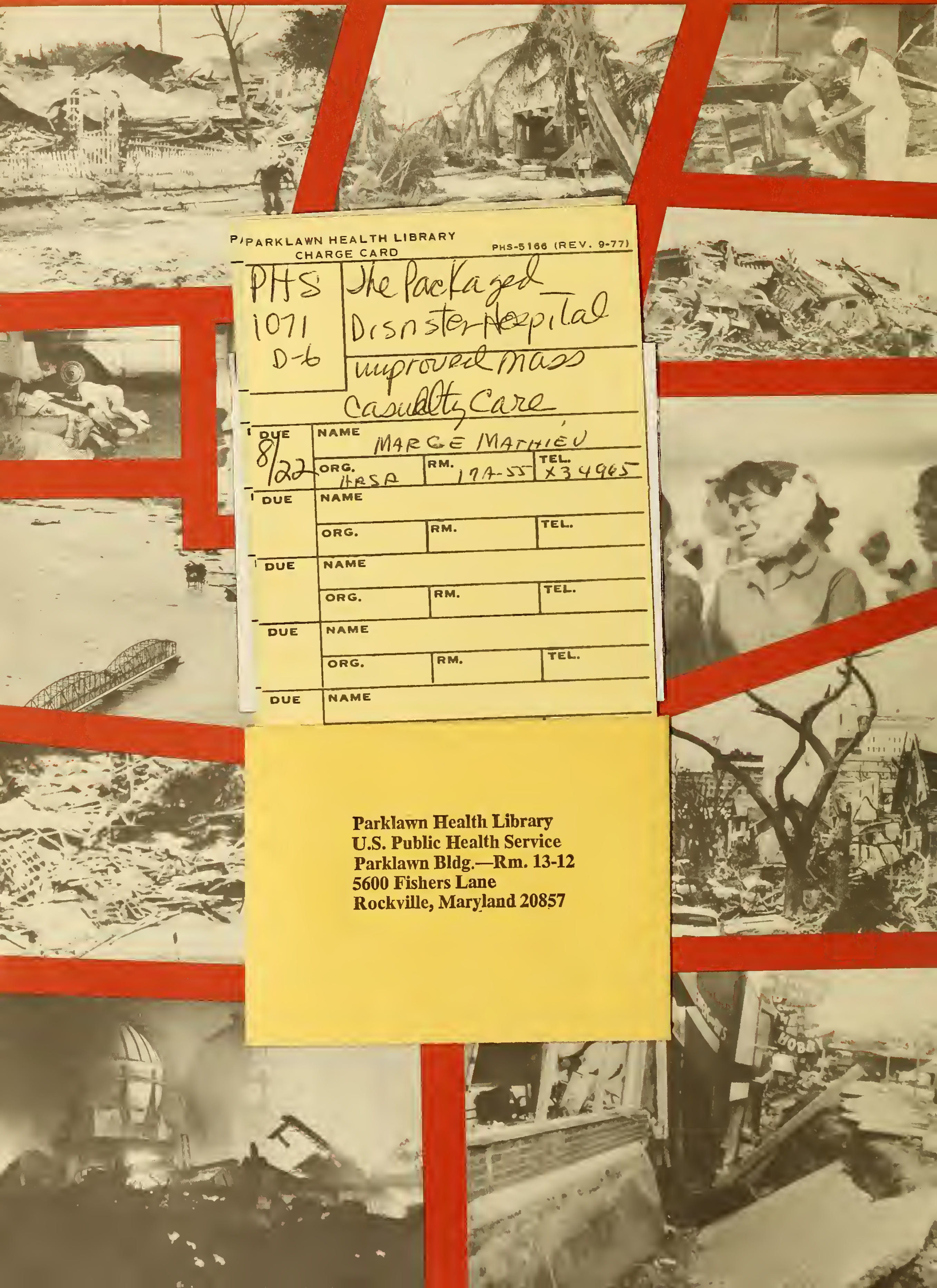
THE PACKAGED DISASTER HOSPITAL . . .



. . . IMPROVED MASS CASUALTY CARE

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

PUBLIC HEALTH SERVICE



Health Mobilization Series D-6

THE PACKAGED DISASTER HOSPITAL

IMPROVED MASS CASUALTY CARE

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

PUBLIC HEALTH SERVICE
DIVISION OF HEALTH MOBILIZATION
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INTRODUCTION

Any massive disaster must almost inevitably be accompanied by acute shortages of hospital beds and medical supplies needed for the care of disaster victims. At the time they would be most needed, hospitals could be seriously hampered by damage and certainly by an overwhelming influx of casualties. In the extreme event of a nuclear attack, a large percentage of the Nation's hospital facilities might be totally destroyed.

In an effort to assure continuity of health care under such conditions, the Federal Government has stockpiled medical supplies and equipment to help communities meet their emergency health requirements. This material is contained in Packaged Disaster Hospitals, in Public Health Service Emergency Medical Supply Depots, and in Hospital Reserve Disaster Inventory units, 30-day reserve medical supplies which augment normal inventories. This book is concerned with the Packaged Disaster Hospitals, which are assembled by the Public Health Service and stored in carefully selected communities in affiliation with local hospitals.

A Packaged Disaster Hospital (PDH) consists of hospital supplies, equipment, and pharmaceuticals packed for long-term storage. In a disaster, it can be used to expand the hospital to which it is assigned or it can be set up as a separate 200-bed hospital in an appropriate preselected building and operated as an adjunct to its affiliated hospital. PDH components permit setting up the following hospital sections: receiving and sorting, operating rooms, wards, central sterile supply, pharmacy, laboratory, X-ray, and general stores. Generators and a water tank and pump are provided for use when public utilities are disrupted.

This publication deals primarily with the planning and preparation necessary to use a PDH following the most severe type of disaster, nuclear attack. It presupposes the necessity for setting up the entire PDH as a separate facility and operating it for an extended period under the direction of the affiliated community hospital. The planning which would prepare the community for this ultimate disaster would simultaneously prepare it for the lesser but more likely disasters — flood, hurricane, earthquake, fire, or major accident— which strike many communities each year.

In some natural disaster situations, local supplies of some essential medical items will become exhausted. When this happens, the Public Health Service will grant permission to open the most accessible PDH in order to meet the emergency. Nonexpended items must be repacked and returned to storage after the disaster need has passed.

Careful planning predisaster is required to ensure the rapid and effective utilization of a PDH or its components. This publication is intended for the general guidance of hospital staffs with which PDH's are affiliated and also for the information of those which are considering assuming responsibility for one. It does not attempt to provide specific instructions because circumstances which influence PDH storage and use will vary from one community to another.

ESTABLISHING AND MANAGING THE PDH

OBTAINING A PDH

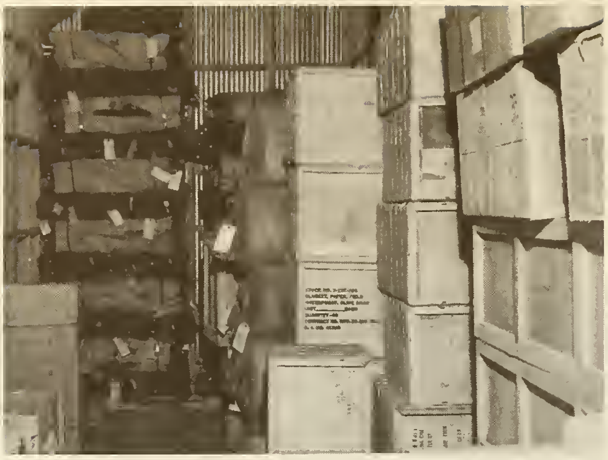
A Packaged Disaster Hospital (PDH) is acquired by application through local health or civil defense officials to the State agency responsible for the State emergency health program. The application must outline proposed storage and operating sites and name the local hospital responsible for the utilization of the unit. If the application meets the criteria of the State plan, the State applies to the Federal Government. If Federal criteria are met, a storage agreement is prepared. The PDH remains subject to Federal procedures of property accountability.

STORING THE PDH

The State agrees to provide safe storage for the PDH through local channels. A typical PDH is contained in about 660 boxes and crates, weighs about 45,000 pounds, and requires about 7500 cubic feet of storage space. Of this, 33 must be refrigerated, 50 must be safe for the storage of flammables, and 1050 must be protected from freezing. The remaining space must simply provide dry shelter and security from theft or tampering. The PDH must be inspected periodically to assure its constant readiness.

THE UTILIZATION PLAN

Utilization of the PDH must be written into the disaster plan of the hospital accepting responsibility for the unit. The disaster plan of the affiliated hospital must comply with the recommendations set forth by the Joint Committee on Accreditation of Hospitals. Consideration should be given both to using the PDH components to expand the operating capability of the hospital to which it is assigned and also to setting up the PDH



Stacks of folded cots plus over 600 crates and boxes comprise this PDH in storage. About 7500 cubic feet of storage space is required.

as a separate unit in another building should over-crowding or damage to the assigned hospital make this necessary. The PDH contains equipment and expendable supplies needed to operate as an independent 200-bed hospital for 30 days without re-supply.

In a major disaster, the resources of the PDH must be used to provide rehabilitative and life-saving care to non-ambulatory sick and injured patients. When it is set up, however, the less seriously sick and injured will also arrive seeking treatment. Since it is imperative that as many people as possible be returned to productive activity as soon as possible following disaster, provisions must be made to treat the ambulatory. In preparing the utilization plan, consideration should be given to locating an out-patient installation within or near the receiving and sorting area so that those who do not require hospitalization can be diverted from the mainstream of the hospital itself.

Detailed predisaster planning enabled personnel to set up this PDH and receive disaster victims within a few hours postdisaster.

Local health officials, medical society and hospital association executives, hospital administrators, and appropriate local governmental authorities should be informed of the location and proposed use of each PDH in their area. Publicity regarding the PDH should be released to local news media. Not only should citizens of the community be made aware of the PDH's proposed operating site, but their interest and support will be needed in recruiting volunteers to augment the PDH staff.

Expanding the Existing Hospital

When the PDH is to be activated in or near its assigned hospital to permit the accommodation of more patients within the framework of that hospital's established systems, the PDH components will be utilized as specified in the hospital's disaster plan. This plan may call for using PDH cots and patient-care supplies to convert lobbies, sunrooms, halls, nurses' quarters, etc., into additional wards and for setting up the PDH equipment to expand the workload capability of the hospital's own laboratory, X-ray service, etc. The following predisaster preparations are necessary:

1. Included in the affiliated hospital's disaster plan should be specific provisions for the utilization of all components of the PDH.
2. A large enough disaster staff to care for the additional patients must be assigned.
3. Provisions must be made for orientation and training, both for the permanent hospital staff and supplemental disaster staff.
4. Arrangements, if not included in the current disaster plan, must be made for supporting goods and services such as water, fuel, food, laundry, communications, transportation, and traffic control.

Establishing a Separate Facility

When the PDH is to be used as a separate facility, predisaster preparations must include:

1. Selecting a building and preparing a floor plan to show where each section of the PDH will be housed.
2. Arranging to transport the PDH to the operating site if it is not stored in the building selected for its use.
3. Preparing a written utilization plan which outlines how the PDH will be set up and operated in a disaster.

4. Assigning personnel to prepare the building postdisaster, to open cases, and to set up equipment.
5. Assigning personnel to staff the hospital postdisaster.
6. Providing necessary orientation and training for the staff.
7. Arranging for necessary supporting goods and services such as water, fuel, food, laundry, communications, transportation, and traffic control.

Other Uses of a PDH

There is always the possibility that in an actual disaster situation the PDH may not be needed as specified in the hospital's utilization plan and it may be put to alternate uses as the situation dictates. For instance, if the PDH is not required postdisaster in the community where it is stored, it may be decided to move both the unit and its assigned staff to another community where medical care is urgently needed. Also, the PDH may be used to provide supplies and equipment to support first aid activities or to serve as a general supply back-up to other community medical care activities. It is important to remember, however, that if large amounts of material are removed from the PDH for first aid or other purposes, the usefulness of the remainder of the unit as a complete hospital is seriously impaired if not altogether destroyed.

PREDISASTER PREPARATIONS

As soon as a community hospital accepts responsibility for a PDH unit, the key positions of chief of staff, hospital administrator, and director of nursing should be assigned so that orderly plans can be made. Alternates to these positions should also be named.

THE PDH OPERATING SITE

Selection of the Building

Modern one or two-story school buildings are especially well suited as operating sites for PDH's because of their size, floorplans, and available facilities. However, other buildings such as motels or community centers may be used. Whenever possible, a PDH should be stored at the site where it will be set up. If it is necessary to store the unit at another location, this storage site should be within a reasonable transporting distance of the planned operating site and in the general area it is expected to serve. Availability of the selected building for the postdisaster activation of the PDH should be confirmed periodically. The following features should be included in the criteria used to select a building:

1. Floorspace of approximately 15,000 usable square feet with as much space as possible on the first floor. Schools with 16 to 25 classrooms usually have this much or more space. Certain areas must support heavy equipment, such as the X-ray unit, and stacked bulk supplies.
2. An entrance easily accessible to ambulances, preferably on a driveway with two open ends to permit easy entrance and exit of vehicles.
3. Doorways, halls, and stairways wide enough to facilitate unpacking the PDH, delivering supplies, and moving patients on litters.
4. Toilets and washrooms to meet the requirements of a total of at least 400 patients and personnel.
5. A kitchen in or near the building.
6. Adequate water, heat, lighting, and ventilation. (The PDH contains generators to provide auxiliary power and a 1,500 gallon water storage tank and pump for an alternate water supply should public utilities be disrupted.)
7. Space suitable for setting up an outpatient facility, possibly as part of the receiving and sorting area.
8. Space suitable for housing the PDH staff if this should be necessary.

The layout of the selected building will naturally influence the location of certain hospital areas. For instance, rooms with sinks and running water should be used for the laboratory, surgical scrubroom, and the preparation room of the central sterile supply section. The food preparation service would logically be located in the existing kitchen-cafeteria area, if there is one, and an office with switchboard or intercom system would become the administration-communications area. Figure 3 lists some suggested minimum space requirements and other criteria for selecting appropriate areas for various hospital sections.

Preparing a Floorplan

An essential part of the PDH utilization plan is the preparation of a floorplan of the selected building showing where each section of the PDH will be located. A receiving and sorting section, wards, operating rooms, laboratory, X-ray, pharmacy, general stores, central sterile supply, an administrative center, and if necessary, a monitoring and decontamination section must be provided for. Specific suggestions on the requirements for the various sections are discussed in the chapters referring to each. The sample floorplans, (figs. 1 and 2) show two schools adapted to PDH use. A copy of the final floorplan should be posted predisaster in a conspicuous place in the building so that it will be available postdisaster to personnel unfamiliar with the building.

THE PDH STAFF

When a PDH is set up in a building independent of the affiliated hospital, the staff, including auxiliary and volunteer, should be assigned and trained predisaster. When the full staff does not report, additional personnel would necessarily be recruited and assigned postdisaster.

The PDH can be efficiently operated with a minimum staff such as is outlined in figure 4. Local circumstances will almost always require adjustments and departures from this pattern. Less skilled personnel may have to be substituted in some positions, and individual staff members may have to perform the function of two or more positions. It may be necessary to begin operations with a much smaller staff which would be augmented gradually by personnel recruited locally and from neighboring communities. Physician specialists and

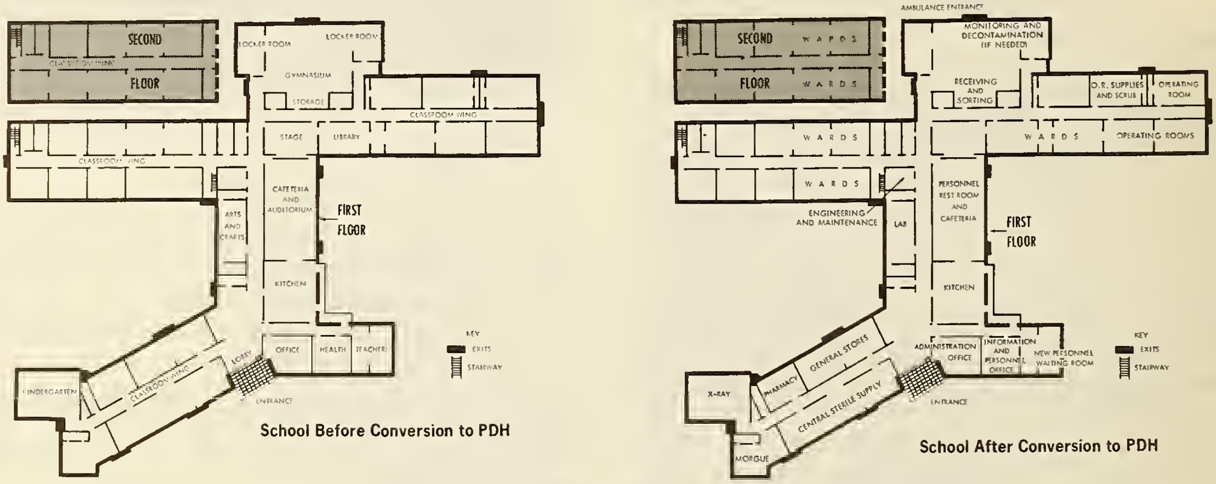


FIGURE 1

SCHOOL BEFORE CONVERSION TO PDH

SCHOOL AFTER CONVERSION TO PDH —ENTIRE SCHOOL ADAPTED TO PDH USE.

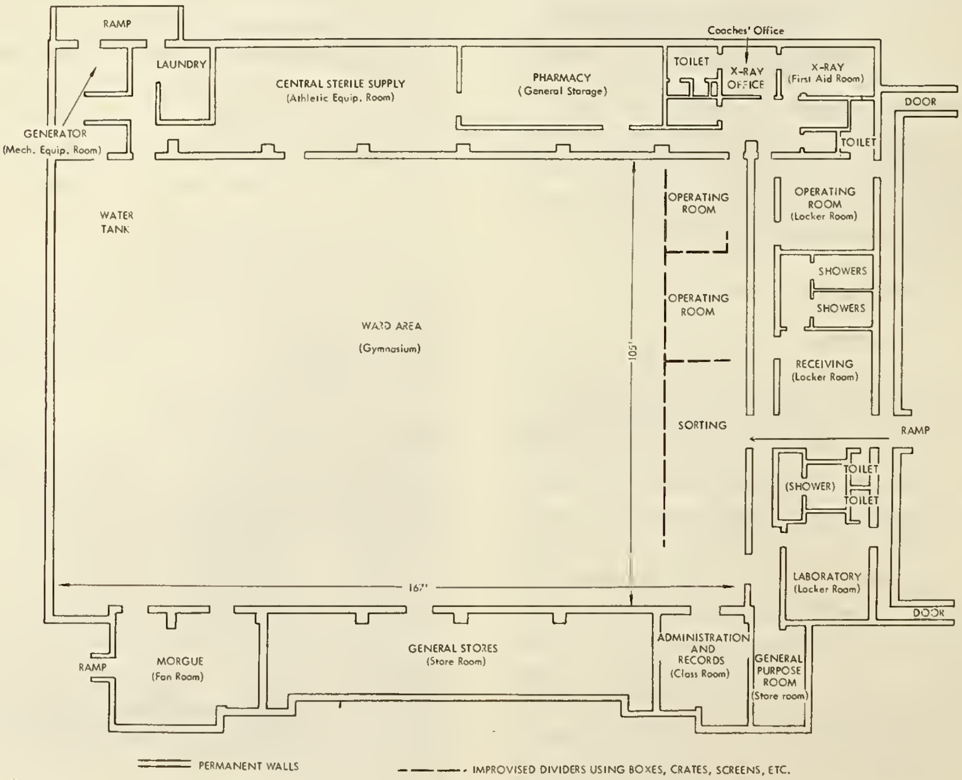


FIGURE 2—SCHOOL GYMNASIUM AREA ADAPTED TO PDH USE.

Area	Sq. Ft.	Requirements
MONITORING AND DECONTAMINATION (If needed)	300	Should adjoin entrance to receiving and sorting section. Source of water if possible.
RECEIVING AND SORTING	1,000	Must have wide entrance on driveway.
WARDS	9,000	Should be grouped together with as many as possible on first floor. If shock ward is set up, it should be near receiving and sorting section and operating rooms.
OPERATING ROOMS	800	First floor, away from hospital traffic.
X-RAY	300	First floor, isolated from other sections and with protective shielding if possible.
LABORATORY	200	First floor, with source of water if possible. (Second floor if necessary.) Additional space, not necessarily adjoining, must be allocated for blood bank activity.
PHARMACY	800	First floor, near general stores. (Second floor if necessary.)
CENTRAL STERILE SUPPLY	700	First floor, at least 150 ft. from operating rooms. Source of water and good ventilation are necessary.
GENERAL STORES	900	Floor must support stacked bulk supplies.
PDH CONTROL CENTER AND OTHER ADMINISTRATIVE OFFICES	500	Away from heavy traffic, either first or second floor. Must include space for communications and records sections.
ENGINEERING AND MAINTENANCE OFFICE	200	Central location. Should include space for housekeeping and traffic control-security section chiefs.
MORGUE	300	First floor, away from patient traffic, with exit to driveway. An adjacent building, if available, is preferable.
TOTAL:	15,000	

FIGURE 3—RECOMMENDED MINIMUM SPACE AND OTHER LOCATION REQUIREMENTS FOR PDH SECTIONS.

other professional personnel may find it necessary to practice beyond the bounds of their normal specialties while serving in a disaster situation.

Activation Personnel

The chief of staff, administrator, director of nursing and chief building engineer will share the supervisory responsibility for setting up the PDH postdisaster. Assigned to them should be thirty to forty helpers (who will have other assignments after the PDH is set up). These people should be prepared to report to designated points as soon as conditions permit after the disaster to handle the moving, unpacking, and setting up of the PDH supplies and equipment. All section chiefs should report to supervise and assist with the activation of their individual sections.

Skill Categories	Hospital Sections: PDH CONTROL CENTER	RECEIVING & SORTING	WARDS	OPERATING ROOMS	PHARMACY	LABORATORY	X-RAY	MORGUE	CENTRAL STERILE SUPPLY	COMMUNICATIONS	PERSONNEL	PUBLIC INFORMATION	RECORDS	HOUSEKEEPING	ENGINEERING & MAINTENANCE	GENERAL STORES	TRAFFIC CONTROL & SECURITY	LAUNDRY SERVICE	FOOD SERVICE	TOTALS
Physicians	2*	2		6																10
Dentists and/or Veterinarians				4																4
Nurses, Professional	2	2	18	8					4											34
Anesthetists (MD or allied medical)				6																6
Nurses, Practical		2	8	8																18
Pharmacists					2															2
Laboratory Technicians						2														2
X-ray Technicians							2													2
Medical Aides**		12	88	6	2	2		2	12											124
Administrators	2																			2
Maintenance Engineers															2					2
Clerks	2	2				2	2			4	2	2	4			2				22
Helpers and Messengers	2	2			4	2	2	2	6	4		2	2			4				32
Service Personnel														24	4		8	8	12	56
TOTALS	10	22†	114	38	8	8	6	4	22	8	2	4	6	24	6	6	8	8	12	316

*In addition to their administrative functions, the chief of staff and his alternate may perform treatments as conditions demand.

**Such skills as nurse aide, ward maid, attendant, orderly, surgical aide, and first aid technician.

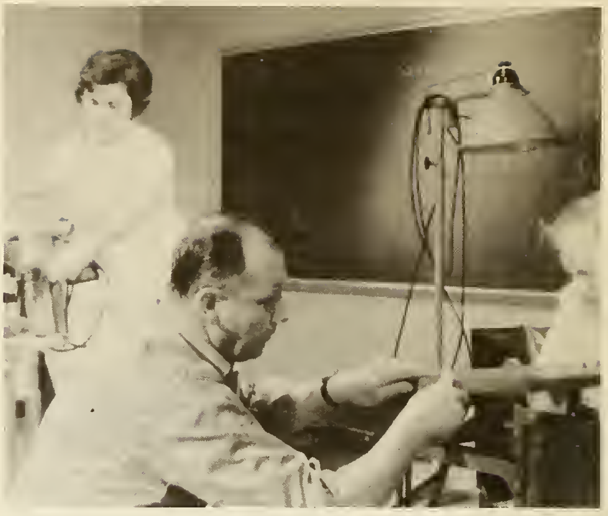
†When monitoring and decontamination are necessary, these services may be performed either by the regular staff or by especially designated personnel. In the latter case, necessary positions should be added to this total.

FIGURE 4— SAMPLE PDH STAFFING PATTERN FOR 24-HOUR, 2 SHIFT OPERATION.

Chief of Staff and Hospital Administrator

These people will oversee the activation of the PDH and direct its operation. Should the chief of staff of the local hospital be unable to serve also as the PDH chief of staff, another physician, preferably one with experience in directing a hospital staff, should be designated. He is responsible for clinical or treatment-related sections. The hospital administrator is responsible for the predominantly non-medical sections. Because the planning duties of these two positions overlap to some extent or are to be performed jointly, both should work from the following predisaster planning check list:

1. Become familiar with the community and State plans for civil defense, especially with the emergency health sections of these plans.
2. Become familiar with the supplies and equipment in the PDH.
3. Inspect the building selected for the PDH operating site and prepare a floorplan designating space for each PDH section.
4. Have signs naming all PDH sections prepared so that they will be ready to put up postdisaster before workers begin moving supplies and equipment into the hospital sections.
5. Prepare a detailed plan which specifies procedures for setting up and operating the PDH and which outlines organization and staffing.
6. Ascertain the selected building's utilities, i.e., heating, water, and power, and see that plans are made to supplement them if disaster conditions should make this necessary.
7. Become familiar with the building's present communications facilities and determine what radio equipment and operators would be needed postdisaster.
8. Agree with the chief building engineer on a procedure for clearing areas of the building which will be occupied by the hospital. Furniture appropriate for hospital use should be designated so that it will not be removed.
9. Arrange with civil defense officials for necessary supporting goods and services such as transportation, communications, radiation monitoring, water, traffic control, food, and laundry. Specify these arrangements in the final written utilization plan.
10. Plan for the postdisaster procurement of necessary supplies which are not provided in the PDH unit, and for resupply when it becomes necessary.



Under the direction of nurse, activation staff members deliver and set up the operating room equipment during a PDH text exercise.

11. Plan for postdisaster housing of PDH staff, should this become necessary.
12. Plan a method of reporting regularly, postdisaster, to the community emergency health service headquarters to give data on admissions as well as manpower and support requirements.
13. Assign personnel, recruiting outside staff if necessary. This staff should include all activation personnel and should be large enough to get the PDH set up and into operation.
14. Arrange for and participate in PDH training sessions, and test exercises as a part of the hospital disaster plan.

Director of Nursing

The director of nursing will work closely with the chief of staff and hospital administrator in directing and coordinating the PDH operation. She is responsible to the chief of staff for all nursing service personnel including professional nurses, practical nurses, and medical aides, and for organizing and supervising nursing services throughout the hospital. Predisaster she should:

1. Become familiar with the community and State plans for civil defense, especially with the emergency health sections of these plans.
2. Become familiar with the supplies and equipment in the PDH.
3. Work closely with the chief of staff and hospital administrator in the nursing aspects of their plans for setting up the PDH.
4. Develop a nursing service staff organization chart, indicating lines of authority and assigning specific people to supervisory positions.

5. Work with the chief of staff in preparing written policies including standing orders.
6. Develop, with the chief of staff, a plan to assure the availability of essential pharmaceutical items on the ward.
7. Develop a simple plan for giving medications.
8. Plan for ward furniture, taking into consideration furniture available in the selected building and making plans to improvise as necessary. Arrangements should be made for as many nurse's stations as the ward layout allows.
9. Participate in PDH staff training and test exercises.

Chief Building Engineer

The chief building engineer of the PDH should preferably be the regularly employed engineer or custodian of the building selected as the operating site so that the PDH planning staff will have the advantage of his familiarity with the layout of the building and with its wiring, heating, water system, etc. He should be responsible for the maintenance of the building postdisaster and for the operation of the necessary utilities. Predisaster he should:

1. Consult with and advise the chief of staff and hospital administrator in their predisaster planning for adapting the building for hospital use. He would be involved in supervising the clearing of the building in preparation for setting up the hospital. He should designate items which should be left for hospital use such as chairs, cabinets, etc.
2. If the hospital is stored at the operating site, be responsible for unlocking storage areas for inspection.
3. Determine the kinds of personnel needed for PDH maintenance, such as electricians, plumbers, carpenters, etc., and help recruit, assign and train such personnel.

The Chief Building Engineer and two helpers at the PDH operating site carefully examine wiring and operating plan for hospital's generator during Packaged Disaster Hospital training exercise.

4. Prepare a plan for setting up the PDH electrical equipment including the special lighting equipment furnished for areas such as the operating rooms. He should be prepared to supervise the hospital's essential lighting and power needs through the use of generators furnished with the PDH if the community power should be cut off. He should also ascertain sources of gasoline and fuel oil needed for postdisaster operation of the generators. See page 259 for detailed instructions for operating PDH generators.
5. Prepare a plan for using the water storage tank and pump furnished with the PDH if an alternate water supply is necessary. See page 291 for detailed instructions on setting up the tank and pump and treating and testing water.
6. Through consultation with a sanitary engineer, familiarize himself with the alternate methods of disposing of wastes in case the community sewage system is inoperable postdisaster.
7. Make arrangements for emergency heating.
8. Participate in PDH staff training and test exercises.

Activation Personnel

Recruiting, assigning and training the staff necessary to set up the PDH will require community cooperation. Thirty or forty people should be assigned to perform most of the labor of loading trucks when necessary, moving the unit to the operating site, unpacking, and setting up the PDH. Preferably, they should live or work in the neighborhood near the building selected as the operating site. Some should have construction and building maintenance skills. Predisaster, a foreman should be designated and all helpers should:

1. Become familiar with the PDH in storage and learn the initial duties they will be called on to perform postdisaster.
2. Ascertain what tools are supplied with the PDH unit and arrange to bring their own tools, such as nailpullers, claw hammers, screwdrivers, and wire-cutting pliers when they report to the operating site for activation.
3. Participate in PDH training in order to become familiar with the building where the PDH will be set up and to learn about additional duties which they may assume after PDH activation is accomplished. They will also take part in PDH test exercises.

POSTDISASTER RESPONSIBILITIES

As soon as conditions permit, the activation personnel, chief of staff, administrator, director of nursing, and section chiefs who have been designated predisaster should go at once to their assigned posts and begin to carry out their part of the plan for setting up the PDH. Alternates to key positions will serve opposite 12-hour shifts to assure 24-hour supervisory coverage of all sections.

CHIEF OF STAFF

Activation Responsibilities

1. Consult with hospital administrator to verify mutual understanding of responsibilities. See that the predisaster plans properly cover existing needs and that they are being carried out.
2. Oversee setting up the clinical sections of the hospital as soon as supplies and equipment are moved into the operating site.
3. Designate a supervisor for each clinical section which lacks one and assign available personnel to these sections.
4. Inform the administrator of requirements for additional professional manpower so that a request can be made to the community emergency health service control center.

Operating Responsibilities

1. Jointly with the administrator, direct and coordinate all PDH operations.
2. Direct all clinical services through the supervisors of the clinical sections.
3. Assign to clinical sections additional physicians, veterinarians, and dentists who volunteer after the PDH has begun operation; reassign professional medical personnel as the workload requires.
4. Coordinate with the director of nursing the assignment of additional nurse volunteers to clinical sections.
5. Keep apprised of the medical supplies and manpower on hand and of additional needs, informing the administrator so that reports can be made to the community control center.

HOSPITAL ADMINISTRATOR

Activation Responsibilities

1. Consult with the chief of staff and chief building engineer to verify mutual understanding of responsibilities.
2. Establish the best communications system possible under disaster conditions—telephone, two-way radio, and/or messengers.
3. Establish contact with the local civil defense or emergency health control center, report that the PDH is being set up, and request that predisaster plans for supporting services be carried out.
4. Oversee preparation of the operating site.
5. Post signs to designate location of all hospital sections before helpers begin to move supplies and equipment into operating positions.
6. Supervise moving in of all supplies and equipment and direct the setting up of the administrative sections.
7. See that supplies needed but not furnished with the PDH are obtained according to predisaster plans or, if necessary, make arrangements on the spot.
8. Designate a supervisor for any administrative section which lacks one and assign available personnel to these sections.
9. Establish and maintain a pool of untrained helpers who can be assigned anywhere in the hospital.
10. Initiate security regulations immediately so that hospital entrances can be guarded and incoming patients, volunteers, and staff can be directed to proper sections.
11. Determine initial shortages in manpower and supplies and needs for supporting services anywhere in the hospital and report this to the emergency health service center.

Operating Responsibilities

1. Jointly with the chief of staff direct and coordinate the PDH operation.
2. Direct all administrative services through the supervisors of the administrative sections.
3. Keep apprised of manpower and supplies on hand and needed, of the present and expected workload, and of requirements for supporting services.
4. Maintain close communication with the emergency health staff at the community control center and report to them regularly.
5. Assign to administrative sections additional volunteers who arrive after the PDH has begun operation, reassigning personnel as the workload requires and as special skills of workers become apparent.

DIRECTOR OF NURSING

Activation Responsibilities

1. Temporarily assume the responsibilities of the chief of staff or hospital administrator if she arrives at the operating site before them.

2. Assist the chief of staff in setting up the clinical sections.
3. Assign available nursing personnel to the clinical sections.

Operating Responsibilities

1. Supervise the nursing personnel, coordinating their performance of clinical services with that of other personnel.
2. Keep apprised of nursing manpower availability and of the quantities of supplies needed for patient care, reporting this to the chief of staff or hospital administrator.
3. Assign additional nursing volunteers who arrive after the PDH has begun operations, reassigning personnel as the workload requires and as special skills of workers become apparent.

TRAINING

Course Material

Everyone who will be involved in the operation of a PDH should receive orientation and training in the general organization of the PDH and in using the supplies and equipment packed with the unit to care for the sick and injured. Training the staff is a responsibility of the affiliated hospital. Assistance and training aids are available from health mobilization representatives through State Departments of Health.

Lesson plan guides based on this publication, are available for use by affiliated hospitals in training their personnel. The guides are contained in individual booklets, one for each functional section, and are accompanied by 35 mm. color slides suitable for lecturing and training purposes.

Physicians and Allied Medical Professions

Physicians and members of the allied medical professions should become familiar with mass casualty care procedures and study the types and quantities of supplies and equipment furnished in the PDH. Where not prohibited by law, allied medical personnel (dentists, veterinarians, nurses, and pharmacists) should also receive supplemental training in disaster-oriented medical treatment techniques so that they can be useful assistants to the physicians. All should participate actively in PDH training courses and exercises.

Auxiliary Personnel

Aides, mostly volunteers, will make up the majority of the PDH staff. Although they may have little or no hospital experience, it is essential that they have some knowledge of patient care. In addition to their general introduction to the PDH, they should receive training in first aid or Medical Self-Help, hospital procedures, medical record-keeping, and the duties performed throughout the various sections of the PDH. Such training is available in most communities through local Red Cross chapters. The American National Red Cross has agreed, that upon request of the affiliated hospital, local chapters will add PDH orientation to current appropriate training courses.

Aides should know what their assigned duties will be postdisaster, however, thorough predisaster training will enable them to function interchangeably from section to section of the PDH as conditions and patient load require.

Physician presenting PDH orientation during disaster exercise.

Volunteers with little or no hospital experience can be trained predisaster as PDH aides.

Medical Self-Help Training

All non-medical and volunteer receiving and sorting personnel would benefit from taking Medical Self-Help Training. It will not only aid them in preparing for emergency care of the sick and injured, but will also give them some concept of the types of casualties that might be encountered in any disaster situation.

An eleven-lesson course, Medical Self-Help was developed by the U.S. Public Health Service, and the Office of Civil Defense in cooperation with the Committee on Disaster Medical Care of the American Medical Association Council on National Security.

Information regarding the Medical Self-Help Training Program is available through health departments and civil defense offices. There is no charge for the course.

Exercises

A good way to evaluate the PDH utilization plan and to test the effectiveness of the staff's training is to conduct a PDH exercise. This activity will also serve to familiarize the entire PDH staff with the hospital's operation. Such an exercise can be conducted among the PDH personnel as a part of the affiliated hospital's regularly rehearsed disaster plan or it may be part of a community-wide civil defense exercise. All or some combination of the following activities can be included:

1. Setting up representative portions of the PDH, where possible in the building where it would be activated.
2. Staging a simulated disaster in which "casualties" are admitted to the PDH, "sorted," and "treated".

Public Health Service press, armed forces Air Rescue Service, and MEDS physician participate in disaster test exercise.

3. Practicing or testing the staff's knowledge of the assembly and operation of the mechanical equipment provided in the PDH.
4. Setting forth problems of resupply, shortage of personnel, etc., and solving them.

SUPPLIES AND EQUIPMENT

PACKAGING OF THE PDH UNIT

Master lists of the entire contents, case by case, of each PDH are furnished. One copy of this list is sent to the PDH custodian at the time the unit is delivered for storage. Additional copies are packed with the PDH. Each box, crate, or bundle is numbered and the master list indicates by case number the functional section to which each belongs, as well as its contents. An assortment of items has been packed in some of the boxes in order to reduce the total number of boxes. Separate lists of the contents of each mixed case are also furnished. One copy is packed inside the case in an envelope. The other copy, also in an envelope, is fastened to the outside of the case. For ready reference during unpacking, one of the copies can be fastened to the opened case.

DIFFERENCES IN PDH UNITS

The Federal Government program of assembling and packaging hospital units and lending them to States for storage at the community level was begun in 1953. In the ensuing years, considerable research has been devoted to the problems which can be expected following a nuclear attack. As a result, the PDH has been raised from its original 3 to 4 day operational capability. Today the PDH contains enough supplies and equipment to permit it to operate for 30 days without resupply. Also, manufacturers have made advances in some types of equipment and supplies. Later model PDH's reflect these advances and contain a number of items not furnished in earlier units. A program is now underway to upgrade the earlier PDH's to the 30-day operational standard.

TRANSPORTING THE PDH

Whenever possible, the PDH should be stored in the building which is to be used as the operating site. When this is not feasible, arrangements must be made to load the unit into local trucks and move it to the selected building postdisaster. These predisaster transportation arrangements will also be found valuable should the unit be needed in a distant disaster area.

UNPACKING AND DISTRIBUTING PDH COMPONENTS

As each box is brought into the PDH operating site, it should be taken to the hospital section where it will be used, as indicated on the master list. Health Mobilization publications are available which will be of aid both in planning and carrying out this operation.

Designated helpers should unpack and set up the large pieces of equipment. Boxes of supplies and smaller equipment should be opened but not unpacked. These boxes should be stacked so that there is easy access to their opened sides. Hospital personnel should be able to get to the contents as they are needed without having to move other boxes.

Crates and boxes should be opened carefully so that neither the container nor its contents are damaged. After they are emptied, the boxes can be used as tables,

Careful unpacking of crates prevents damage to their contents and permits efficient repacking.

stands, and storage cabinets. Also, when the need for the PDH has passed, these boxes will be needed to repack equipment and remaining supplies when the PDH is put back into storage.

ADDITIONAL SUPPLIES TO BE OBTAINED LOCALLY

Some supplies necessary for the operation of the PDH are not furnished and arrangements must be made for designated persons to obtain them from local sources and bring them to the operating site as soon as the PDH is activated. The following list of items is given as a checklist. Not all the items are needed in all the PDH's, and planners should refer to the lists of supplies and equipment furnished with the PDH to see which items on this list will be needed.

1. Silicone grease for centrifuge.
2. Gasoline (any type) to fuel autoclaves, sterilizer burners, lanterns, and generators.
3. Antifreeze for those generators which are water-cooled.
4. Additional electrical cable for generators.
5. Enough 220-volt electrical cable to connect the 16x36″ sterilizer to the building power supply.
6. Extension cords, sockets, receptacles, and light bulbs (a supply is included in some PDH's).
7. Automobile batteries. Some generators require 6-volt batteries. In case of power failure, some of the operating room lights can be operated on batteries.
8. Spray bottles for the suction and pressure apparatus.
9. L.P. gas tank, hose, adapter, regulator, and fittings needed for the stoves used with some of the sterilizers.
10. Hand tools for opening crates and making simple repairs. Hammers and nails, nailpullers, wire-cutting pliers, and prying tools will be especially useful. While some PDH's contain tools, it will speed setting up operations if all helpers bring their own tools.
11. Bags for weights on the Balkan frame are furnished, but they must be filled with buckshot, sand, or even rocks.
12. Radiological monitoring equipment (calibrated and ready for use) and dosimeters.
13. Commercial solvent (nonvolatile and nontoxic, such as trichloroethylene) and detergents for the initial removal of the preservative coating in which instruments are stored.
14. Detergent for use in the preparation subsection of the central sterile supply section; heavy brown wrapping paper and sensitized tape or twine and tags for making sterile packs.
15. Rubber glove dusting powder (a supply is included in some PDH's).
16. Housekeeping supplies such as brooms, mops, cleaning preparations, insecticides, etc. (a supply is included in some PDH's).
17. Disassembled sawhorses. Set up postdisaster, these make good litter supports.

PDH SECTIONS

THE PDH CONTROL CENTER

Office space must be provided for the administrator, chief of staff, and director of nursing. One room should be adequate and perhaps even preferable in a disaster situation. From this center, all phases of the PDH operation can be directed and coordinated. This office should be located where the best communications system (switchboard or building intercom) exists. If the necessary office furniture and supplies are not already in the room, these items may be available elsewhere in the building. If not, they can be brought to the building from other local sources.

Medical and Surgical Care

With the exception of sorting, no detail is included in this publication concerning the activities of the physician during disaster. Several excellent publications are available on this subject, among them, the NATO Handbook, "Emergency War Surgery." Much of the material contained in this book is applicable to a civilian mass casualty situation. Available at no charge to all physicians who will be working with the Packaged Disaster Hospital is "The Treatment of Mass Civilian Casualties in a National Emergency." This booklet was published by Medical Education for National Defense and with their permission has been reprinted by the Division of Health Mobilization for distribution to physicians involved with the PDH program.

THE CLINICAL SECTIONS

Monitoring and Decontamination (When Necessary)

When the PDH is operated in a postattack situation and radiation or radioactive fallout constitutes a danger, a monitoring and decontamination area should be set up near the receiving and sorting area and operated under the direction of sorting personnel. Water for washing should be available. Predisaster arrangements must be made with the local civil defense authorities for monitoring equipment and operators. Patients should be screened in this section before entering the receiving and sorting area.

Decontamination consists of removing outer clothing, washing exposed skin surfaces, and, if necessary, cutting off hair. Contaminated clothing and hair should be put in labeled boxes and placed in an area away from patients and PDH personnel, preferably out-of-doors.

The patient's condition determines how thoroughly decontamination should be effected. Life-saving treatment should not be delayed in favor of decontamination and nothing should be done which will worsen the condition of seriously ill or injured patients.

Receiving and Sorting

This section should have a wide entrance which is easily accessible to ambulances and other vehicles. Patients are examined here by the most experienced surgeons available, sorted, and classified according to their condition and priority for treatment. They are then routed to the appropriate hospital section. Usually a clinical record and jacket and an index and information card are initiated in this section. At this time the patient's personal effects can be placed in bags or envelopes, labeled, and either sent with him to the ward or to the records section for secure storage.

See page 27 for detailed information on sorting classifications, and PDH equipment supplied for the receiving and sorting area.

Patient flow actually begins in and revolves about the receiving and sorting section. A suggested flow chart is shown in figure 5.

PATIENT FLOW CHART

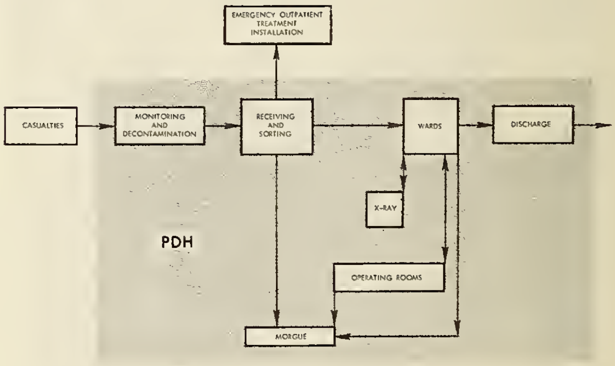


FIGURE 5

Wards

Ward areas are set up at the direction of the chief of staff, in consultation with the director of nursing, as the predominant categories of sick and injured patients become apparent. It may be necessary to designate areas for pre-operative, post-operative, medical, burn, shock, fracture, psychiatric, and communicable-disease patients. An observation or holding ward may be established where patients with poor prognosis can be given palliative treatment. After the initial heavy influx of patients passes and the PDH has settled into more routine operation it may be desirable to designate separate wards for men, women, and children. See page 121 for detailed information.

Wards are set up as the predominent categories of sick and injured patients become apparent; for example, burn, surgical, medical, fracture, shock, psychiatric.

Operating Rooms

The PDH contains sufficient equipment to set up five operating areas. Surgery should be located near a room with running water which can be designated as a scrub room. Table arrangements must be determined by the space available, patient load, and predominant injury classifications. A sample floorplan for a two-table arrangement is shown in figure 6.

NOTE:

As a precaution against the danger of explosion and fire, when open flame sterilization methods are necessary, no sterilization equipment should ever be placed in the operating room. In fact, the operating rooms should be located some distance from the central sterile supply section to minimize fire hazards.

Each set of operating room equipment in a typical PDH includes a lightweight folding operating table, anesthesia equipment, a surgical lamp, instrument stand, and basic surgical instruments. These instruments should be sent to central sterile supply for cleaning and sterilizing as soon as they are unpacked. Additional instruments are packed with supplies assigned to the central sterile supply section. Anesthesia equipment provided with some PDH's is of the closed-circuit, gas-oxygen-ether type. Oxygen and nitrous oxide cylinders are supplied with these PDH's. Cones and masks are supplied with all units so that ether can be administered by the open-drop method.

X-ray

Because of the radiation hazard, the X-ray section should be located in an outside corner room with masonry partitions or walls separating it from other rooms. If this is not possible, it should be at least 25 feet from areas housing patients or hospital personnel. See page 157 for detailed information on setting up and operating this section.

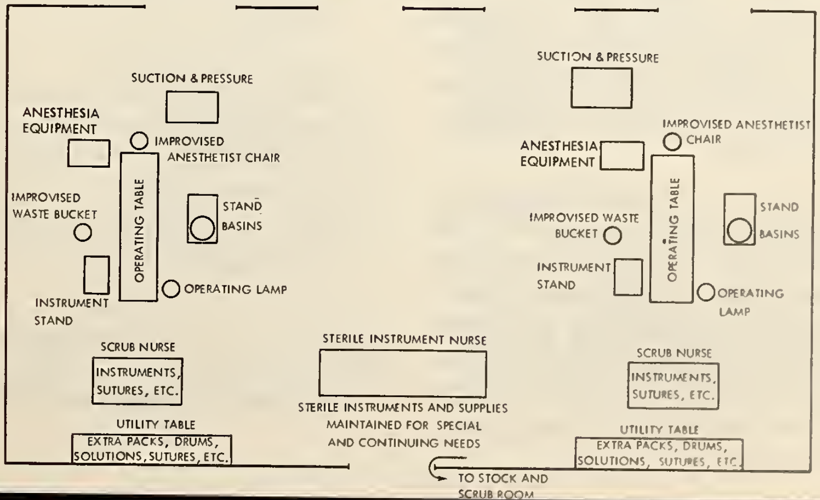
The equipment includes a 15-milliampere X-ray unit and developing unit which processes radiographic paper in 60 seconds. The X-ray unit also has a fluoroscopic screen. Power can be furnished by generator (provided with the PDH) or by commercial 115-volt current. The unit is designed primarily to permit the examination of fractures and dislocations and the detection of foreign bodies.

When the X-ray unit is in use, the radiographic paper should be isolated from it to prevent fogging. This paper has a shelf life of about one year at room temperature, but if stored under continuous refrigeration it is usable up to five or six years.

Laboratory

The laboratory should be located in a room with a sink and running water. The PDH laboratory supplies and equipment permit essential diagnostic tests. See page 173 for instructions on setting up the section, assigning personnel, processing requests and reports, and other operational procedures. Also given are step-by-step laboratory methods for handling specimens and conducting these tests:

1. Urinalysis: acetone, albumin, glucose, pH, spe-



SAMPLE FLOOR PLAN FOR TWO-TABLE OPERATING ROOM

FIGURE 6

cific gravity, microscopic examination, and reports on other physical characteristics.

2. Blood analysis: Hematology—A-B-O grouping, Rh typing, cross-matching, hematocrit, leukocyte (white cell) count, differential leukocyte count. Blood chemistry—total protein. Bacteriology—stained smear examination (methylene blue stain). Copper sulfate screening tests are also included.

Blood Bank Activities

If the laboratory itself is to be used for the drawing of blood, it should be located so that it is accessible from an outside entrance so that donors can come and go without entering the treatment areas. It may be preferable to set up this activity outside the main PDH building, possibly near the public information section where donors can be recruited.

Pharmacy

This section should be reasonably accessible to those clinical sections which it will be supplying with pharmaceutical items. It may be found convenient to locate it near the general stores and central sterile supply sections in case any of these three supplying sections are operated under joint supervision.

PDH supplies include at least one medication in each essential therapeutic catagory: anesthetics, analgesics, sedatives, anti-infectives, antiseptics, stimulants, antispasmodics, antihistamics, ophthalmic medications, and large-volume intravenous solutions including resuscitative fluids.

Refer to page 239 for detailed information on setting up and operating the pharmacy section. **Therapeutic Guide for Pharmaceuticals in the Packaged Disaster Hospital** (Health Mobilization Series C–3) lists drugs contained in the PDH with information as to category, action, uses, cautions, side effects, dosage, and similar preparations which can be substituted for listed drugs.

Central Sterile Supply

The central sterile supply section is responsible for cleaning and sterilization of all PDH supplies and for dispensing them to treatment areas. The preparation area of this section must have a supply of water, preferably a sink with running water.

Because of the immediate need for sterile supplies in surgery, this section should be one of the first functional areas to be set up. Three types of sterilizers are furnished, depending upon the PDH series: 40-quart pressure cooker-type sterilizers, open boiling water sterilizers, and electrical or gasoline-heated steam pressure autoclaves. Although sterilizers may be used in other sections, most sterilization will be done in this section.

See page 201 for detailed information on setting up and operating this section, including step-by-step instructions on sterilization procedures.

Mortuary Services

The morgue should be located in an out-of-the-way area of the building. Provisions for special security and for post-mortems in instances of deaths from unknown causes may be necessary.

Following nuclear attack or natural disaster or accident of overwhelming proportions, the bodies of patients who die in the PDH will probably be delivered to a mortuary service unit activated immediately post-disaster.

In some states it is customary for a community emergency health service to be given responsibility also for the provision of mortuary services. In such cases the emergency health organization includes an organizational subunit which has total mortuary responsibility and the health plan describes the procedures for collecting, identifying, and disposing of the dead.

In most States, however, mortuary services are the responsibility of a separate mortuary service unit of the civil defense organization. When the health service and mortuary service are separate there must, of course, be coordination between them in disaster to ensure that sanitation standards are maintained in the disposal of bodies.

THE ADMINISTRATIVE SECTIONS

Administrative management of the PDH is discussed on page 25. A suggested organizational chart for the PDH is shown in figure 7. The administrative subsections listed here are based on this chart.

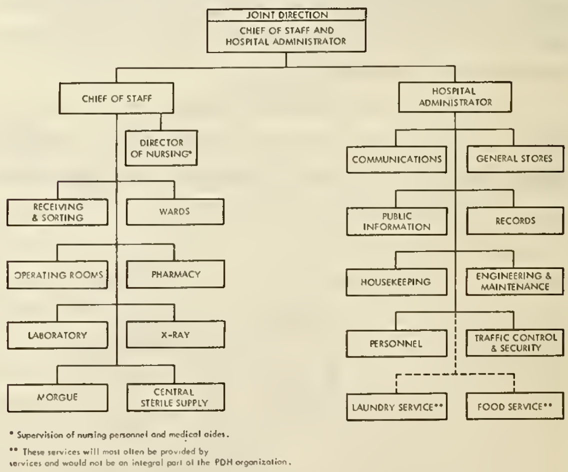


FIGURE 7—

SUGGESTED ORGANIZATION OF A PDH.

Communications

Communications must be maintained between the PDH control center and external agencies and other hospitals. Internal communications between the PDH control center and all PDH sections is also a necessity. The presence of a switchboard and/or central control panel for an intercom or public address system will probably determine the location of the communications center. If the selected building does not have such equipment, communications should be located near the control center in an area suitable for installing two-way radio equipment.

Necessary radio equipment and operators should be arranged for predisaster, in cooperation with civil defense communications officials. Specific equipment and operators may be designated predisaster to serve the PDH when telephone service is interrupted or impractical.

Civil Defense communications experts use two-way radio to communicate with hospitals during Test Exercise.

Walkie-talkie radios should be provided to augment or, when necessary, supplant electrical internal communications systems and to serve the control center. Messenger communications among other hospital sections should be performed as needed by personnel of those sections in addition to their other duties. Messengers should be used for external communication only when absolutely necessary.

General Stores

Most of the bulk supplies which do not go to the pharmacy or central sterile supply sections are delivered to this section when the PDH is activated. Case lots of supplies and equipment are stored here and dispensed in small quantities as requested by the hospital sections.

The success of the entire PDH is dependent to a great extent upon the efficiency with which this section handles the great quantity and variety of items for which it is responsible. Like the central sterile supply section, the stores section should be set up at once so that other hospital sections can obtain the supplies they need to begin operation.

The general stores section may be operated as a separate section under the supervision of the hospital administrator or a supply officer or it may be operated in conjunction with the central sterile supply section or the pharmacy. This is an administrative decision which should be made predisaster. See page 249 for detailed information on setting up and operating this section.

If general stores is operated separately, it can be located in almost any room with sufficient floorspace which is reasonably accessible to sections requiring supplies. If the room does not contain shelves and tables, they must be improvised from packing cases and boxes. If an existing large storeroom in the selected building can be cleared, this would probably be the most suitable space.

Records

A records section should be located reasonably close to the PDH control center. Disaster conditions will not permit extensive record-keeping; only those vital to patient care will be maintained. This section may also assume responsibility for patients' personal effects sent from the wards or from receiving and sorting for safekeeping.

Packed with the PDH are supplies of several forms suitable for disaster use. Together with other forms to be provided locally, they are illustrated and discussed here. The records section will keep control center copies of the index and information card, and the completed clinical records of discharged patients.

It is highly desirable that the staff of each PDH adopt a system of serial numbering for patient records. Assigning an individual number to each patient will lessen identification problems and expedite treatment. This is further discussed on page 29.

If the PDH is used to expand a permanent hospital and if the disaster plan for that hospital provides for the use of an emergency record system, the forms specified in the hospital disaster plan should be used instead of those supplied with the PDH.

PDH FORMS

Disaster Hospital Clinical Record

The Disaster Hospital Clinical Record (figure 8) provides space to record diagnosis and treatment information during the patient's entire time in the hospital.

Form Approved
Budget Bureau No. 97-R005.1

DISASTER HOSPITAL CLINICAL RECORD

Last name First Middle

Sex Age

Home address

Received at (*Name or symbol and location of hospital*)

Date

Source of admission

Diagnosis on admission, additional diagnoses, operations, etc., with dates.

Disposition

Date

Signature

M. D.

Received at (*Name or symbol and location of hospital*)

Diagnosis on admission, additional diagnoses, operations, etc., with dates.

16—70060-1

(Front)

Received at (*Name or symbol and location of hospital*)

Date

Diagnosis on admission, additional diagnoses, operations, etc., with dates.

Disposition

Date

Signature

M. D.

Received at (*Name or symbol and location of hospital*)

Date

Diagnosis on admission, additional diagnoses, operations, etc., with dates.

Disposition

Date

Signature

M. D.

INSTRUCTIONS

Used as a brief consecutive clinical record for all patients admitted to an emergency hospital.

Initiated at the first hospital to which patient is admitted; transferred with the patient to succeeding hospitals. When the patient is moved from one hospital to another, this record is enclosed in the emergency hospital medical record jacket along with other medical records; jacket is attached to patient during transport. This record closed upon discharge from hospital.

If one card is inadequate, continue record on a second card, or a third, etc., marking the cards as first card, second card, etc. Each additional card or other record must bear satisfactory identification of the individual.

When this record is closed, it and all other pertinent medical records will be disposed of as directed by the State civil defense authority.

U. S. GOVERNMENT PRINTING OFFICE 16—70060-1

(Back)

FIGURE 8

EMERGENCY MEDICAL TAG Serial No.

Name and home address of casualty

Sex: Age:

Location when injured (describe exact location)

Found at (describe exact location)

Tagged: Date Hour

Type of injury and treatment (by first-aid worker)

Name of first-aid worker

Diagnosis and treatment at first-aid station

Sedation	Dose:	Hour:
Morphine	Dose:	Hour:
Disposition	Date:	Hour:

Symbol of station | Signature—M. D.

SUPPLEMENTAL RECORD

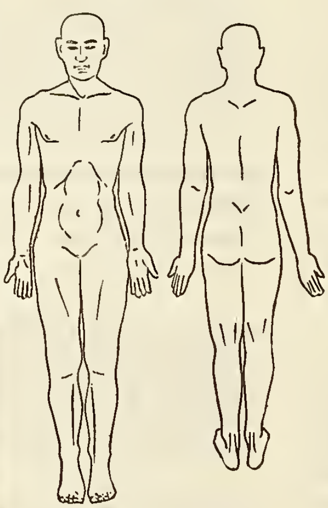


FIGURE 9

EMERGENCY MEDICAL TAG Date ______ Time ______

Name ______

Treatment ______

Indicate Whether Physician, Other Allied Health Worker or Lay Person Rendered Treatment: ______

FIGURE 10

It is initiated in the receiving and sorting section and placed at that time in the Disaster Hospital Clinical Record Jacket (figure 11) with any other records, such as an emergency medical tag made out by first aid or rescue workers, which are with the patient when he is admitted. If the patient is not able to identify himself, an effort should be made to find identifying papers or cards on his person or to find someone admitted at the same time who may know him.

The clinical record stays with the patient and is continued as long as he is in the hospital. It goes with him if he is transferred to another medical facility. It should be retained as a permanent case record by the facility from which the patient is ultimately discharged.

Emergency Medical Tags

These tags, which are not furnished with the PDH, should be made out by the first aid teams or rescue workers who give initial treatment to the patient before he is brought to the PDH. Two sample tags are shown. Figure 9 is a tag which has been stockpiled in some communities. Figure 10, considerably simpler, provides the basic information which would be needed by the physician in the PDH receiving and sorting section in order to diagnose the patient's condition and place him in the proper sorting category. If printed tags have not been provided by the community predisaster, plain shipping tags which can be tied to the patient's wrist or ankle can be used. Tags should not be attached to clothing, such as a jacket, which might become separated from the patient during treatment.

Disaster Hospital Clinical Record Jacket

The Disaster Hospital Clinical Record Jacket (figure 11) is tied to the patient in receiving and sorting. The clinical record and other tags and records are placed in it. Most of the information required on the jacket will be self-evident. Some will be given on the emergency medical tag or will be known by other victims brought from the same area or by a friend or relative who may have brought the patient to the hospital.

"Principal diagnosis" will be given on the clinical record. "Special attention needed in transit" is for the guidance of the ambulance driver or medical personnel if the patient is moved to another medical facility. At the time of such a move, the patient's destination and the date should be entered on the back of the jacket where space is provided to record transfers from one hospital to another in chronological order. The item "Final disposition" should be filled in upon discharge or death of the patient.

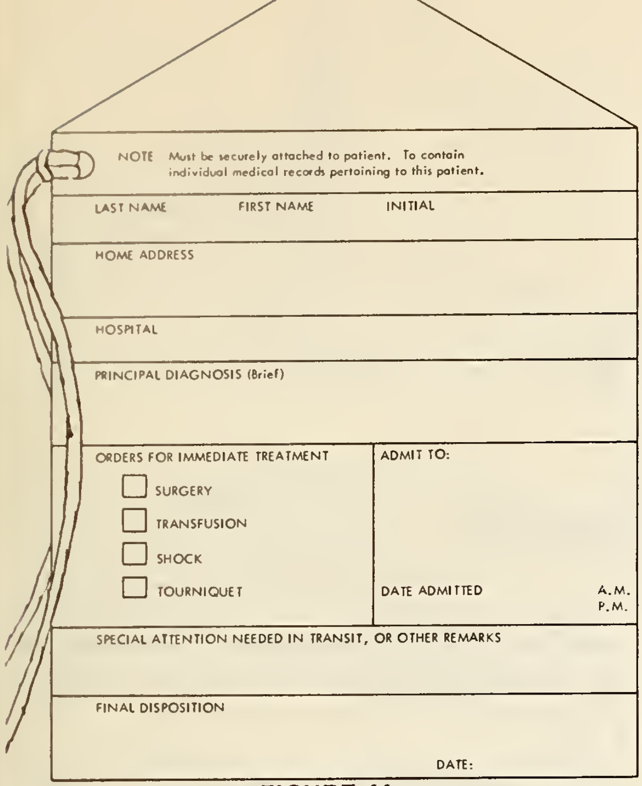


FIGURE 11
DISASTER HOSPITAL CLINICAL RECORD JACKET

Index and Information Card

The Index and Information Card (figure 12) comes as a set so that an original and two copies can be made. Items 1 through 13 should be filled out in the receiving and sorting section. If the patient is unconscious, an attempt should be made to find a wallet or personal cards and papers in his possession. Also, other patients may be able to answer most of the questions. "Source of admission" should indicate if the patient was transferred from another medical facility and by what means he was transported. The back of the card gives space for supplemental information and chronological follow-up notes.

All three copies of this card go to the PDH control center. The original is filed in the records section. One copy is sent to the PDH public information section and the other copy is sent to the community emergency health control center for use in compiling lists and other reports.

1. Last name	First name	Middle name		2. Bldg-room
3. Address				4. E.M. tag No.
5. Date of birth	6. Age	7. Sex	8. Race	9. Religion
10. Person to be notified (Name, address, telephone No.)				
11. Source of admission			12. Date admitted	AM PM
13. Admitted for (Check one or more) ☐ Mech. trauma	☐ Burns	☐ Shock ☐ Radio. sick.	☐ Hemorrhage ☐ Other	
14. Disposition of case ☐ Home		☐ Transfer to other hospital	☐ Died	☐ Other
(Insert destination – name of hospital, or home and street and city address.)				
15. Date and hour of disposition		AM	PM	
Index and information card				Hospital

FIGURE 12
INDEX AND INFORMATION CARD

As copies of the daily Hospital Disposition Log are distributed, each office holding a copy of the card completes items 14 and 15, "Disposition of case" and "Date and hour of disposition" on the patient's card.

Radiographic Report Form

This form (figure 13) is filled out in duplicate by the medical personnel requesting the test. Both copies are sent to the X-ray section with the patient. The X-ray section completes the report, keeps a copy and returns the original to the requesting section. This copy should be put in the patient's record jacket. Each section which requests X-ray service should keep a log of such requests and check them off as the completed form is delivered.

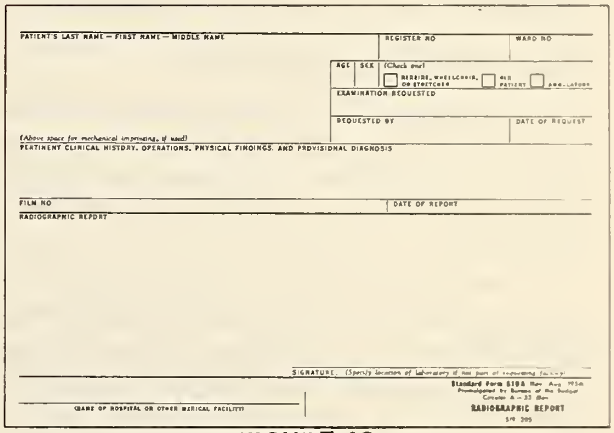


FIGURE 13
RADIOGRAPHIC REPORT FORM

Laboratory Report Forms

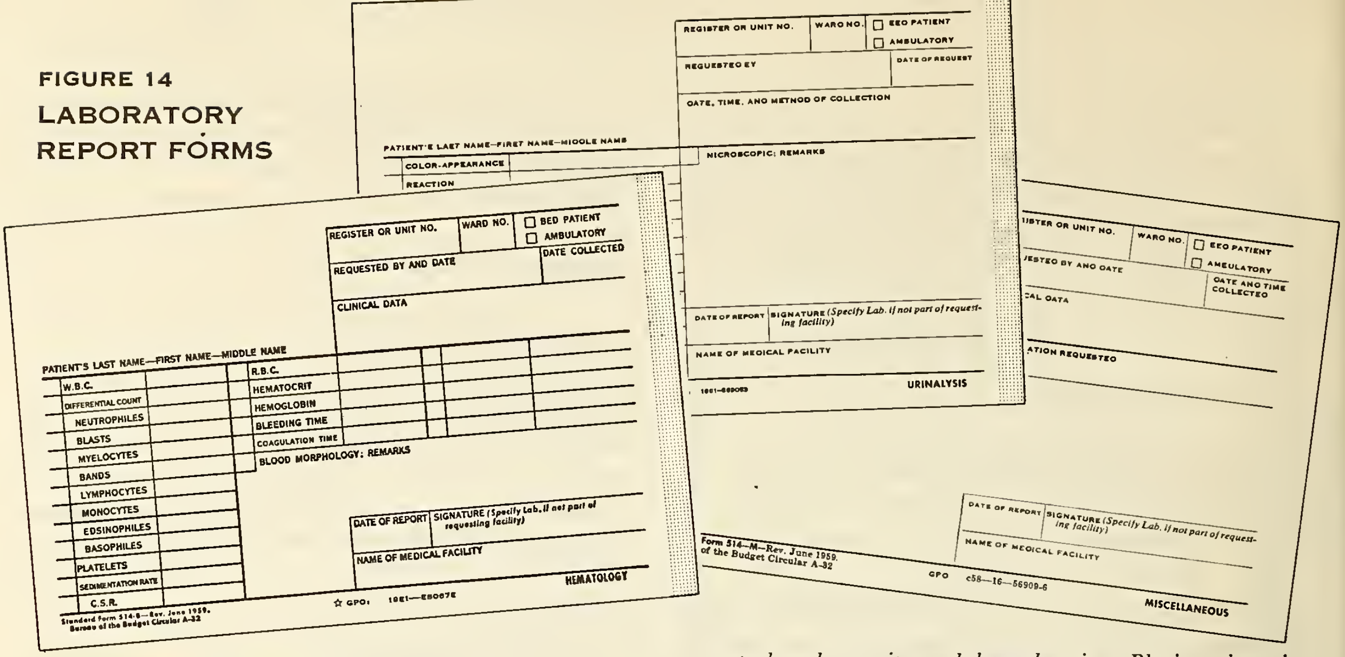
(Urinalysis, Hematology, Miscellaneous Test or Examination)

These three forms (figure 14) are filled out in duplicate by the medical personnel requesting the test. Both copies are sent to the laboratory. When the tests are completed, the laboratory enters the results on the form, keeps the copy, and returns the original to the requesting section. Each section which requests laboratory tests should keep a log of such requests and check them off when the completed test reports are delivered. The test report should be put in the patient's record jacket.

OPTIONAL FORMS

The use of two optional forms is suggested—a Disaster Hospital Supply Request Form and a Hospital Disposition Log. Some communities may decide to use additional forms such as operating room records and birth records. The design and reproduction of such optional forms should be arranged for locally.

FIGURE 14
LABORATORY REPORT FORMS



Disaster Hospital Supply Request Form

A suggested form is shown in figure 15. If the community does not reproduce such a form for storage with the PDH, requisitions can be made out in triplicate on pads of plain paper with the same general format as this sample.

This form is used to requisition supplies and equipment from central sterile supply, general stores, and the pharmacy. The requesting section keeps one copy as a record of what was ordered and when. The original and the other copy are sent to the supplying section which files the original and returns the copy to the requesting section with the supplies ordered.

Hospital Disposition Log

A suggested form is shown in figure 16. If the community does not reproduce such a form in advance, the information can be recorded in triplicate on plain sheets of paper.

The Hospital Disposition Log is prepared every day in each ward to report patients' discharge, transfer, or death. All three copies go to the PDH control center and from there the original is sent to the records section. The copies go to the public information section of the PDH and to the community emergency health control center. Each of these offices holds a copy of every patient's index and information card and should enter this disposition information on the appropriate card.

Housekeeping

This section is responsible for cleaning the interior of the building and its furnishings, moving furniture as necessary, and removing waste and trash from the building.

One room with three desks should be adequate for the chiefs of engineering and maintenance, traffic control and security and housekeeping. Placing them in one central location would simplify internal communications, especially if messengers must be used.

Laundry

Unless the PDH is set up in a school building with modern athletic facilities, the operating site will rarely contain a laundry, and arrangements will have to be made with an existing laundry near the building if the affiliated hospital laundry cannot handle the extra load. These arrangements should be made predisaster. Plans for volunteers to augment regular laundry staffs may have to be made.

DISASTER HOSPITAL SUPPLY REQUEST FORM

FROM________ SECTION Date________

ROOM________ Time________

TO: (check one) ☐ STERILE SUPPLY ☐ PHARMACY ☐ STORES

QUANTITY	ITEM NEEDED	IDENTIFYING NO.

DISPOSITION OF REQUEST: ☐ ISSUED ☐ NOT AVAILABLE REORDER ________ ☐ OUT OF STOCK

INSTRUCTIONS: Prepare in triplicate. Send two copies to Sterile Supply, Pharmacy or Stores. Retain one copy.

FIGURE 15

HOSPITAL DISPOSITION LOG

________ Name or designation of hospital   Ward ________   Date ________

Name	Disposition: To: Place, unit or person	Time

FIGURE 16

Food Service

A modern school building selected as the operating site will almost always have a kitchen and cafeteria which will be adequate for the patients and staff of the PDH. Many other buildings also have some kind of food preparation facilities. If possible, the kitchen staff regularly employed in the building should be recruited for the hospital operation. This staff may have to be augmented by volunteers. Most such facilities would probably have sufficient food supplies on hand for several days, but sources of resupply should be determined predisaster.

If the building does not contain a feeding facility, arrangements must be made predisaster for food service for PDH patients and staff. To prepare for natural disaster, contact the local Red Cross chapter or a local restaurant or catering service and plan for the post-disaster preparation and delivery of food. To prepare for the eventuality of national emergency, PDH feeding arrangements must be made with civil defense welfare service.

Public Information

A room or area easily accessible to the public and out of the way of the main flow of patient traffic should be set aside for an information office. It may be in the main PDH building near an entrance not used by patients or in a nearby building. A regular system of obtaining copies of patient records must be established so that current information on the identity and condition of patients can be made available to those who inquire. This is important in a disaster because people trying to find relatives and friends in the hospital could otherwise occupy too much of the time of medical personnel and hamper the flow of patients. Signs directing the public to this section should be prepared and posted at other entrances to the hospital.

The public information office will assume its usual functions as indicated by the state of communications and news media and by the size and type of disaster.

Personnel

This section might be located near or in the same room with the public information section. Volunteers who wish to work in the PDH and who have no predisaster assignment can be directed to this section. If they can be used, they will be assigned to an appropriate PDH section from here. Good communications with the PDH control center is important so that current manpower needs will be known at all times and assignments can be made effectively.

Engineering and Maintenance

The chief building engineer will probably be in charge of this section. He should have a desk in a convenient location from which he can direct activities of personnel under his supervision, and where messages can be left for him when he is working elsewhere in the building. He should be in constant communication with the PDH control center.

The work of this section includes the operation and repair of the building's heating plant, air conditioning system, and other mechanical equipment; any necessary repairs to the plumbing and wiring systems and essential repairs to the building itself. Personnel from this section will set up, operate, and maintain all emergency utility equipment such as the PDH generators and the water pump and storage tank. Assembly instructions for the water tank and pump (page 291) and for generators (page 259) are included in this publication.

Traffic Control and Security

Personnel from this section are responsible for guarding entrances and directing internal traffic. The general public must be restricted from treatment and ward areas. All inquiries, including volunteer personnel should be directed to the public information and personnel offices. Traffic control and security personnel will also direct vehicular and pedestrian traffic in the immediate vicinity of the PDH building. The chief of this section should have a desk in a convenient location from which he can direct the activities of his personnel and communicate with the PDH control center, and where he can be reached quickly in an emergency.

ADMINISTRATIVE PLANNING FOR PDH MANAGEMENT

THE ADMINISTRATOR

Although he must often function in an austere environment, the work of the administrator is little different in a disaster situation than under normal conditions. He continues to be responsible for providing nursing care and all other services required by the physician in caring for his patient. The administrator's primary concern is with the management functions of planning, coordinating, motivating, and controlling. He delegates the responsibilities for the performance of individual functions to those who are specialists. His job is one of working through other people to facilitate all aspects of patient care.

One of the accepted responsibilities of the administrator is that of providing for hospital care under emergency conditions. The PDH, for which he is largely responsible, enables him to improve and expand the mass casualty care potential of his hospital. It is an obligation of the administrator to see that a plan is written for the use of the PDH, and that PDH utilization is incorporated into the hospital's regularly rehearsed disaster plan. Today's hospital administrators, in conjunction with their medical staffs and health and civil defense authorities, must provide the leadership which will result in effective utilization of the PDH.

OPERATIONAL PLANNING

The goal of the hospital is modified under disaster conditions and changes from that of providing the highest quality of medical care to a standard of care consistent with the disaster situation. With regard to the PDH this requires:

A. Planning B. Staffing C. Training
D. Coordination of Supporting Services

To meet these requirements, the parent hospital administrative staff must gain understanding of the total community civil defense and emergency health service programs. Then they can begin to develop a thoroughly effective PDH program.

When a community has an official public health agency, that agency normally coordinates emergency health services. A physician as head of the public health agency usually is the chief of the emergency health service and coordinates the disaster planning of all health agencies and hospital facilities. Where there is no official public health agency, the local medical association or State society will appoint a physician as director of emergency health services. This action often is initiated by civil defense.

By coordinating with emergency health services, the administrator may be assured that his hospital's disaster plan takes into consideration the total plans of the community, the county, and the State. It is a responsibiliy of public health officers and hospital administrators to insure that all disaster plans, including the use of Packaged Disaster Hospitals, are interwoven.

Each hospital disaster plan should indicate the number of patients that can be handled with existing personnel and equipment. The plan should further state at what point the PDH would become operational.

It is recognized that disaster patient load maximums cannot be determined until after a disaster has occurred. The standard of professional care invoked will vary with the magnitude of the disaster and the resulting patient load. For planning and training purposes, you might consider your disaster patient load to be the sudden influx of a large number of patients far exceeding normal bed care capacity, requiring full austerity of resources.

ALLIED AGENCIES

Enlisting the cooperation of many agencies outside the hospital's organizational structure is part of a hospital administrator's normal responsibility, and this is mandatory for a PDH operation. Active participation by members of groups and organizations whose normal, ongoing programs are related to the hospital are important resources. Some of these include: law enforcement, fire, welfare, local government, Red Cross, public health, and news media. The coordination of PDH needs from all of these groups is one of the major administrative functions.

AUXILIARY STAFF

Sufficient auxiliary disaster staff must be added to provide medical care for the additional patients. Among the resources for finding such people are: (1) volunteer services; (2) medical schools and pre-med programs in colleges; (3) nursing associations; (4) veterans' organizations, which can help locate former military medics; (5) collegiate and hospital schools of nursing are a source of experienced nurse instructors and nurses attending college (some have added disaster training to their curricula); (6) Red Cross instructors (the Red Cross will also have lists of persons who have completed various training courses for the care of the sick and injured); (7) Medical Self-Help training graduates; (8) active and inactive Red Cross and other hospital and disaster volunteers; (9) health and physical education teachers and athletic trainers; (10) Boy Scout first aid merit badge counsellors; (11) fire departments; (12) rescue squads; (13) ambulance crews; and (14) industrial doctors and nurses, including those from insurance companies who may not be in general practice.

Auxiliary personnel should be assigned specific duties, trained, and contacted regularly so that lists may be kept up-to-date.

Administration of PDH as Separate Facility

It is a much more complex operation to use the Packaged Disaster Hospital as a separate facility. However, disaster preparations should include plans and training for use of the PDH as an independent unit. This provides greater flexibility in your disaster plan. The PDH can then be used to augment the parent hospital's patient care potential and, if need be, replace a destroyed facility.

When the PDH is set up within the confines of the affiliated hospital, the regular staff assumes complete responsibility for planning, supplies, equipment, procedures, and routines. When a PDH is used as a separate unit, these systems must be supplemented by outside resources. It is conceivable that the PDH would be staffed almost entirely with volunteer personnel.

The planning, establishment, and operation of the PDH as a separate unit set up in a preselected building is more difficult than incorporating the components into an existing facility. However, the problems involved are closely related to those which the administrator encounters on a smaller scale daily. Sound management through careful planning will result in a smoothly operating medical care facility once it becomes necessary to activate the PDH.

RECEIVING AND SORTING

SORTING CONCEPTS

Following nuclear attack or major natural disaster, the goal of all medical personnel must be to return the largest possible number of people to productive activity in the shortest possible time. Sorting, sometimes called triage, is the first step toward achieving this end. Sorting is the process by which patients are placed in categories for priority of treatment, based upon type and extent of injury or illness and medical resources available. These categories are discussed briefly on page 31 and in detail in "The Treatment of Mass Civilian Casualties in a National Emergency."

In the Packaged Disaster Hospital patients are admitted and sorted in one area called, appropriately, Receiving and Sorting. This is the first section to see the disaster victim as he arrives at the hospital. Admission and medical records are initiated here and the most experienced surgeon available performs a rapid evaluation of the patient's injuries or illness. Based upon this diagnosis, the patient is given his initial sorting classification. Sorting does not end in the admitting area; it is a continuous process whereby a patient's condition is constantly re-evaluated during the minutes, hours, and days following his admission.

When caring for emergency room patients under normal conditions, a physician often examines (sorts) them, directs them to various hospital areas, and then personally institutes definitive care. While working in a mass casualty situation, such as would be encountered when the Packaged Disaster Hospital is activated, the physician must not expect to follow a patient through. Chaos would result if the sorting physician attempted to categorize patients and then proceed with them to treatment areas.

In any hospital handling mass casualties, the most astute and experienced professional personnel available must be initially allocated to the receiving and sorting area. This priority is based upon the urgent need for accurate diagnosis, expert lifesaving care, and rapid admission before transfer of casualties to appropriate sections. When the sorting emergency subsides, personnel may be reassigned to areas where their particular talents are needed most.

One of the principles underlying successful and efficient sorting is delegation of authority. It may be necessary for physicians to ask allied medical personnel to perform extraordinary functions in receiving and sorting. Adequate training as well as medical supervision is essential to assumption of these duties. A nurse, for example, with training and experience to qualify her, might be delegated the duty of pre-sorting patients into ambulatory and litter categories. Such assistance will be invaluable to the sorting physician during a major influx of disaster victims.

The physician working in the receiving and sorting area must make decisions that on the surface will seem to be dispassionate. Occasionally, he must leave a badly wounded patient to die. However, the physician with mass casualty care training and experience knows that in major disaster, medical supply and personnel limitations will not tolerate heroic treatment in an attempt to save the life of a single patient with poor prognosis at the risk of sacrificing several whose prospects for recovery are good. The receiving and sorting physician must base all decisions on the basic concept of sorting: to achieve the greatest good for the greatest number.

ESTABLISHING THE SECTION

Location

When it becomes necessary to activate the Packaged Disaster Hospital, either as a separate facility or to augment the patient load capacity of its parent hospital, one of the first sections to be set up must be receiving and sorting. This section must be located adjacent to the patient entrance. The entrance is selected by its ease of access, size of doorways, and proximity to a large, preferably paved area where emergency vehicles can unload patients with little or no delay. All vehicles carrying patients should be directed to the designated patient entrance. This will help to establish the routine routing of all patients through receiving and sorting, since all must be sorted before being transferred to other areas of the hospital or to other medical care facilities.

When the PDH is set up as an independent facility, sufficient space must be allotted to the receiving and sorting area to accommodate a minimum of thirty patients at any given time, a ratio of 15 patients per 100 beds. It is understood that no one can foresee a disaster patient load, however, consultants experienced in mass casualty care believe this arbitrary figure to be adequate for planning purposes. During planning for space requirements consideration should also be given to the space needed for litters, attending personnel and equipment being used in the care of patients. When PDH components are set up within the confines of the parent hospital, the area designated for receiving and sorting should take into consideration patients who will be

sorted and sent directly to other hospitals for definitive care. Some thought should be given to the care of outpatients in a section of this area if it is large enough and if there are no other facilities for outpatients.

Under the most severe disaster conditions, it may be necessary to leave patients out-of-doors in the unloading area until they can be processed through receiving and sorting. This has been the case in many extensive industrial and transportation disasters. Medical personnel will find it difficult to instigate such measures, but experience has shown that the prognosis of the majority of patients will be markedly improved if they are first seen in receiving and sorting and given medical sorting classifications.

In the event of nuclear, biological, or chemical warfare, the entrance to the receiving and sorting section should lend itself readily to patient monitoring and decontamination prior to entry into patient care areas. In cases of contamination of severely ill or injured patients, receiving and sorting personnel must supervise decontamination procedures.*

If at all possible, receiving and sorting should be equipped with a communications center and should maintain contact with all sections of the hospital, other community medical care facilities, and where applicable with the disaster site itself. Effective emergency communications between the receiving and sorting area and other medical care facilities will increase the efficiency of the sorting process, especially where patients are sent directly to another facility for definitive care. If it has been determined that they may be admitted immediately elsewhere, they need never enter the PDH patient flow pattern.

*See Page 25, "The Treatment of Mass Civilian Casualties in a National Emergency."

Rapid Admission Procedures

Because patients will enter and leave the receiving and sorting section rapidly, a large portion of the registration and admitting clerical work must be done on a roving basis. Clerks must accompany examining physicians and complete admission records, hospital clinical records, and emergency tags as dictated by the physician. They should carry clipboards or similar hard-surfaced objects to facilitate printing rapidly and legibly. *It should never be necessary for the physician to touch a pen or pencil; his time must be reserved for patient examination and lifesaving care.* Frequently, admission records cannot be completed until after the patient has received definitive medical care in other sections of the hospital.

With proper preparation and personnel orientation predisaster admission time can be cut to less than two minutes per patient. All records are keyed to a numerical admission chart which should be prepared locally predisaster and packed with the PDH. The amount of time required to prepare such records is nominal considering admission time saved during and immediately following a disaster.

The patient's admission number is written on his forehead with a skin pencil. Where head injuries prevent, the admission number is written on the back of the right hand. A set of numbered admission records and a personal effects bag are placed between his legs on the stretcher. If the patient is ambulatory, he will carry his records with him. At no time will identity take precedence over patient care. Once identity has been established, the numbered patient's name and address will be recorded on admission records. All administrative and medical care records may then be completed. If the patient never regains consciousness and is not identified by neighbors or family, identity will become a problem for mortuary services.

Supplies and Equipment

Available desks or tables and chairs should be set up near the patient entrance. When furniture is not available, six or eight equipment packing crates will suffice. These will be needed by registrar clerks who will initiate admission records on patients.

Receiving and sorting will be the first area requiring surgical and other sterile supplies. Arrangements should be made, predisaster, with general stores and central sterile supply personnel to insure availability of these vital supplies as soon as possible following off-the-premises activation of the PDH. An ideal arrangement would be for advance preparation of packs of sterile supplies requisitioned from parent hospital supplies which would be stored with the PDH. Immediately upon activation of the PDH these packs would be delivered to receiving and sorting.

Other critical PDH supplies and equipment, including the list following, are designated for receiving and sorting:

- Diagnostic Head Lights
- Double Decker Litter Cots
- Folding Litters
- Folding Litter Supports
- Otoscope and Ophthalmoscope Sets
- Sphygmomanometers
- Stethoscopes
- Stoves, One-Burner Alcohol
- Suction and Pressure Apparatus
- Operating Table and Lamp (when available)

Predisaster planning should include the provision for almost instantaneous delivery of these critical supplies to receiving and sorting. Patients cannot be admitted, sorted, or lifesaving care administered without them.

Sufficient table space to hold such items as sphygmomanometers, tourniquets, dressings, syringes and needles, drugs, and various surgical instruments should be centrally located. If not needed immediately in the operating room section, one Packaged Disaster Hospital operating room table, lamp, and instrument tray may be set up in receiving and sorting for administration of lifesaving procedures and for close examination of select patients with critical traumatic injury.

It is extremely difficult for the physician to examine and treat patients at floor level. When sufficient litter supports are not available, sawhorses, packing crates, benches and any other suitable devices should be arranged to support litters as patients are brought in. Provision should also be made to vary the height of litter ends, so that patients may be placed in positions indicated by their conditions.

The examination area must be well-lighted, and provision must be made for a supply of potable water. Ideally, bathroom facilities, including shower, will be adjacent to the examination area.

Faced with a patient who cannot breathe because of an obstructed airway, a physician has no choice but to use any instrument available to provide an airway. To contend with such emergencies when sterile supplies are not available, plans should also include the means for emergency on-the-spot cold sterilization in the receiving and sorting area, plus provision for an immediate supply of hot, soapy water. While these methods will by no means insure complete sterilization, they are better than none at all.

RECEIVING AND SORTING IN OPERATION

Establishing Patient Flow

Under normal conditions in an average hospital, an individual enters the patient flow pattern by being routinely admitted and assigned a bed. In an emergency, he is first seen in the emergency or operating room. After emergency treatment, the patient is assigned a bed if necessary, and his admission records are completed.

In the PDH, patient flow patterns always stem from receiving and sorting. Without exception, these rules apply:

- All patients must first be seen in receiving and sorting regardless of condition.
- Each patient must be assigned to a sorting category.
- Receiving and sorting is the only route to definitive medical and surgical care.

As he is examined, the patient is tagged for therapeutic action according to the sorting classification into which he is placed. The tag implies or states specifically the treatment he is to receive. Later, he may be sorted into another category, as conditions permit.

In many instances, procedures to combat shock as well as operative procedures will actually begin in receiving and sorting. Well-defined patient traffic patterns will assure that these procedures are continued without undue interruption and will avoid delay and confusion in forwarding casualties to appropriate patient care areas. Prior planning should also provide for unobtrusive removal of the dead to the morgue area.

Sorting Classifications

Seriousness of injury is not always the determining factor in sorting. Early return to productivity and the avoidance of future disability are the prime considerations in sorting patients for Immediate definitive care.

Percentages of injured expected to fall into the various sorting classifications, regardless of type of disaster, are shown below. If sorting is handled successfully, 60% (Categories I and II) of the total should be able to return to an active productive life within a minimum length of time.

Mass casualties are placed into four basic sorting categories. They are:

I Minimal Category: (40%) — Injured falling into this category really have no priority for treatment. In practice, they will receive early outpatient care in order that most may rejoin the community and aid in postdisaster rehabilitation.

II Immediate Category: (20%) — This category will include persons with minor injuries, as well as patients with more severe injuries where brief, uncomplicated treatment procedures will prevent prolonged illness, disability, or death.

III Delayed Category: (20%) This group of casualties includes those sustaining serious injuries requiring significant treatment, but who are not in danger of losing their lives from lack of immediate surgical attention.

IV Expectant Category: (20%) This category is made up of those with critical injuries with poor prognosis even with the performance of major surgical procedures of a time-and-material-consuming nature. Those placed in the Expectant category will be made as comfortable as possible. As time and supplies permit, they will be recategorized.

The sorting of mass masualties under a variety of circumstances is discussed at length in "The Treatment of Mass Civilian Casualties in a National Emergency" and in "Emergency War Surgery," NATO Handbook.

Lifesaving Care

While it would defeat the purpose of sorting to hold patients there for treatment, here are exceptions where lifesaving procedures must be initiated immediately, regardless of the sorting classification into which the patients are ultimately placed. Among those conditions will be:

Pain—Not only is there a humanitarian aspect to the administration of medication for severe pain, but there is the physiological aspect of the relationship of pain to shock.

Shock—While there may be an area designated for the treatment of shock, (perhaps an intensive care or pre-op ward) it is always possible that a patient arriving at the PDH may be in such critical condition that shock treatment must be initiated in receiving and sorting.

Hemorrhage—When there is active hemorrhage at the time of admission or evidence of previous severe hemorrhage with near exsanguination, the institution of replacement of blood volume in receiving and sorting before rapid transfer of the patient to the shock section may mean the difference between life and death.

Establishment of an Airway—Obviously, should the patient arrive at the hospital with cessation or threatened cessation of respiration, treatment must be administered immediately before the patient is referred to any other area of the hospital. Few casualties will be treated in receiving and sorting for this condition.

Cardiac Resuscitation—Similarly, few patients will arrive who will need cardiac resuscitation in a disaster situation. However, for the small percentage who develop cardiac arrest, resuscitation must be initiated immediately and continued during transfer to another area.

Sucking Chest Wound—Such wounds should be closed with a firm occlusive dressing in the receiving and sorting section, and the patient then transferred to the operating area for the surgical treatment indicated.

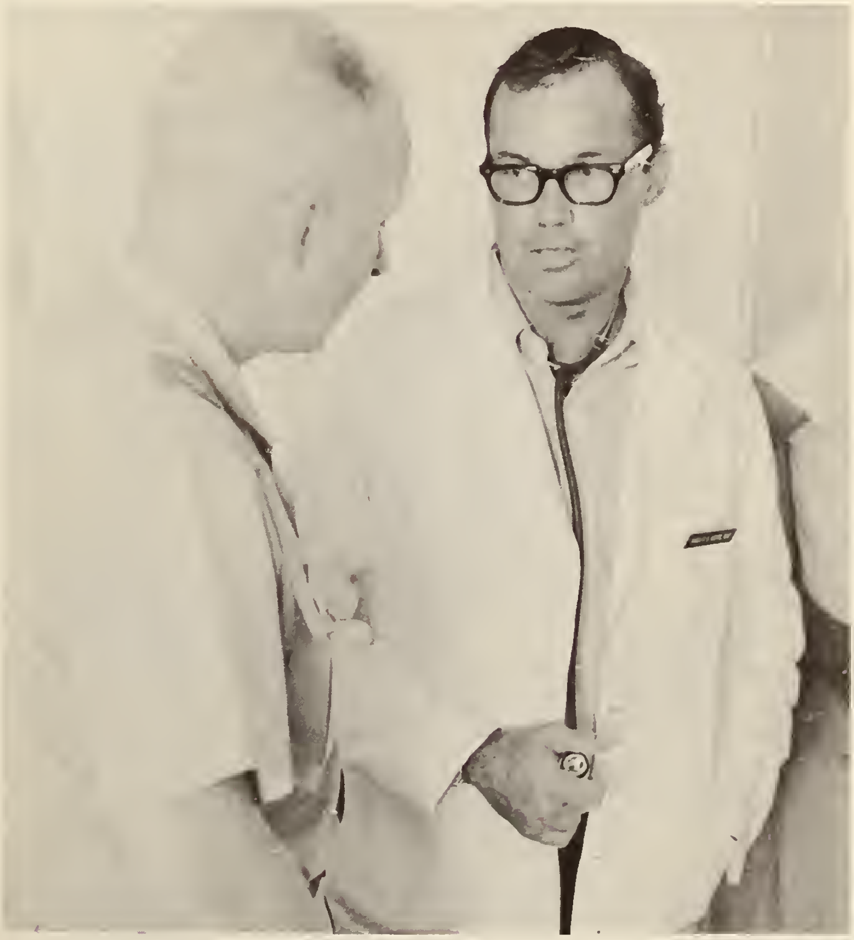
Even though the sorting physician may find it necessary to initiate lifesaving measures, he should recognize that he must limit himself to immediate care only, leaving completion of procedures to support personnel. Patients must be transferred to the next section as soon as possible in order to make room for incoming casualties.

The efficiency of this area will be seriously impaired if an attempt is made to initiate time-consuming definitive treatment. To avoid patient flow bottlenecks, this care must be deferred until the patient reaches other sections of the hospital.

PERSONNEL

Because speed and competence in sorting is the single most important medical professional function in mass disaster situations, the physician assigned as chief of receiving and sorting must be the most experienced surgeon available. His assistants must be among the most qualified professional persons on duty in the disaster hospital. Volunteers assigned to receiving and sorting should be taught the principles of mass casualty care and should have Medical Self-Help or Red Cross First Aid training.

Physicians and nurses with a background of combat military medicine or those who have worked



in situations where mass casualty care techniques were employed, are prime candidates for assignment to receiving and sorting.

Personnel who have worked in hospital emergency rooms, because of previous experience, will probably adapt readily to duty in the receiving and sorting section.

Many medical people are of the opinion that emergency medical care as it is normally practiced in hospitals and in physicians' offices will prepare them for sorting casualties during a disaster. This is not true. The sorting of mass casualties has no distinct parallel in the routine care of the sick and injured. There is no more important or difficult task in an emergency than the sorting of mass casualties. None requires more training, experience, informed judgment, hard work, or courage.

Under disaster conditions the influx of large numbers of casualties, many with serious injuries, will overwhelm a fully staffed hospital and rapidly deplete its supplies if cogent planning and training have not been completed. All personnel involved in disaster preparedness will benefit from practical training under the leadership of individuals who have had actual experience or intensive training in mass casualty care.

It is impossible to designate specific numbers of people to staff the receiving and sorting section of the Packaged Disaster Hospital. During periods of heavy influx of patients, receiving and sorting will require more personnel than at slack times. Depending upon activity in receiving and sorting, personnel may be transferred temporarily or permanently to other hospital sections.

To plan for maximum utilization of receiving and sorting personnel, it is essential that all, as a part of the hospital disaster plan, participate in exercises simulating disaster conditions.

A sample skeleton PDH staffing pattern is shown on Page 11. However, where manpower resources permit, the staff should be enlarged and expanded. During a major disaster, receiving and sorting could be expected to operate efficiently with the following personnel:

- 2 Physicians
- 4 Nurses
- 2 Nurse Anesthetists
- 2 Intravenous Technicians
- 12 Medical Aides
- 2 Clerks
- 4 Messengers

For morale purposes, consideration should be given to the addition of one or two clergymen to this list.

Some may question the inclusion of intravenous technicians in the suggested staffing pattern. When intravenous procedure is necessary it is even more likely during disaster that the patient's condition will inhibit venipuncture. Therefore, highly skilled personnel are needed for this purpose. Some modern hospitals assign nurses to intravenous therapy teams. Nurses so trained become extremely adept at intravenous administration and their services would be in great demand in many

sections of the PDH. It is always the responsibility of the sorting physician, however, to determine if intravenous therapy should be initiated in receiving and sorting or deferred until the patient reaches another section.

While a nurse anesthetist may seem a luxury in the receiving and sorting section, if she can be spared from the operating room she can be of tremendous assistance in the maintenance of airways and in administering anesthetic agents as they are needed.

Litter bearers should be trained in the methods of lifting patients onto a litter and transferring them from litters to beds or operating tables. It is important also that bearers learn the proper method of opening a litter. This may seem a small point, but serious injury to hands and fingers can result if improper techniques are employed. See page 64.

CHEMICAL AND BIOLOGICAL WARFARE

In preparation for the eventuality of chemical warfare, all personnel should be acquainted with general principles of chemical warfare agents and in the treatment of casualties resulting from this type of warfare.

Perhaps the most urgent of such casualties would be those who are victims of the various organic phosphorus compounds known as "nerve gases." The treatment of these casualties is based primarily upon the immediate administration of heroic amounts of atropine, supportive therapy to combat shock, and the removal of fluids from the airway by means of suction. Patients exposed to suffocating types of gases must receive supportive treatment and artificial respiration. In the case of vesicant gases, the treatment of these patients will closely resemble that of the treatment of patients suffering from thermal burns.*

Potential bacterial and viral warfare agents are listed under Section XVI, "The Treatment of Mass Civilian Casualties in a National Emergency." Techniques of decontamination, disease prevention, immunization, chemoprophylaxis and therapy are also discussed.

POSTEMERGENCY FUNCTIONS

Following the major influx of disaster patients, the receiving and sorting area, while still admitting patients, may also expand the outpatient department and dental clinic. Its location is ideal for outpatients. After treatment, patients would leave the premises without entering other sections of the hospital.

*See page 62 "Emergency War Surgery," NATO Handbook.

Supplies and equipment adequate for emergency dental care are packed in the PDH. A field-type dental operating chair and an adjustable dental operating light, both easily and quickly assembled, together with a Mayo-type instrument stand included with the PDH, will suffice for any dental procedures that would be undertaken during a disaster situation. See page 39.

Personnel originally assigned to receiving and sorting, if not more urgently needed in other sections, could continue to function in this area, taking on additional duties as required by the outpatient department and dental section. All would be subject to immediate recall to receiving and sorting duties following an influx of additional casualties.

TRAINING THE STAFF

Because few members of the receiving and sorting staff will have had disaster experience, predisaster training by an informed physician is essential if the sorting operation is to be successful. Certain aspects of disaster medical care as practiced by the physician must be presented to other members of the staff so that they will thoroughly understand the principles of sorting and will be able to work more efficiently with the physician during the disaster. Some of these principles are described briefly here.

Minimal Injury

For those patients with minor injuries, reassurance is often all that is necessary. After outpatient care, they may be enlisted to help with the nonprofessional work in the PDH.

Psychological Problems

Since psychological problems will vary from relatively minor to extremely severe, the judgment of the receiving and sorting physician is of utmost importance here.

Those with minor emotional problems will respond to simple supportive measures. The emotional stability of these patients may be greatly improved if they are put to work.

Sedatives or tranquilizers may be needed for individuals with more serious emotional problems. It is unlikely that psychiatrists will be immediately available to treat these patients. Physicians with varied specialties will probably be called upon to use their medical skills to care for patients placed in the Immediate sorting classification.

If there is a suitable, safely accessible building near the PDH, it might be best to establish a clinic there for the treatment and care of psychiatric patients.

Pain and Medication

Pain is a subjective symptom, and the degree of pain is known only to the patient himself. It is likely that the pain may be worsened by certain emotional and psychological factors. These fears and anxieties should be allayed and it is here that the clergy may have a role in receiving and sorting.

Because of the physiology of shock, medications administered to these patients may not be well absorbed by circulation. This is due to the stagnation of the blood at the site of administration of the medication. Failure to recognize such stagnation may result in overmedication of the patient, with a worsening of his condition. For example, if a patient is given a quarter grain of morphine by hypodermic injection upon arrival at the hospital, it may not be absorbed rapidly due to circulatory deficiency. Since he does not absorb this medication properly and therefore will not respond promptly, the patient may be given another dose, and still another shortly afterward. When circulatory function is restored he may then absorb the entire amount simultaneously and suffer from narcotic poisoning. It is often advisable to administer barbiturates and narcotics slowly by the intravenous route diluting drugs to 5 cc. or 10 cc.

Shock

Personnel working in the receiving and sorting section must have a good practical knowledge of the physiology of shock. While this knowledge is presumed to be part of the training of physicians and nurses, the nonprofessional staff should also be trained to recognize and assist in the treatment of shock. They should know that shock is essentially a condition in which there is *a decrease of blood supply to the vital centers of the body, including the heart and brain.* This may be due to loss of the total blood volume or it may be due to improper distribution of the blood in the body or a combination of both.

As a general rule, the head of the shock victim should be lowered, and personnel should be trained in simple practical methods of placing the patient in this position. On the other hand, there may be some conditions involving head injuries or respiratory distress in which even though there may be a condition of shock, the patient should be kept level or even with the head slightly elevated. The very simple method of remembering these positions from the standpoint of lay personnel should be: "Face red, raise the head; face pale, raise the tail."

For those patients who appear to be in impending shock, the oral electrolyte fluids are excellent. See pages 16 and 17, "The Treatment of Mass Civilian Casualties in a National Emergency," for preparation and administration of oral electrolyte solution. One of the most important points to remember about shock is that these patients must be monitored frequently and carefully. Not only should they be watched for any increase in the degree of shock but they should also be given frequent small sips of fluid. The ingestion of large amounts of fluid will usually result in gastrectasis, vomiting, and perhaps a worsening of the condition. If the patient does not respond to oral fluid and if his shock continues in spite of treatment of the primary cause, then obviously intravenous fluids should be administered.

A patient requiring intravenous fluids will be in relatively poor condition. This makes for great difficulty in introducing the needle into the vein. Therefore, the fluids will not be allowed to run out completely, but should be monitored so that a new bottle may be substituted when the current bottle of intravenous fluid is almost empty.

Minor Contusions and Abrasions

The sorting physician must first determine that such injuries *are* minor and that they do not mask more serious underlying conditions. For example, a large contusion with hematoma might mask broken bone ends of a fracture.

Hemorrhage

Patients may require heroic measures where hemorrhage has occurred. Most victims who have had major vessels severed will not live to reach the hospital. However, there will be some exceptions to this because of rapid transportation of casualties and because of retraction and clotting in the large vessels. Hemostasis may be accomplished by means of hemostats applied directly to the vessel, by pressure, and by means of rapid ligation of the vessels. Meanwhile, the patient should be treated for shock.

Maintenance of Airways

Because of the numbers of patients who will be seen with respiratory difficulties, including pulmonary edema, and with bleeding into the airway, adequate suction methods are essential. There are generally three types of suction techniques available in the Packaged Disaster Hospital:

1. Suction apparatus operated from an electric motor on the 110 volt line.
2. Hand operated suction pumps with the large tank for producing negative pressure (Wangensteen-Phelan type).
3. Use of an irrigating syringe if the other two methods are not immediately available.

The hand operated suction pumps packed in some PDH's, because of prolonged storage, may not operate efficiently until oil or grease is applied to the piston of the machine. The electric pump is the more efficient of the two.

A patient who is "drowning in his own fluids" cannot wait and it may be necessary to use the more basic method of an irrigating syringe or large hypodermic syringe to which a catheter is attached. The catheter may be introduced into the nose or mouth and suction applied to withdraw fluid of any type.

Resuscitation

Cardiac resuscitation might be required in any section of the PDH. All medical care personnel in receiving and sorting should know how to accomplish closed heart massage. This procedure should only be started in receiving and sorting, then continued in other areas of the hospital.

In a mass casualty situation most victims needing artificial respiration will have had respiration restored before their arrival at the Packaged Disaster Hospital. However, there will almost certainly be some patients with cessation of respiration. All personnel in receiving and sorting should be acquainted with the mouth-to-mouth method as well as back pressure arm lift technique. While physicians and nurses will generally be acquainted with these techniques, other personnel should be so trained.

The introduction of an airway may be lifesaving. Under circumstances where the number of casualties is overwhelming, it is permissible to prevent laryngeal obstruction by the tongue by means of placing a large safety pin through the tip of the tongue in such a way as to hold the tongue outside the mouth. While this may sound crude and almost brutal, it is lifesaving in many instances.

Intracranial Injury

Patients who exhibit signs of intracranial injury or whose history indicates they may have had such injuries, should be carefully checked for the progressive signs of this type of injury. Careful examination should be made of the pulse, temperature, pupils, eyegrounds, reflexes, respiration and blood pressure. Bleeding from the ears, nose, or mouth may or may not be of importance but the source of such bleeding should be determined in all cases. Nausea may accompany intracranial injuries but it also accompanies many other conditions. The patient with intracranial injury who is in shock should not be placed with the head down, but kept level or even with the head slightly elevated.

Chest Wounds

Patients with sucking chest wounds will be in varying degrees of shock, and cardiac and respiratory embarrassment. Sucking wounds represent an emergency because of the frequent valve-like action of the wound with resultant progressive shifting of the mediastinum. It is urgent that these wounds be closed as quickly as possible to prevent further entrance of air into the pleural space. There are various ways of accomplishing this in an emergency situation. Where avulsion of tissues is minor and where the remaining tissues may be easily approximated, the receiving and sorting physician may quickly approximate the soft tissues by means of large curved cutting needles and heavy suture. The objective here is not neatness of surgery but simply the mechanical approximation to seal the wound against further entrance of air. If this approximation does not completely seal the wound, further sealing may be accomplished by the snug application of vaseline gauze at the site of the wound. Where there is a large defect in the soft tissues in a sucking chest wound, heavy layers of vaseline gauze should be applied tightly to seal the wound and strapped in place by adhesive. Sometimes a combination of these two methods is indicated. In some cases, sutures are placed on either side of the wound, drawn tight, and ligated over vaseline gauze. The introduction of a catheter into the pleural space should be deferred until the patient reaches the operating section.

Burns

Serious burns may comprise a fairly large percentage of those casualties brought to a disaster medical installation. More personnel and material are required to care for seriously burned patients than for any other type of injury. All burns must be considered as contaminated wounds. The major principles to be observed in the early treatment of burns are those of alleviation of pain, prevention and treatment of shock, maintenance of fluid and electrolyte balance, and prevention of infection. The later problems in treatment of burns such as rehabilitation and plastic surgery will not be of primary concern.

The general principles of treatment of shock will apply in burns as in other cases. Oral fluids as suggested on page 37 may be of help if the patient is in condition to take such fluids without gastrectosis and vomiting. Everything possible should be done to prevent further contamination of the wound. Debridement of any extent should *not be* undertaken in the receiving and sorting area.

Fractures

The care of fractures in receiving and sorting is limited to the immobilization of the fracture by splinting and prevention of further injury and shock. Definitive care of the fracture should be deferred.

Patients with suspected spinal injuries should be immobilized as completely as possible in order to avoid aggravating the injury. Sandbags or pillows at the side of the head are essential where there is suspicion of a fractured neck. Obviously the transportation of these patients is of the utmost importance. *In any case, all measures should be taken to prevent further injury to the spine.*

In fractures involving the jaw or face, immobilization may be accomplished by an ordinary bandage placed under the chin and tied at the top of the head. It should be remembered that patients with this type of injury are in grave danger of death by suffocation if vomiting occurs and if they are unable to loosen the bandage. The danger of aspiration of vomiting can be minimized by tying the bandage in a bow knot which may easily be loosened.

Eye Injuries

Eye injuries will generally not be treated in a definitive manner until the patient is seen in the ward or operating section by an ophthalmologist. However, in a disaster situation there may be a considerable lapse of time before an ophthalmologist is available. Because of the extreme pain accompanying eye injury, it may be necessary for the receiving and sorting physician to instill prepared tetracaine solution or tetracaine ophthalmic ointment solution into the eye as a local anesthetic.

Following this, the eye may be rapidly irrigated with sterile physiological saline solution, using an irrigating syringe. In every such case the eye should be covered with an eye patch to protect against further injury while anesthetized. In all such cases an ophthalmologist should check the patient as soon as possible.

Where chemical injuries of the eye have occurred, and the eye has not been flushed with sterile water or saline solution before the patient arrives at the receiving and sorting area, this should be done immediately. Then the eye should be treated with one of the anesthetic and/or antibiotic ophthalmic ointments and an eye patch taped in place.

Multiple Injuries

Many patients will exhibit multiple injuries. Just as a receiving and sorting physician must exercise his judgment in determining which casualty must receive priority care, he must also decide which condition must receive priority care in the patient with multiple injuries.

DENTAL CHAIR

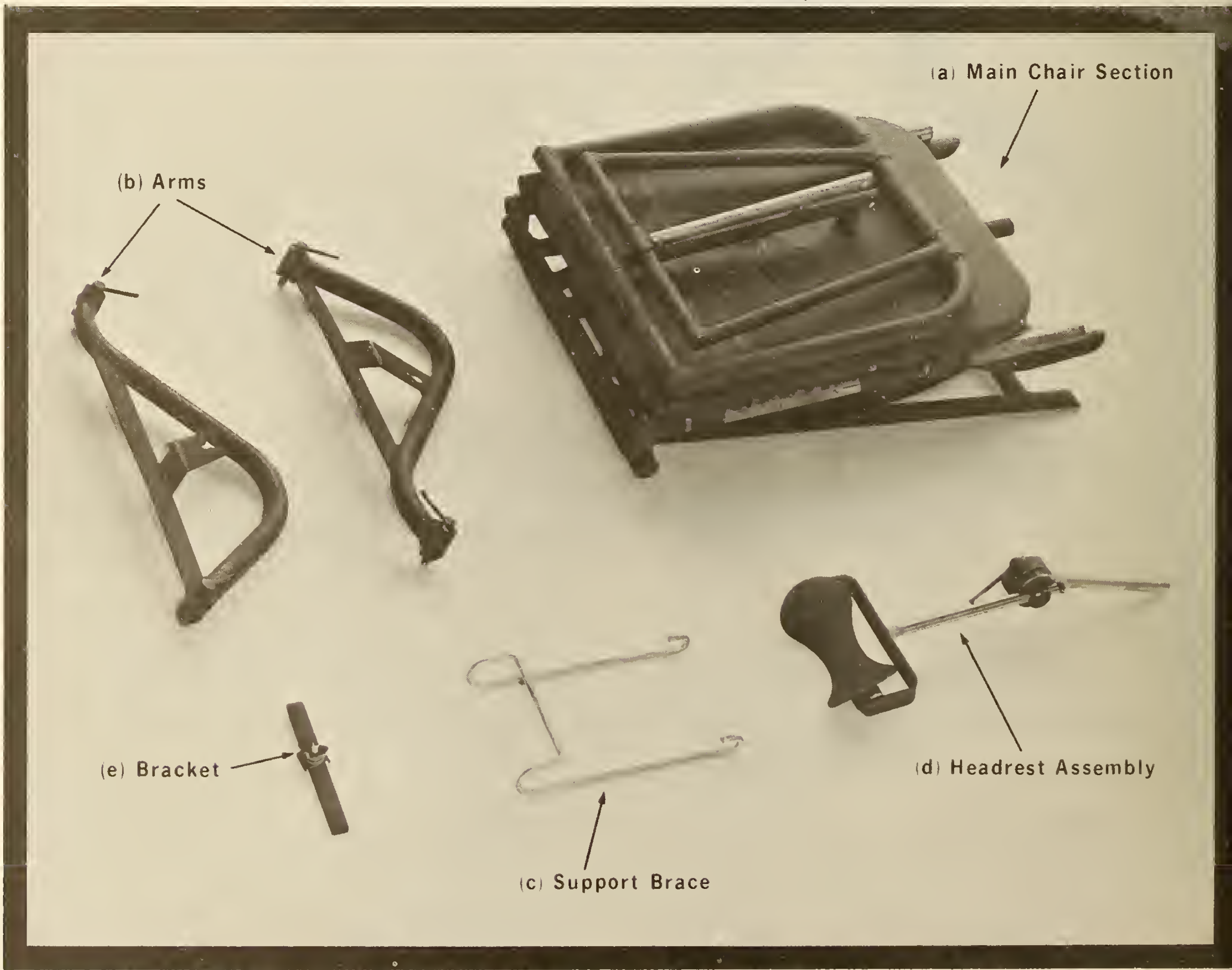
FEDERAL STOCK NUMBER:	6520-514-3255
FEDERAL NOMENCLATURE:	CHAIR, DENTAL OPERATING
HOSPITAL SERIES:	62000 AND SUPPLY ADDITIONS

Dental chairs are packed in cleated plywood boxes with the exception of those designated for tropical storage. They are then packed in moisture-proof 30-gallon steel drums. Removable drum lids provide easy access to chair parts.

STEP 1:

A. Open box with hammer and screwdriver or other appropriate tool from hospital toolbox.

B. Remove the following components from protective paper wrapping:
(a) main chair section, (b) arms,
(c) support brace, (d) headrest assembly,
and bracket (e).



STEP 2:

A. Placing chair (a) on floor, raise seat section up, leaving legs on floor.

B. Insert perforated steel tube on leg assembly into tube on back chair brace. Secure with locking pin chained to leg brace. Locking pin may be placed in any hole and later changed to another hole if leg adjustment is necessary.

STEP 3:

A. Place hooked end of support brace (c) over hinged portion of leg brace, hooks facing away from seat assembly. Fit curved portion of support brace over top of leg assembly as shown. See Step 4 photo for rear view of support brace positioned properly.

STEP 4:

A. Pull up on footrest. Insert steel rod on footrest into rod extending from back of seat. Insert locking pin to hold in place. Lower seat toward floor.

STEP 5:

A. Arms (b) are attached by inserting hand turn screws attached to arms into holes in frame of seat and back. Tighten securely by turning lever on hand turn screw.

STEP 6:

A. Attach headrest (d) to seat back by inserting steel rod on headrest into bracket on chair back. Headrest may be raised or lowered by releasing and then retightening hand turn screw on headrest.

NOTE:

Bracket (e) for implements which may be obtained locally may be slipped into hole in chair arm so that it will not be misplaced and may be used as required. Bracket is shown in place on arm of chair set up and ready for use, first photo.

Instrument (Mayo) Stand, page 107, may be used as substitute for a bracket table. This stand is adequate for instruments used in oral surgery and other emergency dental procedures.

LITTER COT

FEDERAL STOCK NUMBER: 7105-000-0212

FEDERAL NOMENCLATURE: COT, LITTER

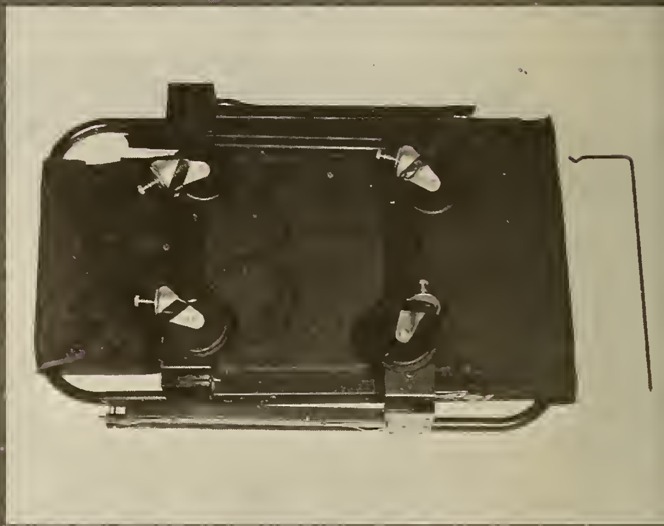
This litter cot may be used as two single cots, as a stationary double-decker cot with all legs extended, or as a litter for moving patients from one hospital area to another. Two irrigator rods are included with each set of litter cots. Holes for attaching the rods are located at either end and on both sides of each litter cot. Litters are more easily assembled by two people, but can be managed by one.

STEP 1:

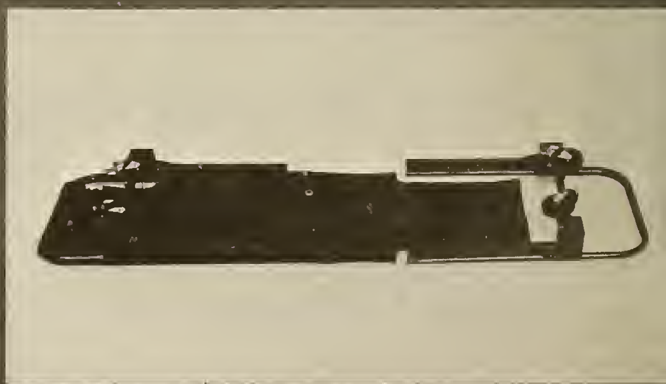
A. Open tri-wall fiberboard carton by slitting tape with any sharp instrument. Remove two litter cots and two irrigator rods. Each litter cot consists of two separate pieces before assembly.

STEP 2:

A. Place litter cot to be assembled on floor with wheels facing up as shown.



B. Separate two halves. Extend canvas cover full length. Remove tape holding wheels in place. Nuts and washers are attached to wheels.



STEP 3:

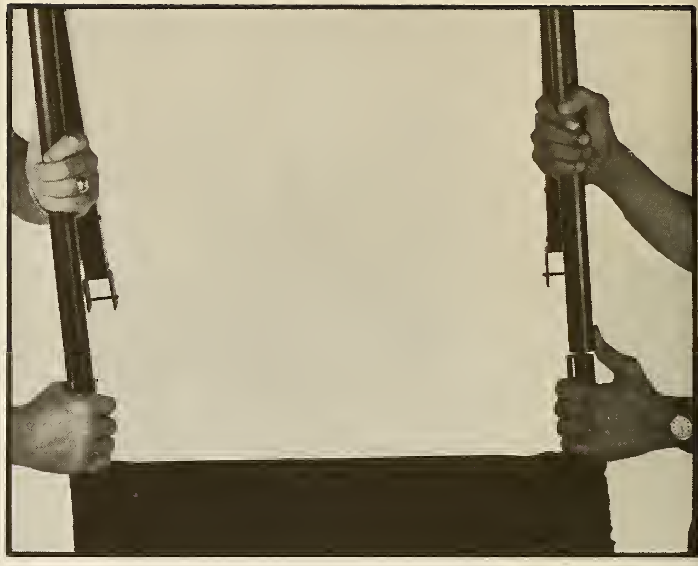
A. Insert wheel into axle assembly. Place washer on wheel screw, then tighten nut over washer. Repeat on all four wheels. Use open end wrench and/or pliers found in PDH toolbox to tighten nuts.

STEP 4:

A. Stand canvas half of litter cot upright. Push canvas down over metal frame until about 5 inches of frame protrudes.

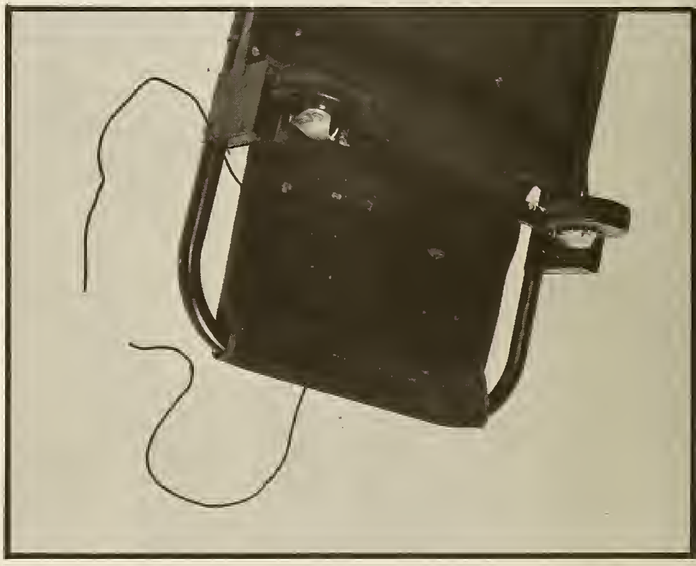
STEP 5:

A. Still holding canvas half upright, raise other half of frame and slide upper half of tubular frame into canvas half. It will be necessary to exert considerable pressure to force inner tubes into outer. Once inserted, press until tubes lock in position.

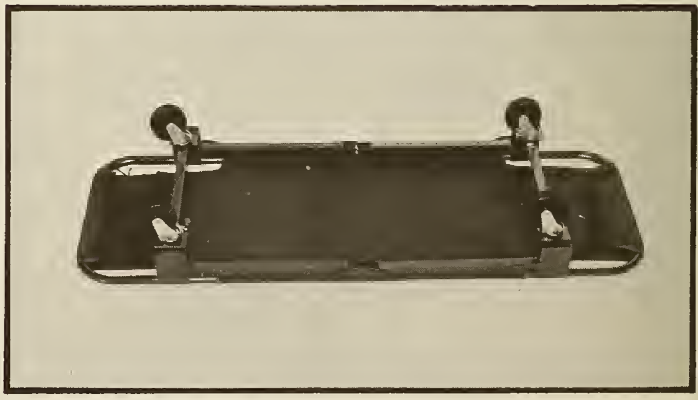


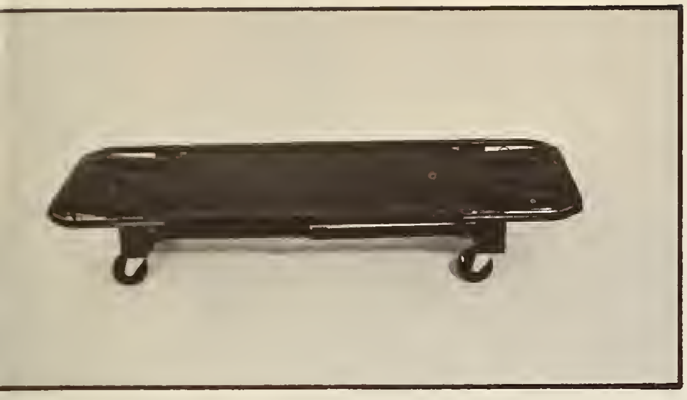
STEP 6:

A. Pull canvas over side frame, extending over end of frame and lace as shown. Tie securely.

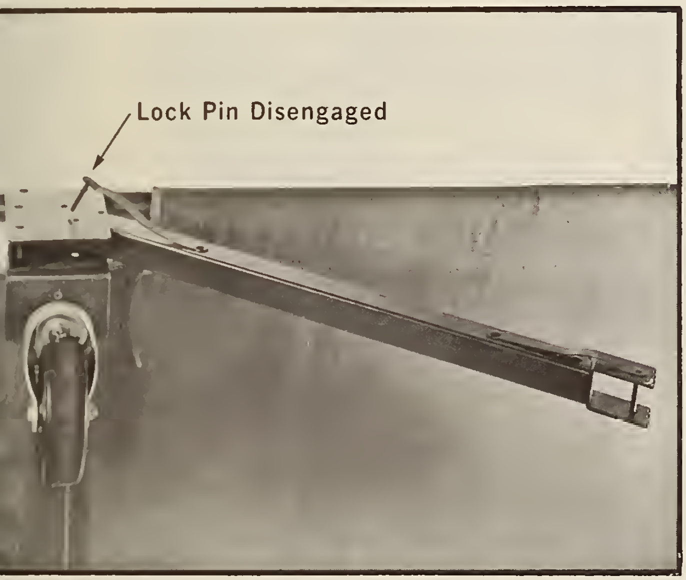


B. Loosen or tighten prelaced end of cover as necessary, making certain to retie securely.



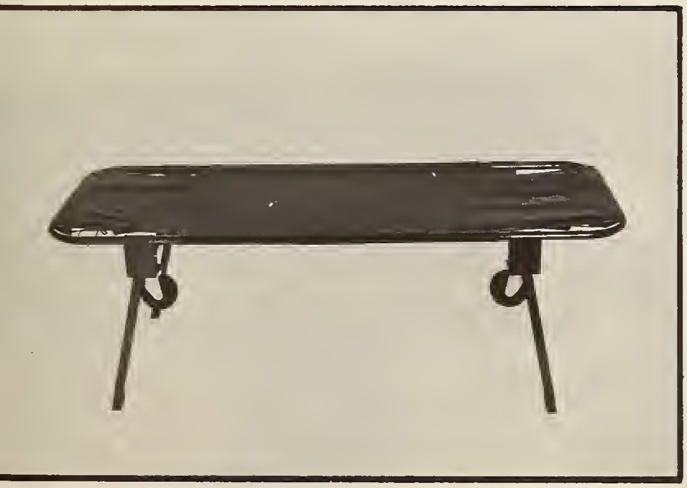


C. Turn litter cot over—it is now ready for use as a single, easily moveable unit. Note legs still held in place with pins.



STEP 7:

A. Pins located on leg support assembly and on bottom of legs are a key to the versatility of this particular litter cot. To release leg from horizontal position, disengage pin from retainer hole by pulling forward.



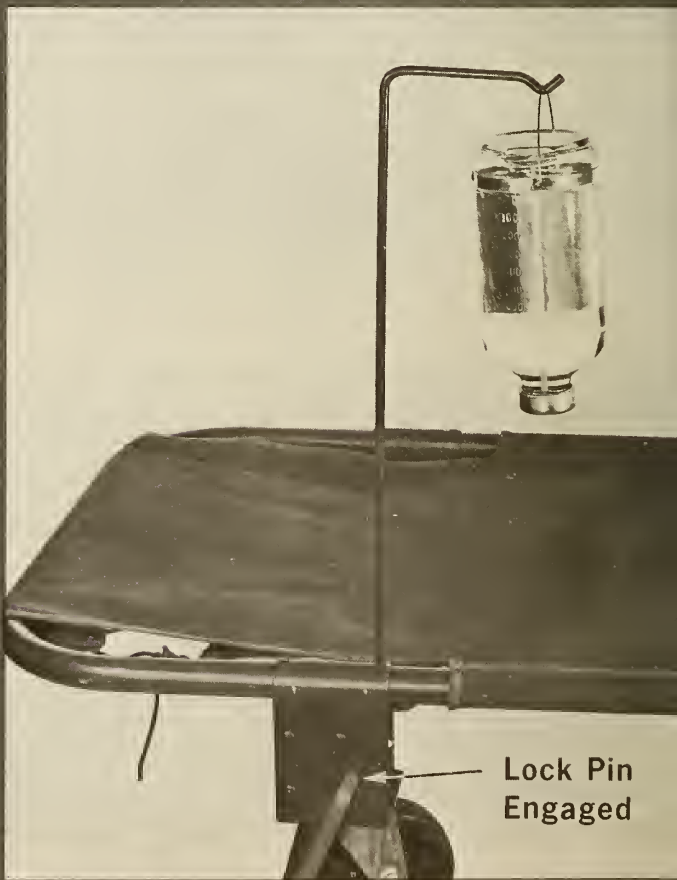
B. Pull legs down and lock pins in holes at tops of legs. Unit may now be used as stationary litter cot, or may be placed on lower litter cot to form a double-decker.

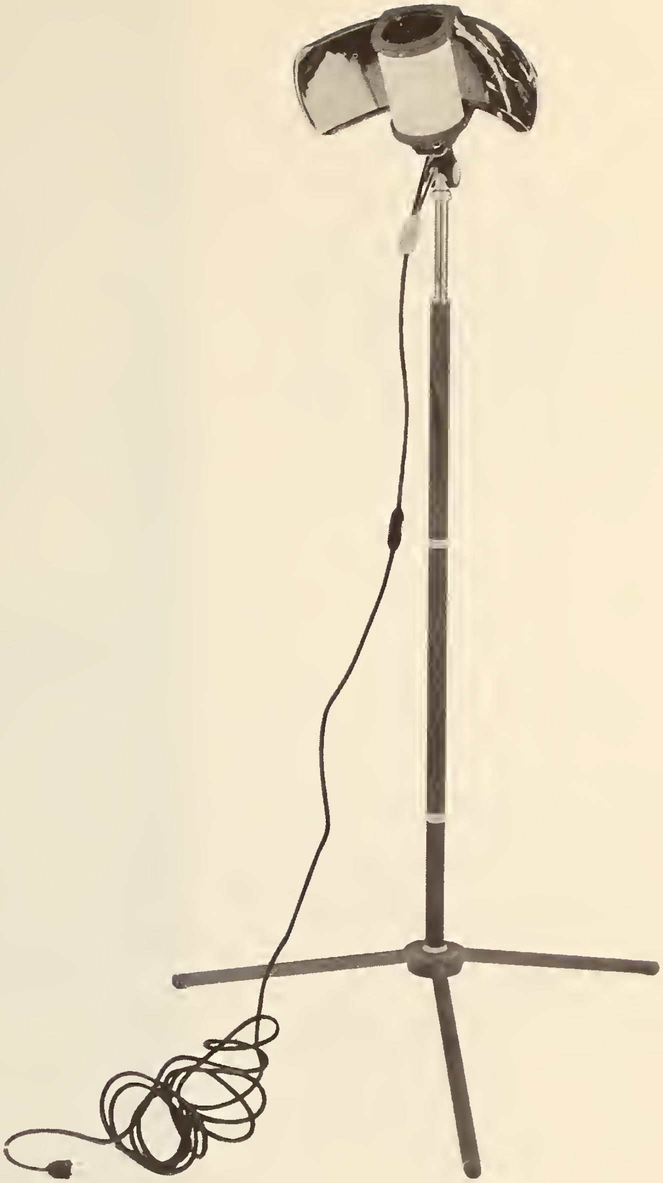
STEP 8:

A. When litter cot is to be used as top section of a double-decker, legs are locked in "down" position. Slotted legs of the upper litter cot should then be dropped over tubular frame of lower litter cot and locked into place with spring clip retaining pin which snaps into place when released. When all four pins are locked, the upper litter cot cannot slide off the lower.

STEP 9:

A. Irrigator rod is attached by placing in one of the several holes provided at either end of litter cot. Rod is shown holding a bottle for intravenous injection.





DENTAL OPERATING LIGHT

FEDERAL STOCK NUMBER: 6520-538-7100

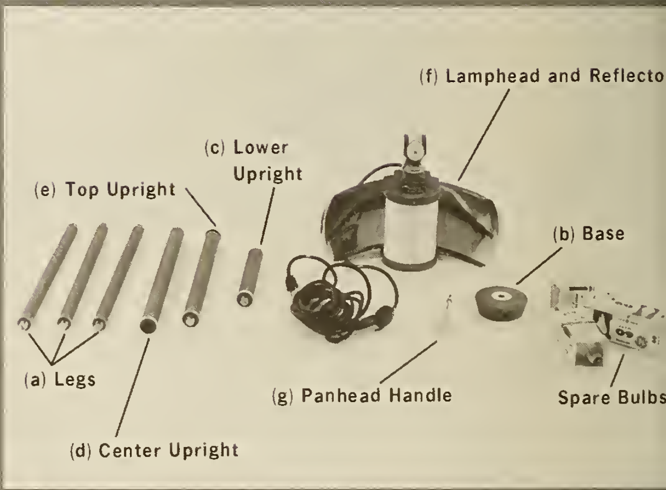
FEDERAL NOMENCLATURE: LIGHT, DENTAL OPERATING, FIELD TYPE

This lamp is for use on 24 and 110 volts, AC or DC. When electricity is not available the lamp may be operated by connecting two 12-volt batteries in series. An electrician or other qualified person will be required to connect the lamp to the batteries. When the lamp is battery operated, use the 24-volt bulb packed with the lamp.

STEP 1:

A. Open fiberboard carton by slitting tape with any sharp instrument. Lamp parts are packed in an inner carton. It is not necessary to remove the inner carton to gain access to components.

B. Lamp parts include (a) legs, (b) base, (c) lower upright, (d) center upright, (e) top upright, (f) lamp and reflector unit, and (g) pan-head handle. Spare bulbs are also included.



STEP 2:

A. Screw legs (a) into base (b) to form tripod stand.

STEP 3:

A. Screw lower upright (c) into hole in top of base (b).

STEP 4:

A. Screw center upright (d) into lower upright (c).

STEP 5:

A. Screw top upright (e) into center upright (d). Top upright (e) contains a chrome extension with a lock nut which will hold the lamphead in desired position.

STEP 6:

A. Raise the chrome extension on top upright (e) several inches, releasing the lock nut to loosen by pressing upward on nut. Screw lamphead (b) into position by rotating chrome portion of top upright (e) inside of lamphead shaft until tight.
Lock chrome extension holding lamphead by pressing lock nut against rim of upright (e).

STEP 6: (CONTINUED)

Lock chrome extension holding lamphead by pressing lock nut against rim of upright (e).

STEP 7:

A. Screw pan-head handle (g) into hole on lamphead unit (b). Tilt of the lamphead is controlled by twisting the pan-head handle counterclockwise to release. Tilt lamphead to desired position and lock by a clockwise twist of pan-head handle.

TO BE OBTAINED LOCALLY:

(When electricity is not available)
Two 12-volt automobile batteries, power clips, jumper, conductor cord, female receptacle.

SURGICAL LIGHT

Operating and Examining

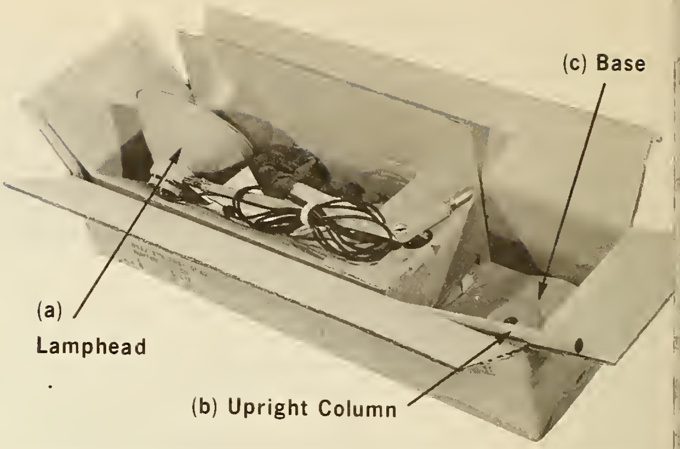
FEDERAL STOCK NUMBER: 6530-042-6342 (6530-000-0247)

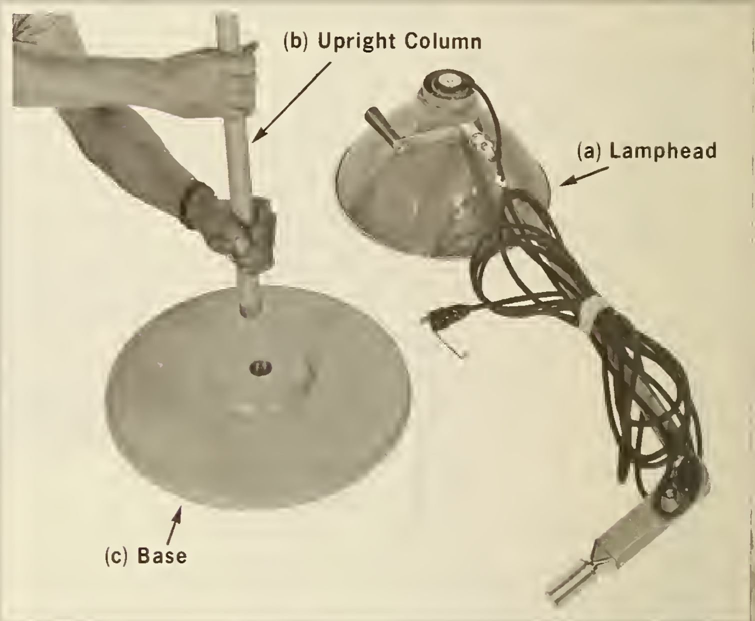
FEDERAL NOMENCLATURE: LIGHT, SURGICAL STAND, OPERATING AND EXAMINING

An easy-to-assemble lamp, this one consists of only three parts—the lamphead assembly, the upright column, and the base. The lamp may be operated with a 12-volt automobile battery when connected by an electrician or other qualified person. . . . 12-volt bulbs are packed with other lamps .

STEP 1:

A. Slit tape on tri-wall carton with knife or other sharp instrument. Lamphead assembly (a) is packed in an inner carton. Also easily accessible are the upright column (b) and base (c).





STEP 2:

A. Place base (c) on floor. Screw threaded end of upright column (b) into base.

STEP 3:

A. Drop chrome stud on lamphead assembly (a) into top of upright column (b). Handle on top of reflector to be used in adjusting position of lamphead.

STEP 4:

A. Lamp cord is fitted with adapter for two-prong outlet. If a three-prong outlet is used, remove adapter and plug into outlet.

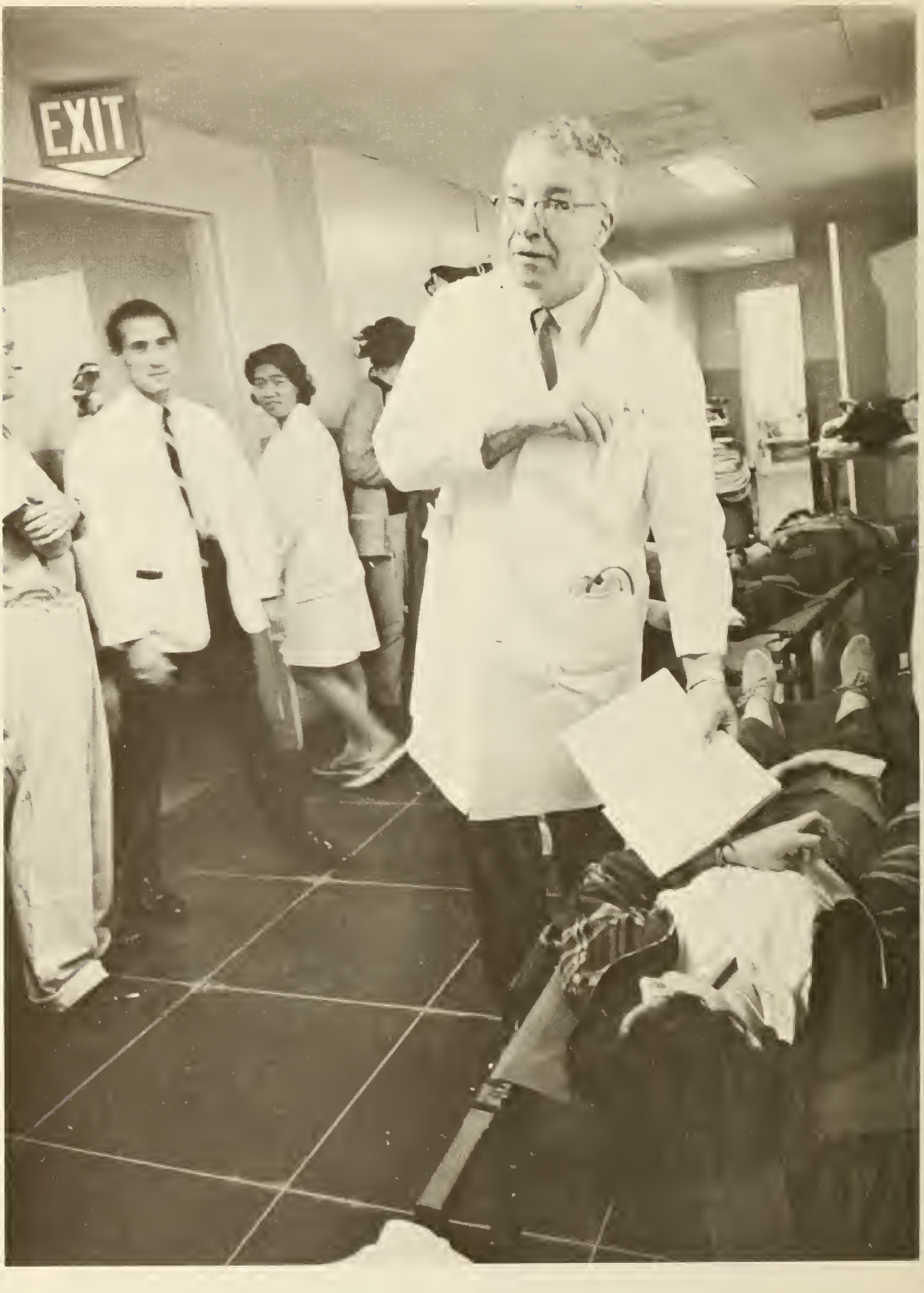
B. If used with two-prong outlet, be sure to ground. A forked ground connector is attached to the adapter. Loosen screw on outlet cover plate and slide connector under screw. Tighten screw.

STEP 5:

A. After plugging into outlet, check lamp by flipping switch to "ON" position. Turn "OFF" until needed.

TO BE OBTAINED LOCALLY:

(When electric power is not available) 12-volt automobile battery, power clips, conductor cord, and receptacle.


EXIT

POLE LITTER
AND
SUPPORT

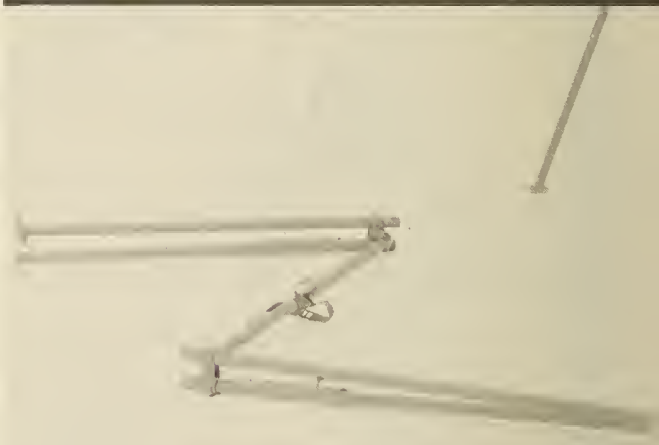
FEDERAL STOCK NUMBERS:	**LITTER—6530-000-0001; SUPPORT—6530-660-0034**
FEDERAL NOMENCLATURE:	**LITTER, FOLDING, RIGID POLE; SUPPORT, LITTER, FOLDING**

Because these two items will almost always be used simultaneously, they will be treated as a unit for setting-up instructions. Particular attention should be given to the photographs showing positioning of the leg joints on the supports.

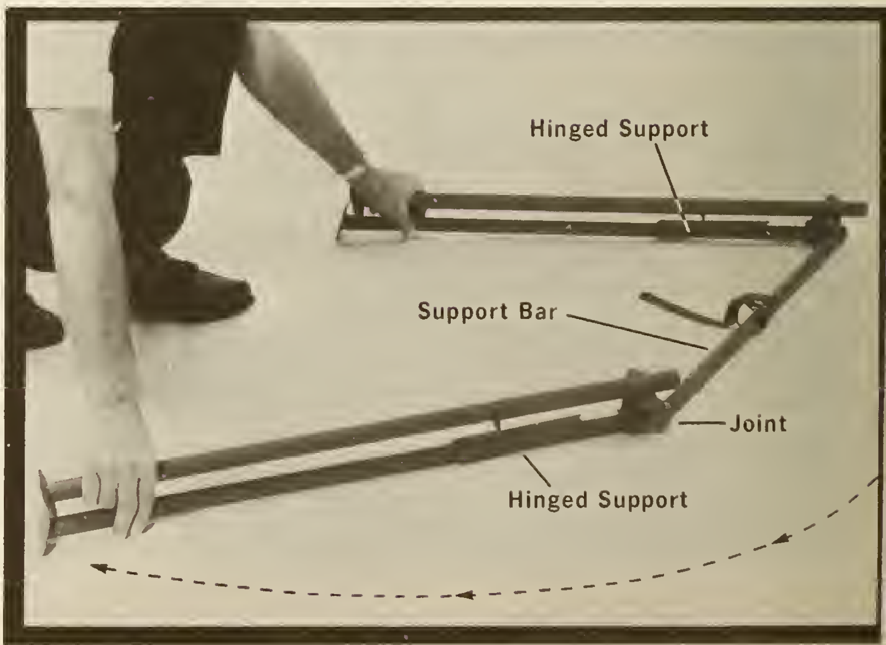
TO ASSEMBLE SUPPORTS

STEP 1:

A. A pair of supports is packed in one triwall fiberboard carton. The supports are most easily removed by slitting the tape on one end of the carton and sliding the supports out.

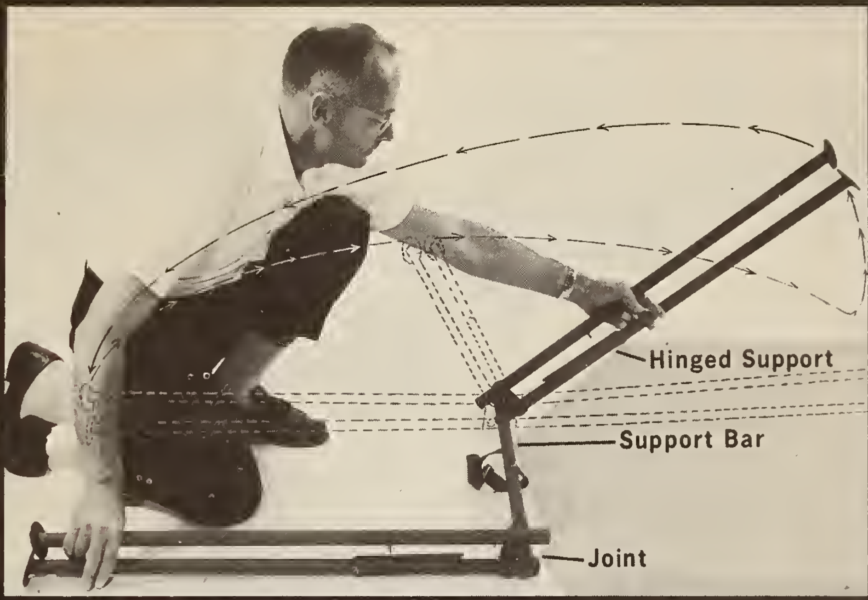


B. Set one support aside and spread the other as shown. Support bar will remain in same position for next three photos illustrating preliminary procedure for setting up legs.



C. Rotate right pair of legs out and around until joint is outside of legs as shown. Note placement of hinged support on legs.

D. Move left legs out, up and over as illustrated by dotted lines in photograph.



Both pairs of legs should now be parallel as shown in illustration.

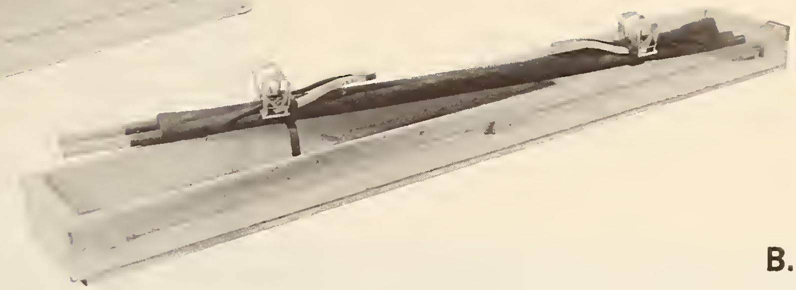
E. Lift and spread legs until support stands.

F. Press brace on leg downward until it catches on retaining bar on opposite leg. Support will not be stable unless hinged braces on both pairs of legs rest directly on opposite bars.

G. When viewed from the side, each pair of legs should be positioned as shown in photo.

Overhead view should be as shown. Assemble second support in identical manner.

A.



B.

STEP 1:

A. Litter is packed in cleated plywood box. Open with wire cutters, screwdriver and hammer, or other tools found in PDH toolbox.

B. Remove packing and lift litter from box.

C. Unbuckle retaining straps on each end of litter.

D. Turn litter canvas side down and spread ends.

TO ASSEMBLE LITTER

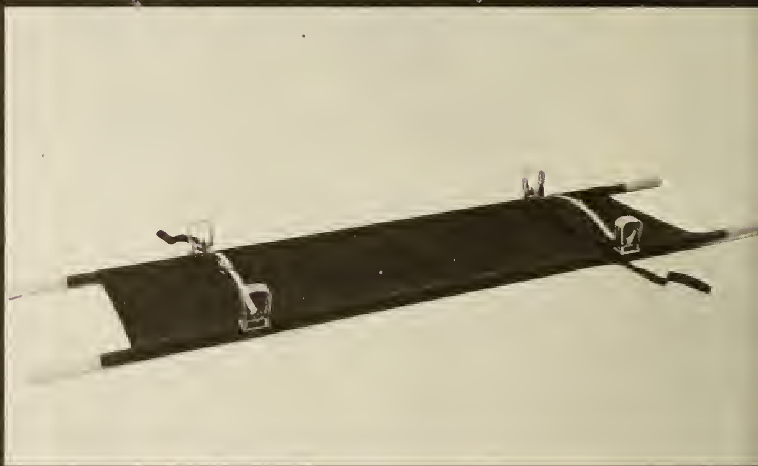
C.

D.

217-167 O-66—7

E. Pull spreader bar toward one end of litter until it locks in place. Repeat on opposite end.

F. Litter should appear as pictured, canvas side down (f).



G. Turn upright for use as a comfortable emergency floor or ground cot or place on supports as pictured on page 59.

THE PDH OPERATING ROOM

When properly staffed, the independently operating Packaged Disaster Hospital can handle a surgical workload of approximately 100 patients per day under an austere standard of professional care. This workload assumes that emergency health services planning and operation have provided necessary general support in terms of power, fuel, food, water, heat, sewerage and refuse disposal, and other non-medical supplies. The principles of mass casualty surgical care will apply following large scale nuclear attack or in any disaster when a great disparity exists between workload and resources.

When the PDH is set up in an independent building in support of an existing operable community hospital, the same standards of surgical care should apply in both facilities.

PRIORITIES FOR SURGICAL PATIENTS

Initial sorting takes place in the receiving and sorting section and delineates those patients who are surgical candidates and establishes preliminary priority groups according to the severity or nature of the injury. See page 27, "Receiving and Sorting."

Highest priority is given to patients of the Immediate category of sorting, such as those in whom a limited surgical procedure will save life. Next will come those patients with minor injuries who can be restored to complete useful function by a simple procedure.

Patients previously placed in the Delayed category of sorting, such as those with moderate lacerations, closed fractures, and noncritical central nervous system injury should be advanced to the Immediate group and receive treatment as conditions permit.

Patients with multiple and critical injuries, who under normal standards would receive highest priority for treatment, will have been placed in the Expectant sorting group and should be treated by definitive surgery only after all other categories of patients have been cared for. These patients should be handled by conservative nonsurgical measures in the interim. Many will survive to be treated later.

The surgeon in charge of the operating room section establishes a surgical schedule in accord with these priorities while preoperative care is being administered in another designated area.

PREOPERATIVE MANAGEMENT

Sound preoperative management to the maximum degree consistent with available resources is essential for good surgical results, no matter how severe the disaster.

Preoperative management and shock therapy should be supervised and guided by the surgeon and anesthesiologist in charge of the surgical section, but carried out largely by physicians and their helpers assigned to areas designated for preoperative and shock care.

The usual preoperative measures including continuance of emergency care and resuscitation, recording of vital signs, fluid and blood administration, emptying of the stomach, relief of pain, and premedication for surgery should be applied as vigorously as conditions allow.

As a general rule, patients taken to surgery should have a rising systolic blood pressure (80 or above) combined with a steady increase in pulse rate, the return of some warmth and color to the skin, and an improvement in the passive vascular return (pressure test).

Patients with shock or suspected bleeding, not responding to shock therapy and fluid or blood administration, should have surgery as soon as possible, regardless of blood pressure and pulse readings.

Patients demonstrating a decided blood pressure drop when the head or torso is elevated generally have not received sufficient fluid or blood volume replacement and are not good candidates for general anesthesia until additional fluid restoration has been accomplished.

SURGICAL PROCEDURES

The key to successful surgical management for the PDH is to select the patient whose problem can be solved by a short, simple surgical procedure—one of 30 to 60 minutes duration, anesthesia time included—usually not requiring deep anesthesia or muscular relaxation.

Amputations for crushed extremities or incomplete amputations, tracheostomy, debridement of soft tissue wounds and open fractures, and restoration of oral and ventilatory function by suturing the soft parts of the mouth are examples of surgical procedures receiving priority under austere standards.

It may be necessary, in lieu of performing a complete debridement, to perform only relaxing incisions, wound cleaning, and removal of obviously devitalized tissue. See page 21, "The Treatment of Mass Civilian Casualties in a National Emergency," and page 209, "Emergency War Surgery," NATO Handbook.

With few exceptions, wounds should not be sutured initially. If conditions permit, clean wounds of the face and scalp may be closed. Wounds exposing nerves, vessels, joints or body cavities should be partially closed.

Fractures should be restored to the best position possible by conservative means.

Insufficient time, personnel, and supplies require that laparotomies, thoracotomies and formal craniatomies be deferred.

Provisions must be made for the care of patients entering the disaster hospital with a variety of urgent surgical emergencies unrelated to the disaster situation. These patients must be sorted into categories and then treated according to the priorities and types of surgical procedures applied to disaster victims.

In "The Treatment of Mass Civilian Casualties in a National Emergency," procedures for treating large numbers of casualties under acute emergency conditions are discussed in detail. Surgical treatment is based upon sorting priorities. Detailed, illustrated surgical procedures which relate to the care of mass civilian casualties are shown in "Emergency War Surgery," NATO Handbook.

PHYSICAL ARRANGEMENT OF THE OPERATING ROOM

The PDH operating section has five operating tables, three of which may be supported by general anesthesia, while two may be used for procedures requiring only local or regional anesthesia. Procedures for setting up equipment provided for PDH operating rooms are shown on page 69.

Ideally the three operating tables supported by general anesthetic machines should be placed in one enclosure or room, but may be separated from one another by sheets strung on ropes. The other operating tables used for patients requiring local, regional, or no anesthesia, such as for minor debridements, case application, drainage procedures, burn dressing changes, etc. may be placed together in the same fashion, or in an adjacent room. If possible, each operating table should be allowed a space of 12 x 15 feet, making a total space requirement of from 800 to 1000 square feet.

An example of a table arrangement for mass casualty surgical care is shown below:

Table 1—Debridements; general surgery

Table 2—Debridements; general surgery

Table 3—Orthopedic surgery; specialty surgery

Table 4—Minor general and orthopedic surgery

Table 5—Specialty surgery using local or regional anesthesia, and obstetrics

Numerous variations are possible and will depend entirely on the workload. The five tables and their surgical teams must always be grouped for maximum control, yet each team should have an allocated specific portion of the professional problem upon which it can concentrate.

SURGICAL INSTRUMENT SUPPLY

By using a system of 3 minute flash sterilization only, the 16 x 36 autoclave packed with most PDH's can handle a surgical instrument workload of approximately 100 instrument sets of mixed types per 24 hours, plus providing sterilized materials for ward use during periods when surgery is not in use. The 3 minute flash sterilization method means that instrument sets would be handled openly between central sterile supply and surgery. Wire baskets would be needed to carry the instruments and sterile cooling fluids would be needed at the operating table.

The relatively limited supply of instruments available may preclude extensive use of wrapped instrument packs, unless there is a decidedly slow pace of surgery.

Assignment of instruments to a given operating table would allow better division of professional talent among the various tables, thus yielding maximum productivity. Only under the most severe press of casualties should the sterile instruments be pooled on a central supply table and issued to each table on call. This method requires excessive expenditure of circulating time, leads to unnecessary competition, and decreases sterile technique.

Obviously, maximum conservation must be practiced. Surgical gloves should be carefully washed before removal and dried immediately by the person wearing them. Surgical sponges and drapes, while considered to be in reasonable supply, should be soaked in cold water immediately to remove blood stains. If this is the rule, even surgical sponges can be resterilized and reused several times. Conservation of suture may be obtained by using needle holder ties wherever possible. Catgut suture can be conserved by using running closures.

WORKLOAD CAPABILITY

It has been estimated by surgeons with experience in mass casualty care that the PDH operating room section could handle approximately 100 patients per day for 20 days with a mortality rate of less than 10%. These figures are based on allocation of all 5 operating tables to the operating room section, and modest resupply of surgical expendibles.

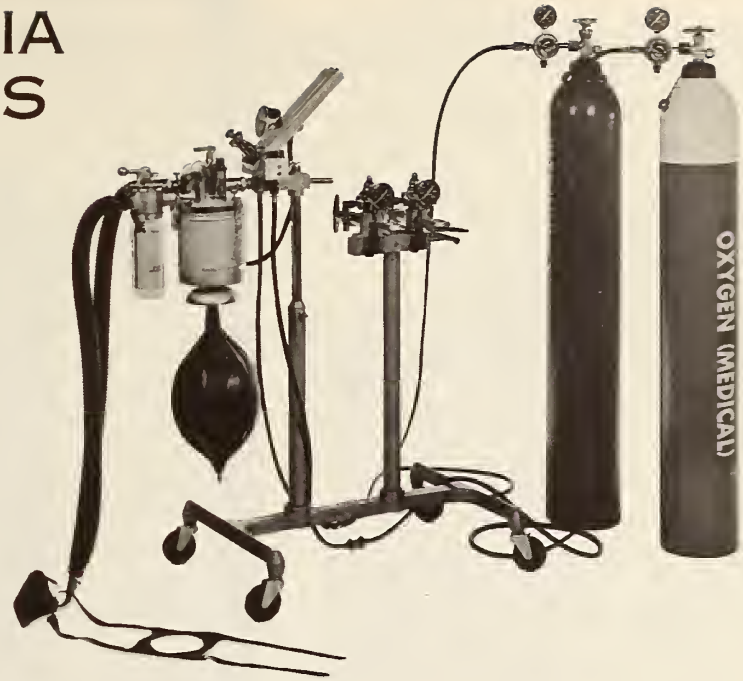
PERSONNEL

It is presumed that trained personnel will be in short supply and that many will be needed for sorting and supervisory functions, at least initially. Any and all types of physicians may have to function as surgeons and will be assisted at the operating tables by paramedical workers as necessary. Paramedical workers may also be needed to administer anesthesia and for circulating or scrub duties on occasion.

If at all possible, a few trained specialty surgeons should be placed at tables employing local or regional anesthesia, since productivity will be greatly increased. This would particularly apply to neurosurgeons, oral surgeons, plastic surgeons, or dentists who could handle a sizable number of head and face wounds using local anesthesia.

A sample staffing pattern, including personnel needed to adequately staff the PDH operating room, is shown on page 11.

ANESTHESIA APPARATUS



FEDERAL STOCK NUMBER: 6515-000-0222

FEDERAL NOMENCLATURE: ANESTHESIA APPARATUS, GAS, NITROUS OXIDE, OXYGEN, AND ETHER

The following instructions apply specifically to units with assemblies designed to accommodate small (Type D) Oxygen and Nitrous Oxide cylinders. Often, only large (Type M) cylinders are available making it necessary to bypass the yoke assemblies on these anesthesia units to allow direct attachment of the large cylinders. Anesthesia units in other PDH's are similar in design and assembly.

After assembly, the absorber may be filled with soda lime and the ether vaporizer jar with ether. This should be done either by or under the supervision of an anesthesiologist or medical equipment technician who is completely familiar with anesthesia equipment of this type. It is suggested that the word "empty" be printed on a piece of adhesive tape and attached to the absorber by the person assembling the equipment if that person is not qualified to fill the absorber. This safety feature is not necessary with the ether vaporizer jar because it is made of glass and the state of its contents may be seen at a glance.

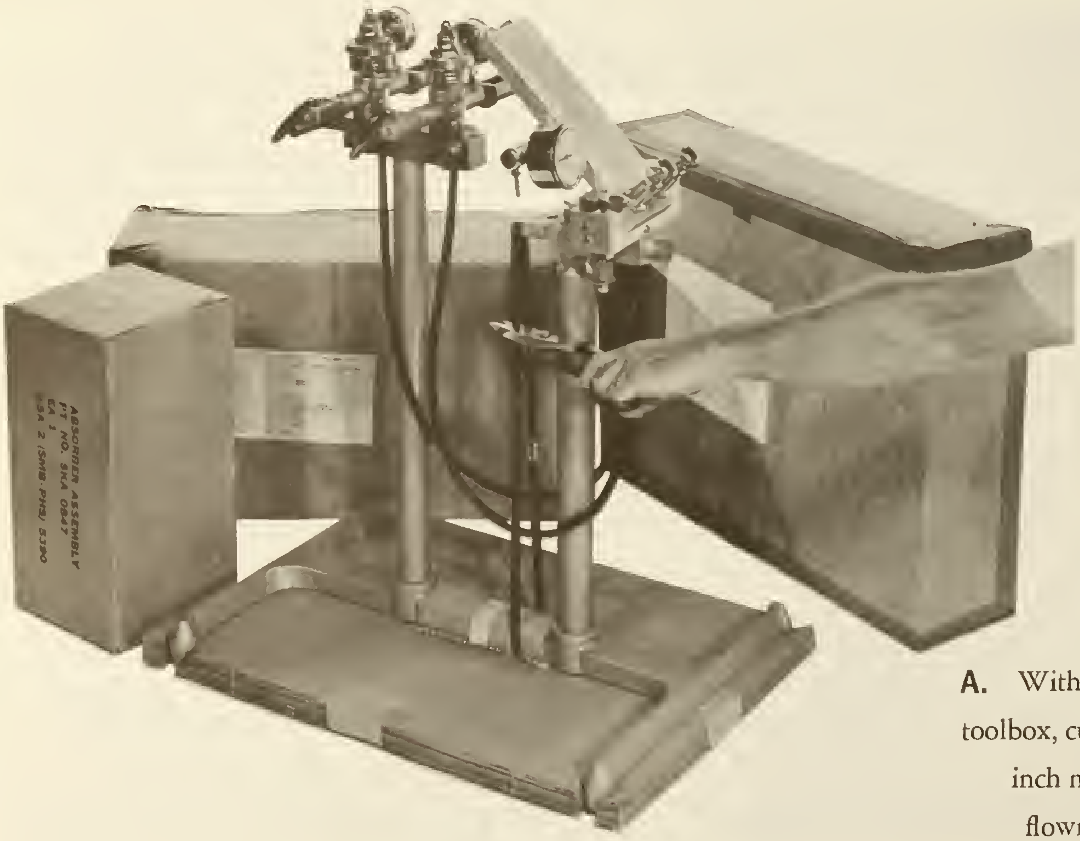
It is vital to keep in mind the importance of attaching Nitrous Oxide and Oxygen fittings snugly in order to avoid dangerous leakage. Connection of the apparatus to Nitrous Oxide and Oxygen cylinders will be simplified by remembering that all fittings are color-coded. Nitrous Oxide cylinders, fittings, and attachments are colored blue; Oxygen, green.

STEP 1:

A. To open wooden box, remove all screws from front panel. Panel will then fall forward. Tilt wooden box slightly and shake gently until fiberboard carton inside will slide forward a few inches.

B. With any sharp instrument, slit tape on fiberboard carton, allowing carton to remain in wooden box. Remove all corrugated packing. Remove box of components packed in front of Apparatus.

C. Pull forward on Anesthesia Apparatus, tipping slightly forward to remove. Remove other boxes of components. Take polyethylene cover from top of Apparatus. Remove protective tape.



STEP 2:

A. With tin snips from hospital toolbox, cut and remove one-half inch metal band which holds flowmeter assembly to base

STEP 3:

A. Tip base slightly to insert casters. Casters lock into position with upward pressure.

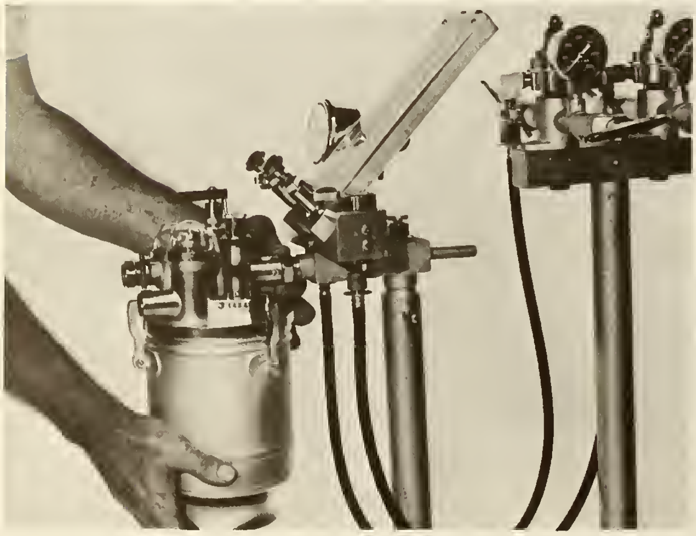
STEP 4:

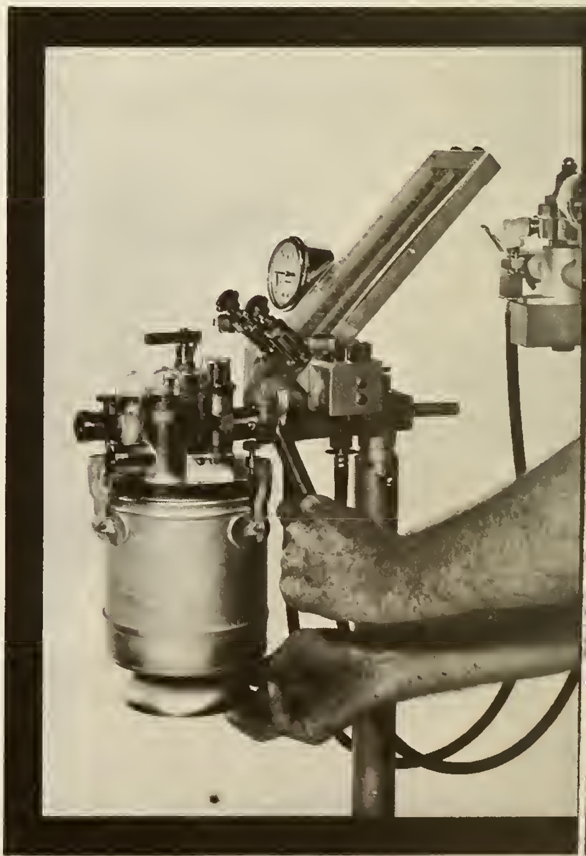
A. Lay out parts and identify as follows. These include everything necessary for the initial setting-up operation: (a) breathing tubes, (b) mask retaining strap, (c) mask, (d) rebreathing bag, (e) ether vaporizer assembly, (f) absorber assembly, (g) manometer adapter, (h) Y-connector, (i) bag holder assembly, (j) mask-catheter adapter, (k) regulator and hose for Oxygen, (l) regulator and hose for Nitrous Oxide, (m) tools, and (n) manometer delivery tube.

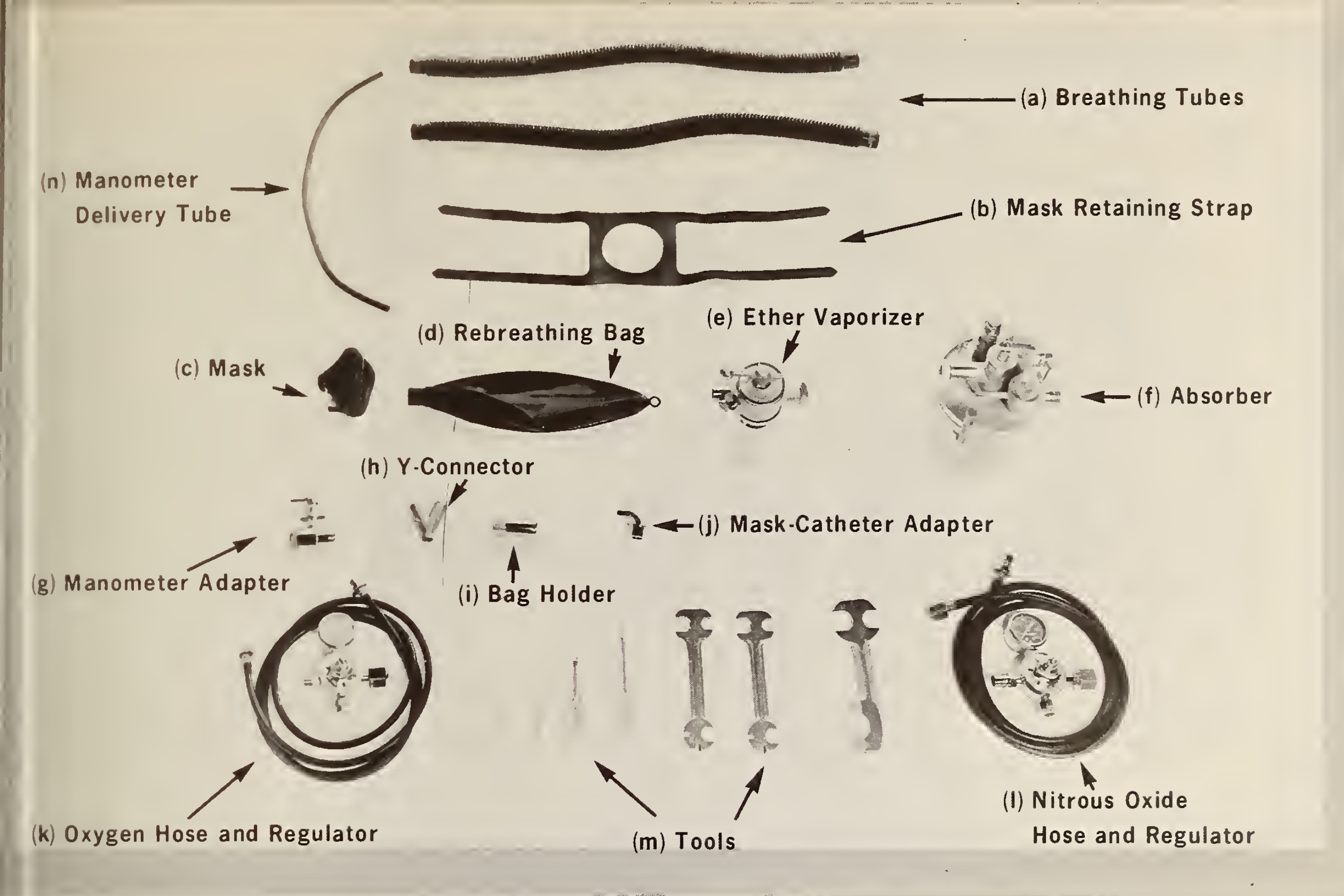
NOTE: *Make certain to tighten each connection with the proper tool (m). This will eliminate leakage which could prove harmful to patients and to medical personnel. Never smoke while working with anesthesia equipment. Never apply oil or grease to any part. Keep these simple rules in mind and you will not endanger yourself or anyone else connected with this equipment.*

STEP 5:

A. Connect the absorber assembly (f) to the gas head by placing screw attachment over ground fitting on gas head. Tighten with wrench (m).

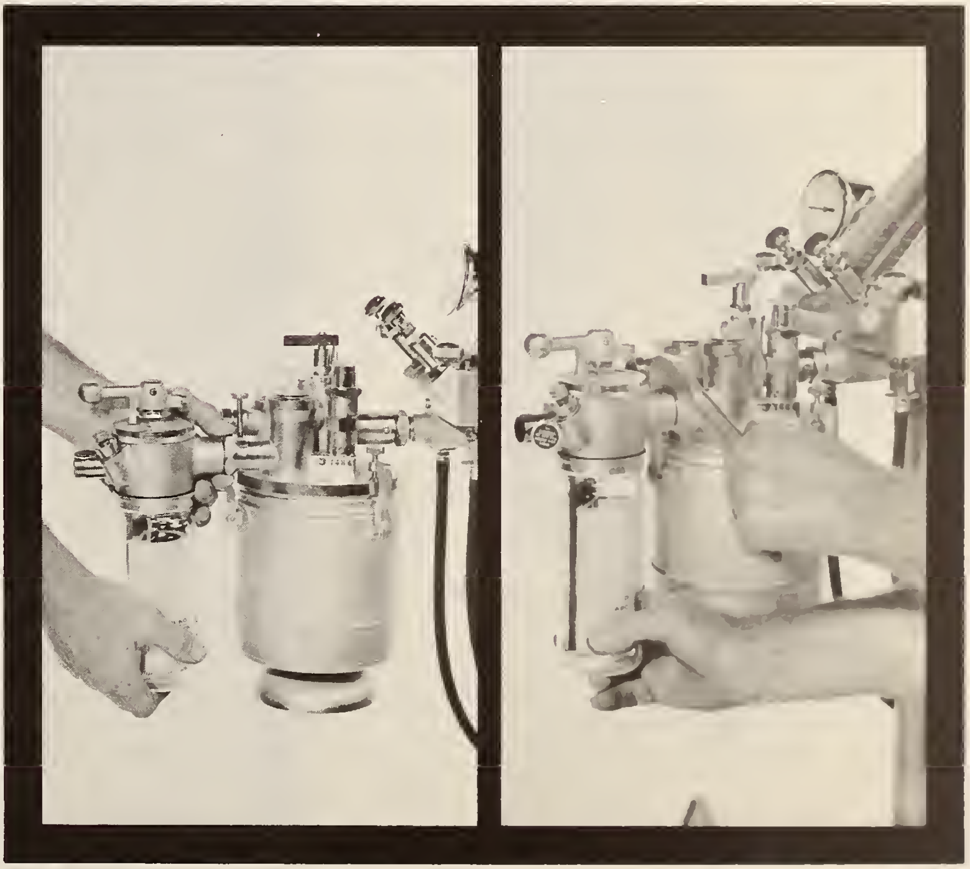






STEP 6:

A. Connect the ether vaporizer assembly (e) to the absorber (f) by screwing jar onto ground fitting on right side of absorber. Tighten with wrench (m). Do not turn any other movable part on either the absorber or ether vaporizer assembly.



STEP 7:

A. Attach manometer adapter (g) on ground fitting on left side of absorber (f). Tighten with wrench (m).

STEP 9:

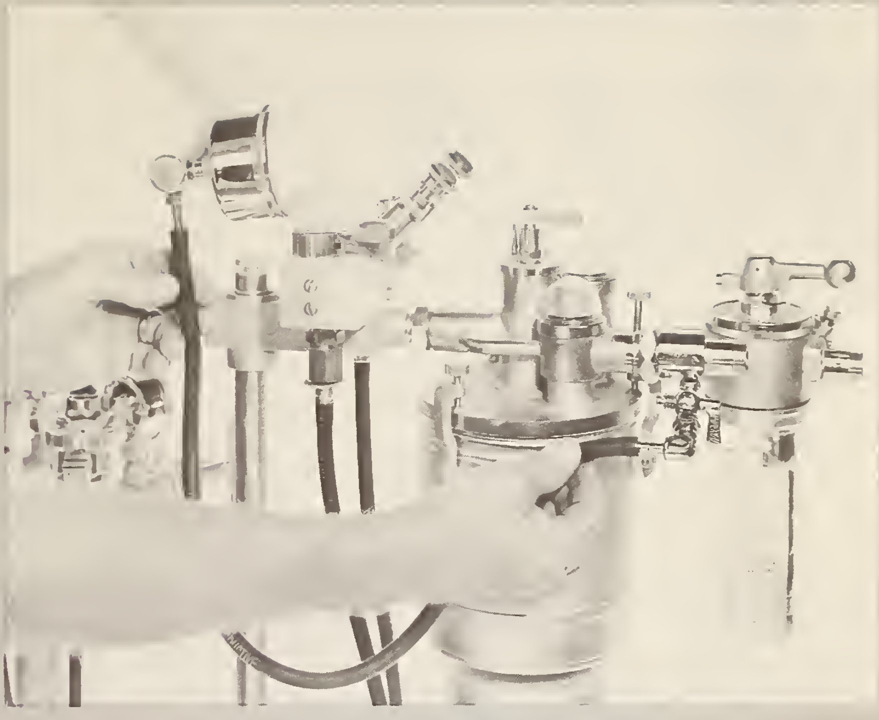
A. Connect breathing tubes (a) to grooved fittings on absorber (f) and ether vaporizer (e). Press firmly.

B. Connect other ends of breathing tubes (a) to Y-connector (h). Slip tube endings over Y-connector as far as possible.

STEP 8:

A. Connect manometer delivery tube (n) to hose fitting on manometer adapter (g). Press firmly to prevent leakage.

B. Attach other end of delivery tube (n) to hose fitting on manometer gauge. Press firmly in place.



A. Connect mask adapter (j) to Y-connector (h) by pushing small end of adapter into Y-connector.

B. Fit large end of adapter (j) into opening in mask (c).

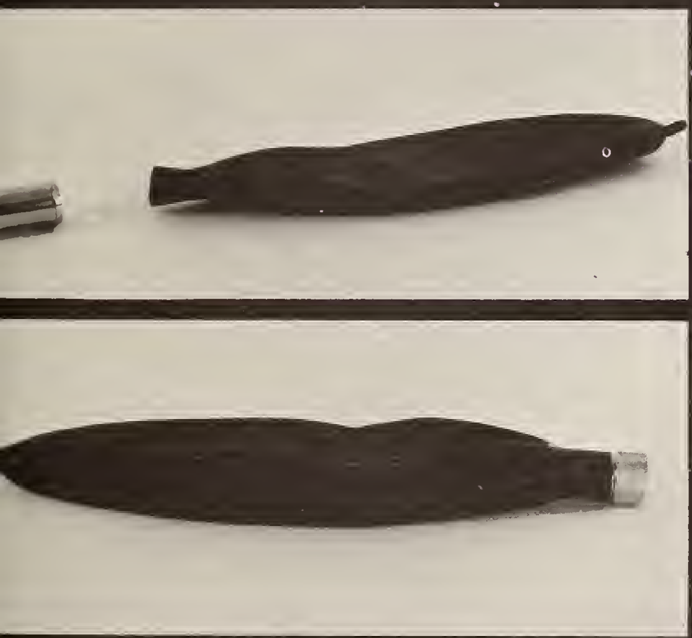
STEP 11:

A. Rebreathing bag (d) is equipped with a rubber bushing which is not necessary for use with Anesthesia Apparatus, Federal Stock Number 6515–000–0222. Remove the bushing from the neck of the bag.

STEP 10:

Make certain adaptor is fitted snugly into opening in mask.

C. Attach mask retaining strap (b) to prongs on mask (c). Holes in strap permit adjustment to patient's head.

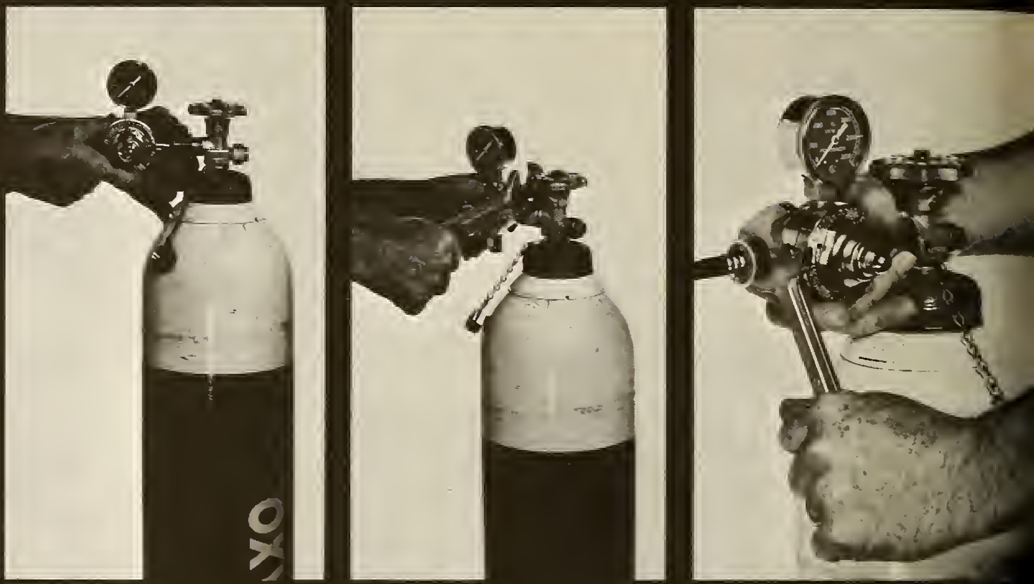


B. Stretch the mouth of the rebreathing bag (d) over the bag holder assembly (i), taking care not to tear the mouth of the bag.

C. Screw bag holder assembly (i) to bottom of absorber (f).

NOTE: *The following procedures are for one purpose only—that of bypassing the yoke assembly on the unit base. This is necessary because the assembly was built to hold small Nitrous Oxide and Oxygen cylinders. Since only large cylinders are packed with 62000 Series hospitals, the equipment must be adapted to use these cylinders.*

STEP 12:



A. After removing top from Oxygen cylinder, unscrew chained valve cap from cylinder. Screw regulator (k) on valve opening. Tighten with open end wrench (m), to prevent leakage. Do not turn knob on top of cylinder.

B. Attach hose (k) to fitting regulator (k). Tighten with wrench (m). Discs with the word "Oxygen" will be colo green. Oxygen cylinders are white and green

STEP 13:

A. After removing top from blue-and-white Nitrous Oxide cylinder, unfasten chained cap attached to valve opening. A washer is provided which is to be placed between nipple on regulator (l) and valve opening.

B. Screw regulator (l) to valve opening, washer between regulator and valve opening.

CAUTION: *Oxygen and Nitrous Oxide cylinders should be placed side-by-side. If there is any danger of tipping, they may be placed in a box.*

C. Disconnect hose on Oxygen side of yoke assembly on anesthesia unit. It will probably be necessary to loosen with a wrench.

D. Attach end of hose taken from yoke assembly to end of hose extending from Oxygen cylinder. Use two wrenches (m) as shown to tighten securely.

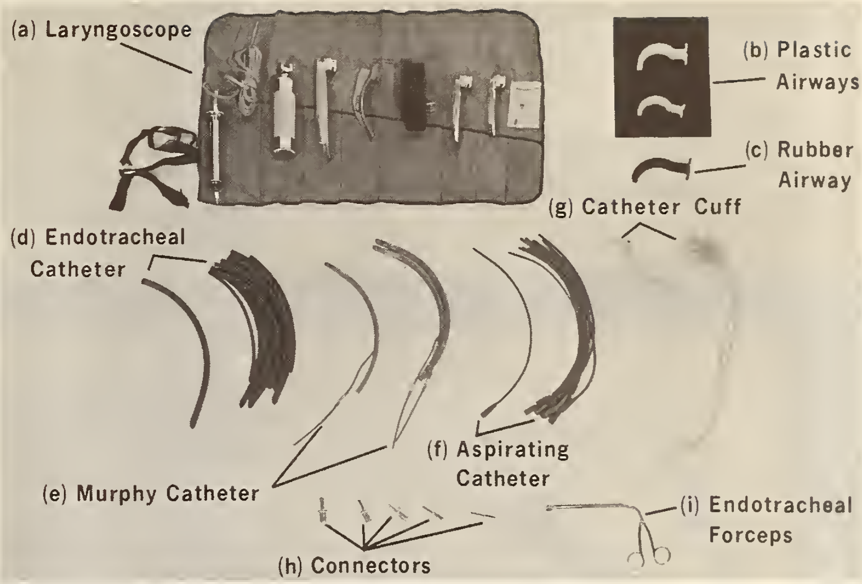
C. Tighten connection with wrench (m). Attach hose (l) to fitting on regulator (l), same as STEP 12, B.

D. Disconnect hose from Nitrous Oxide side of yoke assembly.

E. Connect end of hose taken from yoke assembly to end of hose (l) attached to regulator (l). Tighten with two wrenches (m) as in STEP 12, D. Note that discs on hose connected to Nitrous Oxide are colored blue.

LARYNGOSCOPE
AND
ASSOCIATED EQUIPMENT

(Packed with Anesthesia Apparatus, FSN 6515–000–0222)



FEDERAL STOCK NUMBERS: VARIED (SEE BELOW)

FEDERAL NOMENCLATURE: SEE BELOW

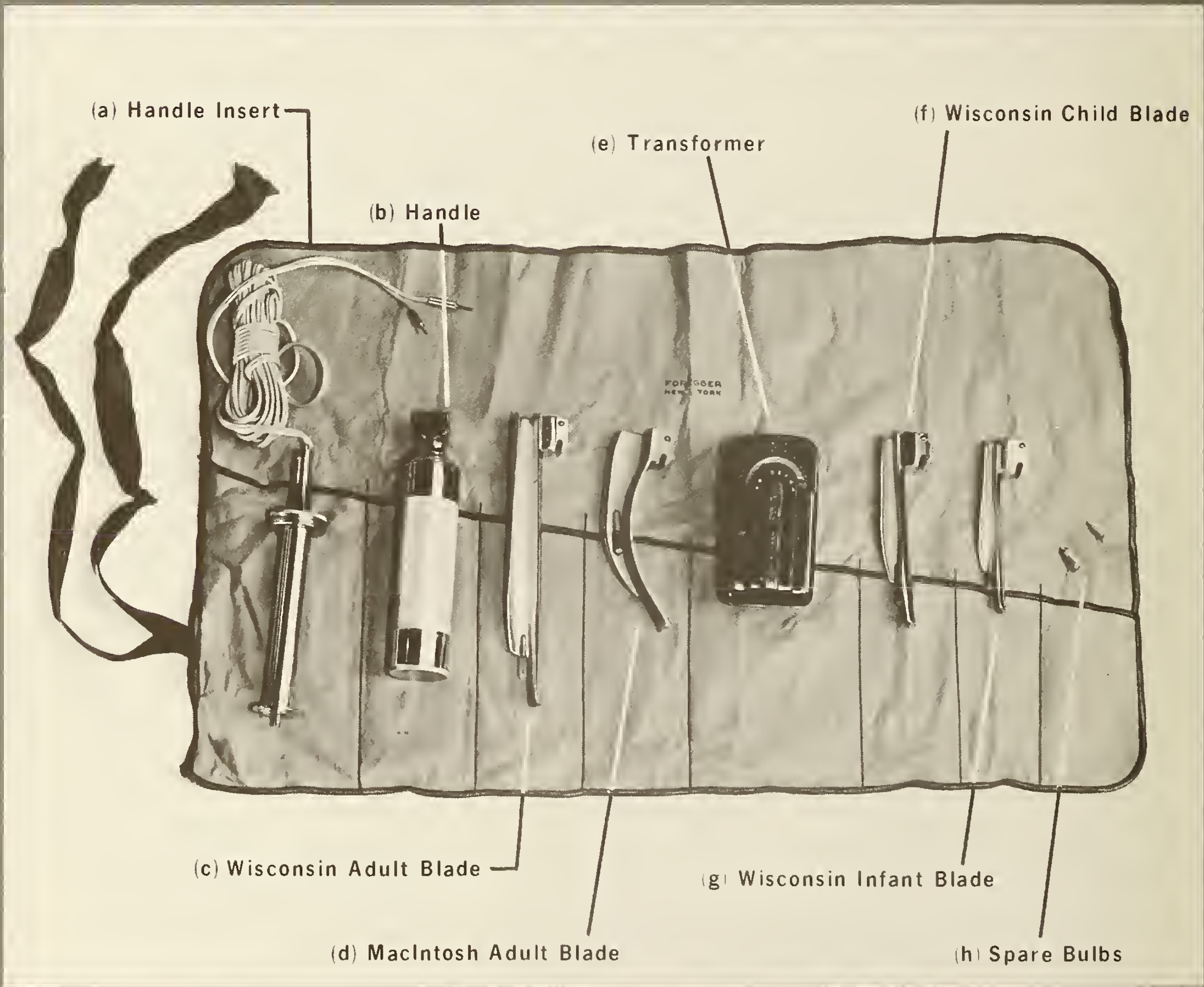
The items pictured and listed in this section will most often be used in connection with anesthesia equipment and operating room procedures. They are packed with the Anesthesia Apparatus, Federal Stock Number 6515–000–0222. Each of the pictured items carries its own stock number. Listed below are the names, descriptions, and stock numbers of this equipment.

(a) Laryngoscope, Infant-Child-Adult	6515-000-0259	
(b) Airways, Plastic, Medium and Small	6515-000-0202	
(c) Airway, Pharyngeal, Rubber, Large	6515-300-2900	
(d) Catheter, Endotracheal	6515–000–2090,	6515–000–0288,
	6515–000–0286,	6515–000–0284,
	6515–000–0282,	6515–000–0280,
	6515–299–8542	
(e) Catheter, Murphy, Nasal	6515–000–0298,	6515–000-0297,
	6515–000–0296	
(f) Catheter, Aspirating	6515–000–0293,	6515–000–0294,
	6515–000–0295	
(g) Cuff, Catheter	6515–000–0291,	6515–000–0292
(h) Connectors, Straight, Various Sizes	6515–000–0210,	6515–000–0214,
	6515–000–0215,	6515–000–0216,
	6515–000–0218,	6515–000–0220
(i) Forceps, Endotracheal	6515-332-3300	

LARYNGOSCOPE

STEP 1:

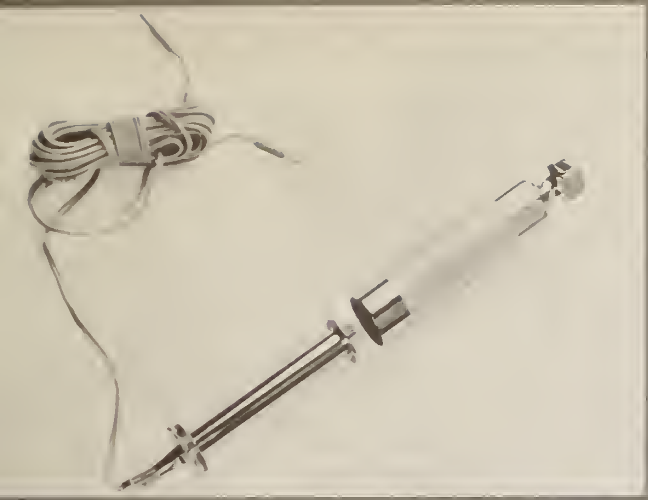
A. Unpack components which consist of: (a) handle insert for electrical use, (b) handle assembly, (c) Wisconsin adult blade, (d) MacIntosh adult blade, (e) transformer for electrical use, (f) Wisconsin child blade, (g) Wisconsin infant blade, (h) spare bulbs for blades.



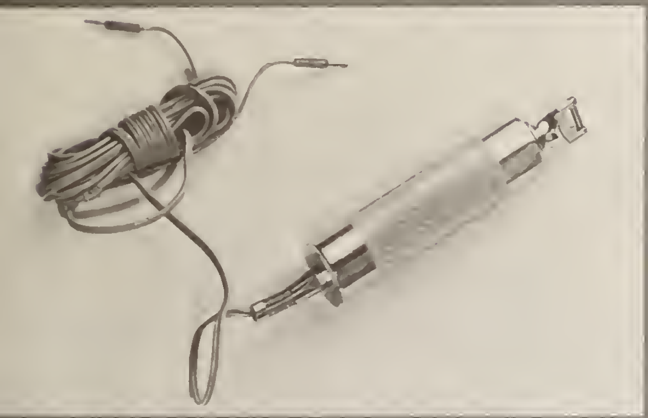
STEP 2:

A. To use with batteries (cordless), unscrew end plug of handle (b), insert two Size "D" dry cells, Federal Stock Number 6135–542–6216, and replace plug. See Step 3.

ALTERNATE STEP 2:

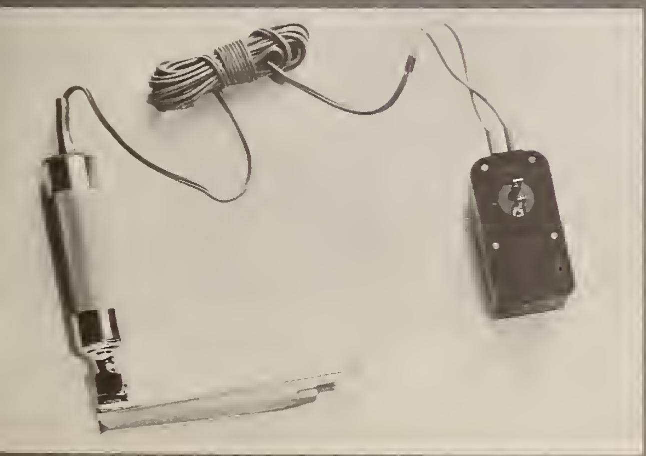


A. To use electrically, remove end plug of handle (b) and set aside. Replace with handle insert with cord (a).



B. Screw plug attached to insert (a) into threaded end of handle (b).

C. Insert the two knurled contacts on cord (a) into holes in top of transformer (e).



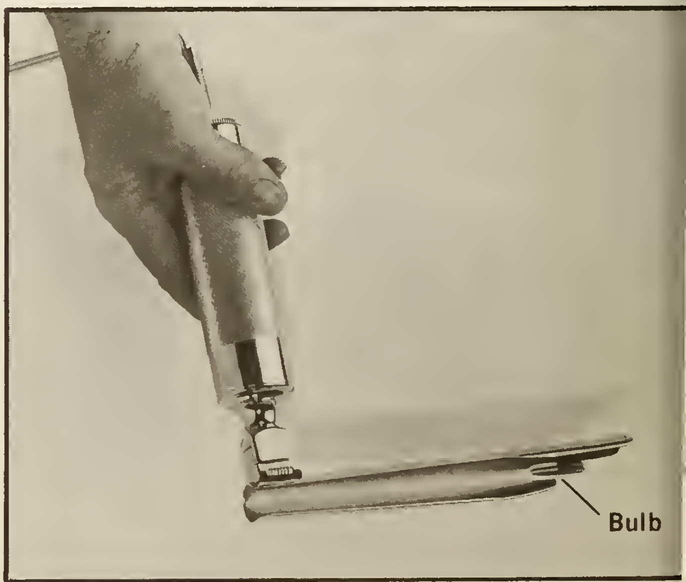
D. The prong assembly on the back of the transformer (e) is adjustable. Hold the transformer in a vertical position and adjust the prongs to fit the wall socket where it will be connected.

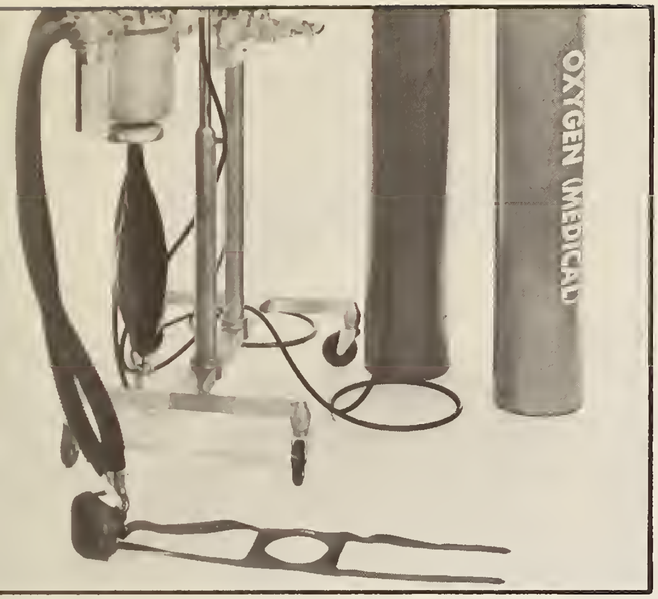
STEP 3:

A. To insert blade (c), (d), (f), or (g), hook lip of blade over pin on handle assembly (b).

B. Push down on blade and press forward. Blade will lock into place.

C. With either batteries or electrical power, bulb at end of blade should glow when blade is attached to handle. If it does not, replace with another blade; if bulb glows on this blade, first bulb was defective and should be replaced with spare bulb (h). When battery operated, if bulbs will not glow, replace cells with fresh, dry cells.

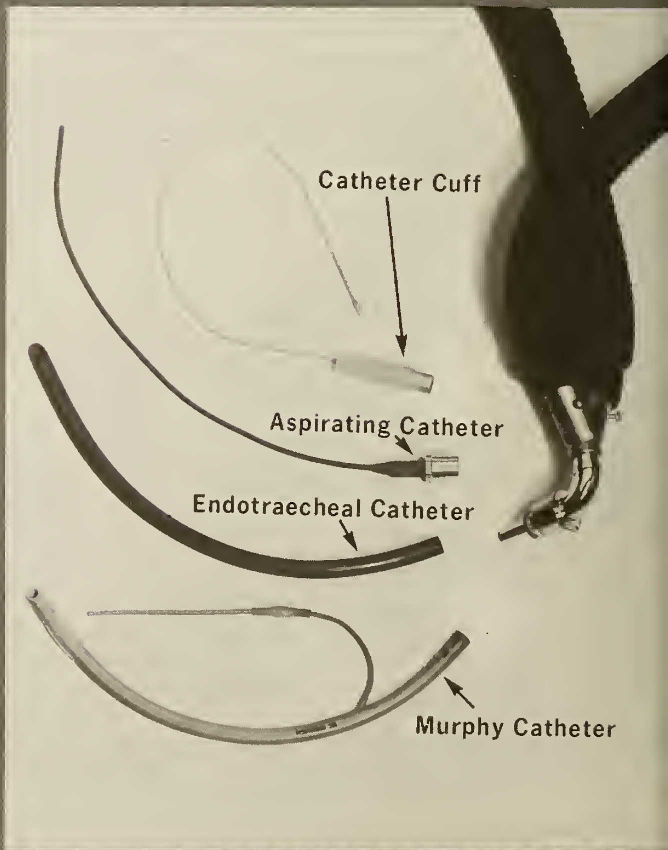




ENDOTRACHEAL TUBES AND ASSOCIATED EQUIPMENT

A. Remove face mask from elbow adapter on anesthesia apparatus. Insert connector (h) sized to fit tube (d) intended for use. All connectors fit snugly into large end of elbow adapter.

B. Insert tube to be used over end of connector. Use as directed by physician or other medical personnel.



SURGICAL LIGHT

FEDERAL STOCK NUMBER: 6530-781-3719 (6530-000-0244)

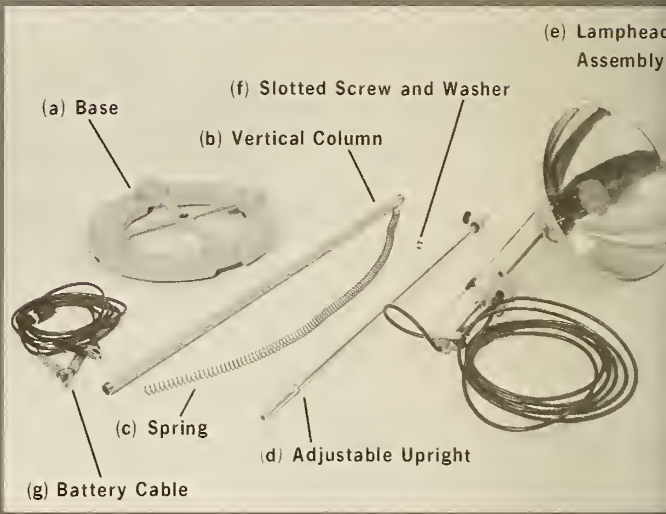
FEDERAL NOMENCLATURE: LIGHT, SURGICAL STAND

This lamp may be used either with 110-volt, AC or DC current or with a 12-volt automobile battery obtained locally. 12-volt bulbs are packed with the lamp.

STEP 1:

A. Cleated plywood box containing components may be opened with hammer and screwdriver or other suitable tool found in the PDH toolbox.

B. Remove components which consist of: (a) base, (b) vertical column, (c) spring, (d) adjustable upright, (e) lamphead assembly, (f) slotted screw and washer, and (g) battery cable. Bulbs are also included.



STEP 2:

A. Screw vertical column (b) into base (a). Casters are already attached to base.

STEP 3:

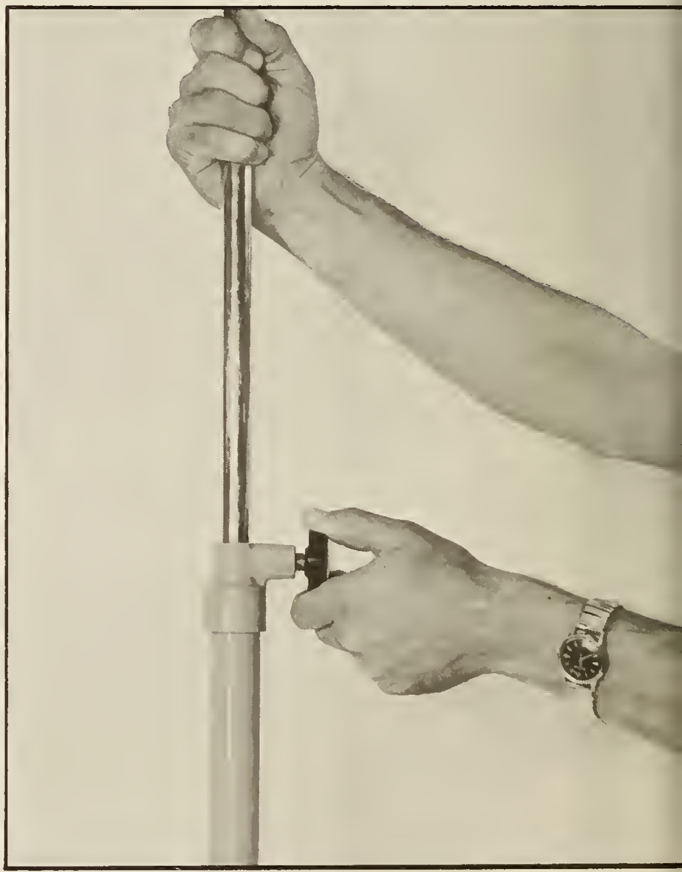
A. Thread spring (c) into vertical column (b) as far as it will go without tightening the coils.

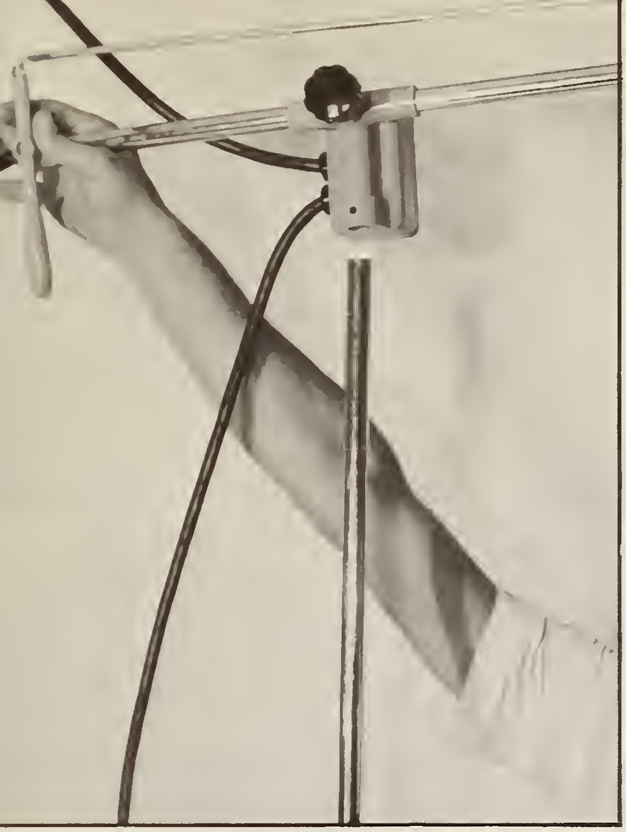
STEP 4:

A. Insert adjustable chrome upright (d) into vertical column (c). If necessary, loosen knob assembly and slide it upward in order not to create excessive tension on spring as chrome upright is inserted. Retighten knob if it is loosened.

B. Screw knob assembly on adjustable chrome upright (d) over threads on vertical column (c).

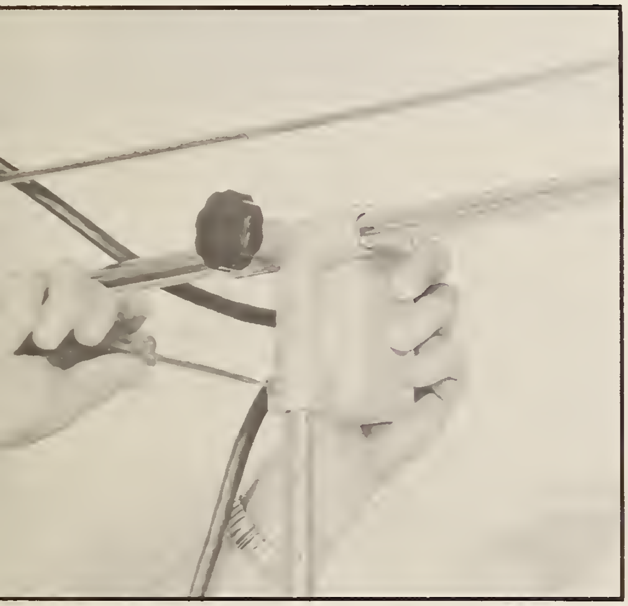
C. Loosen knob on chrome upright (d) and firmly push downward on upright (d), depressing spring (c) into column (b). Tighten knob immediately so that taut spring will not force chrome upright upward, possibly causing damage or injury.





STEP 5:

A. Lift lamphead assembly (e) and place over chrome upright (d).

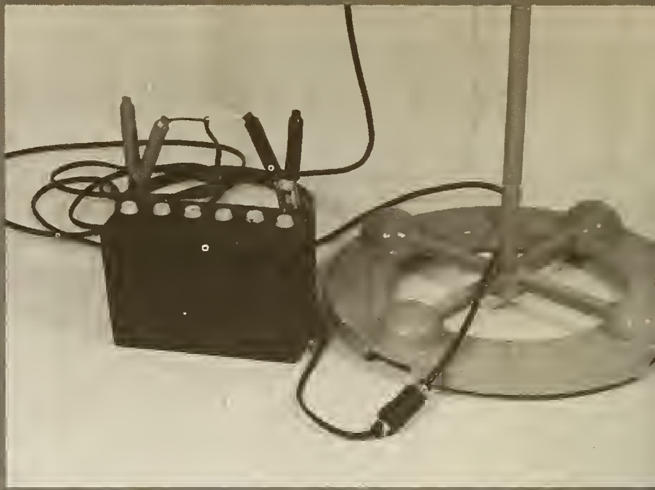


STEP 6:

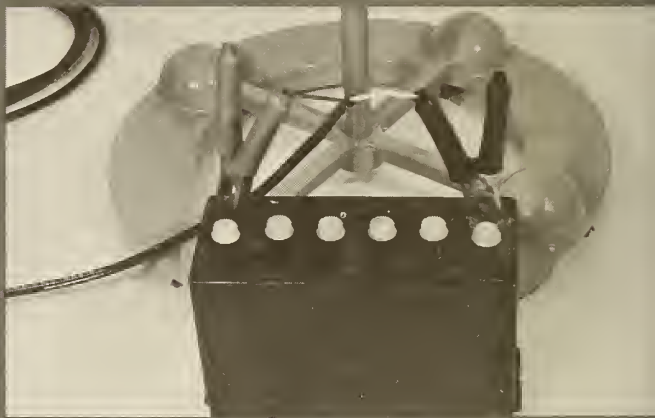
A. Rotate lamphead assembly (e) until screw hole on side of assembly matches hole in chrome upright (d). Place screw over washer (f) and tighten with screwdriver. This will hold lamphead securely in place.

STEP 7:

A. When using 12-volt battery connect battery cables (g) to battery.



B. Connect socket on lamp to that on battery cable (g).

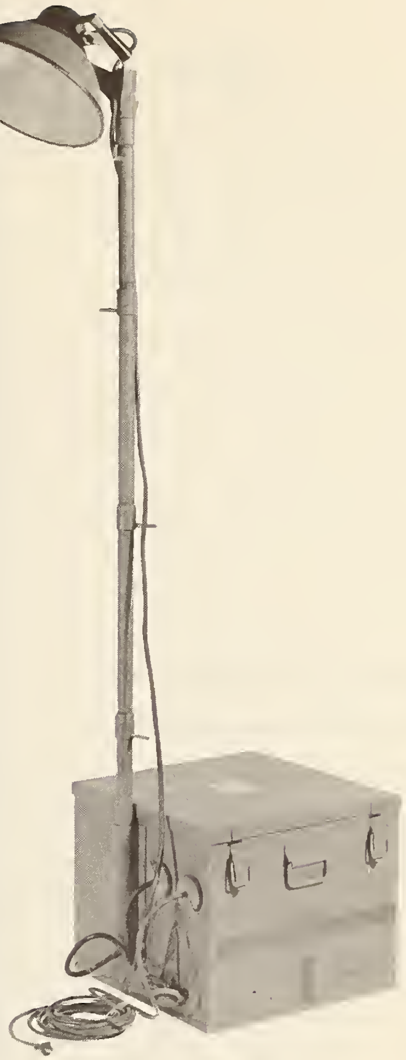


TO BE OBTAINED LOCALLY:

(When electricity is not available) 12-volt automobile battery.

SURGICAL LIGHT

Field



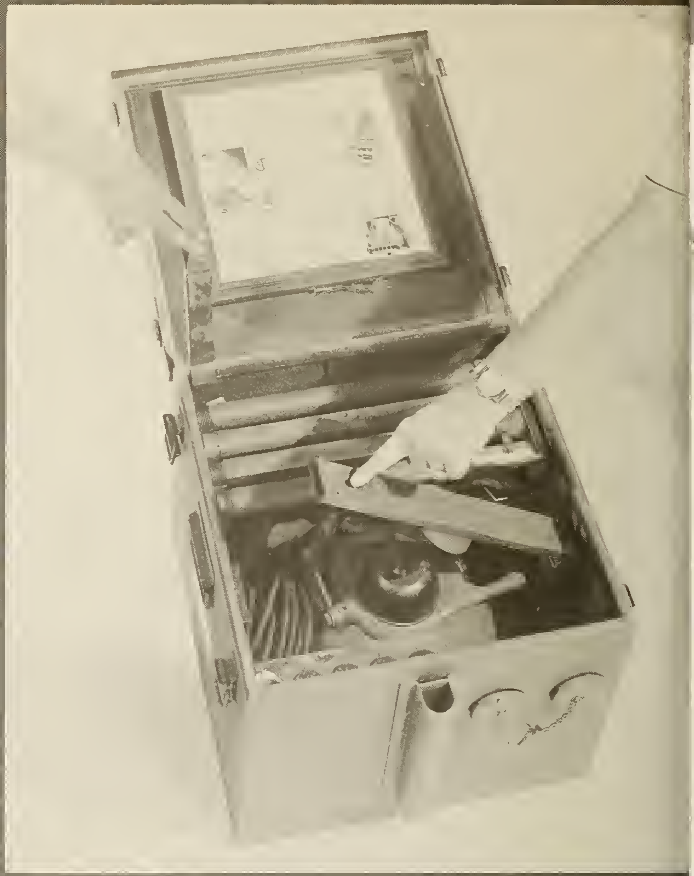
FEDERAL STOCK NUMBER: 6530-706-6325

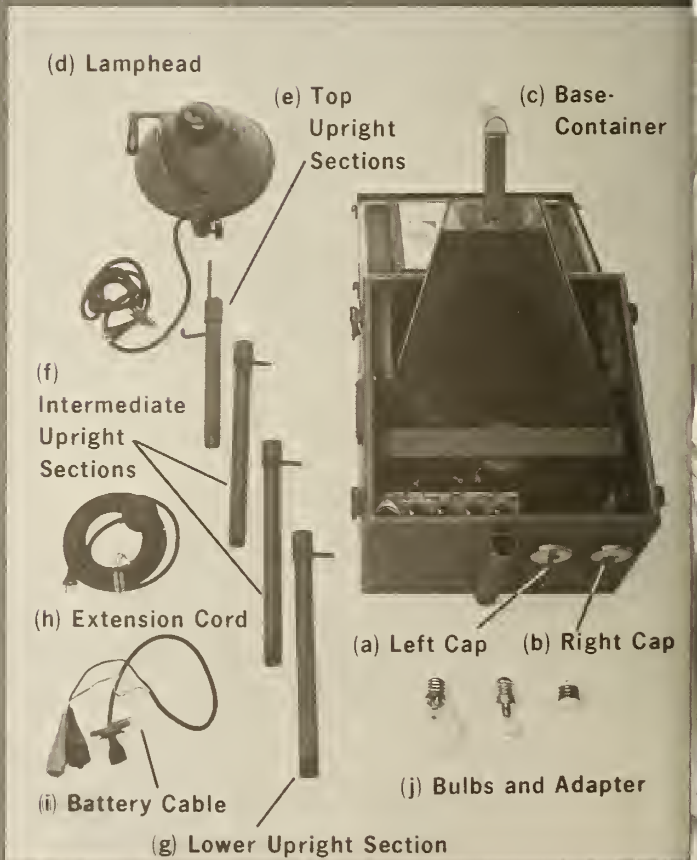
FEDERAL NOMENCLATURE: LIGHT, SURGICAL, FIELD, 110\220V., AC-DC OR BATTERY OPERATED.

This lamp is found predominately in 56000 Series Hospitals, however, it will be packed occasionally in another Series as a replacement item. Ordinarily the lamp will be packed in a wooden crate which may be opened with a clawhammer and screwdriver or crowbar found in the PDH toolbox. The metal case in which the lamp is enclosed will be wrapped in a waterproof liner. When battery operated, a 6-volt automobile battery must be procured. Bulb is included in case with lamp.

STEP 1:

A. All parts of the lamp are packed inside the carrying case which also serves as a base for the lamp. No batteries are included. The lid holds a spare lens for the lamphead and instructions for use with a 6-volt battery. Parts and other information necessary for assembly instructions include: (a) left cap on base, (b) right cap on base, (c) base-container, (d) lamphead and cord, (e) top upright section, (f) interchangeable intermediate upright sections, (g) lower upright section. (h) extension cord for 110-volt outlet, (i) 3-foot battery cable, (j) bulbs and adapter.





B. To release lamphead assembly (d), press button on overhead bracket of case and lift up.

C. Remove four pieces of pipe which form upright shaft (e, f, g). Grasp semicircular metal loop attached to hinge in rear of case. Pull forward to release shelf on which lamphead (d) rests. Carefully lift lamphead from case to prevent scarring or breaking of lens.

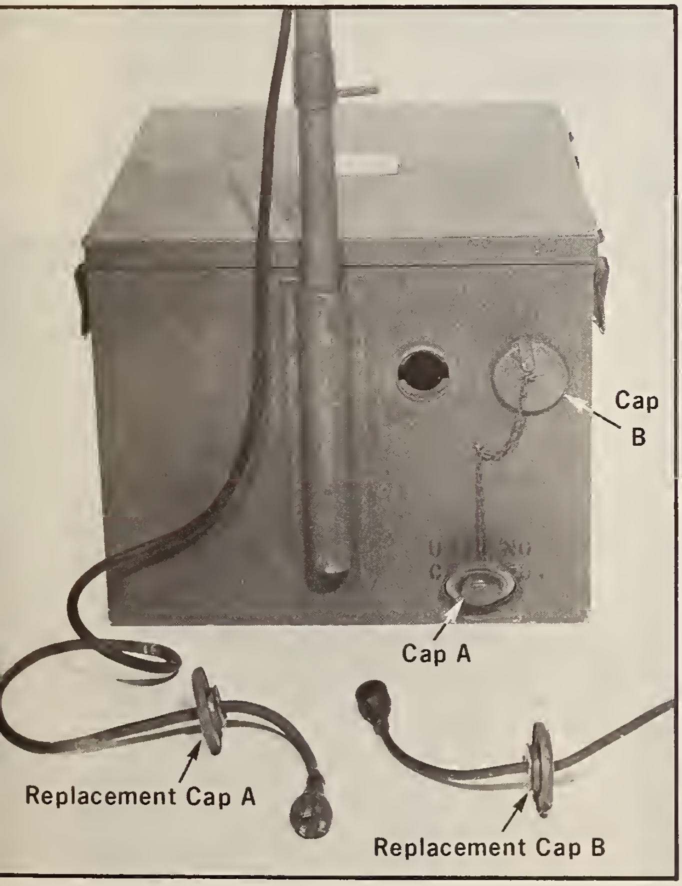
STEP 2:

A. Insert lower section of upright (g) into bracket on front side of base. Then screw intermediate upright sections (f) into lower upright (g). The two intermediate uprights are interchangeable.

B. Screw top section of upright (e) into second section of upright (f). Top section (e) is easily identified by the chrome-plated lamphead connector on top.

STEP 3:

A. Place lamphead (d) on upright (e). Tighten knob on lamphead to secure in position.



STEP 4:

A. Twist caps (a) and (b) on front of base to loosen. They will hang from chains attached to base and may be replaced when lamp is dismantled. Insert cord attached to lamphead (d) into left hole (a) in base. Replace cap (a) with cap attached to cord (d).

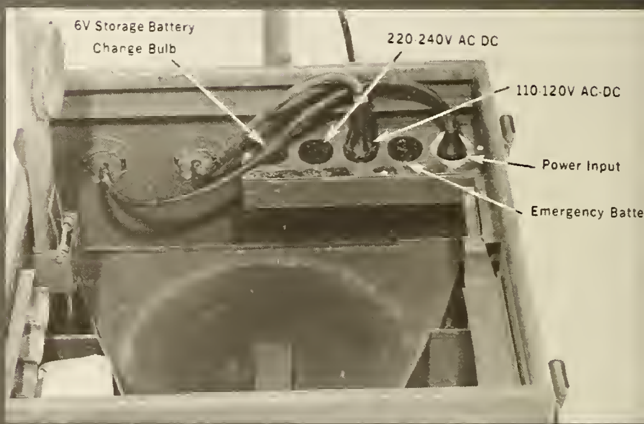
B. Insert extension cord (h) into right hole (b) on base. Replace cap (b) with cap on extension cord (h).

C. With base lid open, pull lamp cord (d) and extension cord (h) through holes (a) and (b). Plug lamp cord extending through hole (a) into socket marked "110 volts AC–DC." Plug the extension cord extending through hole (b) into "Power Input" receptacle. Lamp is now ready for electrical operation.

Clear, concise instructions for operation with a 6-volt battery are contained in the lid of the case along with a spare lens for the lamphead. Six-volt bulb (j) and battery cable (i) will be used only when lamp is battery operated.

TO BE OBTAINED LOCALLY:

(When electric power is not available) 6-volt automobile battery.



SURGICAL LIGHT

Enclosed Dome

FEDERAL STOCK NUMBER: 6530-706-6475

FEDERAL NOMENCLATURE: LIGHT, SURGICAL STAND, ENCLOSED DOME

This light is sometimes packed in two cleated plywood boxes—at other times in three. Inside the wooden boxes are fiberboard cartons. The base is exceptionally heavy for its size and is most easily handled by two people as shown in the photographs. An electrician or other qualified person can easily connect this lamp to a 12-volt battery procured locally. If a battery is used, 12-volt bulbs must also be obtained. None are packed with the lamp

STEP 1:

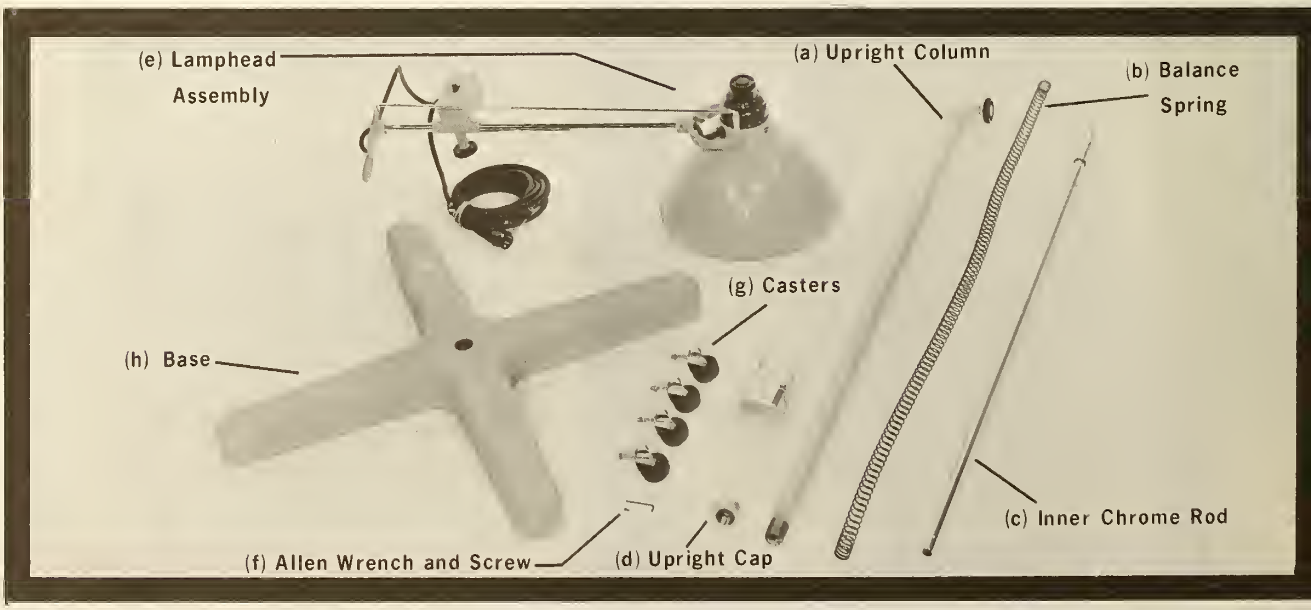
A. Open wooden boxes with hammer and crowbar.

B. Remove fiberboard cartons from boxes. It will probably be necessary to turn the box containing the base upside down because of its weight.

C. Remove packing carefully—small parts and light bulbs will be included with the main lamp parts and may be lost or broken if care is not exercised. Casters are included in box containing base.

STEP 2:

A. Lay components out. They will include: (a) upright column, (b) balance spring, (c) inner chrome rod with washer, (d) upright cap, (e) lamphead assembly, (f) allen wrench and screw, (g) casters, and (h) base.

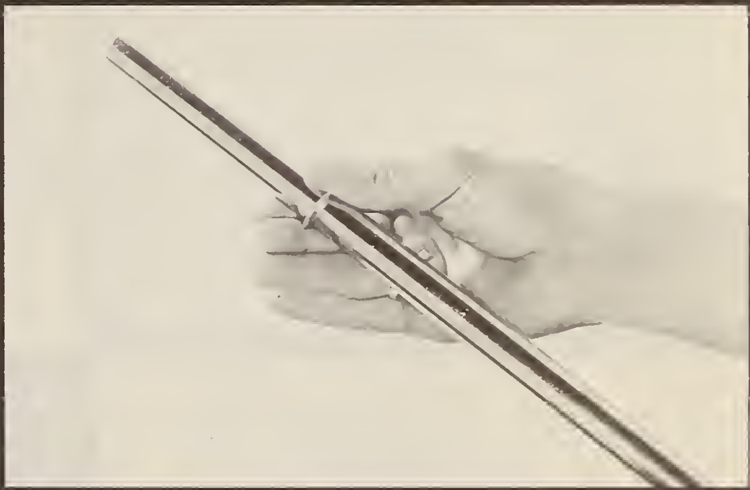


STEP 3:

A. Loosen knob on upright (a).

STEP 4:

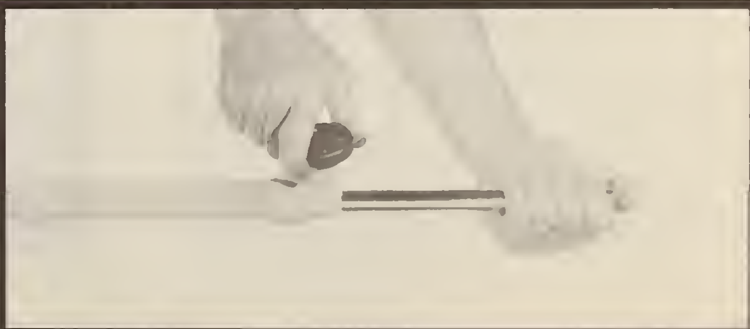
A. Place washer over end of inner chrome rod (c) nearest retainer pin. Washer should rest on pin. If washer is taped to rod, remove tape.



STEP 5:

A. Insert inner rod (c) into upright (a), washer end last.

B. Allow inner rod (c) to extend through upright (a), as far as possible. This is important since dangerous tension may result later when spring is inserted if it is tightly coiled. Tighten knob to hold temporarily in place.



STEP 6:

A. Insert spring (b) into upright (a) over inner rod (c).

STEP 7:

A. With base (h) upside down or on its side, insert casters (g) by pushing each into slot until locked into position. No tools or washers are needed.

A.

B.

STEP 8:

A. Allow end of upright with spring protruding to fall through hole in base. This is best accomplished with base standing on side.
Photo in this case is for clarification only.

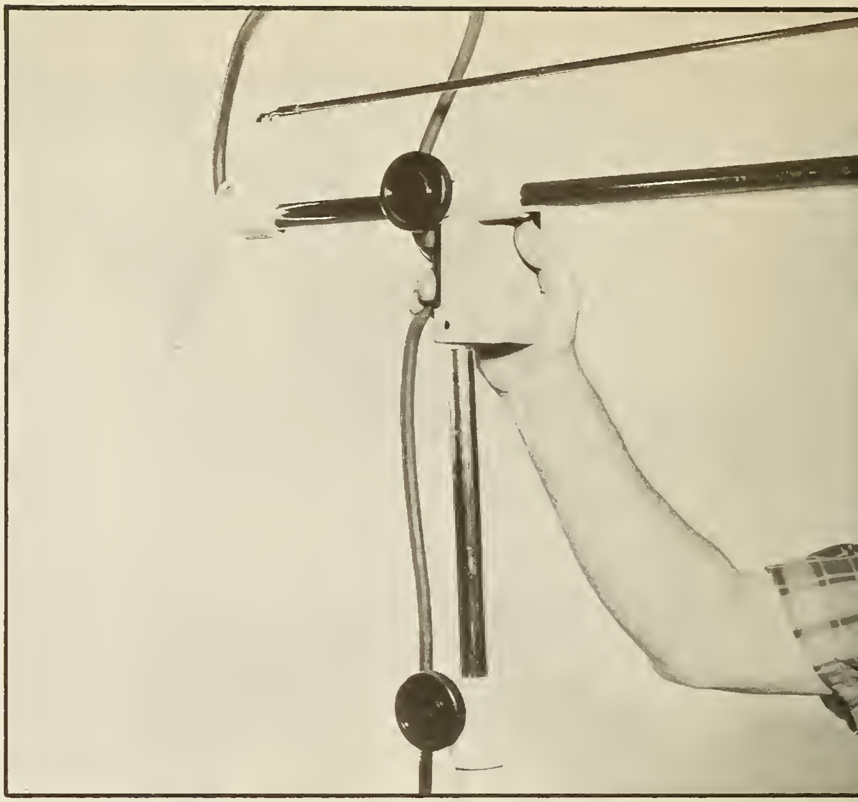
B. Place cap (d) over spring (b) and press carefully toward end of upright (a), extending through hole in base (h).

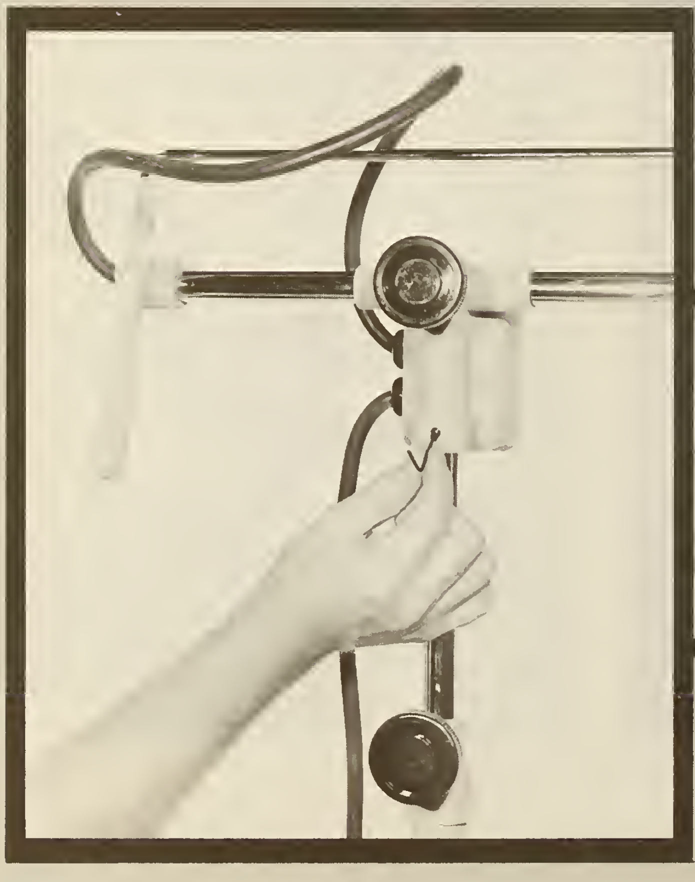
C. Screw cap (d) securely in place. Set base (h) upright.

C.

STEP 9:

A. Loosen knob on upright (a). This will allow movement of chrome rod (c). Extend rod (c) upward about a foot. Tighten knob. Drop lamphead assembly (e) over chrome rod (c).



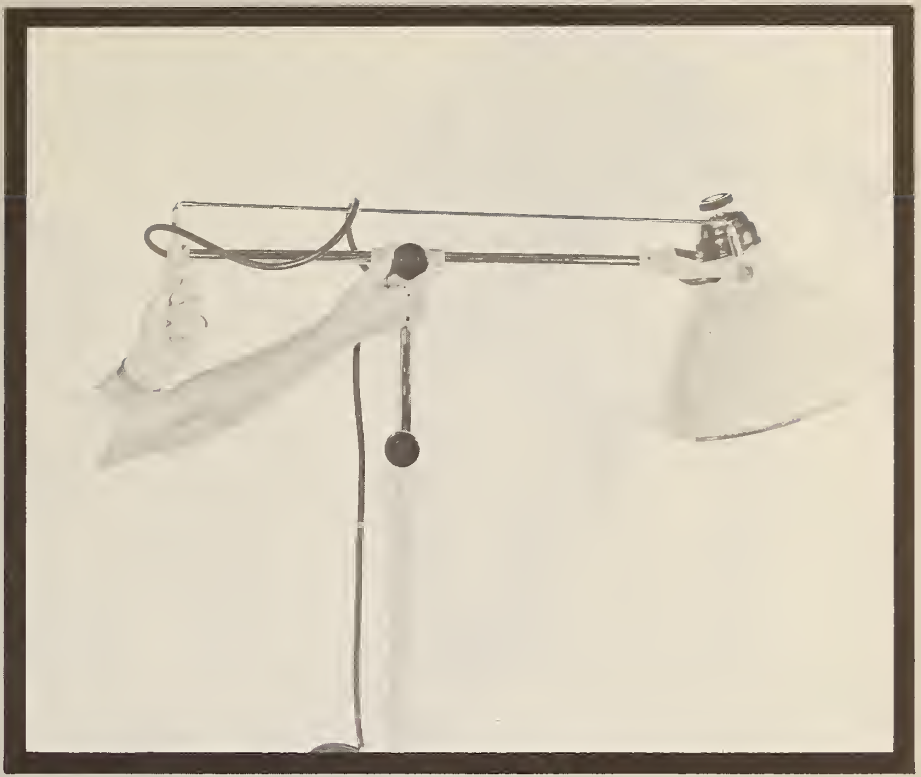


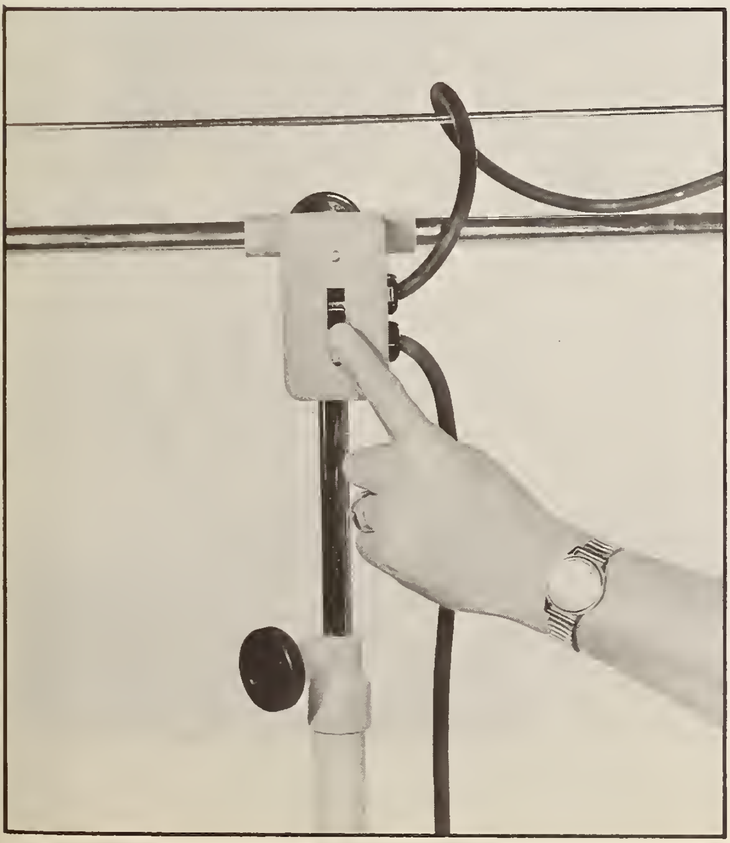
STEP 10:

A. Line up hole in base of lamphead assembly (e) with hole in chrome rod (c).

B. Insert allen head screw (f) into hole and tighten with allen wrench (f).

C. Lamphead may be moved backward and forward by loosening knob on base of lamphead assembly (c). Knob must be immediately tightened when lamp is in desired position.





STEP 11:

A. Test lamp by placing switch in "ON" position. Turn "OFF" until lamp is to be used. For grounding of plug, see page 57, Step 4.

TO BE OBTAINED LOCALLY:

When needed, a 12-volt automobile battery, power clips, conductor cord, receptacle, and 12-volt bulbs.

SURGICAL INSTRUMENT STAND

(MAYO)

FEDERAL STOCK NUMBER: 6530-708-1610

FEDERAL NOMENCLATURE: STAND, SURGICAL INSTRUMENT, WITH REMOVABLE INSTRUMENT TRAY

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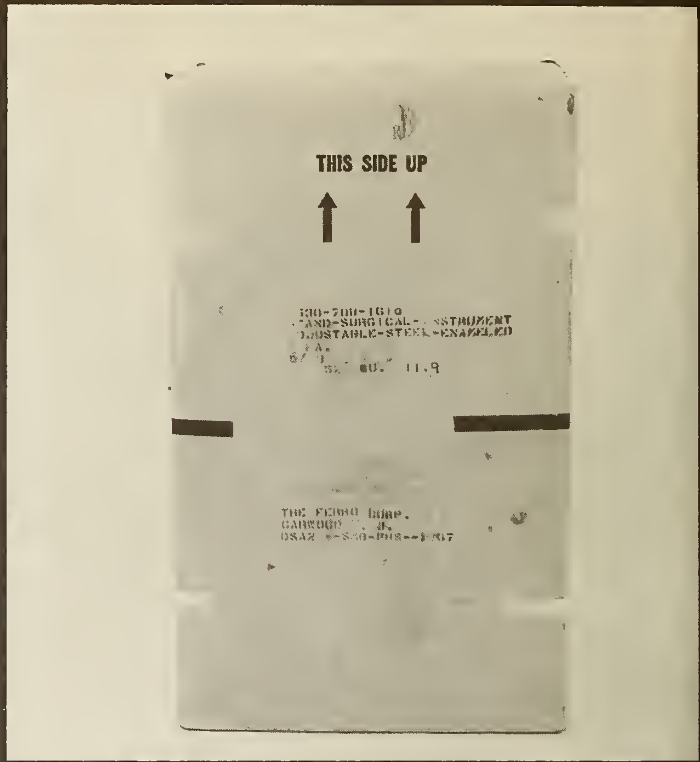
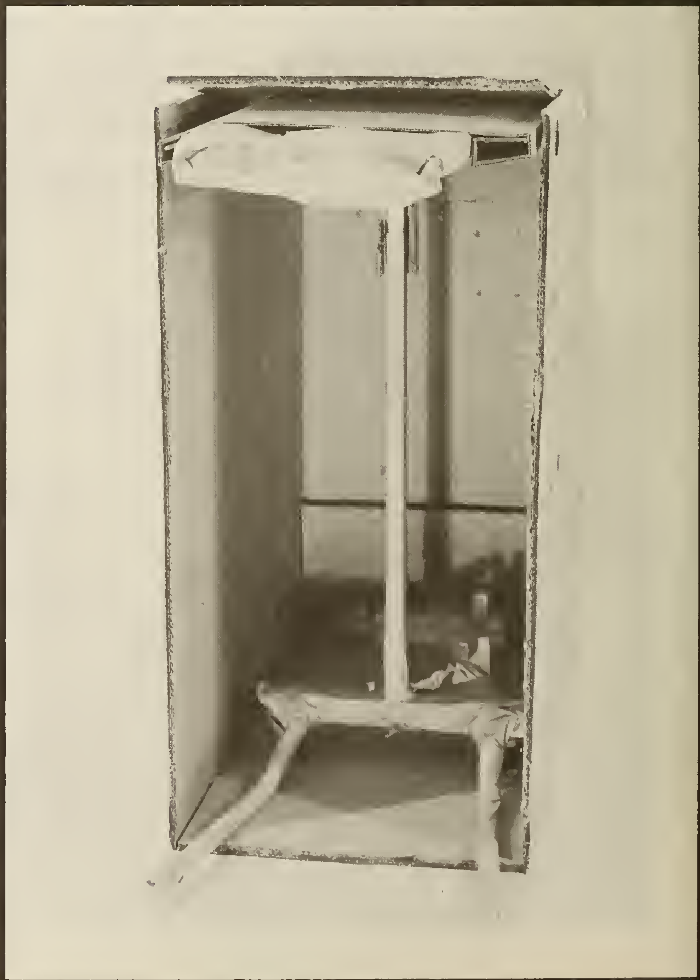
No assembly is involved with this stand. These photographs were made specifically to explain the raising and lowering of the removable tray. Additional trays are packed under Federal Stock Number 6530-793-9570.

STEP 1:

A. Stand comes packed individually in triwall carton.



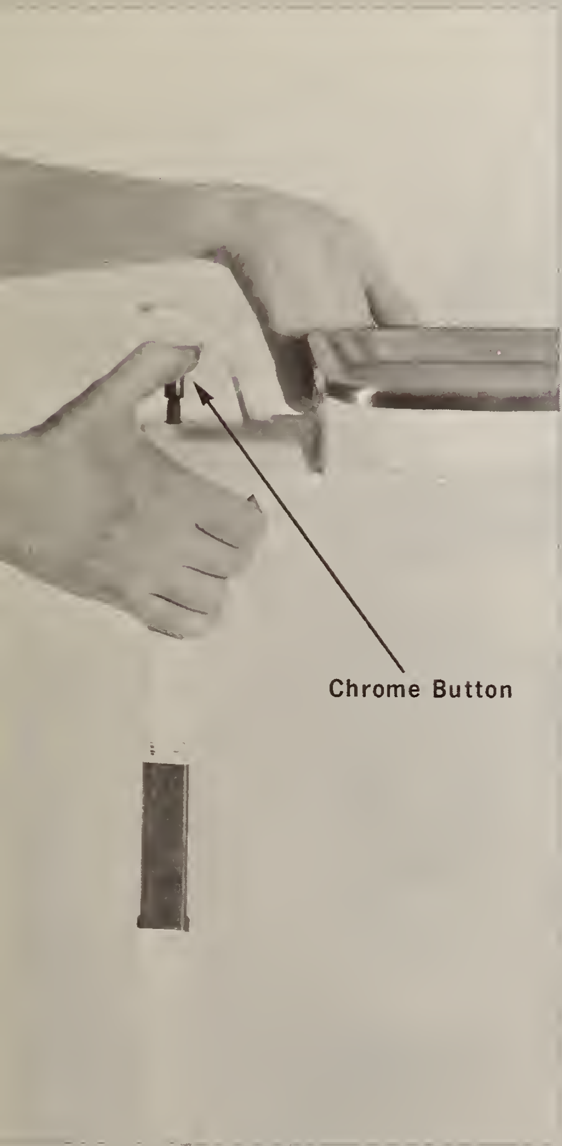
B. Slit carton lengthwise. Stand is taped to wood block attached to inside of box. Slit tape and pull assembled stand out.
Remove packing.



STEP 2:

A. To raise and lower tray, press down firmly on chrome button located on top of back of stand. At the same time, lift upward on the tray support.

B. Tray simply lifts out of stand for cleaning or replacing. Casters are attached to base so stand may be moved about with little or no effort.



SUCTION AND PRESSURE APPARATUS

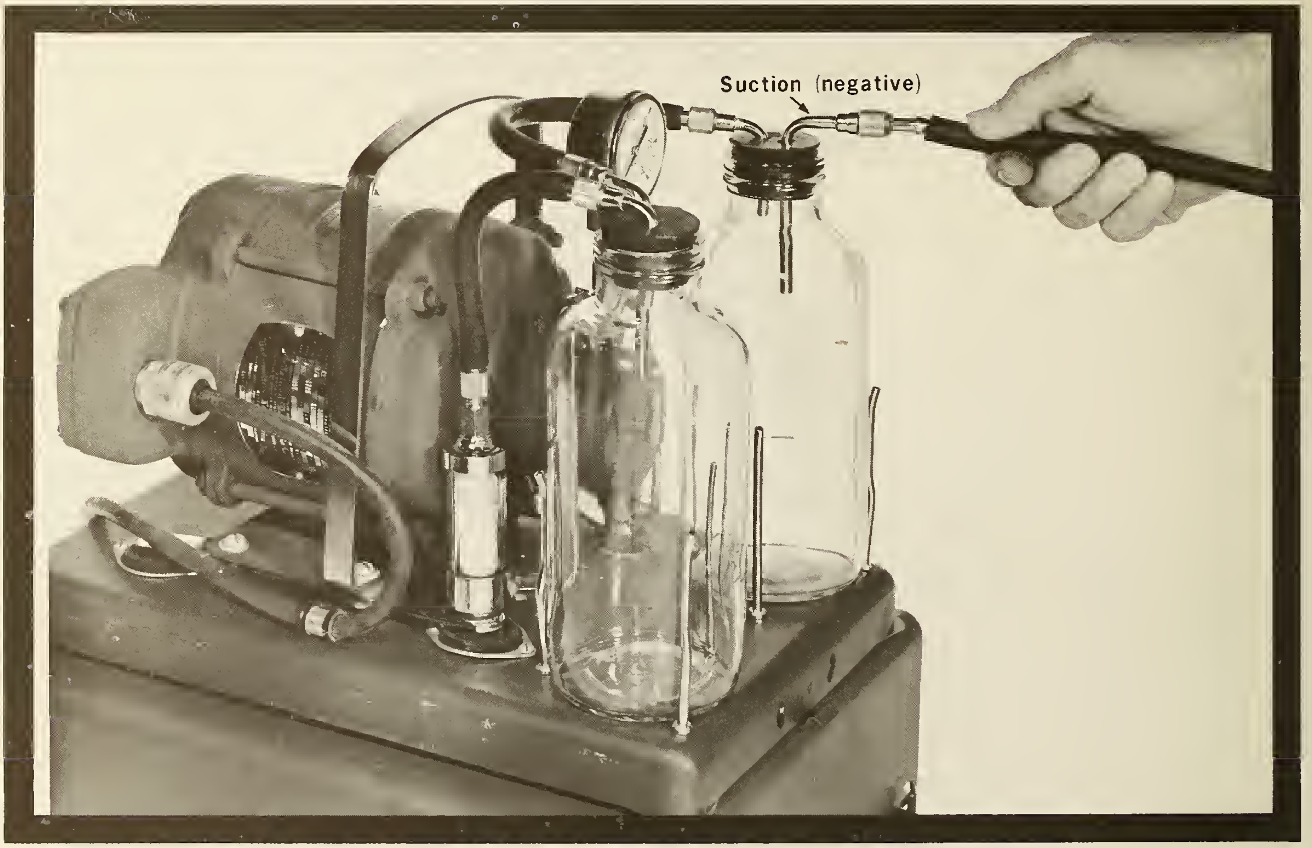
FEDERAL STOCK NUMBER: 6515-299-8337

FEDERAL NOMENCLATURE: SUCTION AND PRESSURE APPARATUS, SURGICAL, PORTABLE

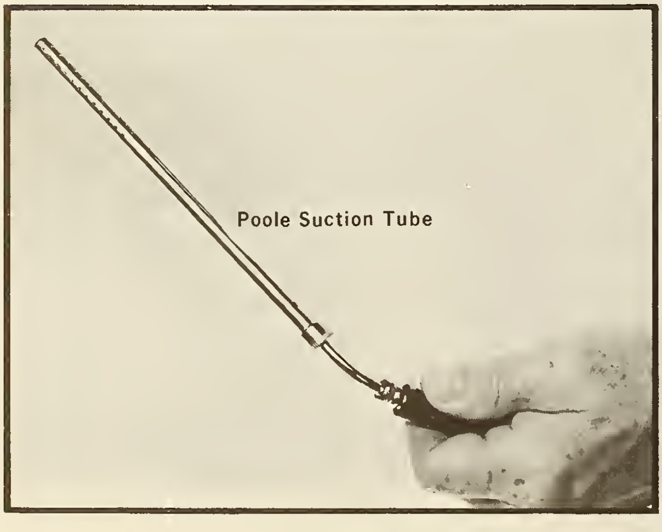
The carrying case in which the Suction and Pressure Apparatus is packed may be used as a stand while it is in use. The unit is already assembled with the exception of the spray tube and the suction hose and tubes which are packed in compartment in top of cover. Sprays must be obtained locally. Before starting motor, remove all packing material and be sure that all hose connections are tight and that rubber stoppers in both suction bottles are firmly seated. This will prevent leakage of suction.

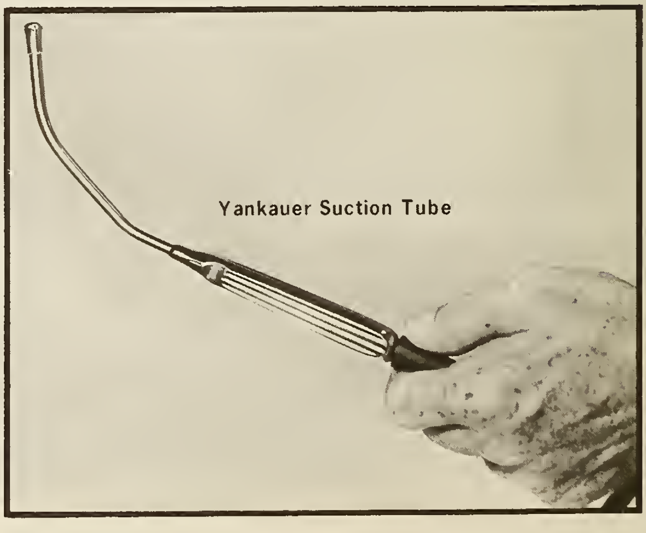
STEP 1: FOR SUCTION:

A. Attach extension hose to suction (negative) side of unit by pressing either end firmly over coupling.



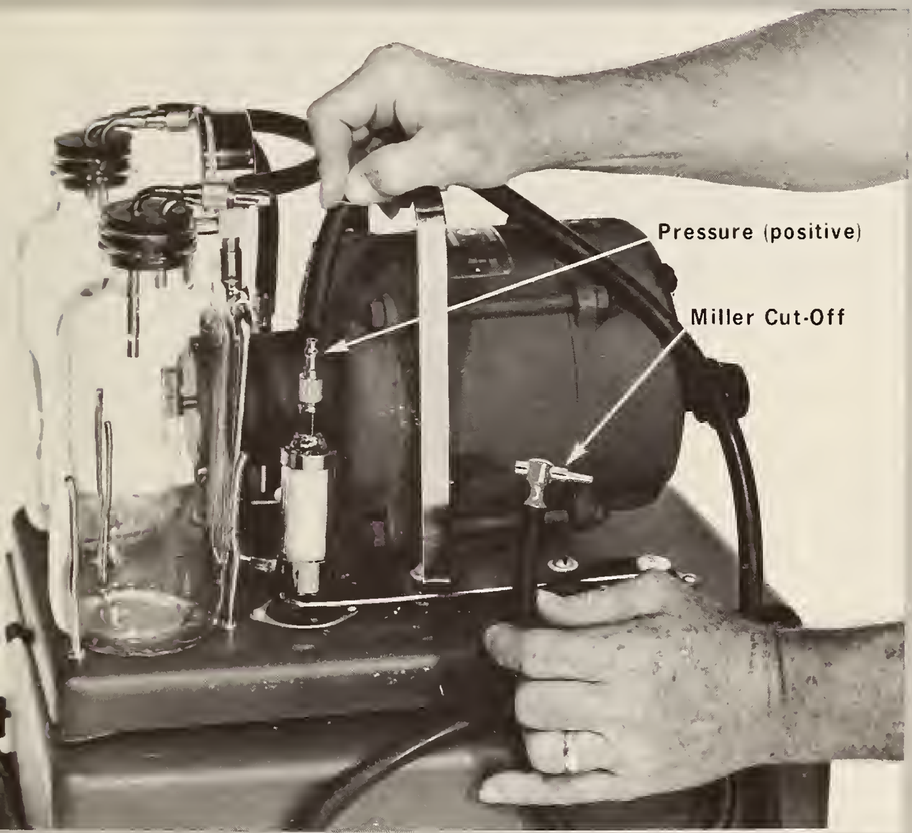
B. Attach loose end of extension hose to suction tube as shown in photographs below. Photo at lower left shows Poole abdominal suction tube correctly attached. Lower right illustrates Yankauer laryngeal suction tube ready for use by physician.





STEP 2:
FOR SPRAYING:

A. On pressure (positive) side of unit, connect spray tube with Miller cut-off to filter by pushing hose firmly over chrome coupling. Miller cut-off fits standard sprays (not shown).



TO BE OBTAINED LOCALLY:

Sprays fitting Miller cut-off.


POSITIVELY
SMOKING

OPERATING TABLE

FEDERAL STOCK NUMBER:	6530-709-8155
FEDERAL NOMENCLATURE:	TABLE, OPERATING, FIELD

The manufacturer of the five operating tables included in each hospital packs each table first in its own fiberboard carrying case, next in a corrugated fiberboard carton, and finally in a wirebound wooden box.

Any table that has been repackaged due to servicing, use, or routine inspection will not have been replaced in a wirebound box. Instead, the carrying case will have been placed in a triwall corrugated fiberboard carton. This carton may be opened easily by slitting the tape with any sharp instrument.

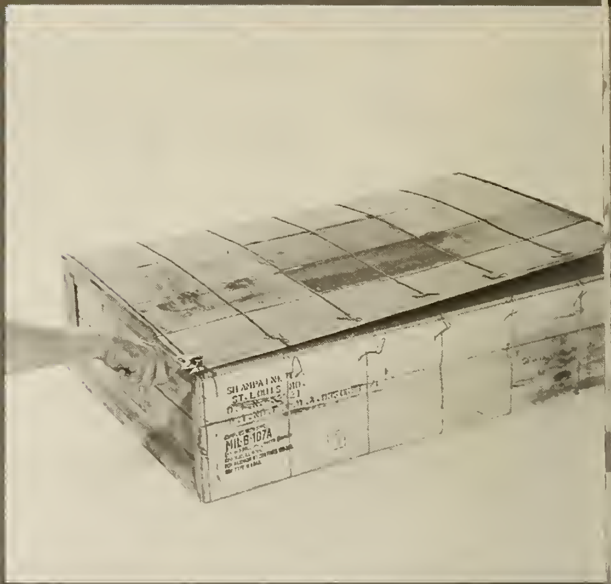
Care should be exercised in setting up this table—not because the assembly is unduly complicated—but because painful injury may result from a finger being caught in one of the many hinges necessary to hold the table in position.

The six carriage bolts included with the table have square fittings near the head which slip into square holes in the inside legs and side braces of the table. This prevents the bolts from slipping when tightened. The carriage bolts to be positioned properly must be fastened with the wing nuts on the *outside* of the table.

STEP 1:

A. With pliers found in toolbox provided with hospital, release wire catches on wooden box.

B. With hinged lid pulled up and back, turn box upside down to remove carton.



C. Using any sharp instrument, slit tape to open carton. Remove case containing table.

D. Open hinged "suitcase-type" lid. Lid will fall back affording easy removal of table and other components.

E. Components include preassembled folded table, six carriage bolts, six wing nuts, and two side brace bars.

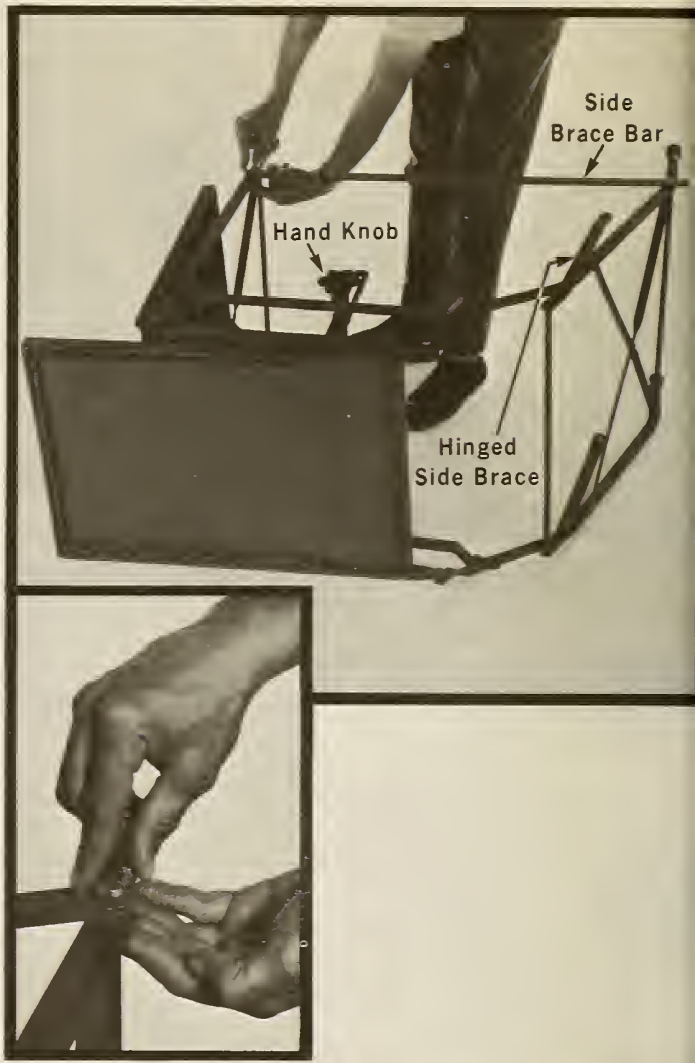
STEP 2:

A. Place table on side, hand knob up. Loosen knob and swing rear legs back and out.

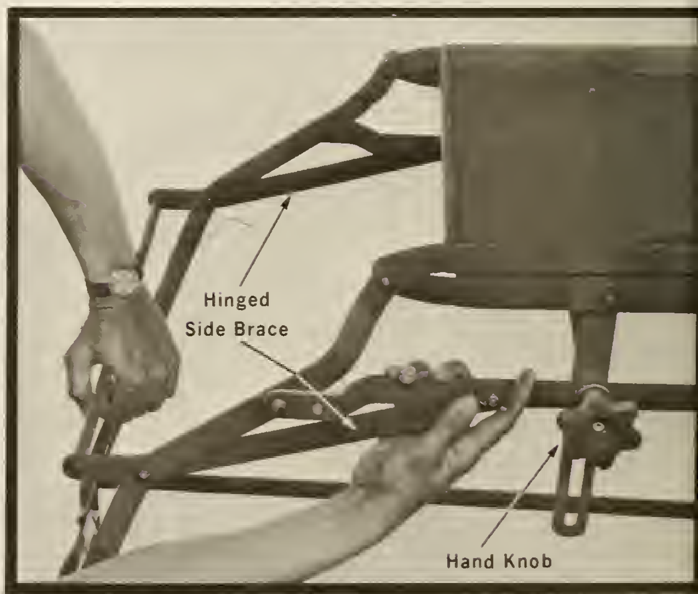
B. Swing seat section and front legs out making certain that the seat section rests on the stops located on top of the front legs.

STEP 3:

A. Attach one side brace bar with carriage bolts and wing nuts, with wing nuts outside.



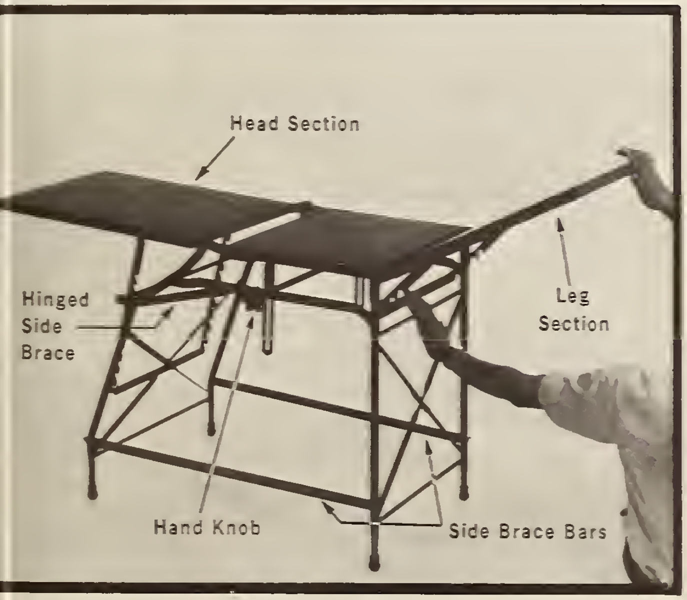
B. Move one hinged side brace into position as shown and fasten with carriage bolts and wing nuts, tightening wing nuts firmly from outside.



STEP 4:

A. Table should now be placed on its legs in an upright position. Fasten second hinged side brace same as Step 3, B, and attach other side brace bar same as Step 3, A.

B. Swing head section back and engage on cross bar of hinged side brace as shown.



STEP 5:

A. Raise leg section and engage rack over support rod as shown.

STEP 6:

A. When table is fully assembled, tighten hand knob. Hand knob must be loosened to adjust position of table. Be sure to retighten firmly before weight is placed on table.

NURSES' WARD MANAGEMENT GUIDE

THE DISASTER HOSPITAL CONCEPT

The type of disaster which necessitates the use of a Packaged Disaster Hospital will make relentless demands on the hospital staff. Everyone will be under severe stress. They will have to work long hours. Only a basic minimum of supplies and equipment are included in the Packaged Disaster Hospital unit. Furnishings taken for granted in a modern hospital will have to be improvised or done without when the PDH is set up independent of the parent hospital.

Nurses, accustomed to giving thorough care to individual patients will find themselves called on, instead, to manage the care of large numbers of patients by directing aides and helpers in procedures ordinarily performed by the nurse herself. Many of these helpers will be unfamiliar with disaster procedures, possibly even with hospitals. There will almost certainly be an acute shortage of bed space and patients will have to be discharged much earlier than they would be in normal circumstances.

This text is intended to assist nurses designated to staff a PDH in essential predisaster planning. It is a guide to the management of a single PDH ward, whether that ward is one large area or several smaller rooms. The number of wards and their size will depend on the type of building. In an armory or warehouse, large expanses of floorspace may require setting up all 200 cots in one or two large wards. In a school or office building, the floorplan may permit several smaller wards. In any case, the principles presented here will facilitate the best possible care of large numbers of acute injuries and illnesses under disaster conditions.

A Master Plan

At the time a PDH is pre-positioned, the hospital staff responsible for it must write a plan for its utilization. A nurse, to be designated as director of nursing for the PDH, should be a member of the committee which does this initial planning. An estimate of the personnel which would be available to staff the PDH should be made and, if possible, specific people should be assigned to supervisory positions. Thus, a nurse who knows she will be head nurse of a PDH ward will be able to make plans in advance for the best use of the nurses, practical nurses, medical aides, and helpers she can expect to have assigned to her unit. She may also assist in their training for duty in the disaster hospital.

Disaster Conditions ● There is no way of accurately anticipating conditions which will exist at the time a PDH is put into operation. The situation may vary from early activation for a large number of casualties with traumatic injuries to delayed activation with fewer injuries and a greater number of illnesses. Certain generalizations, however, can be made and it is helpful in the planning stage to study predictions of the types of injuries and illnesses that can be expected in different kinds of disasters. A thorough awareness of the kinds and amounts of equipment and supplies stocked in the PDH is also necessary.[1]

It is expected that patients in a Packaged Disaster Hospital following a nuclear attack will be suffering from blast injuries with fractures and radiation reactions, severe physical and emotional shock, severe burns, and other acute injuries and illnesses. Those whose needs can be met by neighbor-help or self-help will not occupy hospital beds. This is an important point to remember in planning the hospital's operation.

PDH Activity ● As the PDH goes into operation and the facts of disaster conditions replace the theories of predisaster planning, alterations in the master plan will be necessary. The whole hospital team will begin to see where needs are the greatest and the staff can be reassigned as necessary. Reassignments are more readily made and accepted when the master plan is thoroughly understood by the entire staff. For example, the operating rooms may be under intense pressure when the hospital is first activated. When this slackens, some of the operating room nursing staff can be reassigned to ward service with the understanding that these nurses will be recalled to the operating room should the need arise.

The nurse designated to manage a ward will be responsible for planning total patient care, selecting and assigning personnel to provide this care, organizing and supervising associated clerical activities on the ward, supervising the general condition of her unit, establishing and maintaining working relationships with other PDH sections, and helping patients and their families prepare for self-care after discharge.

Staffing

A community's professional health personnel will be overtaxed in a disaster and there will be a limited number available to staff the PDH. The pressure of work in the first days of the hospital's activation will require the staff to work long hours to assure the availability of someone who is competent to give or direct others in giving essential patient care.

Nurses may be required to assume some medical responsibilities delegated to them by physicians and may, themselves, have to delegate some professional nursing functions to practical nurses and aides. All the personnel of a PDH must be prepared to accept responsibilities beyond their ordinary practice but they must also be prepared to relinquish those responsibilities when better qualified personnel become available.

Assignments ● The mission of the PDH to give immediate care to a constant flow of acutely sick or injured patients must be kept in mind in making staff assignments. In the receiving and sorting area, patients will be assigned to appropriate wards. Ward designation immediately postdisaster will depend on the numbers of casualties and the types of injuries. In general, patients who need immediate care and have a prospect of recovery will be separated from those for whom only palliative care and treatment can be given. This sorting principle affects the staffing of the wards since the highest skilled help must be assigned to work with patients who can be expected to recover.

In the administrative plan, the head nurse of a ward is directly concerned with planning and using the services of practical nurses, medical aides, and any helpers and messengers who may be assigned to her unit. The nursing service administrator may alter the assignment of personnel to various sections depending on the workload. For instance, a heavy operating room schedule might call for taking some of the available practical nurses away from ward duty. Aides might have to run the central sterile supply section with only one professional nurse to supervise them. If there is not sufficient professional personnel, the best trained helpers will have to be used. Where none are trained, the nurse will have to train them on the spot.

a. The head nurse

The head nurse is responsible for the total care of all patients assigned to her unit. She must designate which staff member is responsible for

[1] Determine the model number of your PDH and check the appropriate component listing available from your hospital's administrative office or from the official designated to direct PDH activities.

each aspect of this care, see that medications and treatment are given as ordered by the physician, supervise serving of meals and see that patients' other needs are met, supervise the general housekeeping in her ward, see that necessary records are kept, assign personnel hours and duties, schedule ward activities and maintain working relationships with other PDH sections.

b. The professional staff nurse

The primary responsibility of professional nurses is to see that all patients assigned to them receive the best possible care and that treatment is given according to the physician's orders. They may have to delegate much patient care to the practical nurses, trained medical aides, and helpers on the ward.

c. The practical nurse

Practical nurses will help with all duties as assigned by the professional nurse or a physician, particularly those concerned with the immediate care and treatment of patients. When there is no professional nurse, the practical nurse will take over her duties.

d. The medical aide

Personnel designated as medical aides (or nurses' aides) should have had previous training and/or experience in working with patients in hospitals. They will help with bedpans, urinals, and emesis basins; feed patients; help with admission, transfer, and discharge of patients. If no nurses are available to do so, they may give medications and treatments.

e. The helper

Helpers will perform essential non-nursing duties. They can transfer and escort patients, get supplies and pharmaceuticals, record and check personal property of patients, serve as messengers, housekeepers, and clerical help as their abilities permit.

Training

When the PDH has been incorporated into the affiliated hospital's disaster plan and the PDH staff has been designated, all personnel should be trained in the aspects of setting up and operating the hospital for which they will be responsible. This predisaster planning and training greatly increases the efficiency with which a PDH can be used.

While information, such as is found here, is available for the guidance of the designated staff, nothing can substitute for actual practice. Many hospitals hold training exercises periodically, simulating, to a degree, problems which can be expected to occur in a disaster situation. In such exercises, nurses who will be managing PDH wards often have an opportunity to see exactly what equipment is provided and how to operate it. (See page 133 for photographs and assembly instructions covering ward equipment packed with the PDH.) They also can begin to appreciate how care and treatment of large numbers of patients must differ from the medical and nursing care possible under usual hospital conditions.

Scheduling

When a PDH is activated, a schedule of two 12-hour shifts will probably have to be established in order to make the maximum use of limited professional personnel. As the flow of patients and pressure of work change and the hospital settles into prolonged operation, this schedule can be altered. By that time personnel abilities and weaknesses will have become apparent and it will be easier to make assignments to cover a schedule of three 8-hour shifts.

In the first few days of disaster, many workers, especially nurses, will not want to go off duty at all as patients continue to arrive. The wise and responsible head nurse must override her staff's eager desire to keep working beyond their endurance in order to prevent the fatigue and subsequent irritability which will result—in both staff and patients. The 12-hour shift with regular rest periods is the best solution to this problem because even the most dedicated person will usually admit the need to get some sleep after 12 hours of steady work.

Actually, it is often in the later cleanup period following a disaster when the greatest skills and freshest approach to problems are needed. If everyone is physically and emotionally exhausted by then, sustained operation of the hospital is much more difficult.

WARD MANAGEMENT

The Plan

The nurse in charge of a ward will find that the principles of management used in any kind of business apply equally well to managing a ward. First, she must have a plan which indicates, simply, what must be done, who is to do it, and how it is to be done. This plan must be understood by everyone involved. She must then see that this plan is carried out. Such a plan must be based on clearly defined objectives and, of course, must be in harmony with previously determined policies and regulations of the entire PDH plan. For disaster nursing, the following objectives are essential:

1. Lifesaving measures must be applied in the treatment of traumatic injuries, acute infectious diseases, and chronic diseases with acute complicating factors.
2. The spread of disease must be prevented to keep the incidence of illness as low as possible.
3. The period of illness must be shortened in order to release the hospital bed and return the patient to the community work force as soon as possible.
4. Crippling or hazardous complications of illness must be prevented.
5. Suffering must be alleviated and the spread of emotional upset prevented.

The simpler the plan, the more readily it will be understood and accepted by the staff. It must be flexible enough to permit rapid adjustment to emergency conditions which can never be entirely anticipated.

The head nurse is, of course, responsible for seeing that her ward plan is carried out. This should not be difficult if she has made the proper assessment of needs and resources. If difficulties arise, she should be prepared to alter her plan in accordance with a more realistic evaluation of the situation.

A nursing care plan for each patient and an activity plan for each nursing team are the basis of coordinated and efficient ward operation. If paper and pencils are lacking, these plans will have to be issued orally. They should be specific enough to let everyone know exactly what she is expected to do.

Ward Layout

The most probable ward arrangement will be two rows of cots with the nurse's station at one end or in the center, depending on which will permit the best service to patients. The most acutely ill patients should be closest to this station so they can be constantly observed and so that medications and supplies for their care are readily available. This station may be nothing more than a packing case with another packing case for a chair. It may have to serve, also, as a storage cabinet for medicine glasses, hypodermic equipment and other supplies.

The nurse's station is also the logical center for exchanging messages and receiving supplies. Custodial and housekeeping personnel should report here when they complete one assignment and are available for another.

Admissions

Standing orders for newly-admitted patients may have been made by the chief of the medical staff and a standard form may have been designated. If not, the nurse may wish to devise a form for the use of her staff. Regardless of how the treatment and medication orders are given, the professional nurse is responsible for seeing that they are carried out.

The professional nurse may have to delegate some ward admitting functions to the practical nurse or even to a capable medical aide. She should, nevertheless, try to see each patient in her unit daily. When a patient is admitted, she should check his clinical record and give or arrange for such treatment and medication as has been ordered.

Bedside Care

Each bedside activity will have to be planned to conserve time, energy, and limited supplies and at the same time to sustain and comfort the patient. This care is likely to be restricted to the specific and simple treatment of immediate needs. Adaptability and improvisation will be required of all personnel to make the best of disaster conditions. Everyone working with patients should know what medical asepsis is and how to achieve it—or the nearest possible asepsis—in emergency conditions and how to carry on in septic conditions. Each ward staff member must know how to provide bedpan and urinal service and how to dispose of waste.

Treatment and Medications

Treatment and medications should be given by professional or practical nurses. If neither is available, the best trained medical aide can be given this duty. If necessary, someone can be trained on the spot to carry out simple treatments. When properly trained help becomes available, the less qualified person should be reassigned to other duties.

The simplest plan for giving medications may be to keep the entire stock of medicines for the day in a box or tray and take it on complete ward rounds at specified times. The person dispensing medicines can stop at each cot, read the patient's order, select the proper medicine from the supply, put it directly in the patient's hand or mouth and record it immediately on the patient's chart. With 20 to 60 or more patients, the person in charge of medications may spend almost full time giving medicines, recording them, and ordering new stock through whatever system is established.

Records

The administrative staff will decide upon the system to be used in keeping records. The importance of patients' clinical records should be impressed on all PDH personnel, particularly all nursing team members. Admission and other records will be initiated in receiving and sorting. A record should be made of the personal belongings a patient has with him. These may be the only things he has left and they also may be the only means of identifying him if he is unconscious.

The ward staff will be very busy and there will be little time for maintaining the thorough records of a normal hospital organization. Daily ward reports, census sheets and other paperwork to which the nurse is accustomed will be held to a minimum. Some information, however, must be recorded, even in the greatest emergencies. There should be a chart for each patient, although chart racks may have to be improvised or dispensed with. Notations on temperature, pulse, respiration, and blood pressure should be made as regularly as possible and medication and treatment must be recorded. It is advisable that the person who gives the medication or treatment record it at once. Information such as laboratory and X-ray reports will probably be prepared in those sections of the hospital and a copy kept with the patient's record.

Instructions on After-Care

In normal times, the professional nurse helps to teach patients and their families how to continue care after the patient is well enough to leave the hospital. In the PDH, patients may move through too quickly for this type of teaching to be done in much detail, but even the most temporary patient should be given some instruction in self-care. The nurse can do this even in the few minutes of direct contact she has with the patient while giving his treatment. Under disaster conditions, this instruction could prove lifesaving.

When the patient is discharged, the nurse should see that he has a record of the treatment he has received and a list of his special needs. This will facilitate any further care and treatment he may need after he leaves the hospital.

Ordering Supplies

The professional nurse, practical nurse, or medical aide (in that order) should order medicines, equipment and other supplies. If the PDH sets up a system of taking daily inventories of such supplies and maintaining them, this will free nursing personnel for direct care of patients. It also permits better control of expendable materials. Nurses have a tendency to hoard some items against future need and the limited supplies provided in the PDH will not allow this.

Ward Environment

Helpers should be instructed in a routine for keeping the ward environment as comfortable as possible. This may be difficult in a disaster situation but it is very important for both the patients and staff.

1. Ventilation

The odor which will result from massive wounds and burns can actually hinder work and even affect the patients' condition and morale. If ventilation cannot be satisfactorily maintained, the use of activated charcoal or some other air purifier (not a product which merely scents the air) should be considered.

2. Housekeeping and Laundry

The PDH administrator will decide what arrangements are to be made for housekeeping and laundry services. Attention should be given to working in as neat and orderly a manner as possible because this will lighten the housekeeping burden and encourage the prudent use of supplies. Linens must be used conservatively throughout the emergency because the hospital's supply is very limited.

3. Waste Disposal

The decision of how waste disposal is to be handled is a supervisory responsibility. The head nurse may have to instruct the nursing team in the proper handling of waste and proper disposal methods. Because nurses will be on duty around the clock and are familiar with hospital routine, they will be aware of this continuing requirement and must be prepared to meet it themselves if no one else is available to take care of it.

4. Electricity

The PDH is equipped with emergency generators which can supply sufficient power for the hospital's most important requirements should the community power supply be shut off. This emergency power supply will permit no nonessential lights. Packed with all PDH's are gasoline lanterns and the nurse may well find herself faced with one of these as her only light in the ward. She will do well to learn beforehand how to operate such a lantern and also to have in mind other possible emergency measures (such as her own flashlight or an old-fashioned kerosene lamp).

5. Water

Whether the disaster is natural or caused by attack, lack of water may be a major problem. The PDH is equipped with a portable 1,500-gallon water tank and a pump which permits the hospital to be self-sufficient if community water lines are disrupted. This will, however, supply only the most imperative needs, and strict conservation will be necessary. Availability of water is an important point to consider in predisaster planning, as well as during the hospital's operation, because it affects so many ward duties.

Scarcity of water can mean both unwashed patients and unwashed staff—neither being very readily accepted by those accustomed to the modern hospital. It is, nevertheless, possible to give expert care without washing a patient.

Bed baths, daily oral hygiene, and shaving may not be possible. Nurses will have to devise comfort measures which do not depend on water—a dry rub with a towel instead of a bath; chewing gum (if it is available) instead of brushing teeth.

TEAM NURSING

A head nurse will be in charge of several professional nurses, a few practical nurses, and a large number of medical aides. It will probably be most efficient to make up teams consisting of one professional nurse as team leader and several medical aides whose work she will supervise. If there are enough practical nurses, one can be assigned to each team. If not, those who are available can circulate to the teams which need them most at the time.

The head nurse's unit may be several small wards, each of which can be staffed by one team, or one large area in which all the teams will work. Specific patients should be assigned to each team and the team leader will be responsible for a continuing evaluation of their condition. She will also be responsible for appraising the quality of her team's work.

The team pattern will vary according to the needs of the patients in the unit, the physical arrangement of the unit, and the head nurse's familiarity with team planning. The professional nurse will give as much direct patient care as the workload permits, but she will have to delegate tasks to various team members according to their abilities and the needs of the patients.

Predisaster Practice

Training sessions plus frequent drills in team activity as well as exercises which simulate disaster conditions help the nursing team members become familiar with their assignments and with working together. The resulting coordination helps each member become so adept at her job that her actions are almost automatic. Good nursing is built, in large part, on these automatic skills which are the product of thorough training and long practice. Team work which has become deft and automatic enables the members to answer questions and work out problems without interrupting their actual physical care of patients.

On-the-Spot Organization

If the team has had no predisaster practice, it will have to be organized and drilled in actual operation. The head nurse will be responsible for assigning duties —and reassigning them if necessary—until the team becomes a productive entity. She must be prepared to give on-the-spot training. All PDH personnel will have to adapt their skills to meet frequent changes in personnel, limited supplies and equipment and severe emotional stress. Those in supervisory positions, however, will be the ones who must solve the problems these conditions generate. One solution is to keep the team members as versatile as possible so that they can interchange tasks as needs dictate.

Assigning Duties

The head nurse will know, either through previous practice sessions with her team or from reports of their past activities, what each person assigned to her unit can do. Helpers who have had Medical Self-Help training, American Red Cross home nursing or nurses' aide training will be especially valuable because they will require less time to train on the job. On request of the parent hospital, local Red Cross chapters will add PDH orientation to the chapter's current training programs for disaster nursing and other appropriate training. Those team members with no experience or training in patient care can do clerical work, help feed patients, perform messenger and housekeeping services, transfer and escort patients, check and record patients' personal property, and similar tasks.

Untrained, unskilled personnel work more effectively if they know exactly from whom they are to receive their instructions. This avoids the disorganization which can result when a helper leaves an assignment unfinished to follow instructions issued by someone else.

As work progresses, special abilities will become apparent and some reassignment of duties will be indicated. The general plan of patient care should remain unchanged, however. Thus, if medications are given at 10 A.M., the time will remain the same even if a new person is assigned the duty.

Assignments must be made on the basis of using the special training and experience of skilled persons where they are most needed. Although a professional or practical nurse may be able to perform some tasks with more skill and speed than an auxiliary worker, routine tasks such as taking temperature, pulse, respiration, and blood pressure may have to be delegated so that the professional nurses can give direct care. Aides and helpers can be taught the simpler tasks and the head nurse will soon see that time spent in giving such instruction is a good investment as it frees the more skillful staff members for tasks where their experienced judgment is needed. The nurse in charge of a ward may find that some of her untrained helpers will show a natural bent for nursing which she should be prepared to utilize to the fullest.

Assignments by Function

While team nursing is suggested as the most satisfactory way to provide the best possible care and treatment, disaster conditions may require that other arrangements be made. It may be that one person will have to be assigned to give treatments to all new admissions, another to give medications, and two or three others to give physical care. Practicality is the order of the day in disaster work and the nurse in charge of a unit must decide what system will be most effective in her particular situation.

WARD SCHEDULE

Personnel

In the first days of PDH operation, the only way to provide adequate coverage will probably be to schedule personnel on two 12-hour shifts a day, stressing the need for meal and rest periods. As soon as the pressure of work lessens, the head nurse should arrange for a day off for each of her staff members.

A simple way to set up a 6-day week schedule is to designate one relief person for each six persons on the ward. This will allow everyone a full day off each week. To provide time off for meals and rest periods without depleting ward coverage, it may be a good idea to put a practical nurse and some of the medical aides on a relief shift to be on duty over the hours when the peak workload is expected. When a 3-shift day, 5-day week becomes feasible, the 2-shift schedule can be altered by designating more relief personnel.

The head nurse should make out a staff schedule, posting it on a bulletin board, wall, blackboard, or even writing it on the side of a packing case if necessary. This will let anyone know at a glance how many people are on duty at the time and will give relief personnel a reminder of how their assignment rotates from day to day.

The greatest number of highly skilled personnel should be assigned to the period when the workload is heaviest. At least one of the most highly skilled persons should be on duty at all times. For example, it would be inefficient and would increase pressure to give two professional nurses the same hours off duty if that meant there would be a time when only a practical nurse was available.

Relief Personnel • Personnel should be relieved by personnel of equal training. When this is impossible, a rule of thumb is that better trained personnel may have to relieve lesser trained personnel, but no one should be assigned a relief duty which requires performance beyond her capability. Thus, a professional nurse should be relieved by another professional nurse whenever possible. Sometimes a practical nurse may have to be relieved by a professional nurse, and the practical nurse may have to relieve a medical aide. Medical aides, however, should relieve no one but other aides. This safety rule may have to be broken in an emergency, but it should be considered in all scheduling.

Rest Periods • Some rest periods are necessary, although they probably cannot be scheduled at a definite time each day. If a rest area can be arranged, this is most helpful. A spot within the hospital but removed from the work area provides the hospital staff with an apportunity for a cup of coffee and a few minutes of relaxation. The head nurse must see that those under her supervision take these breaks and she must take them herself.

Change of Shift • As the shifts change, all oncoming staff should be at the nurse's station promptly to hear the off-going nurse in charge report on her tour of duty. She will cover admissions, discharges, deaths, treatments, medications, and special details on the condition of the patients and ward. While this report is being given, the off-going medical aides remain at work until the on-coming aides have heard the report and take over their duties. Nurses or team leaders may confer further with the head nurse before they report to their stations. If a relief shift comes on duty during a regular shift, the head nurse on duty will give them a report and make assignments.

The head nurse should announce her plans for the general daily routine after she hears the report from the staff going off duty. The team leader should hear these instructions and know the assignment of each team member. Anyone who thus knows the requirements of the patients in her care will be aware of tasks left undone in the absence of a team member and can see that some arrangements are made for handling them.

Substitutions • Plans which seem efficient in theory may go awry in practice because of the human quirks which make individuals of every person—staff member or patient. Someone must be ready to substitute for those who, for any reason, cannot carry out their assigned duties. Secondary assignments within the range of each individual's abilities are suggested. That is, Person A will have tasks she is to carry out in the absence of Person B. These will not be her usual tasks but they must be within the range of her ability. The head nurse must check on the staff's awareness of her ability to perform these secondary duties.

A time schedule for personnel has little meaning if ward activities are not also scheduled. A definite schedule is the best way of assuring that necessary tasks are performed. Also, old-fashioned as the idea may be to some, there is value in maintaining fixed routines for giving medications, for treatments, for serving meals, and for offering bedpans and urinals. In the badly disrupted situation following a disaster, such predictability may well be the one reality patients and staff can rely on until some degree of normal living is restored.

The following 24-hour schedule is offered only as a guide. It will have to be altered to meet existing conditions.

7:00 A.M.	Conference or morning report.
	Check ventilation and other environmental factors.
	Offer bedpans and urinals.
	Wash patients' faces and hands if possible.
7:30 A.M.	Breakfast, supervise feeding.
8:00 A.M.	Collect meal trays.
8:30 A.M.	Check and chart patients' TPR and BP.
	Start treatments.
	Check charts and reports, supplies and equipment.
9:00 A.M.	Give medications and chart them.
10:00 A.M.	General cleaning.
	Continue treatments, dressings, etc.
11:00 A.M.	Bedpan/urinal service.
12:00 Noon	Noon meal. Supervise feeding.
12:30 P.M.	Collect meal trays.
1:00 P.M.	Medications.
	Treatments.
	Bedpan/urinal service.
2:00 P.M.	Check and chart TPR and BP.
	Treatments.
3:00 P.M.	Distribute special liquids.
4:00 P.M.	Special cleaning.
5:00 P.M.	Evening meal. Supervise feeding.
5:30 P.M.	Collect meal trays.
6:00 P.M.	Medications.
	Incontinent care.
7:00 P.M.	Make final rounds.
8:00 P.M.	Give medications.
9:00 P.M.	Bedpan/urinal service.
	Treatments.
	Check vital signs and record them.
10:00 P.M.	Lights out.
	From now until 7:00 A.M., make complete rounds of assigned area every hour, or more often as needed, giving medications, treatments, incontinent care, and bedpan service as needed. Check ventilation and environment regularly on these rounds.

Coordination • It is helpful if each section of the PDH is aware of the needs of other sections so that schedules can be coordinated as much as possible. The nursing department should explain its particular need for fairly rigid schedules to the rest of the PDH staff. For instance, it is advisable for patients to be on the same meal schedule as X-ray, laboratory, and pharmacy personnel. Thus, patients will not be scheduled for X-rays or laboratory work precisely at mealtime, nor will time be wasted by sending to the pharmacy for medications when the pharmacy attendant is out. This arrangement also helps the dietary personnel organize their work with less need for special meal service for those absent from the ward at the regular mealtime.

Routine • Definite routine facilitates assignments, relief activities, and rest periods and allows the work of the ward to proceed smoothly. Lack of organization can easily lead to chaos. Routines may have to be altered or temporarily abandoned, depending on circumstances. Nevertheless, the skeleton of a routine helps the staff know what has to be done and gives some pacing to bedside care.

IMPROVISATION

Knowing what must be accomplished is the first step in improvisation. The professional nurse's training has shown her both the "how" and the "why" of treatment and this should enable her to find substitutes for equipment and supplies which are not available.

Inventive people will find that splints, traction, weights, protective bed padding, bedpans, containers, simple sheet restraints, suction apparatus, and emergency litters usually can be improvised with materials at hand. Predisaster reading will produce good ideas. Many books (among them, the American National Red Cross Home Nursing Textbook) gives directions and pictures of items which can be improvised from common articles. It must be kept in mind, however, that some things such as straight chairs or large quantities of newspapers may not be available in the building where the PDH is set up.

All crates and boxes from which PDH supplies are unpacked should be saved for possible use, as should rope, twine, heavy paper, plastic bags, and other packing material. Wooden crates can be used as tables, desks and storage cabinets. Heavy cardboard boxes can serve as bedside tables and desks. They also can be put under the legs of a cot to elevate a patient's head or feet as needed. The bags and envelopes in which many small PDH items are packaged can be used as containers for patients' small personal belongings.

The heavy cardboard tubes from large rolls of adhesive tape makes good splints or arm boards. An eyeglass case can be made from the cardboard tube from a roll of toilet paper and the owner's name can be written on the tube. These tubes make protective containers for other items—scissors, for instance. And remember: the first stethoscope was nothing more than paper rolled into a tube!

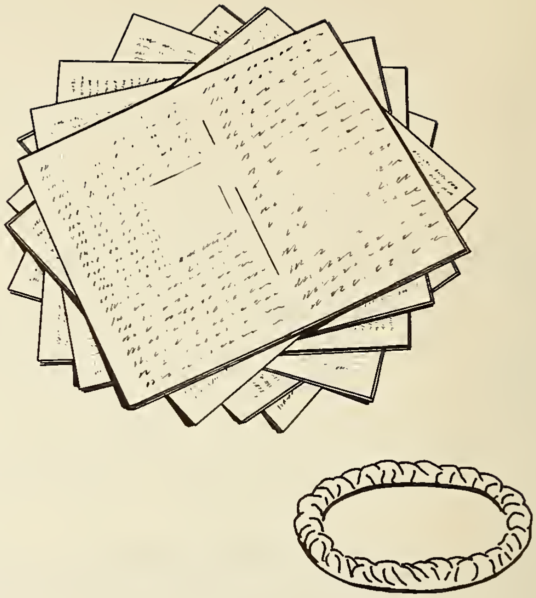


FIG. 17—NEWSPAPER BEDPAN

Newspapers

Newspaper can be used for bed padding and can even be made into an improvised bedpan or drainage pad. For this, lay many single sheets of newspaper so that they form a circle. Roll the edges into a tight rim (figure 17). It should take about a half an hour for liquid to soak through such a container.

Newspaper can also be folded into bags to use as waste containers (figure 18). Such bags can be pinned to the cot within easy reach of the patient.

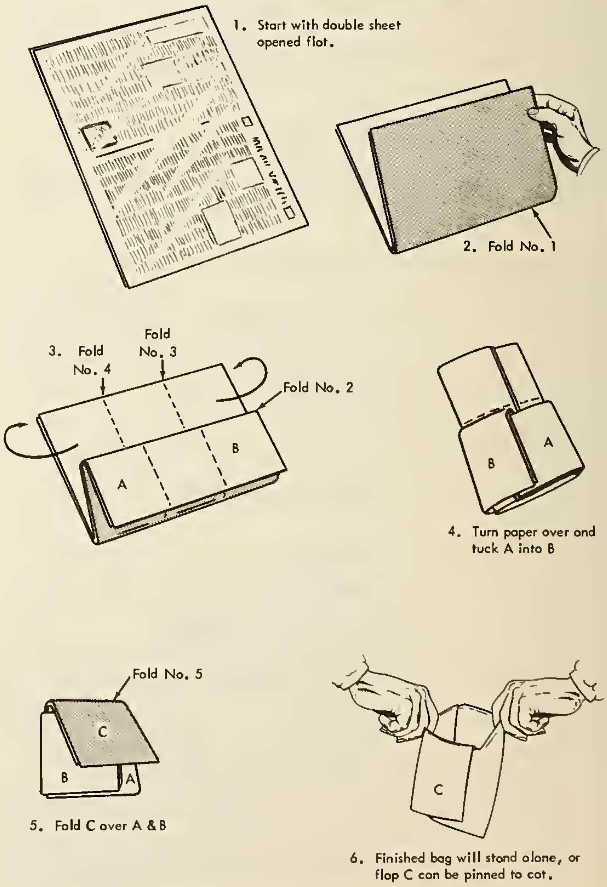


FIG. 18—NEWSPAPER WASTEBAG

Tin Cans

In addition to their obvious use as emergency pitchers and pans, tin cans which have been opened so that they have no rough edges can be used as urinals, commodes, and wastebaskets. Should the hospital be using beds with straight legs, the bed can be made higher by setting its legs in tin cans which have been partially filled with sand or pebbles. (For this, save the top of the can when it is cut out to put on top of the sand for a firm surface.) Cans filled with sand can also be used as weights for traction.

Cardboard Boxes

Overbed tables and lapboards can be cut from heavy boxes (figure 19.) A pillow placed on one of these overbed tables provides a support for patients with distressed breathing who must sleep in a sitting position. A larger box cut in the same way can be used as a bed cradle. Placed under the sheet and blanket, it keeps the weight of the bedding off the patient's body.

Scraps of boxes can also be used at the foot of a cot to hold the covers off the patient's feet.

Backrests can be made from heavy cardboard boxes (figure 20). Score and fold the box on the dotted lines in the order indicated by the numbers. Tape as indicated. Similar wedges of various angles can be made to provide elevation of feet or of an injured limb. Because there will be few extra pillows in the PDH, this method of supporting patients will be very useful.

To make a bedpan, a small, heavy cardboard box can be cut to contain a washbasin (figure 21). After use, the basin is easily removed for emptying and washing. Unless it is soiled, the box can be kept for repeated use. A washbasin can be used without the box, of course, but the box gives added support to the patient and prevents spills and soiled bedding.

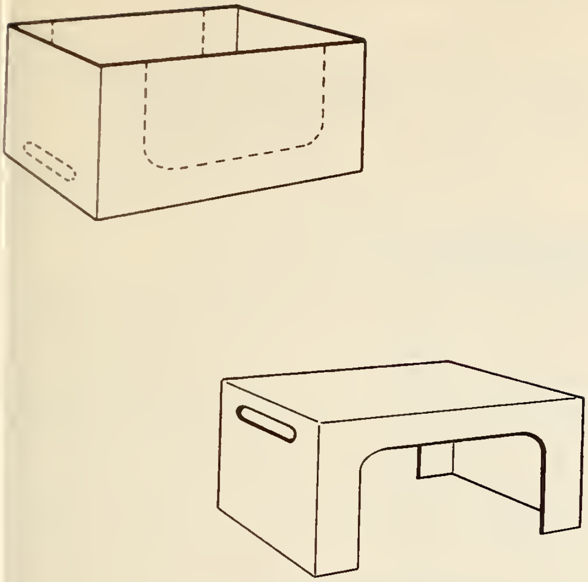


FIG. 19—OVERBED TABLE

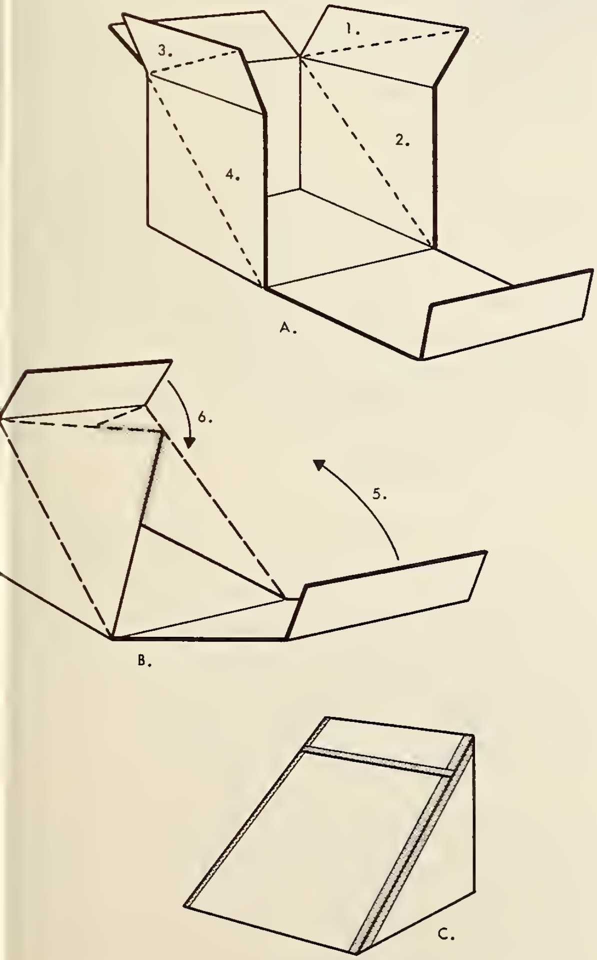


FIG. 20—BACKREST

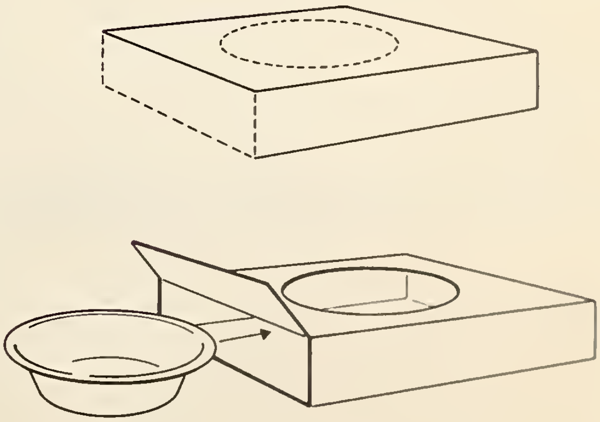
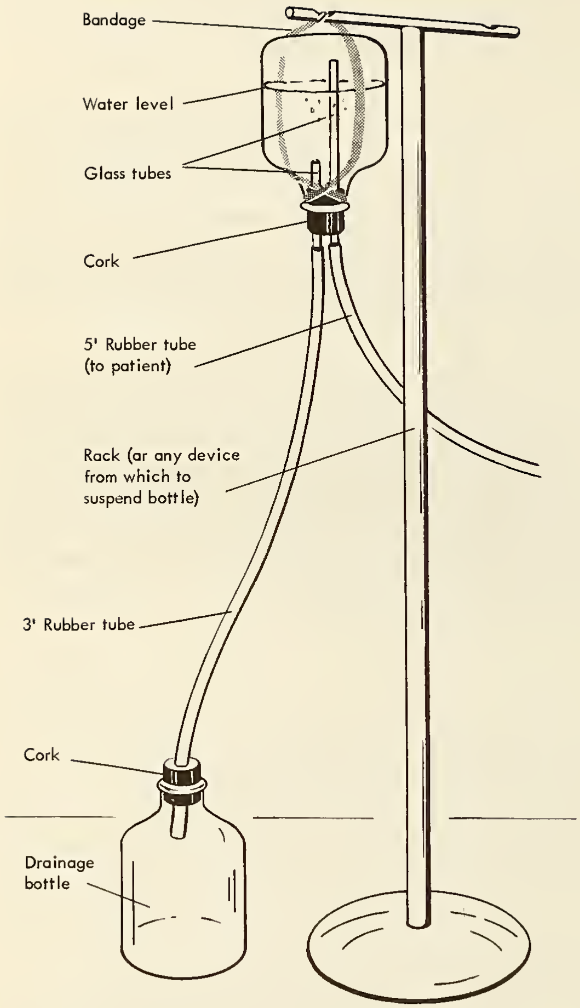


FIG. 21—BEDPAN



EMERGENCY WANGENSTEEN APPARATUS.

An Emergency Wangensteen Apparatus

For the relief of acute distention, an emergency Wangensteen suction apparatus for drainage can be devised as shown in figure 22. To make it, the following items are needed:

- 2 large bottles (such as the gallon bottles furnished in the pharmacy section)
- 2 tightly fitting corks for the bottles
- 2 glass tubes, one about 10 inches long, the other 7 inches or less
  (Glass tubing is not furnished in the PDH.)
- 2 rubber tubes, one about 3 feet long, the other about 5 feet, of a diameter to fit the glass tubes
- Length of bandage or cord with which to hang one bottle.

Make a hole to fit the rubber tube in one of the corks and two holes to fit the glass tubes in the other cork. Fit the 3-foot rubber tube onto the shorter glass tube and the 5-foot rubber tube onto the longer glass tube. Insert both glass tubes in the cork. Then insert the other end of the 3-foot rubber tube into the other cork. At this point, temporarily clamp the rubber tubes closed or fold them and tie the fold with a piece of cord or a rubber band.

Tie a piece of bandage or cord around one of the bottles so that it can be hung, inverted, from a nail, a coat rack, or an I.V. stand above bed level. Fill the bottle about three quarters full of water and insert the cork with the two glass tubes. Invert and hang the bottle. The end of the shorter glass tube should be in the water, extending an inch or so beyond the cork. The longer glass tube should be above the water line. Insert the other cork holding the rubber tube into the second bottle and set this bottle on the floor.

Be sure the tube in the water goes directly to the drainage bottle on the floor. The longer rubber tube goes from the patient to the upper bottle. To establish suction, release the clamps or whatever is holding the rubber tubes closed. As the gas or liquid causing the distension is released, it will displace the water in the upper bottle. This suction will usually maintain steady enough drainage to relieve and control the distension.

The upper bottle will have to be refilled and the lower bottle emptied. If the distention is caused by gas only, the same water can be poured from the lower bottle back into the upper bottle. If the water is mixed with feces or other body fluids, it must be discarded as a body waste and fresh water used to refill the upper bottle.

BALKAN FRAME

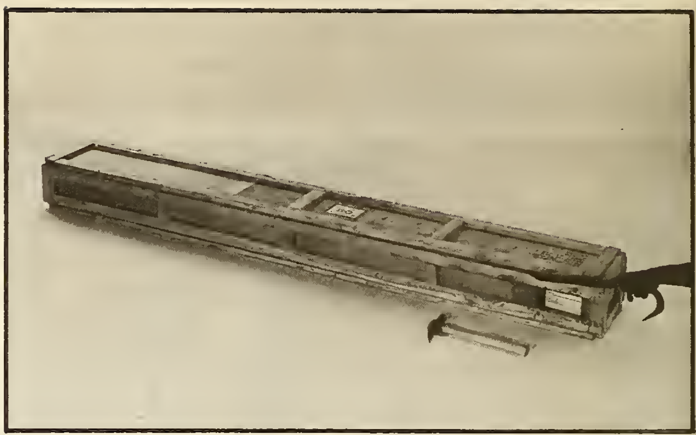
FEDERAL STOCK NUMBER: 6530-000-0233

FEDERAL NOMENCLATURE: FRAME, OVERHEAD, HOSPITAL BED, WOOD, BALKAN TYPE

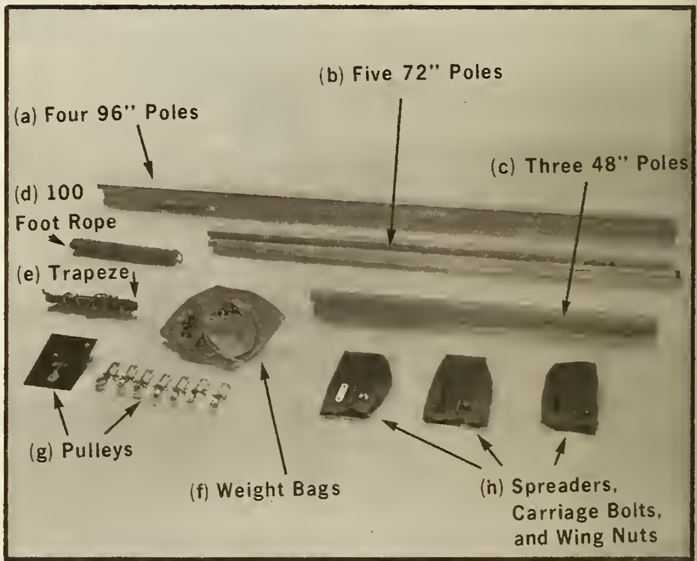
Two Balkan Frames are packed in each box. Assembly of the frame will be simplified if the exact number of components for one frame are removed from the box as listed in STEP 1, C. The frames are to be attached to Folding Cots, Federal Stock Number 7105-269-9279, packed with hospital. See page 139. Weights for bags are not included.

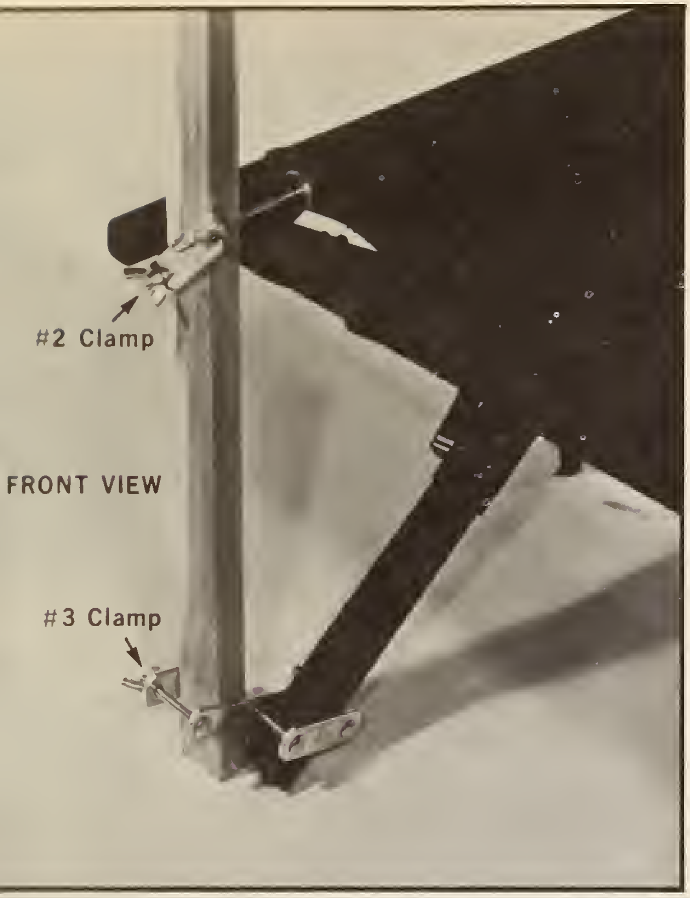
STEP 1:

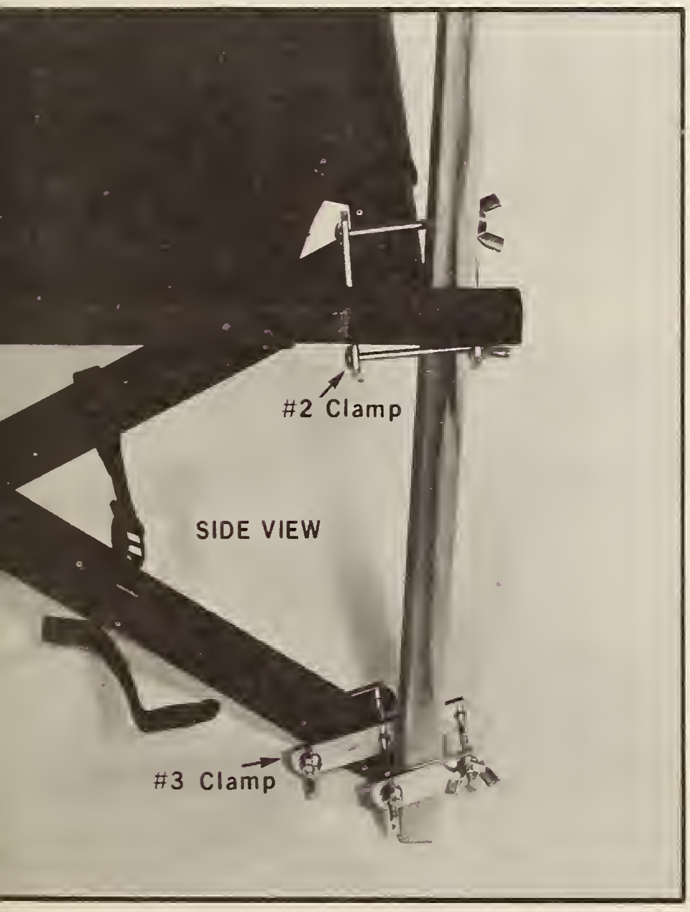
A. Open the wooden crate containing two Balkan Frames. A hammer and crowbar such as those found in the PDH toolbox will suffice.



B. Remove components for one frame. They are: **(a)** four 96″ poles, **(b)** five 72″ poles, **(c)** three 48″ poles, **(d)** 100-foot length of rope, **(e)** trapeze assembly, **(f)** two bags for weights, **(g)** eight pulley assemblies, **(h)** spreaders, carriage bolts, and wing nuts which form various clamp assemblies. Each frame requires eight No. 1 single clamps consisting of two $3\frac{1}{8}$″ spreaders, two $4\frac{1}{2}$″ carriage bolts, and nuts; twelve No. 2 single clamps consisting of two 4″ spreaders, two 3″ carriage bolts, and nuts; and four No. 3 double clamps made up of two $3\frac{1}{8}$″ spreaders, one $5\frac{1}{4}$″ spreader, one 2″ carriage bolt, one $2\frac{1}{2}$″ carriage bolt, one $4\frac{1}{2}$″ carriage bolt, and nuts.







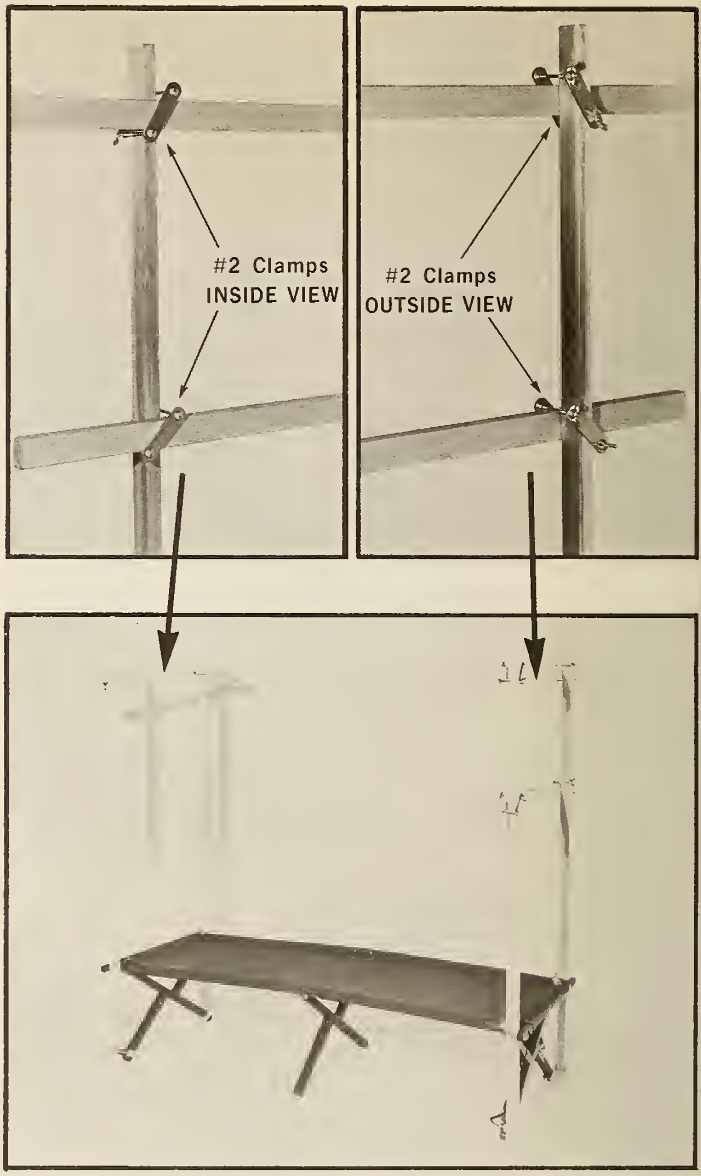
STEP 2:

A. Four 72″ poles form the vertical support of the frame. One pole is placed at each corner of a Folding Cot with wide side of pole against side of cot. Fasten each pole to frame of cot with one No. 2 clamp. Then secure to lower legs of cot with one No. 3 double clamp. Illustrations Show front and rear views of No. 2 (upper) and No. 3 (lower) clamps.

STEP 3:

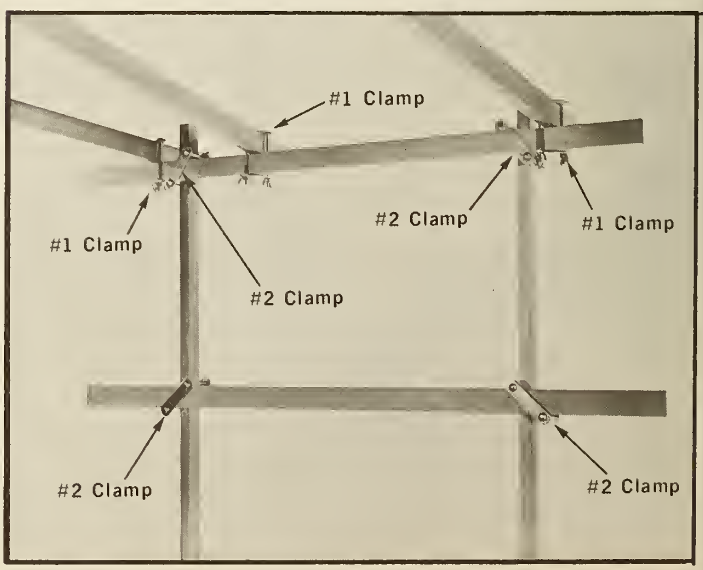
A. Position horizontally one 48″ pole across head end and one 48″ pole across foot end. Place inside the vertical poles about 3 inches from top with wide side of 48″ pole against vertical pole. Secure each end with one No. 2 clamp.

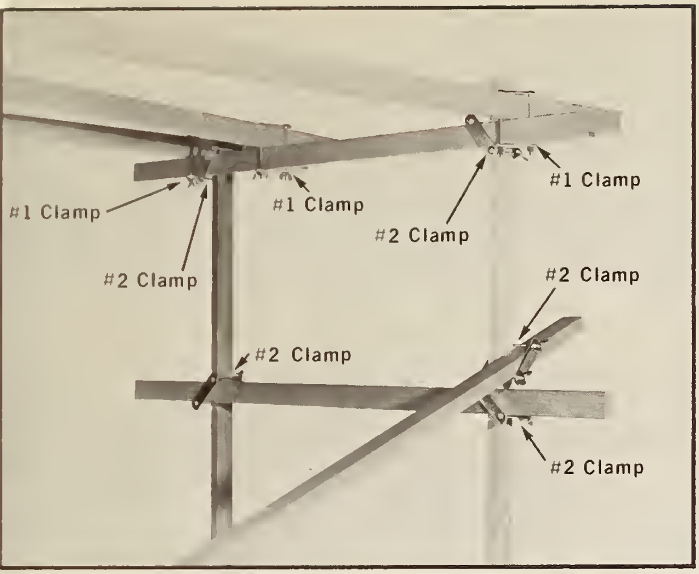
B. Place one 48″ pole across one end of cot about 18″ below top 48″ pole. Secure with No. 2 clamps.



STEP 4:

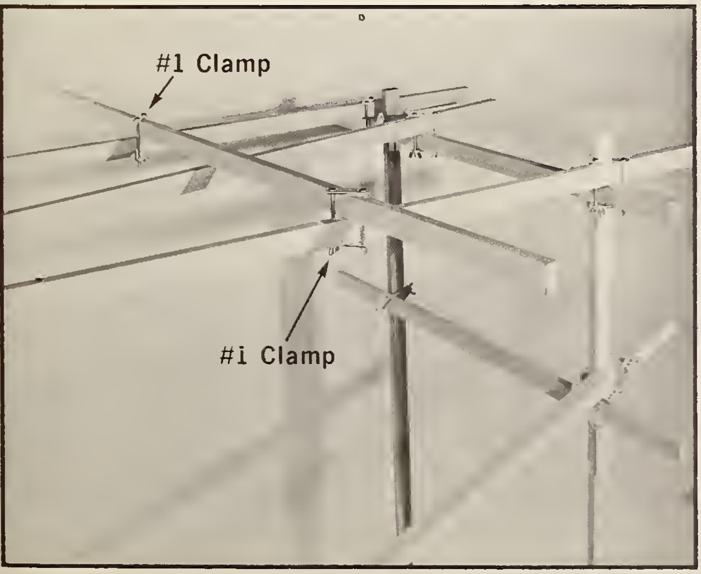
A. Place three 96″ poles on edge lengthwise across 48″ horizontal poles. Two 96″ poles are placed outside uprights and one is placed between uprights. Secure each end with a No. 1 clamp. Center pole will often be used as shown, placed diagonally from left of head end (double 48″ bars) to right of foot end.





STEP 5:

A. Position one 96″ pole with narrow edge against outside of two vertical poles, head to foot, about 1 foot above side of cot. Pole may be easily adjusted in this position. Fasten each end of pole with one No. 2 clamp.

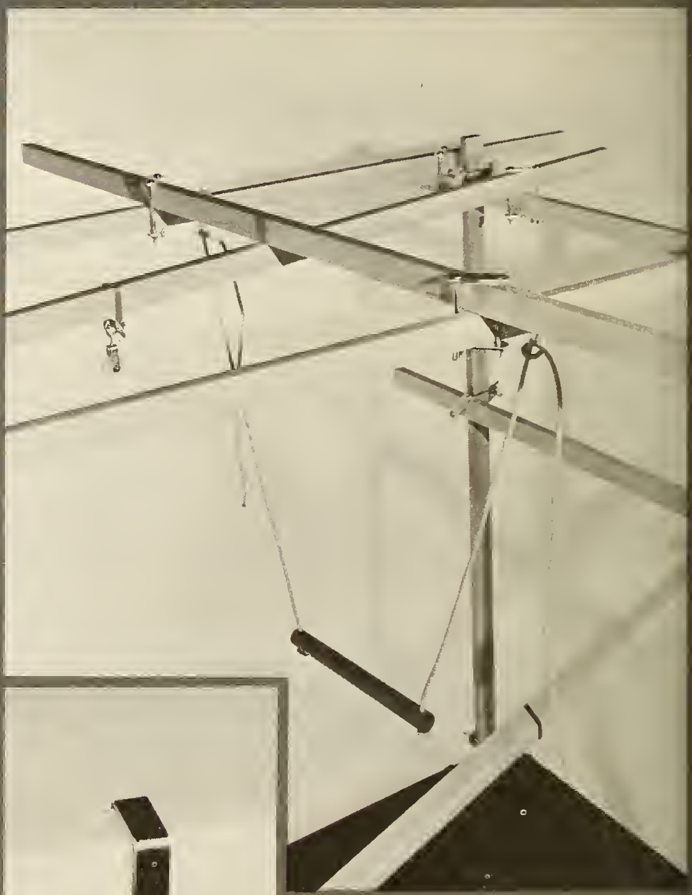


STEP 6:

A. Lay one 72″ pole on edge near head of frame across top of the three overhead 96″ poles. Secure each end with a No. 1 clamp.

STEP 7:

A. Pulley assemblies and trapeze are positioned as directed by medical personnel. Examples are shown in photographs.



TO BE OBTAINED LOCALLY:

Buckshot, sand, or other heavy material to be used in bags for weights.

CANVAS COT

FEDERAL STOCK NUMBER: 7105-269-9279

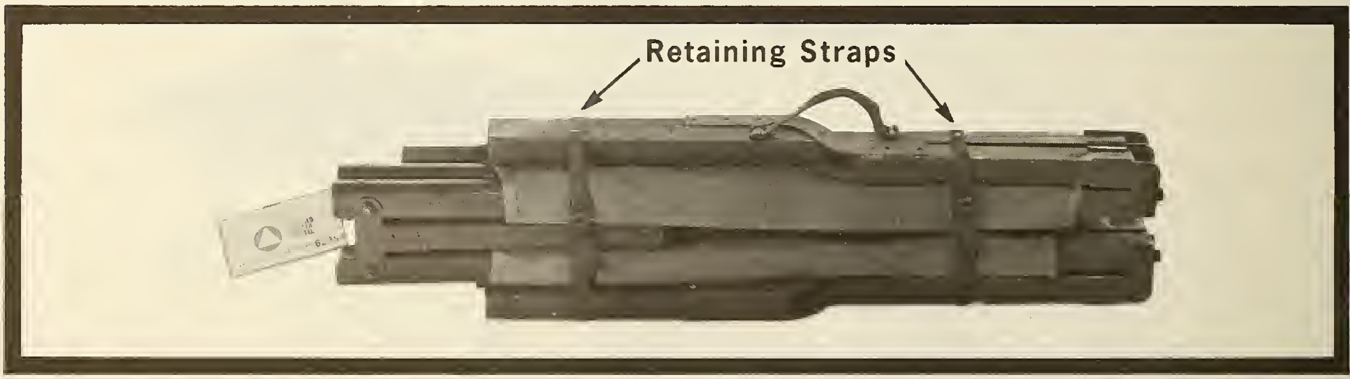
FEDERAL NOMENCLATURE: COT, FOLDING, CANVAS COVER

In most stored Packaged Disaster Hospitals, two cots will be wrapped together in kraft paper and secured with two metal bands. When packed for tropical storage, three cots are encased in a moisture-proof cylindrical aluminum drum. To open the drum, lift the two levers on the top of the lid. Using the levers as handles, unscrew and remove the lid.

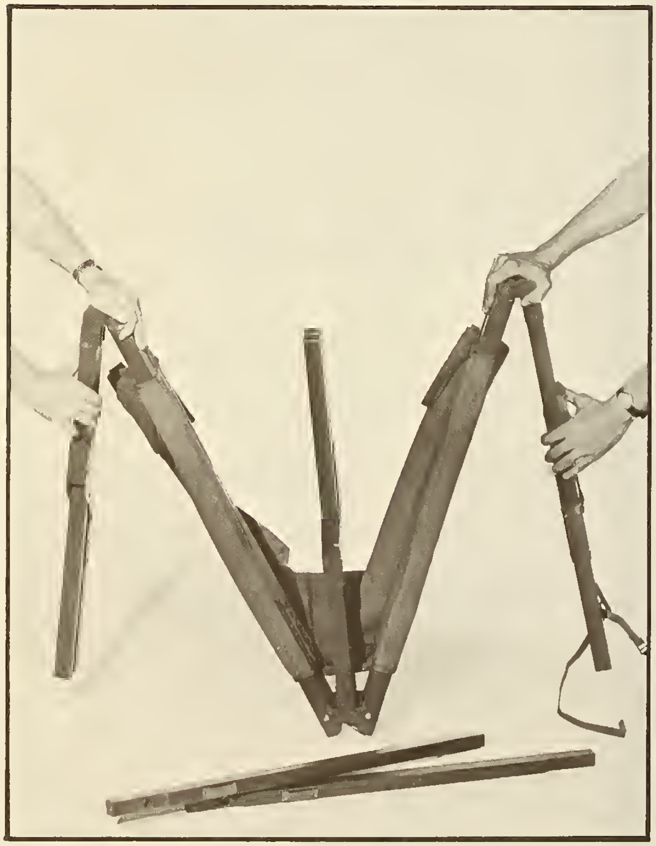
STEP 1:

A. Cut two metal bands using metal shears found in the hospital toolbox. Remove paper. Set one cot aside for later assembly. Use handle for carrying.

B. Unfasten retaining straps. This will release the two end sticks.

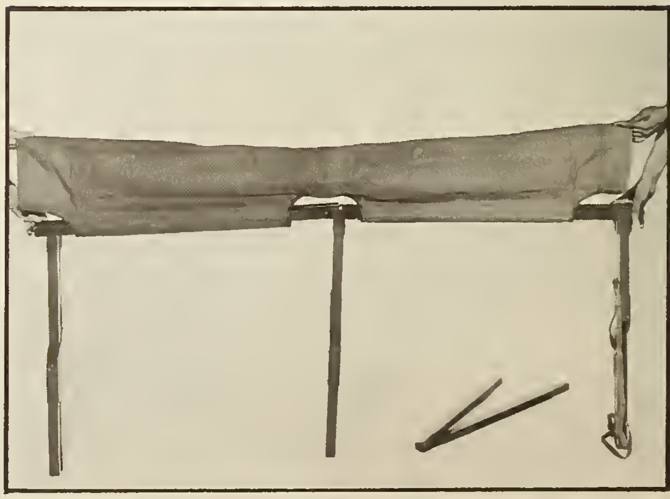


STEP 2:



A. Pull both ends away from center legs which will remain upright. Grasp end legs and pull outward until frame forms a straight line.

B. Turn cot over so three sets of legs touch floor. Straighten canvas cover and pull upward. Spread three sets of legs and press canvas cover into place.



STEP 3:

A. Insert end stick through casing in one end of canvas cover. Place holes in ends of stick over knobs on each side of cot frame.

B. Stretch canvas as far as possible toward empty casing and insert second end stick into casing. One hole of second end stick must be inserted on knob on frame as shown in order to facilitate the insertion of the second stick. Cots previously used will be sufficiently stretched so that the other end of the second stick may be secured by merely stretching the canvas.

C. When the cot has not been used, it may be necessary to apply force in order to secure the second end stick. A good way is to sit on the floor with left foot braced against top of right cot leg and right foot against bottom of left leg of cot. Grasp end piece and pull until hole slips over knob. Some experienced medical supply personnel prefer to apply pressure with a crowbar.

D. As a safety measure, the retaining straps should be fastened to the legs once the cot is assembled. The straps may also be used to hold patients personal effects.


EXIT

DRAINAGE AND SUCTION APPARATUS

(Wangensteen-Phelan)

FEDERAL STOCK NUMBER: 6515-326-8875

FEDERAL NOMENCLATURE: DRAINAGE AND SUCTION APPARATUS, WANGENSTEEN-PHELAN TYPE, PORTABLE

Completely assembled, this apparatus is packed in a tri-wall carton, easily opened by slitting tape with any sharp instrument. The following instructions are for preparing the unit for use with patients.

STEP 1:

A. Procure a one-gallon jug-type bottle, Federal Stock Number 6530–326–8880.

B. Plug stopper on hose firmly into bottle. Make certain the connection is tight so that no leakage will occur.

STEP 2:

A. Attach extension tube to connector on stopper. Again, make certain connection is tight and leak-proof.

STEP 3:

A. Obtain Connector, Federal Stock Number 6640–000–0204. Insert connector into extension tube. Connector is then fastened to equipment going to patient, in this case a nasal catheter. Nasal catheter is packed with Inhalator, Federal Stock Number 6515–079–4288 (6515–000–0129). Aspirating catheters are packed with Anesthesia Apparatus, Federal Stock Number 6515–000–0222.

INHALATOR

FEDERAL STOCK NUMBER: 6515-079-4288 (6515-000-0129)

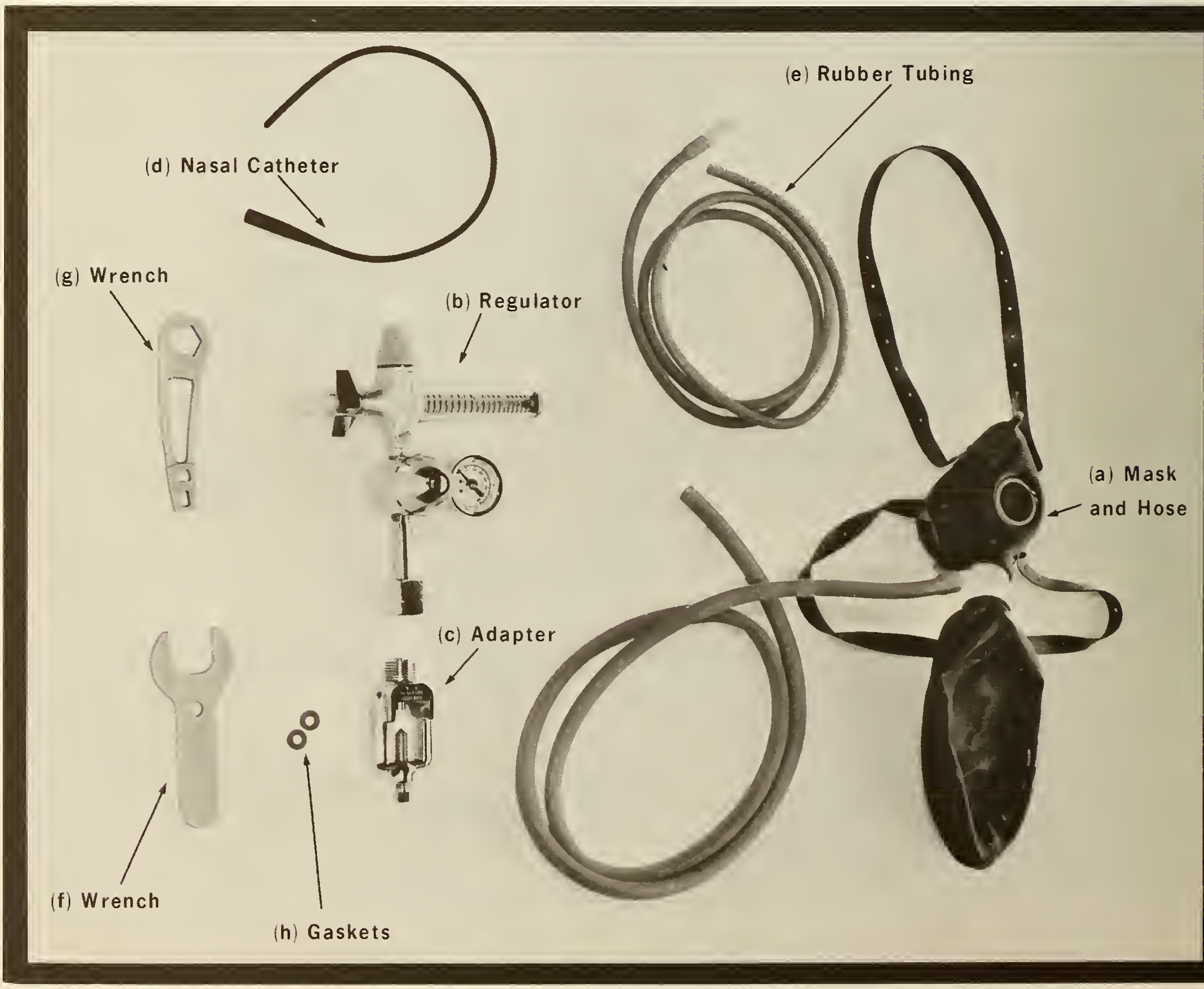
FEDERAL NOMENCLATURE: INHALATOR, SINGLE

This inhalator may be used without an adapter with Type M Oxygen cylinders An adapter is included for use with Type D cylinders.

STEP 1:

A. Components are packed in a corrugated carton easily opened by slitting tape with any sharp instrument.

B. Components include (a) mask with hose attached, (b) regulator, (c) adapter, (d) nasal catheter, (e) rubber tubing for use with catheter, (f) wrench for tightening nut on regulator, (g) wrench for securing adapter to small tank of Oxygen, (h) washers for use with adapter. When using the large (Type M) Oxygen cylinder, set aside the adapter (c), wrench (g), and washers (h). In some instances the adapter (c) will be attached to the regulator (b). If the adapter is not to be used, simply unscrew.



STEP 2:

(FOR USE WITH TYPE M OXYGEN CYLINDERS)

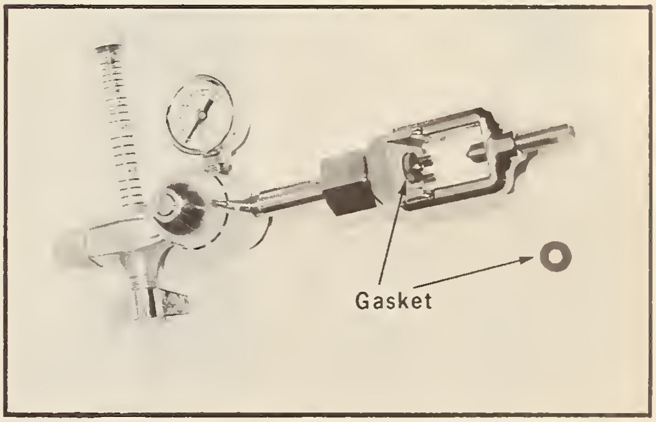
A. Remove cover from top of Type M Oxygen cylinder and set aside. Unscrew cap chained to valve assembly at top of tank. Use crescent wrench (f), if necessary.

B. Screw regulator (b) to valve assembly on tank. Use crescent wrench (f) to tighten thus preventing dangerous leakage.

ALTERNATE STEP 2,

(FOR USE WITH TYPE D OXYGEN CYLINDERS)

A. When small (Type D) Oxygen cylinders are available, it is necessary to use the adapter (c) in order to attach the regulator (b) to the cylinder. Firmly tighten adapter to regulator and place gasket (h) over adapter check valve as shown. A spare gasket is included.



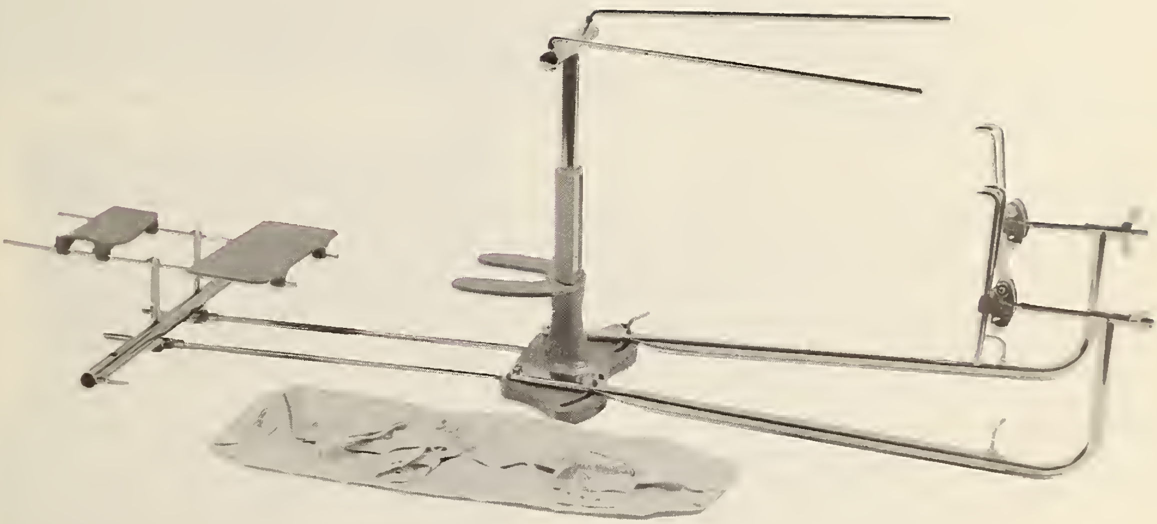
B. Slip adapter (c) over top of cylinder and tighten, holding screw with wrench (g).

STEP 3:

A. To use mask, attach hose connected to mask (a) to nylon connector on regulator (b) by firmly pushing rubber tubing up over connector until connector is covered by tubing.

B. To use nasal catheter (d), attach connector on catheter to rubber tubing (e). Tubing is pressed over connector on regulator (b).

TRACTION APPARATUS



FEDERAL STOCK NUMBER: 6530-709-9400

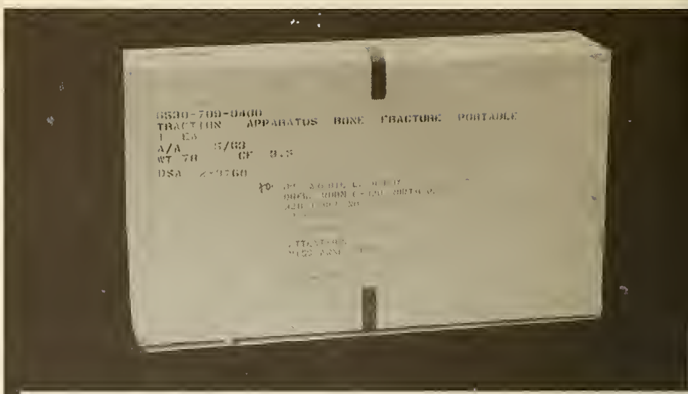
FEDERAL NOMENCLATURE: TRACTION APPARATUS, BONE FRACTURE

Although this orthopedic traction apparatus consists of many parts the assembly is not complicated if illustrated instructions are followed without exception. Instructions on the use of ankle hitch and body assemblies are not included since this is a medical procedure performed by a specialist for the specific patient.

STEP 1:

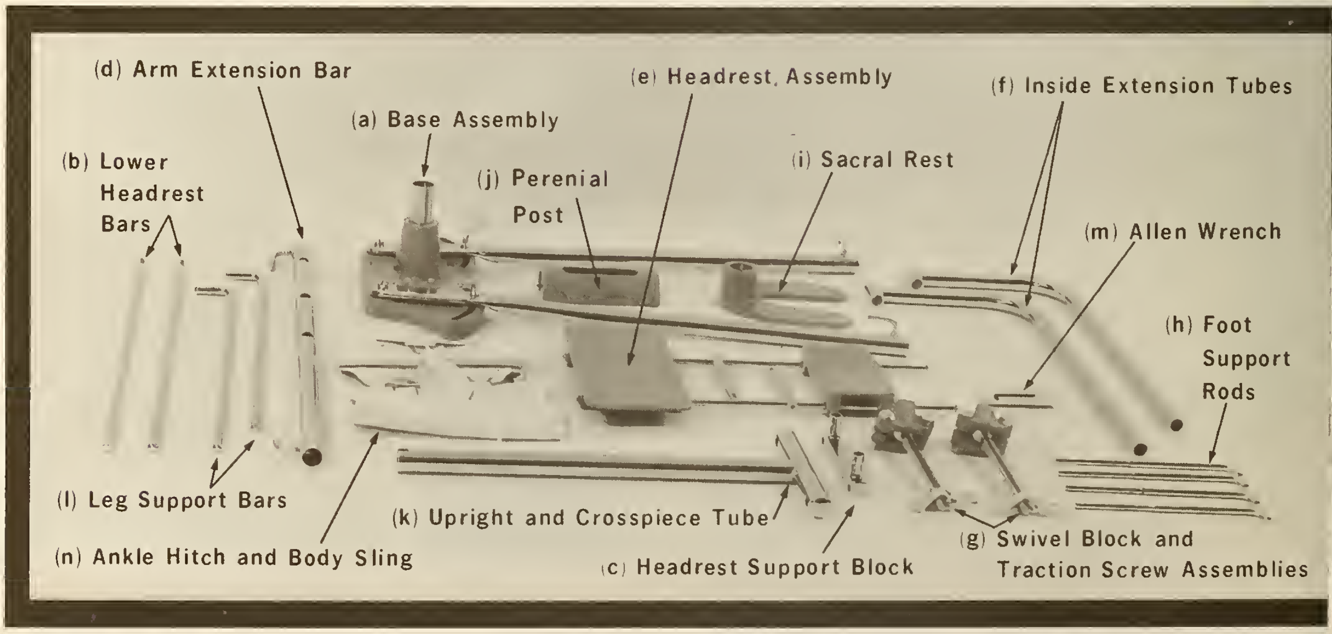
A. Traction apparatus is packed in fiberboard carton. Slit tape with any sharp instrument to open.

B. Remove olive drab hinged carrying case.



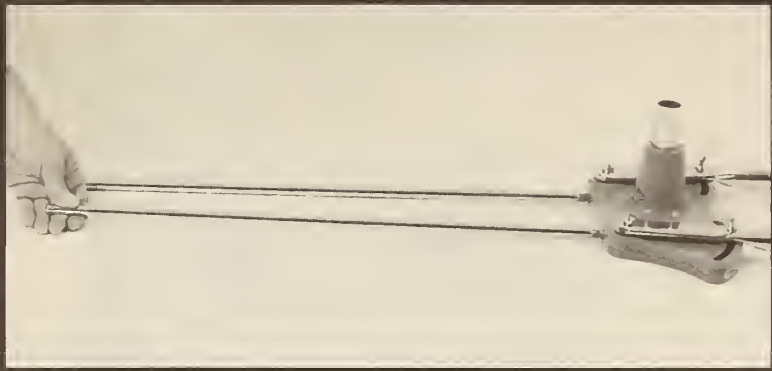
STEP 2:

A. Open case and remove all components shown in illustration. They will include: (a) base assembly, (b) lower headrest bars, (c) headrest support block, (d) arm extension bar, (e) headrest assembly, (f) inside extension tubes, (g) swivel block and traction screw assemblies, (h) foot support rods, (i) sacral rest, (j) perenial post, (k) upright and crosspiece tube, (l) leg support bars; and for use by technicians in orthopedic procedures with patients, (m) allen wrench, and (n) ankle hitch and body sling assemblies.

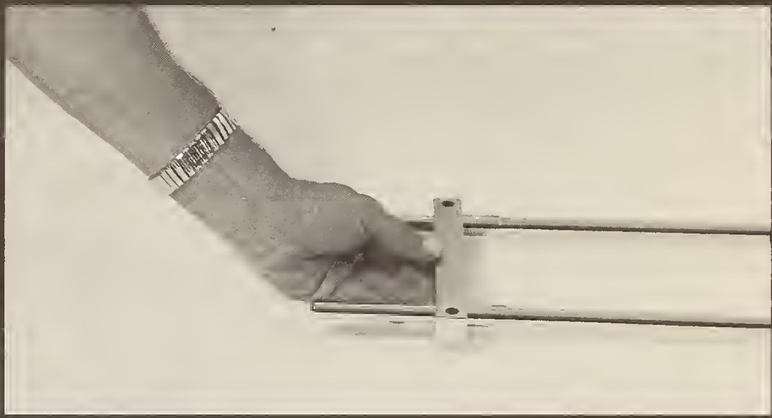


STEP 3:

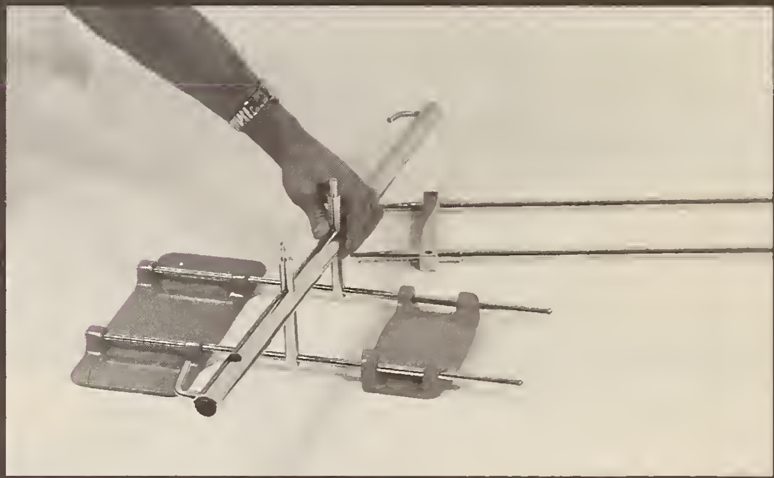
A. Screw lower headrest bars (b) into base assembly (a).



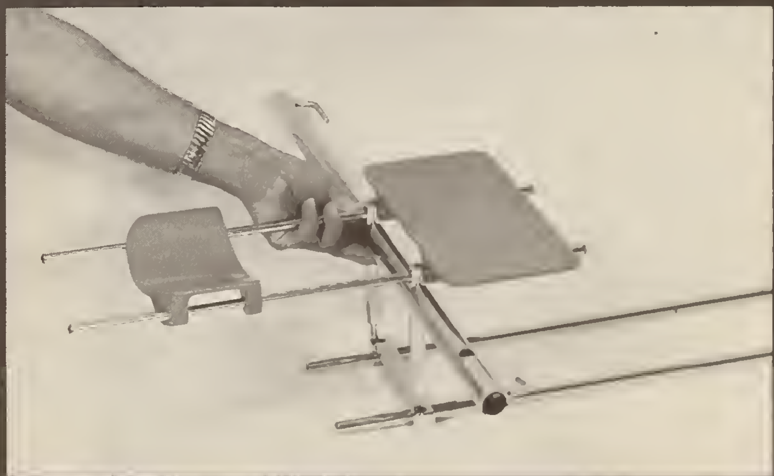
B. Slide headrest support block (c) over ends of lower headrest bars (b).

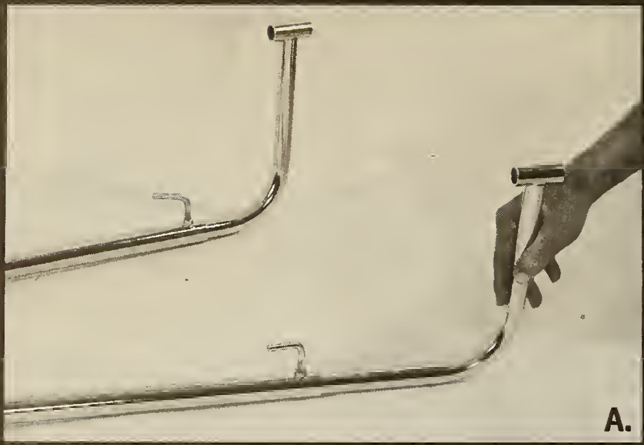


C. With headrest assembly (e) upside down, raise tubes and insert arm extension bar (d) over tubes while they are in an upright position. Slide bar firmly downward as far as possible. Return headrest assembly (e) to upright position.



D. Place tube endings on headrest assembly (e) into matching holes in headrest support block (c).



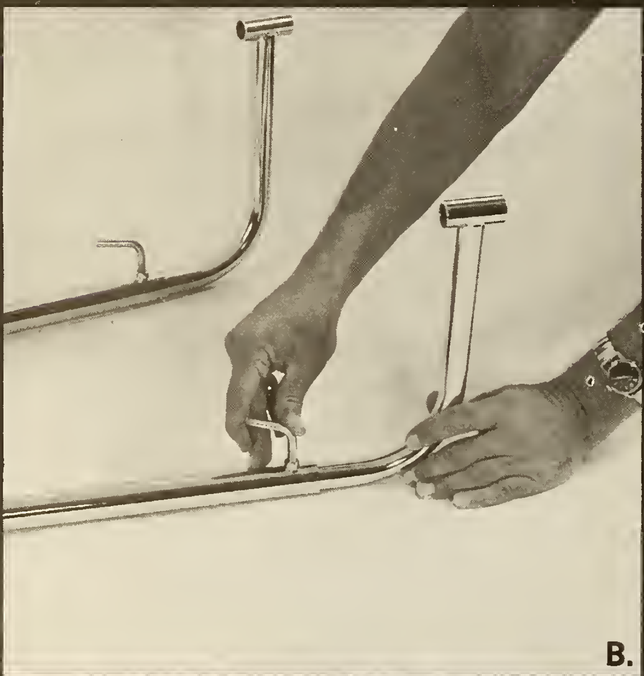


A.

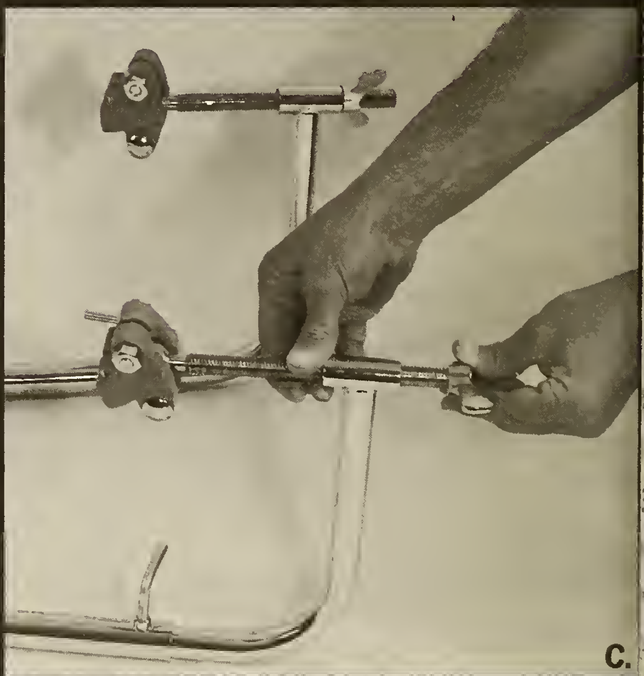
STEP 4:

A. Move to opposite end of apparatus and position the two inside extension tubes (f) into the outside extension tubes on base (a).

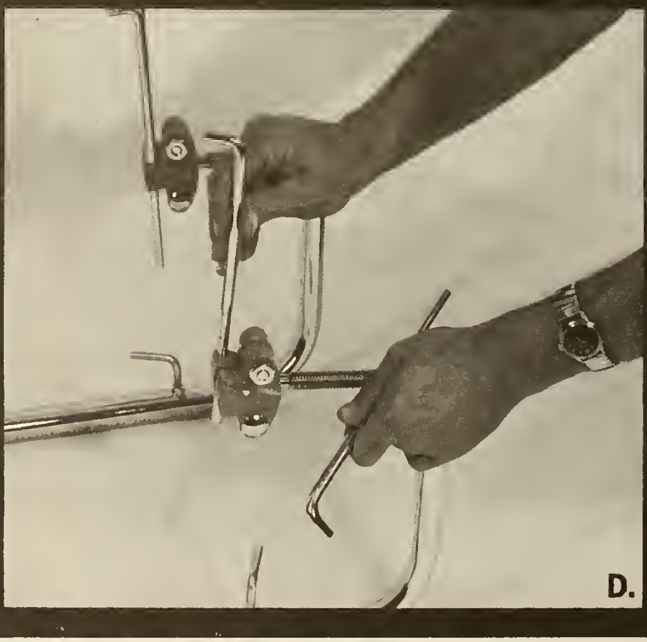
B. Secure inside extension tubes (f) by turning tightening screws on outside extension tubes (a).



B.



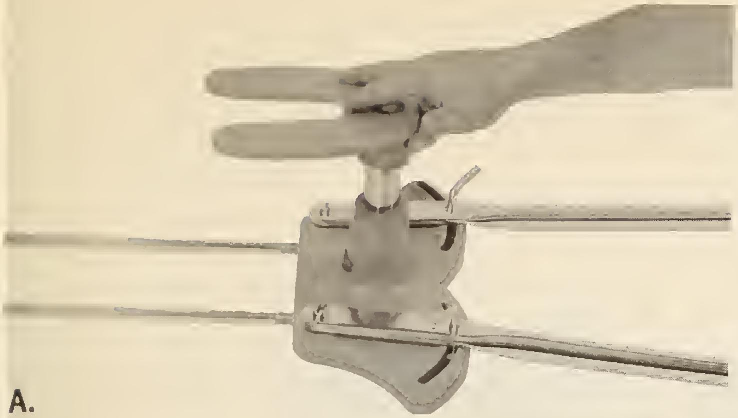
C.



D.

C. Remove wing nuts from swivel block and traction screw assemblies (g). Place screws through end collars of inside extension tubes (f). Replace the wing nuts on the traction screws.

D. Two foot support rods are placed in holes in the swivel blocks (g).



A.

B.

STEP 5:

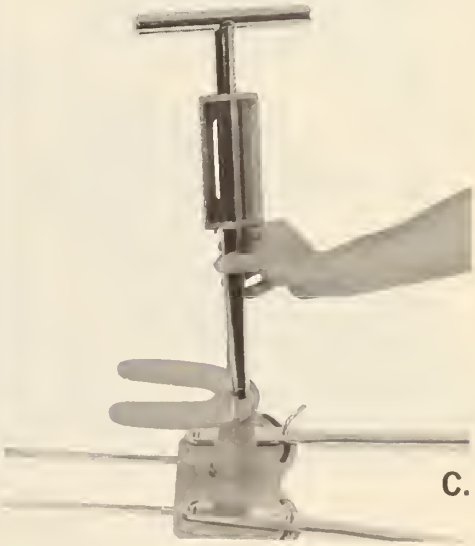
A. Returning to base assembly (a), place the sacral rest (i) on the vertical tube of the base with the pin fitted into small hole on the base.

B. Slip the perenial post (j) over base end of the upright and crosspiece tube (k).

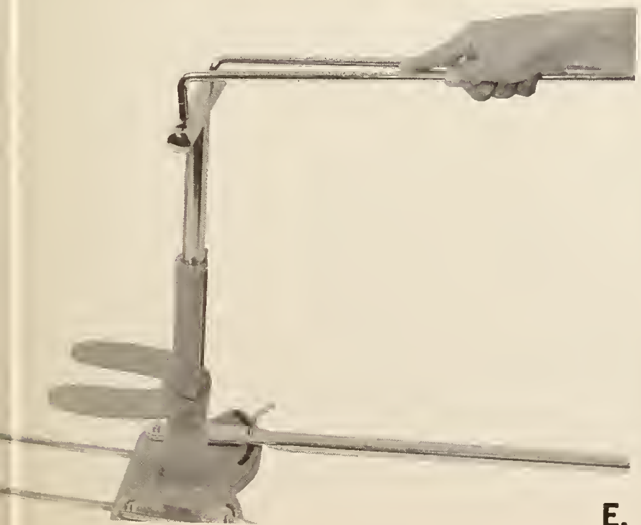
Then place upright (k) into base (a) through sacral rest (i).

D. Twist upright (k) and post (j) until both slip into locking position.

E. Place leg support bars (1) in holes in top of cross section of upright (k). Make certain that allen wrench (m) and ankle hitch and body slings (n) are near apparatus for use of physician or other medical personnel.



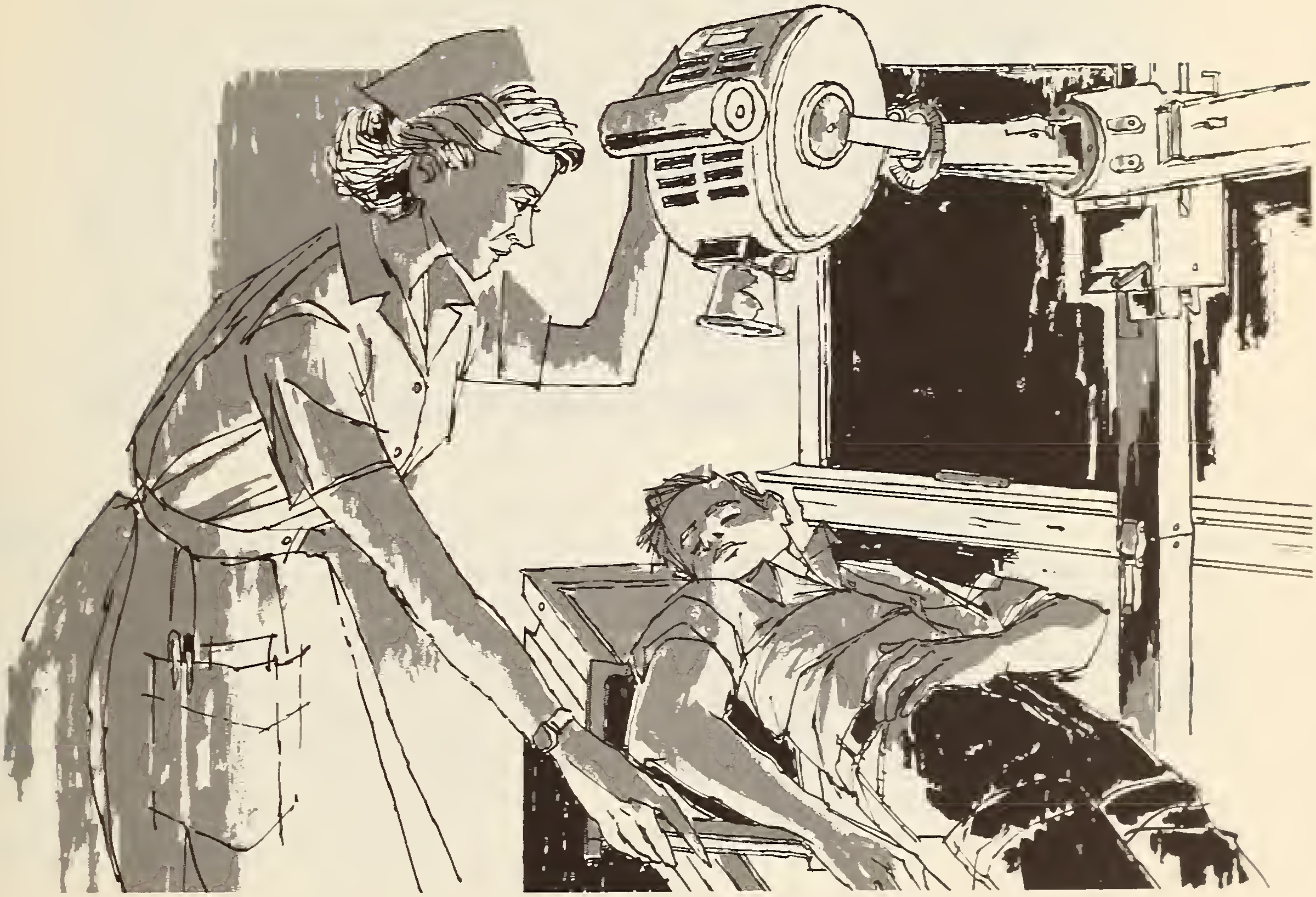
C.



E.

D.

ESTABLISHING THE X-RAY SECTION



GENERAL DESCRIPTION

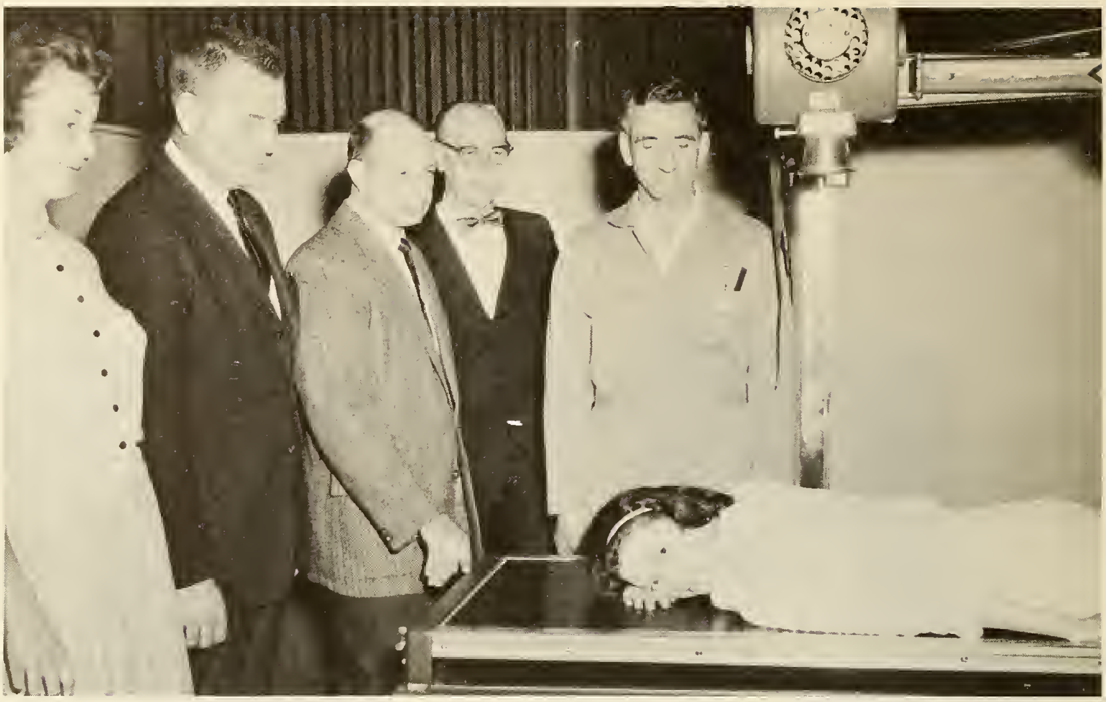
The equipment of the X-ray section consists of a 15-milliampere X-ray unit, a developing unit to process Polaroid radiographic paper in 60 seconds, and either a portable gasoline-driven 2½ kilowatt generator or provisions for power from central generators or from normal power sources. This mobile X-ray equipment is similar to that used in field operations in the armed services and is easy to set up. It consists of two carrying or shipping units (figure 23). Its primary use in the PDH will be for examining fractures and dislocations, and detecting foreign bodies. A supply of Polaroid radiographic paper is packed in each PDH. The paper has a shelf life of about one year at room temperature, but when stored under continuous refrigeration it is usable up to 5 or 6 years from date of manufacture.

LOCATION AND FACILITIES

When the PDH is to be activated as an independent hospital, the X-ray section should be convenient to operating rooms, should contain a minimum of 300 sq. ft. and should be located in a room with as many masonry outside walls as possible.

Predisaster training exercises and equipment familiarization sessions for staff assigned to the PDH X-ray section are essential for effective use of the section following a major disaster.

The X-ray machine should be placed at least 25 feet from any adjoining room. If this is not possible, the adjoining room(s) should not be occupied by personnel or patients. Sufficient table space should be available for the processing machine and clerical work. If at



all possible, the arrangement should be such that only the technician is in the X-ray room. Clerks should be located in the hall or an adjoining room at a point as far from the X-ray machine as possible. Provisions should be made for protective storage of unexposed film as well as filing of completed pictures when returned from the ward. The unexposed film should be stored in another room. If an extra leaded apron is available it can be used as a protective cover for small amounts of film kept in the X-ray room. It may be necessary to improvise tables and shelves from available material such as unpacked crates.

No X-ray shielding is provided with the PDH. Shielding should be obtained locally. Leaded gloves and aprons are provided in some PDH's, but must be obtained locally for others.

PERSONNEL FOR THE PDH OPERATING AS A SEPARATE FACILITY

For 24-hour, 2-shift operation, it has been determined that the X-ray section will require a minimum of two technicians, two clerks, and two helpers. When available, a radiologist should have overall responsibility for X-ray services. During disaster, however, this physician will ordinarily be engaged in other professional duties. PDH X-ray equipment may be efficiently operated by technicians with occasional direction from a physician when needed to cope with unusual problems.

Predisaster Preparation ● X-ray personnel, including clerks, helpers, and professional volunteers, should participate in training which includes:

1. Familiarization with the location of the room or area in which the equipment is to be set up, the plan for conversion and utilization of the area, and the characteristics and limitations of the equipment.
2. Familiarization with the X-ray requirements for the major types of anticipated injuries resulting from nuclear attack.
3. Familiarization with the setting up, operation, and maintenance of the equipment provided. Shortages of equipment should be considered and acceptable procedures developed for improvising or compensating for lack of items which ordinarily are available.
4. Adoption of a suitable marking and indexing system for identifying and filing X-ray pictures. Inasmuch as these are positive pictures, the backs can be marked with indelible pencils supplied with the PDH.
5. Participation in test exercises as a part of the parent hospital's regularly rehearsed disaster plan.

Postdisaster Activities ● All personnel should report to the designated X-ray area at the PDH operational site.

Whenever possible, the parent hospital's director of X-ray services or his alternate, should be responsible for the overall organization of the section. In the absence of a radiologist, one technician, appointed predisaster, will act as chief of the section.

Duties of X-ray technicians are as follows:

1. Supervision of the moving in and setting up of equipment.
2. Establishment of the X-ray service, the record system for marking, indexing, and filing X-ray pictures.
3. Anticipation of supply and personnel shortages, requisitioning additional supplies, and requests to the administrator for needed personnel.
4. Supervision of the overall operation of the section, taking X-rays as requested by the medical staff.

Postdisaster duties of clerks and helpers will probably be interchangeable. Under the supervision of technicians, they will assist in setting up equipment and furnishings. They will act as receptionists, receive and deliver forms, complete report forms, and operate the processing machine as directed by a technician. Also, they may assist the technician in positioning X-ray subjects, requisition supplies and equipment, and maintain the X-ray section's entire record system. When clerks and helpers are available, the technicians should never be responsible for the time-consuming task of filing report forms and exposed film.

COMPLETED X-RAY FILMS

Radiographic Report Forms are provided for use in requesting X-ray services and reporting findings. See page 23. The form is made out in duplicate, and both copies are sent with the patient to X-ray. Upon completion of the report, X-ray retains one copy and returns the other copy along with the X-ray picture to the patient's ward. The former copy will be filed in the X-ray record section and the latter with the patient's record.

Films will be suitably marked for identification and sent to the patient's ward with one copy of the Radiographic Report Form. When the physician in charge of the patient is finished with the picture, it will be returned to X-ray for filing.

ASSEMBLING THE EQUIPMENT

TABLE AND TUBE STAND

Manufacturer's assembly and disassembly instructions are printed inside the case lid and a detailed manual is packed with the control unit and transformer head. To remove case lid unlatch the 12 toggle catches.

One large carrying case holds the entire table and tube stand assembly (figure 24).

To assemble tube and tube stand proceed as follows:

1. Remove the lid and set it aside temporarily.
2. Remove the table top and set it aside.

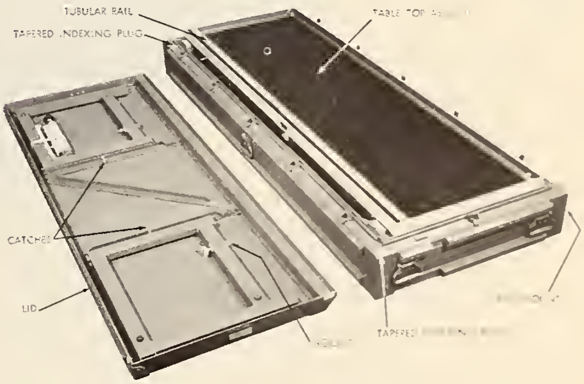


FIGURE 24

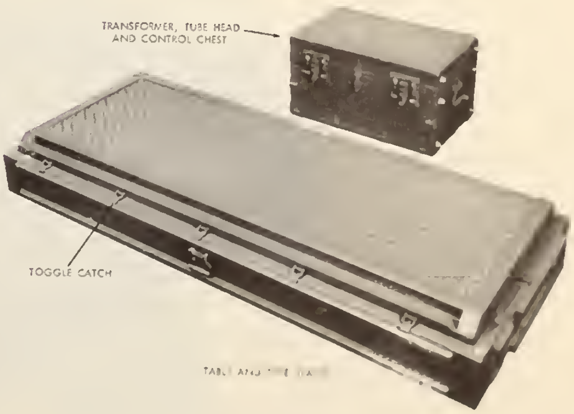


FIGURE 25

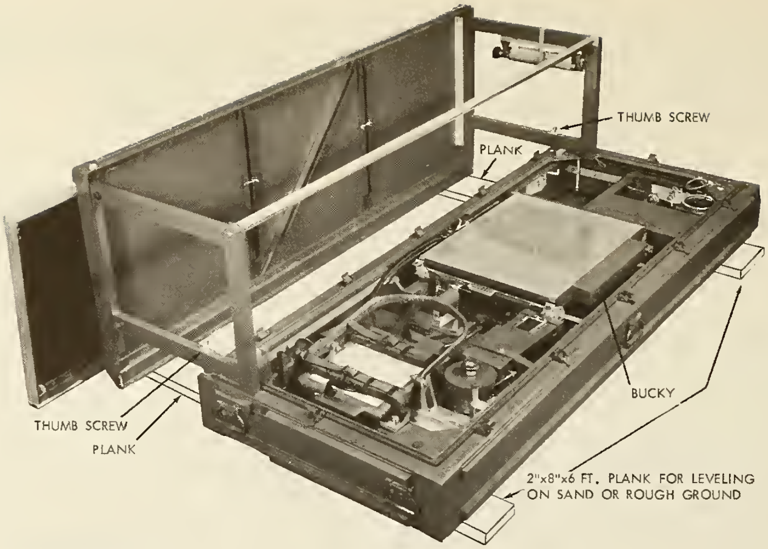


FIGURE 26

3. Install the lid on the front of the base where it becomes the front panel and serves as a frame for the table top.

4. Remove tubular rail from table top and insert in the slots in the rear top of the legs. Rotate rail so threaded holes are up.

5. Remove the bucky from the chest and slip the "c" bracket over the tubular rail. Drop the forward edge down so the channel engages the steel track on upper edge of the front panel.

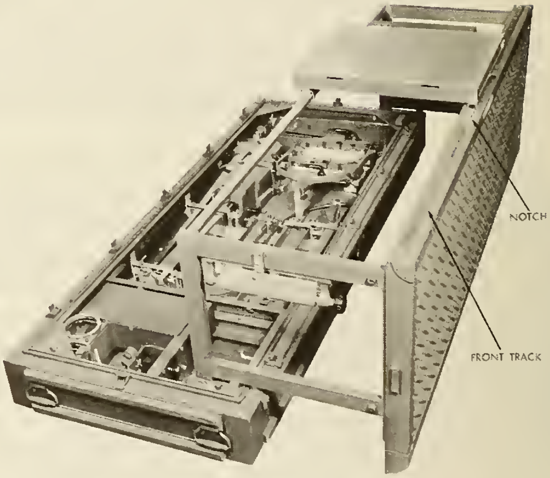


FIGURE 27

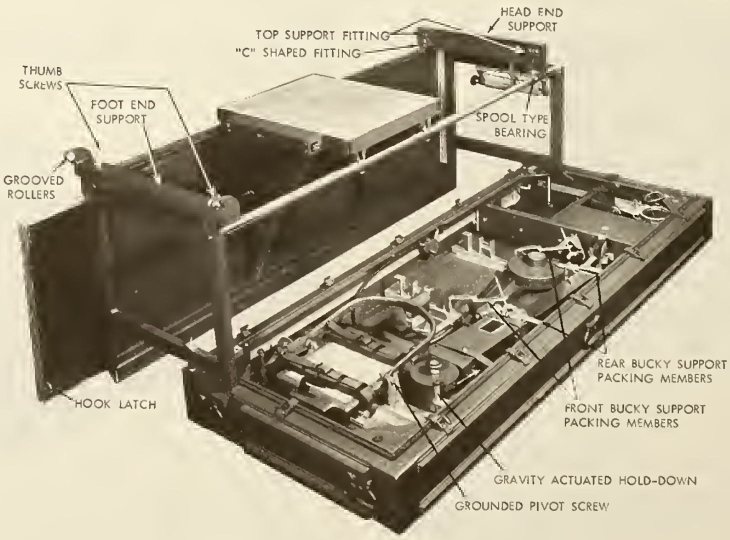


FIGURE 28

6. Remove foot end support from chest and attach to threaded fitting in front panel and to the threaded hole in tubular rail at foot end of table. Tighten thumb screws.

7. Remove head end support and engage "c" shaped fitting with the notch in the middle of the track on front panel. Resting the spool shaped bearing on the tubular rail, slide the head end support to the head end of the table. Engage latch at the head end.

8. Position table top over table frame assembly with hook latch at foot end. Engage grooved rollers in the foot end support with the "c" channel ways along the side of the table top (fig. 28). Slide table top toward foot end and engage the flange with channel fittings in head end support (fig. 29). Tighten thumb screws.

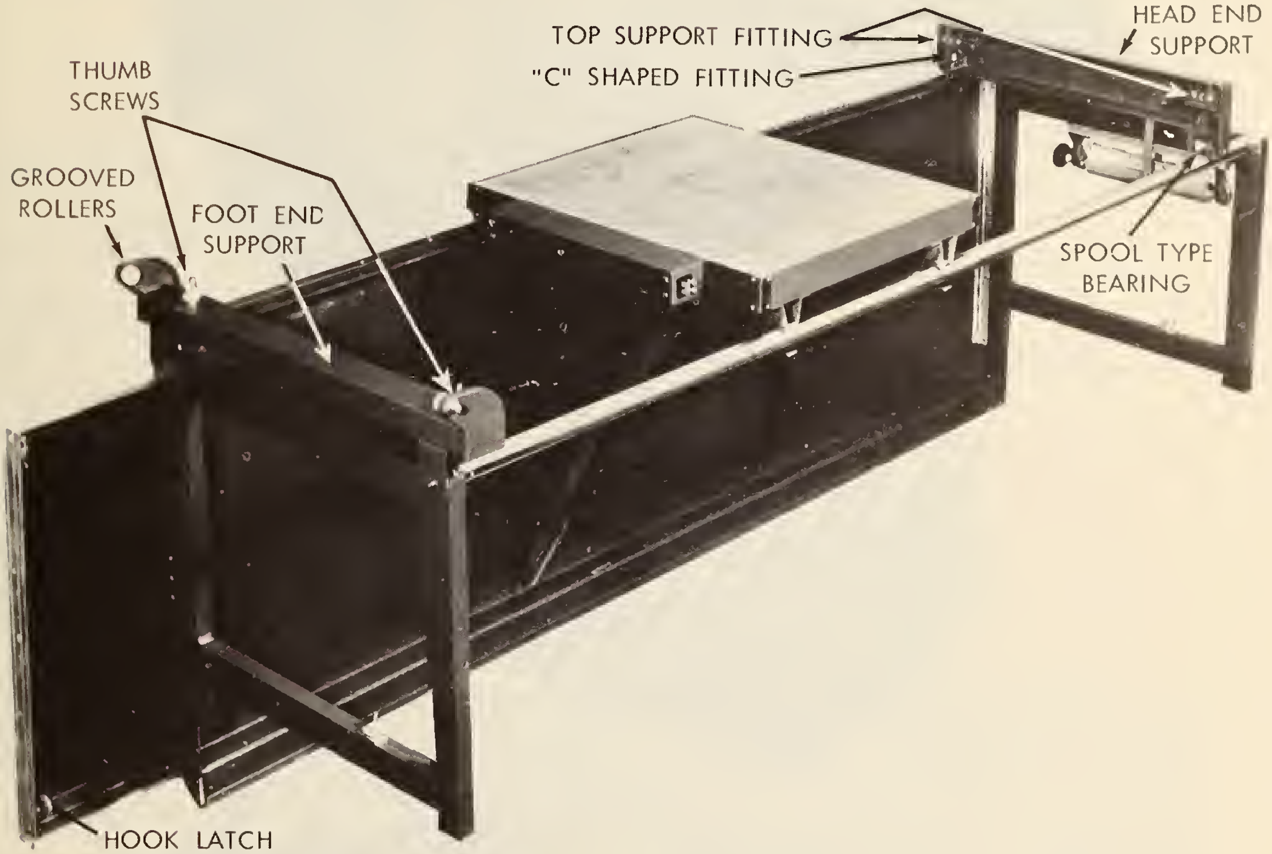


FIGURE 28

FIGURE 29

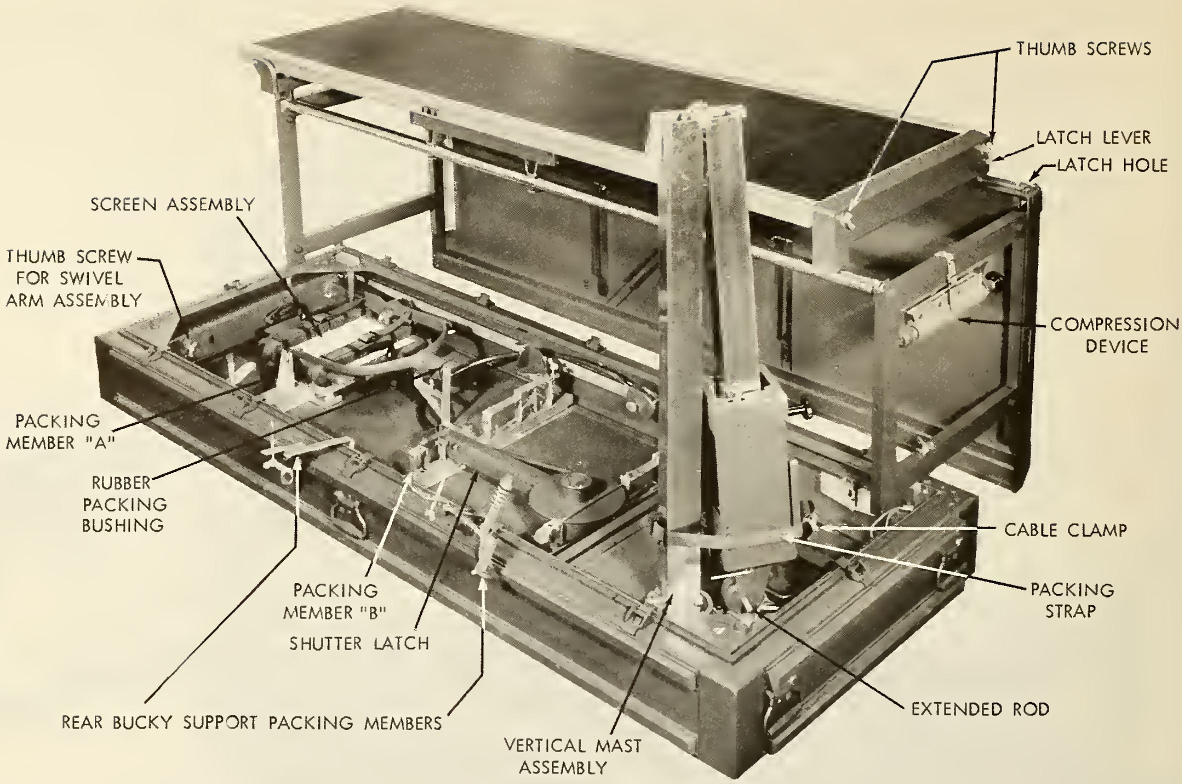


FIGURE 30

9. Remove vertical mast from chest, unfold into straight line position and lock. Carefully insert square end of the mast into circular recess in the carriage until the load bearing rests upon the finished surface of the well. Remove rubber-headed retaining pins at the case corners to permit carriage to drift free.

CAUTION:

The tube arm carriage on the tube stand is spring counter-balanced. To avoid possible damage and personal injury do not attempt to move or lock the vertical carriage in any position along the mast, without its first being counter-balanced with the tube head.

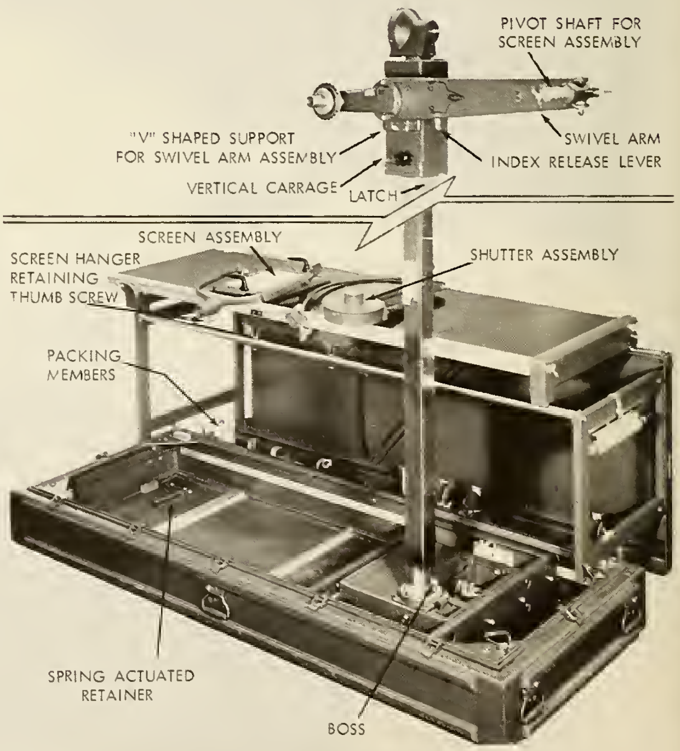


FIGURE 31

10. Remove screen assembly from chest and place carefully on the table top for later assembly.

11. Remove thumb screw fastening the shutter control lever against inside back wall of chest. Remove shutter assembly and place complete assembly with cables on top of table for later assembly.

12. Remove swivel arm assembly from chest. Engage the "v" shaped support into the matching slot in the vertical carriage and push firmly downward until anchored.

CAUTION:

Do not press the swivel arm release lever or rotate arm until the weight of the screen and shockproof head have been added.

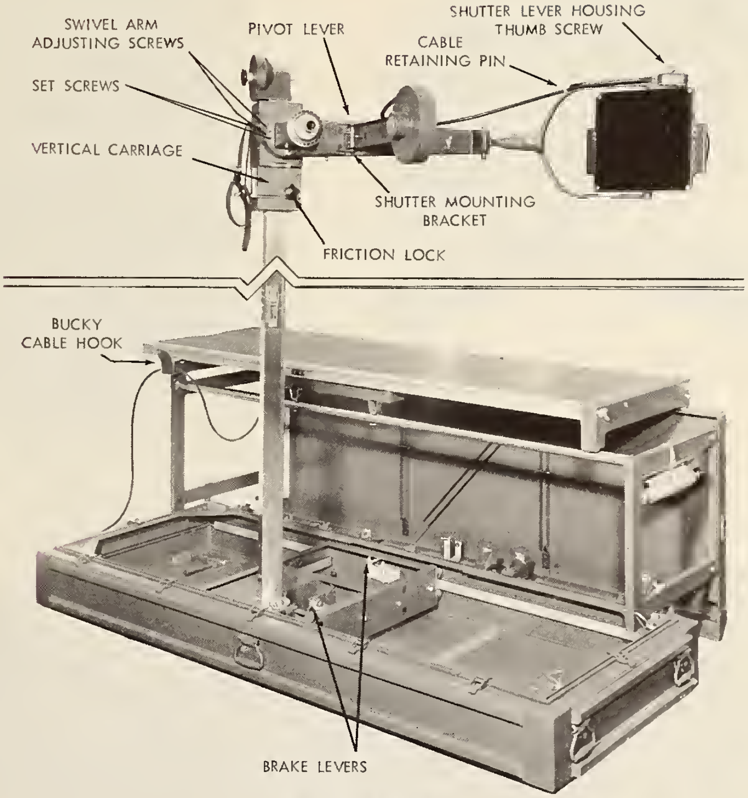


FIGURE 32

13. Loosen the screen hanger retaining thumb screw and install the screen and hanger over the pivot shaft of swivel arm assembly. Gently tighten thumb screw.

14. Install the shutter assembly on the swivel arm bracket with the movable pin on the shutter arm engaging the hole in the *upper* bracket. Thread the shutter cable over the retaining pin in the screen arm and insert cable in channel running along screen arm. Engage pins in shutter control housing with holes in screen handle and tighten thumb screw. Be careful not to kink the cable.

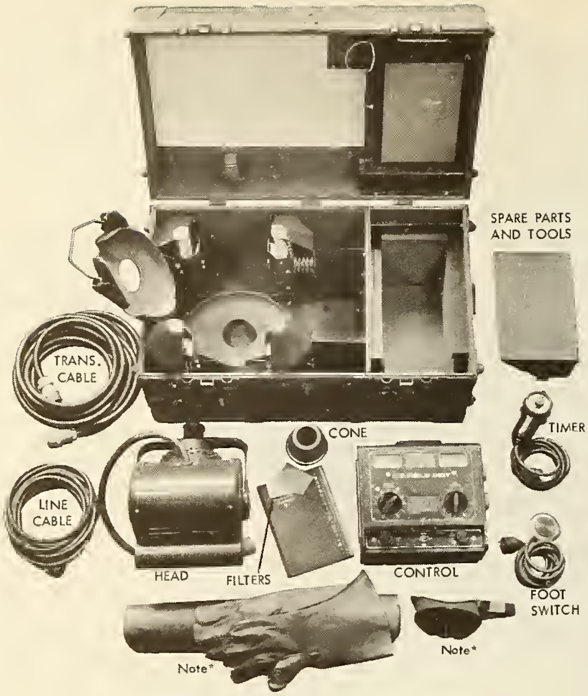
TUBE TRANSFORMER HEAD

The tube transformer head is packed in a separate chest along with the control unit and associated cables. To assemble the transformer head proceed as follows:

1. Remove tube head from chest by backing off on knurled hold-down nuts. Swing rubber-backed hold-down support up and remove tube head carefully along with its cables.

NOTE:

Lead shield, gloves, and goggles are not provided in some PDH models. Check your component listing and provide locally, where necessary.



TRANSFORMER, TUBEHEAD AND CONTROL CHEST

FIGURE 33

2. While maintaining downward pressure on swivel arm, loosen fastening ell.
3. Lower tube arm and carriage assembly to a convenient height by pulling down against counterbalance pressure. Tighten fastening ell.
4. Insert end of the tube head hanger over the nose of the tube arm until spring actuated catch engages back of the tapered face of the locking ring (figure 34).

CAUTION:

After assembly, do not attempt to lock the vertical carriage in any position on the mast without it first being fully counterbalanced.

CONTROL UNIT

1. Remove the control unit from its chest along with cables, cone, hand timer and other accessories.
2. Stand the empty chest on one end with the large spring clip up and the latch side of the chest facing the operator. By setting up the controls at the most distant point possible, where operator can still observe the patient, greater protection for the operator will be achieved.
3. Locate the control so the bottom front domes and the handle at the rear engage the spring clip.

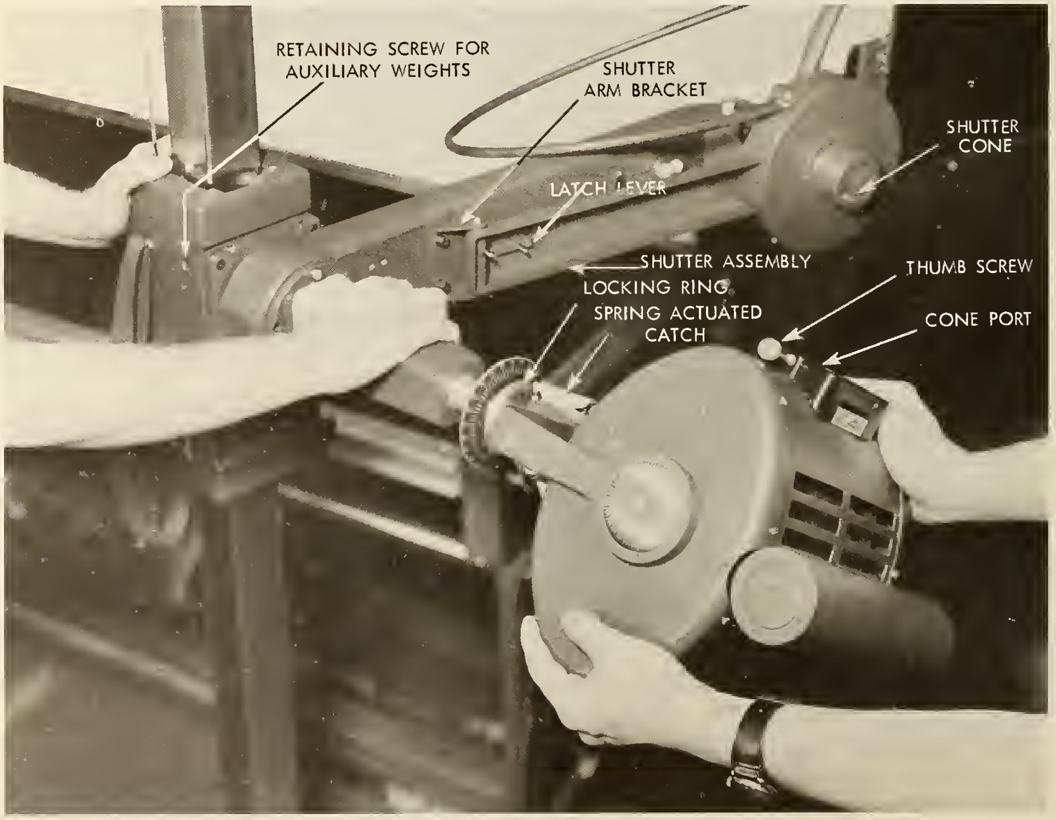


FIGURE 34

4. Remove dust cap from electrical receptacles.
5. Connect all cables into their corresponding outlets (all are keyed) leaving the line cable until the last. Run the head control cable over the pulley at the top of the tube stand.

FIGURE 35

6. Remove bucky cable from spare parts compartment in table carriage and connect to designated receptacle on the control.
7. Install radiographic cone in head. Tighten set screw. If unit is to be used as fluoroscope, connect foot switch to designated receptacle on control unit and remove cone so shutter assembly can be properly located.

PROCESSING MACHINE (POLAROID)

1. Connect cable from processing machine to power source.
2. Remove film receptacle from inside processing machine and slip into position on the exterior flange of the machine.

POWER SOURCES

When local electric power is available in the PDH, and line overloading is not a problem, the X-ray is operated on 115 volts, 60 cycles A.C. When local power is interrupted or in danger of being overloaded in the PDH, the X-ray should be operated directly from a circuit powered by one of the two generators provided with

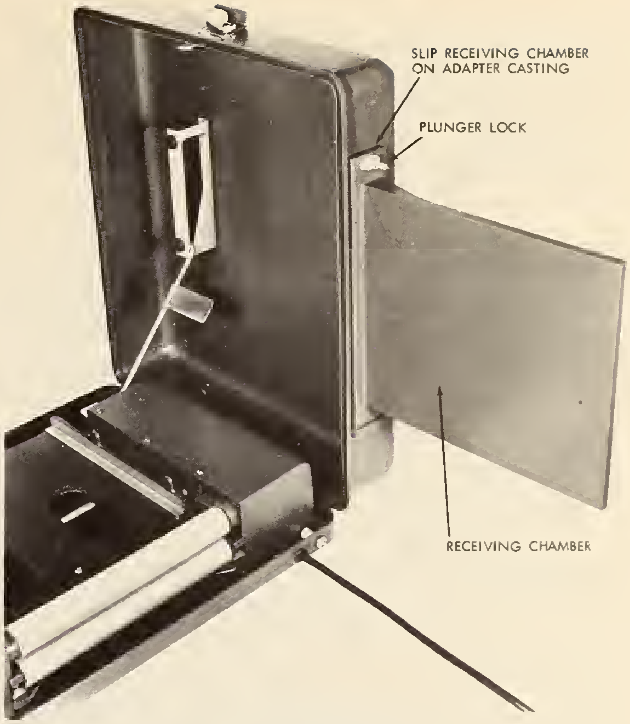


FIGURE 36

the PDH. Some PDH's are supplied with a 2½ KW gasoline-operated generator to be used as a power source for the X-ray when electric power fails or overloading is a problem. In other model PDH's, the X-ray may be hooked up to a larger generator, along with other equipment. The assembly, operation and maintenance of these generators are described in illustrated detail on page

OPERATING THE EQUIPMENT

TUBE STAND AND TABLE

Compression Device • The compression device (figure 30) is attached to the table leg at the head end of the table. To remove, unfasten the strap and pull downward on the device so as to break the spring tension on the two spring fasteners. To install on the table, press the knob inward as far as it will go, then slide the retainer, at the end opposite the knob, until it engages the groove in the shaft. This will free the ratchet at the knob end of the device and allow the band to be adjusted with greater ease.

With the knob end of the compression device facing the foot end of the table, insert the channel member into the groove of the front finishing strip, starting at the head end of the table. Slide the device to the desired position. Now grasp the free end of the compression band, position it over the table and engage the channel member with the rear finishing strip by hooking it to the upper portion of the groove in the finishing strip. Release the slide catch at the end opposite the knob and turn knob counterclockwise to obtain desired tension on compression band. (Some of the earlier models were produced with a detachable compression band. For instructions see manual packed with unit.)

Brakes and Adjustments for Tube Stand • The tube stand, which sets in the bearing well of the transverse carriage, may be moved transversely as well as longitudinally in the rail mount or chest of the table. Each of these movements is controlled by a friction type brake (figure 32), one being assembled to the transverse carriage and the other to the longitudinal carriage. Turning the brake lever clockwise will apply enough friction on the carriage so that it may still be moved, and yet the friction will immobilize the carriage sufficiently for any radiographic techniques. The degree of friction may be varied by making a slight adjustment in the brake assembly.

Tube Stand Rotation and Adjustment • The tube stand may be rotated 360° to facilitate maneuvering the tube head. Four grooved notches have been machined on the top surface of the bearing well which permit the tube stand to index every 90°.

Vertical Carriage Friction Lock and Latch • A latch has been provided on the vertical carriage for immobilizing the carriage assembly at the lowest extreme of travel which is necessary in horizontal fluoroscopy. When the carriage assembly is moved all the way down, the latch will engage with a boss (figure 31) which is anchored at the bottom of the mast. To release the carriage, it will be necessary to exert a slight pressure downward on the carriage assembly while lifting upward on the release rod.

CAUTION:

Do not attempt to lock the carriage in any position along the vertical mast without first fully counterbalancing the tube stand.

Swivel Arm Assembly • The swivel arm is attached to the tube stand in a horizontal manner. However, when doing horizontal fluoroscopy it becomes necessary to first position the tube under the table while the screen assumes a position over the table. To accomplish this, lower the carriage assembly to a convenient position on the tube stand, grasp the swivel arm at the end nearest the screen assembly and depress release lever (figure 31). Carefully lift up on the swivel arm until it engages a positive lock in the upright position. To restore the arm to the horizontal position, depress the release lever and carefully allow the arm to come down to a positive stop, enabling a catch to take hold.

CAUTION:

Do not, under any circumstances, attempt to depress release lever or try to rotate the swivel arm without first attaching the tube head and screen assembly to it.

Shutter Assembly • For fluoroscopy, the shutter arm can be swung so that the shutter cone will engage the cone port of the tube head after properly aligning the tube head. The shutter assembly will be retained in this manner by tightening thumb screw on cone port. The size of the shutter aperture is controlled by the movement of the two shutter control levers. For radiography, the shutter assembly may be swung away from the tube head until the latch engages the strike which is part of the shutter mounting bracket. To release, depress the latch lever.

Bucky Centering Device • The bucky centering device is fastened to the rear of the bucky and provides a visual means of aligning the tube stand with respect to the bucky. The device is made of a flexible wire-wound spring which, in turn, is fastened to an indexing bracket. When the indexing bracket is turned so that the wire-wound spring is vertical, it becomes possible to align the X-ray tube target with the center of the bucky by centering the tube stand column with the wire-wound spring.

Positioning for Vertical Fluoroscopy (figure 37) • To erect the tabletop into a vertical position for doing vertical fluoroscopy, slide the tabletop toward the foot end until the tilting stops, approximately midway along the two outside extruded trim strips, contact the two rollers at the foot end of the table. Now grasp the tabletop along the front trim, near the head end support, and lift upward until the latch at the foot end of the top engages with the lower portion of the front panel. It will be noted that the top cannot be raised until the "c" shaped fitting (figure 27) at the bottom of the head end support member coincides with the notch in the front track along the upper edge of the front panel.

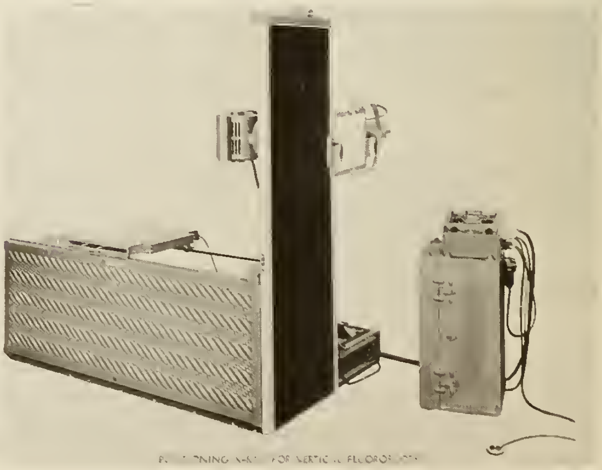


FIGURE 37

With the swivel arm and screen assembly in a position parallel with the table, insert the cone of the shutter assembly into the tube head cone port and tighten securely with thumb screw. Move the tube stand toward the foot end of the table until the carriage spring catch engages the groove in the tapered plug fastened to the end of the chest. This engagement will arrest the movement of the stand permitting the screen to be positioned. A sudden pull toward the head end will release the tube stand. With the carriage in the lock position, swing the screen assembly to the front of the tabletop.

Positioning for Horizontal Fluoroscopy • With the swivel arm and screen assembly in a horizontal position, rotate the tube stand so that the tube head faces away from the back of the table. Align the tube head with the shutter assembly cone and fasten the two together securely. Lower the arm assembly all the way to the bottom allowing the retaining latch to take hold. Now rotate the swivel arm assembly into the vertical position by depressing release lever and rotate the tube stand with the tube head until it indexes with the tube head directly under the table.

Positioning for Horizontal Radiography • With the swivel arm and screen assembly in a horizontal position, swing the shutter assembly back toward swivel arm until the latch engages. Install the radiographic cone and position tube head over the table.

Positioning for Laterals • Swing the shutter assembly back toward the swivel arm until the latch engages, then depress swivel arm release lever and position swivel arm so that it is vertical. Install the radiographic cone and position the tube head. To obtain maximum lateral distances rotate the tube and stand approximately 45° and then position head.

Positioning for Vertical Radiography • *Patient erect:* The tube stand is flexible enough to permit vertical radiography when used in conjunction with a wall type cassette or wall type cassette holder mounted on a wall adjacent to the tube stand. Position the tube stand and the tube head so that the X-ray beam is directed at the center of the cassette. *Patient in sitting position:* In cases where it is possible to bring the patient into a sitting position, it may be desirable to take vertical chest films with the patient positioned in this manner on the tabletop or litter, and with enough horizontal distance between target and patient to produce a good film.

Roll the entire tabletop assembly with patient and litter toward the foot end until the lock pin engages a hole in the front track just ahead of the notch. This will immobilize the tabletop, preventing it from acci dently being pushed into the release or notched position where it would come out of engagement with the track.

Move the tube stand as far as it will go toward the head end of the table and angulate the tube head with respect to the patient and cassette while the latter is being held in front of and against the patient.

Positioning for Extremities and Head • For techniques involving skull exposures, the sliding feature of the tabletop may be used advantageously. The design of the table permits the top to be rolled longitudinally which effectively increases the travel of the tube stand and, thereby, increases the flexibility and ease in making exposures of extremities.

Move the tube stand as far as it will go toward the head end of the table, angulate the tube head and slide the tabletop, with the patient, toward the foot end of the table to a position midway between the center and head end of table. Then make the final adjustments in positioning the patient and tube head.

CAUTION:
Do not slide table top with patient to the extreme limit of travel, where the "c" shaped member of the head end support coincides with the notch in the upper track, as this may allow the top to come out of engagement with the table frame.

CONTROL UNIT AND TUBE TRANSFORMER HEAD

General Preliminary Check and Adjustments • Before turning on any switches, check to see that all cables are properly connected. Make sure the unit is connected to the proper kind of power source; namely, 110-220 volts, 50-60 cycles A.C.

CAUTION:
Never attempt to operate the X-ray equipment on D.C.

When everything is in order, with operator and others properly shielded from X-rays, proceed with a preliminary check making sure that the equipment is in correct working order. Before closing line switch, set the main controls as follows:

1. Set the line adjuster on step "1"—fully counterclockwise.
2. Set the radiography fluoroscopy changeover switch to RADIOGRAPHY. (This is usually referred to as the R-F switch.)
3. Set the kilovolt selector, or KV switch, to step "7" (near the red dot).

Then proceed with caution. Make sure the main switch on the control is in OFF position, then turn on any wall switch or main power box that is used in the supply line to the control. If everything is in order, place the main switch (A) on the control in the ON position, and check the following points:

For line voltages of 200 or 248:

1. The KV meter (E) should read at the red line or below.
2. The meter lights should show.
3. The blower on the head should be operating.
4. The LINE ON indicator lamp should show.

With the settings as mentioned in (1), (2), and (3) above, and with line voltage 110-128:

1. The KV meter will barely indicate.
2. Meter lights will not show.
3. The blower may not operate on this reduced voltage.
4. The LINE ON indicator lamp will just barely glow.

Setting Line Adjuster ● Before proceeding with the operation of the control, it will be necessary to set the line adjuster switch (B). This is done with the kilovolt selector on step "7" and the R-F switch on RADIOGRAPHY. Slowly turn the line adjuster switch clockwise one step at a time until the KV meter (E) reads approximately "70" (within the red line area). If the line voltage is in the 110-volt range, you will notice that the control is de-energized when you reach the blank step between steps "5" and "6". This is purposely a reminder that you are entering the lower voltage range, and that if the power source is 220 volts, do not turn the switch above this step. When the line adjuster is set properly, proceed with a further check of operation. It is best to start by checking the operation of the unit at low outputs to make sure the control and head are in good working order before proceeding to the higher KV and MA values.

Fluoroscopy Check (preliminary) ● Without further change in the line adjuster setting, turn the R-F switch to fluoroscopy. The KV reading on the meter will automatically rise to recalibrate the control for lower milliamperage operation. Lower the KV to about "50" and set the fluoroscopic MA control (F) to its lowest point (fully counterclockwise). Make sure that the MA rises slowly but will never exceed 8 MA. Normal working range of MA should be 3-5 as read on the milliammeter (G). If MA range seems correct, check to see that control and head work at 4 MA and about 80 KV.

Hand Timer ● To set the time of exposure, the timer pointer knob is first turned so that the pointer indicates the desired exposure. The pushbutton is quickly and firmly depressed with the thumb (*and is held down throughout the exposure* until the timer automatically terminates the exposure as its pointer passes "zero"). As the exposure is terminated, you will hear the timer switch and control contacting relay click as they open. The milliampere meter will also fall to "zero" reading to indicate the end of the exposure. The pushbutton is then released and the hand timer returned to its hang-up hook.

NOTE:
The foot switch will operate only when the R-F switch is set to FLUOROSCOPY and the hand timer will operate only when the R-F switch is on RADIOGRAPHY.

Tube Transformer Head ● The tube head is supplied, in accordance with specifications, with the following filtration: (1) inherent filtration of the tube head port—0.5 mm. aluminum equivalent, (2) fixed filter under cone mounting assembly—0.5 mm. aluminum equivalent, (3) two filters each for insertion in filter slide—0.5 mm. aluminum equivalent, and (4) one filter for insertion in filter slide—1.0 mm. aluminum equivalent. Since the total fixed filtration, (1) and (2) above, is only 1.0 mm. aluminum equivalent, it is necessary, in order to comply with National Bureau of Standards requirements, that one of the 0.5 mm. filters and the 1.0 mm. filter be inserted in the filter slide provided on the cone holder to give the required total filtration of 2.5 mm. (figure 16). If for any reason, one or more of the required filters are removed, it will be necessary before resuming operation to replace all filters as listed above to prevent possible radiation injury.

FIGURE 38

Warnings and Precautions in Connection with X-Ray Equipment:

- *Never connect the main line cable to a source of current supply without being positive that the voltage and frequency are right.*
- *Never connect the line cable to a source of supply unless the main switch is shut off.*
- *Never use the equipment without adequate X-ray protection.*
- *Don't forget that because of differences in line voltage drop on different supplies that the kilovoltmeter cannot be made to read accurately as a prereading device. It must be read with a load and the kilovoltage selector switch finally adjusted to the desired kilovoltage. This switch must never be adjusted while the load is on.*
- *Don't forget to return the tools and spare parts to the space provided for them in the spare parts compartment so that they will be available in an emergency.*
- *Don't forget that this is half wave (self-rectified) equipment, and that current is passing through the X-ray tube only on alternate half wave. In other words, it is on half of the time. The milliammeter reads the average current. Therefore, when the unit is operating so that the milliammeter reads 15 MA, this is the average current. Actually an average of 30 MA is passing through the tube for half of the time giving the same effect radiographically as 15 MA on full wave.*
- *Don't forget to carefully retain and preserve the chest and all packing material, protecting it from the elements. Be sure to attach ground clip to a good ground at the same time the main line plug is connected and check this point before beginning operation of the generator.*
- *Never turn the line voltage adjuster switch into the 110-volt area unless you are sure that the line voltage is in that range.*
- *Never connect a permanent circuit in place of the timer or foot switch or in any way lock these devices in the ON position because excessive radiation to both patient and operator will result as well as damage to the equipment. Be sure always to set the line adjuster switch with the R-F switch set to RADIOGRAPHY, otherwise the pictures will show too low a radiographic kilovoltage.*
- *Never exceed the tube ratings. Be sure to allow sufficient rest time between exposures to allow the tube to cool.*

THE PROCESSING MACHINE

Loading Cassette • The lever at the back of the cassette (figure 39) permits the back to be raised when the springs are in the engaged position. To load the cassette, grasp the Polaroid packet at the perforated rip end, taking care that the pods which lie between the receiving sheets and the black envelopes are not squeezed, insert the black envelope between the screen and the Bakelite front of the cassette and permit the receiving sheet (the white glossy sheet) to pass over the top of the aluminum mounting plate on which is mounted the intensifying screen. Extreme care must be used to avoid fingerprints on the face of the receiving sheet since skin acids will etch into the surface and affect the final positive radiograph. Also, care must be taken that the receiving sheet is not buckled since any slight deformation will break down the surface of the receiving sheet and also appear as a defect in the positive radiograph. Insert the packet until the perforations of the rip end are projecting ¼ inch beyond the end of the cassette frame (figure 40). Now close the back and apply the pressure springs. Be sure that the pressure lever is down so that the pressure springs apply their full force. Carefully grasp the rip tab and sever the black envelope, taking care that the white withdrawal tab concealed in the black envelope is not severed in the process.

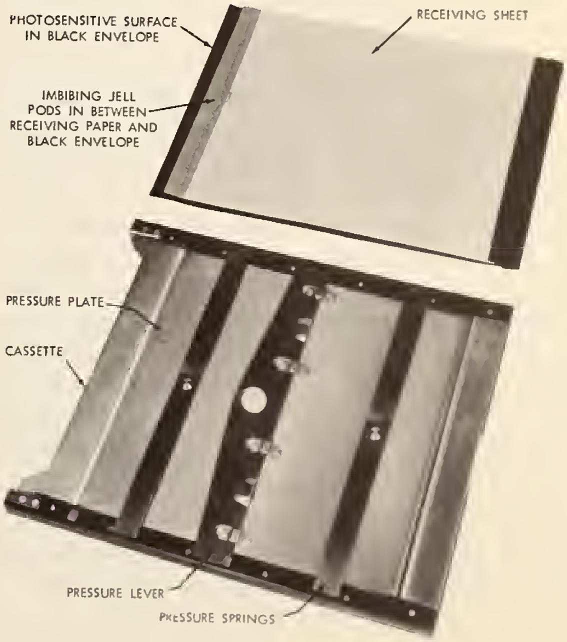


FIGURE 39

After ripping the perforated end from the packet, a tab projecting slightly from the end of the packet should be pulled out carefully to its full length, which is approximately 1½ inches.

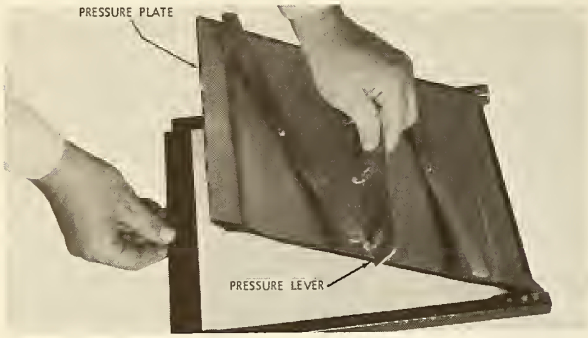


FIGURE 40

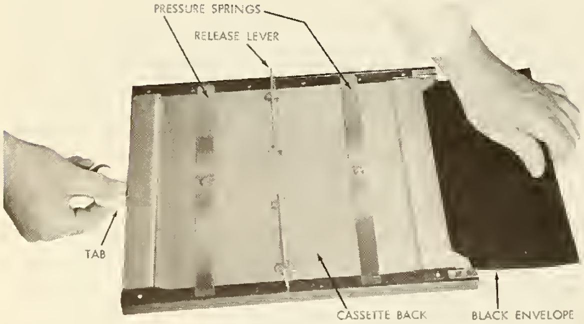


FIGURE 41

Now raise the back of the cassette (figure 41) by raising the pressure lever (figure 43), keeping the pressure springs in place. With thumb and index fingernails, grasp the first ¼ inch to ⅜ inch of the black envelope projecting from the hinged end of the cassette and, with the other hand, grasp the white tab, keeping that end of the packet flush with the end of the pressure back (figure 41), and withdraw the black envelope at the opposite end of the cassette. Release the pressure lever (figure 41) so that it assumes the position shown in figure 39, thereby applying pressure to the intensifying screen and the film packet. The cassette is now ready for a radiograph. For non-screen technique, the film packet is inserted into the cassette as described, but the perforated end is not ripped off to remove the black protective envelope until after the radiograph has been made.

NOTE:
X-ray technique charts are found on the Polaroid packets.

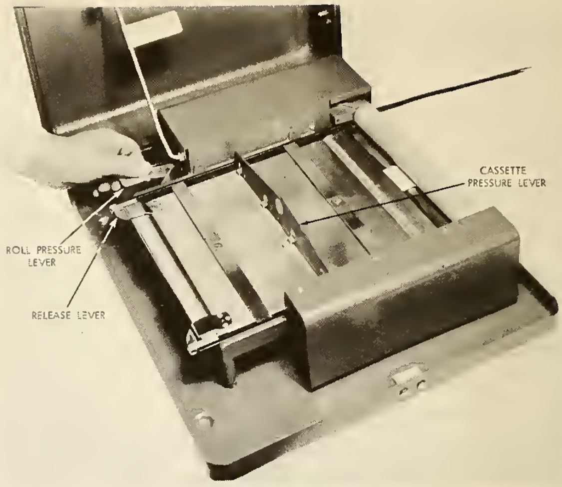


FIGURE 42

Processing of Film Packet • Grasp the cassette at the hinged end with the Bakelite face down, and guiding the white tab on the film packet between the rollers, carefully insert in the guideways of the base of the processing unit. Be sure the film tab is flattened out and the cassette is as far forward as it will go. Now depress the roll pressure lever marked PRESS as far down as it will go. Release the pressure lever as shown (figure 41), otherwise the unit will not operate. Close the processing unit lid, being certain the lock catches and prevents any light from entering the chamber and fogging the film. Depress the push-button and hold in the depressed position until you hear a dull thud indicating the rolls have separated. This interval is between 2½ to 3 seconds. The film packet has now advanced into the receiving chamber and will be light-sensitive until the imbibing time has been reached (figure 44). A warning buzzer will sound at approximately 45 seconds and will continue for 15 seconds until the imbibing time of one minute has been reached. (See table on film package for imbibing time at various temperature ranges.) At the end of the proper imbibing time, the processing unit is opened and the film packet withdrawn from the receiving chamber.

FIGURE 43

Stripping Packet • The film packet then should be stripped, that is, the positive radiograph and the photo-sensitive surface should be separated and the barrier for the developing medium about the periphery of the positive radiograph should be stripped from it. Extreme care should be observed in handling to avoid contact of the developing medium on skin or clothes as it may cause skin eruptions or clothing damage.

The rubber rolls should be cleaned with a damp cloth and wiped dry if for any reason the developing medium should appear on the rolls. Do not process a packet if the rolls are damp.

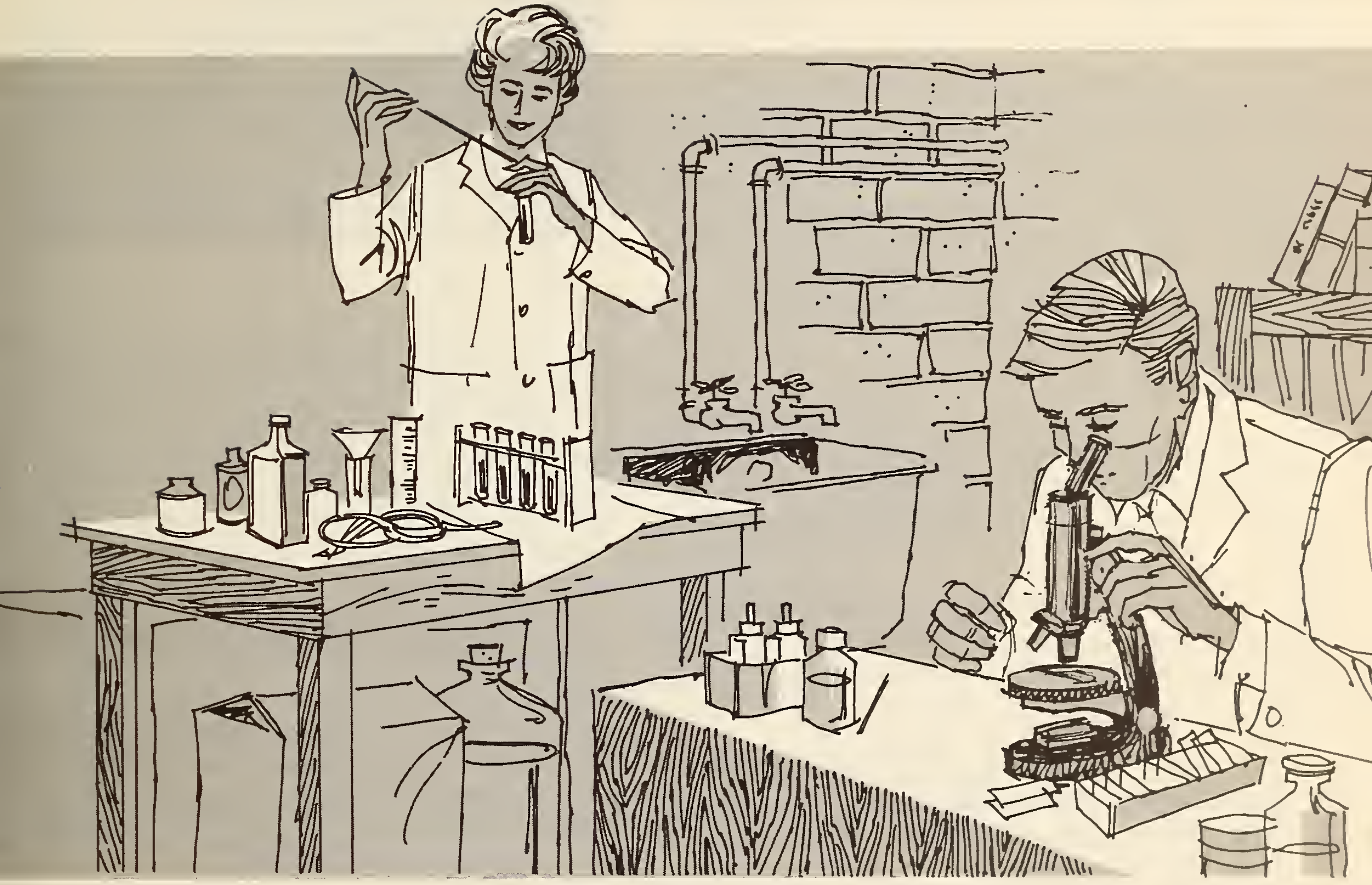
Imbibing Timer • The one-minute warning buzzer in the processing unit covers the imbibing time for a temperature of 60° to 130° F. A two-minute imbibing time is required for a temperature range between 45° and 60° F. and a three-minute imbibing time for a temperature range between 32° and 45° F. These subnormal temperature ranges should be timed with a watch.

REPACKING EQUIPMENT

When dismantling the X-ray tube head be sure the fastening ell is securely tightened on the vertical stand.

When placing equipment in the packing case, make sure the tabletop is inverted and that the latch corner is adjacent to the inscription, "latch end here" on the packing case. It is most important that the repacking steps on the instructions posted inside the lid of the packing case be followed in the sequence outlined.

PDH LABORATORY PROCEDURES



SUPPLIES AND PROCEDURES

The supplies and equipment of the laboratory section permit those laboratory procedures essential in diagnosis and treatment of the sick and injured in an emergency situation. A complete list of the laboratory items packed in your PDH is contained in the component listing included with your hospital.

Included in this section are those tests considered to be essential to the provision of austere medical care in the early postattack period or immediately following a major natural disaster. Other tests, which may be judged desirable in view of particular operating conditions at an individual PDH, are outlined which may be performed with the addition of certain supplies and equipment to be procured locally. At all times the policy pertaining to the scope of laboratory functions must be established by the PDH chief of staff with consideration given to the volume and type of workload, the number and skills of personnel available for laboratory work, and the availability of required supplies and equipment.

Staff members of those hospital sections requiring laboratory services should be familiar with the procedures for collecting and submitting laboratory specimens and for requesting and receiving laboratory reports. They should also be thoroughly aware of the limitations of the PDH laboratory and understand clearly that many laboratory services which are standard under normal conditions will not be available in a disaster situation.

LOCATION AND FACILITIES

When the PDH is activated as an independent facility, the laboratory should be set up as near as possible to those sections which will require its services.

Approximately 200 sq. ft. of floor space, preferably a separate room, should be assigned to the laboratory section. The area should be supplied with a laboratory-type workbench or an improvised substitute. Also essential are a nearby sink with running water, a number of convenient electrical outlets and good lighting. A source of fuel for gas burners (gas line or bottled gas) is desirable but not absolutely essential to carry out the tests outlined in this manual.

Most of the supplies and equipment assigned to the laboratory are packed in wooden or heavy fiberboard boxes. After they are unpacked, these boxes can be used as improvised side tables or shelves. To complete the stock of laboratory essentials, arrange to get the additional supplies from other appropriate sections of the PDH, or from the stocks of the affiliated hospital, or when necessary, from community supply sources.

PERSONNEL

The minimum personnel requirements for 24-hour laboratory operation (two shifts) are:

- Two clinical laboratory technologists or technicians
- Two aides with laboratory experience (not necessarily clinical)
- Two clerks
- Two helpers

Predisaster, it is essential to recruit and train qualified volunteers to staff the laboratory unit of the PDH. Technologists and technicians employed in the parent hospital probably can not be counted on for total staffing of the PDH as it is likely that in a disaster all fixed hospitals will be utilizing their entire complement of personnel for expanded operating capacity.

Predisaster training of the laboratory staff should include familiarization with the room in which the laboratory is scheduled to be set up and the arrangements necessary to convert it to a laboratory. Laboratory staff orientation should also include discussion of the limitations and difficulties which must be overcome in order to provide laboratory services.

Laboratory Technologists and Technicians

Through predisaster training technologists and technicians must become familiar with the kinds of laboratory services needed to support medical care activities in a disaster. They should become acquainted with the various items of PDH equipment provided for the laboratory and with the operation of any equipment for which they will be responsible. They should make arrangements for improvising or compensating for lack of items which ordinarily are available in fixed hospital laboratories. Laboratory personnel may also be requested to aid in determining staffing requirements in the PDH laboratory and to assist in the recruitment and training of auxiliary personnel. They will be expected to participate in training programs and test exercises.

Postdisaster, the laboratory technologists and/or technicians, one of whom will have been appointed laboratory director, will report to the chief of staff at the PDH operating site. Under his direction, they will supervise the setting up of laboratory operations. They must anticipate supply and personnel shortages and requisition additional supplies as needed, and arrange a work schedule for the laboratory staff to permit 24-hour operation.

Laboratory tests will be performed as requested by the medical staff. Blood bank operation will be under the supervision of the laboratory director unless blood banking services are provided by another designated agency.

Additional Laboratory Personnel

Clinical laboratory aides and other volunteer laboratory personnel should, through predisaster training, become familiar with types of laboratory services likely to be required and PDH equipment provided for the laboratory and the operation of that equipment for which they will be responsible. They should also be prepared to participate in test exercises. Postdisaster, auxiliary personnel should report to the laboratory director at the PDH operating site where they will help move in and set up laboratory equipment and supplies as directed by the laboratory director. They will then assist in the performance of laboratory tests under the supervision (if necessary) of a technologist or technician, and assist in other hospital medical care activities if the volume of laboratory test requirements decreases sufficiently.

Clerks and Helpers

In preparing for disaster, it is wise to train volunteer and other nonskilled workers to handle routine tasks in order to free professional personnel from these duties. Clerks and helpers should learn laboratory terminology, become familiar with the report and request forms to be used and the procedures for processing them and participate in test exercises.

Postdisaster, they would report to the laboratory director at the PDH operating site, and help move in supplies and set up laboartory equipment. During PDH operation, they would fill out report forms and supply request forms as directed by technologists and technicians and perform simple laboratory procedures, if necessary, under close direction of a technologist or technician. They would maintain laboratory record files, wash and store laboratory equipment, pick up and deliver supplies, and deliver laboratory reports and perform other errands and duties as required.

FORMS

Three standard forms for requesting laboratory tests and for transmitting laboratory reports are packed with the Packaged Disaster Hospital:

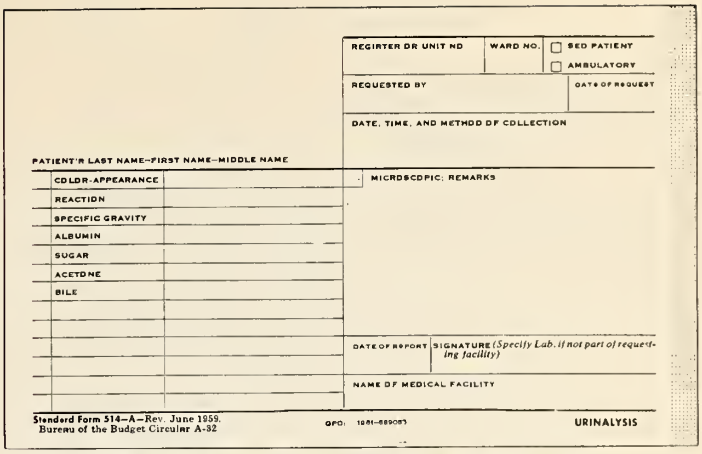
SF—514A (Urinalysis)

SF—514B (Hematology)

SF—514M (Miscellaneous Tests)

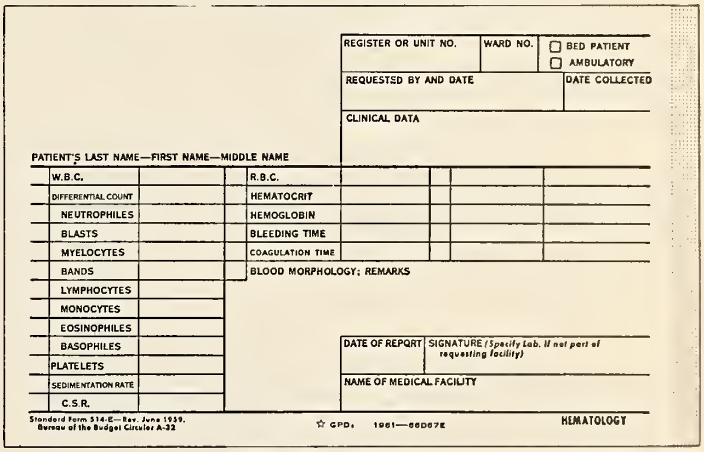
These standard forms (figs. 44, 45, and 46) are bound in sets of two, with carbon paper between. Both copies are forwarded to the laboratory by that hospital section requesting a test. The laboratory returns one completed copy of the form to the originating section upon completion of the test and files the other copy. A log of all laboratory tests requested should be maintained in the laboratory until the completed test reports are returned to the section which originated the request. The log should show the date of receipt, source and type of request, and a serial number.

In addition, a supply request form such as is shown on page 24 is recommended for requesting equipment and supplies from central sterile supply or pharmacy. It is not supplied with the PDH. This form is to be made out in triplicate; two copies are sent to the section from which supplies are requested and one is retained in the laboratory as a record of what was ordered. One copy is returned with the supplies ordered. If this form is not reproduced by the parent hospital for storage with the PDH an existing hospital form or pads of unruled paper can be used as a substitute.

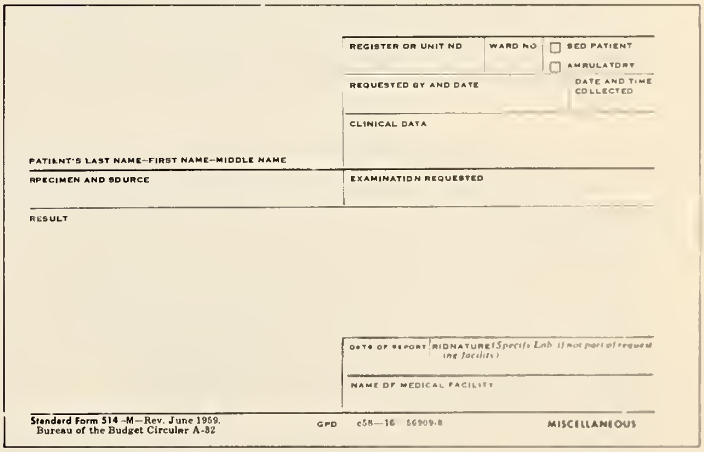


REGISTER OR UNIT NO | WARD NO. | ☐ BED PATIENT ☐ AMBULATORY
REQUESTED BY | DATE OF REQUEST
DATE, TIME, AND METHOD OF COLLECTION
PATIENT'S LAST NAME—FIRST NAME—MIDDLE NAME
COLOR-APPEARANCE
REACTION
SPECIFIC GRAVITY
ALBUMIN
SUGAR
ACETONE
BILE
MICROSCOPIC: REMARKS
DATE OF REPORT | SIGNATURE (Specify Lab. if not part of requesting facility)
NAME OF MEDICAL FACILITY
Standard Form 514—A—Rev. June 1959. Bureau of the Budget Circular A-32 | GPO: 1961—589083 | URINALYSIS

FIGURE 44 –URINALYSIS FORM



REGISTER OR UNIT NO. | WARD NO. | ☐ BED PATIENT ☐ AMBULATORY
REQUESTED BY AND DATE | DATE COLLECTED
CLINICAL DATA
PATIENT'S LAST NAME—FIRST NAME—MIDDLE NAME
W.B.C.
DIFFERENTIAL COUNT
NEUTROPHILES
BLASTS
MYELOCYTES
BANDS
LYMPHOCYTES
MONOCYTES
EOSINOPHILES
BASOPHILES
PLATELETS
SEDIMENTATION RATE
C.S.R.
R.B.C.
HEMATOCRIT
HEMOGLOBIN
BLEEDING TIME
COAGULATION TIME
BLOOD MORPHOLOGY; REMARKS
DATE OF REPORT | SIGNATURE (Specify Lab. if not part of requesting facility)
NAME OF MEDICAL FACILITY
Standard Form 514-E—Rev. June 1959. Bureau of the Budget Circular A-32 | ☆ GPO: 1961—O-60067E | HEMATOLOGY



REGISTER OR UNIT NO | WARD NO | ☐ BED PATIENT ☐ AMBULATORY
REQUESTED BY AND DATE | DATE AND TIME COLLECTED
CLINICAL DATA
PATIENT'S LAST NAME—FIRST NAME—MIDDLE NAME
SPECIMEN AND SOURCE | EXAMINATION REQUESTED
RESULT
DATE OF REPORT | SIGNATURE (Specify Lab. if not part of requesting facility)
NAME OF MEDICAL FACILITY
Standard Form 514 -M—Rev. June 1959. Bureau of the Budget Circular A-32 | GPO | MISCELLANEOUS

FIGURES 45 AND 46

HEMATOLOGY AND

MISCELLANEOUS TEST OR

EXAMINATION REPORT FORMS

URINALYSIS

COLLECTION AND PREPARATION OF SPECIMENS

Special wide-mouth bottles for the collection of urine samples are included in the laboratory supplies and equipment in some PDH's. These should be thoroughly cleaned and dried before delivery to the ward or other area where specimens are to be collected. Cardboard stoppers are also provided for distribution with the bottles.

A specimen is ordinarily collected directly into the bottle to avoid the possibility of contamination. The bottle is capped with the cardboard stopper on which has been written the name of the patient, and the date and time collected. After completion of all required tests, the remaining portions of the specimen are discarded and the bottle rinsed, washed, and dried for reuse.

In view of the emergency situation, disposable, clean nested drinking cups are much more practical and are packed with PDH's—some are 6 oz; some 8. These cups should be destroyed after use.

TESTS

Tests should be performed on specimens as soon as possible after collection, as decomposition of urine occurs rapidly at room temperature. It should be remembered that urine may contain infectious organisms, such as those of tuberculosis, typhoid, or gonorrhea, and suitable precautions in handling and disposal of specimens and in cleaning up after laboratory work, should be observed.

The reagents used in the tests described hereafter should be handled carefully to avoid contamination and undue exposure to air, moisture, light, fumes, and heat. Bottles should be recapped tightly immediately after each use. Some of the reagents are especially subject to deterioration, and if the quality of any reagent is suspected, control tests on known samples should be performed to check its response and sensitiveness.

Acetone

a. Description

A color-comparison test for the presence of acetone, ketone bodies, or acetoacetic acid in urine based upon the formation of a purple colored complex with sodium nitroprusside in in the presence of aminoacetic acid.

b. Equipment and supplies

1. Acetone Test Tablets, with Color Chart.
2. Paper, Filter, Qualitative.
3. Pipette, Dropping (Medicine Dropper).

c. Procedure

1. Place one tablet on a small piece of filter paper, other white paper, or any clean surface.
2. Using a dropper, place one drop of the urine specimen on the tablet.
3. After 30 seconds compare the color of the upper surface of the tablet with the color chart.

d. Interpretation

Negative: No lavender or purple color appears.

Positive: A lavender or purple color appears, the depth of color depending upon the amount of acetone bodies present. Report the results as *trace, moderate,* or *strongly positive,* as determined by comparison with the color chart.

Normal: Negative.

Sensitiveness: A trace positive finding indicates approximately 10 mg. of acetone or acetoacetic acid per 100 ml. of urine.

CAUTION:

A definite yellow or orange discoloration of the reagent tablets or failure of the tablet to absorb the drop of urine sample within 30 seconds may be an indication of deterioration of the reagent tablets. The sensitiveness of any bottle of tablets showing such defects should be checked before reporting any results of findings with them.

Albumin

a. Description

A turbidity test for the presence of protein in urine based upon the precipitation of protein by sulfosalicylic acid.

b. Equipment and supplies

1. Albumin Test Tablets.
2. 2 oz. Prescription Bottle.
3. 100 ml. Cylinder, Graduated.
4. Funnel, 65 mm.
5. Gummed Label.
6. Qualitative Filter Paper.
7. 5 ml. Serological Pipette.
8. Test Tube, 13 x 100 mm.

9. Water, Demineralized or Distilled.

c. Procedure

1. Dissolve four reagent tablets in 30 ml. (1 fl. oz.) of demineralized water in graduated cylinder. This reagent solution is ready for use as soon as the tablets have dissolved and effervescence has subsided.
2. Put equal parts of reagent solution and the urine sample (2 ml. each) in a test tube and shake gently.
3. Immediately observe for any turbidity against a dark background.

d. Interpretation

Negative: No turbidity is produced.

Positive: A turbidity is produced, the degree of cloudiness depending upon the amount of protein present. Report the results as *trace, moderate,* or *strongly positive,* according to the degree of turbidity.

Normal: Negative.

Sensitiveness: A trace positive result indicates approximately 10 mg. of protein per 100 ml. of urine.

e. Additional information

1. If the original urine specimen is noticeably cloudy, it should be filtered or centrifuged before performing this test. If only a very slight turbidity is present in the sample, this operation may not be necessary as the untreated sample can be used as a control to determine if there is any increase in turbidity.
2. This test may falsely indicate positive results when the patient is receiving tolbutamide, certain X-ray dyes or massive doses of penicillin.
3. The reagent solution prepared from the tablets can be kept in labeled prescription bottles up to 30 days if stored in a tightly closed container in a dark place.
4. If the supply of reagent is exhausted, add a few drops of 3 per cent acetic acid to acid urine in test tube and heat upper portion to boiling. Report the results the same as indicated under "d. Interpretation" above.

Glucose

a. Description

A color-comparison test for the presence of glucose (dextrose) in urine based on the oxidation of glucose by glucose oxidase to form gluconic acid and hydrogen peroxide. The latter then reacts with a catalyst-chromogen combination to produce a color change (yellow to green or blue).

b. Equipment and supplies

Urine Sugar Test Paper, with Color Chart.

c. Procedure

1. Withdraw approximately 1½ inches of test paper from the dispenser and tear off against the cutting edge.
2. Dip one end of the paper strip into the urine sample, remove, and wait 1 minute.
3. Immediately compare the darkest area of the strip with the color chart on the dispenser. For values of 0.5% (+++) or more, allow 1 additional minute before making the final color comparison.

d. Interpretation

Negative: The test strip remains yellow in color.

Positive: A green or blue color appears on the strip, depending upon the amount of glucose present. Report the semiquantitative result in terms of plus values and percent as given on the color chart.

Normal: Negative.

Sensitiveness: Depending upon the exact conditions, 0.01% to 0.1% of glucose in urine will be required to produce definite positive results.

CAUTION:

Misleading results may be obtained if patient is taking therapeutic doses of ascorbic acid. Sugars other than glucose are not detected by this test.

pH (Acidity or Alkalinity)

a. Description

A color-comparison test for the pH of urine based upon the color of a mixed indicator in the presence of a specific hydrogen ion concentration.

b. Equipment and supplies

pH Test Paper, with Color Chart

c. Procedure

1. Withdraw approximately 1½ inches of test paper from the dispenser and tear off against the cutting edge.
2. Dip one end of the paper strip into the urine sample and remove.
3. After a few seconds compare the color of the wetted portion of the paper with the color chart on the dispenser.

d. Interpretation

pH: Report the pH value to the nearest whole number by determining the best color match with the chart.

Normal: 6 or 7.

Sensitiveness: The usable range of the test paper is from pH3 (red-orange) to pH9 (blue-green). The neutral color (pH7) is yellow-green. With care, pH value can be estimated to 0.5 unit if required.

e. Additional information

This test should be performed as soon as possible after collection of the urine specimen, because the sample will increase in alkalinity on standing.

Specific Gravity

a. Description

A determination of the specific gravity of urine compared with water by the use of a hydrometer (urinometer).

b. Equipment and supplies

1. Urinometer, Squibb, with Cylinder.
2. Qualitative Filter Paper.

c. Procedure

1. Transfer enough of the urine sample to the urinometer cylinder so that the float, when inserted, will float freely and not touch the bottom of the cylinder.
2. Remove any foam or bubbles from the surface of the sample by touching with a strip of filter paper.
3. Insert the float of the urinometer into the cylinder with a twist to prevent the adherance of air bubbles and to keep the float away from the sides of the cylinder.
4. When the float is stationary and floating freely (not touching sides or bottom of cylinder), read the specific gravity from the scale on the stem of the float at the point indicated by the bottom of the meniscus of the liquid.

d. Interpretation

Specific gravity: Report the reading of the urinometer to 3 decimal places.

Normal: 1.005 to 1.030.

Sensitiveness: The specific gravity can be estimated to 0.001 or 0.002 unit with this instrument.

Microscopic Examination

a. Description

A microscopic examination of the insoluble matter contained in urine to determine the presence of casts, blood cells, pus cells, epithelial cells, and crystals.

b. Equipment and supplies

1. Centrifuge (If not packed in PDH, obtain locally).
2. Test Tube, 13 x 100 mm.
3. Microscope Slide .
4. Microscope Slide Cover Glass.
5. Microscope, Monocular, with Lamp.

c. Procedure

1. Mix the urine specimen thoroughly and transfer about 10 ml. to a test tube.
2. Centrifuge the tube containing the sample at moderate speed (1500 r.p.m.) for 5 minutes.
3. Carefully pour off most of the supernatant fluid, taking care not to disturb the sediment in the tube.
4. Shake the tube thoroughly to resuspend the sediment in the few drops of liquid remaining.
5. Place one drop of the sediment suspension on a microscope slide and cover with a cover glass.
6. Examine the slide with the microscope, using first the low-power objective to determine the presence of casts, epithelial cells and crystals, and then the high-dry objective to determine the presence of red blood cells and pus cells.

d. Interpretation

Casts and epithelial cells: Report type and number found per low-power field.

Crystals: Report kind and frequency (occasional, few, many) found per low-power field.

Red blood cells and pus cells: Report number of each kind present per high-power field.

Other organized sediments: Report presence of other constituents in the urine sediment.

Normal: Amorphous sediments and occasional crystals and epithelial cells are found.

e. Additional information

1. Contaminants, such as pollen, fibers, diatoms, fungi, fat droplets, and starch granules, may be introduced into the urine specimen during or after collection and their presence should not be misinterpreted.
2. A thorough examination of the urine sediment under low power with subdued illumination should be performed to locate any unusual constituents before shifting to a higher power for their identification. The high-power field is of such small area that the rarer components may be missed unless a preliminary low-power scanning is performed.
3. Urine samples should ordinarily be examined within a few hours after collection because upon standing acid specimens may show a precipitate of urates and alkaline specimens a precipitate of phosphates. If either of these precipitates has formed, remove the former by warming to 50° C., or the latter by slightly acidifying with dilute acetic acid before proceeding with the examination.

Five Test Reagent Test Strips

a. Description

In some PDH's plastic reagent strips with five test areas for color comparison determination of urinary pH, protein, glucose, ketones, and occult blood are included. Color charts for each test are supplied on label of each bottle.

b. Equipment and supplies

1. Plastic Test Strips.
2. Container for Urine.

c. Procedure

1. Dip test portions of strip in fresh, well-mixed urine. Remove immediately.
2. Gently tap edge of reagent strip against specimen container to remove excess urine.
3. Compare colors of reagent areas with corresponding color blocks on bottle containing strips.

d. Interpretation

Negative findings of protein, glucose, ketones or blood in urine most closely match the respective "NEGATIVE" color blocks at the time specified on the bottle label.

1. pH Test Portion (Orange Test Area)—Color blocks on the color chart indicate the pH of urine in the range from 5 to 9. Values for colors intermediate between those on the color chart may be interpolated.
2. Protein Test Portion (Yellow Test Area)—Albumin in quantities of 5 mg. to 20 mg. per 100 ml. of urine may be detected as "TRACE" reactions. Physiologic amounts of albumin may be interpreted as "TRACE" reactions in urine of high specific gravity because of the concentration of chromogens, buffers and salts. Clinical judgement will determine the significance of a "TRACE" reaction.

Positive: Depending on the quantity of protein present, the yellow test area will change to a color closely approximating one of the color blocks. Color change corresponding to 30 mg.% (+) or greater may be regarded as clinically significant.

NOTE:

The protein test portion of the strip is more sensitive to albumin than to globulin, hemoglobin or Bence-Jones Protein.

3. Glocuse Test Portion (Red Test Area)—The glucose test portion of the plastic strip is essentially a qualitative test. Large amounts of ascorbic acid in urine may inhibit the color development on the glucose test portion.

Positive: Within 10-seconds, the test area develops a shade of purple color. In a majority of cases, a purple color that corresponds to "Light" may indicate ¼% or less of glucose; a color that corresponds to "Dark" may indicate ½% or more of glucose. A "Medium" color may be due to either a small or large amount of glucose.

NOTE:

All positive colors will tend to intensify to a darker purple if read later than the 10-second reading time.

4. Ketones Test Portion (Tan Test Area)—Positive: Within 15 seconds, the test area develops a shade of purple color. The color blocks indicate reactions that correspond to "Small," "Moderate" and "Large" amounts of ketone bodies in urine.

NOTE:

The ketones test portion of the strip detects from 5 mg. to 10 mg. of acetoacetic acid per 100 ml. of urine and is less sensitive to acetone.

5. Occult Blood Test Portion (Tip)—Large amounts of ascorbic acid in the urine may inhibit the color development of the occult blood test portion. Positive: Within 30 seconds, the test area develops a shade of green-blue color. The color blocks indicate reactions that correspond to "Small," "Moderate" or "Large" amounts of occult blood in urine.

NOTE:

The occult blood test portion of the strip is sensitive to hemoglobin and myoglobin but is less sensitive to intact red blood cells. A chemical test for occult blood in urine is designed to supplement the microscopic examination of the specimen.

e. Additional information

1. The use of fresh, well-mixed urine is important. If testing is delayed, specimen should be refrigerated. The use of a specimen previously frozen will not affect test results.

Other Physical Characteristics

Careful observation of the physical characteristics of urine is a major diagnostic aid to the physician. In an emergency situation with limited laboratory facilities, the urine may be the most important indicator of disease and the most reliable means for its determination. It is therefore important that the technician report on the following physical characteristics and be alert to recognize any abnormalities.

a. Volume

The volume of a single specimen is of little significance, however, the total output over a 24-hour period provides valuable information when correlated with the total 24-hour intake.

b. Odor

Normal urine has a characteristic odor, which becomes ammoniacal in urine that has begun to decompose. Various foods may cause a distinctive odor. Any putrid or other unusual odor should be described in the report.

c. Turbidity

On standing, normal urine forms a cloud of mucus and cells (nubecula) floating in otherwise clear urine. This gradually settles to the bottom of the container unless the specific gravity of the urine is high. Turbidity due to abnormal sediment usually remains evenly dispersed and its presence should be reported. In addition, turbid samples should be examined microscopically. See page 192.

d. Color

Normal urine is usually yellow in color, varying from almost colorless to deep amber depending upon the concentration. Abnormal color may be of varying shades, usually reddish or brownish from the presence of blood, or amber due to the presence of bile. Certain drugs being used by the patient may also cause an abnormal urine color.

CONSTITUENTS OF URINARY SEDIMENTS

1. Hyaline casts.[1]
2. Hyaline and finely granular casts.[2]
3. Waxy (colloid) and granular casts.[1]
4. Granular and fatty casts.[1]
5. Epithelial casts.[1]
6. Blood casts.[2]
7. Mucous threads and cylindroids.[2]
8. Pseudocasts composed of swollen epithelial cells.[1]
9. *A.* Vaginal epithelium;
   B. Ureteral epithelium;
   C. Renal epithelium;
   D. Epithelium from pelvis of kidney;
   E. Spermatozoa.[1]
10. Squamous epithelium and pus cells.[2]
11. Epithelium from uretha (*B*) and bladder (*A*).[2]
12. Epithelium from pelvis of kidney.[2]
13. Leukocytes.[2]
14. Erythrocytes.[2]
15. Molds.[1]
16. Artefacts.[1]
17. Uric acid.[1]
18. Calcium urate.[1]
19. Acid ammonium urate.[1]
20. Calcium oxalate.[2]
21. Amorphous phosphates.[1]

22. Triple phosphates.[2]
23. Calcium sulfate.[1]
24. Leucine (round) and tyrosine (needles in tufts).[1]

[1] After Rieder.
[2] After Todd and Sanford.

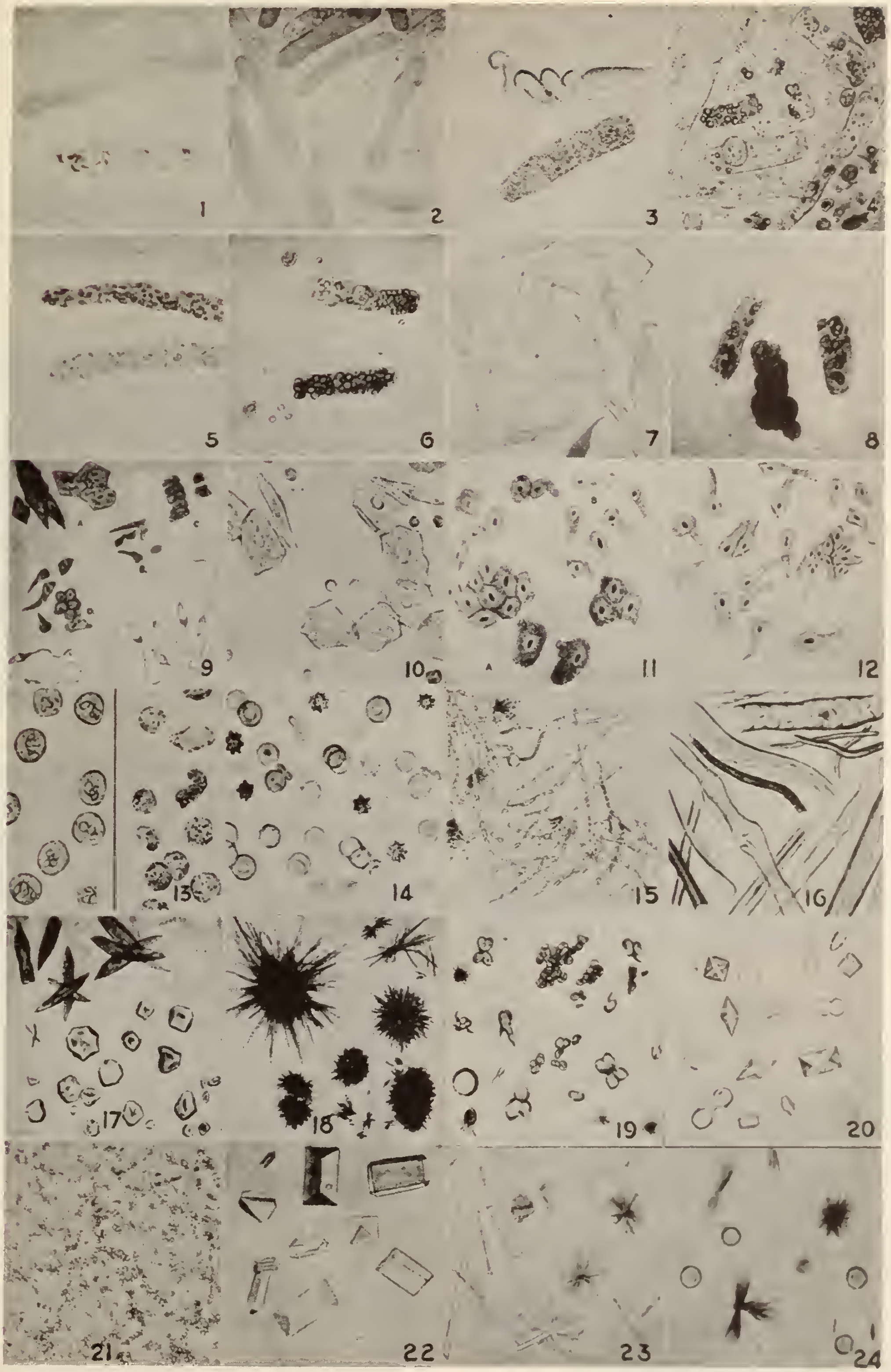


FIGURE 47 – CONSTITUENTS OF URINARY SEDIMENTS

BLOOD ANALYSIS

COLLECTION AND PREPARATION OF SPECIMEN

Capillary Puncture Technique

This method may be used to obtain small volumes of blood for grouping, cell counts, and other laboratory procedures requiring only a drop or two of sample. The site chosen may be either the palmar surface of a fingertip or the edge of an ear lobe. In infants the lower surface of the great toe or the heel is frequently used. The site, which should be clean and dry, is rubbed with alcohol (preferably with 70% ethyl or acetone) and dried and a puncture is made with a sterile, disposable lancet. To prevent cross infection, the disposable lancet should be discarded. The first drop of blood is wiped away; the second or succeeding drops are used for examination. Blood may be collected in a heparinized capillary tube for hematocrit, in a blood diluting pipette for cell count, or directly on a glass slide or cover slip for smears.

Venipuncture Technique

In this method the bend of the elbow is cleansed with alcohol (preferably 70% ethyl or acetone) and dried with sterile cotton or a gauze pad. A tourniquet is applied with moderate pressure to the upper arm, or an assistant may grasp the upper arm firmly if a tourniquet is not available. Pressure should not be sufficient to impede flow of arterial blood. Tourniquet is applied just tightly enough to distend the vein and should not exceed a normal diastolic blood pressure (80 mms. of mercury). The patient extends his arm and clenches his fist to distend the veins. A sterile needle attached to a sterile syringe with depressed plunger is inserted into any prominent vein near the bend of the elbow. Other superficial veins may be more suitable in the presence of injury and burns (ankle, hand, wrist). The needle should be about 20-22 gauge and should enter the skin about 3 mm. from the vein with the bevel at its tip uppermost. Two movements are required: one to puncture the skin and a second to seek out the vein. The size of syringe depends on the amount of blood to be drawn. After sufficient blood is drawn, remove the tourniquet, have the patient unclench his first, withdraw the needle, place sterile alcohol-dampened gauze over the site, and ask the patient to flex his forearm immediately and hold it in this position for a few minutes.

The blood sample is transferred to a test tube which is then stoppered and labeled for delivery to the laboratory.

Disposable syringes and individually packaged disposable needles are commercially available and ideally suited to meet the needs of emergency laboratory medicine. In addition, needles, adaptors, and appropriate vacuum sealed test tubes for blood collecting are commercially available in sizes ranging from 3 to 20 ml. These are routinely used by many clinical laboratories. The tubes are selected to meet the need of the test to be performed. If serum is desired, an empty tube is used. Tubes are also available containing a variety of anticoagulants (heparin, sodium citrate, sodium oxalate, sodium versenate) and there are other special tubes for shipping specimens to support labs for blood sugar, enzyme studies, or other tests.

TESTS

The reagents used in the tests described hereafter should be handled carefully to avoid contamination and undue exposure to air, moisture, light, fumes, or heat. Bottles should be recapped tightly immediately after each use and any special storage precautions stated on the labels should be strictly observed. Some of the reagents are especially subject to deterioration, and if the quality of any reagent is suspected, control tests on known samples should be performed to check its response and sensitiveness.

Copper Sulfate Specific Gravity Screening Tests for Recipients and Donors

a. Description

Test methods for rapidly screening potential blood donors as to their eligibility to give blood and for rapidly screening patients as to their need to receive blood. For emergency postattack medical care, the standard specific gravities have been set at the equivalent of 12.8 gm. of hemoglobin per 100 ml. of blood for donors and 7 gm. of hemoglobin per 100 ml. of blood for recipients.

b. Equipment and supplies

1. Cupric Sulfate, Pentahydrate, ACS, Special Reagent 170 gm.
2. Flask, Volumetric, 1 liter.
3. Pipette, Serological, 10 ml. (or 5 ml.)
4. Bottle, Stock Solution, 1 liter, with Stopper.
5. Flask, Volumetric, 100 ml.
6. Burette, 50 ml.
7. Thermometer, Chemical.
8. Bottle, Screw Cap, Prescription, 2 fl. oz. or 4 fl. oz.
9. Pipette, Dropping (Medicine Dropper).
10. Water, Distilled or Purified.
11. Funnel, Common, Laboratory.

NOTE:
Supplies not included in the PDH must be obtained locally.

c. Preparation of Test Solutions

1. Transfer quantitatively the contents of the bottle of copper sulfate (170 gm.) to the stock solution bottle. Adjust the temperature of the supply of distilled water to 25°C. (77°F.) and add exactly 1006.2 ml. of the water to the copper sulfate in the stock bottle, using the 1000 ml. volumetric flask and the serological pipette.

NOTE:
If a water temperature other than this is more convenient, directions provided on the copper sulfate bottle label may be used.

Stopper and mix until the crystals have dissolved and then rinse the original copper sulfate container and the volumetric flask with portions of the solution, returning all the rinsings to the stock bottle as quantitatively as possible. Again mix thoroughly. This solution is the *stock solution* of specific gravity 1.100.

2. Prepare two *test solutions* from the stock solution by measuring with the burette the following amounts of stock solution into the 100 ml. volumetric flask, in each case bringing to the mark with distilled water,

mixing thoroughly, and then transferring to properly labeled prescription bottles for use.

Donor Screening Solution (specific gravity 1.053) 52 ml. of stock solution diluted to 100 ml.

Recipient Screening Solution (specific gravity 1.0410) 40.0 ml. of stock solution diluted to 100 ml.

d. Testing Procedure

From a height of 1 cm. above the surface of the appropriate copper sulfate screening solution, allow a small drop of freshly drawn whole blood (preferably from finger puncture) to fall directly on the surface. The drop will break through the surface and penetrate 2 or 3 cm. into the solution. After the momentum of the fall is lost (within 5 seconds), note whether the drop of blood tends to rise or fall in the solution, or floats indifferently. This characteristic should be noted within the next 5 or 10 seconds, as after this period the specific gravity of the blood drop will change and the sample will eventually sink to the bottom of the bottle. If the drop rises at all during the 5 to 10 second observation period, it should be considered to be lighter than the screening solution being used. If the drop stops in its original downward descent, but does not rise, it should be considered to be of the same specific gravity as the solution. If the drop continues to fall without stopping, it should be considered to be heavier than the solution.

e. Interpretation

To be eligible as a donor, the blood sample must *sink* in the *donor screening solution,* indicating a blood specific gravity of more than 1.053 (nominal hemoglobin content of 12.8 gm./100 ml., or more).

To be eligible as a recipient, the blood sample must *float indifferently* or *rise* in the *recipient screening solution,* indicating a blood specific gravity of 1.0410 or less (nominal hemoglobin content of 7 gm./100 ml. or less.

f. Additional information

1. The same solution can be used for a number of tests before the specific gravity will be changed significantly. A good standard for limiting the number of tests per portion of copper sulfate solution is one test drop per each milliliter of original volume. Thus a 2 fl. oz. portion (60 ml.) should be used for 60 tests only and then discarded.
2. It should be emphasized that this specific gravity test using whole blood is a rough screening test only. Any other factors or indications pertaining to the eligibility of persons as potential donors or recipients should be carefully considered and given precedence over the findings from this test.

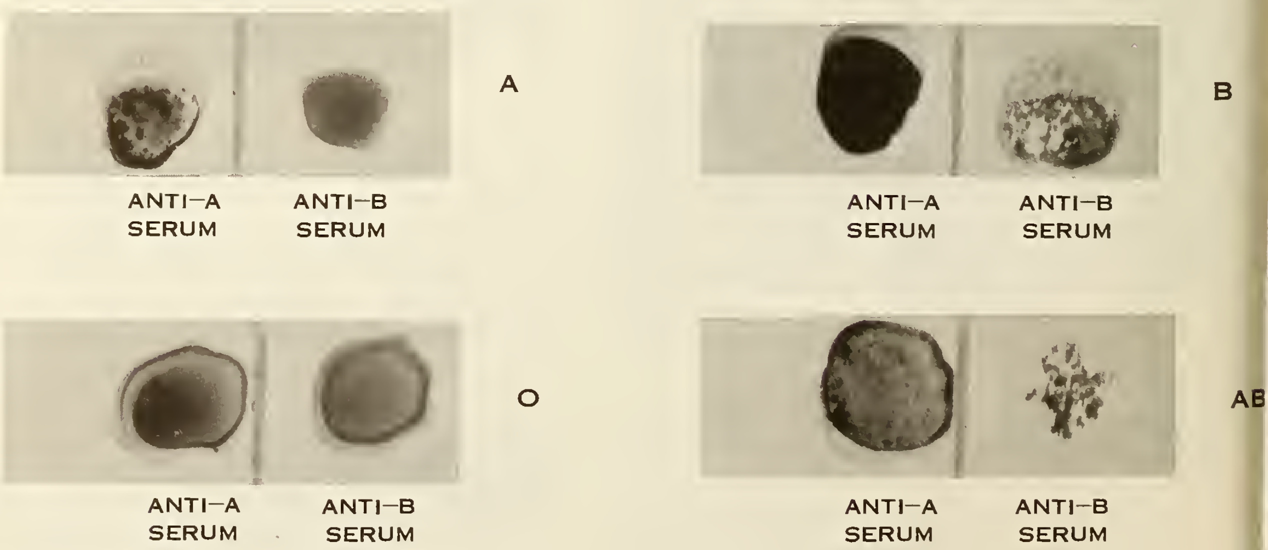


FIGURE 48—BLOOD GROUPINGS

A-B-O-Grouping

a. Description

The slide method described below can be used on fresh blood, blood containing anti-coagulant, or red cells from clotted blood. The use of the latter is described here. The group is determined by the reaction of the red blood cells to standard Anti-A and Anti-B sera.

b. Equipment and supplies

1. Applicator, Wood.
2. Blood Grouping Serum, Anti-A.
3. Blood Grouping Serum, Anti-B.
4. Pencil, China-Marking, Red.
5. Pipette, Dropping (Medicine Dropper).
6. Slide, Microscope.

c. Procedure for recipient blood

1. If the blood sample is fresh, allow to stand until clotting occurs.
2. Mark 1-inch squares on a microscope slide with a wax pencil and label "A" on left and "B" on right.
3. Thoroughly stir the clotted blood with a clean applicator stick to resuspend the cells in the blood serum.
4. Place a small drop of the cell suspension on each of the two squares marked on the slide.
5. On the *left* hand square place a large drop of Anti-A grouping serum, and on the *right* hand square place a large drop of Anti-B grouping serum. *The drop of grouping serum should be four times the size of the drop of blood used.*
6. Mix the cells and grouping serum with the clean end of an applicator stick for each square.
7. Rotate or incline the slide to keep the mixture moving for 2 minutes.
8. Observe for clumping of cells (agglutination) by naked eye.

NOTE:

The mixture must not be warmed as this may minimize or even reverse agglutination.

d. Interpretation

If agglutination occurs, distinct clumps will appear within a few seconds. Within 2 minutes, with continuous rotation, the clump should be 1 mm. in diameter. Report the blood group of the sample on the following basis:

No agglutination on either side: Group O

Agglutination with Anti-A serum only: Group A

Agglutination with Anti-B serum only: Group B

Agglutination with Anti-A and Anti-B sera: Group AB

e. Serum grouping (back typing)

If time permits, it is wise to confirm blood grouping techniques by the procedure called back typing, slide method. Use a flat slide and known Group A_1 and B red cells. (These may be locally available or may be acquired during blood banking operation). Place one drop of serum or plasma from the specimen being typed on the left and right sides of a glass microscopic slide. Add one drop of known A_1 cells to the drop of serum on the left side of the slide and one drop of known B serum on the right side of the slide.

Interpretation: If the interpretation was Group A in the foregoing procedure, the B cells on the right will be clumped by the serum from the specimen with Group A blood. Similarly, if the specimen was Group B in procedure outlined, there will be clumping of the serum on the left. In the case of AB blood there should be no clumping on either side. If the blood is Group O there should be clumping on both sides of the slide.

f. Confirmation of Group O blood

To verify Group O blood for emergency use without crossmatching, in order that the weakly reacting variants of A may be avoided, Group O serum, if available, should be used since all red cells except those of Group O are agglutinated by this serum. If Group O serum is not available, the test may be repeated by a second technician using the same Anti-A and Anti-B serum as was described in the foregoing procedure.

CAUTION:

Use extreme care in handling the grouping sera to avoid any possibility of contaminating one serum with the other.

Rh Typing

a. Description

The slide method described below can be used on resuspended clotted blood or blood containing anticoagulant. The type is determined by the reaction of the red blood cells to standard Anti-Rh$_0$ typing serum.

b. Equipment and supplies

1. Applicator, Wood.
2. Trouble Light.
3. Pipette, Dropping (Medicine Dropper).
4. Slide, Microscope.
5. Typing Serum, Anti-Rh, Anti–Rh$_0$ (D).

c. Procedure

1. If blood without anticoagulent is used, it must be allowed to clot before proceeding.
2. Thoroughly stir the clotted blood with a clean applicator stick to resuspend the cells in the blood serum. If anticoagulated blood is used, thoroughly mix this with its plasma.
3. Place a large drop of the cell suspension and a small drop of the typing serum side by side on a warm slide. *The drop of blood should be twice the size of the drop of typing serum used.*
4. Mix the cell suspension and typing serum thoroughly with the clean end of an applicator stick, spreading the mixture over an area of the slide.
5. Rotate or rock the slide to keep the mixture agitated for 2 minutes. During this process keep the slide warmed to 45°-50° C. by holding it close above a lighted lamp bulb.
6. Observe for clumping of cells (agglutination).

d. Interpretation

If agglutination occurs, distinct clumps will begin to appear in about 30 seconds and the reaction will be essentially complete in 2 minutes. Report the blood type of the sample on the following basis:

No agglutination: Rh-negative

Agglutination: Rh-positive

e. Additional information

1. Blood from donors giving a weak or questionable reaction should be considered as Rh-positive. Donor blood should not be called Rh-negative unless careful inspection at the end of 2 minutes reveals no indication of agglutination. (Approximately 85 percent of the population have Rh positive blood.)
2. A crossmatch test of Rh-negative recipient serum with that of the donor cells by the indirect antihuman globulin (Coombs) method is recommended if facilities for its performance are available.

Crossmatching

a. Description

A test tube method for determining the compatibility of the recipient's fresh serum with the donor's erythrocytes and the donor's serum with the recipient's erythrocytes, using the high-protein technique.

NOTE:
An excellent reference source is the manual, "Technical Methods and Procedures of the American Association of Blood Banks." Of particular interest to those who will be working in the PDH are "Crossmatching," page 91, and "Techniques for Compatibility Testing," page 96.

b. Equipment and supplies

1. Albumin, Bovine Serum, 30 percent.
2. Applicator, Wood.
3. Beaker, Laboratory, Glass, 400 ml.

4. Burner, Alcohol.
5. Centrifuge, Electric.

NOTE:
Illustrated information concerning the Centrifuge packed with many PDH's is given on page

6. Pipette, Dropping (Medicine Dropper).
7. Sodium Chloride Tablets, USP (for normal saline), 2.25 gm.
8. Test Tube, without Lip, 13 x 100 mm.
9. Timer, Interval.
10. Thermometer, Self-Indicating, minus 10° to plus 110° C.
11. Tripod.
12. Rack, Test Tube.

Procedure

1. Allow samples of donor's and recipient's blood to clot.
2. With a medicine dropper remove small amount of supernatant serum from donor's and recipient's clotted blood samples. Place each in a separate clearly marked tube.
3. Major side: Prepare a 2 percent suspension in physiological saline of cells from the donor's clotted blood sample. Into a clean test tube place one drop of 2 percent suspension of the donor's cells, two drops of the recipient's serum and three drops of 30 percent bovine albumin.
4. Minor side: Prepare a 2 percent suspension in saline of cells from the recipient's clotted blood sample. Into a clean test tube place one drop of 2 percent suspension of the recipient's cells, two drops of the donor's serum and three drops of 30 percent bovine albumin.
5. Make a preliminary check of each tube for agglutination. If clumping of the cells has already occurred in either of the tubes, incompatibility on that side is indicated and further testing of that tube is not needed.
6. Shake the tubes well and incubate at 37° C. for 10 minutes.
7. Centrifuge to pack the cells firmly (2,000 r.p.m. for 2 minutes in a small radius centrifuge head; lower speeds may be optimal in larger radius heads).
8. Gently agitate the tubes to dislodge cell packs. Observe to determine if agglutination has occurred. Apparent absence of agglutination should be verified by a microscopic examination of the cells.

d. Interpretation

Incompatibility as indicated by agglutination in this type of crossmatch may show either blood-group reaction or other antigen-antibody reaction. This test detects most incompatibilities, but certain possible reactions due to incomplete antibodies will be missed.

Incompatibility on the major side indicates the blood must not be given, *because a serious reaction would result.*

Incompatibility on the minor side is present when Group O blood is matched with recipient blood of other groups and when blood of Group A or B is matched with AB recipients. *The major side should be compatible in these cases.*

e. Pseudoagglutination

Pseudoagglutination (rouleaux formation) may be mistaken particularly by an inexperienced worker, for true agglutination. Under the microscope the cells look like rows of stacked coins. Rouleaux formation occurs most readily when there is too great a concentration of serum or when the reading is too long delayed. The addition of a drop of saline usually disperses rouleaux formation but not true agglutination.

f. Additional information

Detection of blocking antibodies • This procedure consists of adding to a suspension of washed cells a drop of anti-human globulin. See "Preparation of Washed Cells" following. The anti-human globulin coats the cells upon incubation at 37°C. After the globulin is attached to the red cell, this complex is thoroughly washed (3 times) to remove any excess anti-human globulin remaining in the suspension.

Another procedure, which appears impractical in an emergency situation, is for the detection of certain weakly reacting antibodies and consists of using enzymes such as papain or trypsin. Details of these procedures are outlined in the manual of the American Association of Blood Banks, but the time required for performing such elaborate tests as well as the availability of satisfactory reagents may limit the use of such procedures immediately following disaster.

Alternate procedure for major crossmatch

● In the absence of the availability of reagents, a major crossmatch by a tube test should be performed if at all possible.

1. Prepare an approximate 2% suspension of donor cells.
2. With a dropper, place two drops of the washed donor cells into a 13 x 100 mm. test tube and add to this two drops of recipient fresh serum. This suspension is incubated at 37°C for at least 15 minutes, preferably 30 minutes. The appearance on visual inspection of microscopic clumping indicates incompatibility and this blood is unsuitable for the prospective recipient. Invisible clumps may become apparent if a small amount of the two contents is placed on a microscopic slide and examined under the high power objective of a microscope.

Preparation of washed cells

1. Add 2 ml. of donor's blood to a clean 13 x 100 mm. test tube.
2. Add an equal volume of normal saline (0.85%).
3. Mix and centrifuge at approximately 2,000 rpm for two minutes.
4. Remove the saline.
5. Repeat steps 2-4 twice.

NOTE:

The label on the donor blood must show an identifying name or number and expiration date. The label should be clearly marked to show the blood group and Rh type of the blood contained in the bottle. If the manufacturer's label is the only one available, the necessary information must be clearly written on it in pencil or waterproof ink.

Hematocrit

a. Description

A determination of the percent of the total volume of a blood sample occupied by the red blood cells when packed by centrifugation (packed cell volume).

b. Equipment and supplies

1. Centrifuge (Electric with Hematocrit Head).
2. Isopropyl Alcohol.
3. Disposable Lancet, Finger Bleeding.
4. Pad, Gauze 2" x 2".
5. Microhematocrit Reader.
6. Sealing Compound.
7. Interval Timer.
8. Capillary Tube (Heparinized).
9. Capillary Tube (Nonheparinized).

c. Procedure

1. Fill two heparinized capillary tubes about ⅔ full with fresh blood obtained from the patient's finger. Venous blood with an added anticoagulant may be used for this test if desired, in which case plain nonheparinized capillary tubes are used.
2. Seal one end of each tube (the end opposite from the blood) by plugging it with sealing compound or by passing it through a small flame to fuse the glass.
3. Place the tubes in the centrifuge head with the open ends toward the axle.
4. Centrifuge for 5 minutes at top speed.
5. Obtain a reading of the hematocrit value by measuring the height of the packed red cell volume compared to the total volume by the use of the microhematocrit reader. This gives the result directly in percent by volume.

d. Interpretation

Report the volume percent of the packed red blood cells to the nearest unit.

Normal:

Men	42% to 54%
Women	36% to 48%

Leukocyte (White Cell Count)

a. Description

A method for determining the number of white cells (leukocytes) per unit volume of blood by using a microscopic counting technique after diluting the blood with a fluid which hemolyzes the red cells (erythrocytes).

b. Equipment and Supplies

1. Chamber, Counting, Hemacytometer.
2. Cover Glass, Microscope Slide, Hemacytometer.
3. Acetic Acid, Glacial 3%.
4. Isopropyl Alcohol.
5. Microscope.
6. Needle, Hypodermic, 20 gauge, 1½".
7. Pad, Gauze, 2" x 2".
8. Pipette, Blood Diluting, White Corpuscle.
9. Pipette, Blood Diluting, Red Corpuscle.
10. Syringe, Luer, 10 ml. or Lancet, Finger Bleeding.

c. Procedure

1. Draw fresh blood directly from a finger puncture of the patient exactly to the 0.5 mark in a white cell pipette. If desired, venous blood with an added anticoagulant may be used in this test as a substitute for fresh blood.
2. Wipe off any blood adhering to the outside of the pipette tip with gauze.
3. Draw 3% acetic acid diluting fluid into the pipette to bring the total volume to the 11.0 mark. This will provide a 1:20 dilution of the blood in the bulb of the pipette (a dilution factor of 20).
4. Seal off the ends of the pipette with the fingers and shake for 3 minutes to mix the contents.
5. Expel and discard the first few drops from the pipette.
6. Place the hemacytometer cover glass over the ruled platform of the counting chamber. Fill both chambers of the hemacytometer by holding the pipette with the tip at the edge of cover glass and allow a drop of diluted blood from the pipette to run by capillary attraction under the cover slip without any forcing. The drop must be large enough to cover the platform and yet not so large that it runs into the moat.
7. Wait for three minutes to allow the cells to settle.
8. Using the microscope under low power, count the number of leukocytes in the four large corner squares (each of which consists of 16 smaller squares). Begin counting at the extreme upper left of each large square and work to the right, then down to the next line and work to the left. Continue back and forth until the leukocytes in all 16 small squares within each of the large corner squares are counted. Count those cells touching dividing lines to left and above and omit those touching dividing lines to the right and below.
9. Add together the number of white cells counted in all four large squares and multiply by 50.
10. Repeat the counting procedure, steps 8 and 9, for the second chamber and average the two results. This value is the white cell count per cubic millimeter.
11. If the white cell (leukocyte) count as determined above is less than 2500, repeat the entire procedure, steps 1 through 10, except in step 1, draw blood to the 1.0 mark of the white cell pipette instead of the 0.5 mark, and in step 9, use a multiplying factor of 25 instead of 50.
12. If the white cell (leukocyte) count is markedly elevated (as in many patients with acute infections), use the red cell pipette in place of the white cell pipette in making the dilution in step 1. If blood is drawn to the 0.5 mark with this pipette (and the diluting fluid is added to the 101 mark), the multiplying factor for use in step 9 is 500. If, in using the red cell pipette, blood is drawn to the 1.0 mark and the diluting fluid is added to the 101 mark, the multiplying factor for use in step 9 is 250.

d. Interpretation

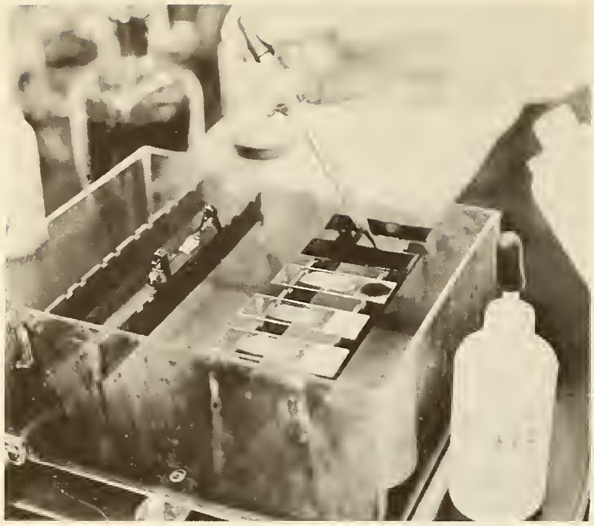
White blood cell (leukocyte) count: Report the number of cells per cubic millimeter as determined above.

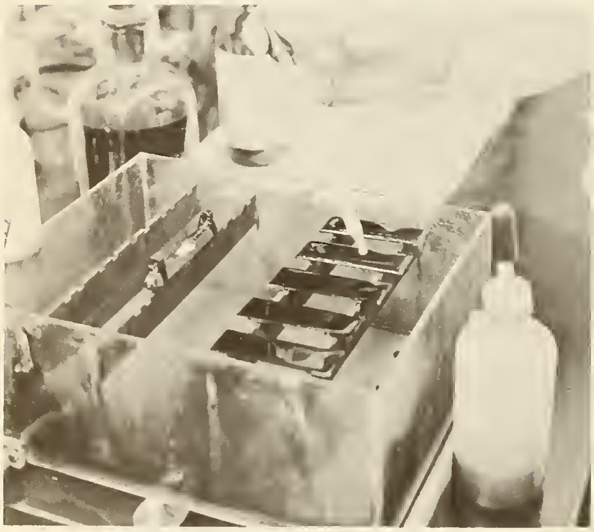
Normal: 5,000 to 10,000/cu. mm.

e. Additional Information

1. The large corner squares of the ruling on the hemacytometer are exactly 1 mm. square. The depth of the chamber is 0.1 mm. Accordingly, the general formula for determining the multiplying factor for use in step 9 of the procedure above is:

$$\frac{\text{Dilution factor}}{0.1 \times 1 \times \text{number of squares counted}}$$





2. The pipette, hemacytometer, and cover glass must be scrupulously clean and dry before being used. In cleaning the pipette it is advisable to partially fill it with detergent solution and agitate thoroughly. Then rinse with tap water, distilled water, and acetone in order, followed by thorough drying. As a substitute for acetone, alcohol followed by ether may be used. All equipment should be cleaned as soon as possible after each use.

Differential Leukocyte (White Blood Cell) Count

a. Description

A method for determining the percentages of the various types of white cells present in blood by a microscopic count of these cells in a stained blood smear.

b. Equipment and Supplies

1. Staining Rack (This may be fashioned from materials found in the PDH or from supplies procured locally.)
2. Immersion Oil.
3. Isopropyl Alcohol.
4. Finger Bleeding Lancet.
5. Microscope, Monocular.
6. 2″ x 2″ Gauze Pad.
7. Pipette, (Medicine Dropper).
8. Slide, Microscope.
9. Interval Timer.
10. Water, Demineralized or Distilled.
11. Wright's Blood Stain Kit (Consists of Tablets and Methyl Alcohol).
12. Qualitative Filter Paper.

c. Procedure

1. Transfer a small drop of fresh blood from the patient, obtained by finger puncture, to the center of one half of a clean microscope slide.
2. Hold one end of another slide (spreader) above the first at an angle of 30 to 45 degrees. Touch the drop of blood with the end of the spreader so that the drop is within the angle formed. Attempt to move the slide before the blood has run out to touch the edges to produce a margin-free slide as the slide is pushed in the opposite direction. Move the upper slide slightly so

that capillarity will spread the blood along the end of this slide. Then move the angled slide in the opposite direction, spreading the blood over the first slide in a thin film. Dry the film by waving the slide in the air.

3. Add from pipette sufficient Wright's staining solution to completely cover slide and allow to stand 1 to 2 minutes. (Staining time will vary with each batch of Wright's staining solution and should be adjusted to obtain a distinctive coloring of the cells.)

4. At the end of the 1 to 2 minute period, add an equal volume of demineralized or distilled water to the staining solution on the slide. Gently blow the surface to mix the stain with the water and allow to stand for 3 to 4 minutes. (Ideally a buffer solution with pH 6.8 is desirable. If the distilled water on standing becomes too acid, poor staining will result.)

5. Wash the diluted stain off the slide by flooding with demineralized or distilled water.

6. Air dry the slide, wiping excess stain from back side.

7. Examine under the microscope using the oil immersion objective and count the number of the various types of leukocytes present by following a definite path, moving the slide up and down, and from right to left in an orderly fashion. A large area of stained film should be examined to obtain a representative count. In general, for leukocyte counts up to 10,000 per cubic millimeter classify 100 cells. For each increase of 5000 in the total count classify an additional 100 cells up to a maximum of 500. Leukocytes are to be classified as neutrophils, lymphocytes, monocytes, eosinophils, and basophils.

d. Interpretation

An interpretation should include at least 100 white cells tabulated by types in percent. In addition, each report should attempt to evaluate the morphology of red blood cells noting alteration in size, shape and color. An estimate of the number of platelets should also be made and reported as normal, increased, or decreased. Unusual cells should be described.

e. Additional information

1. The Wright's staining solution used in this determination is prepared from the Wright's Stain Kit included in the PDH. The tablets provided in the kit are dissolved in the methyl alcohol furnished in the proportion of 1 tablet to 10 ml. of methyl alcohol.
2. A staining rack may be fashioned with materials found in the PDH or procured locally. See Photo on Page 190.

BACTERIOLOGY

The PDH laboratory provides limited supplies for staining and identification techniques. It has no facilities for culturing. Staining of direct smears is limited to Loeffler's Methylene Blue. If a bacteriologist is available postdisaster, the capability of the PDH laboratory can be expanded in this area as operational conditions permit and as supplies from outside sources become available.

COLLECTION AND PREPARATION OF SPECIMENS

Although a wide variety of materials can be examined microscopically by the stained smear technique, the collection of only a few kinds of samples is described here because of the limited capability of the PDH laboratory in this field.

Pus is collected from ulcers or surface wounds by the *swab* technique, using a cotton-tipped applicator stick to pick up quantities of the exudate. The swab is then inserted in a sterile test tube for delivery to the laboratory.

Pus from subsurface infections is usually collected by aspiration with a sterile syringe and needle after first cleansing the skin around the infection with an antiseptic. The aspirated material is then expelled into a sterile test tube and the mouth of the tube closed with a loose plug of cotton.

Sputum samples are collected directly in sterile wide-mouth glass jars with suitable closures. The patient should be instructed to avoid contaminating the outside of the container when collecting the specimen. The jar is then capped for delivery to the laboratory.

To prepare a smear for staining, transfer a portion of the specimen to a microscope slide with a wire inoculating loop previously sterilized by heating in an alcohol burner flame. Spread the material over a large area in the center of the slide with the loop, adding more of the specimen as required to obtain an even film of moderate thickness. Dry the film by waving the slide, with the specimen side up, back and forth through an alcohol burner flame several times. The slide should become warm during this procedure, but not enough so to char or discolor the smear. Allow the slide to cool before staining.

Loeffler's Methylene Blue Stain Smear Examination

a. Description

A general stain suitable for the morphological study of many organisms. The polychrome staining properties cause it to stain the granular portions of certain bacteria purple and the remainder of the cell body a light blue.

b. Equipment and Supplies

1. Cover Glass Forceps.
2. Microscope, Monocular.
3. Loeffler's Methylene Blue Staining Solution.
4. Immersion Oil, Microscopy.
5. Qualitative Filter Paper.

c. Procedure

1. Cover the heat-fixed smear with the methylene blue staining solution and allow to remain for 1 or 2 minutes.
2. Wash the slide thoroughly by flooding with water to remove excess stain, and blot dry with filter paper.
3. Examine under the microscope using the oil immersion objective.

d. Interpretation

Report the types of organisms observed, based on their morphological appearance.

THE PDH MICROSCOPE

A microscope is included with the PDH laboratory equipment for use in certain blood and urine tests and for bacteriological work. A number of different makes and models of microscopes are included in various PDH's. All microscopes are of the monocular type, equipped with a revolving nose piece and three objectives, one or more eyepieces, a movable stage, a substage condenser, and lamp. A detailed instruction book is packed with each microscope.

The specimen to be examined is first mounted on a slide and overlayed with a cover glass as directed in the procedure for the specific test being performed. The slide is then placed on the stage of the microscope and held in place by stage clips or other device, with the specimen centered over the stage opening. The low-power objective (the shortest of the three objectives) is rotated to line up with the microscope tube and an approximate focus is obtained by rotating the coarse adjustment. Use the plane mirror to reflect light from the lamp (placed a few inches away) through the condenser and specimen while focusing. Center the area of the specimen to be examined in the field and shift to the proper higher power objective by rotating the nose piece, unless a low power examination is called for.

Adjust the illumination by focusing the condenser up or down, by opening or closing the iris diaphragm, and by moving the lamp or mirror. Obtaining proper illumination is a matter of technique which improves with practice. Best illumination is achieved when the following two conditions are met:

1. The field of view is evenly illuminated.
2. The upper lens of the objective is just filled with light when observed after removing the eye piece from the microscope tube.

In using the low power objective, the plane mirror and condenser can be used, or the condenser can be swung out of the optical path (or removed) and the plane or concave mirror employed, whichever is found to be most suitable for the specimen under study. With the low power objective, daylight from a north window can be used as a source of illumination (instead of the lamp) if desired.

For the medium power (high-dry) objective, the condenser must be used to completely fill the field with light. Either the plane or concave mirror can be employed depending upon the type of light source and the amount of light required.

When using the high power (oil immersion) objective, the lamp, condenser, and plane mirror must be used. A drop of special immersion oil must be placed between the objective and cover slip. The lighting for the high power objective can be further improved (if required) by using immersion oil between the slide and the top lens of the condenser.

The final adjustment of lighting can be made by using suitable filters in the lamp or condenser, after which the final adjustment of the focus is accomplished by rotating the fine adjustment knob on the microscope.

In the handling and use of the microscope, certain special techniques should be employed and certain precautions must be observed in order to obtain maximum usefulness from the instrument and to insure its continued functioning. The following suggestions are offered for those who have had limited previous experience in working with this instrument:

1. The microscope is a delicate optical instrument. It should be handled carefully. Avoid jarring and sudden shocks.
2. When moving the microscope, pick it up by the arm, never by any other part. Use the other hand to support the base while carrying the instrument.
3. Keep the microscope covered when not in use. Keep the eyepiece and objectives in the microscope to prevent dust from entering the tube. Store the microscope in a cool, dry place.
4. Clean lenses only with lens tissue or a soft lint-free cloth, after a preliminary dusting to remove coarse particles. Lens tissue may be moistened with distilled water or xylene, if necessary. Xylene is particularly useful for removing grease or dried immersion oil, but it should be used sparingly and as quickly as possible because it will dissolve the lens mounting cement in some microscopes.
5. Never disassemble any of the lens systems. Clean only the exposed surfaces of the ocular, objectives, condenser, and mirror systems, and these only when necessary. Do not touch the lens surfaces with the fingers.
6. Always use a cover glass over a specimen on a slide.
7. Do not hold the coarse adjustment knob while rotating the fine adjustment knob.
8. Always start the examination of a specimen with the low power objective to obtain centering and approximate focus before shifting to a higher power objective.
9. When focusing with either of the two high power objectives, be careful not to lower the objective so that it strikes the slide.
10. In using the oil immersion objective, the usual procedure is to apply a small amount of special immersion oil or cedarwood oil to the slide. Lower the objective carefully with the coarse adjustment until contact is made with the oil on the slide, as indicated by a flash of light illuminating the oil. Then obtain the final focus with the fine adjustment only. Clean all traces of oil from the lens with lens tissue immediately after the completion of work.
11. The substage diaphragm is not intended for the control of the intensity of illumination. If the field is too bright, use one or more neutral (uncolored) filters in the light path or move the lamp away from the microscope.

CENTRIFUGE

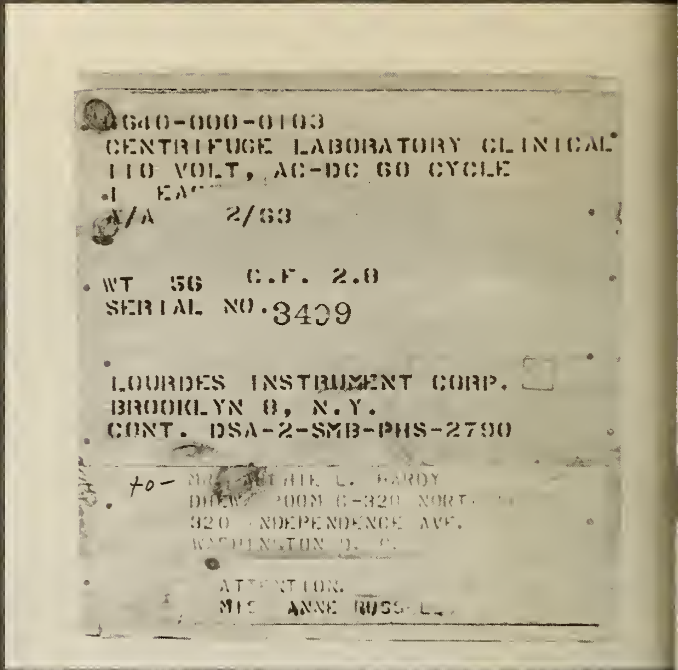
FEDERAL STOCK NUMBER: 6640-689-6999 (6640-000-0103)

FEDERAL NOMENCLATURE: CENTRIFUGE, ELECTRIC, CLINICAL MODEL

This centrifuge is wired for operation on 110–120 volts, 60-cycle, AC or DC, and is supplied with a three-pronged plug for use with a grounded system and an adapter for use with other standard outlets. For grounding instructions, see page 57, Step 4. Operation of the centrifuge will be briefly discussed in order to adequately explain its assembly.

STEP 1:

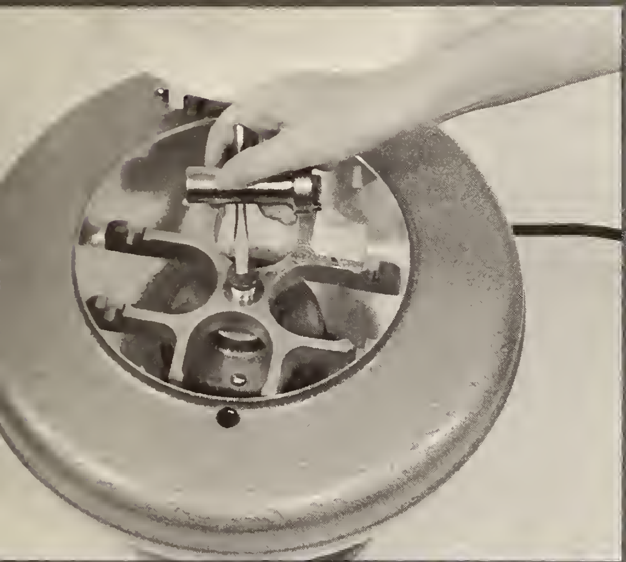
A. Open wooden box with hammer and screwdriver from hospital toolbox. Unpack components.



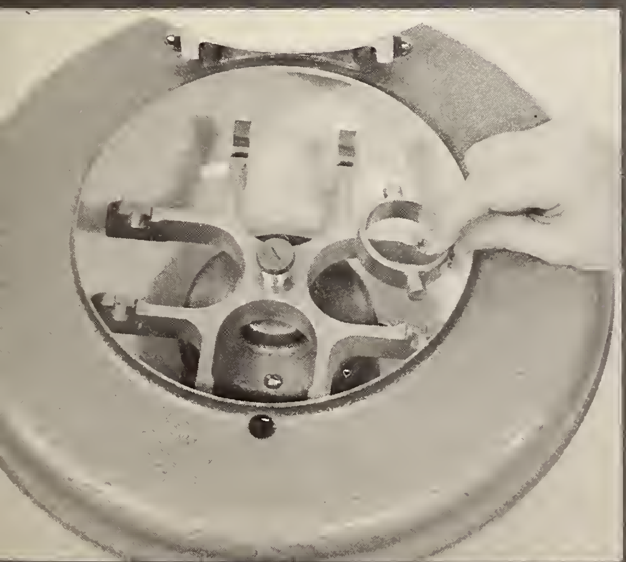
B. Check components against the following list: **(a)** centrifuge, **(b)** trunion head and nut, **(c)** rotor removal wrench, **(d)** trunion rings, **(e)** four-hole adapters, **(f)** hematocrit rotor, **(g)** hematocrit rotor cover, **(h)** gasket for hematocrit rotor, **(i)** rubber cushions for use in four-hole adapters. Also included is a Spiracrit Reader **(j)**.

STEP 2:
TO USE WITH TRUNION HEAD:

A. Place trunion head (b) over motor shaft extension inside centrifuge bowl (a).

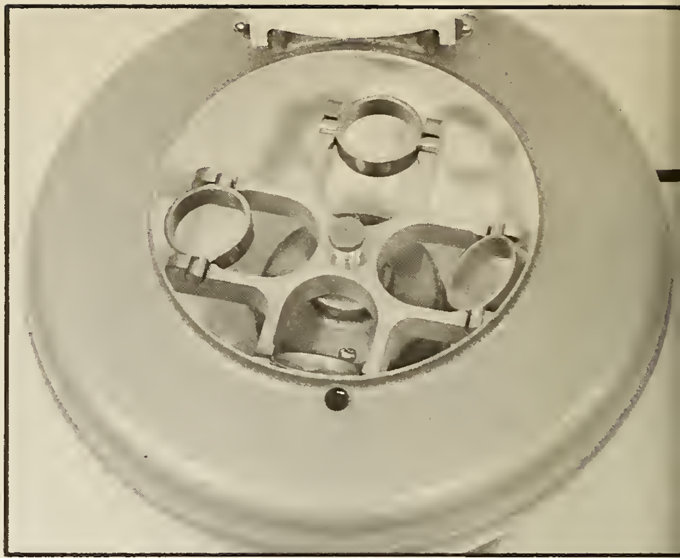


B. Place nut (b) over fitting in center of trunion head (b) and tighten with wrench (c).

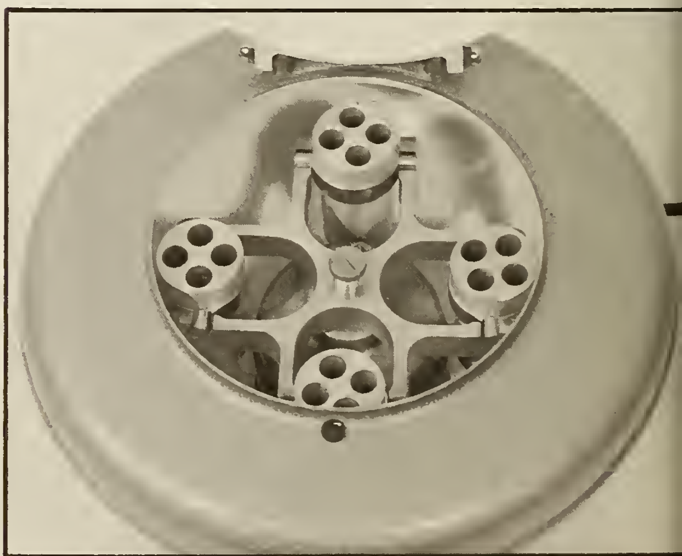


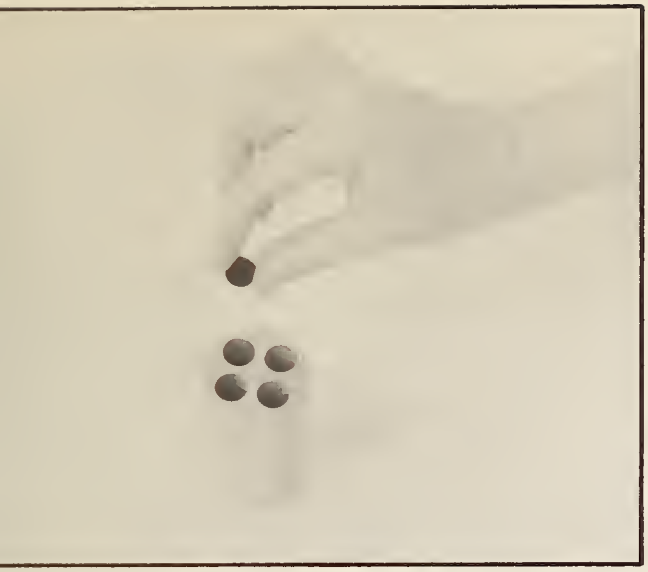
C. Trunion rings (d) fit in slots in trunion head (b).

D. Position four trunion rings in slots. When operating centrifuge, all rings must be filled in order to properly balance load.

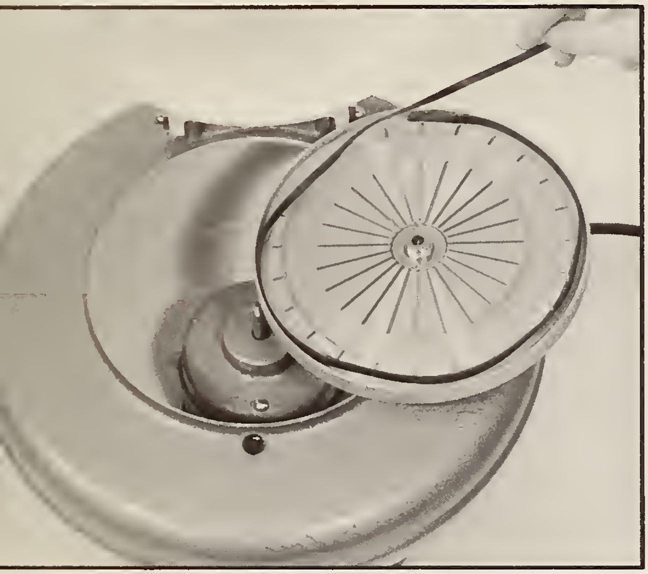


E. Adapters (e) are dropped into trunion rings (d), holes up. Drop all four adapters into place to properly balance load.



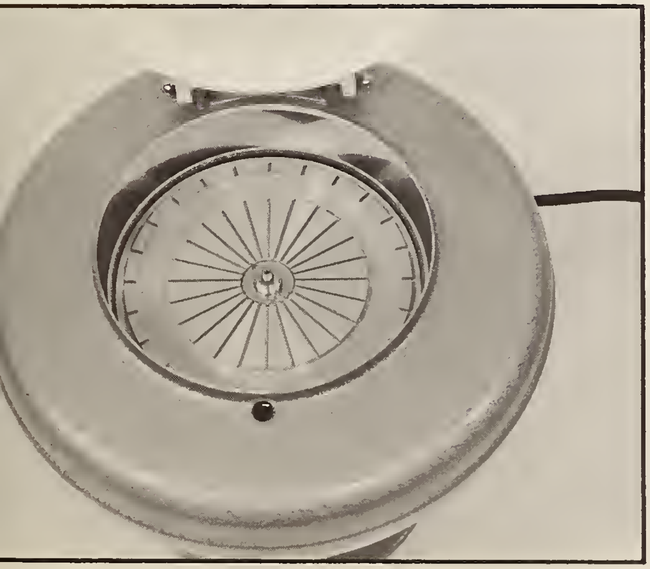


F. Before tubes are placed into holes in adapters (e), it is necessary that a cushion (i) be placed in each hole. This prevents breakage of tubes.



STEP 2A:
TO ATTACH HEMATOCRIT ROTOR

A. Gasket (h) is cut to fit inside wall of rotor (b). Ends must meet. Gasket is attached to wall by applying a thin coat of silicone grease on the side of the gasket touching the wall. Silicone grease is not included in the PDH.



B. Lower rotor (b) into centrifuge bowl (a), over motor shaft.

C. Lower rotor cover (g) over rotor (b).

D. Fit projections on wrench (c) into two holes in rotor cover (g) to tighten.

NOTE: *With the exception of A, all of Step 2A is followed only after the hematocrit rotor is ready for use.*

TO BE OBTAINED LOCALLY:
Silicone grease.

ORGANIZATION OF THE CENTRAL STERILE SUPPLY SECTION

An area of approximately 700 square feet is required for the central sterile supply section. Figure 50, page 203 , is a suggested layout for this section. If more than one room is used, they should be adjacent. If one room is used, it should have two entrances so that one can be used for receiving soiled and contaminated materials into the preparation subsection and the other can be used for issuing sterile supplies from the sterilization subsection.

Because open flame burners are in use in this section, it should be located a safe distance from the operating rooms to reduce explosion hazards from anesthesia agents.

If possible, the central sterile supply section should be located near general stores because all clean linens will be stored there and central sterile supply frequently will requisition linens to sterilize for use in the operating rooms. Because central sterile supply cannot operate without water, the section should be set up in an area which has a sink with running water. If the operating site of the PDH is in a school building which has a home economics room, this is a good location for central sterile supply because it is equipped with sinks, stoves, counter work space, cabinets and drawers. The counter space will serve as tables and the cabinets and drawers will provide excellent storage space for the preparation subsection.

When the PDH is activated as an independent hospital, high priority must be given to setting up the central sterile supply section. Surgery cannot be performed until sterile supplies are available and there will be immediate need for these in receiving and sorting and in other treatment sections. Also, it may take longer to set up this section than some others because of the time involved in handling large quantities and varieties of supplies and putting the sterilization equipment into operation. Therefore, central sterile supply must be set up as soon as the PDH arrives at the operating site. It is suggested that the section be divided into two subsections: preparation and sterilization.

Preparation Subsection ● This subsection must have a water supply, so it should be set up in an area with a sink. Items to be sterilized are received, sorted, cleaned, assembled, inspected, wrapped and labeled for sterilization here. On request from surgery, packs, trays and sets are also made up and labeled.

The preparation subsection needs storage space for cleaned supplies and instruments. When the hospital is in operation, soiled instruments will be cleaned promptly and stored until requisitions for sterile items are received. Then the cleaned items will be taken to the sterilization subsection.

Sterilization Subsection ● In this subsection assembled packs and individual items are sterilized, stored and issued as needed to the areas of the hospital requesting them. Sterilizers are furnished in all PDH's. Pressure and boiling water sterilizers, or a combination of the two, are supplied. While other sections of the PDH may also operate boiling water sterilizers, the bulk of all sterilizing will be done in this area.

The sterilization subsection needs only table space for sterile storage. The PDH has a limited inventory of instruments and supplies, which means that sterilization will be done for actual, rather than possible use. Permanent hospitals, on the other hand, have large inventories and can store quantities of sterile packs, sets and trays for many days in anticipation of possible use. In the PDH the physician in charge of assigning priorities to surgical patients will provide the central sterile supply chief with surgery schedules as far in advance as the situation permits. Packs, trays and sets will be made up and sterilized according to these schedules.

When the section is set up in an area without storage cabinets, storage space can be improvised by arranging PDH boxes in layers along one wall; in the center of the room, if it is large enough; or, a nearby storage closet can be used.

Environment ● Good ventilation is essential in this section. The gasoline burners will cause some fumes and when the large free-standing sterilizer, Federal Stock Number 6530–781–3683, packed with many PDH's, is heated with a gasoline burner it must have a piece of stove pipe to vent the fumes out of the building. It is desirable that the room, or rooms, used for central sterile supply have more than one window.

Nurses must impress upon volunteers and helpers the high degree of cleanliness that is standard for the central sterile supply section. A thorough daily cleaning of all table tops, sinks, and other work areas is essential, along with the proper maintenance of all mechanical equipment used in the processing of supplies. Cleaning service provided by housekeeping personnel must be diligently supervised. All routine cleaning should be performed at a time when it will least conflict with the work of the section's personnel.

Also stress to non-medical assistants: In the continuing battle against microorganisms, the primary problems are created by people rather than supplies. Central sterile supply personnel have an obligation to maintain a high standard of personal hygiene and to exercise continuous care in handling contaminated materials for the safety of the patients and the personnel.

Furnishings ● The furniture for the central sterile supply section must be obtained locally. If sufficient tables are not available, they can be improvised with PDH packing boxes and crates. A table with casters, if available, will reduce handling in the preparation subsection. The subsections should have the following furnishings:

a. Preparation Subsection

   Sink with running water

   2 cleaning tables near sink

   2 cleaned equipment tables

   4 preparation tables

   4 supply tables for items awaiting cleaning and wrapping

b. Sterilization Subsection*

   5 tables for pressure sterilizers

   3 tables for boiling water sterilizers

   * PDH's containing the one large free-standing sterilizer and one table model require only one table.

INITIAL DISTRIBUTION OF SUPPLIES AND EQUIPMENT TO THE SECTION

The sterilizing equipment and supplies for the central sterile supply section, and all PDH equipment and supplies which require sterilization before use in other sections, should be delivered to central sterile supply when the PDH is moved to the operating site. Arrangements should be made, predisaster, with receiving and sorting personnel, for sterile supplies needed in that area immediately upon PDH activation.

While such items as needles, syringes, surgical gloves, catheters, etc. are available in disposable form, postdisaster conditions preclude the use of disposable items in a PDH. They are considered impractical because of overall procurement costs, the marked increased storage requirements, and the potential postattack resupply problems.

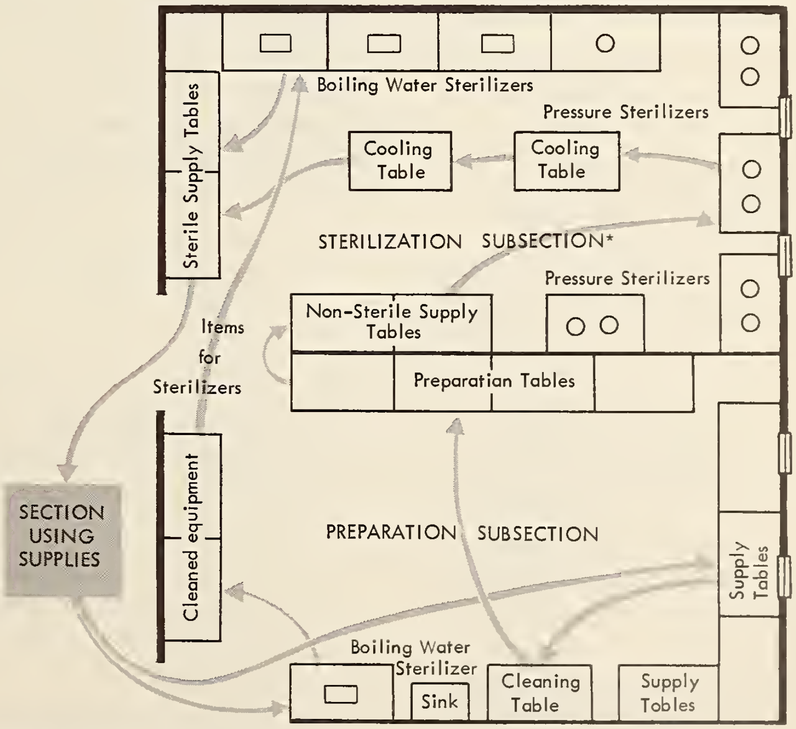
Disposable supplies were developed for normal hospital operation. In selecting PDH supplies the assumption had to be made that resupply of expended disposable materials may not be possible for many months following an enemy attack because of destroyed stocks and an immediate halt in manufacturing. The increased use of disposable items in modern hospitals and the resulting decrease in inventory levels of reusable items further complicates the postattack resupply problems. Accordingly, the PDH is stocked with reusable supplies wherever practical, assuring their availability for an extended period of time.

To reduce long-term storage space requirements, some unrelated PDH supplies are packed in the same box. For instance, a box of laboratory equipment may contain one or more items intended for general stores; a box of surgical supplies, which will be delivered to central sterile supply for sterilization before use, may have a few items which are intended for ward use without sterilization. During the activation of the PDH the hospital administrative staff should provide for the immediate pick-up of these miscellaneous items from each PDH section and delivery of them to the proper sections.

FLOW OF SUPPLIES AND EQUIPMENT WITHIN THE SECTION (FIGURE 50)

Preparation Subsection ● Supplies to be cleaned are placed on the *cleaning tables* near the sink. These items are thoroughly cleaned, scrubbed with detergents or solvents, and dried.

The cleaned supplies are placed on the *cleaned equipment tables.* From there the cleaned supplies are moved either directly to the sterilization subsection *nonsterile supply tables,* or to the preparation tables to be assembled into packs and wrapped. Wrapped packs are placed on the *nonsterile supply tables* in the sterilization subsection.



* When using horizontal pressure steam sterilizers only one table is needed for sterilization equipment. The larger sterilizer stands on floor.

FIGURE 49

Suggested Layout for Central Sterile Supply Section

All treatment sections of the hospital must return promptly to central sterile supply all reusable items for sterilization after each use. These items will be routed through the preparation area in the above manner before sterilization.

Sterilization Subsection ● Figure 50 shows the sterilization subsection set up with portable pressure sterilizers and boiling water sterilizers, equipment provided in some PDH's. In other models, these sterilizers are replaced with two pressure sterilizers, one table model and a free-standing horizontal model.

Individual cleaned supplies which are not wrapped in packs are taken from the *cleaned equipment tables* in the preparation subsection to the boiling water sterilizers, or to the table model pressure sterilizer. Wrapped packs are taken from the *nonsterile supply tables* to the portable pressure sterilizers, or to the large horizontal sterilizer, depending upon the PDH model.

The subsection supervisor directs the sterilization of supplies and coordinates the use of the sterilizers for individual items and packs as the situation requires.

After sterilization, wrapped packs and dressing drums are placed on the *cooling table* until dry. Tables with metal tops, if available, will permit greater air circulation for the dressing drums. Dry sterile supplies should be stored on the *sterile supply table* until requisitioned.

ORDERING SUPPLIES AND EQUIPMENT WITHIN THE PDH

It is advisable that any section of the hospital needing sterile supplies and equipment send a requisition for them to the central sterile supply section. A similar procedure should be set up for ordering supplies from the general stores section and the pharmacy.

Printed requisition forms are not furnished with the PDH because their use is optional. Pads of unruled paper, which can be used for requisitioning supplies, are furnished. If parent hospital administration decides to use a requisition form similar to the sample shown on page 24 , a quantity should be printed locally, predisaster, and stored with the PDH.

Requisitions should be made out in triplicate. A carbon copy should be retained by the section ordering supplies and the original requisition and second carbon copy should be forwarded to the supply section. The original is retained by the supply section and the carbon copy is returned with the supplies.

If the supplies are not available, the requisition is returned to the originating section. The requisition should indicate that the section may either reorder at a specified time or that the supplies in question are not available at all.

Packages of carbon paper are furnished with some PDH's. Hospitals having other PDH's should obtain carbon paper locally and store it, or obtain used carbon from the receiving and sorting section when the hospital is in operation. Triplicate carbon interleafed index cards are furnished for that section and after the cards are filled out the carbon paper can be used by other sections.

STAFFING

Personnel ● Central sterile supply, like other PDH sections, will operate initially on two 12-hour shifts. The following staff of 11 is suggested for each shift: a central sterile supply chief, a preparation subsection supervisor, a sterilization subsection supervisor, 5 trained aides and 3 helpers. If possible, all should participate in the predisaster PDH planning.

The section chief will oversee the activation of central sterile supply and directs its operation. The chief should be a professional nurse, or a practical nurse experienced in surgical and sterilization techniques. The chief is responsible to the hospital chief of staff for the management of central sterile supply, including the scheduling of preparation and sterilization of supplies for treatment areas, for organizing and coordinating all activities, and for directing the subsection supervisors. Upon activation of the PDH, the section chief:

a. Organizes the arrangement of the subsections, including furniture and equipment, as soon as the PDH is moved to the operating site.

b. Assigns the subsection supervisors and other personnel to their respective areas of responsibility.

c. Supervises the uncrating, sorting, setting up and storage of all equipment and supplies.

d. Directs the setting up and activation of the sterilizers and stoves.

e. Coordinates and supervises the selection of instruments for packs, trays and sets; directs the preparation and sterilization of all instruments and supplies.

f. Schedules the preparation of supplies for the operating rooms, using the schedule of operations received from the physician responsible for assigning priorities to surgical patients.

g. Establishes priorities for the distribution of supplies to treatment sections upon receipt of requisitions.

h. Reports on the situation in central sterile supply to the hospital administrator and requests additional personnel as needed.

In addition to the two subsection supervisors, the suggested initial staffing pattern, page 11, for this subsection calls for five trained aides and four helpers. Aides and volunteers should be familiar with cleaning instruments and should know how to prepare packs. All personnel assigned to the central sterile supply section should be instructed in the operation of pressure and boiling water sterilizers and stoves.

PREPARATION FOR STERILIZATION

All central sterile supply personnel must be familiar with the assembly and operation of the specific sterilizers packed with the PDH to which they are assigned. Assembly instructions are outlined on page 217.

In addition to PDH orientation offered as a part of Red Cross training programs, volunteer aides assigned to central sterile supply should become familiar with equipment operating procedures for the PDH with which they will be working and with the preparation of surgical instruments and other supplies for sterilization.

The information contained here will be of interest to nurses who are not familiar with PDH sterilization equipment, and who are not regularly involved in hospital sterile supply duty, but will be of special benefit to aides and volunteers.

CLEANING

Materials for Cleaning • The following materials for cleaning instruments and supplies will be needed on the cleaning tables; those not furnished in the PDH will have to be obtained locally and stocked during the PDH utilization planning period.

Paper towels

Surgeon's brush

Gauze

Detergent

Glove dusting powder

Huck hand towels are furnished in PDH's and will be stocked in general stores. Some should be requisitioned for the preparation subsection. Cloth toweling by the yard, is available in some PDH's.

Cleaning Instruments After Unpacking • Because the PDH has been packed for long-term storage, many instruments are coated with oil or other preservatives. Before these instruments can be sterilized this coating must be removed. When the instruments are delivered to central sterile supply they will be placed on the *cleaning tables.*

The coating can be removed by washing the instruments in hot water at 149 degrees to 180 degrees F., or by scrubbing in warm water with detergent. Nonflammable and nontoxic commercial solvents, such as trichloroethylene, may be used to clean instruments. Solvent, however, must be thoroughly washed off instruments before they are sterilized. Flammable commercial solvents must *never* be used.

Caution • *There is always the possibility that people cleaning instruments may nick their skins; breaks in the skin can be easily infected by contaminated instruments. As a precautionary measure, soiled instruments from surgery should be boiled before cleaning. This preliminary boiling will reduce the hazard of infection from bacteriologically contaminated instruments. Some PDH's have boiling water sterilizers, one of which should be placed in the receiving area of the preparation subsection for this purpose. In other PDH's, a one-burner alcohol stove and pan for boiling water can be used.*

All instruments should be processed promptly after use. If this has not been possible, and soil and blood have dried, they should be soaked. The following steps are taken to process soiled instruments.

a. Rinse with cold water.

b. If necessary, soak in warm water and detergent at 125 degrees F.

c. Boil soiled surgical instruments in water for 20 minutes.

d. Wash with detergent and warm water. Use a hand brush to scrub all exposed parts, hinges, stopcocks and other crevices.

e. Rinse with hot tap water.

f. Dry with a towel while the instruments are still hot. Unless the instruments are thoroughly dried they will rust, corrode, or be spotted with water marks.

g. Place on *cleaned equipment table* or *preparation table.*

Cleaning Needles • Used needles, like instruments, should be cleaned prior to sterilization to reduce the hazard of infection from bacteriological contaminations.

a. Rinse in cold water.

b. Presterilize by boiling for 20 minutes.

c. Remove and soak in cool water and rinse.
d. Thoroughly flush with warm water and detergent. Clean hub with an applicator.
e. Rinse by flushing with three separate rinses. *Some moisture must be present in the needles if they are to be sterilized by steam.*
f. Place on *cleaned equipment table* or *preparation table.*

Cleaning Syringes ●

a. Disassemble syringes and soak in cool tap water.
b. Wash separate parts thoroughly with warm water and detergent.
c. Rinse several times with tap water.
d. Match the barrels and plungers by serial numbers and hold the parts together by rolling a piece of gauze between and around them. Syringes in the PDH are *not* multifit types. The two parts of the syringe, the barrel and plunger, have the same serial number marked on each part. *These must be matched or the syringe cannot be used.*
e. Place on the *cleaned equipment* or *preparation table.*

Cleaning Rubber Gloves ● Handle gloves very carefully to avoid tearing or puncturing.

a. Wash first in cold water to remove blood.
b. Wash in warm water and detergent.
c. Rinse thoroughly three times.
d. Check gloves carefully for tears or puncture holes by filling gloves with air and observing whether there is any leakage. Damaged gloves cannot be used for sterile procedures. Set aside damaged gloves to be used for other purposes.
e. When speed is essential dry gloves inside and out with a towel. Be sure all parts are thoroughly dry. When there is time, it is preferable to hang gloves to dry.
f. As soon as they are dry, powder the gloves inside and out. Powder one side, turn inside out and powder.
g. Place them on the *preparation table.*

Cleaning Rubber Supplies ● Rubber goods must be scrubbed thoroughly. All surfaces of rubber goods should be moist when sterilized. Clean such supplies as catheters, tubing and drains in the following manner.

a. Soak for two hours in warm water and detergent.
b. Flush interior thoroughly with clean water several times.
c. Wash thoroughly in warm water and detergent.
d. Rinse thoroughly three times. *Do not dry.*

Cleaning Utensils ● This category includes bedpans, urinals, basins, pitchers, etc. Stainless steel should be washed, rinsed and dried as soon as possible. Aluminum is best cleaned with mild soap or detergent, using a stroke that follows the grain of the surface.

a. Soak, if necessary.
b. Wash thoroughly in warm water and detergent.
c. Rinse in hot water.
d. Dry thoroughly.
e. Place on *cleaned equipment table* or *preparation table.*

Cleaning Flasks ●

a. Remove caps and collars before washing flasks.
b. Wash flasks, collars and caps in warm water and detergent.
c. Rinse thoroughly three times in clean water, drain.
d. Inspect for cleanliness and cracks.
e. Place on *cleaned equipment table* or *preparation table.*

PREPARING FOR STERILIZATION

Cleaned articles are inspected, sorted and wrapped before sterilization. In general, items which do not need to be wrapped are placed on the *cleaned equipment tables,* others will be placed on the *preparation tables.*

Inspection and Sorting ● All cleaned articles are inspected for cleanliness and working condition. Any items found unclean will go back to the cleaning table. Put aside any that are in poor working condition to be discarded or repaired.

Items are sorted categorically and by size and type so that like items can be sterilized together.

Assembling Packs, Trays and Sets ● Materials for basic packs, trays and sets will be assembled for wrapping. A discussion of basic packs, trays and sets is found on page 216 .

Folding Linens ● Sterile linens for operating rooms including sheets, drapes, towels, pillow cases and gowns, will be processed in central sterile supply. When these items are requisitioned, central sterile supply will obtain them from the clean linen supplies in general stores. The operating rooms will requisition masks and caps, which do not need to be sterilized, directly from general stores.

Linens must be folded before being wrapped in packs so that they can be unfolded without danger of contaminating the sterile surfaces. The following instructions for folding allow the linens to be unfolded by touching only the corners.

a. Sheets (figure 50)

Fold sheets in half with the hems together; then fold twice more in the same direction, leaving the hems on the outside. This procedure will make a strip as long as the sheet width and about 12 inches wide. With the hems on the outside, fold the strip in halves in the opposite direction until it measures about 12 inches by 13 inches.

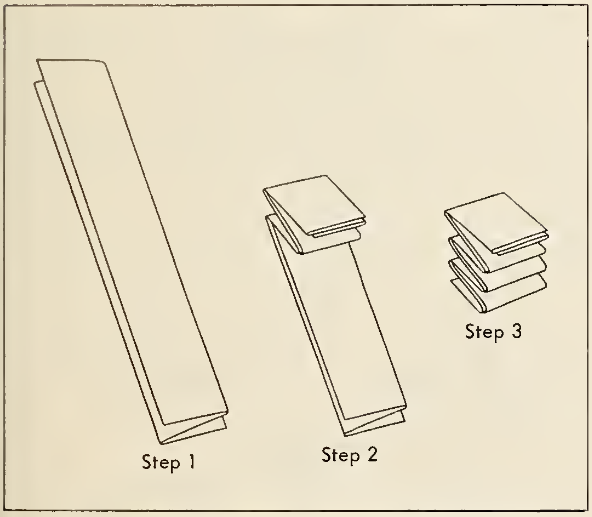


FIGURE 50 –*Folding Sheet for Sterilization.*

b. Drapes (Cut-out and hole drapes)

Fold drapes in half lengthwise; starting with the fold, fold in thirds. Keeping the stitched edges on the outside, fold this long strip in halves until it measures 12 inches by 12 inches.

c. Hand Towels and Pillow Cases (figure 51)

Hand towels and pillow cases should first be fan-folded lengthwise in thirds, making a long narrow strip. Fan-fold this strip into three or four inch folds.

When the pillow case is to be used to cover an instrument stand, turn back the open end to form a three-inch cuff. Then fan-fold the case crosswise until a three-inch strip is made. Fold the strip in half with the cuff on the outside.

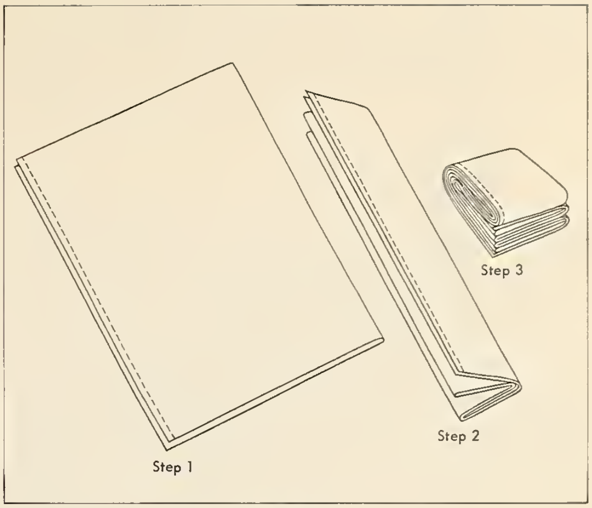


FIGURE 51
Folding Towels or Pillow Cases for Sterilization.

d. Gowns (figure 52)

Hold the gown by the inside center of the neck and fold back, inside out, in thirds. The sleeves will now be folded inside. Fold in half; fold again in half with the inside of the neck up.

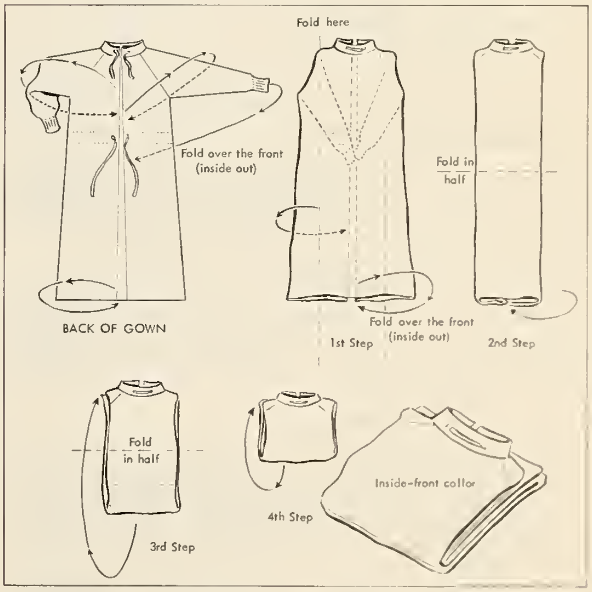


FIGURE 52 *Folding Surgical Gown for Sterilization.*

WRAPPING

Materials for Wrapping • Individual items and basic packs, sets and trays will be wrapped at the preparation tables. The following materials will be needed there; those which are not furnished with the PDH must be obtained locally.

18″ and 36″ square cloth wrappers

Paper towels

Pencils

Brush, surgeon's

Gauze

Heavy brown paper

Twine

Shipping tags

Pressure sensitive sterilizing tape

Chemical sterilizer indicators

Packs are fastened with twine and their contents are recorded on the tags. After the packs are sterilized, they are dated in the sterilization subsection. Pressure sensitive tape is preferable to twine and tags because, in addition to sealing the packs more effectively, it changes color under sterilization and indicates that the packs have received favorable temperature, steam pressure and exposure time.

Chemical sterilizer indicators inserted in the center of large packs detect air pockets which impede sterilization. These controls come in pellet and cardboard strip forms. The pellet sealed in a glass tube melts when the sterilizing time and temperature are favorable. The cardboard strip impregnated with dye changes color under favorable steam pressure.

Tapes and controls should be used with all sterilizers, if possible. Since these items are not supplied in PDH's, PDH readiness planners should consider obtaining them locally. If the staff decides to use these optional items, they should be obtained in large quantity because the tape and controls can be used only once.

General Procedures (figure 53) • If there are too few cloth wrappers available to handle the work load, wrapping can be done in a single thickness of heavy brown paper. Wrapping procedures are the same for paper as for cloth wrappers.

a. Select the proper size double thickness cloth wrapper for the items to be wrapped and lay it flat on the table. Center the articles on the wrapper.

b. Pick up a corner of the wrapper and bring it across the articles. The corner of this first fold should be turned back on itself slightly so that the package can be opened by unsterile hands without contaminating the inside of the wrapper or the articles.

c. The two adjacent corners are then folded over. The pack should now look like an unsealed envelope.

d. Pull the fourth corner of the wrapper over the previous folds and tuck in.

e. Tie the pack with string, do not draw it tight.

f. Write the contents of the pack on the shipping tag and tie it securely to the pack.

If the pressure sensitive sterilizing tape is used instead of string: turn under about ½-inch at one end of a strip of tape to form a tab which makes it easier to remove the tape from the pack after sterilizing. Fasten the pack securely, making the packs snug but not tight. Tuck in any loose ends. Record the contents on the tape.

Wrapping Instruments •

- Protect all cutting edges with gauze or paper before wrapping.
- Open all jointed instruments before wrapping.
- Select and assemble instruments for trays and sets.

Wrapping Needles and Syringes •

- These items are wrapped separately.
- Be sure that matching parts of each syringe are held together with gauze before wrapping. Do not insert the plunger in the barrel.
- When needles are to be sterilized by steam, *stylets should be packaged with, not in, the needle.*

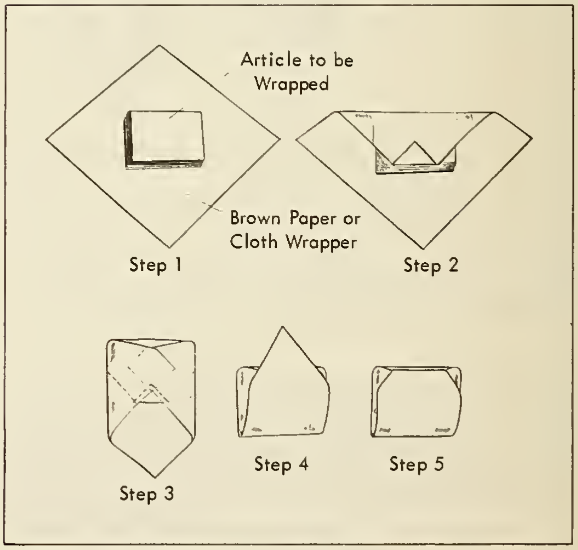


FIGURE 53 –

Wrapping Articles in Brown Paper or Cloth Squares.

Wrapping Rubber Drains • Soft, flat drains should not be folded when packaged because the steam must circulate through them.

Wrapping Gloves •

a. Turn cuffs down about two or three inches.

b. Place a strip of paper toweling in each glove.

c. Lay a piece of paper toweling, three sheets long, flat on the table and place a pair of gloves in the center about one inch apart, right glove on the right (figure 54).

d. Fold each end of toweling over gloves so the ends meet in the center.

e. Fold again, one glove over the other. Be sure that gloves do not slip out of place and overlap. Each glove must be covered with the paper toweling.

f. Tie with a piece of string or sterilizing tape and record glove size.

g. Place six packets of gloves (six pairs) on a cloth wrapper and wrap, recording glove size on shipping tag or outside tape.

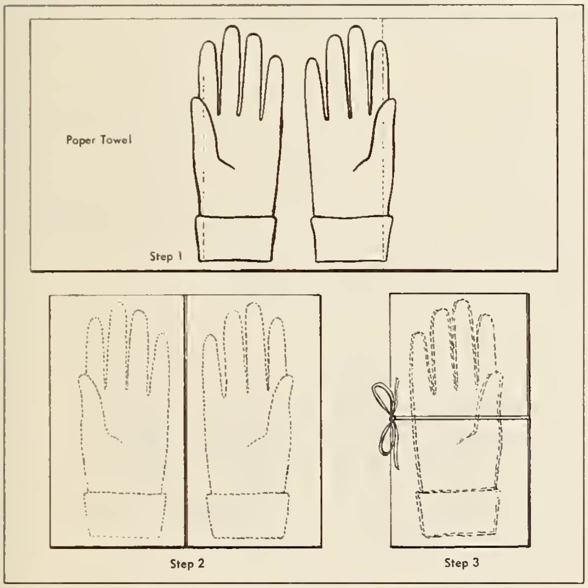


FIGURE 54 – *Wrapping Gloves for Sterilization.*

STERILIZATION

TIMER CONTROL SHEET

Sterilizers packed with some PDH models work automatically or with handset timers. Other sterilizers, however, are not equipped with timers. Although a timer control sheet is essential only for sterilizers without control devices, such records are valuable and the central sterile supply chief may recommend that they be completed regardless of the type of equipment used for sterilization.

A special timer control form can be printed locally, or the information can be recorded on writing pads supplied with the PDH, depending on the decision of the PDH utilization planners.

STERILIZATION EQUIPMENT

Insofar as sterilization equipment is concerned, PDH's usually may be divided into two groups. The following equipment is furnished in the first group:

9 Pressure cooker sterilizers with liquified petroleum (LP or bottled gas) stoves

6 Open boiling water sterilizers with gasoline-fueled stoves

The second group contains:

One table model 8″ x 16″ steam pressure sterilizer, operated by electricity, solidified hydrocarbon fuel (canned heat), or gasoline saturated ceramic blocks

One free-standing 16″ x 36″ steam pressure sterilizer, operated by electricity, gasoline burner, or direct steam

Instructions for using this equipment follow. Detailed assembly instructions for sterilizers and stoves are given on Page 217 .

STERILIZATION BY STEAM PRESSURE

Saturated steam under pressure is the most reliable method of sterilization and the one most frequently used in modern hospitals. It is the most dependable method because of the ability of steam to penetrate and to destroy microorganisms, including spores.

The 3-minute flash type of sterilization under steam pressure—used in many hospital operating suites—can be used to advantage in a PDH to service a heavy surgery schedule with the somewhat limited PDH supply of instruments. When the temperature reaches 270° F., unwrapped instruments and utensils can be sterilized in three minutes. This is possible, of course, only with the steam pressure sterilizers.

The presence of air in the steam chamber will impede positive sterilization and the gauges and thermometers will not always indicate air pockets. If small amounts of air remain in the chamber, they will concentrate in pockets in the load where they are difficult to remove. Any mixture of air and steam also will lower the temperature in the chamber.

Portable Sterilizer, Pressure Cooker Type • For assembly instructions, see page 221. This unit has the following components and accessories:

40-quart Sterilizer

Aluminum container

Perforated metal rack

Kit of spare parts and paraffin stick

Instructions for operating sterilizer and stove

An LP gas stove, packed separately, may be used to heat this sterilizer. Dressing drums, for use with this unit, are included with some PDH's.

IMPORTANT PRECAUTIONS:

Do not overload sterilizers with too large packs or packs too tightly packed.

Pack sterilizers loosely to allow free access of steam and escape of air.

Do not shorten exposure time because of a rush order.

Clean outlet screen and exhaust line regularly.

Follow all maintenance instructions carefully.

Filling the Sterilizer

1. Pour one quart of water in sterilizer.
2. Set metal rack on the bottom of the aluminum container.
3. Place packs, or dressing drum containing packs, in the container (see page 222.)
4. Place container in sterilizer, making certain that the vertical channel in the container is on the right.

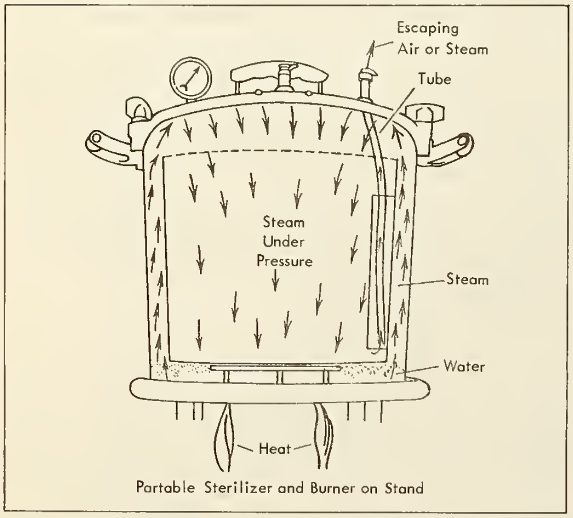


FIGURE 55—*Schematic Diagram of Sterilization Operation.*

5. Soften paraffin stick and run it around outer edge of sterilizer to insure a tight seal when the sterilizer is heated.
6. With arrow and gauges on the lid facing front (air-ejector valve attached to flexible hose on right), place the lid on the sterilizer, threading hose through vertical channel on container as the lid is lowered.
7. To seal, tighten any two opposite wing nuts. Tighten the other parts until all are firmly secured.

How the Sterilizer Operates (figure 55)

The portable unit sterilizes with high pressure steam (15 pounds per square inch). The boiling water in the bottom of the sterilizer produces steam which rises to the top around the outside of the aluminum container. When it can rise no further, it is forced down inside the container. As the steam moves down it pushes the air in the sterilizer ahead of it. The air escapes from the bottom of the container through the flexible hose which is connected inside the cover to the air ejector valve. After all the air is pushed out of the sterilizer, the steam escapes. All the air in the sterilizer must be replaced with steam or sterilization will be incomplete. When there is a steady flow of steam from the air ejector valve, and the temperature and steam pressure reach the required levels, sterilization begins.

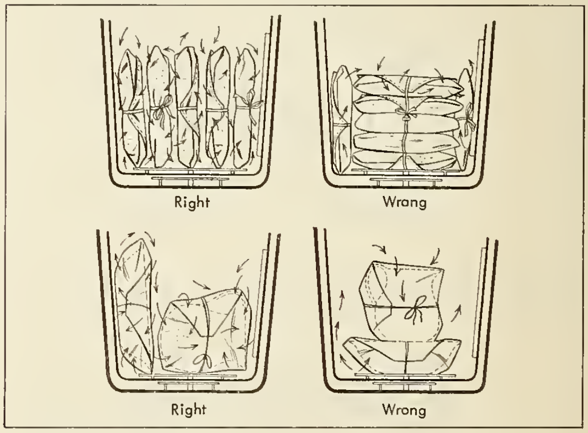


FIGURE 56—*Placement of Packs in Sterilizers.*

Placing Packs in Sterilizer (figure 56)

Packs can be placed directly on the rack in the container, or in a dressing drum. The dressing drum is convenient for carrying and storing a quantity of sterilized packs. The drums should be used whenever possible because packs can be left in them to dry, whereas the sterilizer container must be reused immediately for the next load to be sterilized.

The circular dressing drums have hinged tops and a double perforated band around the outside wall. This band slides to permit the holes to be covered after sterilization and drying when sterile packs are to be stored in the drums.

Important points to remember when packing container or drum:

1. Do not place packs tightly against bottom and sides of container or drum.
2. Stand all packs on end and be sure they rest on the rack and not on bottom of container.
3. Packs of folded linens should be placed with the open fold toward the bottom of the sterilizer to permit the steam to circulate freely between the folds and penetrate the packs.
4. A wrapped basin should be placed vertically in the container and a wrapped pitcher on its side.
5. When a dressing drum is used, be sure the holes are open.

Operating Stove and Sterilizer

1. When the LP gas stove is to be used, assemble according to instructions on page 235 .
2. The stove comes with the gas valve adjusted for LP gas, so if this type of gas is used, the gas supply line is attached directly to the valve.
3. The stove is lit and operated like a kitchen gas stove. Instructions for using the stove with LP gas, or adapting it for other types of gas are provided with each stove. Place the sterilizer on the stove before lighting it.
4. When sterilizer is placed on fuel source, position the pressure gauge so the operator can read it easily.
5. See that the safety and ejector valves on the sterilizer cover are screwed on tightly, and that the valve levers are in horizontal position during the entire sterilization period (except for solutions which are discussed in item 17, following).
6. When the pressure gauge needle moves into the green field and a steady stream of steam flows from the ejector valve, sterilization begins. *Start timing at this point.*
7. Record starting time on time control sheet, along with type of load, required sterilization time, and time scheduled for completion.
8. Continue sterilization for the time prescribed. Adjust the burner, if necessary, to maintain a slow but constant stream of steam from the ejector valve. If the pressure gauge needle starts climbing rapidly, turn the flame down. If the pressure should rise too high, steam will be released through the safety valve.
9. If, for no apparent reason, the pressure in the sterilizer drops rapidly, and there has been considerable leakage of steam around the sterilizer cover, turn the burner off immediately. *Raise the ejector valve lever and wait for the pressure to drop to zero.* Remove cover and check to see if water has boiled away. If so, wait until the sterilizer has cooled, refill with water and start the sterilization procedure again, making sure to follow operating directions.
10. When the sterilization period is completed, turn off heat and raise the ejector valve lever to release the steam.
11. Record sterilization completion time.
12. When the pressure drops to zero, completely loosen the knobs on the cover, but leave the cover on for at least 15 minutes so that the heat in the sterilizer can assist in drying the sterilized packs.
13. When the packs are sufficiently dry, remove the cover and take out the packs or dressing drum. Leather or cloth gloves, not supplied with the PDH, will help protect the hands while handling hot drums.
14. Caution should be exercised when the packs are removed from the container or drum because the packs can be contaminated easily by placing them on wet surfaces. Packs should be left in the drums until completely dry.

FIGURE 57—*Removing Pack with Sterile Forceps.*

15. If the packs have to be removed while they are still wet, they must be handled with sterile sponge forceps and placed on a sterile surface (figure 57).

16. Record the date on the shipping tags or sterilizer tape on packs.

17. For sterilizing solutions: Place ejector valve lever in a vertical position before sterilizer is placed on the stove. When a steady stream of steam is escaping, place lever in a horizontal position. Watch the pressure gauge to *be sure it does not go beyond the 250° F. point,* which is the beginning of the green field. Reduce the flame and maintain pressure at this point for the required sterilization period. When sterilization period is over, remove the sterilizer from the stove and allow the pressure to drop slowly to zero. Remove cover and take out solutions. Do not raise the ejector lever for solutions when there is still pressure indicated on gauge or solutions will be boiled out of their containers.

18. When reusing sterilizer: Water must be added to the sterilizer each time it is used to bring the volume to one quart. Wait until the sterilizer has cooled before adding cold water. Apply paraffin to the edge of the sterilizer each time while the sterilizer is still warm.

Maintenance of Sterilizer and Stove

Follow the instruction sheet accompanying the stove for maintenance procedures. Detailed instructions for maintenance of sterilizer are also included with unit. Be sure to take the following precautions.

1. Empty the water from the sterilizer and dry thoroughly when unit is not in use.
2. Clean when necessary with soap and water. Never use soda, lye or alkali. Be careful not to immerse the gauge or control valves in water.
3. Never put cold water into the sterilizer when it is very hot and dry and never place the unit on a cold floor. Sudden change in temperature may crack the aluminum.
4. If the pressure gauge is damaged, replace it with the spare gauge included in the unit. Two spare knobs for bolting down the cover are also included.
5. If steam should escape through the safety valve before it flows through the ejector valve, it may mean that the safety valve has not been properly adjusted. Find the spring inside the safety valve and stretch it until it is ¼-inch longer.

The safety valve should operate automatically at the pressure of 25-27 pounds per square inch to release the steam pressure. After adjusting the safety valve, observe the operation carefully and if for any reason this pressure is exceeded, (1) immediately extinguish the flame and (2) manually operate the safety valve to reduce the pressure. Then have the valve repaired.

Small Horizontal Steam Pressure Sterilizer ● This 8″ x 8″ x 16″ sterilizer (see page 231) can be operated electrically, with solidified hydrocarbon fuel, or with ceramic blocks saturated with gasoline. Components and accessories include:

- Solidified hydrocarbon fuel—306 cans packed with unit
- 2 Ceramic blocks (fire bricks)
- Combustion cup to hold can of solidified fuel
- Asbestos lined combustion cup for ceramic block
- Stove which burns solidified fuel or gasoline soaked ceramic block
- Trays for instruments or dressings
- Electrical cable cord equipped with adapters which may be used with either double or triple prong outlet.

When operating room schedules are heavy, the supervisor may want to use this equipment exclusively for 3-minute flash sterilization and reserve the large free-standing autoclave for all other sterilizing.

Operating Electrically ● This unit requires an outlet with power at 110-120 volts, 60-cycles, A.C. The operating steps are:

1. Turn the time knob to the OFF position. Raise operating valve to maximum height. Turn the thermostat knob fully counterclockwise.
2. Connect electrical outlet.
3. Fill the water reservoir as instructed on page 233.
4. Load sterilizer.

   Instruments: Place a layer of muslin or a towel in the bottom of tray and place the instruments on it. Cover the instruments with a sterile towel to prevent contamination after the tray is removed and in transit.

   Small packs: Place on edge in tray, never flat, to permit circulation of steam.

   Utensils and empty glassware: Whether wrapped or not, place them on their sides or inverted in tray.

Record type of load and required sterilization time on time sheet.

5. Close and lock sterilizer door and push operating valve handle down until it rests on the door locking bar.
6. Turn thermostat knob clockwise to desired temperature setting.
7. Snap toggle switch to STER position.
8. Set timer for *preheat cycle,* (approximately 20 minutes). Red and white pilot lights will glow. Red indicates that power is on and white indicates that heaters are on. A bell will ring when the cycle is completed.
9. When the temperature reaches the thermostat setting, the white light will go off. Thermometer will now register the desired temperature. If it does not, reset the timer for additional preheating.
10. When the thermometer registers desired temperature, set timer for the exposure time desired. Record time sterilization begins and scheduled time for completion. A bell will signal the end of the sterilization period and the timer cuts off the electric power. Record actual completion time.
11. Pull the operating valve handle to the maximum height to exhaust the steam and residual water in the chamber back to the reservoir. When the thermometer registers 212° F. or less, open the door about ¼-inch to hasten drying.
12. If drying cycle is required, snap toggle switch to DRY position. Set timer for desired drying time (10-15 minutes). Both red and white pilot lights will glow. When the bell indicates the completion of the drying time, open the door. Let the sterilizer cool for 10 minutes, remove the load and reuse. Before reusing be sure to fill the reservoir to level as before.

Operating with Stove • If for some reason it is not possible or desirable to operate the sterilizer electrically, it can be used with the stove and solidified heat or ceramic blocks. The sterilizer operation will remain the same when the stove is used. See page 233 for instructions.

RECOMMENDED MINIMUM EXPOSURE PERIODS FOR STEAM STERILIZATION*

ITEM	MINUTES AT 250°-254°F.	MINUTES AT 270°F.
INSTRUMENTS		
Metal only	15	3
Metal combined with other materials	15	7
Metal in covered tray	15	7
Metal and other materials in covered tray	20	10
Wrapped in packs	20	10
DRESSINGS		
Wrapped	30	10
In open canisters (on sides)	30	10
UTENSILS		
Unwrapped	15	3
Wrapped	20	10

ITEM	MINUTES AT 250°-254°F.	MINUTES AT 270°F.
RUBBER GOODS		
Gloves, wrapped	20	
Catheters, Drain, Tubing, wrapped	20	
Catheters, Drain, Tubing, unwrapped	20	10
FLASKED SOLUTIONS		
75—250 ml	20	
500—1000 ml	30	
1500—2000 ml	45	
NEEDLES, INDIVIDUALLY PACKED IN GLASS TUBES OR PAPER	30	10
SYRINGES, WRAPPED	30	10
TREATMENT TRAYS, WRAPPED	30	10
SUTURES, WRAPPED	30	10
LINEN PACKS	30	
GLASSWARE, INVERTED	15	3

*Prepared by The Educational and Research Department of American Sterilizer Company, Erie, Pa.

Large Free-Standing Steam Pressure Sterilizer (See page 225 • This unit operates either by electricity (220 or 440 volts, 60-cycles A.C.), by gasoline burner, or by direct steam. When the PDH is used to expand an existing hospital, this sterilizer should be operated on the hospital's direct steam, if available. If the PDH is set up as an independent hospital and the preselected operating site has a direct steam line, it should be used for this sterilizer. When it is operated electrically, the electrical connection must be made by a professional electrician or medical equipment technician. Electrical cable will have to be obtained locally.

NOTE:
If the PDH is operating on auxiliary power supplied by the PDH generators, this large sterilizer must not be operated electrically. It should be operated electrically only when a local power source is available.

Operating Electrically

1. After the unit is set up and connected to current, open the sterilizer door. Turn the double handle counterclockwise and pull up on latch handle until door-locking arms are retracted.
2. Shelves may be arranged in steam chamber as desired by sliding them into the brackets.
3. Fill with water. Remove the pipe plugs on the tanks, located on either side of the top of the sterilizer. *Open water supply valve.* Turn operating valve to STER position. Using attached funnel, fill tanks until sight glass shows FULL. *Close water supply valve. Turn operating valve to* OFF. Continue filling tanks until they are full. Replace pipe plugs.
4. Turn the pressure control switch knob fully clockwise. Turn the heater switch on; the red pilot light will glow. When the pressure gauge shows proper pressure, turn the pressure control switch slowly counterclockwise until the pilot light goes out.
5. Wait 10-15 minutes for the sterilizer to preheat and allow the pressure to stabilize.
6. Load the sterilizer.
7. Close the door; rotate the handle clockwise; tighten the handwheel securely.
8. Turn the operating valve to STER position.

9. When the thermometer in the chamber drain line shows the desired temperature, sterilization begins. *Start timing at this point.*

10. At the end of the sterilization period turn the operating valve to FAST EXHAUST for fabric and instrument loads, to SLOW EXHAUST for solution loads.

11. Do not touch the sterilizer until the chamber pressure gauge shows ZERO.

12. If drying cycle is required, turn the operating valve to DRY and open door ¼-inch.

13. Turn operating valve to OFF and loosen door-locking arms. Cool load for five minutes.

14. Remove load and date each pack on shipping tag or tape. The sterilizer may be reloaded and recycled immediately.

Operating with Gasoline Burner

1. Take the burner unit outdoors and pour gasoline in the tank on the right. Ignite the burner and adjust the flame while it is still outdoors. Throttle the flame down and carry the lighted burner inside to the sterilizer.

2. Pump air into left tank with pump provided. Follow instructions attached to the unit to achieve air pressure.

3. Operating procedures are the same as those given for operating electrically.

NOTE:
It is characteristic of this burner to smoke profusely when first ignited. This is caused by incomplete combustion of the fuel. The smoke will gradually diminish as the generator pressure increases and the flame becomes bluish green. For this reason, the burner should be ignited and brought up to operating temperature out-of-doors. Ignition in the sterilizer will result in an accumulation of carbon on the heat exchanger which will reduce the sterilizer efficiency to the point that a much longer period of time will be required to attain operating temperatures.

Maintenance • Detailed instructions are included with the unit, along with tools and spare parts. The following must be done daily.

1. The chamber drain plug screen (in the bottom of the drum just inside the door) should be removed and lint and sediment removed from the strainer.

2. Before heating, the interior surface of the steam chamber should be cleaned with mild detergent and water. Do *not* use steel wool or abrasive. Clean the shelves in the same manner.

Storing Sterilized Items • Sterilized packs and trays should be used as soon as possible. If they are not used immediately, dry sterile packs should be stored in a dry, protected place. In some PDH's 24 dressing jars are provided for storing and transporting packs. They must be obtained locally if not included with your PDH. Sterile supplies are dated immediately after sterilization.

STERILIZATION BY BOILING

Boiling water is the simplest method of sterilization and may be used chiefly for sterilizing instruments and utensils when the steam sterilizing facilities are overcrowded. It may also be used in the preparation subsection for sterilizing contaminated instruments and needles before they are cleaned to protect the cleaning personnel.

Sterilizing Equipment

The boiling water unit contains the following:

Sterilizer

Tray

Handles for lifting tray

2-burner gasoline stove and stand

Metal wind protector for use out-of-doors or in a draft

Kit of spare parts

The stoves and sterilizers are packed together and the stove is completely assembled. See page 217 for photographs.

Operating

a. Be sure that the stove fuel control valves are closed tightly by turning them to the right. Take the stove outside the building to fill with gasoline. Remove the filler cap and fill the tank. A tube installed inside the opening prevents overfilling. Replace filler cap and tighten firmly by hand.

b. Fill the sterilizer with three gallons of water or until the water reaches just above the two parallel screws which hold the tray supports.

c. Be sure the fuel control valves on the burner are closed. Unlock the pump by turning the handle to the left several times. Hold thumb or palm of hand over the vent hole in the end of the pump handle and pump 25 or 30 strokes of air into the tank. Turn pump handle to the right and close tightly.

d. Light each burner head

1. Revolve the wire lever on the fuel control valve several times. This cleans the gas tip. Stop lever in DOWN position.

2. Open the fuel control valve a quarter turn to the left. After a few seconds apply lighted match to top of burner head.

3. Five minutes or more are required before the flame settles down to a steady blue. After the flame burns a steady blue for two or three minutes, open fuel control valve as far as possible.

e. Pump additional air during the first few minutes to keep up the air pressure. It may be necessary to operate the stove several times to determine accurately the number of strokes of the pump required to maintain proper air pressure. Be sure to turn the pump handle to the right and close it tightly after each pumping.

f. The size of the flame cannot be controlled by the fuel control valve. If the flame is too high, it may be adjusted by turning the wire lever up slightly to reduce the flow of gas. A higher flame can be obtained by increasing air pressure with a few strokes of the pump.

g. When the water in the sterilizer is near the boiling point, fill the tray with items to be sterilized. The items should be completely submerged in the water when the cover of the sterilizer is closed.

h. Time the sterilization period from the time the water boils vigorously and continue for 20 minutes. If it is not practical to submerge the items completely (in the case of basins and large instruments), the period of sterilization should be increased to 30 minutes. The sterilizer should be kept closed and the water boiling vigorously so that the area above the water is filled with flowing steam.

i. Record sterilization information on timer control sheet for each of the boiling water sterilizers.

j. Turn the fuel control valves to the right as far as possible to turn off the stove.

Removing Items from Tray • One of the problems of sterilizing by boiling water is the handling of sterile articles when they come out of the boiling water.

a. Most of the boiling water sterilizers in the PDH's are opened by raising the handle to lift the cover. The tray must be removed by using the hand loops furnished with the unit. Some models in PDH's are opened by pushing the cover handle down which lifts the cover and also raises the instrument tray above the water level. The tray should be allowed to stand until the water drains off and the instruments are dry.

b. Cover a tray with a sterile towel of double thickness. As soon as the instruments are thoroughly dry, place them on the tray, using sterile forceps. Another sterile towel should be used to cover the instruments and tray while it is carried to the *sterile equipment table,* or to the hospital section where the instruments are needed.

c. Sterilized instruments should be stored in central sterile supply for as short a time as possible.

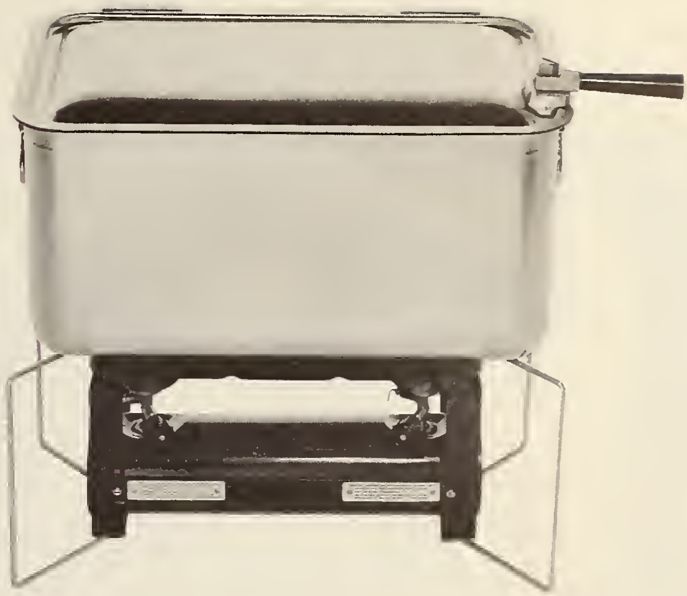
BASIC PACKS, TRAYS AND SETS

Surgical packs, trays and sets are made up by central sterile supply to meet specific or anticipated hospital requirements. The components vary according to the preferences and requirements of individual hospitals.

The PDH instruments and supplies which are suitable for basic packs, trays and sets are by necessity considerably more limited in variety and quantity than those available in permanent hospitals. Therefore, key hospital personnel charged with the responsibility for staffing and directing the operation of a PDH should become familiar with its equipment.

When a PDH is used to expand an existing hospital, the staff probably can assemble packs, trays and sets in their usual way, using their own hospital's equipment augmented by PDH supplies. When the PDH is set up as a complete hospital, however, the composition of basic packs, trays and sets will have to be modified to conform with the limitations of available PDH equipment. In this case, to save time and avoid misunderstandings when the PDH is activated, the PDH staff should establish predisaster, some standard lists of items for basic packs, trays and sets based on anticipated disaster needs and PDH equipment.

STERILIZER, BOILING



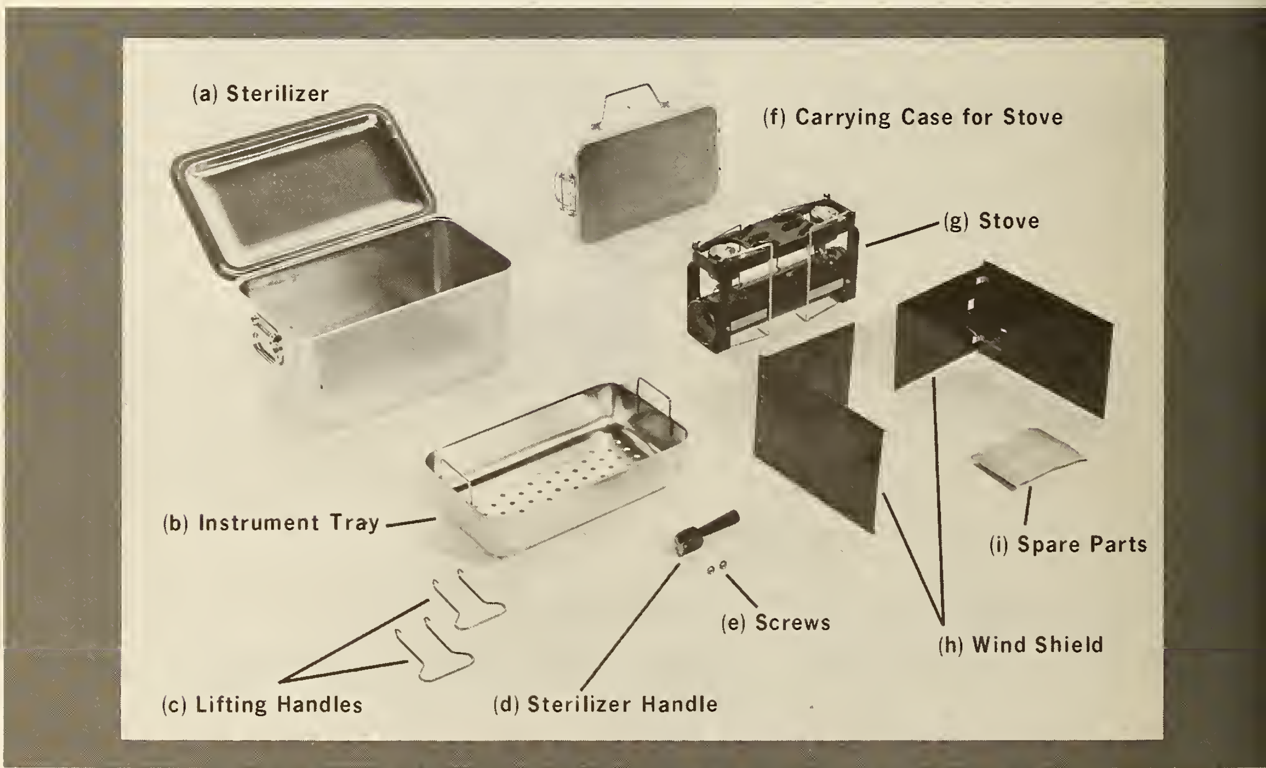
FEDERAL STOCK NUMBER: 6530-708-4735

FEDERAL NOMENCLATURE: STERILIZER, SURGICAL INSTRUMENT, FUEL HEATED

This sterilizer is packed in a triwall fiberboard carton along with its own heating unit which is contained in a metal case packed inside the sterilizer. The sterilizer is already assembled with the exception of the lock-type handle. The stove burns any gasoline, including leaded, and is equipped with a windshield which may be added when used out-of-doors or in a draft. When other heating equipment is available, the use of the stove will be unnecessary.

STEP 1:

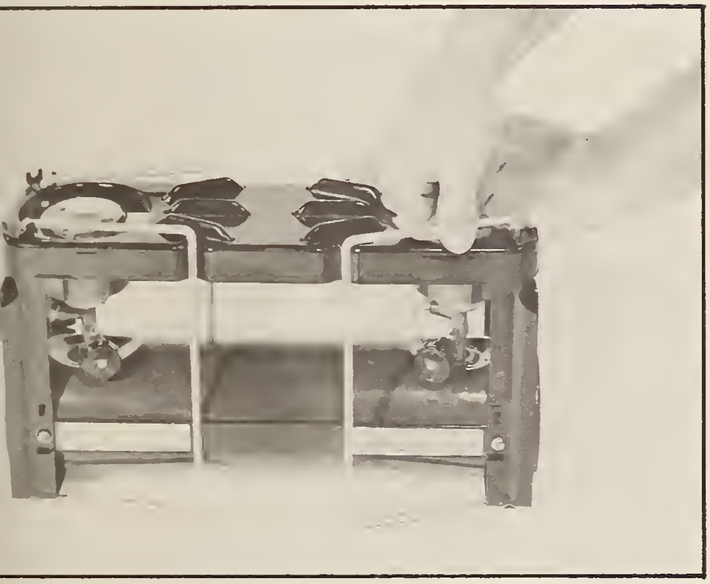
A. Open the fiberboard carton by slitting tape with any sharp instrument. Lift out the components.



B. Components shown in photograph comprise the sterilizer and stove. The sterilizer parts are: (a) sterilizer, (b) instrument tray, (c) handles for lifting tray, (d) sterilizer handle, (e) screws for attaching handle to sterilizer lid. Stove parts include: (f) carrying case, (g) two-burner gasoline stove, (h) two-part windshield which attaches to folding legs of stove. Spare parts for burners are included in envelope (i).

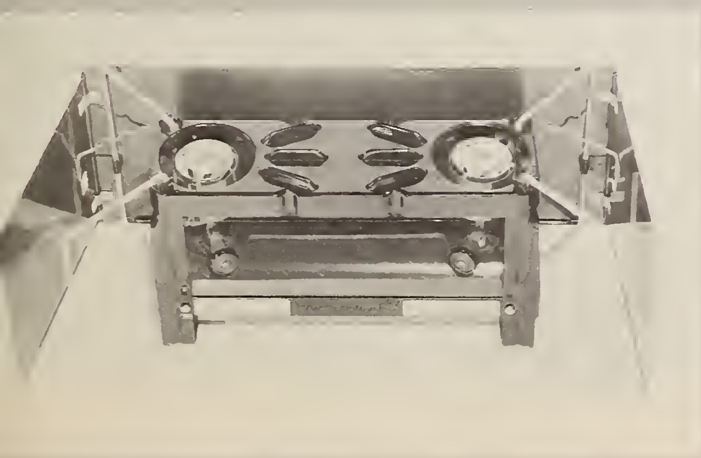
STEP 2:

A. Hold handle (d) firmly against outer lid of sterilizer (a) as shown, attaching screws (e) from inside. Test handle to make certain lid locks in place securely.



STEP 3:

A. Pull firmly up on each hinged leg of stove (g) before pulling out to standing position. Legs lock in place in slots in corners of stove.



STEP 4:

A. If windshield (h) is needed, snap into place on rear legs of stove as shown.

TO BE OBTAINED LOCALLY:

Gasoline.


Circus Train

STERILIZER, COOKER

FEDERAL STOCK NUMBER: 6530-000-0004

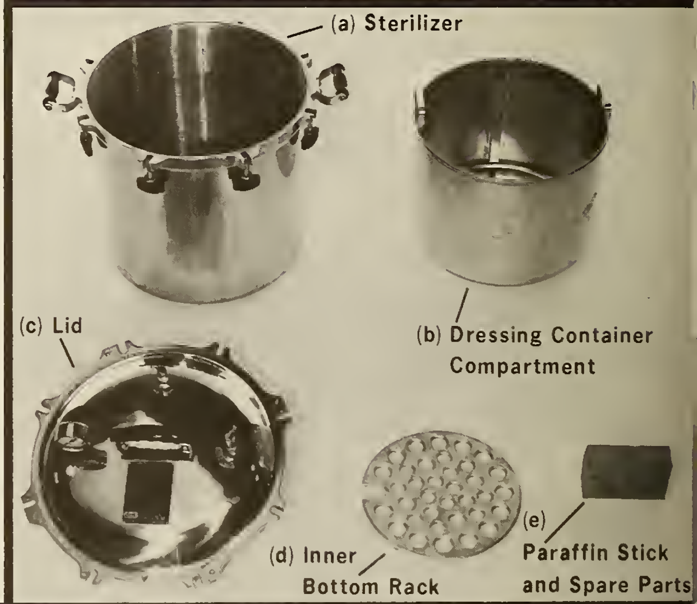
FEDERAL NOMENCLATURE: STERILIZER, INSTRUMENT AND DRESSING, PRESSURE COOKER TYPE

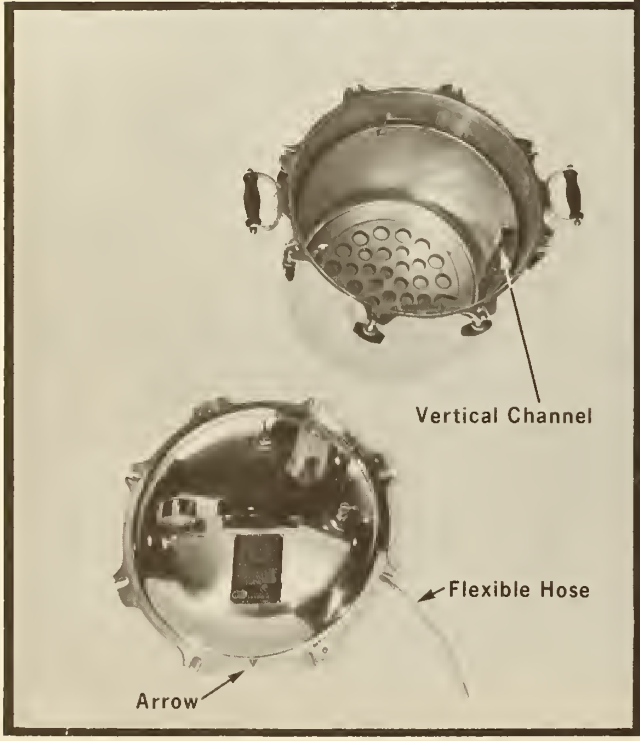
It is improbable that this sterilizer would be set up unless it was being loaded for use. This is with the exception, of course, of a training exercise. The instructions following are primarily for the use of a person experienced in sterilization who is not familiar with this particular unit. Also packed with the PDH, Federal Stock Number 6530-000-0006, are perforated Dressing Containers which may be used with this sterilizer.

STEP 1:

A. Each sterilizer is packed in a fiberboard carton. Open the carton by slitting the taped top with any sharp instrument. Some sterilizers will be encased in a heavy polyethelene bag; others in conventional packing materials.

B. Sterilizer components pictured are: (a) sterilizer, (b) dressing container compartment, (c) lid, (d) inner bottom rack, and (e) kit containing paraffin stick and spare parts.





STEP 2:

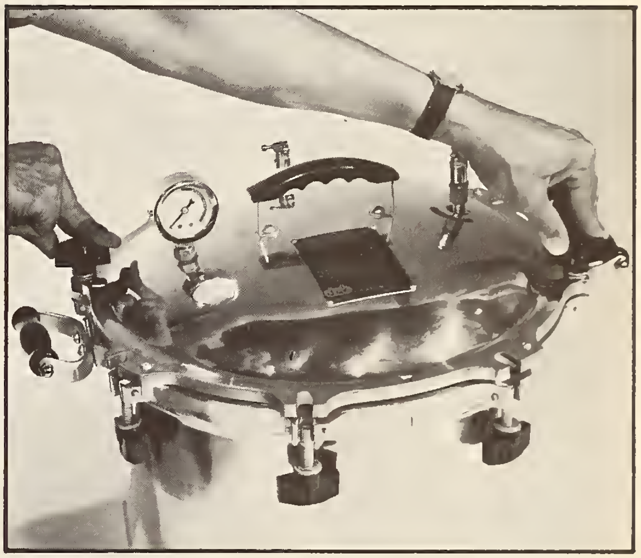
A. Set inner rack (d) in bottom of dressing container compartment (b). Place dressing container in sterilizer. Make certain that vertical channel on dressing container is on the right as shown.

STEP 3:

A. With arrow and gauges on lid facing front (air-ejector valve attached to flexible hose on right), place lid on sterilizer, threading hose through vertical channel on dressing container as lid is lowered.

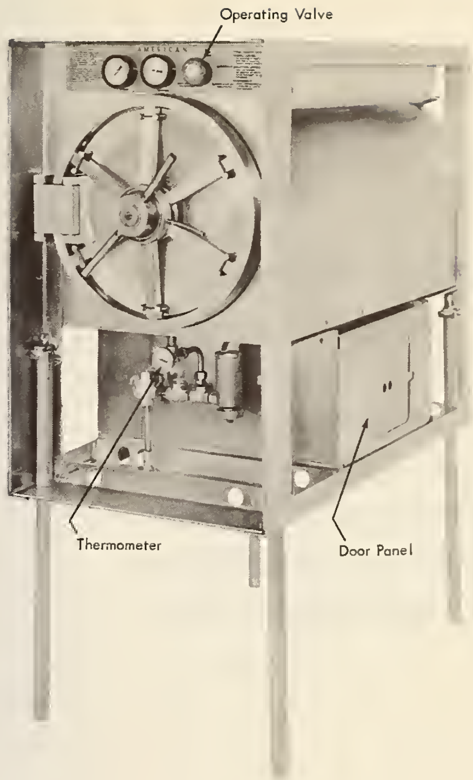
STEP 4:

A. To seal lid, swing bolts into notches of cover, then tighten any two bakelite wing nuts. Continue tightening opposite nuts until all are secured.



B. If sterilizer is being prepared for immediate use, pour one quart of water into bottom of sterilizer (a), soften the paraffin stick (e), and run it around the outer rim of the sterilizer. This affords a tight seal when the sterilizer is heated. Vaseline will suffice in the absence of paraffin.

STERILIZER, FLOOR MODEL



FEDERAL STOCK NUMBER: 6530-781-3683 (6530-000-0011)

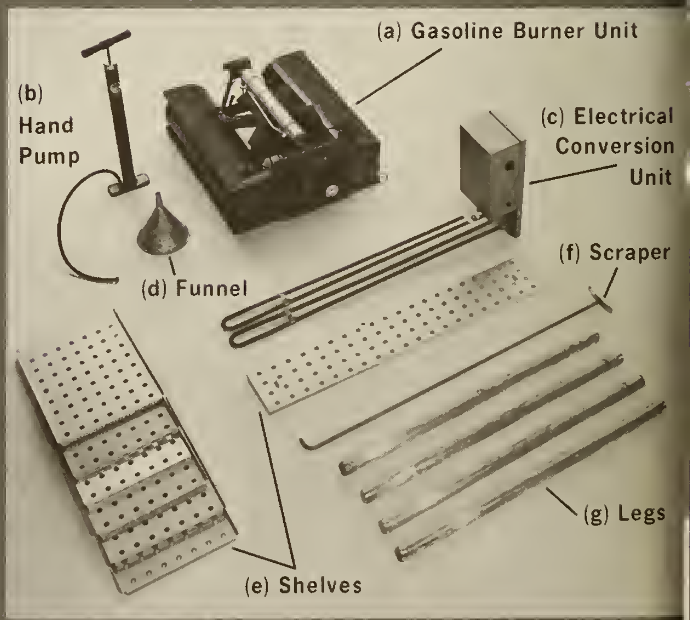
FEDERAL NOMENCLATURE: STERILIZER, SURGICAL INSTRUMENT AND DRESSING, 16 X 36″

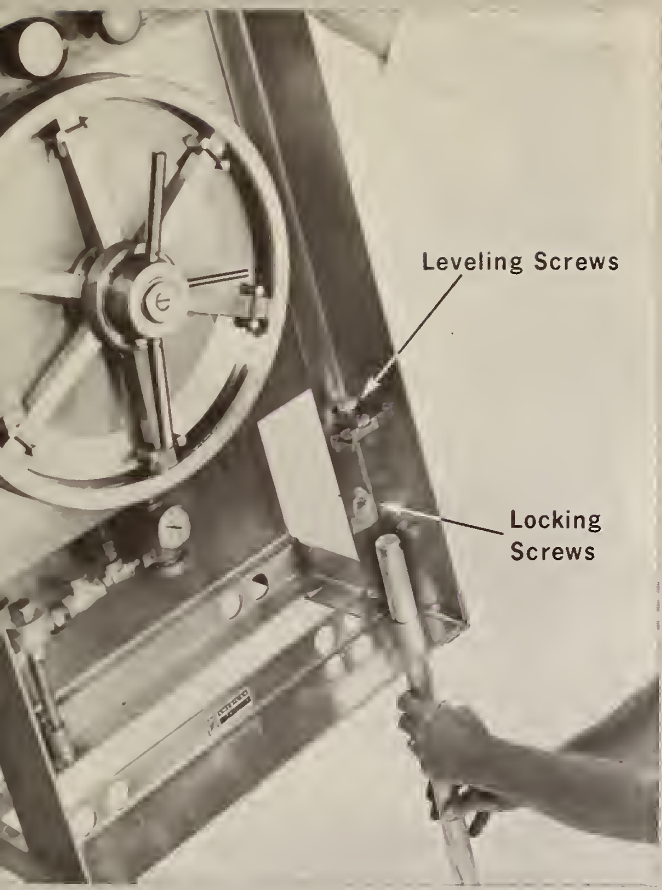
This sterilizer weighs about 400 pounds unpacked. If at all possible, it should be handled with a lift or hoist. When operated electrically, it will be necessary to procure electrical cable locally. The power supply is 220 volts—60 cycles, or 440 volts—60 cycles, both AC. The magnetic contactor has a dual voltage coil which will enable an electrician to wire for either 220- or 440-volt operation. When the gasoline burner is used to heat the sterilizer, it will be necessary either to operate the unit out-of-doors, indoors with windows open, or, ideally, indoors with the fumes vented out through a stovepipe attached to the top of the sterilizer. The stovepipe must be obtained locally.

STEP 1:

A. With hammer and crowbar found in PDH toolbox, remove top of crate and knock both ends off. Remove boxes containing components, tools, and spare parts. Knock sides of crate off and remove packing. Sterilizer may then be lifted off base for insertion of legs.

B. Sterilizer components with the exception of the sterilization chamber with internal dimensions of 16″ x 36″ are shown. They are: (a) gasoline burner unit, (b) hand pump for creating air pressure in tanks, (c) electric conversion unit, (d) funnel for chamber drain, (e) shelves, (f) scraper for cleaning jacket, and (g) legs.





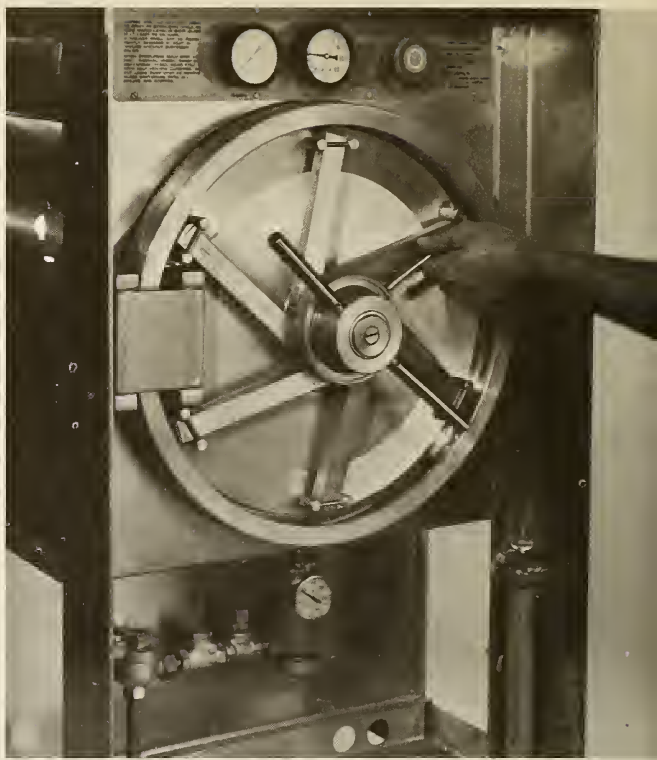
STEP 2:

A. If no lift or hoist is available, three men should lift sterilization chamber while fourth inserts legs through holes in bottom of frame. Legs should be removed from storage in bottom of chamber before it is lifted. Legs are leveled by adjusting screws on brackets holding tops of legs. Legs are locked in place by tightening thumb screws behind frame holding legs.

STEP 3:

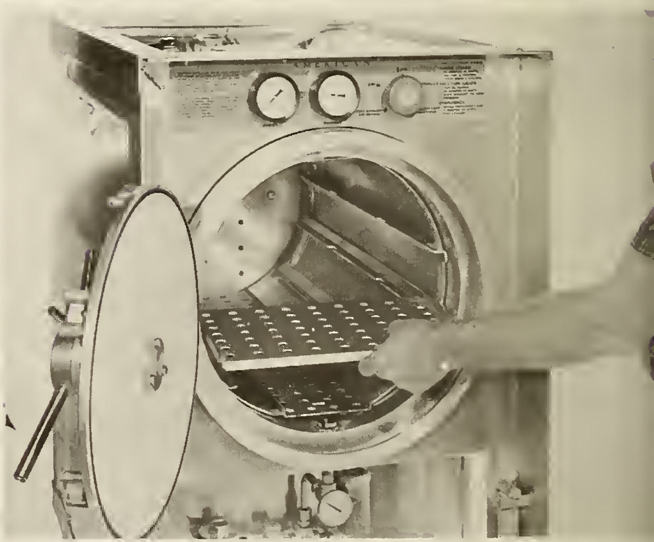
A. To open sterilizer door, turn the double handle counterclockwise.

B. Pull up on latch handle until door-locking arms are retracted. This will open door.



STEP 4:

A. Shelves (e) may be arranged as desired by sliding into brackets inside chamber.



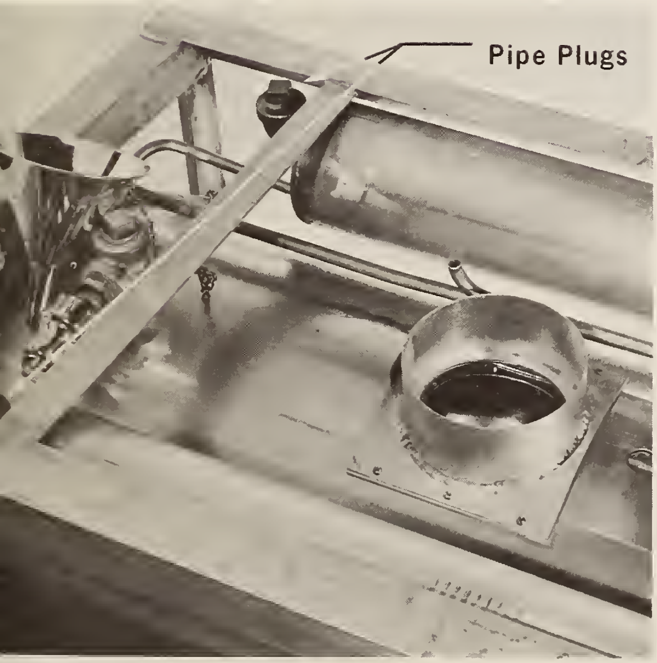
STEP 5:

FOR USE WITH GASOLINE BURNER UNIT.

(SEE ALTERNATE STEP 5 FOR USE WITH ELECTRICAL CONVERSION UNIT.)

A. Remove door panel on side of sterilizer. Gasoline burner unit (a) is slipped in opening, drawer fashion. Gasoline will be poured in tank on right; air will be pumped into left tank. Follow instructions attached to unit for pumping air pressure and adjusting flame. Use pump (b) to create air pressure.

B. Replace door panel. Door may be opened or closed by sliding to right or left.



C. To vent fumes, open sliding panel on top of sterilizer chamber. Be sure that maximum opening is obtained as pictured. Standard stovepipe may be attached to vent opening.

PRECAUTION:

Do not operate with gasoline in closed room without adequate ventilation. Attendant may be overcome by fumes.

ALTERNATE STEP 5:
FOR USE WITH ELECTRIC CONVERSION UNIT

A. Remove four nuts and washers over studs on back of sterilizer chamber to release cover and gasket from the jacket cleanout opening. Remove cover from electric conversion unit (c).

B. Make certain gasket is in place over heating elements of conversion unit (c) before inserting elements into jacket cleanout opening. Place the electric control box over the four studs on the outside of the opening and secure it with four screws and four lock washers.

C. Replace the four nuts and washers previously removed (A) from the studs.

D. Using 200-volt electrical cable obtained locally, electrician can hook cable into control box and connect to 220-volt outlet. Follow wiring diagram on back of control box.

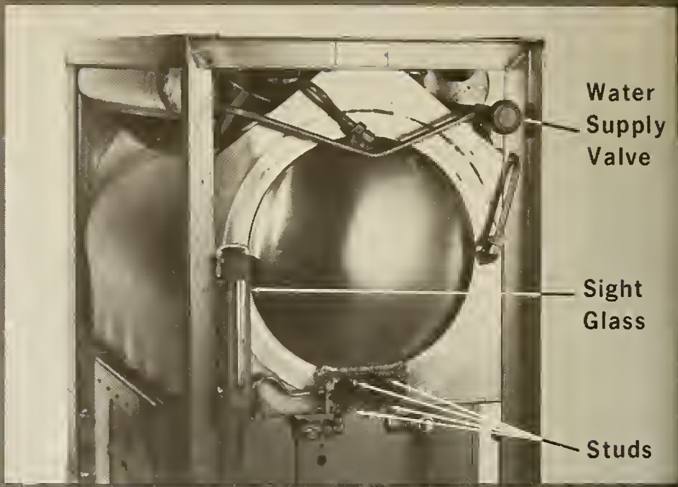
E. Photo illustrates correct position of vent opening when electricity is used.

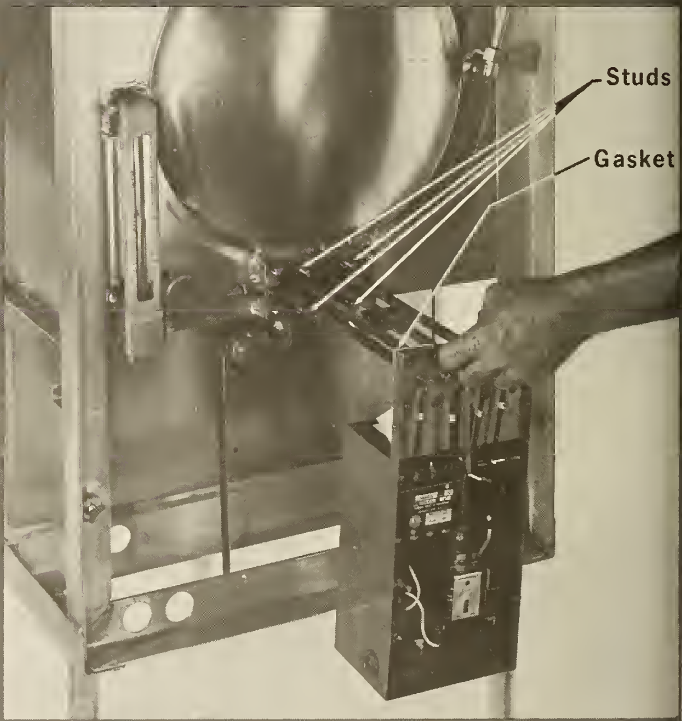
STEP 6:

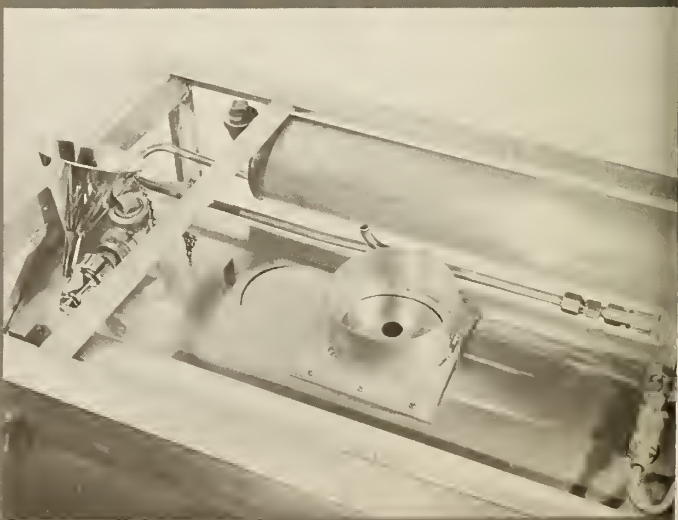
A. To fill water tanks and jacket, remove pipe plugs as shown in photo, page 229, Step 5, C, on water tanks located on either side of top of sterilizer. Using attached funnel, fill tanks with water. Open water supply valve, Alternate Step 5, A. Turn operating valve (see photo Step 3) to "Sterilizer" position. Water will flow through tanks to jacket. Fill jacket until sight glass (see photo, Step 5, A) shows "Full." Close water supply valve immediately. Turn operating valve to "Off." Continue filling until both tanks are full. Replace pipe plugs.

TO BE OBTAINED LOCALLY:

Electrical cable. When electricity is not available, gasoline and stovepipe for venting fumes.







E.

STERILIZER AND STOVE,

Table Model

FEDERAL STOCK NUMBER: 6530–781–3684 (6530–000–0010)

FEDERAL NOMENCLATURE: STERILIZER, SURGICAL INSTRUMENT AND DRESSING

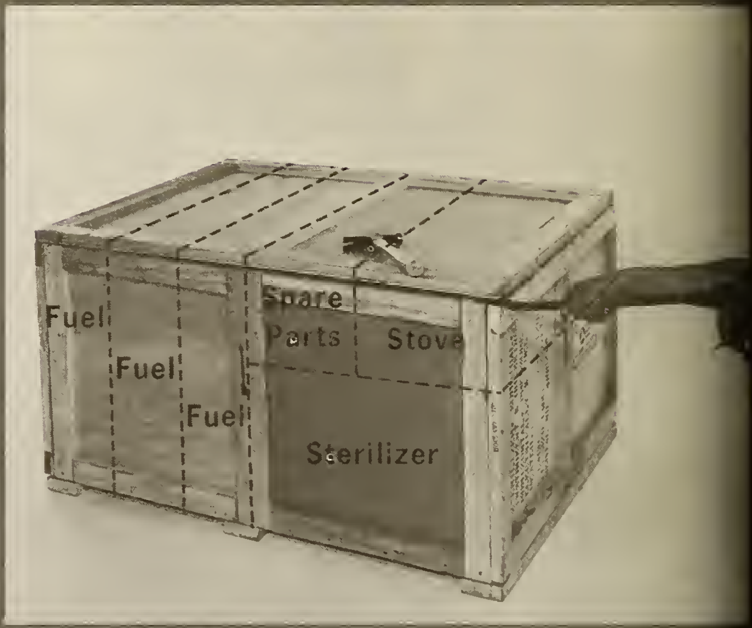
This 8″ x 8″ x 16″ pressure sterilizer may be heated electrically or with its own auxiliary heating unit. A fuel supply is included in the packing case. The sterilizer is shown mounted on the auxiliary heating unit.

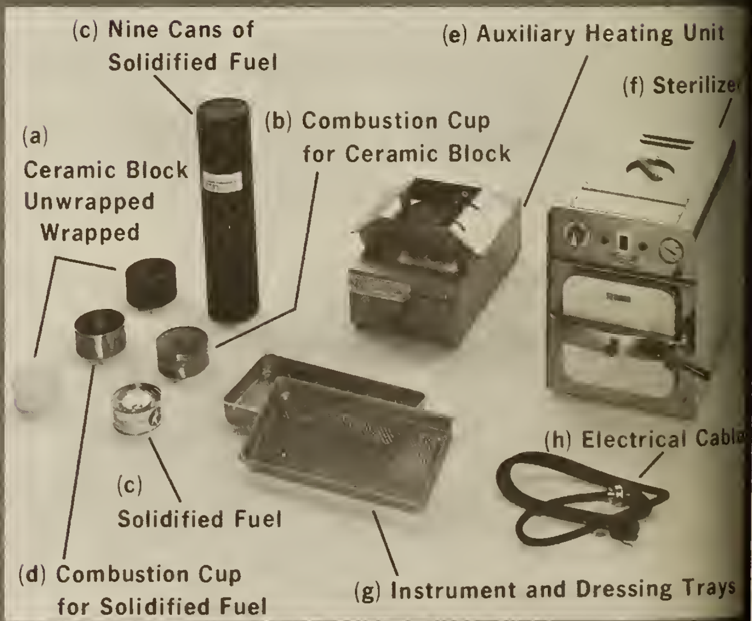
STEP 1:

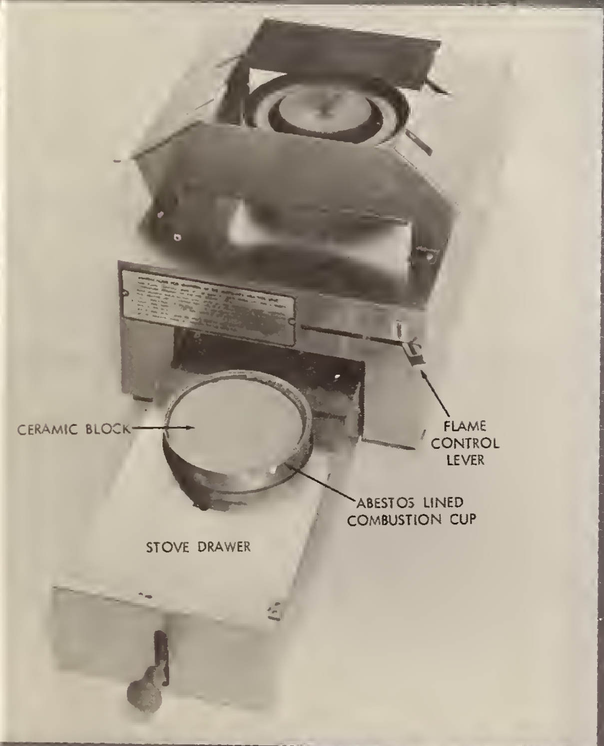
A. The sterilizer, heating unit, spare parts, and fuel are packed in a cleated plywood box which should be opened by removing the top with a crowbar and hammer or other tools found in the PDH toolbox.

B. If the box is opened as pictured, three cartons wrapped in waterproof paper containing fuel will be packed on the left. If the sterilizer is to be operated electrically, it will not be necessary to unpack these cartons.

C. Individual components are: (a) ceramic block, (b) asbestos lined combustion cup for holding ceramic block, (c) solidified fuel, (d) combustion cup for holding can of solidified fuel, (e) auxiliary heating unit to be used with either solidified fuel or gasoline-soaked ceramic block, (f) sterilizer, (g) trays for holding instruments and dressings to be sterilized, and (h) electrical cable for use when 110-volt, separate circuit outlet is available. Cord is equipped with adapter, may be used in either double or triple prong outlet.







CAUTION: *Before sterilizer is put into service, the water reservoir must be filled with approximately three quarts of water. Distilled or demineralized water is recommended if available. Remove the water reservoir cover (do not attempt to detach chain) and fill to about 1/2" below the filling opening. Replace cover. Open sterilizer door and push the operating valve down. When water in chamber reaches the water level indicator, pull operating valve up. Water should barely touch bottom edge of word "Level."*

STEP 2:
(TO HEAT STERILIZER ELECTRICALLY)

A. Attach electrical cord (h) into connection at rear of sterilizer (f). Plug cord into electric outlet of voltage specified on rear of sterilizer. A 110-volt outlet (normal household) is sufficient if the sterilizer is the only piece of equipment plugged into the circuit.

B. A two-prong adaptor is attached to the cord (h). When the adapter is used, it is best to ground the attached wire.
See page 57, Step 4 for grounding procedure.

STEP 2A:
(TO HEAT STERILIZER WITH AUXILIARY HEATING UNIT AND CERAMIC BLOCK)

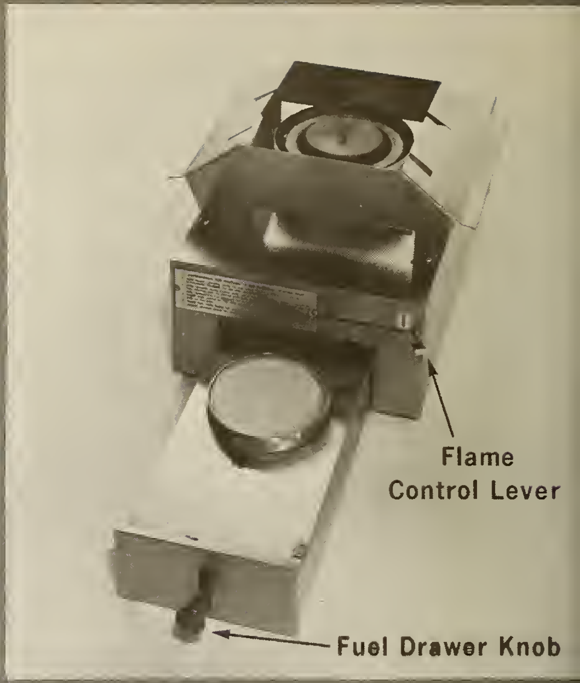
A. Insert abestos-lined fuel combustion cup (b) into fuel cup holder. *Never* use unlined cup with ceramic block.

B. Preferably out-of-doors, soak unwrapped ceramic block (a) in liquid gasoline 10 to 12 minutes. Remove block from gasoline.

C. Insert gasoline-soaked ceramic block (a) into fuel cup (b) as shown.

D. Move flame control level to far left. If sterilizer is to be used immediately, ignite fuel and rapidly close drawer. Height of fuel drawer knob may be adjusted to prevent initial sooting and to obtain maximum heat. See Step 3 before placing sterilizer on heating element.

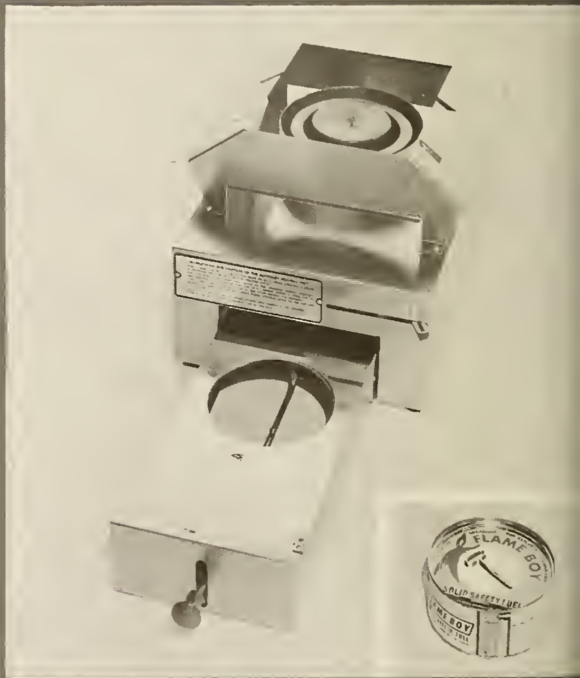
EXERCISE USUAL CARE WHEN HANDLING GASOLINE. DO NOT SMOKE OR WORK NEAR FLAME—DO NOT INHALE FUMES, ETC.



STEP 2B:

(TO HEAT STERILIZER WITH AUXILIARY HEATING UNIT AND SOLIDIFIED FUEL)

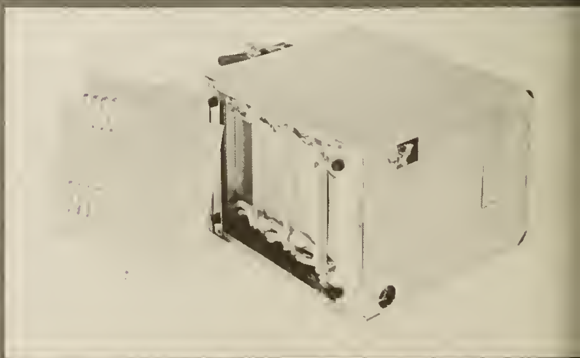
A. Use same procedure as Step 2, A, except that combustion cup (d) is inserted in holder and opened can of solidified fuel (c) is placed in cup (d).



STEP 3:

A. Before placing sterilizer on auxiliary heating unit (e), remove bottom cover of sterilizer (f). This is accomplished by removing four screws which hold the cover in place.

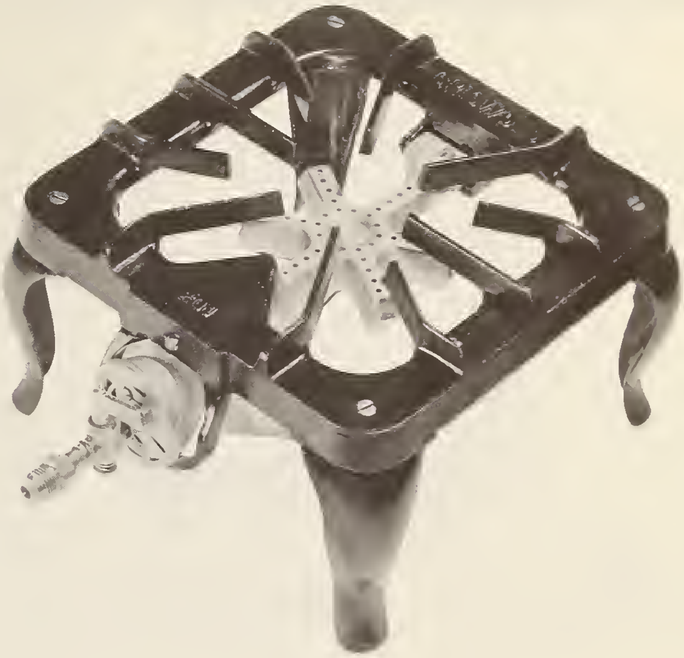
B. Insert the second and third bars of the sterilizer bottom into the slots on the top of the auxiliary heating unit. It is not necessary to replace the sterilizer bottom cover if it is later possible to operate the sterilizer electrically. The heating unit may then serve as a stand.



TO BE OBTAINED LOCALLY:

(When solidified fuel supply is exhausted and electrical power is not available) Gasoline.

L. P. GAS STOVE



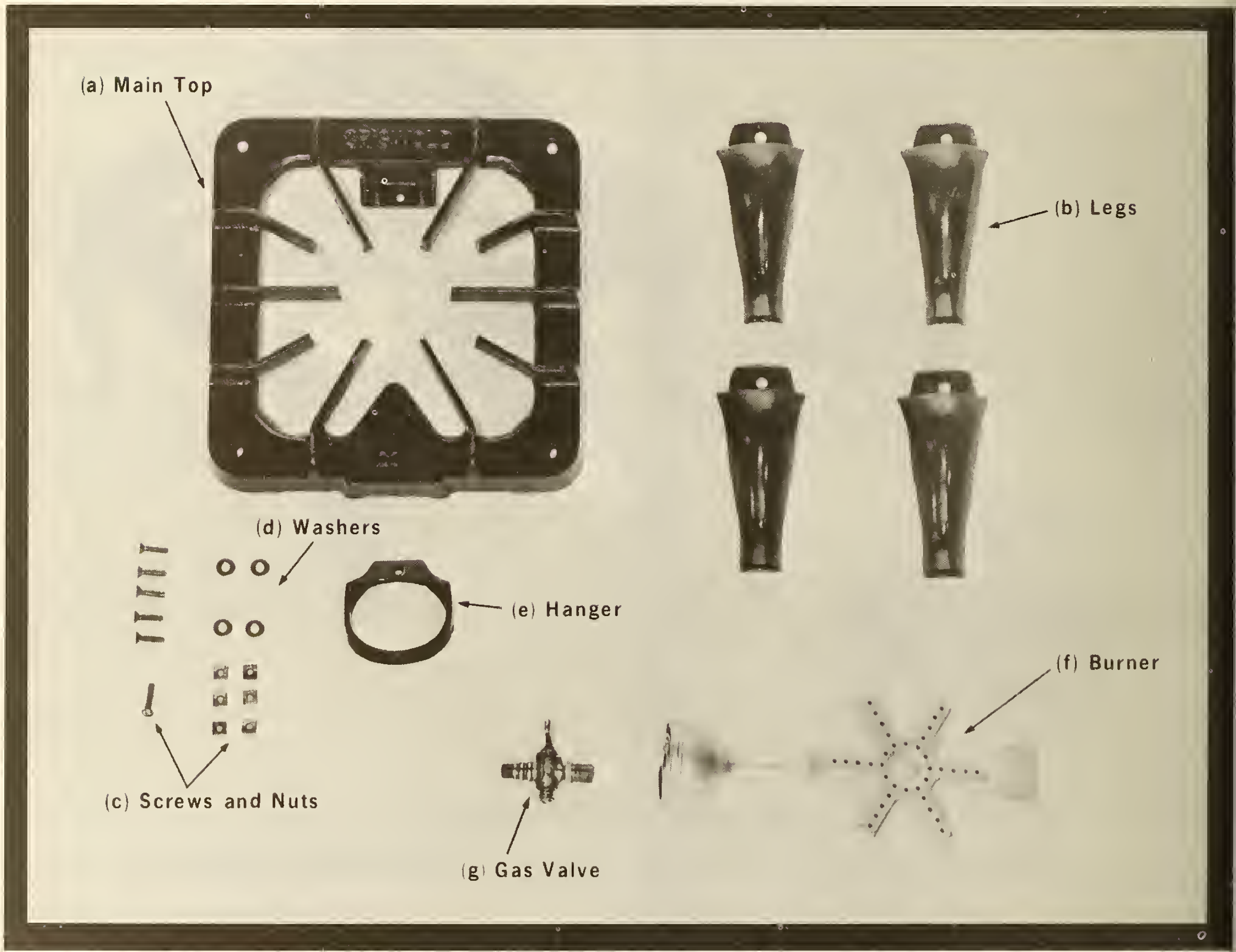
FEDERAL STOCK NUMBER: 7310-000-0002

FEDERAL NOMENCLATURE: STOVE, L.P. GAS, SINGLE BURNER

Stoves packed with some PDH's are slightly smaller than those in others. The basic difference between the stoves is in size only and the following instructions will apply to all stoves carrying Federal Stock Number 7310–000–0002. L.P. Gas, tubing, and adapters are not included in the hospitals. They must be procured locally. The stove may be hooked up to a natural gas supply if available. However, the valve is preset for L.P. Gas and must be reset if natural gas is used. See instructions in the container for adjusting the valve.

STEP 1:

A. Remove parts from fiberboard carton. They should include: (a) main top, (b) four legs, (c) six screws and six nuts, (d) four washers, (e) hanger, (f) burner, and (g) gas valve.



STEP 2:

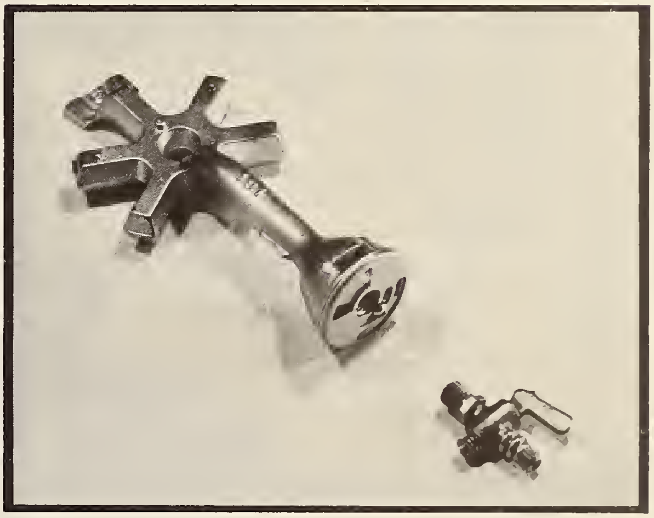
A. Fasten legs (b) to main top (a) by inserting a flathead screw (c) through each corner hole in top (a) and then through the slot in the top of each leg (b). Place a flat washer (d) over the protruding screw and secure with a nut (c).

STEP 3:

A. Hanger (e) is attached to inside wall of main top (a) with a roundhead screw and a nut (c). Screw is inserted through front of top (a) and then through hanger (e). Tighten securely.

STEP 4:

A. Screw gas valve (g) into hole in air shutter of burner (f). When tightening valve, exercise caution in application of wrench. Excessive pressure can alter the L. P. Gas adjustment.



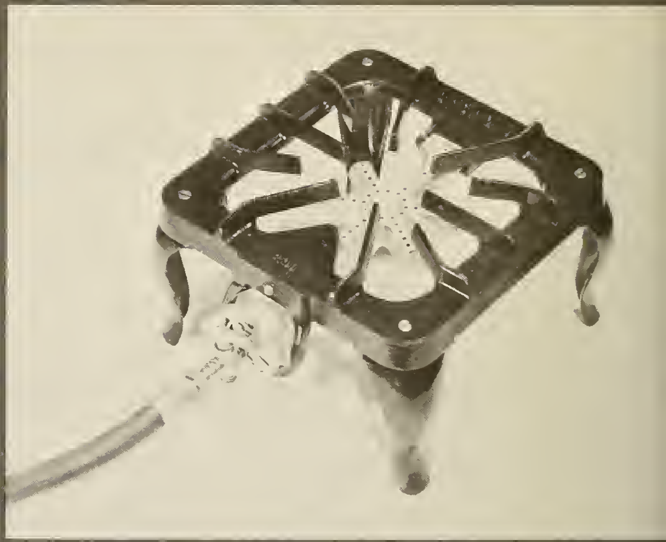
STEP 5:

A. Insert gas valve end of burner (f) through back of hanger (e). Bolt burner (f) to main top (a), inserting roundhead screw (c) through burner (f), then through bracket on back of top (a). Secure with nut (c).

STEP 6:

A. Procure locally tube or hose, adapter, regulator, fittings if needed, and tanks of L. P. Gas.

B. The adapter is screwed firmly to burner valve and tube or hose is connected to the adapter. Hose or tube is then attached to regulator which then is connected to the gas tank.



NOTE: To test flame, light stove by turning handle to "ON" position and holding match slightly above the burner opening. Flame height and intensity is adjusted by opening or closing the valve handle.

TO BE OBTAINED LOCALLY:

L. P. Gas Tanks, adapters, and tubing for connecting tank to stove.

PHARMACY SECTION

When the Packaged Disaster Hospital is set up as an independent facility, as is usual the pharmacy section is responsible for the storage, control, distribution, labeling, and dispensing of all drugs, chemicals, and pharmaceutical preparations. There is at least one medication in each essential therapeutic category: anesthetics, analgesics, sedatives, anti-infectives, antiseptics, stimulants, antispasmodics, antihistaminics, ophthalmic medications, and large-volume intravenous solutions including resuscitative fluids. Narcotics are not supplied with PDH's at the present time, but it is expected that they will be within the near future. Most of the drugs in the PDH are supplied in ready-to-use form to eliminate the need for time-consuming, large-scale bulk compounding and prepackaging.

STAFFING

The chief pharmacist, his alternate, and as many of the staff as possible should be designated predisaster. Activation of the PDH will begin as soon as conditions permit after the disaster and pharmacy personnel should be prepared to set up their section as soon as PDH components are brought to the operating site.

The pharmacy section must be supervised at all times by a licensed pharmacist because even during disaster pharmaceuticals may be labeled and dispensed only under his supervision.

It will probably be necessary to operate the hospital at first on two 12-hour shifts a day in order that enough personnel will be available at all times. The pharmacy section staff should consist of at least two pharmacists, two aides, and four helpers, to be divided between the two shifts. The aides and helpers will be directly responsible to the pharmacist in charge.

Predisaster Preparation

The chief pharmacist should become familiar with the supplies and equipment furnished in the PDH for which he will be responsible and together with the administrator should plan to obtain locally any items beyond those packed with the PDH which he feels will contribute to the efficiency of his section. He should also ascertain principal local sources of pharmaceuticals. It may be necessary to draw on these sources for resupply should Federal back-up supplies not yet be available when PDH supplies are exhausted.

The chief pharmacist should be a member of the professional advisory committee which plans basic PDH operational policy. Specifically, he should confer with the chief of staff and director of nursing in decisions on standard medications orders, supplies of medications to be kept on the wards, etc.

When necessary, he should assist in recruiting the personnel to man his section and must take an active part in their predisaster training. He may wish to compile a list of community pharmacists who could assist him in the PDH pharmacy during periods of peak activity. The entire pharmaceutical staff should participate in PDH training programs and practice exercises in order to become familiar with hospital procedure under disaster conditions.

The two aides assigned to the pharmacy section should be drawn from the best qualified of the lay volunteers available. Preferably, they should have experience in receiving, sorting, and issuing medical supplies and in keeping related records.

The four pharmacy section helpers need not have special health skills, however, drugstore or storeroom employment experience would be desirable.

Postdisaster Duties

The pharmacists should report, as indicated in the predisaster plan for the activation of the PDH, to the operating site to supervise the setting up of the pharmacy section. Once the PDH is activated, either the chief pharmacist or his alternate must be on hand to perform or supervise the performance of essential pharmacy functions.

The aides should report to the pharmacist in charge and begin at once to get the section into operation under his direction. They will assist in sorting, storing, and distributing the supplies as they are delivered to the section. After the PDH is in operation, they will issue pharmaceutical supplies, assist in preparing and labeling pharmaceuticals, and keep necessary records as the pharmacist directs.

The helpers should assist in activating the section. They will unpack, sort, store, and distribute the supplies. They will also perform messenger duties and keep the section clean and orderly.

PREPARING THE SECTION

LOCATION

The pharmacy section should be easily accessible to all of the clinical sections of the PDH. A minimum of 800 square feet of floor space is recommended, preferably on the first floor of the selected building. An efficient arrangement is to locate the pharmacy, laboratory, central sterile supply, and general stores sections close together. Supplies or services are requested from all these units and messenger pickups will be considerably simplified if these sections are in the same area. This layout would also permit joint supervision (of the pharmacy and general stores sections, for instance) if it should be necessary for available personnel to assume responsibility for more than one section.

FURNITURE AND FIXTURES

Arrangements to procure counters, shelves, tables, chairs, and other furniture and fixtures should be made predisaster. None of these items are furnished with the PDH and if they are not already at the operating site they must be brought from local sources. If a room with shelves is available, this would be a good choice for the pharmacy. Shelves and cabinets, however, can be improvised from the crates and heavy boxes in which the PDH supplies are packed.

The pharmacy section should have a sink with running water if possible, otherwise a nearby source from which water can be carried should be available.

A refrigerator should be provided in the pharmacy section for the protection of thermolabile pharmaceutical items. The laboratory section also has some need for a refrigerator and if there is not another available, a portion of the one in the pharmacy section should be designated for laboratory use.

SPECIAL STORAGE CONSIDERATIONS

Locked Storage

To prevent drug abuse and to meet legal requirements, a cabinet which can be locked should be provided for the storage of narcotics and other items such as barbiturates and amphetamines.

Storage of Flammables

The pharmacy section will receive some items which, improperly stored, could constitute a fire hazard and would also be subject to rapid evaporation. Among them are ether, denatured alcohol, and isopropyl alcohol. Such items must be kept from heat and open flame and a special storage area should be provided for them.

Storage of Items Subject to Damage by Freezing

The pharmacy section will receive a number of cases containing bottles of liquids which will break if frozen, as well as other items which must be kept from freezing. Complete lists of these items are given in component listings packed with each PDH. Should it be necessary to store bulk supplies in space other than in the room used as the pharmacy section, it should be ascertained that these supplies will not be subjected to below-freezing temperatures.

NONPREMIUM STORAGE SPACE

It is likely that space at the operating site will be limited and areas which can be used for wards or other clinical functions should not be occupied by the entire 30-day stocks of items which are supplied in large quantities. An area considered unsuitable for patient care may be designated for storage of the items in excess of immediate needs. Careful records of items received and issued should be kept, especially when items from more than one hospital section are stored in the same area. Supervisory responsibility for this storage area should be assigned by the PDH administrator.

PDH PHARMACEUTICALS

As a part of their storage agreement, parent hospitals may agree to accept PDH pharmaceuticals for rotation within their own stock. As an alternate plan, pharmaceuticals will be packed with the PDH and the Division of Health Mobilization will arrange for rotation or replacement, whichever is indicated. Most of the items are stored ready for use but some preparation is required before a few of them can be issued. Procedures are as follows:

Benzalkonium Chloride Solution, 1:1000

Benzalkonium Chloride Solution, 10% .... 10 ml

Purified water, to make .... 1000 ml

Benzalkonium Chloride Tincture, 1:1000

Use either of the following methods:

a. Benzalkonium Chloride Solution, 10% 10 ml

Alcohol (ethyl or isopropyl) 70%, to make .... 1000 ml

b. Benzalkonium Chloride Solution, 10% 10 ml

Acetone .... 100 ml
Alcohol (ethyl or isopropyl) .... 500 ml
Purified water, to make .... 1000 ml

Isopropyl Rubbing Compound, 70%

Isopropyl Alcohol, NF .... 700 ml
Purified water, to make .... 1000 ml

QUALITY SCREENING

Items received by the pharmacy section should be checked carefully for manufacturer's expiration dates. These dates may indicate that the material is beyond its period of safe use. An inspection may have been made during the storage, however, and if the material was sampled, tested, and found to be good, the safe shelf-life dates will have been extended. This will probably be noted on the outer package, although in some cases the notation will be on inner containers. The pharmacist will be responsible for screening all perishable material and also for assuring that material has not been rendered harmful or ineffective as a result of the disaster itself.

LABELING AND DISPENSING

All drugs, chemicals, and pharmaceutical preparations must be dispensed either by the pharmacist or under his direction. The pharmacist in the section is responsible for seeing that all supply requests are accurately filled.

All medications dispensed from the pharmacy must be properly labeled. No medication may be dispensed without a label or identification. The pharmacist is responsible for the proper labeling of all medications, wherever they may be stored in the hospital. He must either label them himself or directly supervise their labeling. No one but a pharmacist should be permitted to change labels on containers or medications.

ORGANIZING SUPPLIES

STOCK CONTROL SYSTEM

If the available pharmaceutical supplies are to be managed properly and made available equitably to all clinical sections, a stock control system must be established. Planning the system predisaster will allow ample time for designing and printing necessary forms and for familiarizing the PDH staff with this system. Otherwise, a system will have to be established as quickly as possible during the first days of operation with an inevitable loss of speed and accuracy.

The system should be simple enough to be workable under the pressure of disaster conditions and yet complete enough to permit the pharmacy chief to establish an initial inventory, account for issued stock, determine balances, and compute resupply requirements.

INITIAL INVENTORY

Master lists of the entire contents, case by case, are furnished with each PDH. One copy of this list is sent to the designated PDH custodian at the time the unit is delivered for storage. Additional copies are packed with the PDH. When the PDH is activated, cases are delivered to the PDH section indicated on the master list. Publications covering various PDH models are available for guidance during activation.

Quantities of all items received in the pharmacy should be noted as they are unpacked to provide an accurate inventory list. This will be the basis for all future records as supplies are subsequently issued and new stocks procured.

PERPETUAL INVENTORY

As soon as possible, a set of control records should be made, using a form such as the one shown on Page 254. This form is not furnished with the PDH. It may be decided predisaster to have the form prepared locally and stored with the PDH. If this is not done, the information can simply be written on blank sheets of paper. There should be a separate sheet for each item of supply and it should carry the name of the item, unit of issue, size, dosage, etc. Columns should provide space to enter quantities received, quantities issued, the balance, and any remarks. The sheets should be arranged alphabetically in a notebook or file box. They should be kept up-to-date and a balance obtained regularly to allow ample time to arrange for resupply before shortages develop.

INITIAL DISTRIBUTION

In order to consolidate items in a manageable number of crates and boxes, some PDH cases contain an assortment of items needed in different hospital sections. For example, in some PDH's one of the cases which contains pharmacy equipment also contains the alcohol burners needed in the laboratory and on the wards, as well as a variety of brushes and other items needed in several clinical sections. Other cases contain the entire PDH supply of an item which will be used in several sections.

These cases must receive special attention to assure that they are unpacked and their contents sorted and delivered as quickly as possible, according to the breakdown information given in the component listing covering the specific PDH model. No supply requests are required for this initial distribution.

UNPACKING

Care should be taken during the unpacking not only to avoid breaking bottles of pharmaceuticals but also to avoid damaging the boxes. Crates and heavy boxes can be used as improvised counters and storage cabinets and should be saved for this purpose. When the need for the PDH has passed, the equipment and any remaining supplies will be repacked and returned to storage, requiring the use of the original packing boxes. If the pharmacy section has no need for them, the boxes which contain expendables may be used in other sections, especially in the wards where improvised bedside tables, backrests, overbed tables, etc. can be made.

Boxes of supplies and smaller pieces of equipment (such as prescription bottles) should be opened but not unpacked other than to meet immediate needs. These boxes can be stacked with their opened sides facing out into the room in an improvised shelf arrangement. Supplies should be arranged so that pharmacy section personnel can locate items readily and get to them without having to move other boxes.

SUPPLY DISTRIBUTION

CONTROLLED ITEMS

In many hospitals, barbiturates, amphetamines, alcohol, etc., are controlled in much the same way as narcotics. Particular care should be exercised in distributing, accounting for, and storing such items to prevent abuse or unauthorized use. As a minimum, these items should be kept in locked storage and inventory records should be kept with special care. Other controls are left to the judgment of the chief of the pharmacy section with the agreement of the chief of staff and administrator. The acquisition and control of narcotics is discussed on Page 244 .

SUPPLY REQUESTS

It may be found efficient to designate one person within the entire supplying area (pharmacy, general stores, and central sterile supply) to receive all supply requests and direct them to the section where the requested items are stored. This coordination will be helpful in locating various miscellaneous items which could be stored in any of several places depending upon facilities in the individual building, available section personnel, etc.

The pharmacy section will release supplies to the various PDH sections on receipt of written supply requests. Forms for this purpose are not supplied with the PDH. It is recommended that a form such as the one shown on Page 24 be reproduced locally predisaster. The requests can, however, be written on the pads of unruled paper which are supplied with the PDH.

Supply requests should be made out in triplicate. The originating section should keep a copy and send the original and second copy to the pharmacy section. The second copy is returned with the supplies and the original is kept by the pharmacy section. By referring to these originals, the pharmacy aides can keep their perpetual inventory records current.

STANDARD ISSUE QUANTITIES

It may be difficult at first to determine use rates accurately enough to be able to establish any rules on what quantities a section should be allowed to request at one time. To assure equitable distribution, however, some limits must be set. One possible standard is to allow a section to keep on hand no more than a 5-day supply of an item. The initial automatic distribution is based on an estimated 5-day supply of expendables.

UNFILLED ORDERS

A procedure should be established to handle instances in which the requested supplies are not available to fill a requisition. The original and copy of the supply request can be returned to the originating section marked with a reorder date or the copy can be returned with the notation that the supplies will be sent when they are available. In the latter case, the original requisition should be kept in a pending file in the pharmacy section until supplies can be obtained from an outside source.

ROUTINE REPLENISHMENT

After the initial heavy influx of patients has subsided, the PDH will settle into a more routine operation. At this time it may be possible for the pharmacy section to establish a procedure for picking up supply requests and delivering supplies on a regular basis. Emergency or "stat" orders should, of course, be filled as soon as they are presented.

RESUPPLY

When inventory balances show that supplies are being depleted, the pharmacist in charge of the section should notify the PDH administrator so that arrangements can be made to procure the needed items from outside sources. The pharmacist and the administrator should know, as a result of their predisaster preparation, the community or State plans for health resource control and also the principal community sources of pharmaceuticals and related supplies. The pharmacist should also be prepared to suggest possible substitutes for items on which resupply is difficult. The administrator may obtain items through civil defense supply officials or directly from pharmacies or other local suppliers, depending on the circumstances at the time.

If the disaster has been severe enough to require the prolonged operation of the PDH, there will almost certainly be an accompanying disruption of transportation and communications facilities and the process of resupply could take considerable time. Efforts to obtain more supplies should be begun well before the supplies on hand are exhausted. The time at which a reorder is initiated will depend, of necessity, on the actual situation. Only then will it be possible to know the rate of use and the time lag in obtaining additional supplies.

NARCOTICS

Narcotics are not now stored with the PDH. However, plans are being made for their acquisition and shipment storage arrangements have been made which meet Federal, State, and local narcotics requirements. The chief of the pharmacy section, in consultation with the PDH chief of staff or administrator, should plan predisaster for additional procurement. If local supplies are depleted, narcotics can be ordered through civil defense channels on the standard order form issued by the Bureau of Narcotics.* Narcotic regulations allow orders by no one except designated Civil Defense Narcotics Procurement Officers when a civil defense emergency has been declared by the President or Congress. Anyone in the community who is registered with the Bureau of Narcotics may be so designated. Most pharmacists are qualified for this designation.

DISTRIBUTION IN THE PDH

The procedure for the issue and use of narcotics within the PDH is to be decided by the chief of staff. It should be consistent with existing laws and regulations and with the principles of ethical professional practice.

INVENTORY CONTROL AND STORAGE

The pharmacy section will have custody of narcotics. When the supply is received, a pharmacist must immediately verify the quantity and record the amount on the perpetual inventory records. The material must be placed in locked storage at once. Records of narcotics must be maintained with great care and kept current at all times.

Only a pharmacist may issue narcotics from the pharmacy section and only to another licensed person, usually a nurse. That person signs for the amount received and is responsible for the same exact accounting that is required of the pharmacist. If a supply of narcotics is to be kept in the ward area, locked storage must be provided.

Acquisition of Narcotics During Civil Defense Emergencies *

1. General

   A. The purpose of this memorandum is to restate U.S. Bureau of Narcotics approved procedures for the acquisition of narcotic drugs during civil defense emergencies as authorized by the Harrison Narcotic Act. These procedures were previously contained in the Federal Civil Defense Administration's Advisory Bulletin No. 205 of December 10, 1956.

   B. The U.S. Bureau of Narcotics exercises federal control over all transactions in narcotic drugs. State and local narcotic laws generally serve to further implement and augment the Harrison Narcotic Act. Except for specific restrictions and exacting procedural requirements, narcotics should be viewed in the same manner as any other class of essential medicaments needed for the care of survivors under national disaster circumstances. To obtain and/or maintain narcotic reserves, States and other political entities, communities, public and private institutions, and organizations, as well as individuals, must comply with the laws and policies of the jurisdictional authorities concerned, and with the regulatory measures of the Bureau of Narcotics.

   C. The Public Health Service is not authorized to define the latitudes of the Harrison Narcotic Act, nor to endorse controls, acquisitions and distribution procedures that may ostensibly deviate from the Act, or require a specific ruling. The appropriate district office of the Bureau of Narcotics (Attachment II) is the primary contact for all inquiries in this area.

2. Normal or Peacetime Acquisition

   (This section is included as background information to illustrate the similarity of narcotic acquisition under normal and national disaster situations.)

   A. Physicians (including osteopathic physicians), dentists and veterinarians may prescribe narcotic drugs for individual patients using their standard prescription forms, noting their narcotic registry number for nominal quantities of narcotics consistent with specific patient needs. Such prescriptions may be filled by any pharmacy licensed to dispense narcotics to individual patients.

   B. To obtain narcotics for professional and business purposes, physicians hospitals, clinics, retailers, wholesalers, and manufacturers routinely use the official Federal narcotic order form (IRS Form 2513). All persons obtaining and utilizing the order form for narcotic transactions must be properly registered with the District Director of the Internal Revenue Service for the district in which he practices.

*The procedure is fully described in regulation No. 5 of the Joint Regulations of the Bureau of Narcotics and the Internal Revenue Service, section 151.225(4).

*Reprinted from Division of Health Mobilization Memorandum No. 65-103-H, July 2, 1965.

Throughout the United States, persons so registered number in excess of 350,000 constituting a substantial structure of legally authorized individuals to conduct legitimate narcotic transactions. The acquisitions of narcotics must be made in quantities that are reasonable and must be supportable as the minimum requirements for the service being provided. Exceptionally large inventories must be justified to the satisfaction of the Bureau.

C. Regulation No. 5, Joint Regulations of the Bureau of Narcotics and the Internal Revenue Service (IRS Publication #428), distinguishes among six taxpaying classes and one exempt official (non-taxpaying) class of registrants. Each registrant receives an identifying number from the District Directors, IRS, of his particular district. So-called "exempt officials" are civilian and military officers of the United States and its political subdivisions, who have responsibility for acquiring, dispensing or handling narcotic substances in the course of their official duties.

Pre-emergency Planning

A. All State and local civil defense emergency health organizations should identify those individuals or agencies that are registered under the narcotic laws and should secure their cooperation in maintaining adequate, but not excessive, stocks under appropriate protective safeguards in accordance with Bureau of Narcotics requirements. As many of these registrants as are needed should be included in the State and local civil defense emergency health organizational structure. Virtually all drug manufacturers, producers, compounders, wholesalers, hospitals and clinics have, on their staff, persons so registered. Physicians, pharmacists, veterinarians, dentists and other practitioners are also generally registered. The names of local narcotic manufacturers and wholesalers who hold major supplies in an area may be obtained from the appropriate District Office, Bureau of Narcotics. From such sources, selected registrants should be predesignated as Civil Defense Narcotics Procurement Officers (CDNPO). All such predesignated officials assume "exempt" status postattack regardless of their previous classification.

B. If additional emergency health service or civil defense officials require registration for the performance of their official duties during an emergency, arrangements should be made with the Bureau of Narcotics for their registration during the preattack period. Only during a civil defense emergency as declared by the President or by the Congress would such registrants function as civil defense narcotic procurement officers; and only in time of such emergency would they be authorized to use the official narcotic order form for the acquisition of narcotics for civil defense purposes.

Acquisition During a Civil Defense Emergency

A. Only registrants and exempt officials who have been designated as Civil Defense Narcotics Procurement Officers may execute the above-mentioned official narcotic order form (IRS Form 2513) during a civil defense emergency to obtain the required amount of narcotic items to carry out their respective missions.

B. The narcotics order form will be completed in triplicate, with the words "Civil Defense Procurement" clearly marked across the face of the form, and signed by the registrant, followed by his title, "Civil Defense Narcotics Procurement Officer," or its abbreviated form "CDNPO." The original, which later may be used as a claim for payment, will go to the supplier; the duplicate copy remains with the registrant (CDNPO), while the triplicate copy is forwarded to the jurisdictional district or subdistrict Bureau of Narcotics office.

C. Sources of supply will be stocks in surviving pharmacies, wholesalers, manufacturers and other local distributors. With adequate planning, it is estimated that these sources will fulfill requirements for the first 30 days postattack, or until such time that Federal replenishment can be made from the bulk stocks in the Strategic and Critical Material Stockpile.

D. Detailed procedures for the utilization of such federally controlled bulk stocks will be coordinated by the Office of Emergency Planning. The long-range allocation of narcotics for the civilian sector of the economy, at the Federal level, will be under the control of the U.S. Public Health Service.

5. Disposition of Narcotics to Civil Defense Emergency Health or Medical Care Facilities

A. During a national emergency the narcotic materials required for the health mission, and requested by a CDNPO from a local source as described above, will be delivered to him by the most expeditious means, taking appropriate security measures to insure safe delivery. Subsequent disposition of any part of the shipment by the CDNPO must be covered by a proper receipt signed by a legitimate recipient (Bureau of Narcotics registrant). This should be accomplished by an endorsement on the copy of the narcotics procurement form in the possession of the Civil Defense Narcotics Procurement Officer. Distribution, use, and control of narcotics within medical care facilities will be the responsibility of the medical officer in charge of such activities.

B. It is of utmost importance to anticipate requirements for narcotics and establish coordinated distribution points as part of a community plan. Full use should be made of existing distribution systems and individuals normally engaged in regulatory and enforcement duties. The administration of narcotics to individual patients should be recorded wherever possible and reserve stocks at medical care facilities should be retained, safeguarded and dispensed by a pharmacist who shall maintain accurate records of receipt and disposition.

C. Actual narcotic requirements will vary with patient needs and total medical care workload. A factor of one narcotic dose per inpatient-day has been generally used for planning purposes as a minimum requirement for the first 30 days of postattack hospital operation. Using this factor, for example, 6,000 doses would be required for the first 30 days for a 200-bed Packaged Disaster Hospital operating at full capacity. It is anticipated that usage rates will be at peak level for the first several days, then will gradually diminish with the passage of time. One narcotic dose of any narcotic analgesic substance, for civil defense planning purposes, is that dose of narcotic agent approximately equivalent in analgesic effect to 16 mg (¼ grain) of morphine sulfate, USP—See attached table of equivalencies (Attachment I).

6. Responsibilities and Assistance by the Bureau of Narcotics

In the area of emergency medical care, during a period of national emergency the Bureau of Narcotics, as one of its functions, will provide protection for available supplies of narcotics and will aid the U.S. Public Health Service in the distribution and redistribution of dosage-form narcotics to meet the legitimate requirements of all elements of the population. In the performance of these functions, agents of the Bureau of Narcotics will be responsive through their organizational units to the directives of the emergency health service organization at all levels of government.

7. Disposition of Unused Narcotics

Where there is a close-down of a medical care activity, narcotics will be kept under strict custody and delivered to an officially designated distribution point for reissue or, if appropriate, will be placed under the jurisdiction of a Federal Narcotics Officer for disposition.

8. Penalties for Violation of the Narcotics Act

Persons who violate the Act or fail to fulfill its requirements, in any particular, are liable to punishment. For a first offense, a prison sentence of not less than two years nor more than five years and a fine of not more than $2,000.00 is stipulated by law. Heavier penalties are provided for second and subsequent offenses.

ATTACHMENT I.

NARCOTIC ANALGESIC EQUIVALENTS OF MORPHINE SULFATE FOR CIVIL DEFENSE PLANNING PURPOSES*

DRUG	EQUIVALENT OF MORPHINE SULFATE, 16 MG. (1/4 GR.)
ALPHAPRODINE (NISENTIL)	50 MG. (3/4 GR.)
ANILERIDINE (LERITINE)	25 MG. (3/8 GR.)
CODEINE	60 MG. (1 GR.)
DIHYDROCODEINONE (DICODID, HYCODAN)	50 MG. (3/4 GR.)
DIHYDROMORPHINONE (DILAUDID)	2 MG. (1/30 GR.)
ETHYLMORPHINE (DIONIN)	30 MG. (1/2 GR.)
LEVORPHANOL (LEVO-DROMORAN)	3 MG. (1/20 GR.)
MEPERIDINE (DEMEROL, PRO-MEPERDAN)	100 MG. (1-1/2 GR.)
METHADONE (DOLOPHINE)	10 MG. (1/6 GR.)
OPIUM	150 MG. (2-1/2 GR.)
OXYMORPHONE (NUMORPHAN)	1.5 MG. (1/40 GR.)
PANTOPON	20 MG. (1/3 GR.)
PHENAZOCINE (PRINADOL)	2 MG. (1/30 GR.)
PRIMINODINE (ALVODINE)	20 MG. (1/3 GR.)

ATTACHMENT II.

HEADQUARTERS AND BRANCH OFFICE—BUREAU OF NARCOTICS

(MARCH 1, 1965)

DISTRICT	ZIP CODE	ADDRESS	TELEPHONE
1—BOSTON, MASS.	02109	1425 Post Office & Courthouse	Area Code 617 223-2757 or 223-2758 LI 2-3938 (direct line)
Hartford,Conn.	06101	450 Main Street, Room 746 P.O. Box 1711	Area Code 203 244-3348
2—NEW YORK, N.Y.	10007	90 Church Street, Suite 605	Area Code 212 REctor 2-9100-X-8182 & 8476 REctor 2-9380 (direct line) Teletypewriter 212-571-1597
Buffalo, N.Y.	14203	Niagara Square Station U.S. Courthouse, Room 113 P.O. Box 269	Area Code 716 842-3218
Newark, N.J.	07102	B-39 Main Post Office Building P.O. Box 578	Area Code 201 645-2637
Paterson, N.J.	07509	210 Post Office Building P.O. Box 2006	Area Code 201 278-9249
3—PHILADELPHIA, PA.	19106	605 U.S. Custom House	Area Code 215 597-4310 or 4311 627-4298 (direct line) 597-4599 (night service)

*The equivalents expressed in this table are not intended as therapeutic indices. The purpose of the table is to provide a standard set of conversion factors for use in measuring narcotic-analgesic resources and requirements in terms of a common unit of measure, a 16 mg. "dose" of Morphine Sulfate, U.S.P. For each narcotic listed in the table, the weights are given in terms of the commonly used salt form.

Pittsburgh, Pa.	15230	1011-1013 New Post Office Building 7th Avenue & Grant Streets P.O. Box 494	Area Code 412 644-3391 or 3392 471-0853 (direct line)
5—BALTIMORE, MD.	21202	103 South Gay Street	Area Code 301 752-8460-X-2178, 2179 & 2180 752-3223 (direct line)
Washington, D.C.	20224	7415 Internal Revenue Building 12th & Constitution Avenue, N.W.	Area Code 202 964-4267 347-0499 (direct line) 393-6400 (night service)
Greensboro, N.C.	27402	277 Post Office Building P.O. Box 16	Area Code 919 275-9111-X-458
Norfolk, Va.	23501	410 Post Office Building P.O. Box 476	Area Code 703 627-7471-X-7775
6—ATLANTA, GA.	30303	1056 Federal Office Building	Area Code 404 526-6085 & 6086 688-3919 (direct line)
Birmingham, Ala.	35201	44 Post Office Building P.O. Box 2137	Area Code 205 325-3497
Miami, Fla.	33101	Main Post Office, M-3 P.O. Box 1148	Area Code 305 350-5275 & 5276
Nashville, Tenn.	37202	336 Federal Office Building P.O. Box 1189	Area Code 615 242-8321
8—DETROIT, MICH.	48226	602 Federal Building	Area Code 313 226-6110 961-6758 (direct line) Teletypewriter 313-222-5143
Cincinnati, Ohio	45201	215 & 217 Federal Building P.O. Box 1196	Area Code 513 381-2948 & 2949
Cleveland, Ohio	44114	518 Federal Building	Area Code 216 241-7900-X-7475 & 7476 781-5282 (direct line)
Lexington, Ky.	40501	335 Post Office Building P.O. Box 453	Area Code 606 254-7516
Louisville, Ky.	40201	422-24 Post Office Building P.O. Box 537	Area Code 502 582-5164
9—CHICAGO, ILL.	60604	1836 U.S. Court & Federal Office Building 219 South Dearborn	Area Code 312 828-5810 828-5848 (direct line) Teletypewriter 312-431-1649
Indianapolis, Ind.	46204	406 Federal Building P.O. Box 413	Area Code 317 ME-3-7662 (answering service)
10—DALLAS, TEXAS	75202	1114 Commerce Street, Room 1104	Area Code 214 RIverside 9-2827-2828-2829 RIverside 2-2666 (direct line) Teletypewriter 214-899-8862
Houston, Texas	77002 77061	6102 Courthouse and Federal Office Building P.O. Box 61188	Area Code 713 CApitol 8-0611-X331, 332, 333 CApitol 8-1840 (night number)

DISTRICT	ZIP CODE	ADDRESS	TELEPHONE
San Antonio, Texas	78206	583 Post Office Building P.O. Box 2727	Area Code 512 CApitol 5-5511-X-324, 325, 326 CApitol 5-1301 (night number)
New Orleans, La.	70130	941 Federal Office Building P.O. Box 30554	Area Code 504 527-2317, 2318, 2319
11—KANSAS CITY, MO.	64106	1502 Federal Office Building 911 Walnut Street	Area Code 816 BAltimore 1-7000-X-2686, 2689 BAltimore 1-7622 (night service) BRand 1-2676 (direct line) Teletypewriter 816-556-1455
St. Louis, Mo.	63101	702 U.S. Courthouse & Custom House Building	Area Code 314 MAin 2-4894 & 2-4895 MAin 1-1219 (direct line)
Oklahoma City, Okla.	73101	320 U.S. Post Office Building P.O. Box 940	Area Code 405 CEntral 6-2311-X-2260 CEntral 6-5691 (night service)
12—MINNEAPOLIS, MINN.	55401	402 Federal Building 110 South Fourth Street	Area Code 612 334-2323 & 2324 332-5671 (direct line)
Omaha, Nebraska	68101	3414 New Federal Building P.O. Box 661	Area Code 402 221-1221-X-4720 221-4720 (direct line)
13—DENVER, COLO.	80202 80201	106 U.S. Custom House 19th & California Streets P.O. Box 1588	Area Code 303 297-4304
Albuquerque, N. Mex.	87101	3010 Federal Office Building 517 Gold Avenue, S.W. P.O. Box 93	Area Code 505 247-0311-X-2244 242-7405 (night service)
14—SAN FRANCISCO, CAL.	94102	450 Golden Gate Avenue P.O. Box 36035	Area Code 415 556-6771, 6772 & 6773 Teletypewriter 415-393-8320
Los Angeles, Cal.	90012	414 U.S. Post Office & Courthouse Building	Area Code 213 688-4820 MAdison 8-6981 (direct line) Teletypewriter 213-683-0096
San Diego, Cal.	92101	254 U.S. Courthouse 325 West F Street	Area Code 714 293-5654
Phoenix, Arizona	85025	3321 Federal Building 230 N. First Avenue	Area Code 602 261-3900 (switchboard) 261-3236 (direct line)
15—SEATTLE, WASH.	98104	311 U.S. Courthouse	Area Code 206 MU 2-3300-X-606 & 607 MU 2-3337 (night service) MAin 3-4743 (direct line)
Portland, Oregon	97207	230 U.S. Courthouse P.O. Box 1008	Area Code 503 226-3545 & 3546 CApitol 6-3193 (night service)
Honolulu, Hawaii	96801	213 Federal Building P.O. Box 3285	502-078 (answering service)

GENERAL STORES SECTION

GENERAL STORES AS DISTINGUISHED FROM CENTRAL STERILE SUPPLY

The general stores section is responsible for the storage and distribution of bandages, dressings, all linens, and a variety of miscellaneous items. The section personnel must make an immediate distribution of a portion of the supply of these items throughout the PDH as quickly as possible upon activation. The remaining bulk supplies must then be stored and supply requests from PDH sections filled as long as the PDH remains in operation.

This chapter is intended primarily for the guidance of the PDH general stores section personnel who will work in the disaster situation. They will be responsible for inventorying and distributing the supplies which come with the PDH and also those subsequently procured by the PDH administrator.

The suggestions offered here presuppose the need for operating the PDH in a separate building for an extended period, as might be the case following a nuclear attack. The outlined planning will also greatly facilitate using the PDH for briefer periods following a disaster such as a flood, hurricane, earthquake, fire, or major accident when the affiliated hospital and other local hospitals are temporarily overloaded or damaged so that they cannot provide their usual patient services.

If the PDH is to be kept in operation for a number of weeks, arrangements for resupply must be made before the expendable supplies furnished with the PDH are exhausted. A disaster severe enough to necessitate prolonged PDH operation undoubtedly will have disrupted transportation and communications facilities and local suppliers consequently may find themselves unable to meet the needs of the hospitals in their area. Procurement under these circumstances may well be one of the most pressing problems to face the PDH administrator. As part of his predisaster preparation, he and the designated supply officer should have become familiar with Federal backup supply sources, civil defense supply procedures, and all local sources of supply.

Perhaps more than any other staff members, general stores personnel must become familiar with the precise supplies and equipment packed in their PDH. Component listings should be checked carefully, and arrangements should be made predisaster to procure items needed, but not included in the PDH. This will necessitate conferences between the supply officer and chiefs of all other PDH sections. Working closely with the PDH administrator, general stores personnel are responsible for the procurement and storage of these additional supplies.

The procurement and preparation of food in a national disaster is assigned to Welfare Services. However, in many instances, Packaged Disaster Hospital general stores personnel may be required to procure raw foods for both patients and staff. This would be especially true when the Packaged Disaster Hospital is set up in a separate building. In any disaster situation, national or natural, a function of general stores may be to receive and distribute food for patients and staff. It might even become the responsibility of general stores to obtain food service and preparation equipment.

Staff of this section will be distinguished from other PDH personnel in that few will be members of the medical or health professions. During disaster numerous volunteers will be necessary to staff this section; many will be among the 30 to 40 helpers needed to set up the PDH.

STAFFING

The personnel who will work in the general stores section should be recruited and trained predisaster. Those who are members of the activation staff must be ready to begin setting up the PDH as soon as conditions permit after the disaster. The activation staff helpers assigned to general stores will assume their specific duties as soon as the activation is accomplished.

It will probably be necessary to operate at first on two 12-hour shifts a day to make the best use of the available experienced personnel. Two clerks and four helpers, to be divided between the two shifts should be assigned to man the general stores section.

Clerks • The two clerks assigned to the general stores section should have some experience in receiving, sorting, and issuing supplies as well as in inventory management.

The clerks and helpers should become familiar with the PDH supplies they will be handling and with the general plan for setting up and operating the PDH. Those not employed currently at the parent hospital should be encouraged to participate in PDH training programs and practice exercises where they will receive orientation in identifying supplies and storing them properly.

Postdisaster the clerks should report to their designated supervisor and begin at once to set up their section according to the predisaster plan. They will sort and store supplies, make the initial distribution to appropriate PDH sections, handle subsequent requests for remaining supplies, and keep necessary inventory records.

Helpers • The four general stores section helpers can be drawn from lay members of the community. Those with storeroom employment or some understanding of inventory management would be desirable.

Following PDH activation, the helpers should report at once to their section and assist in its activation. They will unpack, sort, store, and distribute supplies. They will also perform messenger and delivery duties and keep the section clean and orderly.

Postdisaster, it may become the responsibility of general stores personnel to procure necessary supplies and equipment not packed with the PDH, which either were not or could not be obtained predisaster.

PHYSICAL REQUIREMENTS

About 900 square feet of storage space is required for supplies packed with the Packaged Disaster Hospital which are designated for the shelves of the general stores section. This space probably would be sufficient to include supplies obtained locally, although other nearby storage space should be available, especially for items such as gasoline and L.P. gas. Depending upon the area where the general stores section is to be set up, counters, shelves, tables, desks, chairs, and other fixtures and furnishings may have to be installed postdisaster. Ideally, general stores will be set up in an existing storeroom or warehouse area where usual storage items may be removed and placed elsewhere until deactivation of the Packaged Disaster Hospital.

In lieu of proper furnishings (counters, shelves, tables, chairs, etc.) boxes and crates from which Packaged Disaster Hospital supplies have been taken may be used as counters and shelves. Do not alter boxes and crates more than is absolutely necessary. They will be needed to repack Packaged Disaster Hospital supplies and equipment when the hospital is no longer needed.

The general stores section should be accessible to all Packaged Disaster Hospital functional sections. Messenger service to and from areas needing supplies will be expedited if general stores, pharmacy, central sterile supply, and the laboratory sections are located in proximity. This layout would also permit joint supervision (of the pharmacy and general stores sections, for instance) if it should be necessary for available personnel to assume responsibility for more than one section. Two sample floorplans for setting up the PDH in school buildings are shown on page 10.

HAZARDOUS STORAGE

Flammables • The general stores sections will be responsible for flammable items such as cans of solidified alcohol and boxes of safety matches, which, improperly stored, could constitute a fire hazard. These items must be kept from heat and open flame and a special storage area should be provided for them.

Items Subject to Damage by Freezing • General stores may be responsible for storage of blood collecting and dispensing supplies. These cases should never be placed in areas where temperatures are below freezing (32°F). Complete lists of all PDH items which must be kept from freezing are given in various component listings packed with the PDH they cover. Should it be necessary to put any bulk supplies in outbuildings or unheated space where below-freezing temperatures are a possibility, care in selecting items for such storage is essential.

Storage and Handling of Oxygen and Nitrous Oxide Cylinders • Although oxygen and nitrous oxide are not flammable, they do support combustion. In other words, they feed a flame. Oxygen and nitrous oxide cylinders must never come in contact with flames, sparks, or electrical circuits.

Compressed gas cylinders are built to withstand normal hard usage. However, mishandling has resulted in many serious accidents. Because compressed gas cylinders are made of steel, their explosion has the destructive effect of a bomb. Handle carefully when moving; do not allow cylinders to strike one another violently; avoid dragging or sliding.

Compressed gas cylinders should be stored in a specifically designated location. Empty cylinders should be stored in a different place so they will not be confused with charged cylinders. Cylinders should not be exposed to continuous dampness nor be stored near any corrosive chemicals or fumes. Rusting will damage the cylinders and can cause the protective caps of the valves to stick. The caps should always be kept in place.

Cylinders should be placed on their sides where possible, and stabilized to prevent rolling. If stored upright, they must be prevented from tipping. Nothing should be stored on top of cylinders. Treat empty cylinders with the same respect as full ones. They may still retain some pressure.

Never store cylinders of compressed gas where they can be damaged by passing or falling objects; near stoves, radiators, furnaces, heated floors or in any area where they would be subjected to a temperature above 125°F.; or close to cutting or welding operations where heat, slag, or hot metal may come in contact with them. Fusible safety plugs in cylinders and valves have a melting point of 157°F, and soften at lower temperatures. Do not store oxygen or nitrous oxide near L.P. gas cylinders. Do not store them where they will come in contact with oil or grease or any other flammable substance. Never handle cylinders with oily hands or gloves.

If a cylinder develops a leak, move it out-of-doors and have someone experienced with compressed gas cylinders bleed off the contents. Keep personnel and sources of ignition away from a leaking cylinder.

Cylinders of compressed gases should be handled only by experienced and properly instructed personnel and should be protected from tampering.

STOCK CONTROL

If the supplies of expendables are to be managed properly and made available equitably to all clinical sections, a stock control system must be established. Planning the system predisaster will allow ample time for designing and printing necessary forms and for familiarizing the PDH staff with this system. Otherwise, a system will have to be established as quickly as possible during the first days of operation with an inevitable loss of speed and accuracy.

The system should be simple enough to be workable under the pressure of disaster conditions and yet complete enough to permit establishing an initial inventory, accounting for issued stock, determining balances, and computing resupply requirements.

Supplies designated for general stores will fall within four main categories:

1. Cases with entire contents to be delivered initially to general stores and placed on shelves for future requisition by hospital sections.
2. Cases with entire contents to be delivered to general stores and initial distribution to be made to other sections with remaining inventory to be placed on general stores shelves.

3. Cases delivered initially to other Packaged Disaster Hospital sections with partial contents to remain in section and remainder to go to general stores immediately upon unpacking.
4. Supplies obtained locally where bulk will be placed in the care of general stores personnel.

Organizing Supplies • Upon activation of the Packaged Disaster Hospital unopened boxes, crates, and cartons will be placed in the general stores area. Most of these supplies demand some initial distribution to other functional sections. As soon as cases are unpacked, materials designated for initial distribution to other sections should be delivered immediately. Remaining supplies will be stored as indicated by quantity, size, and other general characteristics. Packing materials should be conserved as much as is practical.

Messengers making initial distribution to Packaged Disaster Hospital sections having goods to be inventoried in general stores should pick up the amounts indicated in appropriate component listings, or from a locally prepared standing order form.

Cases with entire contents to remain in general stores until requisitioned should then be placed on shelves or in other areas as indicated. Supplies picked up from other sections for storage should be properly warehoused.

Supplies obtained locally requiring space in general stores will be handled as they are brought into the Packaged Disaster Hospital, by general stores personnel.

All supplies should be identified as they are placed in storage spaces. Labels or other means of identification should be determined and prepared predisaster. These identifying labels or tags should then be affixed to boxes, shelves, tables, etc., immediately upon storage of items.

Initial Inventory • The contents of each PDH are itemized by case number on the master list furnished with the unit. One copy of this list is sent to the designated PDH custodian at the time the unit is delivered for storage. Additional copies are packed with the PDH. When the PDH is activated, cases are delivered to the PDH section indicated on the master list.

Quantities of all items received in the general stores section should be noted as they are unpacked to provide an accurate inventory list. This will be the basis for all future records as supplies are subsequently issued and new stocks procured.

Various publications are available for guidance during activation, depending upon the PDH model affiliated with the existing hospital.

Perpetual Inventory and Initial Distribution • In order to consolidate items in a manageable number of crates and boxes, the PDH is packed so that some cases contain an assortment of items which are needed in different hospital sections. Other cases contain the entire PDH supply of an item which will be used in several sections. All the cases of bandages and dressings, for instance, are delivered to the general stores section although some of the supply will be needed immediately in the wards, operating rooms, and the receiving and sorting section.

These cases must receive special attention to assure that they are unpacked and their contents sorted and delivered as quickly as possible. No supply requests are required for this initial distribution.

As soon as possible, a set of control records should be made, using a form such as the simple one shown on page 254, or a more elaborate standing order form. These forms are not furnished with the PDH. It may be decided predisaster to have forms prepared locally and stored with the PDH. If this is not done, the information can simply be written on blank sheets of paper. There should be a separate sheet for each item of supply and it should carry the name of the item, unit of issue, size, etc. Columns should provide space to enter quantities received, quantities issued, the balance, and any remarks. The sheets should be arranged alphabetically in a notebook or file box. They should be kept up-to-date and a balance obtained regularly. This will make it possible to foresee shortages before they become acute.

When used, a standing order form should be prepared predisaster, with assistance of the hospital administrator, chief of staff, and functional section supervisors. A typed form duplicated by any simple reproduction process is sufficient. This form will enable general stores personnel to determine immediate distribution requirements, to check supplies delivered to general stores, and to determine amounts of supplies to be picked up from other sections for storage.

Unpacking • Care should be taken during the unpacking not only to avoid damaging supplies but also to avoid tearing or breaking the boxes. Crates and heavy boxes can be used as improvised counters and storage cabinets and should be saved for this purpose. When the need for the PDH has passed, the equipment and any remaining supplies will be repacked and returned to storage, requiring the use of the original packing boxes.

The boxes which contain expendables may be needed in other sections, especially in the wards where they can be made into bedside tables, backrests, overbed tables, etc.

Boxes of supplies and smaller pieces of equipment should be opened but not unpacked other than to meet immediate needs. If there is not sufficient shelf space in the section, these boxes can be stacked with their opened sides facing out into the room in an improvised shelf arrangement. Section personnel should be able to get to the stock of each item without having to move other boxes. As much attention as conditions permit should be given to the section's initial storage arrangement so that supplies can be located easily in the ensuing days of PDH operation.

SUPPLY DISTRIBUTION

Supply Requests ● It may be found efficient to designate one person within the entire supplying area (pharmacy, general stores section, and central sterile supply) to receive all supply requests and direct them to the section where the requested items are stored. This coordination will be helpful in locating various miscellaneous items which could be stored in any of several places depending upon storage space in the individual building.

The general stores section will release supplies to the various PDH sections only on receipt of written requests. Forms for this purpose are not supplied with the PDH. It is recommended that a form such as the one shown on page 24 be reproduced in the community predisaster. Requests can, however, be written on the pads of unruled paper which are supplied with the PDH.

Supply requests should be made out in triplicate. Carbon paper is furnished with the administrative supplies in some of the PDH's. Another source of carbon paper is the PDH receiving and sorting section. Index and information cards, filled out for each patient as they come into this section, are interleaved with carbon paper which is still usable after it is removed from the triplicate card sets.

The originating section should keep a copy of the supply request and send the original and second copy to the general stores section. The second copy is returned with the supplies and the original is kept by the general stores section. By referring to these originals, the general stores staff can keep their perpetual inventory records current.

Standard-Issue Quantities ● It may be difficult at first to determine use-rates accurately enough to be able to establish any rules on what quantities a section should be allowed to request at one time. To assure equitable distribution, however, some limits must be set. One possible standard is to allow a section to keep on hand no more than a 5-day supply of an item. The initial automatic distribution is based on an estimated 5-day supply of expendables.

When a functional section orders an item for stockpiling in that section in such quantity that stores would be entirely depleted, an administrative decision must be made in order to allow equitable distribution of supplies to all sections. Such situations should be brought to the attention of the supply officer.

Unfilled Orders ● A procedure should be established for processing supply request forms when the needed supplies are not available.

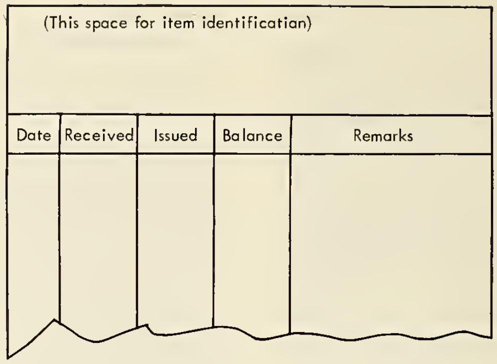
Two possible procedures are suggested:

1. When supplies are on order and are expected shortly, return the copy to the originating section with a notation of expected delivery time or date. Keep original request form in a pending file until the order is filled.
2. When it is not known when supplies will be available to general stores, return both copies of the supply request form to the originating section with a suggested reorder date or state that the item is not available if such is the case.

Routine Replenishment ● After the initial heavy influx of patients has subsided, the PDH will settle into a more routine operation. At this time it may be possible to establish a procedure for picking up supply requests and delivering supplies on a regular basis. Emergency or "stat" orders should, of course, be filled as soon as they are presented.

RESUPPLY

When the inventory balances show that supplies are being depleted, the PDH administrator should be notified so that he can proceed with his plans to procure the needed items. Efforts to obtain more supplies should be begun well before the supplies on hand are exhausted.



The time at which a reorder is initiated will depend, of necessity, on the actual situation. Only then will it be possible to know the rate of use and the time lag in obtaining additional supplies.

Depending upon community planning and decisions made by the Packaged Disaster Hospital administrator and supply officer jointly, general stores may be responsible for pickup of locally obtained supplies to be placed in the general stores area and elsewhere in the Packaged Disaster Hospital, as well as for the pickup of goods when resupply is necessary.

MANAGEMENT OF LINENS

When the PDH is to be set up as an independent hospital, one of the co-responsibilities of administration and general stores will be the management of linens. Predisaster, the administrator must make arrangements for laundry services. Few PDH sites will have adequate laundry facilities. It may be possible to use the facilities of the parent hospital or arrangements may be made with nearby commercial laundries. Postdisaster, the supply officer will probably be responsible for pickup and delivery of laundry.

The general stores section receives the entire PDH stock of sheets, pillowcases, towels, patient gowns, operating gowns, and surgical drapes. The section is responsible for the initial distribution of these items to the wards, operating rooms, and other clinical sections, as necessary, and it also stores the replenishment supply. As withdrawals from this supply begin, soiled linens must be collected and sent for laundering. When the linens are returned, the quantity should be checked and the supply returned to the stock on hand. Central sterile supply will draw upon this stock for those linens it sterilizes for surgical use.

Consultation with the PDH chief of staff, the administrator, and the director of nursing will be necessary to determine priority use and the most efficient distribution system. The limited supply of linens will not permit storing extras on the wards.

ADDITION OF PDH STORES TO EXISTING INVENTORY

When PDH supplies and equipment are used to supplement those of the affiliated hospital, inventory records should be altered to reflect these additions so that accurate figures will be immediately available for resupply planning. In an acute disaster situation, volunteer personnel recruited for general stores duty and trained predisaster might assist regular stores personnel in inventory control as well as in the performance of all tasks assigned to this section.

Dual Inventory • Because of the volume of PDH stock assigned to general stores, it will not always be possible to add these supplies directly to the affiliated hospital inventory. When it is necessary to set up a separate stock room for PDH stores, a dual inventory control system is indicated. Predisaster planning should provide for a system which will integrate PDH inventory with regular inventory. This might be accomplished by requisitioning supplies from PDH stores only when they become low in the parent hospital stores section. When items are taken from PDH stores, records should reflect each withdrawal. Resupply of items packed in the PDH would then be determined by PDH perpetual inventory records.

Regardless of the type of dual inventory system decided upon, routine accuracy checks should be made between records kept in PDH general stores and those kept in the parent hospital's regular supply section.

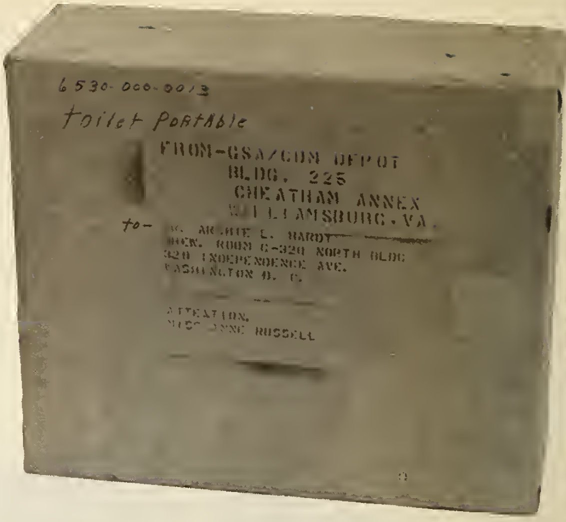
FIELD COMMODE

FEDERAL STOCK NUMBER: 6530-781-3720 (6530-000-0013)

FEDERAL NOMENCLATURE: COMMODE, FIELD, COLLAPSIBLE, FIBERBOARD

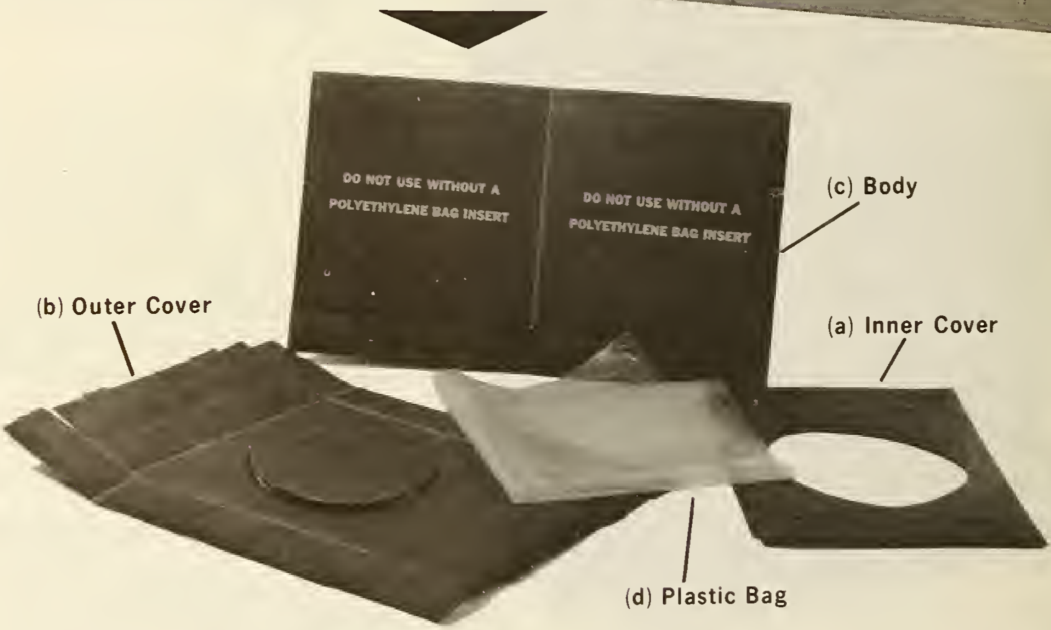
Extra polyethylene bags, Federal Stock Number 8105–000–0002, for use with the Field Commode are packed with each hospital.

STEP 1:



A. Slit tape on fiberboard carton with any sharp instrument. Remove contents, including plastic bag.

B. Only four pieces are involved in the assembly of the Field Commode. They are: (a) inner cover, (b) outer cover, (c) body, and (d) plastic bag.



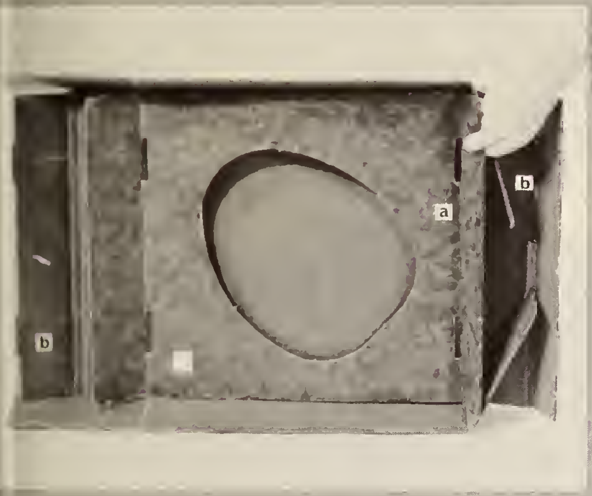
STEP 2:

A. Prefold on all scored creases. Do not attempt to force. Each crease has been scored to fold in only one direction which may be accomplished easily.

B. Place (a) over (b), matching contour of hole in (a) with hole in hinged lid of outer cover (b).

STEP 3:

A. Fold one end of (a) up. Fold flaps on (b) outside and against end of (a).



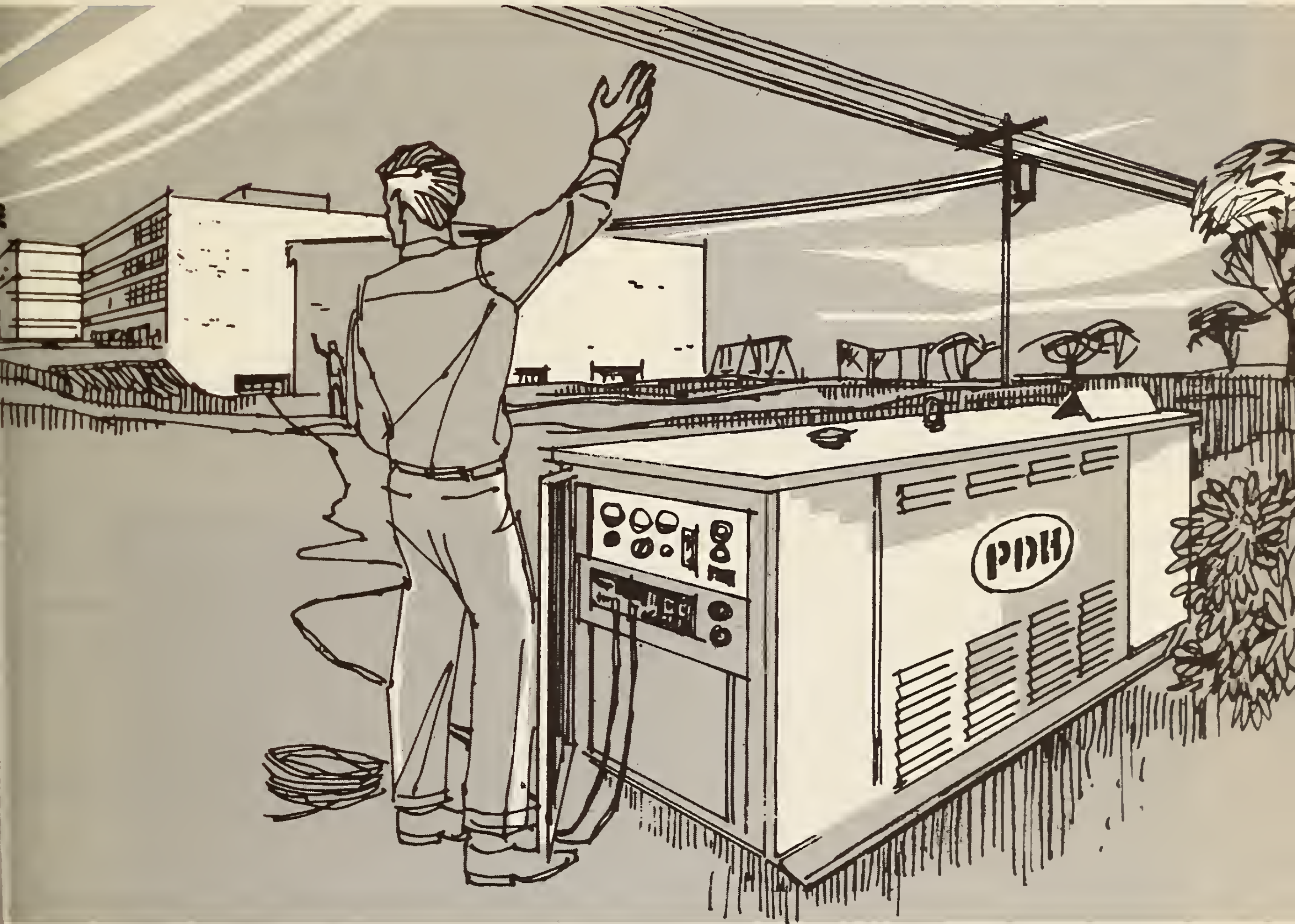
B. Fold end of (b) over end of (a) and flap of (b) and press tabs on (b) into slots in (a). Repeat Step 3, A and B, for other end. Top of commode is now assembled, complete with closing lid.

STEP 4:

A. Fold scored ends of (c) outward to form base for commode body.

B. Place plastic bag in body of commode and fold over outside of top of body at least 4 inches. Place cover (lid) on body.

ELECTRICAL GENERATING EQUIPMENT



Following a major disaster, normal supplies of electrical power are likely to be disrupted and may not be restored for some time. For this reason, each PDH contains gasoline-electrical generating equipment of sufficient capacity to meet emergency operating requirements.

For those with requisite skills, this equipment is relatively easy to set up and operate. If the job is to be done with a minimum of delay and confusion, however, certain predisaster preparations should be carried out now. These include:

1. Assigning responsibility for setting up and operating the equipment in disaster. (Assignments should include at least one electrical and one engine mechanic.)
2. Familiarizing assignees with the equipment and with setting up and operating procedures.
3. Arranging for provision in disaster of certain items which must be provided locally to permit successful operation.
4. Examining the building in which it is tentatively planned to house the PDH in disaster and preparing a wiring diagram to show how the generators will be tied into the existing wiring or otherwise connected to the electrically powered hospital equipment.

This chapter is intended primarily for those electricians and engine mechanics who may have to operate the PDH generators in disaster. It provides enough information to permit setting up, connecting to equipment, and operating any of the various model generators which have been provided in PDH's.

NOTE:
It is assumed that those assigned responsibility for setting up and operating the equipment have knowledge and skills comparable to those of an automobile mechanic or a licensed electrician. Experience with gasoline engine-driven electrical generators is not assumed.

More detailed information concerning the operation and special features of individual generator models will be found in a manufacturer's manual which is packed with each generator. In addition to fuel, several supply and equipment items necessary for connecting and using the generators must be provided from local sources.

Check the manuals packed with your generator carefully. Make arrangements now for the supplies that will be needed when the generator is used. Listed below are some items you will need to obtain locally:

- Spark plugs (spare set)
- Magneto points (spare set)
- Tools
- Fuel drum adapter with straining hose
- Ground rod and attachment cable
- Gasoline
- Oil
- Anti-Freeze
- Extension cords
- Electrical tape
- Manual gasoline pump with hose

CAUTION:
Operators should exercise extreme care in working with this equipment because of the lethal shock hazard. They should see that all hospital personnel are aware of this hazard and that they are protected to the maximum possible extent.

THE 15-KILOWATT GENERATOR

GENERAL DESCRIPTION

There are six 15-kw. generator models in the various Packaged Disaster Hospitals.

Generator Nos.	Model
Kohler Co., Model 15M81H1	A
Eseco Division, B–4836 (Contract GS–03S–16956)	B
John R. Hollingsworth Co., JHE–15 (Contract GS–03S–13040)	J
Winpower Mfg. Co., K–921–1 through K–921–200 (Contract GS–00S–2136)	K
Winpower Mfg. Co., M–1000 through M–1000–1004 (Contract GS–00S–14625)	M
Winpower Mfg. Co., U–932–1 through U–932–10 (Contract GS–00S–34986)	U

The 15-kw. generator sets covered in this section are similar in nature and many of the instructions apply equally to all. Where differences exist, the text contains special notations which refer by the model letters to the specific model or models to which the instructions apply. The model can usually be determined from the contract number which is stamped on the outside of the crate. The generator number is also found on the name plate affixed to each generator.

The 15-kw. generators are capable of 15-kw. output, 60 cycles at 1,800 r.p.m., at 0.8 power factor. Models K, J, and B: 120/208-volt, 3-phase, 4-wire WYE connected. Models M and U: changeover switch included to supply 240/416 volt, 3-phase, 4-wire as well as 120/208-volt service. Model A produces 220 volt, 3-phase, and 127 volt, single phase output simultaneously.

NOTE:
These units are packed with the switch in the 120/208-volt position. It should be left in this position.

Engine • Gasoline, liquid-cooled, 4-cylinder, 4-cycle of approximately 36 horsepower, direct-coupled to generator. Engine is equipped with automatic speed control governor to maintain 1,800 r.p.m. Engine has a 6-volt electrical system and provision for manual cranking.

Housing • Engine and generator are directly coupled and mounted on a steel frame equipped with skids. The entire generator assembly is equipped with a sheet steel housing which is adequate to protect it from most weather. Removable panels or hinged doors are provided for access to the equipment.

Accessories • Accessories packed with each generator model are listed .

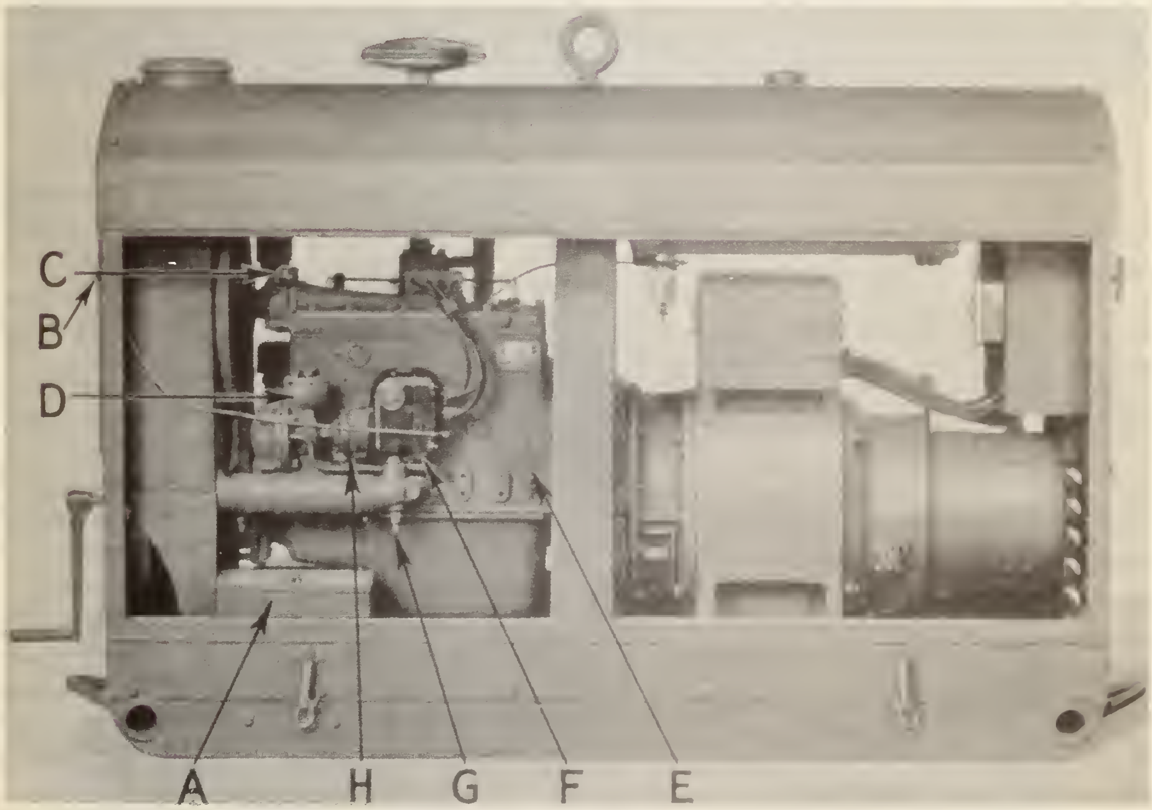
Identification of Components • See illustrations for identification and location of principal controls and components of each model.

MODEL A, 15-KW. GENERATOR

FRONT

KOHLER COMPANY, 15M81H1

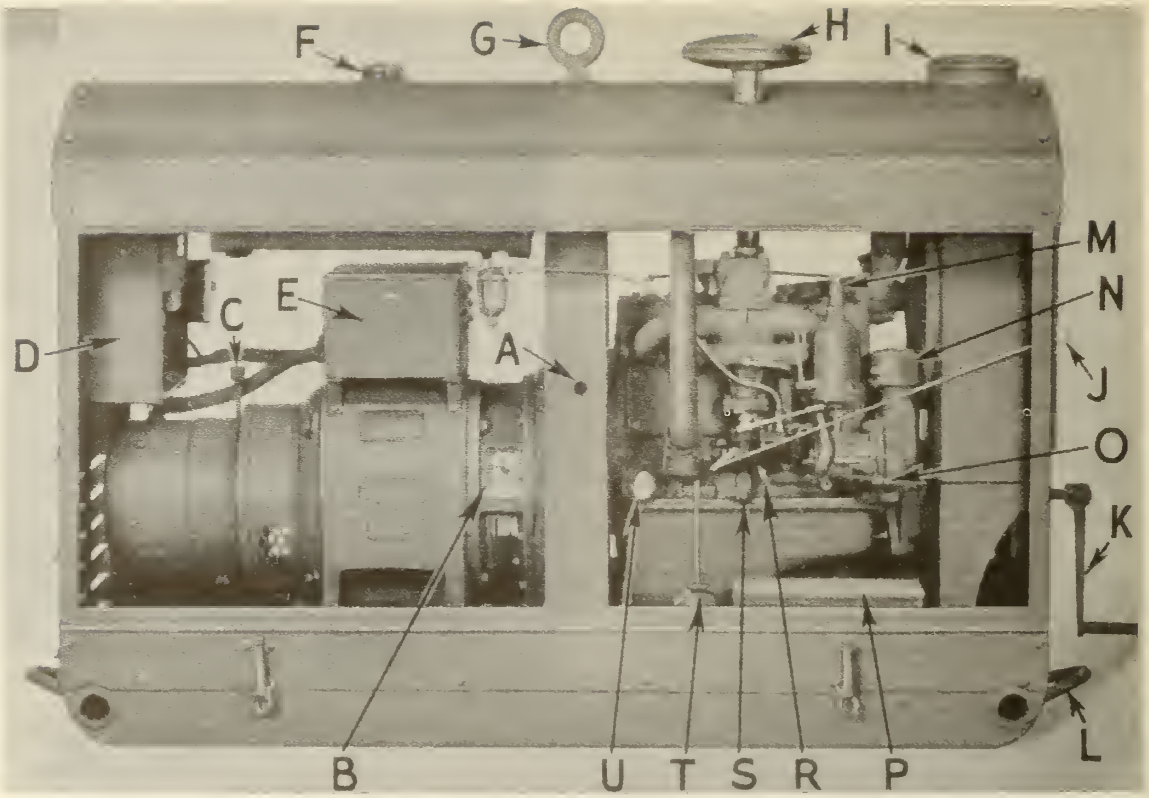
Panel and Line Terminals



MODEL A, 15-KW., LEFT SIDE

Magneto Side of Plant

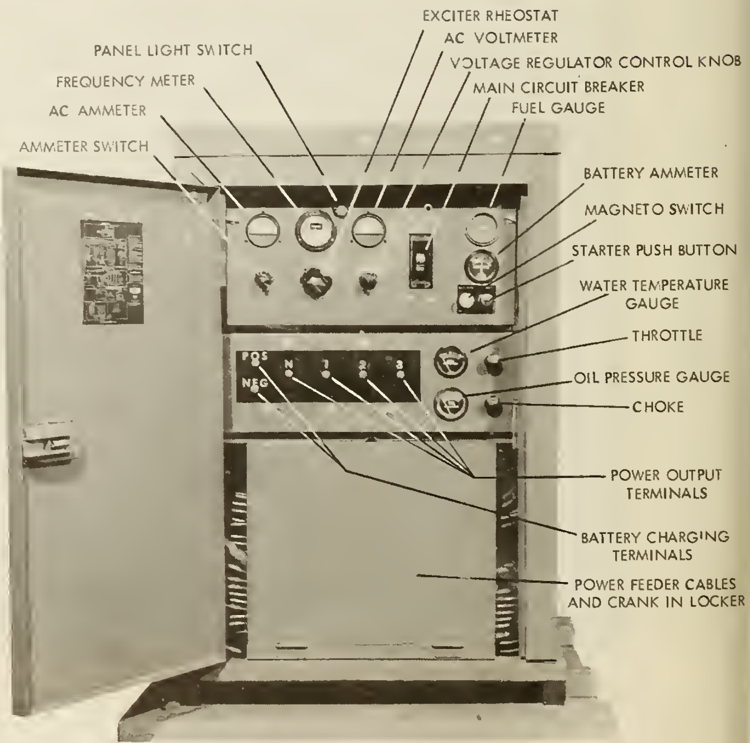
A—Spare parts box
B—Magneto ground switch
C—Water pump grease cup
D—Oil filler opening
E—Oil gauge
F—Magneto
G—Water drain cock
H—Impulse coupling



Carburetor Side of Plant

MODEL A, 15-KW., RIGHT SIDE

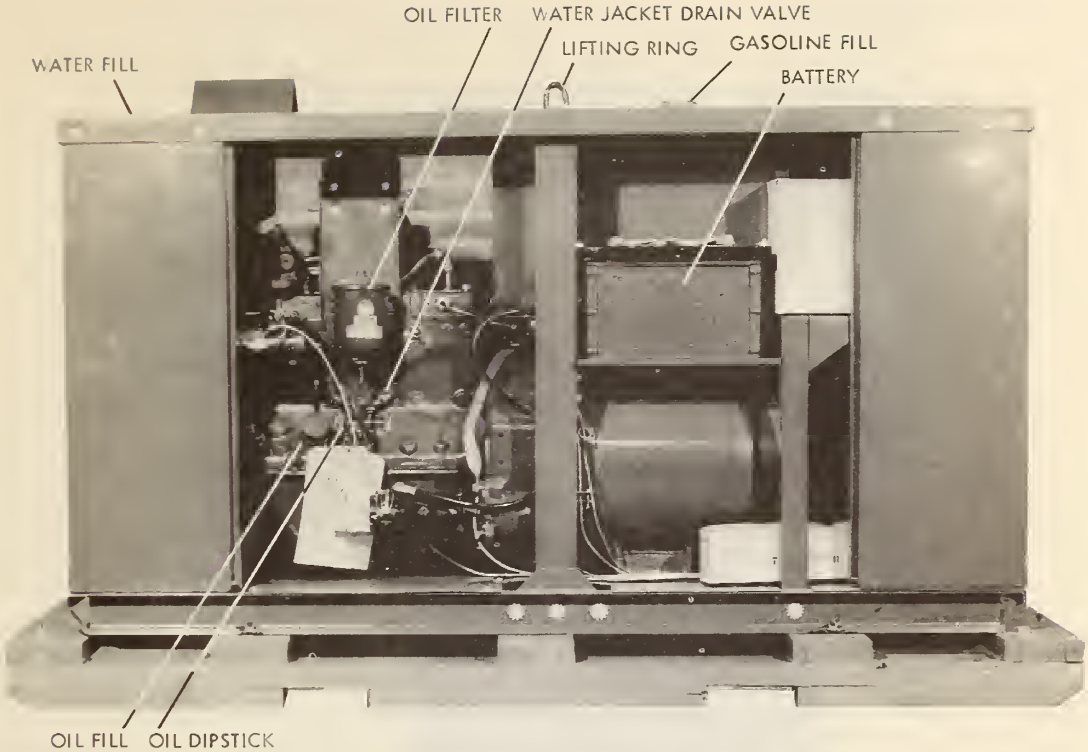
A—Opening to check flywheel timing marks
B—Name plate
C—Generator ball bearing grease cup
D—Instrument and terminal panel
E—Voltage control unit
F—Gasoline cap
G—Eye bolt for lifting unit
H—Muffler
I—Radiator cap
J—Choker wire
K—Starting crank
L—Skid
M—Adjusting screw vacuum compensator
N—Breather and oil filler cap
O—Governor spring adjustment
P—Tool box
R—Carburetor needle valve
S—Oil relief valve
T—Oil can
U—Oil pressure gauge



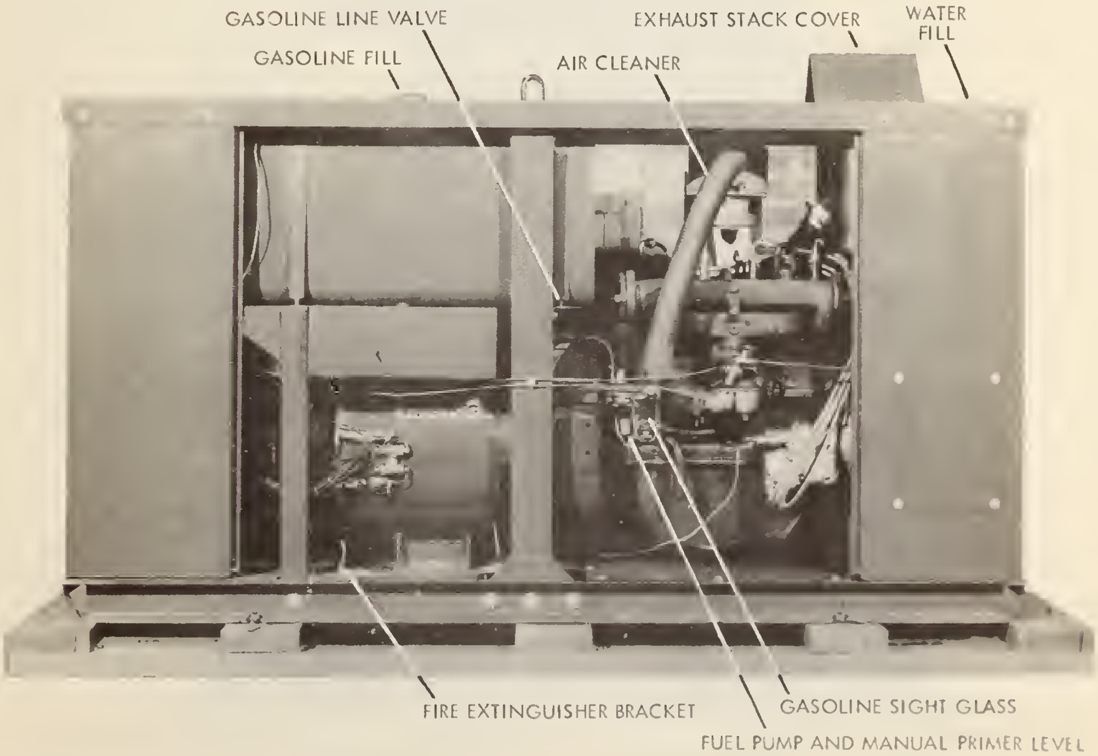
MODEL B, 15-KW. GENERATOR

FRONT

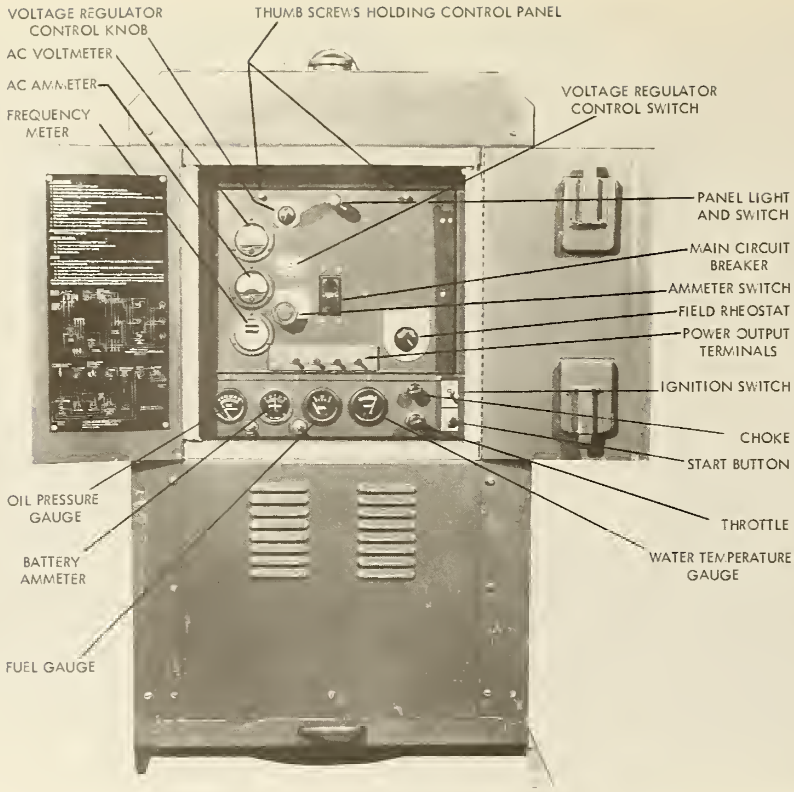
ESECO DIVISION, B–4836



MODEL B, 15-KW., LEFT SIDE



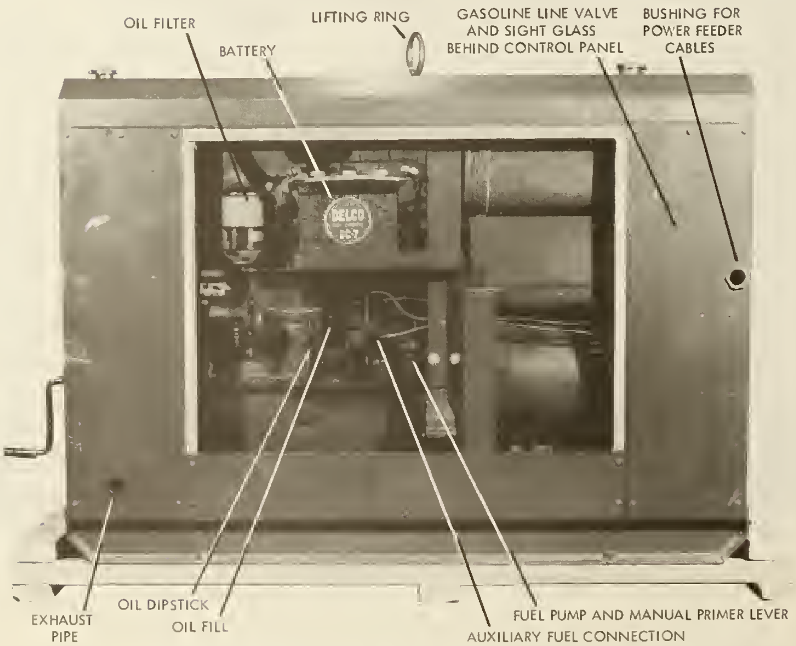
MODEL B, 15-KW., RIGHT SIDE



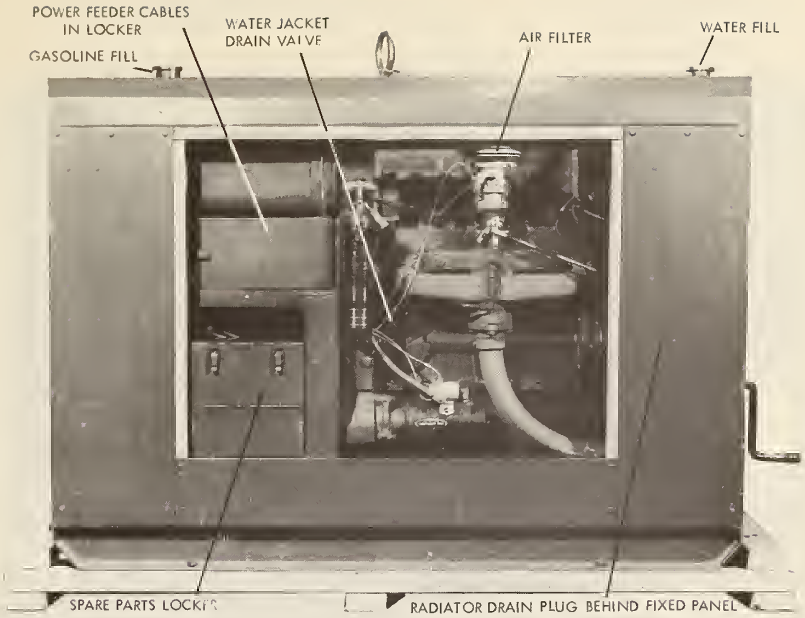
FRONT

JOHN R. HOLLINGSWORTH CO., JHE-15

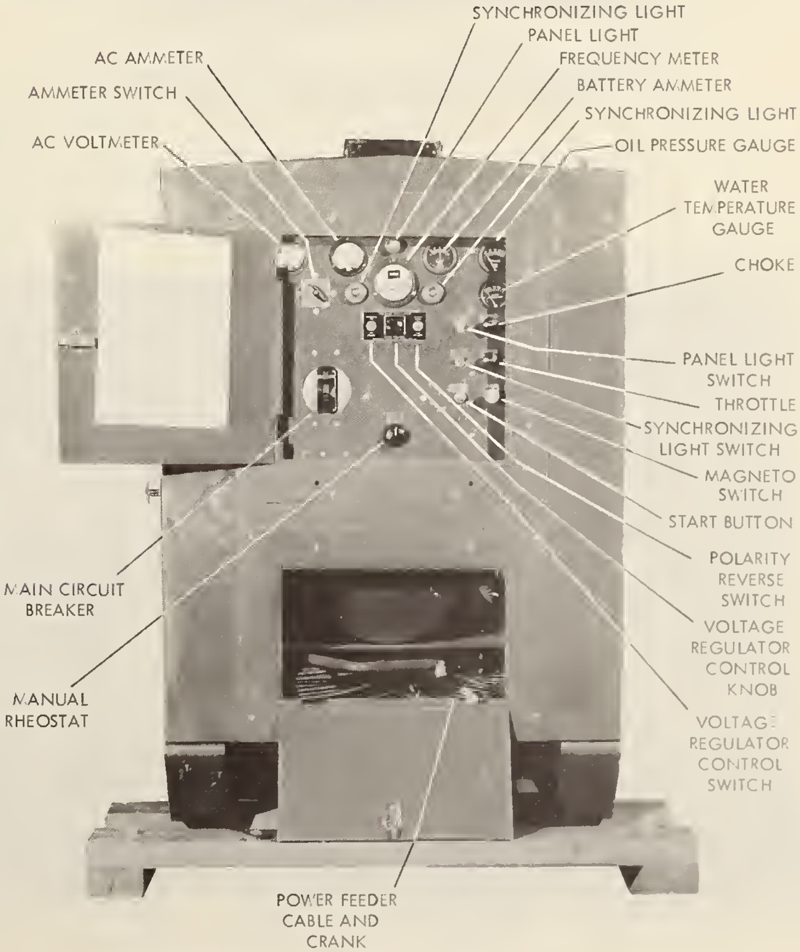
MODEL J, 15-KW. GENERATOR



MODEL J, 15-KW., LEFT SIDE



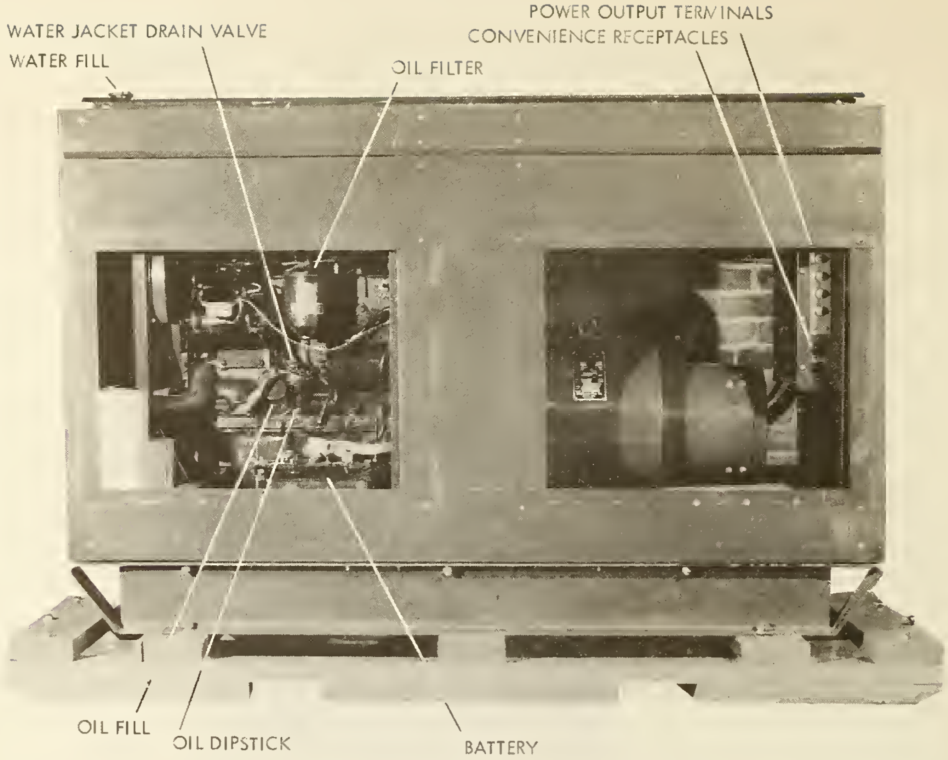
MODEL J, 15-KW., RIGHT SIDE



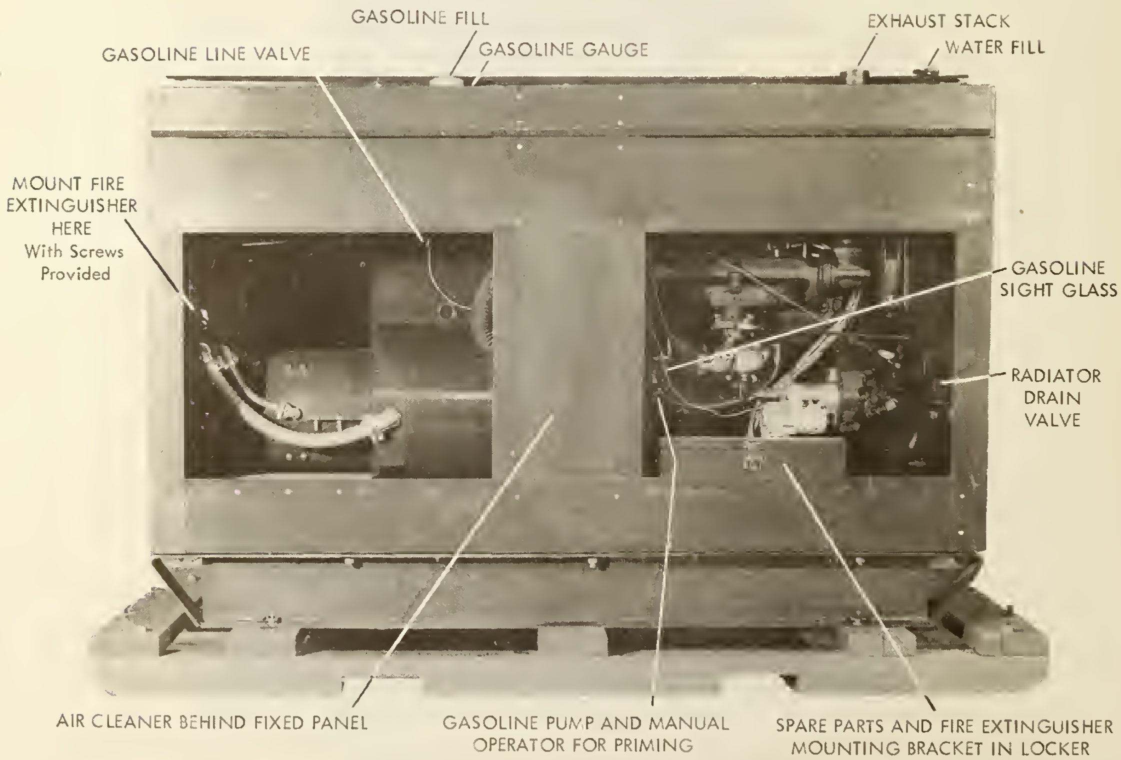
MODEL K, 15-KW. GENERATOR

FRONT

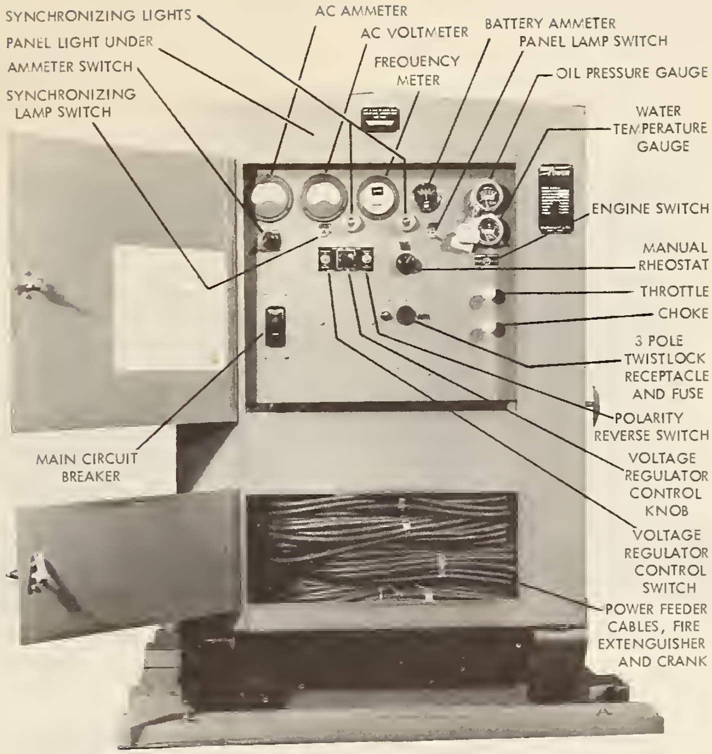
WINPOWER MFG. CO., K-921-1 THROUGH K-921-200



MODEL K, 15-KW., LEFT SIDE



MODEL K, 15-KW., RIGHT SIDE

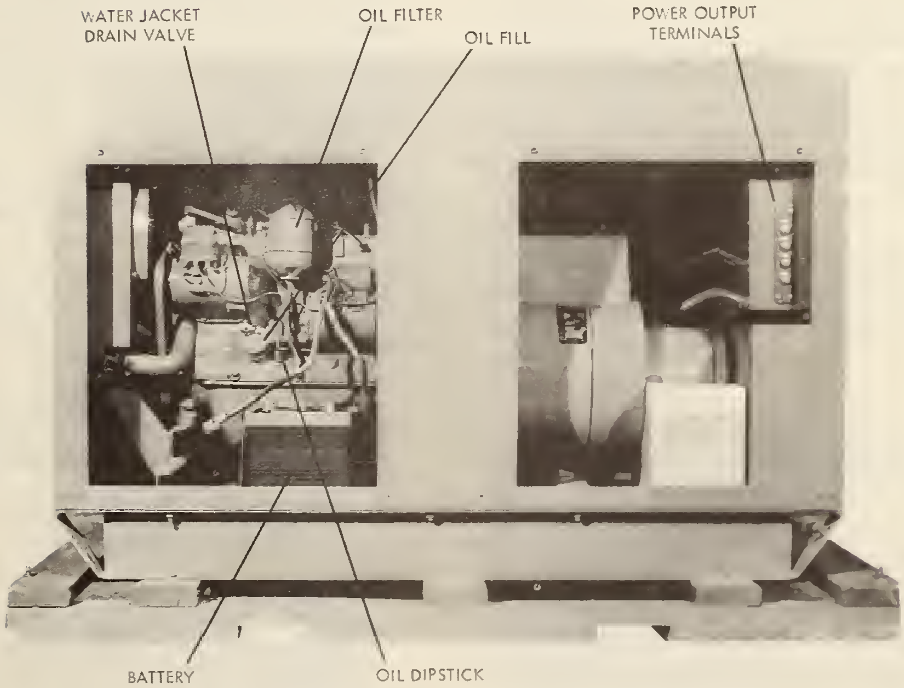


MODELS M AND U, 15-KW. GENERATOR

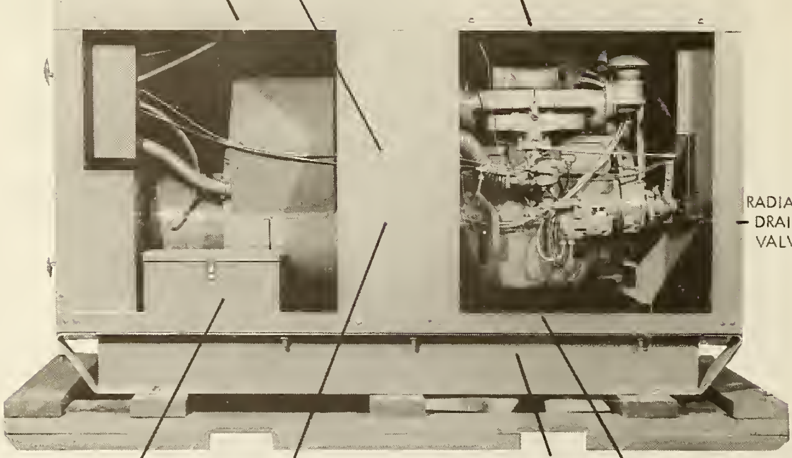
FRONT

WINPOWER MFG. CO., M–1000–1 THROUGH M–1000–1004

WINPOWER MFG. CO., U–932–1 THROUGH U–932–10



MODELS M AND U, 15-KW., LEFT SIDE



MODELS M AND U, 15-KW., RIGHT SIDE

PREPARATION FOR USE

Location ● The generator set should be located outdoors for best ventilation, and to lessen exhaust gas and noise problems. In the extreme circumstances where it may be necessary to place the set inside a building, provision *must* be made to vent the exhaust pipe to the outside and to provide sufficient ventilation for the cooling system. It is also necessary that the exhaust pipe be provided with an insulating sleeve where it passes through walls and should be at least 2½ inches away from flammable material. Exhaust systems presently are not equipped with extensions for tail pipes.

Uncrating and Moving to Position ● Ideally, the engine-generator set should be stored as close as possible to its planned operating location. Often, however, this will not be possible and it must be moved at the time it is to be used.

With its packing case removed, the generator set weighs approximately 1,750 pounds. If a 1-ton capacity forklift, mobile A-frame or other mobile lifting device is available it will simplify handling. Models B, J, and A are equipped with lifting rings.

All models are equipped with steel skids and can be moved to position using pipes or rollers and manpower. To accomplish this at least five men should be available. Also, cables can be attached around the skids for moving.

The generator set is easier to move if the outer packing materials are removed first. Do not open the doors or detach the removable panels of the steel housing until the unit is in the operating position.

Locate the generator within 80 or 90 feet of the building's electrical distribution panel and as far from hospital ward areas as practicable to lessen the noise problem. Locate so that exhaust fumes are directed away from windows and doors.

Place the unit so that the control panelboard end will be facing the building's electrical distribution panel.

Assembly ● Remove the side panels and assemble components as follows:

1. Remove battery electrolyte (acid) containers from housing and set them aside for immediate use. Model A is not equipped with a battery.
2. Remove crank handle from its storage position and set in cranking position.
3. Remove fire extinguisher from its carton and fit it into bracket provided. Model K bracket is packed in spare parts locker and must be mounted to frame of housing. Model J fire extinguisher is stored in place. Model A is not equipped with a fire extinguisher.

4. Remove cover on end of generator (opposite engine) and see that brushes are clean and firmly seated on slip rings. Remove any protective paper that may be found on the slip rings.

5. See that fan belts and blades can run freely without interference with other parts of the engine.

   NOTE:
   Refer to manufacturer's manual for parts identification.

ENGINE

1. (Not applicable to Model A.) Remove the battery from the generator to a place where battery acid, if spilled, will do no harm. Open the container of battery acid, remove the cell caps of the battery and fill the cells to a level just above the top of the battery plates. An indicator shows the proper level. The fluid should be divided equally among the three cells.

   CAUTION:
   Use extreme care in filling. This acid can cause severe burns and will damage many materials.

   For added safety, a glass or plastic funnel should be used for filling. After filling the cells, secure the battery in its frame and connect the leads provided. The flat, braided conductor is the ground and must be connected to the positive terminal, marked +. (Models M and U battery cables are identical. The ground cable is bolted to the housing frame behind the central fixed panel of the housing.)

2. Remove the carburetor air cleaner and fill to the indicated level with lubricating oil of the same type as used in the crankcase. (Model B: while the instructions on the air filter call for No. 10 oil, crankcase oil is satisfactory for this use.) Replace air filter and be sure it is firmly seated. (Model A does not have an air cleaner.)

3. Remove oil dipstick and set in a clean place temporarily. This will allow a release vent for air while the oil is being poured.

4. Check crankcase drain plug and empty crankcase of any preservative that it may contain. Empty into a container for safe disposal. Replace drain plug.

5. Remove oil filler cap and fill crankcase with SAE 10W–30 oil when available. Otherwise, use SAE 10W, SAE 20W, or SAE 30W, depending upon temperature. Four and one-half quarts of oil are required. (Model A requires only four quarts.)

6. Check oil level with dipstick. Oil level should be slightly above the full mark. The oil filter will retain one-half quart when the engine is started.

7. Check the drain valves on the radiator and engine water jacket to be sure they are closed. (Model J radiator is equipped with a drain plug. Be sure it is closed.)

8. Fill the cooling system with approximately 12 quarts of clean water. In cold weather, heating the water almost to the boiling point will help in starting the engine. (See p. 272 for use of antifreeze.)

9. Fill gasoline tank. Use regular or premium gasoline with an octane rating of 80 or higher.

   NOTE:
   See fuel supply suggestions (p. 272). Where generator is located inside a building, fill tank carefully. Allow sufficient time for the dissipation of gasoline fumes before starting engine.

10. Open fuel valve under gas tank and be sure fuel flows into glass fuel cup. If cup does not fill readily, operate the manual priming lever until cup is full.

11. Models M and U: Assemble tail pipe to exhaust stack. Be sure it points away from control panel.

GENERATOR

1. Remove the power cables from this storage point and connect an end of one of the cables to the neutral power outlet terminal. No cables are included by the manufacturer of Model A.

   Model A: Neutral terminal is marked N.

   Models K, M, and U: Neutral terminal is lowest of four and marked N.

   Model J: Neutral terminal is at the extreme right and marked T_0.

   Model B: Neutral terminal is on left (near POS. and NEG. battery terminals) and marked N.

   NOTE:
   It is important that the neutral wire be connected at both ends before the other three wires are strung since all four are the same color and easily confused.

2. Connect the other end of this same cable to the neutral of the desired distribution system for the hospital.

3. In order to provide proper grounding, dig a hole near the generator about 12 inches in diameter by 12 inches deep. Drive a pipe, preferably 5 or

6 feet long, into the ground at the bottom of the hole until the top of the pipe is just above original ground level. Use a piece of wire of the same gauge as the power cables, long enough to reach from the pipe to the generator, strip it of any insulation and connect the bare wire securely to the pipe just below its top and drive the pipe the rest of the way down. Dig a shallow trench from this ground rod to the generator, lay the bare wire in it and replace the earth removed from both the trench and the hole. Connect the bare ground wire to the grounding stud provided on the frame of the generator. Continue the wire up to the power terminals and connect it to the neutral terminal to which the neutral power wire has just been connected.

NOTE:
If there is a water pipe (not fuel or gas) nearby, use this instead of the ground rod. The other connections should be the same in either case.

4. Connect one end of each of the other three power cables to the remaining three power output terminals.

    Model A: Terminals marked L_1, L_2, L_3.

    Models K, M, and U: Terminals marked A, B, C.

    Model J: Terminals marked T_1, T_2, T_3.

    Model B: Terminals marked 1, 2, 3.

5. Connect the other ends of these three cables to the three phase terminals of the desired distribution system. Phase rotation does not matter; any of the three may be connected to any of the terminals, one to each.

    CAUTION:
    Be sure that there is no connection between terminals or between wires. Such a connection would cause a short circuit and could damage or destroy the generator.

6. Be sure the main circuit breaker on the generator control panel and all the circuit breakers or fused branches in the distribution system are in the OFF position.

7. Protect the power wires by elevating them and securing them to trees, walls, etc. Keep them off floors and the ground.

    CAUTION:
    These wires may not be completely waterproof and allowing them to remain on the ground or floor where they may be subject to damage or water could be dangerous to personnel.

STARTING AND STOPPING ENGINE

For easier cold weather starting, it is suggested that cooling system water be heated almost to the boiling point before it is poured into the radiator. If in winter months the temperature drops below 32° F., drain the radiator or put blankets over it to help protect it from freezing if the engine is stopped for more than 1 hour.

To Start: Set controls as directed in the manufacturer's manuals packed with generators.

1. Operate fuel pump manually (with lever at base of fuel pump) four or five strokes to force a little gasoline into the carburetor.

2. Holding choke control in one hand, press start button with other. As engine turns, press choke control in slowly to avoid flooding. When engine fires, release start button and manipulate choke control to obtain smoothest operation. As engine warms, press choke control in.

    CAUTION:
    Never run a warm engine with the choke even partially pulled out.

3. If engine turns over but does not start immediately, release start button, allow battery to rest for a moment and then try again. Never hold start button depressed for more than 2 or 3 seconds at a time. (Models M and U: Starter button is on engine switch. Center position is RUN. Press switch handle to left for start; when released, it will spring back to RUN position.)

4. If the battery is not sufficiently charged to start the engine, leave all controls set as indicated, and crank the engine.

    CAUTION:
    Place thumb on same side of crank handle as fingers and pull up sharply one-half turn. Never push down. A second person should operate the choke control during the cranking.

5. After engine starts and is warm, push throttle in slowly all the way. The governor will then take over.

To Stop:

1. In stopping the engine, remove electric load by opening main circuit breaker in the control panel, allowing the engine to run unloaded for 3 to 5 minutes. If the set has been operating under near full load conditions for an extended time, the water temperature will probably be near the maximum point. During this unloaded period, the water temperature should fall to 170°-180° F.

2. Stop various models as follows:

   Model A: Turn magneto ground switch to STOP position.

   Models M and U: Return the engine switch to STOP position.

   Models K and B: Push magneto switch in.

   Model J: Return ignition switch to STOP position.

3. Close fuel line shutoff valve.

NORMAL OPERATION

1. When the engine is warming to operating temperature, check the a.c. voltmeter and adjust the voltage to 120 volts as follows (Model A is pre-set to 127 volts):

   a. Models K, M, and U: Change the position of the voltage regulator control switch to ON (automatic) and adjust the voltage with the control knob adjacent to it to 120 volts on a.c. voltmeter. If the voltage fails to build up to 120, or if after application of load there is excessive voltage fluctuation, adjust the manual rheostat to compensate. Manual rheostat adjustments are made with the regulator selector switch in the OFF or MANUAL position and the voltage regulator control adjustments are made with the selector switch in the automatic position.

   b. Models J and B: Adjust the voltage regulator control knobs until the voltmeter reads 120 volts.

2. Recheck the distribution system to be sure all branch circuits are in the OFF position.

3. Close the main circuit breaker on the generator control panel.

   CAUTION:

   When this breaker is closed, the power output terminals are "hot" and it is possible to receive a fatal electric shock from them. Extreme care is required, especially for models A, J and B.

4. Connect the various items of electrically operated hospital equipment as required. Each equipment cord is plugged in turn into its circuit. In this way, the load will be applied gradually to the generator.

   NOTE:

   Do not connect all equipment and then energize the system by closing the main circuit breaker. This will apply too much load too suddenly and may damage the generator.

5. Recheck the a.c. voltmeter and adjust the voltage as necessary.

6. Check the balance of the load with the a.c. ammeter and its associated switch. All three positions of the switch should show approximately the same reading within plus or minus 20 percent. If not, hospital equipment loads should be changed from phase to phase by changing the extension cords from one distribution circuit to another. A little experimenting will be necessary to balance the load properly.

   CAUTION:

   The a.c. ammeter should never show more than 42 amperes on any phase. Beyond this point, the generator will be overloaded on that phase and damage may result.

7. The maximum load of all hospital equipment is approximately 9 kw., excluding the X-ray equipment. In some PDH's the X-ray is powered from its own 2.5 kw. generator. If this load is properly balanced, no phase should carry more than about 25 amperes at any time. This will leave approximately 15 amperes per phase for additional equipment, lighting, etc., as may be required. If any 3-phase motors are in operation, check rotation to see that they are going in the proper direction. If they are not, go back to the generator control panel, open the main breaker, and exchange any two of the three phase connections. Do not disturb the neutral connection.

8. Always check the frequency meter on the control panel. This should indicate a maximum of 62 cycles under no load and a minimum of 60 cycles under full load. If the meter shows operation outside of this range by more than one-half cycle, the speed control governor requires adjustment. For this operation, refer to the manufacturer's manual packed with the machine.

9. Water temperature in the cooling system should be maintained between 160° and 210° F. Check the water temperature gauge occasionally to be sure engine is operating within this range. Models M and U have an automatic safety device on the gauge which will stop the engine if excessive water temperature develops. Temperature may be regulated to some extent by the number of side panels in place or removed.

   CAUTION:

   Always have at least one side panel removed, even in the coldest weather, to insure proper air passage through the radiator.

10. The engine should not be operated if oil pressure is below 20 pounds per square inch. Check

the oil pressure gauge occasionally to be sure engine is operating within this range.

Model A should be checked for oil, water and fuel in the same manner that an automobile would be inspected under similar operating conditions.

Models M and U have an automatic safety device on the gauge which will stop the engine if low oil pressure develops. Models K, J, and B should be checked for oil and water every 5 hours of running time when shut down for refueling.

11. Models M and U are equipped with synchronizing lights.

CAUTION:
Do not attempt to synchronize this type of generator either with another generator or with the commercial power source. Disregard these lights.

FUEL SUPPLY

The fuel tank has a capacity of 15 to 20 gallons, sufficient for approximately 5 hours operation at full load. At less than full load, the operating time is extended.

The grade of gasoline is not important. The engine is designed to operate on any clean gasoline having an octane rating of 80 or higher. Clear or leaded gasoline can be used. Determining the source of gasoline is an essential part of the predisaster plan.

In case of emergency, it is highly possible that a failure of commercial electrical power will render gasoline station fuel pumps inoperative. In such an event, a manual fuel pump with sufficient hose to reach down into the storage tank can be used to pump fuel from the tank to drums or other containers for transportation to the PDH operating site. Frequently, the fill pipes of such underground storage tanks have one or more sharp bends which will make it difficult to insert a suction hose. In such cases, insert the hose through the tank vent pipe.

On all engines, except models A and B, there is provision for connection of an auxiliary fuel tank. In model J, this consists of a plugged tap into the cover of the fuel sight glass. This plug can be removed and replaced with a short section of metal pipe which has a shutoff valve and an adapter for a fuel suction hose. These items are not furnished and must be procured locally. In models K, M, and U, the fuel sight glass is equipped with an auxiliary shutoff valve and pressure connector for copper tubing. A 55-gallon drum makes a convenient auxiliary fuel tank. Whatever type of vessel is used, it should be carefully covered to keep contaminants out and should be protected against the possibility of fire. Warning signs should be installed. See p. 289.

NOTE:
Reserve gasoline should be stored at least 50 feet from both the generator and hospital building and should be properly labeled.

SERVICING

Air Filter • Once each week or oftener if the area is dusty, remove the air filter, clean it carefully, and put in new oil. Directions on the filter should be followed carefully.

Lubrication and Oil Filter • The oil level in the crankcase should be checked daily. If it is low add additional oil. Do not overfill.

After the first 50 hours of operation, drain the crankcase, replace the oil filter with the spare packed with the unit and refill the crankcase with SAE 10W–30 or other appropriate weight SAE oil.

After the initial oil and filter change, change the oil after each 100 hours of operation and the filter at least every 200 hours or more frequently if the oil appears unusually dirty. Place a few drops of engine oil on moving parts of linkage and other function points each time oil is changed.

CAUTION:
Never flush the crankcase with kerosene.

Also, after every 50 hours of operation add a few drops of oil to the oil cups on the engine starter and the d.c. generator for the engine battery. Models K, J, and B: the starter has no provision for such oiling because bearings are permanently lubricated. Model A should be lubricated as indicated in the manufacturer's manual.

NOTE:
The above recommendations on lubrication are considered the best practice for prolonging the life of the generator. Under certain emergency conditions, however, it may not be possible to follow these procedures.

Cooling System • The cooling system requires approximately 15 quarts of water: 5 in the water jacket of the engine and 10 in the radiator.

In very cold weather, it may be necessary to close up at least part of the side openings of the engine and generator housing in order to keep the coolant temperature at the proper level.

In freezing weather, if the engine is to be stopped for periods exceeding an hour and antifreeze has not been installed, it will be necessary either to drain the cooling system or to add antifreeze. Alcohol or ethylene glycol antifreeze can be used. Recommended quantities are shown in fig. 58

Type of antifreeze	Minimum temperature expected					
	10° F.		—10° F.		—30° F.	
	Anti-freeze	Water	Anti-freeze	Water	Anti-freeze	Water
	Quarts	*Quarts*	*Quarts*	*Quarts*	*Quarts*	*Quarts*
Ethylene glycol	4	11	6	9	7½	7½
Alcohol (methyl)	3½	11½	5½	9½	7½	7½
Alcohol (ethyl)	4½	10½	6½	8½	9	6

FIGURE 58

NOTE: The alcohols and alcohol compounds evaporate easily. If a hydrometer is available, it should be used frequently to check the effectiveness of the coolant. If a hydrometer is not available use the ethylene glycol type antifreeze.

Battery ● The battery packed with the set may not start the engine initially. After a relatively short running period, however, the battery should be sufficiently charged to start the engine. In case the battery has deteriorated and will not charge, obtain a replacement. In the meantime, leave the dead battery in place and connected. If it is removed, the 6-volt d.c. generator may be damaged. Check the battery for fluid, especially during the first hours of operation. When the battery fluid is low in a particular cell fill the cell to the proper level using clean water. Distilled water is not required. If the local water is cloudy, allow some to stand in a clean container for at least 24 hours, then fill the battery to the proper level, using the water from the upper half of the container. Dirty water can be filtered through a cloth to remove particles which might damage the battery.

A. C. Generator ● The only regular service required is that the generator be kept clean and protected from rain or other dampness.

Bearings are permanently lubricated and should be adequate for up to 4,000 hours of operation. Greatest wear will occur at the slip rings. Care must be taken to keep this area clean and dry. Inspect the slip rings and brushes whenever the set is shut down, and clean as required in accordance with the manufacturer's manual. Because of their high flash point, stoddard solvents or alkaline solutions are preferable for cleaning. If these products are not available, gasoline can be used. If gasoline is used, be sure it has evaporated completely before the unit is restarted or an explosion could result.

THE 2.5-KILOWATT GENERATOR

GENERAL DESCRIPTION

Some PDH's are equipped with 2.5-kw. generators. There are two models:

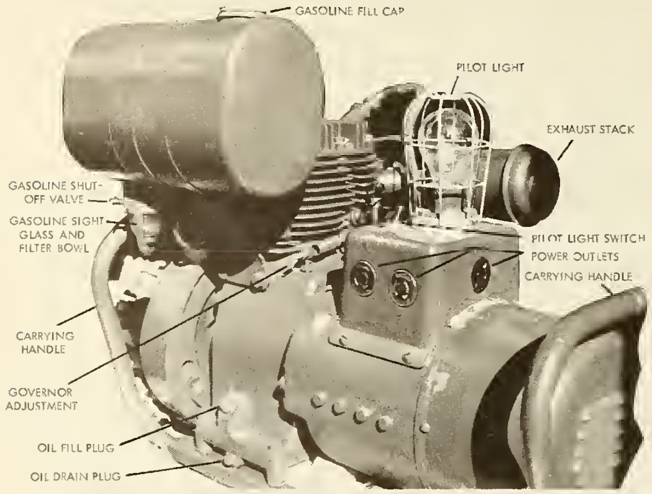
GENERATOR NOS.	MODEL
Fairbanks, Morse & Co., 25PX–36 (Contracts WA–O–43884, WA–O–54490 and FNW–F–1629–2/3)	F
Hamco, Inc., GA–C–250–GSA/19 (Contracts FNW–F–6281/3)	H

The 2.5-kw. generator sets covered here are similar in nature and many of the instructions apply to each. Where differences exist, the text contains special notations which refer by the above model letters to the specific model to which the instructions apply. The model can be determined from the contract number which is stamped on the outside of the crate. The generator number is also found on the name plate affixed to each generator.

The 2.5-kw. generator is a 2-pole machine, having 60-cycle, 120-volt output at 3,600 r.p.m. It is single-phase, 2-wire.

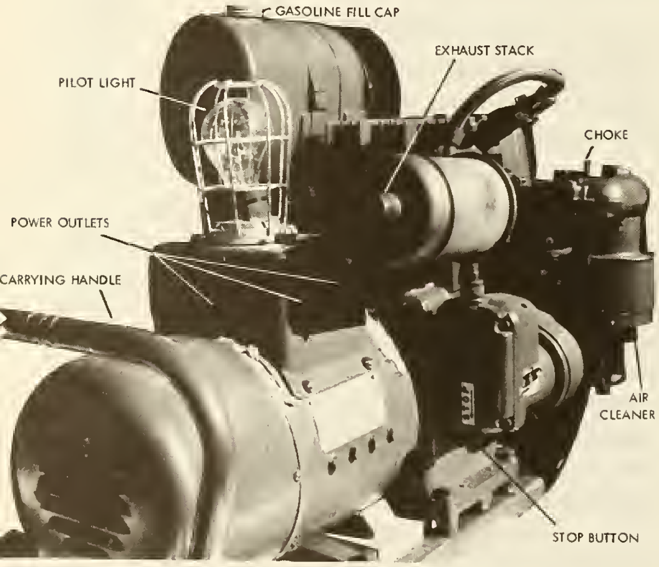
Engine ● Gasoline, air-cooled, four-cycle, direct-coupled to generator. At sea level, model F is rated at 6.8 horsepower and model H at 7.0 horsepower. A governor is provided to maintain proper speed. The engine is of the conventional l-head type with single-barrel carburetor and magneto. It is started with a cranking rope attached to generator frame.

Housing • The engine and generator are mounted together on a frame arranged for easy portability. There is no housing, but individual parts are weather-protected except for the electrical receptacles.



FAIRBANKS, MORSE & CO., 25 PX-36

MODEL F, 2.5-KW., LEFT SIDE



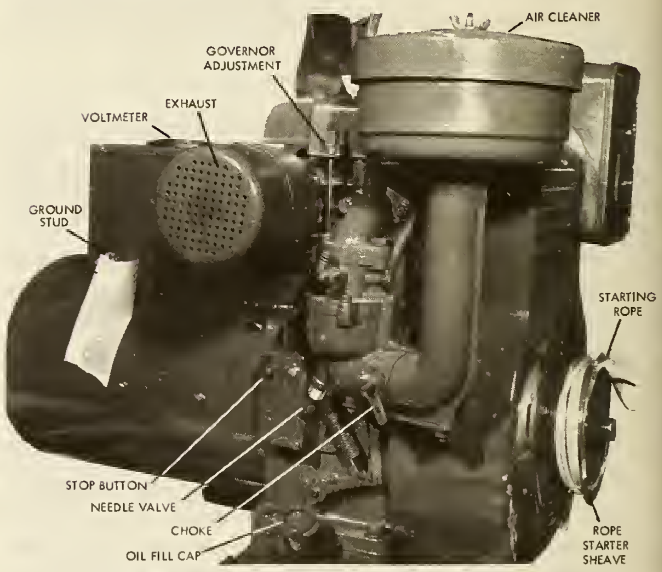
MODEL F, 2.5-KW., RIGHT SIDE

Accessories • Starter ropes and 5-gallon gasoline containers are packed with 2.5-kw. generators. Other accessories and supplies must be obtained locally.

Identification of Components • See illustrations for names and locations of principal controls and components of each model.

HAMCO, INC., GA-C-250-GSA/19

MODEL H, 2.5-KW., LEFT SIDE



MODEL H, 2.5-KW., RIGHT SIDE

PREPARATION FOR USE

Uncrating and Moving to Position • This can be done easily by two men. Set the unit in a level place where there is unrestricted ventilation.

CAUTION:

Set up the unit outdoors when possible. Never run it indoors without venting the exhaust. Death from carbon monoxide poisoning can result from improper ventilation of exhaust gases.

Use • This generator is intended to supply 120-volt power to the X-ray apparatus and film processing machine, and should, therefore, be located as near these units as possible.

Manuals and Accessories • Keep the starting rope with the unit. File the manual packed with each generator in a convenient place for easy reference.

Engine •

1. Fill crankcase, preferably with 10W–30 oil. Model F takes about 2 pints, model H about 3 pints. Both should be filled to the top of the filler plughole.
2. Fill air cleaner, using the same type of oil as for the crankcase. Take off the wingnut or retaining bale and remove the filter element. Fill the bowl up to the oil-level line, which will require about ½ pint. Replace the element and the wingnut or bale.
3. Fill gasoline tank. Use a good grade of regular gasoline.

NOTE:
If only premium gasoline is available and is used in warm weather, it may be necessary to adjust the spark advance. (See manufacturer's manual.)

4. If the cord packed with the X-ray is too short to reach from the generator to the X-ray unit, an extension cord can be used. In case of rain or snow, place a protective cover over the electrical outlets on the generator. A piece of plastic held in place with a string is sufficient.
5. Provide a ground for the common frame of the engine-generator.

STARTING AND STOPPING ENGINE

To Start •

1. Open fuel valve.
2. Close choke, turning lever counter-clockwise.
3. Place knot of starting rope in slot of starting sheave with knot on the outside and wrap rope clockwise around sheave (about two turns). Pull rope slowly until compression of engine is felt. Then pull rope sharply all the way.
4. If engine starts, model F choke will open automatically; model H choke will not, and should be opened gradually as engine warms.
5. If engine does not start, check choke of model F and reset if it has opened. With model H, open choke one-eighth, rewind rope in starting sheave, and pull slowly until compression is felt. Then pull sharply. Repeat until engine starts. If engine does not start, and gasoline begins to drip from carburetor, open choke all the way, wait a minute or two, rewind rope, and pull.
6. When engine starts, open choke of model H gradually until engine runs smoothly with choke wide open. The engine speed can be increased or decreased to secure proper voltage or cycles by means of a square nut connected to a governor linkage rod which is located beside the engine head. Clockwise turns increase engine speed and counterclockwise turns decrease it.

To Stop •

1. To stop engine, press down STOP button and hold until engine comes to rest.
2. When engine has stopped, close fuel line valve.

NORMAL OPERATION

1. The 2.5-kw. generator is intended to power the X-ray apparatus and film processing machine and should be reserved for this purpose.
2. When the engine has warmed and is running smoothly, plug the extension cords for the X-ray apparatus and film processing machine into the outlets provided on the generator.
3. Model F generator has 2-pole Hubbell twist-lock receptacles and cord ends. Model H generator has 3-pole Hubbell twist-lock receptacles and cord ends.
4. To furnish power from these generators to any equipment with 2-parallel-blade plugs:

   Model F: Replace the 2-parallel-blade plug with a 2-pole twist-lock plug.

   CAUTION:
   If equipment has a green or ground lead, connect this lead to the generator frame, not to the plug.

   Model H: Replace the 2-parallel-blade plug with a 3-pole twist-lock plug.

   CAUTION:
   If equipment has a green or ground lead, connect it to the ground element (which is shaped differently from the two line elements) of the twist-lock plug.

5. If it is necessary to provide an extension cord from the generator to the X-ray equipment cord, a single extension cord of at least 14 gauge should be used. If the extension cord has a conventional 2-pole male plug, this plug must be replaced by one of the twist-lock male plugs furnished with the generator.

FUEL SUPPLY

The capacity of the fuel tank is approximately 1¾ gallons, which should permit the engine to operate a full load for about 2 hours.

Either regular or premium gasoline can be used.

CAUTION:

Do not add oil to the gasoline. See page 272 for suggested methods of obtaining a fuel supply.

NOTE:

When filling the fuel tank, extreme care must be taken to prevent spilling gasoline on hot portions of the engine. A small amount of fuel thus spilled can cause an explosive mixture and the heat of the exhaust manifold may be sufficient to ignite it.

SERVICING

Air Filter • Once each week, or more often if the area is dusty, remove the air filter, clean it carefully, and add fresh oil. Check for dirt accumulation as often as possible during the first few days. Experience will soon indicate the amount of time between cleanings for a given installation.

Lubrication • Drain the crankcase and refill it after each 50 hours of operation. Use a good grade of motor oil (10W–30 when available) and fill to the filler opening. Two pints are required for model F, 3 pints for model H. Drain the oil while the engine is still warm. Place a few drops of engine oil on moving parts of linkage and other function points each time oil is changed.

Check the glass strainer bowl at least once daily. If sediment is noted, stop the engine and turn off the fuel valve, remove and clean the bowl and strainer. When replacing, be sure that the gasket is seated properly to prevent possible leakage. There is no prescribed interval for this operation because it depends upon the amount of dirt in the gasoline.

THE 10-KILOWATT GENERATOR

GENERAL DESCRIPTION

All 10-kw. generators are identical and were obtained from the same source:

GENERATOR NO.	MODEL
Hol-Gar Mfg. Corp., model GS–107–AC	G

The 10-kw. generator is capable of 10-kw. output, 60 cycles at 1,800 r.p.m., at 0.8 power factor. It is of the single-bearing, self-excited type.

The generator as packed is wired for 120/208-volt, 3 phase, 4-wire WYE operation. Other voltages which can be obtained by changing the terminal board patch panel are:

120-volt, 1-phase, 2-wire.

120/240-volt, 1-phase, 3-wire.

240/416-volt, 3-phase, 4-wire.

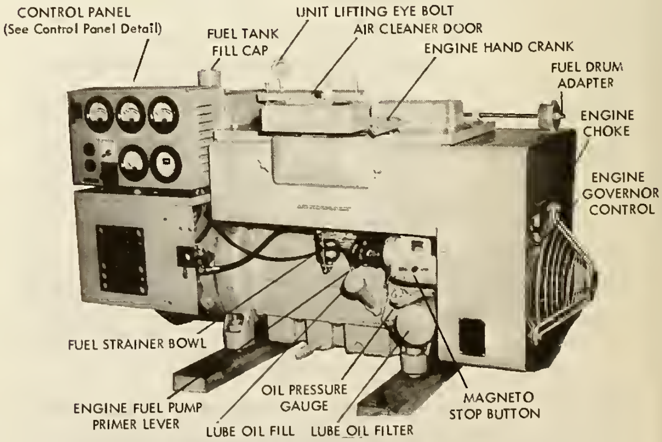
240-volt, 3-phase, 3-wire.

Engine • Gasoline, air-cooled, 4-cylinder, 4-cycle of approximately 30.5 horsepower, directly connected to the generator. Engine is equipped with an automatic speed control governor to maintain 1,800 r.p.m. Starting is by hand crank only with ignition provided by a built-in magneto. There is no battery.

Housing • The engine and generator are of drip-proof construction with the exception of the instrument panel. There is no overall housing.

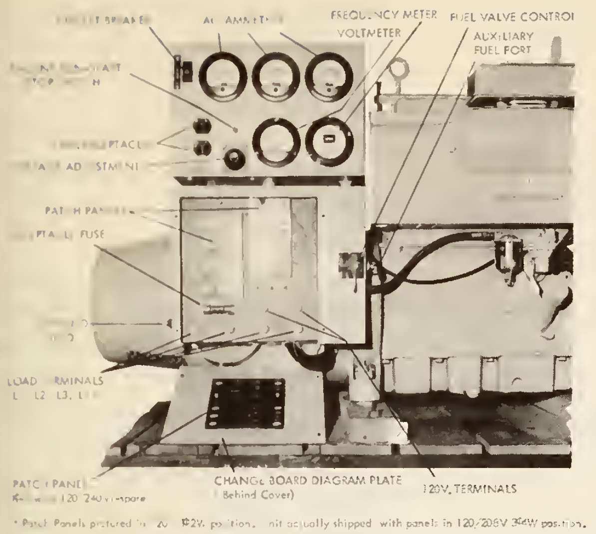
Accessories • Accessories packed with the 10-kw. generator are listed .

Identification of Components • See illustrations following for names and locations of principal controls and components.



HOL-GAR MFG. CORP., GS–107–AC

MODEL G, 10-KW. GENERATOR



MODEL G, 10-KW., CONTROL PANEL

PREPARATION FOR USE

Moving to Position • Select convenient operating position within 80 to 90 feet of the load center which each unit serves.

NOTE:
One generator provides sufficient capacity for all PDH electrical loads except lighting, and in certain models, an 8,000-watt sterilizer. The second generator should be used for lighting or other uses not exceeding its capacity. The 8,000-watt sterilizer is not to be heated by either generator. It should be heated by the gasoline burner. Its electric heating coils are intended for use only with commercial electric power. Only if the gasoline burner fails and there is no commercial power should it be necessary to power this sterilizer from the generator.

Unless special provisions for external exhausting have been made, the generators should be located outdoors to ensure proper ventilation and dispersal of exhaust gases. For each generator, select a level, solid, well-drained location. Good drainage will lessen the electric shock hazard and prevent water damage.

Each unit weighs approximately 1,000 pounds crated. Because there is no protective housing for the generator, it is best to move it into position before uncrating. This can be done easily with a forklift if one is available. Otherwise, pass a rope sling around the crate near the bottom and pull or winch the unit into position. To facilitate moving over unpaved surfaces it may be necessary to obtain boards or sheets of plywood at least ⅝-inch thick in order to provide a surface over which the unit can be drawn. Because of the skid design, pipe rolling is not possible without modification of the skid. If a crane is available, the crate can be removed and the eyebolt assembly secured in place. *DO NOT REMOVE THE WOODEN SKID. IT IS THE MOUNTING PLATFORM OF THE UNIT.*

Uncrating •

1. Remove the protective wooden crate by first unbolting it from the skid and then lifting it off.
2. Remove the accessories packed outside the moisture-proof envelope enclosing the unit, then remove the envelope and the moisture-proof bags within it. Try to keep the envelope from tearing as it can be used later for protective covering.

If time and materials are available, it may be advisable to use the crate to make a temporary roof over the unit to protect it from direct weather. The moisture-proof envelope can then be nailed over the temporary roof to keep rain from leaking through.

There are two copies of the manufacturer's manual packed with each generator. Remove one to a safe place such as general stores. Keep the other with the unit for reference.

Engine •

1. Remove oil dipstick to allow a release vent for air while the oil is being poured. Fill the crankcase with 6 quarts of motor oil, preferably 10W–30.
2. Remove the foam carburetor air filter element from its wire mesh retainer, saturate it with oil of the same type used in the crankcase, and squeeze it as dry as possible. Replace it over the retainer in its original position.
3. Fill the fuel tank with regular grade gasoline. Check to be sure there is no dirt or water in the fuel.
4. Set the muffler in place. No tools are required to make this attachment.

Generator •

1. Remove the ground rod from its packing position and drive it into the ground near the generator. Select a point where the ground seems moist and will provide the best connection. Run the ground wire to the generator and connect it to the ground clamp provided on the frame.

NOTE:
If there is a water pipe (not fuel or gas) near the generator it will probably make a better ground and should be used instead of the ground rod provided. If this is done, be sure to make a strong, tight connection that will not come loose from the pipe.

2. It is possible to change the type of voltage available at the power output terminals. Remove the cover enclosing these terminals and examine the patch panels, noting their position. There should be two panels in place on the upper portion of the terminal board and a third, larger panel in a storage position on the outside of the cover plate. The two small panels should be in the highest position possible, with no studs showing above either. In this position, the lower terminals, marked L_0 (neutral), L_1, L_2, and L_3, (phase terminals), will provide 120/208-volt, 3-phase, 4-wire service with a maximum capacity of 15 kw. at 0.8 power factor. It is expected that this will be the most often used class of service and therefore the generators are packed in this manner.
3. If another class of service is desired, the following are available:

Class of Service	Maximum Output Capacity at 0.8 P.F. KILOWATTS
120/240-volt, 1-phase, 3-wire	10
120-volt, 1-phase, 2-wire	10
240-volt, 3-phase, 3-wire	15
240/416-volt, 3-phase, 4-wire	15

CAUTION:
Do not attempt to change class of service with engine running, even with the breaker off.

Any of these additional classes may be selected by setting the proper patch panels in the proper positions and securing them with the nuts provided. The selected voltage class will then be available at the output terminals L_0, L_1, L_2, and L_3. See the manufacturer's manual, page 14, for sketches of panels and their positions to obtain the desired voltage.

4. Use four 100-foot lengths of AWG No. 6 wire (or larger), for feeder conductors from each generator to the distribution system it will supply in the hospital. Connect one of the conductors to the neutral terminal on the generator terminal panel (terminal L_0) and to the neutral of the distribution system. Then connect the other three feeder conductors to terminals L_1, L_2, and L_3 in any order. Unroll them and connect to the phase terminals of the distribution system.
5. Protect the feeder wires from damage by elevating them and securing them to trees, walls, etc. Keep them off floors and the ground.

CAUTION:
These wires may not be completely waterproof and allowing them to remain on the ground or floor where they may be subject to damage or water could be dangerous to personnel.

Checking • Check both the engine and generator to be sure there are no damaged or loose parts. Make sure electrical connections are tight and clear. Make sure all controls are in the OFF position. Be sure the unit and its skid are firmly seated and will not rock when started.

STARTING AND STOPPING ENGINE

To Start •

1. Open fuel valve and prime carburetor by operating fuel pump priming lever about 15 strokes. Be sure priming lever is left in the down (inward) position where is it disengaged.
2. Set engine switch in START position.
3. Adjust hand choke to suit weather conditions. In very cold weather, pull it out most of the way; in very

warm weather, pull it out only a little. Trial and error will determine the optimum setting.

4. Engage the crank handle at the "7 o'clock" position and pull it up sharply at the "12 o'clock" position. Two or three such cranks should start the engine.

5. Turn engine switch to the RUN position. This is an important step.

6. Check oil pressure. It must be at least 20 pounds on the gauge and will normally be between 30 and 35 pounds per square inch.

7. If there is no oil pressure upon first starting engine, stop engine immediately and recheck oil level. If oil level is satisfactory, proceed as follows:

   a. Start other generator, ascertain that oil pressure gauge is functioning and then shut down the engine.

   b. Remove the good oil gauge and place it on the doubtful generator in place of its own gauge.

   c. Restart doubtful generator and check gauge. If pressure is indicated original gauge is defective but should be used to plug the gauge hole on the other machine until repair can be accomplished. If no pressure is indicated on the good gauge, refer to manufacturer's manual.

8. As engine warms, push choke control in slowly until engine is running smoothly with choke all the way in.

9. There is a preservative compound coating the cylinders for storage. When the engine first starts, this will produce a dense black exhaust smoke.

To Stop •

When stopping the engine, remove electric load by turning load switch to OFF position. Allow engine to idle for 3 to 5 minutes, place engine switch in STOP position, and turn fuel valve to OFF position.

NORMAL OPERATION

1. When the engine is first started, and while it is warming up, check the a.c. voltmeter and adjust the voltage. The voltmeter indicates a maximum of 150 volts and is connected to read from phase to neutral. Thus the voltage that will appear across the terminals of a receptacle in the system may be read directly for the following connections:

   120/208-volt, 3-phase, 4-wire.

   120/240-volt, 1-phase, 3-wire.

   120-volt, 1-phase, 2-wire.

   The voltmeter reading must be multiplied by 2 for the following connections:

   240-volt, 3-phase, 3-wire.

   240/416-volt, 3-phase, 4-wire.

NOTE:
The manufacturer's manual gives multiplying factors which are different from those indicated here. They will give phase-to-phase voltage and will rarely be needed since all but one item of hospital equipment operates on 120 volts.

2. Recheck the distribution system to be sure that the feeder conductors are properly connected and that hospital equipment, lighting, etc., is not connected. Replace cover over the terminal board of the generator.

3. Close the load switch (circuit breaker) on the control panel.

4. Connect the various items of electrically powered equipment which are to use the output from this generator. As each cord is plugged in, turn on its circuit at the distribution point. In this way, the load will be applied gradually to the generator. When all have been connected, readjust voltage to 120 volts.

NOTE:

Do not connect the entire load and then energize it by closing the load switch on the generator control panel. This will apply too much load too quickly and may damage the generator.

5. Recheck the a.c. voltmeter and adjust the voltage accordingly.

6. Always check the balance of the load by referring to the 3 ammeters on the control panel. They should all read approximately the same and the pointer should be in the green area of each scale.

NOTE:

There are different scales for single and 3-phase connection of the output. Be sure to refer to the proper scale.

If one or more ammeters show a reading above the green area of the scale, or if the meters do not indicate the same reading (plus or minus 20 percent), change some of the equipment or lighting loads from one phase to another until a proper balance is achieved and no phase is overloaded.

7. The total load of all hospital equipment, not including the 8,000-watt sterilizer supplied in most PDH's is approximately 9,030 watts (9.03 kw.) and a single generator is sufficient to serve it (fig. 59). All hospital equipment (except the sterilizer) requires 120-volt service. The electric heating coils of the sterilizer require 220-volt, single-phase service. The sterilizer should be heated by the gasoline burner if commercial electrical service is not available.

   If any 3-phase motors are in operation, check rotation to see that they are going in the proper direction. If they are not, go back to the

EXAMPLES OF ELECTRICALLY OPERATED HOSPITAL EQUIPMENT IN A TYPICAL PDH

Item	Federal Stock No.	Voltage	Phase	Watts	Quantity	Load (watts)
Surgical light	6530-042-6342	120	1	150	3	450
Surgical light	6530-706-6475	120	1	150	3	450
Sterilizer	6530-781-3684	120	1	1,600	1	1,600
Light, head	6515-000-0124	120	1	5	4	20
Otoscope	6515-000-0233	120	1	5	6	30
Sigmoidoscope	6515-000-0244	120	1	5	1	5
Suction apparatus	6515-299-8337	120	1	¼ hp.	6	3,060
Dental light	6520-538-7100	120	1	100	1	100
Microscope illuminator	6650-000-0201	120	1	15	1	15
Film processing machine	6525-823-8127	120	1	300	1	300
X-ray apparatus	6525-612-4710	120	1	1,500	1	1,500
Water pump	4320-000-0001	120	1	¾ hp.	1	1,500
Total power required						9,030 (9.03 kw)

The following item will be gasoline-fired when commercial electric service is not available:

Item	Federal Stock No.	Voltage	Phase	Watts	Quantity	Load (watts)
Sterilizer	6530-781-3683	220	1	8,000	1	8,000

FIGURE 59

generator control panel, open the main breaker, and exchange any two of the three phase connections. Do not disturb the neutral connection.

8. Check the frequency meter on the control panel. This should indicate a maximum of 62 cycles per second under no load and a minimum of 60 cycles per second under full load conditions. If the meter shows operation outside of this range by greater than one-half cycle per second, the speed control governor of the engine requires adjustment. See the manufacturer's manual for necessary instructions.

9. Check the oil pressure gauge occasionally. Oil pressure should be maintained at between 30 and 35 pounds during normal operation. It should never fall below 20, although it will be higher at starting and until the engine reaches operating temperature. There is an automatic device provided which will stop the engine if the oil pressure drops dangerously low.

NOTE:

NEVER attempt to operate the two generators in parallel (serving the same load simultaneously) or to parallel either or both with other sources of electrical power such as a commercial source. These units are not designed for such use and will suffer great damage if so connected.

FUEL SUPPLY

The fuel tank on the unit has a full capacitv of 5.3 gallons, which is sufficient for approximately 2 hours of operation at full load. At less than full load, generator will operate for a longer period.

Grade of gasoline is not important. The engine is designed to operate on any clean leaded or unleaded gasoline with an octane rating of 80 or higher. Determining the source of gasoline is an essential part of the predisaster plan. See page 272, for method of obtaining gasoline when gasoline station pumps are inoperative.

There is provision for connection of an auxiliary fuel tank. This consists of a dip-tube, strainer and hose. Connect the hose where indicated, insert the dip-tube into the auxiliary supply tank or drum, and set the fuel valve at the AUXILIARY position.

A 55-gallon drum makes a convenient auxiliary fuel tank. Whatever type of container is used, it should be carefully covered to keep contaminants out and should be protected against the possibility of fire. Warning signs should be installed. See page 289.

NOTE:

Reserve gasoline should be stored at least 50 feet from both the generator and hospital building and should be properly labeled.

SERVICING

Air Filter • Once each 100 hours, or oftener if area is dusty, remove the sponge rubber air filter, clean with gasoline and squeeze as dry as possible. Saturate it with 10W–30 or other appropriate weight crankcase oil, squeeze out excess oil, and replace filter in filter housing.

Lubrication • Check crankcase oil level every 8 hours, and change oil every 100 hours. Change oil filter element every 500 hours. When changing crankcase oil, drain old oil only when engine is warm to assure complete draining. Use a good grade of motor oil, preferably 10W–30. Place a few drops of engine oil on moving parts of linkage and other friction points each time oil is changed.

Gasoline Strainer • Check the glass fuel strainer bowl at least once daily. If sediment is noted, stop the engine and turn off the fuel valve, remove and clean the bowl and strainer. When replacing it be sure that the gasket is sealed properly to prevent possible leakage. There is no prescribed interval for this operation as it depends upon the amount of dirt in the gasoline.

Cooling System • This engine is air cooled and therefore must never be operated unless shrouds are securely in place. Shrouds are held in place by bolts. Check each 8 hours to be sure that bolts are tight and that air flow occurs without excessive leaks around shrouds.

NOTE:
See manufacturer's manual for detailed instructions for 8-, 100-, 200-, 500- and 1,000-hour service.

WIRING OF AUXILIARY BUILDINGS

GENERAL CONSIDERATIONS

Wiring the building where the PDH is to be used is extremely important. Without an adequate distribution system to get the electrical power from the generator to the various items of hospital equipment, the lighting system, etc., the PDH could become electrically inoperative and fail to fulfill its mission.

The most desirable approach is to utilize the existing wiring in the building preselected for use as the PDH operating site. This method permits ready transfer to commercial power if it should later be restored. In order to make the best use of an existing wiring system, the following points should first be considered:

1. Are there enough existing receptacles of the right type conveniently distributed for connection of hospital equipment?
2. Is it possible to disconnect existing heavy loads in the hospital area so that the generator will not be inadvertently overloaded with nonessential connected equipment?
3. Is the wiring system of the building arranged so that the portion of it serving the hospital can be isolated and fed separately from the emergency generator?
4. Is the output of the generator (120/208-volt, 3-phase, 4-wire, 60 cycle) compatible with the class of service for which the distribution system was designed? If not, can it be used, even at reduced efficiency?

RECEPTACLES

There are several PDH models with varying requirements for outlets. A minimum of thirty 120-volt outlets should be distributed throughout the various hospital service areas. (As previously noted, where the X-ray is powered by its own small generator, a single extension cord run through a convenient window can connect it to this generator.) It is important that the outlets in the various hospital areas be served from a sufficient number of branch circuits to avoid shutting down several areas if a defect occurs in one circuit.

AVOIDANCE OF OVERLOAD

The total hospital equipment load for some PDH's is only a little over 3 kw. This means that there is approximately 12 kw. spare capacity in the generator for lighting or other miscellaneous uses. A careful calculation of the existing loads connected to that portion of the wiring system which will be energized by the generator should be made. Nonessential equipment such as large fans, boilers, electric cooking devices, superfluous lights, etc., should be disconnected or locked out. Removing all or a portion of the light bulbs from fixtures and disconnecting some branch circuits can also help prevent overloading the generator.

In some PDH models, the total hospital equipment load is approximately 9 kw. (not including the 8,000 w. sterilizer which should not be powered from a generator). One generator is quite capable of handling this load with some capacity left over. The amount of remaining capacity will depend upon whether a single-phase or a 3-phase connection is used. This reserve may be used for lighting in the hospital area which is served by that portion of the building distribution system to which the generator is connected. As with the other generators, care must be taken to eliminate unnecessary loads such as large fans, cooking equipment, boilers, non-essential lights, and other items not critically needed for operation of the hospital.

ISOLATION OF PART OF THE SYSTEM

The existing system should be such that a portion can be isolated so that only that portion will be energized by the generator. If it is possible to isolate part of the system at the main distribution panel or main service point, it will probably be easier than if it is necessary to do this at a branch panelboard. Normal incoming service wires should be physically disconnected and their ends marked and taped for future reconnection.

CAUTION:
While the generator is in use, the normal service wires should never be reconnected. To do so would seriously damage the generator in the event the commercial power were restored. Also, leaving these wires disconnected will prevent accidental feed to parts of the existing system not needed for hospital use.

NOTE:
Although synchronizing lights are installed in models M and U, no attempt should ever be made to actually synchronize these generators to another source.

In some PDH models, there are two 10-kw. generators. The second generator might be used in several ways. Among these are the operation of lighting, heating, or miscellaneous equipment and as standby for the first generator. If it is decided to operate both generators simultaneously, they must be used on separate, unconnected portions of the building electrical system. Under no circumstances may both generators be connected so that there is a possibility of their feeding a single system or load in parallel. To do so would invariably damage one or both machines.

CLASS OF SERVICE

In various parts of the country there are several different classes of electrical service. Some of the most common are as follows:

- 120/208-volt, 3-phase, 4-wire

This class of service is quite common, particularly east of the Mississippi River. It is the class of service for which the generators are connected, as packed, and no difficulty should be experienced in using them on a wiring system with this class of service.

- 230-volt, 3-phase, 3-wire with 1 side center-tapped to provide 115/230-volt, single-phase, 3-wire

This class is sometimes called the 4-wire delta service. It usually requires double metering, one meter for the 3-phase, 3-wire portion serving the large motors and heavy loads, and a second, single-phase, 3-wire portion serving lighting, receptacle and miscellaneous small loads within the building. It is the latter portion with which the PDH is concerned. The common practice of double metering and employing two incoming services can simplify connecting to the proper portion of this system.

When one of the 15-kw. generators is connected to a portion of the single-phase distribution in a system of this class, one phase of the generator output will remain unconnected and the maximum capacity of the unit will be reduced to 8.7 kw. (58 percent of normal). The operator must take this into account when allowing for loads in addition to the hospital equipment. The generator may tend to overheat as its 8.7-kw. capacity is approached. Overheating should be watched for and, if it occurs, the load should be reduced.

Where two 10-kw. generators, Federal Stock No. 6115–985–7703, are supplied, each can provide 120/240-volt, single-phase, 3-wire service with a capacity of 10 kw. Such service is compatible with the 115/230-volt portion of the existing system and the generator or generators, properly connected, should operate on this system without difficulty.

CAUTION:
Extreme care must be taken to avoid simultaneous operation of the two generators to serve the same load or systems.

- 120/240-volt, single-phase, 3-wire or 115/230-volt, single-phase, 3-wire

Either of these is rather common in smaller buildings. Each can be tied into and used in the same manner as recommended for the single-phase portion of the 4-wire delta class, discussed in paragraph preceding. Notice that capacity of the 15-kw. generator is then reduced.

- 120-volt, single-phase, 2-wire

This class of service may be encountered occasionally in small buildings or warehouses or in barns with very small electrical loads. In case it is necessary to adapt to such a system, two phases of the 15-kw. generator will remain unconnected, and the capacity of the unit will be reduced to 5 kw. Precautions against overheating should be taken in this case also, and the generator should be watched closely while it is in operation.

If it is necessary to adapt the 10-kw. generator to such a system, the generator may be connected to provide this service with a maximum capacity of 10 kw. No difficulty should be encountered.

- 277/480-volt, 3-phase, 4-wire or 265/460-volt, 3-phase, 4-wire

This is probably the most difficult class to which to connect the 15-kw. or 10-kw. generators for it will not adapt to the service voltage without the use of a special transformer, which may be difficult to obtain. In such a system, dry-type transformers are universally included to provide 120-volt service for incandescent lighting, receptacles, small motors, etc. Sometimes these transformers are connected to provide 120/208-volt, 3-phase, 4-wire service (in larger buildings), and sometimes they provide only 120/240-volt single-phase, 3-wire service. In either case the generator should be applied only to a section of this low-voltage portion of the system to serve the receptacles in the hospital area. In order to avoid possible problems from back-feed, the built-in transformer serving the selected portion should be disconnected.

Unfortunately, in such a building, the main lighting is usually of the fluorescent type operating at 277 volts and it cannot be energized by the 15-kw. or

10-kw. generators. It will therefore be necessary to provide for lighting from the generator by other means. If there are sufficient receptacles or a large enough number of branch circuits, it may be that floor or pinup lamps can be provided locally. Otherwise, a wiring harness, discussed below, may be necessary. Note that if the low-voltage system is of the single-phase, 3-wire type, the 15-kw. generator will have a reduced capacity and will be subject to overheating as discussed in preceding paragraphs.

WIRING HARNESS

A wiring harness is another way of utilizing the generator's output. It uses equipment which does not depend upon the existing wiring within the operating site building. A wiring harness consists of a branch panelboard which contains either fuses or circuit breakers for branch circuit protection and duplex receptacles, mounted either in or on the sides. It serves very well as a load center to which the various items of hospital equipment can be connected.

The panel board should contain from twelve to sixteen 15- or 20-ampere branches symetrically connected across the three phases. Each branch will serve one of the duplex receptacles. The receptacles must be located so that they are accessible from outside the cabinet for plugging in the extension cords or the pigtails of equipment. The panelboard should be served from the generator by No. 6 feeders. An eyebolt should be attached to the top of the cabinet so that it can be hung on the wall easily.

Extension cords can be made up from material normally available locally. They must be capable of carrying 120-volt service from the panelboard to hospital equipment and lighting as required for the individual site.

Specifications for wiring harness components

1. Main bussing within the panelboard should have a minimum rating of 50 amperes. Branches should be symetrically connected so that an equal number are served by each phase.
2. The neutral bar should have the same capacity as the main bussing.
3. If it is difficult to find the necessary punches and tools for mounting the receptacles flush in the sides of the cabinet, it may be better to use surface-mounted utility boxes. It is suggested that they be secured by a chase nipple at one end of the bottom of the box and a screw at the other. This will provide a suitable method of passing the necessary wires from the cabinet to each box.
4. U-ground receptacles, Type 5161 or equivalent, should be used, with the grounds tied to the cabinet and neutral bar of the panel. Since the neutral will be grounded at the generator, a sufficient bonding system will be provided.
5. Extension cords should be of AWG No. 16, three-wire type. They should be provided with U-ground caps and receptacles in order to extend the bonding and equipment grounding to the hospital equipment.
6. The power cable on some medical equipment is equipped with a 2-pole plug connector. To use this with a 3-wire receptacle, utilize a 3-wire, U-ground adapter and run an external ground wire to the equipment chassis. An alternate plan is to replace the 2-pole plug connector on the unit power cable with a 3-pole U-ground plug connector and run an external ground wire to the equipment chassis.
7. Additional cords with lamp sockets at intervals may be provided and strung as desired from the ceilings to provide lighting. If metallic shell lampholders are used, these cords should also be of the 3-wire type to provide an equipment ground to the lamp socket shell.

SUMMARY INSTRUCTIONS

MODEL A, 15-KW

Kohler Company, Model 15M81H1

1. Move set to operating position, outdoors and within 80 feet of branch panel location.
2. Remove packaging. Leave set attached to wooden skid.
3. Open panels and remove any shipping straps and any items packed inside.
4. Check fan belt tension and tighten into operating position.
5. Check freedom of movement of generator brushes. Remove any paper or debris.
6. Check radiator and water jacket drain valves and crankcase drain plug to be sure they are closed and snug.
7. Remove crankcase dipstick.
8. Fill crankcase with 10W–30 or other appropriate oil. Four quarts are required.
9. Fill radiator with clean water.

NOTE:
In extremely cold weather, heating the oil and water before they are added will ease starting. Add antifreeze as required.

10. Check oil level with dipstick.
11. Check ignition wires at spark plugs and magneto to see that they are tight.
12. Fill gasoline tank. Use regular or premium gasoline.
13. Set controls as follows:
    Remove magneto ground.
    Main circuit breaker: off.
    Fuel valve: open.
    Choke: pull out.
14. To start, grasp crank handle firmly. Place thumb on same side of crank handle as fingers. Crank by pulling up. Never push down.
15. When engine starts, push choke in slowly as engine warms. Run with choke in all the way.
16. Be sure oil pressure gauge registers at least 15 pounds. If it does not, stop engine and check oil level.
17. Before starting or while engine warms, connect electrical system as follows:
    a. Obtain locally four 100-foot lengths of AWG No. 6 wire.
    b. Be sure circuit breaker is in OFF position.
    c. Connect one wire to terminal N on engine control board. Run this wire to neutral of distribution system.
    d. Connect other three wires to terminals L_1, L_2, and L_3, respectively. Unroll and connect to phase terminals of distribution system.
    e. Ground the system by driving a piece of iron pipe into the ground near the control panel. Connect it to terminal N by a short piece of wire at least as heavy as AWG No. 10. If there is a water pipe near by, use that instead of the pipe. Connect terminal N to frame of generator with the same wire.
18. Close circuit breakers on generator control panel. Plug in hospital equipment.

MODEL B, 15-KW

Eseco Division, B–4836

1. Move set to operating position: outdoors and within 80 feet of branch panel location.
2. Remove packaging. Leave set attached to wooden skid.
3. Open side, front, and rear panels and remove all shipping straps and items packed within.
4. Check fan belt tension and tighten into operating position.
5. Check freedom of movement of generator brushes. Remove any paper or debris.
6. Set battery where battery acid, if spilled, will do no harm. *FILL BATTERY CAREFULLY. DON'T SPLASH.* Replace and connect leads. Flat, braided strap connects to positive + terminal.
7. Check radiator and water jacket drain valves and crankcase drain plug to be sure they are closed and snug.
8. Remove crankcase dipstick.
9. Fill crankcase with 10W–30 or other appropriate weight oil. Use 4½ quarts.
10. Fill air cleaner with same type of oil. Follow instructions on cleaner.
11. Fill radiator with clean water.

NOTE:
In cold weather, heating heavy weight oil and water before they are added will ease starting. Add antifreeze as required.

12. Check oil level with dipstick.
13. Check ignition wires at spark plugs and magneto to see that they are tight.
14. Fill gasoline tank. Use regular or premium gasoline.
15. Set controls as follows:
    Main circuit breaker: off.
    Voltage control: knob center.
    Exciter field rheostat: extreme left.
    Fuel valve: open.
    Choke: pull out.
    Throttle: pull out, then push in half way.
    Magneto switch: on (pull out).
16. Prime carburetor by operating fuel pump manually three or four strokes.
17. Try starter. If battery will not turn over engine, use crank.

NOTE:
Grasp crank handle firmly. Place thumb on same side of crank handle as fingers. Crank by pulling up. Never push down.

18. When engine starts, push choke in slowly as engine warms. Run with choke in all the way.
19. Be sure oil pressure gauge registers at least 25 pounds. If it does not, stop engine and check oil level.

20. Push throttle in all the way; governor will take over.
21. Before starting or while engine warms, connect electrical system as follows:
    a. Remove four 100-foot coils of wire from box under the control panel.
    b. Be sure circuit breaker is in OFF position.
    c. Connect one wire to terminal N on engine control board. Run this wire to neutral of distribution system.
    d. Connect other three wires to terminals 1, 2, and 3, respectively; unroll and connect to phase terminals of distribution system.
    e. Ground the system by driving a piece of iron pipe into the ground near the control panel. Connect it to terminal N by a short piece of wire at least as heavy as AWG No. 10. If there is a water pipe nearby, use that instead of the pipe. Connect terminal N to frame of generator with the same wire.
22. Close circuit breakers on generator control panel. Adjust voltage to 120 volts using voltage adjusting rheostat. Plug in the various items to hospital equipment. Readjust voltage to 120, if necessary.

MODEL J, 15-KW

John R. Hollingsworth Co. JHE–15

1. Move set to operating position: outdoors and within 80 feet of branch panel location.
2. Remove packaging. Leave set attached to wooden skid.
3. Open side, front, and rear panels and remove all shipping straps and items packed within.
4. Check fan belt tension and tighten into operating position.
5. Check freedom of movement of generator brushes. Remove any paper or debris.
6. Set battery where battery acid, if spilled, will do no harm. *FILL BATTERY CAREFULLY. DON'T SPLASH.* Replace and connect leads. Flat, braided strap connects to positive + terminal.
7. Check radiator and water jacket drain valves and crankcase drain plug to be sure they are closed and snug.
8. Remove crankcase dipstick.
9. Fill crankcase with 10W–30 or other appropriate weight oil. Use 4½ quarts.
10. Fill air cleaner with same type of oil. Follow instructions on cleaner.
11. Fill radiator with clean water.

NOTE:
In cold weather, heating heavy weight oil and water before they are added will ease starting. Add antifreeze as required.

12. Check oil level with dipstick.
13. Check ignition wires at spark plugs and magneto to see that they are tight.
14. Fill gasoline tank. Use regular or premium gasoline.
15. Set controls as follows:
    Main circuit breaker: off.
    Ammeter switch: off.
    Voltage regulator control switch: off (manual).
    Field rheostat knob: extreme left.
    Voltage regulator control knob: center.
    Throttle: Pull out, then push in half way.
    Choke: pull out.
    Ignition switch: on.
16. Prime carburetor by operating fuel pump manually three or four strokes.
17. Try starter. If battery will not turn over engine, use crank.

NOTE:
Grasp crank handle firmly. Place thumb on same side of crank handle as fingers. Crank by pulling up. Never push down.

18. When engine starts, push choke in slowly as engine warms. Run with choke in all the way.
19. Be sure oil pressure gauge registers at least 20 pounds. If it does not, stop engine and check oil level.
20. Push throttle in all the way; governor will take over.
21. Before starting or while engine warms, connect electrical system as follows:
    a. Remove four 100-foot coils of wire from locker on right side.
    b. Be sure circuit breaker is in OFF position.
    c. Connect one wire to terminal T_0 on engine control board. Run this wire to neutral of distribution system.
    d. Connect other three wires to terminals T_1, T_2, and T_3, respectively; unroll and connect to phase terminals of distribution system.
    e. Ground the system by driving a piece of iron pipe into the ground near the control panel. Connect it to terminal T_0 by a short piece of wire at least as heavy as AWG No. 10. If

there is a water pipe nearby, use that instead of the pipe. Connect terminal T_0 to frame of generator with the same wire.

22. Close circuit breakers on generator control panel. Adjust voltage to 120 volts using voltage adjusting rheostat. Plug in the various items of hospital equipment. Readjust voltage to 120, if necessary.

MODEL K, 15-KW

Winpower Mfg. Co., K–921–1 through K–921–200

1. Move set to operating position: outdoors and within 80 feet of branch panel location.
2. Remove packaging. Leave set attached to wooden skid.
3. Open side, front, and rear panel and remove all shipping straps and items packed within.
4. Check fan belt tension and tighten into operating position.
5. Check freedom of movement of generator brushes. Remove any paper or debris.
6. Set battery where battery acid, if spilled, will do no harm. *FILL BATTERY CAREFULLY. DON'T SPLASH.* Replace and connect leads. Flat, braided strap connects to positive + terminal.
7. Check radiator and water jacket drain valves and crankcase drain plug to be sure they are closed and snug.
8. Remove crankcase dipstick.
9. Fill crankcase with 10W–30 or other appropriate weight oil. Use 4½ quarts.
10. Fill air cleaner with same type of oil. Follow instructions on cleaner.
11. Fill radiator with clean water.

NOTE:

In cold weather, heating heavy weight oil and water before they are added will ease starting. Add antifreeze as required.

12. Check oil level with dipstick.
13. Check ignition wires at spark plugs and magneto to see that they are tight.
14. Fill gasoline tank. Use regular or premium gasoline.
15. Set controls as follows:

    Main circuit breaker: off.
    Ammeter switch: off.
    Voltage regulator control switch: off (manual).
    Manual rheostat knob: extreme left, counterclockwise.
    Voltage regulator control knob: center.
    Throttle: pull out, then push in half way.
    Choke: pull out.
    Synchronizing lamp switch: off.
    Engine switch: center (push left for start).

16. Prime carburetor by operating fuel pump manually three or four strokes.
17. Try starter. If battery will not turn over engine, use crank.

NOTE:

Grasp crank handle firmly. Place thumb on same side of crank handle as fingers. Crank by pulling up. Never push down.

18. When engine starts, push choke in slowly as engine warms. Run with choke in all the way.
19. Be sure oil pressure gauge registers at least 20 pounds. If it does not, stop engine and check oil level.
20. Push throttle in all the way; governor will take over.
21. Before starting or while engine warms, connect electrical system as follows:

    a. Remove four 100-foot coils of wire from box under control panel.
    b. Be sure circuit breaker is in OFF position.
    c. Connect one wire to terminal N on left side of control panel. Run this wire to neutral of distribution system.
    d. Connect other three wires to terminals A, B, and C, respectively; unroll and connect to phase terminals of distribution system.
    e. Ground the system by driving a piece of iron pipe into the ground near the control panel. Connect it to terminal N by a short piece of wire at least as heavy as AWG No. 10. If there is a water pipe nearby, use that instead of the pipe. Connect terminal N to frame of generator with the same wire.

22. Switch voltage regulator control switch to ON (automatic) and adjust voltage regulator control knob to set voltage shown on a.c. voltmeter at 120. Close circuit breaker on control panel and plug in the various items of hospital equipment. Readjust voltage to 120, if necessary.

MODELS M AND U, 15-KW.

Model M: Winpower Mfg. Co., M–1000–1 through M–1000–1004

Model U: Winpower Mfg. Co., U–931–1 through U–932–10

1. Move set to operating position: outdoors and within 80 feet of branch panel location.
2. Remove packaging. Leave set attached to wooden skid.
3. Open side, front, and rear panels and remove all shipping straps and items packed within.
4. Check fan belt tension and tighten into operating position.
5. Check freedom of movement of generator brushes. Remove any paper or debris.
6. Set battery where battery acid, if spilled, will do no harm. *FILL BATTERY CAREFULLY. DON'T SPLASH.* Replace and connect leads. Flat, braided strap connects to positive + terminal.
7. Check radiator and water jacket drain valves and crankcase drain plug to be sure they are closed and snug.
8. Remove crankcase dipstick.
9. Fill crankcase with 10W–30 or other appropriate weight oil. Use 4½ quarts.
10. Fill air cleaner with same type of oil. Follow instructions on cleaner.
11. Fill radiator with clean water.

NOTE:
In cold weather, heating the oil and water before they are added will ease starting. Add antifreeze as required.

12. Check oil level with dipstick.
13. Check ignition wires at spark plugs and magneto to see that they are tight.
14. Fill gasoline tank. Use regular or premium gasoline.
15. Set controls as follows:

    Main circuit breaker: off.
    Ammeter switch: off.
    Voltage regulator control switch: off (manual).
    Manual rheostat knob: extreme left.
    Voltage regulator control knob: center.
    Throttle: pull out, then push in half way.
    Choke: pull out.
    Synchronizing lamp switch: off.
    Engine switch: center (push left for start).
    Oil pressure gauge: press release button.

16. Prime carburetor by operating fuel pump manually three or four strokes.
17. Try starter. If battery will not turn over engine, use crank.

NOTE:
Grasp crank handle firmly. Place thumb on same side of crank handle as fingers. Crank by pulling up. Never push down.

18. When engine starts, push choke in slowly as engine warms. Run with choke in all the way.
19. Be sure oil pressure gauge registers at least 20 pounds. If it does not, stop engine and check oil level.
20. Push throttle in all the way; governor will take over.
21. Before starting or while engine warms, connect electrical system as follows:
    a. Remove four 100-foot coils of wire from box control panel.
    b. Be sure circuit breaker is in OFF position.
    c. Connect one wire to terminal N on left side of control panel. Run this wire to neutral of distribution system.
    d. Connect other three wires to terminals A, B, and C, respectively, unroll and connect to phase terminals of distribution system.
    e. Ground the system by driving a piece of iron pipe into the ground near the control panel. Connect it to terminal N by a short piece of wire at least as heavy as AWG No. 10. If there is a water pipe nearby, use that instead of the pipe. Connect terminal N to frame of generator with the same wire.
22. Switch voltage regulator control switch to ON (automatic) and adjust voltage regulator control knob to set voltage shown on a.c. voltmeter at 120. Close circuit breaker on control panel and plug in the various items of hospital equipment. Readjust voltage to 120, if necessary.

MODEL G, 10-KW.

Hol-Gar Mfg. Corp., GS–107–AC

1. Move set to operating position: outdoors and within 80 feet of the load center it will serve.
2. Remove packaging. Leave set attached to wooden skid.
3. Remove shipping straps and dessicant bags.
4. Fill crankcase with 10W–30 or other appropriate weight oil. Use 6 quarts.
5. Remove the foam air filter element from its wire mesh retainer, soak it in oil of the same type used in the crankcase, squeeze it as dry as possible and replace.
6. Fill fuel tank with regular grade gasoline.
7. Set muffler in place.
8. Check to be sure load switch on control panel is in OFF position.

9. Open fuel valve to TANK position.

10. Prime carburetor by operating fuel pump priming lever about 15 strokes. Be sure level is left in the down (inward) position where it is disengaged.

11. Set engine switch in START position.

12. Adjust hand choke for weather condition. In very cold weather, pull it out most of the way, in warm weather pull it out only a little.

13. Engage crank handle at the "7 o'clock" position and pull it up sharply to the "12 o'clock" position. Two or three such cranks should start the engine.

NOTE:

Grasp crank handle firmly. Place thumb on same side of crank handle as fingers. Never crank by pushing down.

14. Turn engine switch to RUN position.

15. Oil pressure should be at least 20 pounds per square inch. If it is not, stop engine and check oil level.

16. As engine warms, push choke control in slowly until engine runs smoothly with choke all the way in.

17. Before starting or while engine warms, connect electrical system as follows:

    a. Recheck to be sure that load switch is OFF.

    b. Obtain four lengths of No. 6 insulated wire. Connect one of these to the load terminal system marked L and run it to the neutral of the distribution system.

    c. Connect the other three wires to phase terminals L_1, L_2, and L_3 in any order and run to the phase terminals of the distribution.

NOTE:

When two 10-kw. generators will be operated, be sure that there is NO POSSIBILITY of the two generators being connected in parallel in any way. Such a condition could destroy either or both of them.

    d. Remove the ground rod from its packing position and drive it into the ground near its respective generator. Use the wire provided and connect it to the ground clamp provided on the frame of the generator.

    e. Be sure all branch circuits in the distribution system are OFF.

    f. Close the load switch on the generator panel and adjust the voltage to 120 volts.

    g. Close the branch circuits of the distribution system one at a time to energize the hospital equipment or other loads in increments not exceeding 3 kw. Readjust the voltage to 120, if necessary.

POSTING OF WARNING SIGNS

Warning signs should be printed and placed with the generator or improvised at the time the PDH is put into operation. The types of signs and the areas where they should be placed are as follows:

DANGER—HIGH VOLTAGE

1. By generator.
2. Near electrical cabinets.
3. Near switch boxes that are "hot".
4. At any spliced cable.
5. At any junction box.

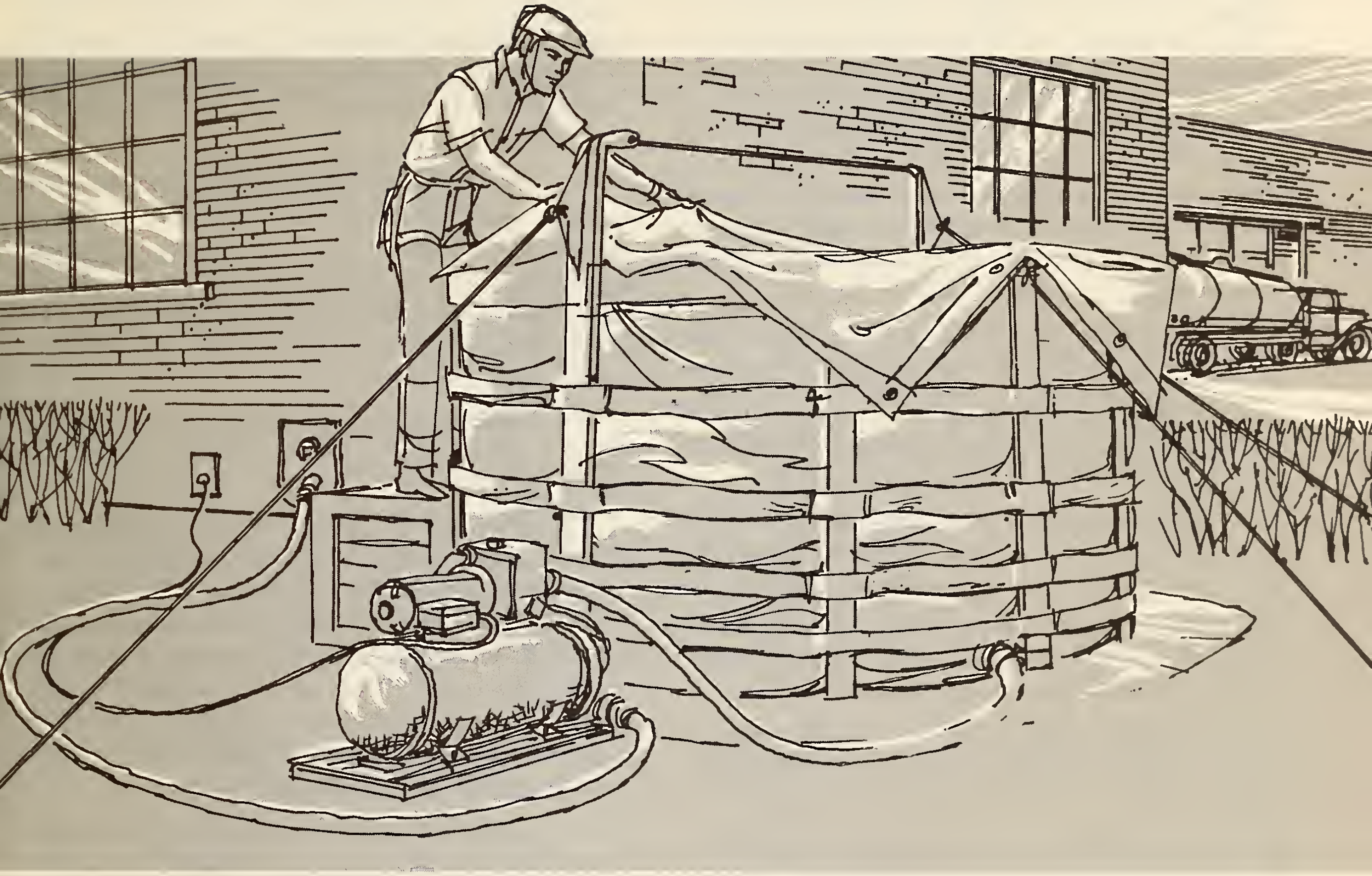
NO SMOKING

1. By generator.
2. Around fuel storage.

AUTHORIZED PERSONNEL ONLY

1. By generator.
2. By control panels.
3. Near switch boxes.

WATER SUPPLY MANAGEMENT



PDH WATER REQUIREMENTS

The normal functions of a well-equipped and fully staffed hospital are dependent in large measure on a bacteriologically safe and adequate quantity of water. Under conditions envisioned to exist when the use of the Packaged Disaster Hospital is warranted, efficient use of available potable water will be mandatory if the mission of the emergency facility is to be fulfilled. This text is directed specifically to those individuals who will actually operate the water supply section of the PDH. It discusses water conservation techniques, suggests guidelines for meeting the emergency water requirements of the PDH (both quantity and quality), and contains sufficient information to familiarize assigned operating personnel with their responsibilities and with actions required to activate the water supply section.

The rate of potable water usage required to support all continuing emergency medical services, for which the 200-bed Packaged Disaster Hospital was designed, is estimated to be 2,000 gallons per day (10 gallons per person per day),* set up as an independent medical facility.

Under an austere environment, holding the consumption to this rate will require strict enforcement of appropriate water conservation measures and advance planning. Operating all services of the hospital in an unrestricted manner could result in a water demand of as much as 30,000 gallons per day. Under optimum conditions, the water supply equipment included with the PDH can supply about 15,000 gallons per day if the water, supportive fuels, supplies, and manpower are available.

*If food preparation facilities, patient decontamination centers, or laundry areas are operated, additional water may be required.

Water Conservation Measures

The immediate objective of PDH water managers in a disaster is to make efficient use of all water available for the Packaged Disaster Hospital, thereby reducing auxiliary equipment and manpower requirements. The PDH functioning as a separate entity will encounter water supply problems peculiar to the building selected to house the facility. Invoking certain general water conservation measures will assist markedly in meeting the above objective. These precautions include:

1. Closing off any damaged or leaking water outlets.
2. Regulating flushing of water closets and urinals, or shutting off these units and using nonpotable water carried to the area as needed for manual flushing.
3. Prohibiting baths or showers by ambulatory patients and assuring compliance by closing waterline control valves.
4. Washing and rinsing surgical instruments in basins rather than under faucets.
5. Rationing water to functional sections of the hospital, such as receiving and sorting, central sterile supply, wards, and operating rooms.
6. Instructing kitchen and housekeeping personnel in methods of accomplishing respective responsibilities with a minimum of water.
7. Placing appropriate signs in strategic areas as reminders to use water only if absolutely necessary.

When PDH's are functioning as adjunct units of a regular hospital, more extensive restrictions on water use will be advisable. Some suggestions are:

1. Substituting paper products for linens and dishes where possible.
2. Using minimum washing formula to remove soil from linen and using rinse water as wash water for subsequent linen washing.
3. Collecting water condensation from refrigeration equipment or steam systems and reusing for clothes washing and heating purposes.
4. Discontinuing use of bedpan washers.
5. Using *pressure* sterilizers, whenever possible, in lieu of boiling.
6. Constructing latrines in appropriate locations for ambulant patients and staff.

Additional curtailment of indiscreet use of water will probably be possible in any particular situation. The severity of damage to the normal water supply source and distribution system will, of course, determine the degree of water conservation necessary at the time.

Sources of Water Supply

Water of questionable quality must not be considered for use in the Packaged Disaster Hospital, unless it is used for manual flushing of sanitary fixtures only and not introduced into the emergency distribution system. Predisaster planning for provision of a minimum of 2,000 gallons of water per day from remote sources may be the key preparation in the successful operation of the hospital.

The emergency water equipment in the PDH provides only facilities for holding and chlorinating water. Therefore, if the effects of a disaster are so severe that potable water is not available within a reasonable mutual-assistance distance from local PDH sites, the PDH should be moved to a site which has access to a suitable water source.

These considerations are discussed in Predisaster Preparations, page 293 .

Possible water supplies for use in the PDH will be limited by the severity of any particular disaster. Each source clearly suitable for use predisaster should be reviewed in the light of the prevailing circumstances following the initial disaster impact to be sure they are still usable and accessible. If several water sources of suitable quality are available after this analysis, the one which requires the least equipment and manpower to transport or treat the water from it should be used.

Depending on the situation, water from the following alternate sources may be available for use in the PDH:

1. The isolated, undamaged portion of the community water distribution system, provided treatment facilities are operating.
2. Community or individual wells within the city or in outlying areas if their sanitary protection remains intact. This determination should be made by a qualified health official, sanitary engineer, or sanitarian following the disaster.
3. Water from private treatment facilities of local industry, e.g. soft drink manufacturers. In addition to water supply, such plants generally have mixed-resin ion exchange filters capable of producing chemically safe water even from fallout contaminated water.
4. Watering points on nearby or distant municipal or private water systems.
5. Interconnections, either permanent or temporary,

with adjacent municipal or private water transmission or distribution systems.

6. Treated water from storage reservoirs, standpipes, or elevated tanks.

In the event water sources are suspected of containing nuclear contaminants, frequent checks should be made with the local waterworks superintendent or civil defense radiological monitoring teams to assure safe water for the PDH. Stored water and sub-surface water supplies will generally be free of such contamination.

PREDISASTER PREPARATIONS

Arrangements to Assure Adequate Water Supply

The lack of suitable water could prevent the operation of a PDH. Essential predisaster preparations to insure availability of adequate water include:

1. Assigning responsibility for investigating all possible sources of potable water (local and distant) for use in the PDH. Personnel assigned should include the parent hospital maintenance supervisor, and if possible, a local sanitary engineer or sanitarian.
2. Assigning responsibility for surveying all ways and means of delivering water to the PDH. This includes:
   a. Identifying and designating tank trucks, tank cars or other mobile containers that could be used for this purpose along with appropriate cleaning equipment.
   b. Establishing alternate or supplemental sources of other water supply equipment such as aluminum irrigation pipe, plastic pipe, pumps, hose, etc. These may be available for loan from local water, fire and rescue departments; from local prorietors' stocks (especially rental equipment establishments), and from farms or farm equipment supply houses.

Planning For Use of Water Supply Equipment

During a major disaster, the normal supply of water to the building selected for a PDH is likely to be disrupted and may not be restored for some time. For this reason, each PDH contains a water storage tank and a pumping unit with pressure tank which have sufficient capacities to meet minimal demands of the disaster hospital. If this emergency equipment is to be installed promptly without confusion, certain predisaster preparations are essential.

These preparations include:

1. Assigning responsibility for setting up and operating the water supply equipment in disaster. These duties could be handled by persons with moderate mechanical experience, such as the maintenance staff of the parent hospital or custodial personnel in the building where the PDH is to be set up when it is not an integral part of the parent hospital.
2. Familiarizing assignees with the equipment and techniques of assembly. Local climatic conditions and physical characteristics of possible PDH sites may require modifications to the assembly procedures outlined in this section. (The standard hookup assumes that water is delivered to the tank by auxiliary equipment and that water requirements are confined to the ground floor.) Training sessions should be led by the parent hospital maintenance supervisor who will probably be named chief building engineer of the PDH. He may request the assistance of a local sanitary engineer, sanitarian, waterworks operator, swimming pool operator, or other technically qualified person.
3. Instructing assigned PDH staff in water disinfection procedures and conservation measures. Extreme care is required in all phases of procurement, transmission, treatment and delivery of water for a PDH. Thorough sanitary precautions are necessary in order to insure that disease is not transmitted through the water supply. When feasible, this phase of planning and practice training sessions should be supervised by sanitary engineers or other appropriately trained health personnel.
4. Developing plans in cooperation with technical persons for any necessary alternate uses of equipment, considering the type of available water sources and climate in the region. Such uses will require supplies in addition to those in the PDH and procurement would be an integral part of predisaster planning.
5. Discussing the water supply management plans for the PDH with the local civil defense agency and local water supply officials and determining their ability to assist in providing water, or purification and transportation equipment in case private sources are insufficient or unavailable.
6. Developing a plan for laying out emergency plastic water lines in the building selected for possible operation of the PDH.

7. Instituting, through the hospital administrator, formal arrangements with owners of water sources and equipment suitable for use in conjunction with supplying water to the PDH site.
8. Developing written procedures for invoking conservation measures outlined on page 292.

WATER SUPPLY EQUIPMENT

Tank

The 1,500-gallon capacity tank, is rubber-coated nylon, and comes with ground cloth, tank cover, stave cap extensions, support tubes, stakes, guy and tie ropes, and fabric repair kit.

Pumping Unit

The unit is electrically operated, rated at 10 gallons per minute against 100 feet total head. Accessory items packaged with pumping units vary. Included are such items as: nipples, reducers, bushings, and rubberized hose lengths for the suction hose assembly; hose lengths, nipples, bushings, and extension pieces for the discharge hose assembly; and tool boxes containing pipe fittings, washers, fuses, and tools.

Some disasters may disrupt the water piping of the PDH building as well as water mains, necessitating the use of temporary lines. Garden hose, nozzles, Y-connectors, and Lyster bags may be used in this eventuality. An adapter will permit direct connection of the garden hose to the pumping unit in lieu of a discharge hose connection.

Check the component listing packed with your PDH to determine what supplies are included, and, consequently, what must be obtained locally.

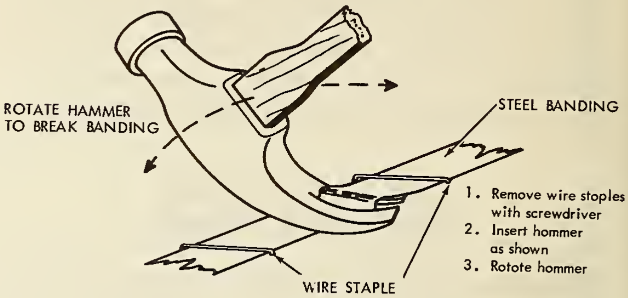
ASSEMBLY INSTRUCTIONS

Water Storage Tank

Three different manufacturers have fabricated water storage tanks for use in the PDH's: the U. S. Rubber Co., Providence, Rhode Island; St. Clair Rubber Co., Detroit, Michigan; and The Firestone Tire & Rubber Co., Akron, Ohio.

Since each type of tank varies in style of components, minor differences in assembly technique will be necessary. These differences are noted throughout the instructions and assembly procedures discussed here.

Four men can uncrate and assemble the water tank in 30 minutes using the proper tools. The crated tank weighs about 450 pounds. It can be handled easiest with a dolly or forklift. A small wrecking bar and claw hammer are the only tools absolutely necessary to open the crate. Tin snips, if available, can be used for band-breaking instead of the technique illustrated. Crate corners can be partially loosened with a large screw-driver so the wrecking bar will not damage the crate.



CLAW HAMMER USED TO BREAK BANDING

Assembly

The individual characteristics of the PDH sites, and prevailing climatic conditions at the time of the disaster, will affect the location and assembly of the PDH water supply equipment. Therefore, some of the following procedures may have to be modified.

Read Entire Instructions Before Starting Assembly

a. Select the most level area possible within 45 feet of the wall hydrant or *proposed connection to* the water service line of the PDH building. This site should not be more than 15 feet lower than the pumping unit site.
b. Remove from the selected area any sharp or pointed objects that might pierce the tank bottom or ground cloth.
c. Open tank crate near site. Remove components from storage container and spread the 9-foot 3-inch circular ground cloth on the surface where the tank will set. (Cloth should be free of wrinkles.)
d. Avoid walking or dropping heavy objects on fabric. *Do not drag tank over ground or pavement.* Place the folded tank near the center of the ground cloth and unfold flat, so as many stave pockets as possible are exposed. Center tank on ground cloth with tank fittings toward building. Do not raise tank sides yet. See figure 60 .
e. Starting with any bottom stave pocket on the side of the tank, insert each wood stave through the five stave pockets provided for each stave. Rearrangement of tank sides will be required to permit all staves to be easily inserted. See

figure 61. Tanks manufactured by U. S. Rubber Co. have five staves with eye rings and five without. Alternate these staves around tank with *eye rings facing outward and toward tank top* to permit even support of tank walls. Drive a stake about 5 feet from the tank base opposite each of the wood staves having an eye ring. Raise tank walls and tie the longest ropes provided to the eyes of the wooden staves, draw snug, and secure them to the stakes.

f. Attach the stave caps as follows:

For tanks manufactured by St. Clair Rubber Company and Firestone Rubber Company:

- Select one of the long aluminum caps. Hold with the upper eyelet toward the inside of the tank and slip down over the top of one of the stave and pocket assemblies at the top of the tank wall. Progressing around the top of the tank, skip one stave and then attach a short stave cap with the horizontal eyelet facing the inside. Continue around the top edge of tank, skipping two staves and on the third stave attach the other long stave cap. Then skip another stave and attach the last or short stave cap. See figure 62.
- Extend each of the telescoping aluminum support tubes to length approximately equal to diameter of the tank. Tighten eyebolts. Ready the assembly pins and cotter pins. See figure 63.
- Raise the four staves now having caps and extend the aluminum support tubes across the tank and mate with the caps using straight pins and cotter pins. Be sure eyebolt of top support tube does not protrude above tube when mated to caps. Expand cotter pins. See figure 64.
- Drive one of the four wooden tent pins included approximately 5 feet from the base of the tank opposite each cap assembly. Tie each of the 10-foot guy ropes to the eyes of the cap assemblies, draw snug, and secure to the tent pins. See figures 65 and 66.

For tanks manufactured by U. S. Rubber Company:

- Select the aluminum telescoping tube assembly with the smallest stave caps; extend it to the approximate diameter of tank; tighten eyebolts; straddle tank with assembly and position one cap over any stave and the other cap over the stave diametrically opposite (i.e. progress around the top of tank in either direction skipping four staves and placing the cap on the fifth stave).
- Extend the remaining telescoping assembly to length approximately equal to diameter of tank; straddle tank with assembly and position one cap over any stave *not* immediately next to one with a cap and the other cap over the stave diametrically opposite.

g. Unfold the 10½-foot square top cover, and place over tank. Tie shortest ropes provided to corner grommets and secure them to the same stakes used for tying the guy lines.

h. Disinfect tank according to directions on page 302.

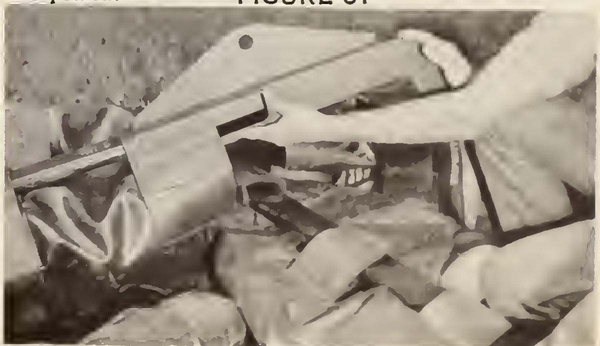
i. The tank is now ready for filling and use.

Water- tank unfolded flat on ground cloth with stave pockets exposed, refer to the assembly directions.

FIGURE 60

Starting with the bottom stave pocket, stave is inserted through its five pockets.

FIGURE 61



A long aluminum cap is slipped over the top of a stave and pocket assembly, per instructions.

FIGURE 62

Tank with staves and caps attached and aluminum supports extended to diameter of tank.

FIGURE 63

Tank is raised and supports matched with stave caps, using straight and cotter pins.

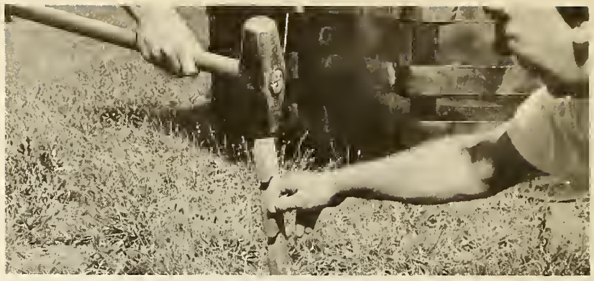
FIGURE 64

Four wooden tent pins are driven into ground to secure guy ropes attached to stave caps.

FIGURE 65

Guy ropes are secured to lower notch in tent pins, leaving upper notch for ropes attached to cover.

FIGURE 66



Assembled tank shown with cover secured. After the tank has been disinfected, as directed on Page 302 it is ready to fill.

FIGURE 67

Repairs to Fabric

Tank need not be dismantled unless it is punctured or torn on the bottom.

- Each water storage tank is supplied with a fabric repair kit consisting of patching fabric, accelerator and cement compound in cans, sandpaper, cheesecloth, brush, and roller. The procedure outlined in the following steps will assure a good watertight patch.

NOTE:
Personnel entering tank to make repairs should not wear street shoes.

(1) If tank is punctured, drain, mark location of leak with chalk on the inside of tank, and allow patching area to dry thoroughly.

(2) Cut a patch from the repair fabric 3 inches larger all around than the tank break to be repaired. Round all corners. (Shears not provided in repair kit. Ten-inch trimming shears recommended.)

(3) With sandpaper, roughen an area around the break on the inside of the tank almost an inch larger than the patch to be used. Also buff glossy side of patch. Wipe patch and fabric clean with dry cloth.

(4) Prepare cement for application by stirring contents of one cement container and one accelerator container before blending together thoroughly.

(5) Brush one heavy coat of mixed cement on roughened areas of tank patch. Allow

to dry 30 minutes. (Cover mixed cement container tightly during drying period to prevent hardening of entire contents.)

(6) Brush second coat of mixed cement over same areas. Allow to dry until tacky. (Test with knuckle after about 15 minutes.)

(7) Position patch over tear and press firmly to tank. Use board backing for support and use roller or equivalent to eliminate air bubbles. Roll from center of patch toward edge.

When a break occurs at an attachment or seam in the tank, butt patch to seam or attachment—do not overlap. Damage in such areas require two-layer patches. Butt the first patch to the seam or attachment. Put on another patch, overlapping the first and straddling the seam or attachment. Patch inside and outside of tank if fabric has a jagged tear.

(8) Brush coat of cement around edge of patch to seal edges and allow to dry thoroughly. Special sealer gum material is provided with Firestone Rubber Co. tank, but its use is optional.

(9) Discard unused mixed cement. Clean brush (for reuse) with unleaded low-test gasoline (not provided). Save empty dry cement containers for mixing cement for subsequent patching.

(10) Disinfect tank interior as directed on page 302. The tank is now ready for use.

Dismantling Tank

a. Drain the tank and attach dust caps to drain assemblies.

b. Remove the top cover and the tank guy ropes.

c. Dismantle the aluminum support tubes from the stave caps and remove stave caps. Put the aluminum pins with cotter pins in the stave cap eyelets.

d. Remove the 10 wooden staves.

e. Turn the tank completely over to drain any remaining water and then turn back. Be sure tank, cover, and ground cloth are completely dry before folding and repacking.

f. Folding the tank:

(1) First fold—With the tank in a collapsed position and the up-right walls folded in, take opposite sides of the tank and fold both to the center.

(2) Second fold—Fold the rounded ends in, at right angles to first fold, one fold overlapping the other.

(3) Third fold—Fold the sides, in the same manner as noted for the second fold, but at right angles to the second fold.

g. Folding top cover: (See Figure 69, page 298 .)

(1) First fold—Fold in half.

(2) Second fold—Fold in half again, same direction as first fold.

(3) Third fold—Fold $\frac{1}{3}$ over, at right angles to second fold.

(4) Fourth fold—Fold opposite end over top of third fold.

(5) Fifth fold—Fold in half, bringing fourth fold line over third fold line.

h. Place the folded tank cover in the center of the ground cloth and on top of this, the folded tank.

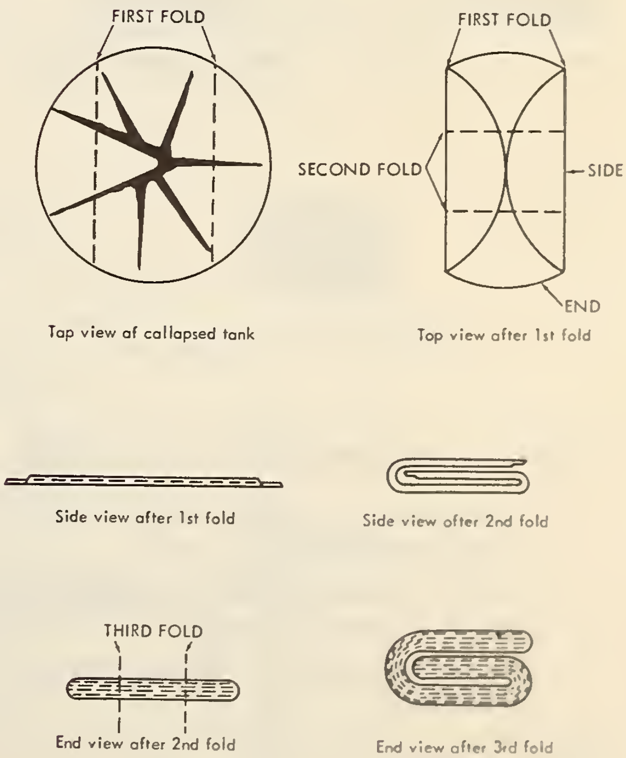


FIGURE 68·FOLDING THE TANK.

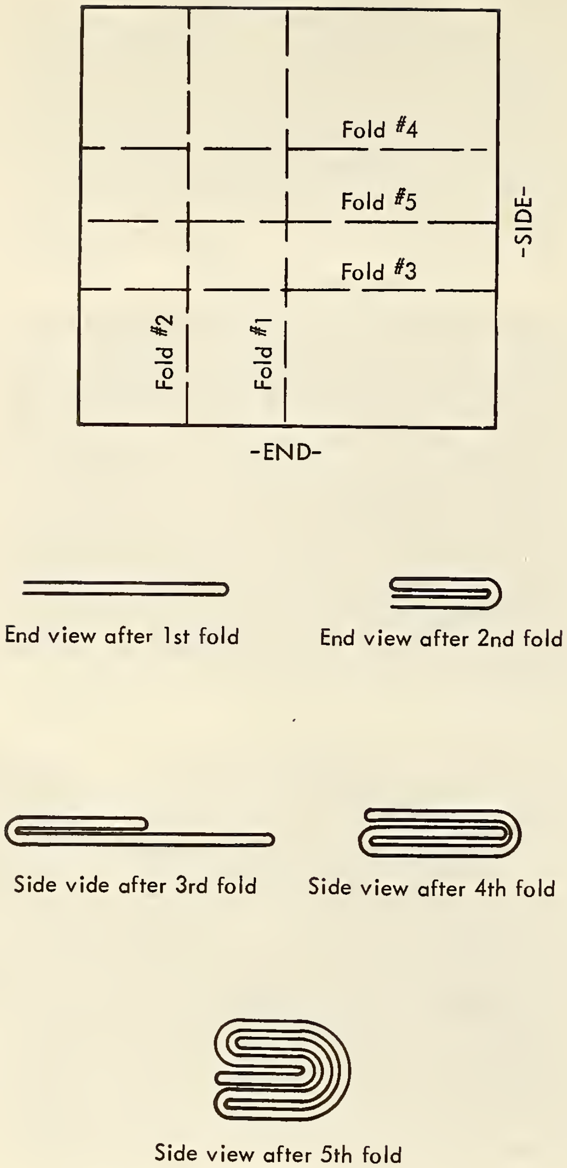


FIGURE 69—FOLDING THE TANK COVER.

i. Fold two sides of the ground cloth over the ends of the folded tank and top cover.

j. Fold the other two sides of the ground cloth over top of folded tank and top cover.

k. Tie package together with two guy ropes (10-foot lengths).

Preparing for Storage

a. After all parts are dry, tie staves together using two of the shortest tie-down ropes.

b. Place bundle of staves at one side of the storage box.

c. Put stave caps, tent pins, ropes, and repair kit items in container provided.

d. Place accessory container at one end of the storage box.

e. Put package of tank, top cover, and ground cloth in the storage box.

f. Lay support tubes (with the eye bolts in place) on top of the tank package.

g. Fasten the lid of the box securely.

Pumping Unit

Two manufacturers have supplied pumping units for the PDH's. They are the New York Air Brake Company, Aurora Pump Division, Aurora, Illinois, and Fairbanks, Morse & Company, Kansas City, Kansas.

After being trained, two men can uncrate the pumping unit and make connections in 15 minutes. The crated pumping unit weighs approximately 250-280 pounds, depending on model and packing method. A dolly would be useful in moving the crate but is not absolutely necessary. It may be necessary to obtain uncrating tools, including pliers, large screwdriver (12 inch), claw hammer, and adjustable end wrench locally. They are not packed with all models of the PDH.

Connection Procedure

a. Select pumping unit site slightly uphill from water storage tank outlet, if possible.

b. Remove top and sides of wood crate from the bottom wood frame, leaving the pumping unit bolted to the bottom. This provides a stable base for the pump to rest on.

CAUTION:
Do not lift Pumping Unit with top-mounted tank by the Pressure Tank. A handle is provided for lifting.

c. Position pump so suction side faces outlet of the water storage tank and remove packing materials, if any, from all inlets and outlets.

d. Insert washers in the female swivel assemblies of both the suction and discharge hoses.

e. Join the two 20-foot lengths of 1¼-inch suction hose using appropriate wrench provided.

Series A Pumping Unit:

(Refer to fitting assembly diagram and schematic, Figures 70 and 71).

(a) Insert washer into the 1¼-inch female socket of the 2-inch hose bushing; attach the bushing to the male threaded end of the 1¼-inch hose and tighten; connect hose (with fittings attached) to the female swivel coupler at the storage tank.

(b) Apply pipe thread compound to threads of pump suction inlet, and to *pipe threads* of 1¼-inch hose nipple; screw nipple into pump and tighten; connect female swivel coupler of hose to nipple and tighten.

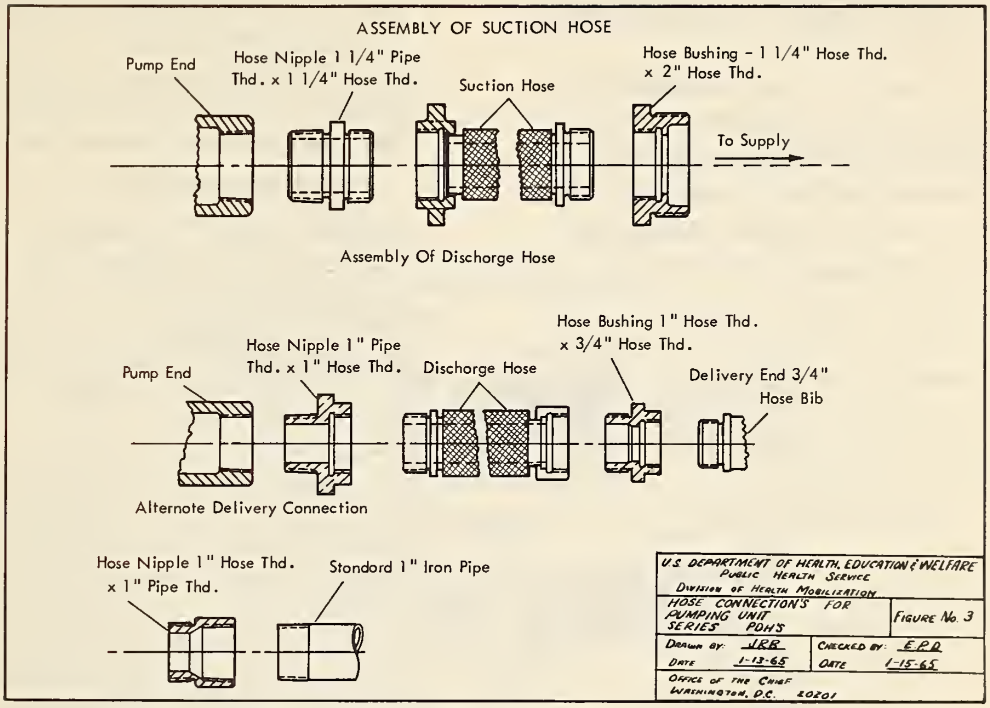


FIGURE 70-ASSEMBLY OF SUCTION HOSE

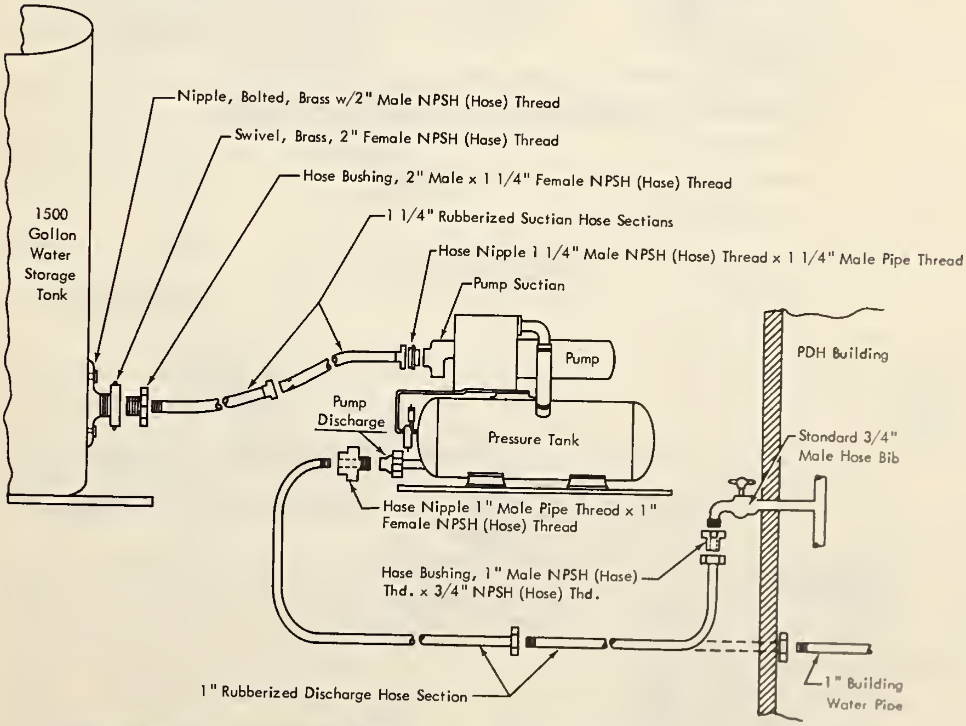


FIGURE 71 –WATER PUMPING UNIT HOOK-UP (SERIES A).

NOTE:
Pipe thread compounds should be used for fitting which threads into pump only. Washer seals for all hose threads at other joints make use of thread compound unnecessary.

Series B Pumping Unit:

(Refer to fitting assembly diagram and schematic, Figures 72 and 73 .

(a) *All fitting and hose connections of these models require the use of pipe thread compound during assembly.*

(b) Assemble the 2-inch close nipple and the 2-inch by 1¼-inch reducing coupling; join to male threaded end of the 1¼-inch hose and tighten fittings; connect hose (with fittings attached) to the female swivel coupler of the storage tank.

(c) Turn 1¼-inch close nipple into suction side of pump; connect female swivel coupler of hose to it and tighten connection.

f. Join the two 20-foot lengths of 1-inch discharge hose using appropriate wrench provided.

Series A Pumping Unit:

(Refer to Figure 71, page 299.)

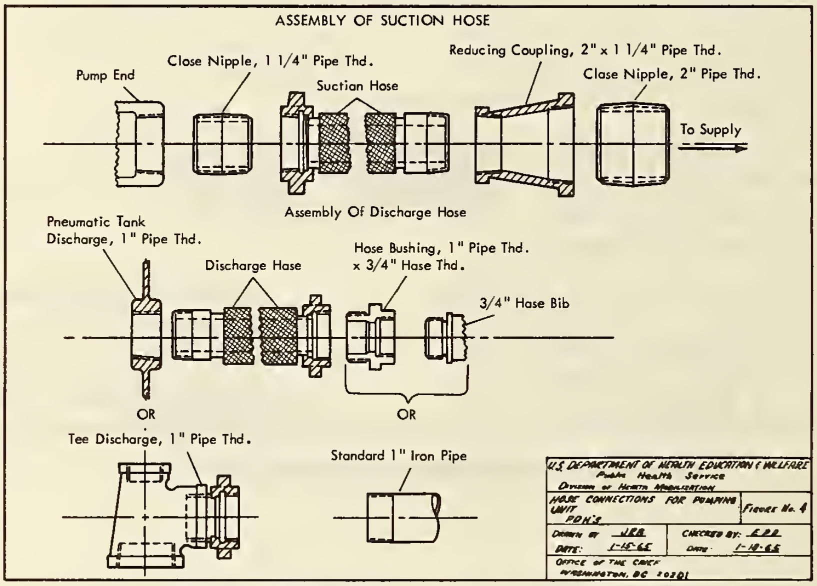


FIGURE 72–ASSEMBLY OF SUCTION HOSE

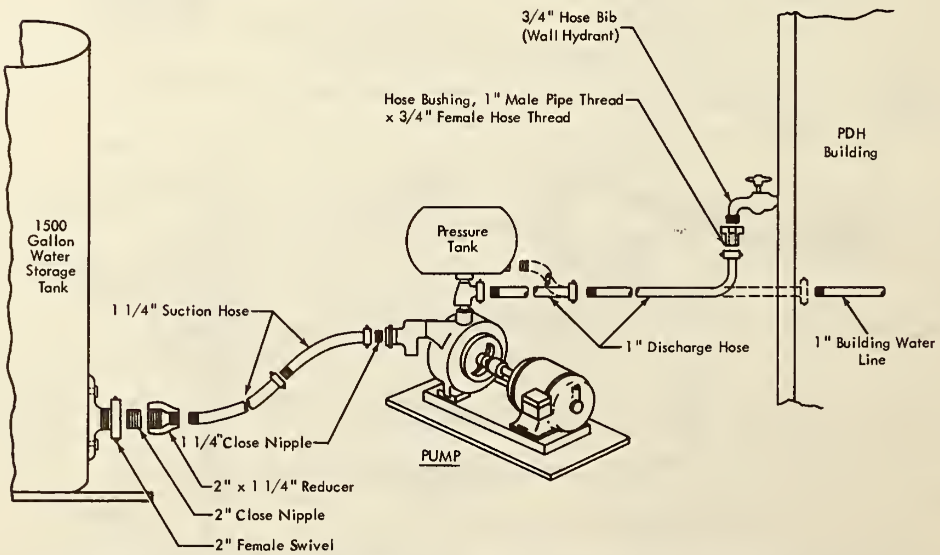


FIGURE 73 –WATER PUMPING UNIT HOOK-UP (SERIES B).

(a) Insert washer into female socket of the 1-inch brass hose nipple (1-inch male pipe thread x 1-inch female hose thread); attach the nipple to the male threaded end of the 1-inch hose and tighten; apply pipe thread compound to female threads of pump discharge assembly and the pipe thread of the 1-inch hose nipple; connect hose (with fitting attached) to female swivel coupler on the pump discharge.

NOTE:

The swivel on the discharge outlet is locked in place for shipping purposes. Before making connections, it will be necessary to release the swivel collar and its machined surfaces in order to allow free rotation. After making hose connection, retighten swivel as required to prevent leakage.

(b) Use whichever of the other two fittings provided with the discharge hose assembly is required to connect the discharge hose to the building piping. If the 1-inch hose nipple (1-inch female pipe thread x 1-inch male hose thread) is required, apply thread compound to both male and female *pipe threads* before screwing it into place. If hose bushing is required, insert washer into female socket before screwing it onto hose bib.

(c) Disinfect the pumping unit according to directions on page 302, and then connect the discharge hose to building piping.

Series B Pumping Units:

(Refer to Figure 73, page 300 .)

(a) Select proper fitting to adapt 1-inch hose to building and attach to building pipe or hose bib accordingly using thread compound on *pipe* threads before screwing fitting into place.

(b) Connect discharge hose to pneumatic tank or tee discharge of pump. Use thread compound and disinfect pumping unit according to directions on page . Following disinfection, make the water delivery connection to the PDH building.

Operation

The pump is intended to supply water under pressure to a building piping system or to temporary waterlines run to essential areas of the PDH. The unit does have other applications, but they require competent technical supervision and additional supplies. The details of pump operation given here describe only the primary use of the pump and accessories.

A. Priming the Pump

- One of three methods of pump priming must be utilized depending on the model of pump at hand.

1. **Aurora Pump with check valve and gate valve between pump and pneumatic tank:**
   - Remove plug or cover plate from pump priming device and pour potable water into opening until water stands at the level of the pump intake opening.
   - Wait a few minutes for any entrapped air to bubble out. Replace plug or cover plate and tighten.
   - Add disinfecting solution to water storage tank (page 302). After disinfecting, maintain chlorinated water level in storage tank sufficient to prevent pump from running dry.
2. **Aurora Pump with tee discharge between pump and pneumatic tank:**
   - Remove ¼-inch plug from pressure tank and pour about 1 gallon of potable water into tank.
   - Replace plug and follow disinfecting procedures.
3. **Fairbanks, Morse Pump:**
   - Remove priming plug from atop pump and fill pump with potable water.
   - Replace plug after several minutes lapse to allow entrapped air to escape.
   - Follow disinfecting procedures.

B. Starting the Pump

Plug electric cord into a 115-120-volt fused circuit receptacle of electric power distribution system or generator. Turn hand-operated switch on side of pressure switch to ON to start pump. If pressure does not begin to build up in pressure tank or water does not discharge from pump within 5 minutes, turn disconnect switch to OFF and reprime as above. (If fuse blows, check voltage being supplied to pump motor and make appropriate adjustments or determine other causes before replacing fuse.)

C. Characteristics of Normal Operation

The pump will stop when the pressure tank pressure reaches 40 psi and will restart when the pressure falls to 20 psi. No pressure adjustments will normally be required but in the event they are desirable, RANGE and DIFFERENTIAL adjustment screws are provided in the pressure switch housing. Remove cover on pressure switch housing and turn screws in appropriate direction.

Lubrication of the Fairbanks, Morse pumping unit is not required except for a few drops in sleeve bearing oiler before starting initial pump operation. Earlier model pumps have grease cups to which ball bearing grease has been added at the factory. Before starting initial pump operation, screw caps down several turns; repeat this every 6 months of operation thereafter. Replenish with grease when caps no longer turn.

Operation of the pumping unit is most efficient when hose connections and fitting joints are tight so that leaks are prevented. Dry joints also show that water is not being lost.

DISINFECTION PROCEDURES

Water Storage Tank and Pumping Unit

Before being placed in service, the entire emergency water supply section of the PDH must be disinfected to remove any contamination that might have been introduced during assembly. The procedure is as follows:

1. After assembling the tank and pumping unit components, but before connecting them to the building water supply system, pour into the storage tank a *slurry* made of 2 tablespoons and 1 teaspoon (7 teaspoons) of 70 percent calcium hypochlorite (such as *Perchloron* or *HTH*), and 1 gallon of water. Add enough water from the potable supply to cover the tank floor with about 4 inches of water. This will result in a solution containing a chlorine concentration of about 50 ppm. If *Perchloron* or *HTH* is not available, 2 cups of ordinary household bleach (5.25 percent sodium hypochlorite) may be used in place of the *slurry*. Add one-half pint of vinegar, if available, to the solution in the tank.
2. Start the water pump and discharge the solution back into the storage tank. (See page 301 for pumping unit operation.) Allow the solution to recirculate for 20 minutes.
3. While recirculating the solution, scrub thoroughly on all interior surfaces of the storage tank (including the underside of the tank cover) with a clean broom or a longhandled window brush. Following the scrubbing, direct the discharge from the water pump onto all interior surfaces of the tank and cover for the final 5 minutes of the recirculation phase.
4. If the liquid discharging from the pump carries a very strong odor of chlorine following the recirculation phase, the tank may be emptied and the entire unit flushed. The tank would be emptied by discharging to waste or to storage barrels for manual flushing of sanitary fixtures. If a strong odor of chlorine is not present, a new *slurry* or its equivalent must be added to the tank and the entire procedure repeated.

Piping System

Before pumping into a building piping system, the main water supply valve from the outside service line into the building must be shut off, so that the emergency water supply is not pumped back into the public water mains and lost.

If it is suspected that the building piping system has been contaminated, or if the system is not under pressure, it should be disinfected before using. This can be done as follows:

1. Instead of discharging the chlorine solution in the storage tank to waste, connect the discharge hose of the pumping unit to the building piping system. Open all outlets on the water line and pump the solution through until the water discharging from the faucets carries a strong odor of chlorine. If the PDH building piping system is extensive, additional batches of chlorine solution will be required. Close the faucets and allow the solution to remain in the line under pressure for 20 minutes. Now open the faucets. If a strong odor of chlorine is still present, the remaining solution in the storage tank, if any, can be discharged to waste, either through the building pipeline system or to the ground surface through the pumping unit discharge hose after disconnecting it from the building piping system. If a strong chlorine odor is not present upon opening the faucets, this procedure must be repeated.
2. After emptying the solution from the tank, the entire unit (storage tank, pumping unit, connecting hoses, and building piping, if disinfected) must be

thoroughly flushed, using the potable water supply. Flushing should continue until the water discharging from the pumping unit, or building faucets, carries only a very slight chlorine odor, or until the desired chlorine residual is reached.

3. The water supply section of the PDH is now ready to place in service. Connect pump discharge hose to the wall hydrant or supply line if not already done, add chlorine solution to the tank, and fill the storage tank from the potable water supply. Then secure the tank cover.

Chlorination of Tank Water Supply

Assuming existing water mains to the PDH building are damaged by the disaster, transportation equipment will be required to deliver water from any of the alternate water sources, suggested on page 292 to the site of the PDH. All water transported by vehicle will first be received in the PDH water storage tank provided for bactericidal treatment.

Each time the 1,500-gallon water tank is filled with water for use in the PDH, chlorine in one form or another is to be added as a safety precaution, regardless of the source of the water. To chlorinate the water:

1. Mix 2 teaspoons of 70 percent calcium hypochlorite powder (or two tablets of 70 percent hypochlorite or ½ cup of 5.25 percent liquid household bleach) in about 1 gallon of water. The gallon of chlorine solution should be poured into the tank prior to filling so that it will be thoroughly mixed with the 1,500 gallons of water by the time the filling process is completed. This procedure provides approximately 1 ppm (part per million by weight)of chlorine. If the chlorine solution is not added prior to filling the tank, a clean paddle (not provided) should be used to thoroughly mix the solution into the water.
2. Allow water to stand for 5 minutes. Take a sample of water from the tank and measure the chlorine residual, using the chlorine comparator in the kit provided. If the chlorine residual is greater than 0.5 ppm, the dosage of chlorine is satisfactory.
3. If the chlorine residual is less than 0.5 ppm add to the tank another gallon of water containing 2 teaspoons of hypochlorite (or 2 tablets of hypochlorite or ½ cup of liquid bleach), stir well, let stand for 5 minutes, and again measure the chlorine residual with the chlorine comparator. Repeat this procedure until the chlorine residual is greater than 0.5 ppm.

Unless the water being furnished to the PDH can be pumped directly to the building through disinfected emergency lines, the PDH water storage tank should not be bypassed. Approval of bypass action should be obtained from the health officials in charge before making such hookups.

USE OF CHLORINE RESIDUAL COMPARATORS

General Precautions

1. Before sampling, be sure that all equipment and glassware is clean.
2. Be sure to keep samples out of the sunlight during the 5 or 10 minutes in which maximum color is developing for the test. Sunlight fades the color quickly.
3. Read the instructions for chlorination and chlorine residual test carefully and be sure you understand them before attempting to test and evaluate the water supply.

Chlorine Comparator Kit

Included in some PDH models is a chlorine Comparator Kit packed in a hardwood case 5½ inches long, 4⅝ inches wide and 4 inches high. The kit has the following components:

1. A black plastic comparator with four permanent glass color standards, showing 0.1, 0.3, 0.5, and 1.0 part per million of residual chlorine as determined by the orthotolidine indicator. Color standards are located on the front of the comparator near the sides. Two center openings of daylight glass are provided for viewing samples. An opal glass is mounted on the back of the comparator to diffuse light through the samples.
2. Five 13-millimeter square glass tubes of clear colorless glass with ground water or etched line at 10 milliliter point.
3. One hundred and fifty orthotolidine dihydrochloride tablets, 0.6 mg. (0.01 gr.) in glass bottle and one plastic stirring rod.
4. Complete instructions for use in testing for chlorine are posted securely on the inner surface of the cover of the case. These instructions are as follows:
   a. Clean three sample tubes and fill two of the cleaned tubes to the etched mark with water to be tested; place these tubes in the two outer compartments of the comparators.

b. To the third tube, add a few drops of the water to be tested and one orthotolidine tablet. Crush the tablet with the stirring rod, then fill the sample tube to the etched mark with water to be tested and mix thoroughly by placing clean dry portion of the hand over top of tube and inverting a few times. Place this tube in the center compartment of the comparator. *Set comparator out of the sunlight* and allow 5 to 10 minutes for maximum color to develop. Compare developed color in center tube with glass color standards and then estimate chlorine content of water to nearest 0.1 ppm.

Chlorine Comparator and pH Test Kit

Certain models of the PDH contain a Chlorine Comparator and pH test kit. Included in this kit are the following parts:

1. Test tube, with stopper.
2. Vial of 40 orthotolidine tablets.
3. Six color chips with chlorine readings of 0.3, 0.7, 1.0, 3.0, 5.0, and 10.0 ppm chlorine.
4. Plastic bottle of wide range pH solution.
5. Five pH standard chips with readings 5.0, 6.0, 6.8, 7.4, and 8.0.
6. Instruction card.
7. Plastic box.
8. Two hundred and sixty orthotolidine tablets and sufficient pH solution packaged in separate container, but packed in the same box, to provide for a total of 300 tests.

Instructions for using this kit for chlorine residual tests are as follows:

1. Crush one orthotolidine tablet in a square of clean paper and pour into clean test tube. Add a few drops to the water to be tested and let stand until the grains of the crushed tablet are broken down. This may take several minutes depending on age of the orthotolidine tablets. (The older the tablet, the longer the time required.)
2. Fill the test tube to the 10 ml. marks with water to be tested. Place the cork in the tube and invert several times to mix the contents. Place the test tube out of the sunlight and allow color to develop for 5 to 10 minutes.
3. Compare color formed with the color chips. If color is a shade between two chips, estimate chlorine residual to nearest tenth or to nearest ppm.

The general procedures for making pH determination is the same as for chlorine residual determinations except that a pH reagent must be used instead of the orthotolidine tablets. The color change is practically instantaneous and may be read at once.

The reagents used in marking pH determinations are susceptible to change through bacterial action if the solution becomes contaminated. Care must be taken, therefore, not to contaminate the supply of indicator solution by getting the dropper into the sample of water being tested.

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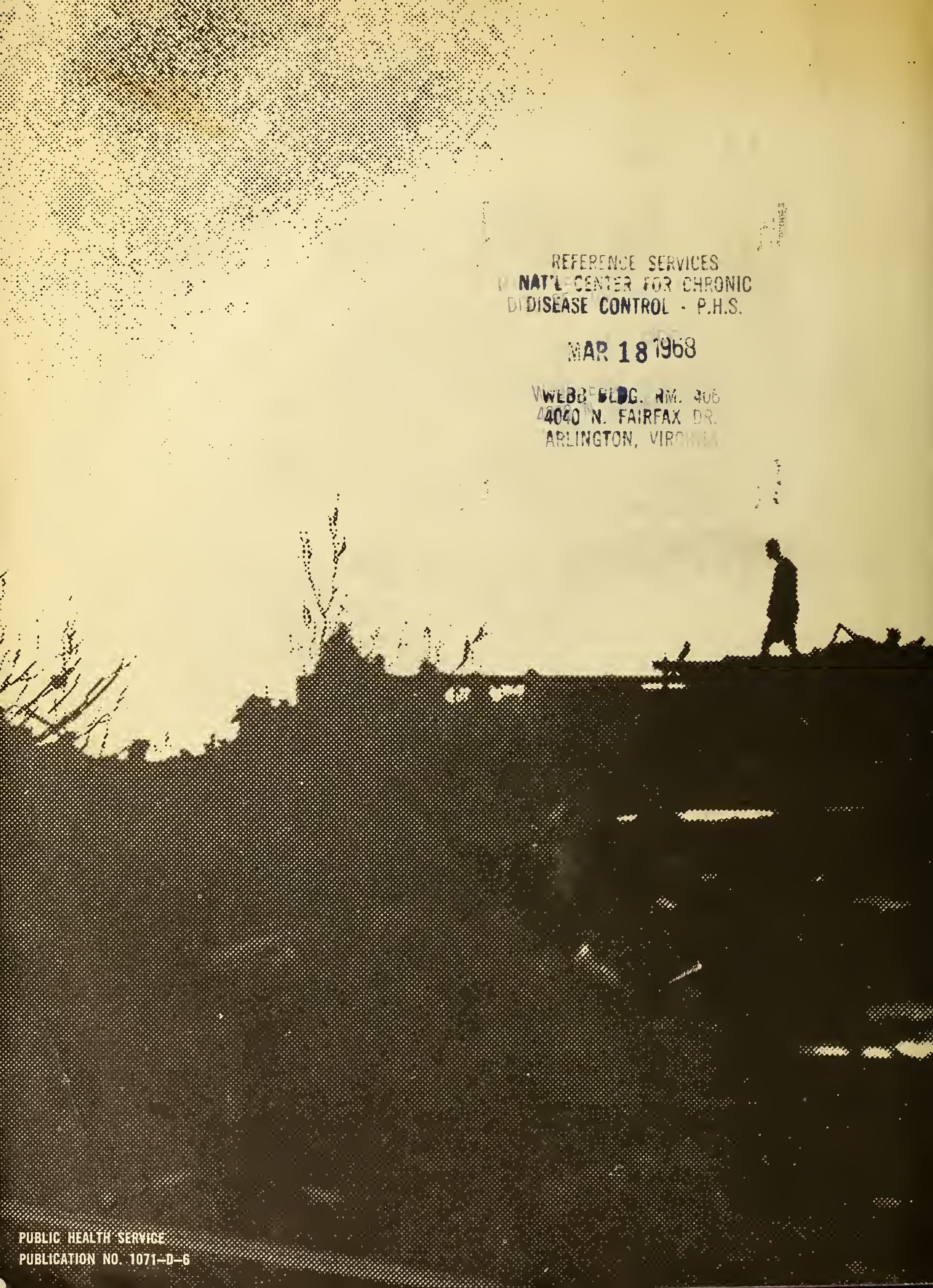

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