The Delivery of Modern Dentistry
To Developing Regions of the World

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Equipment and expendable supplies developed for use in dentistry have made great advances in the last decade. Efficiency and time-in-motion studies have elevated the practice of dentistry to a science few ever dreamed possible.

However, there are many regions of the world where dentistry is non-existent. The people in these areas are familiar with modern dental care through European and American news media that pass from city to town to village.

In the past, dentistry in unserved regions of the world has been limited to extractions by missionaries, government paramedical personnel and witch doctors. Now, many dentists from the industrialized world, primarily Europe and the United States, are traveling to these unserved regions and helping to bring modern dentistry there.

Limitations of dental equipment restrict proper dental care. Not only are the mobile medical coaches expensive (approximately $25,000.00 plus), but there are often impractical in the developing world where modern road systems do not exist. The populations in many areas of the Third World are sparsely distributed which in part discourages building of road systems; most people travel via footpaths. The road systems within these unserved regions make mechanized travel difficult, sometimes impossible. The dental equipment is permanently attached to the vehicle-clinic. Therefore, if the coach fails mechanically in route, dental care ceases. Supply of electricity and piped water is often unavailable in the area to be served. Transportation is very expensive. Thus, a special type of dental equipment is necessary if complete up-to-date dental care is to be administered.

Dental Health International (DHI) is a non-profit foundation dedicated to bringing dentistry to the unserved regions of the world. DHI, with headquarters in Athens, Ga., is funded by the Agency for International Development (USAID), a branch of the U.S. Department of State.

One of DHI's primary objectives was to develop the most reliable portable dental unit possible with existing technology and equipment. The total unit was to be completely self contained, and was to be modular in design to facilitate carrying by pack animal, vehicle, aircraft or by hand (Figure 1) to the most remote corners of the world. The portable unit can also be used as a means of off-site training. This is a significant capability since the Health Manpower Act of 1976 supported "six weeks of off-site training as an alternative to enrollment increases as a condition of capitation" in dental schools. (JADA, October 1976)

A precept of good design equates reliability with simplicity. DHI's most recently developed portable clinic, the DENHI-3A, is one of the simplest, most reliable dental systems available today, complete with a small electric generator, gasoline or electrical air compressor, air dryer, 3-handpiece control unit, instrumentation/expendable supply field chest of drawers, sonic prophylaxis instrument, autoclave, dry suction pump, portable chair and fiber optic oral examining light.

DENHI-3A was developed using off-the-shelf equipment components available today. All equipment described in this article has been modified specifically for DHI programs.

No financial returns are accrued by any person connected with DHI.

New ideas and concepts from the developed equipment are free to be used by other governments, etc., for the benefit of all people. This does not include manufacturer's specific patented components embodied in the equipment.

The modular design provides complete system flexibility to provide for all conceivable situations, i.e., either one or two dentists working in the field or in a remote hospital from below sea level to extremely high altitudes with ambient temperatures above freezing (the freezing point of water) to approximately 100^{o} Fahrenheit or 38^{o} Centigrade.

Oil free air for system operation is utilized for hygienic reasons and to optimize air compressor performance per unit weight.

DENHI-3A was designed as two basic systems, one with a gasoline driven compressed air supply and controls and a second system also with a pneumatic air supply, but with an electrically driven air compressor and dual compressed air capacity control. The gasoline engine compressors have a constant speed capacity control and are the most portable. The electric motor system is designed for use in hospitals having electric generators over 8 kw.

System Development

The first system used by DHI volunteers, DENHI-1, was designed by ADEC, a dental equipment manufacturer. The system consisted of a gasoline engine driven oil-free air compressor (GAST Manufacturing Corporation). An attached small (approximately 8" x 3") surge tank was added by ADEC, however, air pulsations from the compressor were transmitted to the dental

handpiece. The weight of the unit was 80 pounds. There was no air dryer. A prototype portable air operated dental control including a pressurized ½-gallon water supply with two dental handpieces, air/water syringe and a small venturi-type suction unit was connected to the air compressor via a thirty-foot air line with quick disconnects. The control and water supply was housed in a fishing tackle box.

Problems encountered with the first set of equipment were as follows: The high humidity of western Africa eventually caused the dental handpieces to become inoperable. The air syringe released only moisture laden air into the cavity preparations. A unique sonic prophylaxis instrument (Orbison) would not function because of the water-laden air. The first fiber optic light used was engineered as a prototype by Columbus Dental; the metal gooseneck would not stay erect.

A second system was developed by McKesson, Moncks Corner, S.C. The gasoline engine compressor was replaced with a 230v./50Hz. electrically driven air compressor which was an oil-lubricated 3/4 hp. piston type with integral motor. The compressor head was containerized and equipped with a dessicant dryer. The dryer was designed so that the dessicant was automatically renewed by bleeding back dry air from the tank when the compressor was not running. In addition to the dryer the tank assembly had an oil and water filter separator, pressure switch for control of the compressor motor, check valve and drain valves. The Varitrol handpiece control unit was mounted to the tank assembly for this portable unit. The Varitrol unit was fitted with a pressured water supply system and a small vacuum (venturi-type) collection jar

which was found to be inadequate. The Varitrol unit was fitted with quick disconnects throughout. The tank and Varitrol unit, packaged in a separate carrying case weighed 145 pounds. A second Varitrol without suction was attached to the system for use by a para-dental trainee. A small Onan generator (2.5 kw.) powered the compressor.

Problems occuring with the second system included an air supply that was inadequate, the air dryer dessicant needing replacement after five month's continuous duty, and the electric generator at higher altitudes not always starting the compressor's electric engine.

A Rolux/MDT fiber optic light was used successfully for the first time.

The limited output of air (approximately 2.5 SCFM at 100 PSIG) by gasoline operated compressors and the 4.2 SCFM requirement airflow of the Missionair (ADEC) control component (dental handpieces plus venturi-type suction) necessitated modifications resulting in development of the DENHI-3A. A unique electrically operated three cylinder oilless air compressor (ITT) weighing 86 pounds and rated 1½ hp. was selected. Due to the design of these units a high starting torque motor is used to enable the compressor to start against maximum design air pressure, in this case 100 PSIG. To reduce the starting or inductive surge of the squirrel cage motor a starting unloader device known as a "Load Genie" was used.

The air compressor is designed to operate on a continuous basis. (The DENHI-3A design prevents possibility of rapid on-off cycling of compressor (less than 5 minutes on vs. off) during abnormal or unusual air demand, which inevitably would shorten the life of the compressor.)

A continuous unloader/check valve device ("Load Genie", Control Devices Inc., St. Louis, Missouri) is externally mounted on the air compressor. The unloader is set to a predetermined air pressure. Once the assigned air pressure is reached, the delivered air is then diverted and vented to the atmosphere. The compressor continues to vent to the atmosphere until some air has been used from the system. After the system pressure has dropped to an adjusted predetermined cut in air pressure, the atmosphere vent seals off. Two important advantages are seen: The compressor motor life is prolonged by eliminating the possibility of rapid cycling, intermittent operation. The compressor motor and other parts operate under a more constant temperature. The compressor is also equipped with a pressure switch and pressure relief valve that protects the unit in the event of excessive pressure build-up in the event of a failure on the "Load Genie".

The physical size and weight of the electrical generator required for starting purposes of the system precludes portability. Its use therefore is limited to installations with 6 kw. or more power sources.

Oil free or oilless type air compressors were desired for hygienic reasons and for their proven reliability and portability. The ITT air compressor utilizes sealed-for-life bearings and unique nickel-plated flourocarbon infused, cast iron cylinder sleeves, special flourocarbon filled piston rings and skirts to provide oilless air and long life of wearing components.

Two features that make this compressor better for remote areas are: (1) Hard, long-wearing cast iron cylinder sleeves which have been nickel plated and infused with flourocarbon (teflon) providing reduced

friction, long life, and corrosive resistant cylinder sleeve. By not having to replace expensive cylinder sleeves as often as competitive models using soft aluminum sleeves, maintenance is decreased. (2) The pulsation crankcase acts as an air receiver, aftercooler, pulsation dampener, noise reducer for cylinder discharge air and serves as a holding member for the cylinder sleeves. Discharge air temperature is approximately 100° F. cooler than other models not having the chamber. (This compressor can be used without an air receiver.) The latter point is important for remote areas where maintenance must be performed by semi-skilled people. This holding member accurately determines location of the cylinder sleeve on the piston assembly and determines the clearance between the piston and the cylinder head. Therefore, persons with a minimum of mechanical aptitude can easily make minor overhauls which consist of ring, wearskirt (6000 hours), and valve changes, quickly and efficiently.

This compressor has an exclusive integral pulsation chamber that "dampens" or smooths the pulsations of the discharge air and also serves as an aftercooler. The compressed air aftercooler dissipates heat with an air discharge temperature reduction to approximately 180°F. resulting in significantly less initial water condensation. Other compressors provided discharge of approximately 250°F. and upwards.

An electrical heatless air dryer was selected. Internal solenoid switches alternate quite audible air purges through two dessicant chambers every thirty seconds. Although superior to other air dryers tested, solenoid problems and dessicant replacement required a further search for a simpler air dryer.

The Missionair handpiece control, no longer a prototype, was

selected. The air-operated control offers manual selection of one highspeed handpiece with air and water coolant and one lowspeed. A 76-ounce (2.3 liters) water tank supplies water for the air/water syringe, handpiece coolant and an external outlet/supply hose for an ultrasonic scaler. It is lightweight (35 pounds) and has four detachable legs. The working surface is 33 inches in height. Handpiece speed is controlled by variable air pressure from the foot control. Air and water coolant to the highspeed handpiece is controlled by air and water control valves. Drive air pressure is regulated by pressure adjustment screws. The oral evacuator includes one high velocity evacuation tubing and a one-quart plastic jar. Approximately 2.5 CFM of air at 60 PSI is consumed in its operation. However, the small air lines to the venturi within the high velocity tubing do rupture after an appreciable amount of movement through use, resulting in a decrease in suction.

After many years of using headrest attachments and non-reclinable U.S. Army (surplus) portable dental chairs, the prototype "Porta-Chair" (ADEC) was used. It supports a patient from an upright seated to a reclined position. The chair can be hand-elevated for 22 inches to 32 inches allowing "sitdown" dentistry. An adjustable U-shaped headrest provides firm support. The polyurethane foam and heavyweight vinyl fabric allow the chair to be comfortable. The overall length is 68 inches and the weight is 35 pounds. There is an accompanying vertical aluminum pole with bracket to support the Rolux/MDT fiber optic light.

The Rolux operatory light confines illumination to the patient's mouth. Its cool light may be directed for illumination of upper and lower quadrants. However, the flexible fiber-bundle arm should not be

bent more than 90°. The lens is designed to be used not more than 12 inches from the area to be illuminated. Focus is adjustable from flood-to-spot and intensity is adjustable over six positions from no-light to super-bright intensity. Lamp life is decreased considerably if left on maximum light output over five minutes. Aluminum housing contributes to an overall weight of 13 pounds. Light output is adequate. According to the manufacturer, a newly designed prototype lens allows approximately 9000 foot candles of light as compared to approximately 2000 foot candles of light put out by lights commonly used in today's United States dental offices.

Rural locations without electricity necessitated further development of the DENHI-3A system. An ITT Pneumotive (Monroe, La.) gasoline engine driven air compressor (ITT Pneumotive Model EDCOGH) was selected. Its 3 quart fuel tank allows up to 6 hours continuous running on a single tankful. It also delivers pulsation free air. It will deliver 4.3 SCFM air delivered at 35 PSIG (pounds pressure) and weighs 56 pounds. The 3 hp. 4 cycle Briggs and Stratton engine is air cooled with a governed speed of 2700 RPM. Its float-feed carburetor requires minimal maintenance. The unit has a recoil starter. Two modifications requested by DHI to increase the life of the gasoline engine from 150 hours to 800 hours included installation of stellite valves and an exhaust valve rotator. A small external oil drain pipe was added to facilitate draining of oil prior to transporting over rugged terrain. A special Briggs and Stratton muffler to reduce gasoline engine noise was also added.

Bolts attaching the compressor to the metal cradle have slotted

screwdriver-type heads and cannot be tightened to a torque that would prevent loosening from operating engine vibration. Bolts with hexagonal heads remedied the problem.

A spare Briggs and Stratton gasoline engine with pulley will be available with the dental package to allow replacement when gasoline engine overhaul is necessary.

The gasoline operated compressor is mounted in a 48" x 24" x 20" internally cushioned container. Air hoses with quick disconnects are secured in a divided compartment. There is also a spare parts compartment.

An electrically driven ITT Pneumotive Model STOGH 71S radial three cylinder air compressor, discussed previously, is included in the DENHI-3A to be used where electrical power supply (above 6 kw.) is available, e.g. a remote hospital.

A 1½ hp. 220v/50Hz single phase capacitor-start Gould Century (St. Louis, Mo.) electric motor, rated at 1425 rpm. powers the compressor.

At 50 PSI the compressor, which weighs 86 pounds, provides 5.6 SCFM free air. The electric compressor is recommended where a semi-permanent installation is desired, but where portability is still required.

The air compressor is designed to operate on a continuous basis to 100 PSIG. Where intermittent duty of the compressor is required, a duty cycle of 50 percent with on-time to equal off-time with a minimum of 10 minutes on, 10 off, is necessary to prevent excessive heat buildup in the electric motor. Where the air demand approaches the output of the compressor it is advantageous to operate on a continuous duty basis. This can be accomplished through the use of a constant

unloader device. On this design a continuous run unloader/check valve device (Control Devices, Inc., St. Louis, Missouri) is externally mounted on the air compressor. The unloader is set to a predetermined air pressure. Once the assigned air pressure is reached, the delivered air is then diverted and vented to the atmosphere. The compressor continues to vent to the atmosphere until some air has been used from the system. After the system pressure has dropped to an adjusted, predetermined cut in air pressure, the atmosphere vent seals off. Two important advantages are seen: the compressor motor life is prolonged by eliminating intermittent operation, and the compressor head is kept cooler.

The Air Dryer

Air is delivered to the Mission-Air control unit through a very unique air dryer, the Dew-Rite® Dryer model SOO-OK-OOO by Wilkerson Corporation (Englewood, Colorado). Dry air is necessary for dental air-operated handpieces.

Compressed air, expecially in hot, humid climates has proportionately large amounts of water. Dehumidification in many dental air dryers now on the market is achieved by absorption with hygroscopic materials or refrigeration. However, replacement of absorbing chemicals is difficult, and refrigeration presents logistical problems in remote locations. In addition, both of these systems require electricity.

According to the manufacturer, air enters the inlet of the dryer

and flows through a 5-micron-rated filter where bulk liquid and solids are separated and drained. The air then flows through a heat exchanger where the pressure dew point (temperature at which condensation of the water vapor in the air begins) is lowered. The water that condenses is accumulated and automatically drained from the system. Air then flows back through the heat exchanger and is rewarmed to approximate inlet air temperature. A portion of the filtered air flows through a thermal sensing valve to a unique cooling or "vortex" tube which refrigerates the air. The vortex tube divides the air into a hot and cold flow of air utilizing the forced vortex principle. The hot air is vented to atmosphere. The cold air goes to the heat exchanger and after cooling the air to be used in the dental equipment is also vented to atmosphere. The thermal sensing valve controls temperatures in the heat exchanger by intermittently allowing air flow into the cooling (vortex) tube.

Although testing has been limited at this time, the dryer should prove applicable to any dental office application. It is virtually maintenance-free. There are no moving parts. No electricity is needed. There are no chemicals or refrigerant to contend with. It is low in cost in comparison to other air dryers available to the dental profession. The stock dryer measures approximately 19½" x 14½" x 6½" and weighs approximately thirty pounds. DHI has removed the stock outer steel cabinet and placed the Dew-Rite® internal components into one of the DENHI containers to reduce weight.

Handpieces

Most two, three or four hole adapter high-speed or low-speed handpieces will attach to the 3-handpiece Mission-air control. Electrical handpieces have been tested with the DENHI-3A. High humidity and dust appear to have a deleterious effect on their longevity. Their complex mechanism does not lend itself to simple repairs, as does air operated handpieces. Extra air turbines, bur chucks and bur changing tools are included as spare parts.

Sonic Prophylaxis Scalers

Dentsply-Cavitron Unit

A Dentsply-Cavitron model 700 ultrasonic dental unit was selected for developing countries with 220v. current. It operates by converting 220v/50Hz AC current into 25,000 cycles per second current. This in turn is converted by means of the handpiece and insert into 25,000 microscopically small mechanical strokes per second, moving back and forth over a distance of one thousandth of an inch. The rapid, microscopic strokes are then transmitted to the insert tip. Applied to the teeth with a water spray and a light touch, the activated "Thru-Flow" insert tip, in conjunction with the bubbling action of the water, dislodges calculus and stain. The instrument must be applied in a continuous wet field. The tip must be kept moving continuously at an angle of 15^{o} to tooth surface.

The water supply to the Dentsply-Cavitron unit comes from the

Mission-air water reservoir. The unit has four major components: an electronic generator, a handpiece and cable assembly, a set of interchangeable inserts, and a foot control. The unit is 4" x 8 3/4" x 10 7/8" and weighs 15 pounds. Its electrical current consumption is 132 watts.

Orbison

The Orbison looks very much like an ordinary handpiece. It has a standard two hole Borden air hose fitting. It is air driven (10-20 PSI), and operates without heat and without electricity. It also operates without a constant water spray (although a water spray system runs through the instrument and tip and can be used if desired). The Mission-air control unit supplies water from its reservoir. The Orbison attaches to the handpiece tubing and can be detached in three seconds. It comes with three prophylaxis tips and a wrench. Clean dry air is essential for operation of the Orbison. It weighs 11¼ ounces.

Field Chest

An aluminum duplex chest of drawers patterned after U.S. Army dental field chests was developed with the help of Fulton Metal Products (J. M. Tull Industries, Norcross, Ga.), and Dye Metal Works (Athens, Ga.). The military field chest (World War II type to Vietnam War type) examined by the author needed organization. Many of the drawers were filled to overflowing with unrelated dental instruments and supplies. Fragile glass supplies were unprotected. Air or land transportation of the chest further disorganized and damaged the chests' contents.

When closed, the DHI field chest is 45½" long, 20½" wide and 32" deep.

It weighs 320 pounds fully loaded. It can be separated in two. When the chest is opened, one side (16" deep) has 9 drawers. They measure 12" long by 16" wide. Four drawers are 2" deep; 3 drawers are 4" deep; 1 drawer is 10" deep; 1 drawer is 8" deep. On the facing side there are 10 drawers. They also measure 12" long by 16" wide. Seven drawers are 2" deep; 1 drawer is 5" deep; 1 drawer is 7" deep; 1 drawer is 12" deep.

Nylon mini-slides facilitate drawer opening. Each drawer has removable aluminum cover inserts lined with foam urethane to secure by positive pressure the contents of each drawer during transport.

Three instrument drawers (operative, surgical and endodontic) have removable plastic drawer organizers to keep hand instruments easily accessible. Three other drawers contain a removable stainless steel setup tray. (Each setup tray positively seats on top of the Mission-air control). On each tray there is a non-skid vinyl dental instrument mat with built-in bur holder compartments for items needed for work procedures and an instrument holder designed to accomodate up to 27 instruments. Two drawers contain the most commonly used forceps and elevators. The dentist can work directly from the chest and/or from the top of the Mission-air. There is a cold sterilization drawer complete with aluminum/plastic sterilizing dish and three stainless steel sponge, alcohol and suture/needle jars.

A "pharmacy" drawer contains glycerin, peppermint, eugenol, alcohol, iodoform gauze, kenalog in orabase and other commonly used dental pharmaceuticals. Pumice mixture is kept stored in a small urethane-insulated container (Thermos Snak Jar). A Wig-L-Bug amalgamator

(Crescent Dental Mfg.) Model SC-40 is kept in one drawer along with a minute timer for plastic restorative work and x-ray processing. A three month supply of expendable dental material is also included in each field chest.

There are three handles on each side of the closed field chest to facilitate handling. An ultra-lightweight refrigerator dolly is included to permit easy movement of the opened field chest.

This field chest is constructed of aluminum. Information is now being studied whether new thermo plastics can be used instead of aluminum. Graphite reinforced polysulfone (composite) is also being considered in the fabrication of the containers. The material has been originally used in aircraft applications because of its inherent toughness and light weight.

Autoclave

A Pelton & Crane "Sentry" (Charlotte, N.C.) was selected because it has a light weight and quick temperature build-up time. It has solid state controls, stay-cool insulated door and handle, and positive interlock that prevents operation until the door latch is securely in place. The door cover is plastic, as opposed to stainless steel or plated brass on most autoclaves. A swing-out water drain facilitates emptying of unit when portability and time are important factors.

The DHI selection (220v/50Hz) measures 16" x 14½" x 11" and weighs 40 pounds in use. It consumes 1250 watts of electrical current, an important factor when electrical supply is considered. Two trays

of instruments can be sterilized in one cycle.

Dental Aspiration

Dental suction is necessary to aspirate oral fluids, saliva, blood, and cooling water.

Traditional vacuum pumps used in aspirator systems have typically short lives. Such wearing parts as sliding vanes, diaphragms and pistons limit the service-free life of the positive displacement pumps. Multi-stage centrifugal blowers (similar to that of the home vacuum cleaner) must either be of great size or run at very high speeds requiring the use of belts or brush motors. These latter situations contribute to early failures.

The Rotron blower (Woodstock, New York) model SL4, on the other hand, can provide the necessary vacuum to run multiple aspirator setups with all the advantages of small size, low speed, and no wearing parts but the permanently lubricated ball bearings. Its method of suction development is unique. A single rotating multi-bladed wheel throws air outward against the inside of the blower housing wall. This air in turn reflects back in a spiral motion to the wheel where the air is again flung outward - ad infinitum (hence the term "regenerative").

The airflow provided by this regenerative technique exceeds that of the typical positive displacement vacuum pumps. Therefore, the blower does not have to build excess vacuum to generate the required flow reserve, i.e. the flow of solution through the suction lines.

The regenerative blower therefore, has a lesser tendency to pull the soft tissue into the orifice of the dental suction tip.

Because of its construction, the spiral blower is unusually resistant to particular contaminants. This makes it ideal for dentistry since oral debris occassionally slips through the vacuum source. The simplicity and ruggedness of design of its blowers enable the manufacturer to rate operating life at 16,000 hours, or about four years of average usage.

The pump draws air through a collection receiver via a ribbed plastic hose (internal diameter: 1 inch) exiting from the receivers' bottom. A plastic, one gallon aspiration receiver manufactured by Columbus Dental Mfg. (Columbus, Ohio) has a stop-flow valve to prevent aspirated materials from entering the Rotron blower.

The lid of the collections receiver is removable for ease of cleaning. Two Y-fittings project from the lid. A ribbed saliva ejector hose (internal diameter: one half inch) attach to each Y-fitting. Ribbed hoses under vacuum tend to resist collapsing. The suction pump may thus serve two dentists simultaneously.

The author feels that the suction apparatus of the Mission-air control unit previously discussed should be used only when the Rotron is undergoing repair.

Two air dryers, two fiber optic dental examining lights, an autoclave, an ultra sonic scaler and the suction pump and its accessories are secured and cushioned from concussion within a 48" x 28" x 19½" aluminum container. A spare parts compartment for all of these components is included in the container. All of the aluminum containers have

small external loops protecting the fastening latches. The loops also allow rope to pass through them for container stabilization on vehicles or aircraft while in transit.

Radiography

The X-Ray Unit

Attempts to use x-ray units in situations other than fixed installations have proved difficult for the dentist attempting field dental care. Most of the dental x-ray units manufactured in the United States are too bulky and heavy for portable use.

European and Asian made x-ray units do not produce the maximum kVp United States models do. However there seems to be minimal difference seen by the author in the radiographic appearance of oral tissues, bone and teeth when film is exposed by either of the units.

Siemens of Germany and Philips of The Netherlands have extensive worldwide service locations, an important factor in DHI's selection of an x-ray machine.

The Siemens Intraoral Dental X-ray Unit HELIODENT 2 with Dosimatic features automatic dose control. Due to the unique electronic circuitry, the Dosimatic automatically compensates line fluctuation within +5% and -8% of the nominal line voltage, thus correct film blackening (density) is achieved during every exposure.

Simple to operate, symbols of the tooth to identify the object being radiographed, rather than the tooth name, appear on the controls, which is advantageous for use in a foreign country.

The object thickness and patient's age can be selected in four steps in order to keep the patient radiation dose to an absolute minimum.

The HELIODENT 2 x-ray head is fitted with a grid-controlled x-ray tube to produce sharp and high contrast images at 56 kVp and 7mA. This scissor arm has a reach of 67½" inside cone. Easy serviceability; components can be replaced at field locations, should the need arise. The unit head weighs 18 pounds; the arm, 30 pounds; the control unit, 10 pounds.

Philips Oralix 65 (Dental Systems Division, Philips Medical Systems, Inc., Shelton, Conn.) has just been introduced to the dental market.

This unit uses a single-sided tubehead suspension and the unique Dens-o-mat electronic timer. Its anatomically calibrated scale makes it easy to use and it automatically compensates for line voltage fluctuation to provide consistent film density. Radiographic output is 65 kVp, 7.5mA. and the radiation beam is confined to a diameter of 60 mm at the 20 cm (8") S.S.D.

North American Philips Corporation previously produced a portable x-ray unit, Model #415, using earlier model Oralix Super 50 components.

The tubehead employed a unique revolving turret diaphragm providing a choice of apertures which limited the x-ray beam to the size of the film used, minimizing radiation. Maximum beam size at the 10 cm (4") S.S.D. was confined to 2.75".

Radiographic output of the Super 50 was 50 kVp, 7mA., and the unit employed the same type 3-electrode, grid-controlled x-ray tube

used in the present Oralix 65.

Overall weight of Model #415 was 84 pounds.

With the assistance of Dr. Lincoln Manson-Hing, University of Alabama School of Dentistry, DHI is building a container that has manually operated "worm" gears at its four corners. A small metal foot attached to each worm gear will raise or lower each corner of the box. By utilizing a topmounted circular carpenter's "level", balance of the x-ray unit arm will permit extention without drift of the x-ray head.

X-Ray Processor

Selection of a processor was based on simplicity for field use. More mechanism means more potential breakdown time.

Processing of intra-oral dental x-ray film has been made easier with the introduction of portable processors (Microcopy, Culver City, Cal.; Rinn, Elgin, Ill.). Rapid solutions, developer and fixative, on the one hand and heating of standard solutions on the other, expedite processing of films to less than two minutes. They both can be used anywhere under normal light. However, if film is to be stored for record, the manufacturers recommend the film remain in wash water for 20-30 minutes. Hand holes are equipped with fabric and nylon reinforced rubber which grip the wrists to prevent entry of light into the box.

The Microcopy "Insta-Developer" portable darkroom weighs 8¼ pounds complete with accessories (4 jars with lids, 3 single film clips and instructions). It was designed specifically for use with the rapid solutions, Insta-Neg Developer and Insta-Fix. These solutions

require no heating. They are used at normal room temperatures of 64°F. plus. The portable darkroom has a plexiglass see-through filtering panel. The unit is molded of polyurethane - 16 7/8" x 10 2/4" x 10 3/4". The body has a detachable base (for ease of cleaning) with recessed retainers for four processing jars with sealing lids (approximately 2½" diameter x 3" high) and a recessed space for discarded film packets and single film clips. Solutions may be ordered in quarts or gallon cubitainers and is mixed ready for use as received. According to the manufacturer, the solutions last from two weeks to two months in the 8 ounce jars depending upon the amount of film developed and care exercised. In unopened cubitainers, the solutions have a shelf life of one year; storage under refrigeration will prolong chemical life.

The Rinn "Chairside Darkroom" (model #530101) weighs 12 pounds and needs no plumbing or safety lights and has a hinged see-through plastic light filtering top. Its body (15" x 10" x 10") is made of stainless steel, and has four recessed holes to contain the plastic processing non-lid solution cups. There is a 220v/50Hz solution heater with an adjustable temperature range of 60°-100°F. to further expedite the processing time of the chemical solution. One bottle each of developer and fixer concentrate, a thermometer and four single film clips are included. Shelf life of chemicals is eighteen to twenty months and is not prolonged if refrigerated.

It is the author's wish that others with ideas to miniaturize,

modify, simplify and lower the cost of a complete portable dental unit will make themselves heard.

DHI will continue its research and development of portable dental equipment so that areas of the world with minimal resources may enjoy the benefits of today's dentistry.