The Oliver Rehabilitation Machine

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OLIVER. REHABILITATION MACHINE BOOKLET

Page	Errata	Correction
6	Line 3	Delete 'S9. Press ON/OFF Clamps — Secure Seat Cradle to Machine.'
8	Line 5	horse to read h.p.
8	Line 21	Delete 'off each'
8	Line 22	15mm to read 150mm
9	Line 16	heal to read heel
13	Line 2	comma after mechanisms, thus (thus with small 't')
13	Line 3 Sec 3	by to read be
16	Sec 19	Delete & alt, 'If using a grinding wheel' etc to read — 'ALWAYS wear SAFETY GLASSES, when using a grinding wheel, sanding or polishing attachments in the drill chuck.'
17	Last Line	another to read the other
18	Line 4 Sec 6	hygenic to read hygienic
20	Line 1 Sec 3	Delete — 'Release the toggle clamps first and then'
21	Line 2 Sec 14	with to read will
22	Line 3	ginglymous to read ginglymus
22	Line 22	Hemipleglas to read Hemiplegias
22	Line 35	ginglymous to read ginglymus
28	Line 22	patelectomy to read patellectomy
28	Line 23	condules to read condyles
28	Line 28	lumber to read lumbar
30	Line 46	prosthetes to read prostheses
32	Line 2	with to read within
33	Line 3	mains to read motor
34	Line 19	mail to read nail
35	Line 2	Poliomyelilitis to read poliomyelitis
35	Line 3	disseminated to read Disseminated
36	Line 4	Delete 'The' and Insert 'When used as a wheel-chair'
36	Line 15	manoevrable to read manoeuvrable
42	Line 28	for to read fore

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CONTENTS

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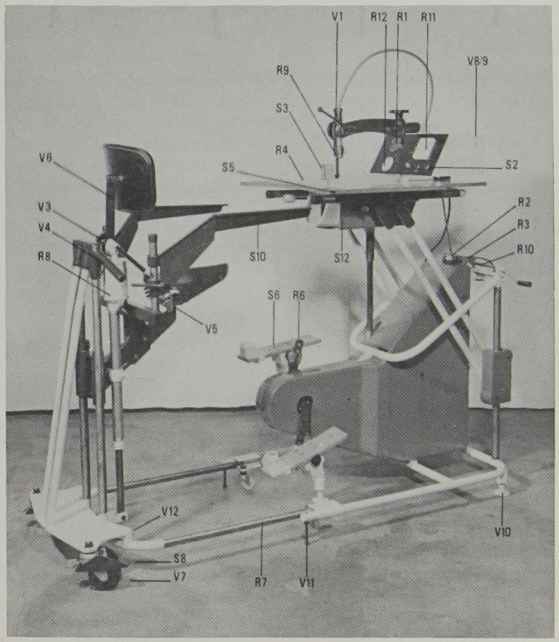

Figure 1

SPECIAL FEATURES
Fig (I)

Purpose Built

Ergonomically designed for rehabilitation exercises of ginglymus orientation from the acute stage to final recuperation.

Recordings

R1. Speedometer/Odometer – facilitates rhythmical pattern of joint movement and indicates amount of work achieved.

R2. Brake Gauge – indicates pressure applied to braking system.

R3. Brake adjuster – enables progressive resistance up to maximum effort.

R4. Variable Height Working Table – ensures correct postural position at all times.

R5. Fore and Aft Table Movement – allows for greater range of movement.

R6. Extendible Pedal Cranks – assists full range of ginglymus movement.

R7. Horizontal Seat Adjustment – accommodates any length of leg and allows full hip extension movements.

R8. Vertical Seat Adjustment – facilitates alteration in range of joint movement **during pedalling operations.**

R9. Sawing Or Drilling/Sanding – direct change without removal of saw-blade or drill.

R10. Mechanical Drive or Electrically Assisted Drive – easy change enables Saw/Drill to operate at constant speed irrespective of pedal speed.

R11. Electrical Output Sockets – 6 volt and 240 volt mains supply for use with auxiliary equipment.

R12. Chronometer – for treatment duration.

Safety

S1. Automatic Cut-out – for all electrical operations as soon as pedalling stops.

S2. Warning Lights – Amber prepare for functional activity.
– Green pedalling is at functional speed, mechanical or electrical.
– Red mains supply electrical source is connected.

S3. Saw Guard – prevents injury to fingers during sawing operations.

S4. Access to patient – unrestricted from side of machine.

S5. Table top Hand Holds – gives confidence to patient when mounting and dismounting.

S6. Stay level Pedal with Footboards – enable correct positioning of feet for maximum efficiency.

S7. Adjustable Foot Straps – prevent feet slipping off the pedals and can be used to hold a prosthesis securely in position.

S8. Rear Brake Castors on Seat Cradle – aids stability of machine or when used as standing frame.

S9. Press ON/OFF Clamps – secure Seat Cradle to Machine.

S10. Variably moveable Arm Rests – for safety, confidence and reassurance.

S11. Clear Work Table – overhead arm can be swung to one side when using auxiliary equipment.

S12. Locking Screws for Table – prevents unwanted fore and aft movement.

Various

V1. Interchangeable Saw/Drill Operations – working from same central position, and at constant speed with motor assistance.

V2. Variable Range of Activities – Audio and Visual Aids etc. with use of 6 volt and mains supply sockets.

V3. Detachable Seat Cradle – gives easy access to machine and can be used independently as wheel chair or walking aid etc.

V4. Steering Handle on Seat Cradle – angle for all heights of therapist and assists location of seat to machine.

V5. Adjustable Seat Angle – can be set according to therapeutic requirements.

V6. Adjustable Back Rest – gives spinal support.

V7. Swivel Wheels on Seat Cradle – makes for easy mobility.

V8. Record Cards – Storage compartment.

V9. Tools and Accessories – Storage compartment.

V10. Self Adjusting Machine Feet – ensures correct alignment on uneven floors.

V11. Stabilizing Screws – gives added stability to machine.

V12. Large platform on Seat Cradle – for patients shoes, handbag, etc.

OLIVER (ELECTRIC) REHABILITATION MACHINE SPECIFICATIONS

DIMENSIONS

Overall Height (table at minimum height)	124 cms.
Overall Height (table at maximum height)	170 cms.
Overall Length (seat unit fully forward)	138 cms.
Overall Length (seat unit extended position)	176 cms.
Overall Width	66 cms.
Overall Weight	108 kg.

Calibrations

Seat Unit – Fore & Aft movement		45 cms.
Seat Height – Point of seat to floor –	Min.	55 cms.
	Max.	114 cms.
Seat Arm Rest – surface arm to surface seat –	Min.	165 mm.
	Max.	254 mm.
Table Height – Work surface to floor –	Min.	96 cms.
	Max.	142 cms.
Work Table – Fore & Aft movement		31 cms.

Pedals

Crank Length – Centre hub to inner hole – Min. radius	5 cms.
Crank Length – Centre hub to outer hole – Max. radius	20 cms.
Pedal revolutions (as per Odometer)	

Resistance

Mechanical – semi circular – external drum brake.
Hydraulically operated – Hand Screw adjustment.
Pressure Gauge 0 – 1000 lbs. sq. ins.
Reservoir – Hydraulic Brake fluid.

Chronometer

Type – Hand Pre-Set – (Smiths)
Bell rings at end of time lapse.
Maximum duration – 1 hour

Drill/Saw Units

Selected by Push/Pull control lever	Push Inwards	– Saw
	Pull Outwards	– Drill
	Centre Position	– Neutral

Drill Unit – operated by flexible drive.	
Total vertical movement, spring return.	30 mm.
Chuck capacity	6 mm.

Saw Unit – operated by flexible drive, via pedals.	
Blades – Standard Jig Saw Pattern	
Stroke	11 mm.

Electrical System

1. **Primary Control**		
	Cycle type DYNAMO	Output–6 volts
2. **Secondary control**		
	by Control Relay	Input–6 volts
		Output–240 volts (UK)
	Life expectancy – mechanical	10,000,000 operations
	Time values	Operate–15 millisecs
		Release–10 millisecs
	Contacts – 3 pole double throw	Rated–10 amps
3. **Mains Input**		
	3 Core insulated cable	3 metres
	U.K. voltage	240 volt

4. **Warning Lights** – situated on instrument panel.
   - Amber – Prepare for functional activity. Pedal speed to be increased.
   - Green – All functions operative.
   - Red – Mains power is connected.

5. **Power Outlets** – situated on instrument panel.

Low voltage – Jack Plug Socket	6 volt only
Switched Socket – U.K. 13 amp	240 volt

6. **Motor** – Drives Drill/Saw units

Type	½ horse constant speed.
Voltage	240 volt (U.K.)
Amps	13 amps

7. **Motor Switch** – situated on instrument panel

Double pole – single throw	2.5 amps

8. **Tests carried out**

Frame & Machine RESISTANCE TO EARTH – less than ¼ ohms

LEAKAGE TO EARTH – 240 volt connected

Normal polarity	min. 30 microamps
	max. 130 microamps
Reverse polarity	min. 20 microamps
	max. 100 microamps
Maximum permissible leakage	500 microamps

Machine Stability

Self Aligning Feet	No. 3 off
Screw adjustment stabilizing bolts	No. 2 off

Record/Accessories Compartments

Length	)	190 mm.
Width (front to back)	) 2 off each	60 mm.
Depth	)	15 mm.

Seat Unit

Seat	Bicycle type saddle	
Rear Castors	Press ON/OFF Locking Swivel	
Seat Lift	Hydraulic Hand Pump	
Arm Rests	Raise/Lower, Swivel – Lever adjustment screw	
Back Rest	Fore/Aft movement	25 cms.

Speedometer

Cable driven from Primary Drive

Maximum speed	40 m.p.h.	64 km.p.h.

Odometer

Integral with speedometer

Automatically resets to zero after 9999 mls.

Mechanical/Electric Drive Selector Lever

Situated at the rear of the Machine
When looking at the lever,
Move to the Left Mechanical Drive
Move to the Right Electrical Drive

Note:– Mechanical Drive is direct from pedals to Saw/Drill.
Electric Drive engages via belt drive from a constant speed electric motor

Work Steady Unit

Vertically adjustable – set with thumb screw,
Maximum table to foot clearance 70 mm.

Saw Unit

Maximum saw cutting length above work table 32 mm.
Note: at the bottom of the stroke.

Foot Straps

Long heal strap Length 66 cms.
Short toe strap Length 50 cms.

Work Table Clearance

Maximum distance from saw blade to nearest frame member
Throat Length Length 305 mm.

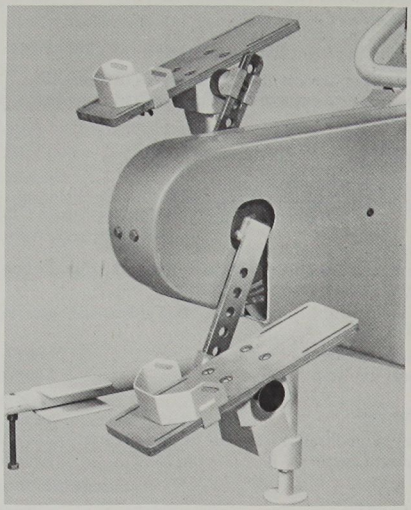

Figure 2

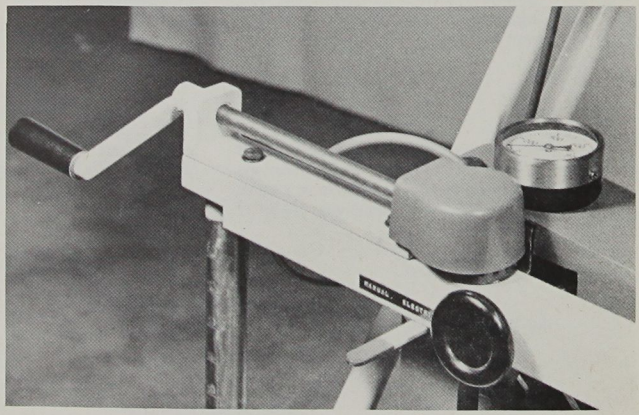

Figure 3

DESCRIPTION OF THE MACHINE

The machine is solidly constructed of tubular steel which gives adequate strength combined with an aesthetically pleasing appearance.

It is possible to use the machine in any position in a room but when electrical connections are made, the machine should be located within two to three metres of a mains power source. With its three self-aligning feet and two additional stabilising screws the machine presents a very safe, secure and rigid structure.

Pedals.

Fig (2) pedals consisting of special stay-level foot boards, carry adjustable heel pieces fitted with straps, as well as toe straps inserted through longitudinal slots. The toe and heel straps help to prevent patients' feet slipping off the foot boards with possible resultant injury. The pedal foot boards are attached by quick release plungers to the pedal cranks, thus enabling them to be adjusted, from a minimum radius of 5 cm. to a maximum radius of 20 cm. giving an effective overall diameter of 40 cm.

Transmission

From the centre hub a cycle chain drive transmits the rotary action to the rear sprocket and pulley, which also incorporates a 6 volt dynamo, thence by a secondary V-belt drive to an idling pulley. At this point a drive selector lever, at the rear of the machine, **Fig (3)** engages either; **(a)** a direct mechanical linkage, or **(b)** an auxiliary belt drive, driven by a constant speed electric motor.

The drive is then continued by means of an industrial flexible cable, which allows for variation in the vertical and horizontal positioning of the worktable, and terminates at the drill/saw selector mechanism situated on the under surface of the worktable. **Fig (4).**

Drill/Saw Selector Mechanism.

The selector mechanism lever engages a flexible drive for the drill unit, which has a spring return lever giving a vertical movement of approximately 30mm. The drill unit can also be used in a horizontal position by slackening the large knob of the drill mounting, or it can be used as an independent flexible chuck.

The selector lever also engages the eccentric drive which operates the vertical type jig saw or sabre saw which protrudes upwards through a hole in the centre of the worktable. A saw roller and work steady, with accompanying saw guard are attached to the overhead arm and are adjustable in height for all thicknesses of material **fig (5).** in the event of the overhead arm being swung to one side, a separate saw cowl should be used to cover the protruding blade if this is not removed.

Brake

Situated at the rear right-hand side of the machine are the brake control knob and pressure gauge **fig (3)** The hydraulically operated semi-circular external drum brake works directly on to the pedal hub and can be used at

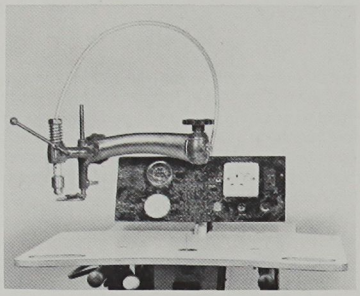

Figure 4

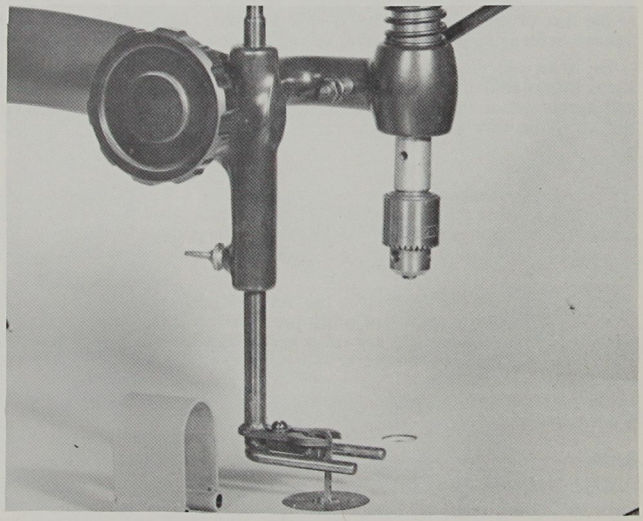

Figure 5

any required treatment stage, irrespective of the mechanical or electrically assisted drive mechanisms. Thus enabling variations in effort required by the patient to be made.

Worktable

Vertical adjustments in the height of the worktable are achieved by a hand operated winding screw, at the rear of the machine, through a total elevation of approximately 47 cms. to a maximum height of 142 cms. above the ground. The fore and aft movements of the table through a range of 32 cms are achieved by pushing or pulling the worktable by the front handholds and then securely locking in position with the thumb screws provided.

Instrument Panel

Fig (4) The instrument panel above the rear of the worktable has a speedometer — operated directly from the primary drive — to assist the therapist and patient to gauge a rhythmical cycling action. This, together with the combined odometer for measuring pedal revolutions or distance covered, enables a comparative indication of work achieved to be recorded, in conjunction with the time setting on the chronometer.

Three indicator lights also displayed on the panel show the relative functions of the electrical aspects of the machine as follows:

1. An amber light indicates that the primary 6 volt dynamo circuit is operative, but that the pedalling speed must be increased before any functional activity can be undertaken.
2. A green light appears as the amber light is extinguished and means that all activities, either mechanical or electrical can be commenced. The 6 volt jack outlet socket adjacently placed to the lights, can be used to operate a 6 volt rear projector visual aid or other low voltage equipment. (Note: 240 volt mains supply functions become inoperative when the 6 volt socket is utilised).
3. The red light, which is illuminated even without any pedalling action, indicates that the main electrical supply system is connected to the machine; no electrically powered equipment will however by operative without first rotating the pedal cranks.

A switched mains socket outlet — 13 amp, 3 pin in the United Kingdom — is also fitted to the instrument panel and can be used to supply energy to any suitable electrically operated auxiliary equipment, e.g. mains, solid state T.V., etc.

The Seat Cradle Fig (6)

The seat cradle being a free and separate structure has four fully directional swivel castors, the rear two being fitted with push on/off locking levers which also stop the swivel action.

The cycle type seat allows for a full range of hip movements and is pre-set at an angle suitable for the majority of treatment programmes, but can easily be re-set **by the therapist** according to therapeutic requirements, the clamp which holds it to the centre column being re-adjusted. The seat can be raised

through a total distance of 59 cms approx. by a hand-operated hydraulic jack enabling a small child or a tall adult to use the machine with equal ease. The seat is lowered, through successive stages or as required, by the finger tip control release valve of the jack. The seat backrest is also adjustable and automatically tilts to accommodate variations in individual spinal curvature.

The seat cradle has sloping bars projecting to either side from the rear column, which act as steering handles to enable the therapist to easily guide the cradle, with the patient on the seat, into its relative position within the machine frame. It is then securely fastened by means of toggle clamps and its rear locking swivel castors.

The infinitely variable armrests with their large locking levers give a feeling of security and confidence to patients, whilst also enabling the cradle to be used as an independent walking aid with the addition of an easily constructed foot board it can be converted into a very manoeuvrable wheel chair. (See chapter — "Seat Cradle as an Independent Aid").

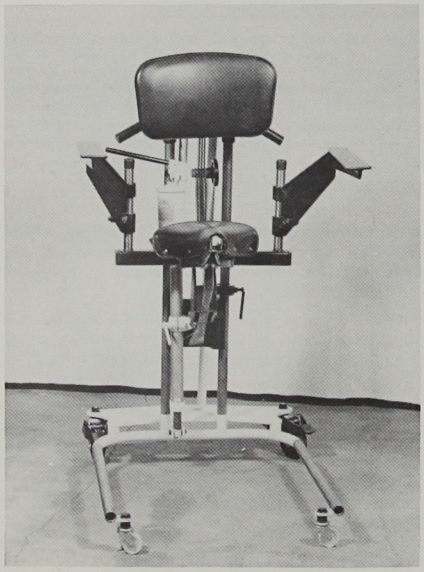

Figure 6

PREPARING THE MACHINE FOR USE

1. Remove all packing materials.
2. Unfasten any ties securing the two sections together.
3. Separate the seat cradle from the machine section.
4. Place the machine section in the required position in the room. Note: If mains voltage assistance is going to be used the machine should be within two to three metres of a power socket.
5. Screw the two adjustable stabilising bolts, at the front open end of the machine frame, downwards, until the bolt ends touch the floor.
6. Raise the worktable, by the winding handle at the back of the machine, to approximately its mid position.
7. Check that the Brake Pressure reading is at zero on the dial. Pedals should rotate freely.
8. Check that the pedal footstraps are unfastened.
9. Check the saw release key operation. **Warning — under no circumstances** must this key be **ENGAGED** in the saw chuck unless a blade is being fitted or removed.
10. Check that the drill-saw selector mechanism — under the left-hand side of the worktable — is in the neutral position.
11. Check that the motor switch on the instrument panel is in the OFF position, before connecting the main cable to a power source.
12. Attach an appropriate power plug to the end of the insulated cable. Note: Green/Yellow earth wire must be connected to the EARTH PIN of the plug.
13. Connect the electric cable to an electric mains supply, as and when required. Note: Ensure that the electric cable does not cross a walkway or cause any obstruction to personnel.
14. Check that the overhead arm is in line with the saw mounting and is securely locked in position by the large knob on the top of the arm.
15. Slacken the two large wing screws — which are under the worktable on either side, then using the handholds at the front of the worktable, check that the table slides freely backwards and forwards. Relock the screws **finger tight only.**

Seat Cradle

16. Release the locking levers of the seat cradle arm rests and open approximately parallel to each other. Lock in position.
17. Check the press on/off locking swivel castors at the rear of the seat cradle.
18. Check that the hydraulic jack release thumb screw is fully closed, by turning it in a clockwise direction. Note: Turn anti-clockwise to release. This adjustment screw must **only** be tightened **finger tight.**
19. Actuate the jack pumping handle to check that the seat rises smoothly. Then turn the release valve slowly anti-clockwise and press on the seat to check the downward movement. The machine is now ready for use.

SAFETY PRECAUTIONS

1. Never connect the machine to a mains power source if the cable is frayed or the plug faulty.
2. When the machine is not in use, disconnect the mains power source.
3. Do not let the mains cable cross a walkway without protective cover.
4. Take extra precautions to ensure that **loose ties** or **long hair do not become entangled with the drill, saw, etc.** when using the electric motor assisted drive or any electrically powered auxiliary equipment.
5. Put all switches OFF and selector levers to Neutral at the end of each treatment session.
6. Ensure that the seat cradle brakes are on when connected to the machine section.
7. See that the table locking screws are secure at ALL TIMES.
8. If the overhead arm is swung to one side, the saw blade should either be removed or covered with a protective cowl.
9. Always push material GENTLY against the saw blade.
10. Don't try pushing work against the saw blade until a rhythm of pedalling has been achieved.
11. Never leave a drill in the chuck when in the horizontal position.
12. Immediately stop pedalling if any equipment appears to be malfunctioning.
13. Keep the worktable area clear and tidy at all times to avoid injury.
14. Always lower the seat jack slowly — especially when a patient is on the seat.
15. Never remove the Thumb Release Valve of the seat jack.
16. Always ensure that the Pedal Plunger is engaged in the crank hole **before pedalling.**
17. Always use a plug, at the end of an electric cable, to connect to the mains supply.
18. **Never** leave the key in the drill chuck, or saw chuck — AT ANY TIME.
19. If using a grinding wheel in the drill chuck ALWAYS wear SAFETY GLASSES, even when there is dust from sanding or polishing.
20. Stop pedalling when changing any of the selector levers or switches.

HOW TO USE THE MACHINE
(Detail, see mounting and Operating of the Machine, page 17)

1. Measure the distance a patient can lift foot of affected leg off the ground.
2. Lock pedals at 1 and 7 o'clock by applying the brake. (See illustration No. 2).
3. Set the pedal crank lengths to half the distance obtained in No. 1.
4. Place the patient on the seat.
5. Temporarily set the seat cradle within the machine section.

6. Strap the feet in position. Use disposable hygienic pads with stockinged feet.
7. Set the arm rests and raise the table to clear.
8. Move the seat cradle into a working position.
9. Adjust the table emplacement and height, to ensure a good posture.
10. Adjust the backrest.
11. Release the brake pressure to zero and try pedalling action.
12. Check the indicator lights.
13. Check the rhythm of pedalling using speedometer.
14. Apply brake resistance if required.
15. Select the functional activity required.
16. Set chronometer for treatment duration.
17. Register all calibrations and functions on patient's record card.

GETTING OFF THE MACHINE

(Detail, see Dismounting from the machine, page 20)

1. Stop pedalling, all switches off, selector lever in neutral.
2. Lock the pedals in the mid position (1 and 7 o'clock).
3. Return the seat to original starting position.
4. Unfasten pedal straps.
5. Separate the seat cradle from the machine section.
6. Lower the seat to allow patient to stand or be transferred to another chair etc.
7. Release brake pressure to zero.
8. Clear the worktable for next patient.

MOUNTING AND OPERATING THE MACHINE

1. It is advisable to set the pedal cranks to approximately the length required before attempting to mount a patient on to the machine.

   To obtain an approximation of the radius required for each pedal, the patient should stand in front of the machine and holding on to the hand holds in the work table — which has been raised or lowered to the level of the patient's elbow — he should now raise his affected foot to its highest position whilst balancing on his other leg. The therapist now measures from the sole of the patient's foot to the floor and thus obtains an optimum length for the diametrical rotation of the pedals. By halving this amount the radius from the pedal hub is obtained for each pedal. In the event of the patient being unable to stand at the work table, then the measurement is taken with the patient sitting in a chair and with both feet projecting forward, bending the affected leg so that a measurement can then be taken from the sole of one foot to the sole of another.

2. These measurements having been obtained the pedals are locked in a vertically opposed position (approximately 1 and 7 o'clock) by application of the hand brake, this will prevent the pedals swinging whilst the therapist is adjusting the pedal crank length and while the patient's feet are being put in position. (Note: the pedal in the lower position being the one used for the most affected leg).

3. With one hand under the centre of the footboard the other hand grasps the pedal plunger release knob which is then pulled outwards, so that the pedal can be slid up or down the crank to the appropriate hole required. On releasing the knob it is very important to ensure that the plunger is firmly engaged within its correct hole before attempting to pedal.
Note: It will be appreciated that when a short radius crank leg is used with the pedal in a hole nearest the centre hub, then the effort required by the patient is much greater due to the decreased leverage available. Therefore it is generally advisable to try and arrange as great a radius as possible, although the required working of particular muscle groups will determine other radius lengths.

4. The seat cradle is now brought up behind the patient, with the seat height adjusted so that the patient can relax on to it. The cradle then moves sufficiently forward to allow the patient's feet to comfortably reach the pedals.

5. The seat cradle is temporarily locked in position by applying the cradle press on/off swivel brake castors.

6. The patient's feet are now strapped in position, commencing with the affected foot on the rear lower pedal. If the patient is in stocking feet then a suitable disposable pad should first be placed on the footboards or an appropriate hygenic shoe worn.

7. The arm rests are now positioned beneath the patient's elbow, when the arm is adducted with the forearm at 90 degrees flexion, the hand is in the mid position and the thumb uppermost. The worktable is then positioned approximately above the level of the patient's hand.

8. The seat cradle should now be moved forward to a position concomitant with the patient's disability and raised or lowered accordingly. (See also: "Therapeutic Aspect and Guiding Principles").
An average pedalling position is achieved when the extended leg to the lower pedal acquires a flexion angle of approximately 10 degrees and the front point of the seat is approximately 5 cm from a vertical line passing through the centre hub.

9. The worktable should be checked to encourage a good postural position. The front concave edge of the table and its height above the arm rests should be approximately one hand's breadth distance. It must also be ascertained that the dust container underneath the table is also clear of the flexed knee in the raised position. **Re-adjust the table height if necessary.**

10. The backrest should be set to give adequate spinal support, fitting comfortably within the lumbar curve. It is very helpful in arresting unwanted compensatory spinal movements, especially when undertaking treatment involving the hip joint.
11. To commence rotary movements of the pedals, which have already been positioned at the most mechanically advantageous position (1 and 7 o'clock), the brake pressure is gradually released to zero rating and the patient encouraged to pedal in a rhythmical manner.
12. The amber light on the instrument panel indicates that the speed of pedalling must be increased and maintained before any functional activity can be undertaken. As soon as an optimum speed has been achieved, the green light will glow and the amber light extinguish.
13. Associated with the indicator light, the speedometer will facilitate the maintenance of a rhythmical pattern of movement and ensure that the drill, saw and any auxiliary equipment are working satisfactorily. The speedometer together with the odometer — recording the distance travelled — give a valuable guide to the patient's progress.
14. The brake can be applied according to individual requirements as the initial pedalling action is virtually friction free. A close watch should be kept on the pressure gauge as adjustments are made, to ensure that too great a pressure is not applied. As soon as a flickering action of the pressure needle occurs the hand control knob should be adjusted to allow the needle to attain as stationary a position as possible. The flickering needle action is caused by the temporary loss of power on behalf of the patient at the top dead centre of the rotary pedal action.
15. Selection of functional activity will depend upon personal preferences and the psychological as well as the physical aims of treatment.

    (a) The 6 volt jack outlet socket can be used independently of any mains supply source.

    (b) The 240 volt mains outlet socket, used for auxiliary electrical equipment, requires the drive selector lever to be in the electric drive position and the electric motor switch on the instrument panel in the OFF position.

    Note: The socket outlet has its own integral switch (in the U.K.).

    (c) With the mains power connected — indicated by a red light on the instrument panel — and the motor switch in the ON position, a constant speed electric motor will drive the drill saw units. This is determined by the appropriate position of the selector control lever under the lefthand side of the worktable.

    (d) moving the drive selector lever — at the rear of the machine — to mechanical drive increases the workload for the patient, as the drill/saw units are then directly powered by the pedalling action. Drill/saw speeds are dependent upon the pedalling speed achieved. Resistance increase is approximately equivalent to a brake load of 200 lbs/90 kg when the machine is in a new condition. This mechanical drive should be selected when developing muscle tone and work tolerance. Note: The brake can however be incorporated with any or all of the functional activities, according to therapeutic requirements.

16. Set the chronometer — on the instrument panel — to the time required for the treatment period. The odometer is now a useful ally in ascertaining work output. It will be realised that if the patient has been pedalling rhythmically at a speed of 10 miles/16 kms per hour for half-an-hour's period the distance covered will have increased by 5 miles/8 kms accordingly. The number of actual revolutions made by the patient can also be checked in a similar manner.

17. The various calibrations of seat/table heights and emplacements together with pedal crank lengths and functional activities undertaken should all be checked BEFORE AND AFTER each treatment session and registered on the appropriate record card for each patient.

DISMOUNTING FROM THE MACHINE

1. Cease pedalling activity and check that the motor switch and the power socket switches are OFF. Disconnect any auxiliary equipment ensuring that the drill/saw selector is also in the neutral position.

2. Lock the pedals in the mid vertical position (1 and 7 o'clock) with the affected leg in the lower plane.

3. Release the toggle clamps first and then holding the seat cradle by the steering handles, press with your foot the off lever of the cradle brake castors. The cradle can then be drawn slowly away from the machine section and the seat simultaneously lowered by turning the release valve in an anti-clockwise direction SLOWLY until the seat position and height are in their original aspect. The brake castors are then locked again.

   The table is also repositioned especially if handholds are needed to assist the patient with standing.

4. If standing is to be undertaken at the machine, the foot straps can now be unfastened and the patient's feet transferred from the pedal boards to the floor.

5. The brake castors are now released so that the cradle can be separated from the machine section and moved to any position in the room. Or it can be used as a mobile chair by moving the arm rests towards each other encircling the patient and ensuring confidence and safety.

6. If it is necessary to transfer the patient directly to another seat, the appropriate arm rest can be swung sideways to give a clear access. The cradle seat is adjusted to the corresponding height of the new seat, the patient then sliding from one seat to the other. Alternatively the patient can use both arm rests as a support when standing.

7. To avoid undue strain on the hydraulic braking system and brake pad it is always advisable to release the pedal brake pressure so that there is zero gauge reading at the end of each treatment.

8. Clearing the workbench of sawdust and auxiliary equipment is strongly recommended after use by every patient, as it not only saves a considerable amount of time, but ensures that the next patient will have every confidence in the professional integrity of the therapist.

USEFUL OPERATING HINTS

1. Place each pedal crank in turn in the vertical position, then lower each pedal to make the required adjustments. The brake can be used to hold the pedal crank in its desired position whilst making the necessary adjustments.
2. Minimum machine resistance and physical effort are obtained when utilising the 6-Volt outlet socket only; psychological stimulation being acquired with visual or audio aids.
3. The work table should be adjusted to a suitable height and emplacement to avoid undue eye strain or postural aberrations.
4. Keep the work surface clear and clean at all times.
5. When the overhead arm is swung to one side, always remove the saw blade or cover it with a suitable cowl.
6. When sawing use the correct blade for the material to be cut:—
   a. Coarse blade for thick wood.
   b. Fine blade for thin wood.
   c. Narrow blade for curves and intricate work.
   d. Metal-cutting blade for metals and plastics.
7. The finer the blade, the smoother the cut, but the longer it takes.
8. The thicker the material, the slower the cut.
9. A little stick wax rubbed on the blade often helps when cutting hard wood or metal.
10. When cutting metals or plastic, always have at least 2 teeth of the blade in contact with the work at the same time.
11. Start drilling operations with a small drill, progressing by easy stages to a large drill.
12. Keep withdrawing the drill to clear away sawdust or metal swarf.
13. Use the saw work steady to hold down work whilst drilling.
14. Flat surface of disc facing the operator:-
    Holding work **below** centre line with throw dust to the **right.**
    Holding work **above** centre line will throw dust to the **left.**
15. With overhead arms swung to the left of the operator:-
    Holding work **below** centre line will throw dust **towards operator.**
    Holding work **above** centre line will throw dust **away** from operator.
16. If the drill chuck is removed, the drill body can be lifted out of its mounting. After replacing the chuck, the drill can be used as independent flexible tool for engraving etc. in conjunction with a dental burr.
17. Always check that the brake is **"off"** before attempting to pedal.

THERAPEUTIC ASPECTS OF THE MACHINE

The Oliver Rehabilitation Machine is ergonomically designed for rehabilitation exercises of ginglymous orientation within the lower limbs, and assists:-

1. In the reduction of internal joint pressures.
2. In non-weight bearing activity, with minimal resistance.
3. The application of progressively-controlled resistance.
4. Reciprocal innovation in cases of one-sided disability.
5. The controlled increase of range of joint movement.
6. Stimulation of good circulation.
7. Strengthening of muscle groups.
8. General increase in mobility.
9. Reinstitution of cortical control.
10. Psychological stimulation through the unique electrical and mechanical features.

Disabilities

Many types of disabilities are being treated on Oliver Rehabilitation Machines, with resultant benefit. These include, interalia:-

1. Fractures of the lower limbs with involvement of ankle, knee and hip joints.
2. Traumatic injuries.
3. Amputation above and below the knee.
4. Hemipleglas and multiple paralyses.
5. Osteo and rheumatoid arthroses.
6. Cerebral Palsy, Multiple Sclerosis, and other neurological disorders.

It will be realised that the maximum benefit derived from any type of therapeutic equipment is:-

1. Dependent on the professional skill of the therapist.
2. The co-operation received from the patient.
3. The correct adjustment of the equipment according to individual requirements.

Guiding principles for various disabilities are given, and the discerning observer will realise that suggestions made for one disability may often equally well apply to another. Therefore, it is imperative that the following notes be regarded as a whole symposium, and not as separate unconnected entities.

A vertical, rotational ginglymous movement is very similar in muscular action to that experienced in walking or running. Extension thrust of one leg occuring during the downward stroke, whilst the other free side leg reciprocally relaxes and is flexed upwards, before swinging forward in preparation for its own extension downward thrust.

Thus, one can see that a gradual development of rhythmical, or ganglyonic pattern can be built up during an early non-weight bearing activity, leading eventually to greater muscular interaction with the application of the braking system. The postural relationships which sustain such an active skeletal muscular pattern are very important and must be carefully checked at all times.

Preparing Treatment Programmes

It will be necessary, therefore, in planning a treatment programme — with this type of equipment — to aim at the primary ideal of developing successive contractures of the gastrocnemius, quadriceps, and gluteal muscle groups to their maximum potential.

Many factors will obviously need consideration and must be taken into account, such as the patient's condition at the pre-therapeutic examination.

1. Limitation of joint function — range of flexion and extension.
2. Speed of mobility and cortical control.
3. Presence or otherwise of joint crepitis or other abnormality.
4. Pain tolerance threshold through all ranges of activity.
5. Muscular malfunction — dropped foot, etc.
6. Psychological attitudes to disability and recovery.

The basic principles to follow in using a cycling type of exercise can be summarised as follows:-

1. **Extension** thrust with plantar flexion of the foot, for the development of walking patterns.
   a. Pedal crank — large radius.
   b. Seat position — elevated to a vertical proximity with the central hub.
2. **Flexion** of joints, required for comfortable sitting and negotiating steps and stairs.
   a. Pedal crank — gradual increase to full radius.
   b. Seat position — gradual lowering of seat posturally from the centre hub.
3. **Joint mobility** and relief of joint pressures.
   a. Joints to be put through as full a range of movements as possible.
   b. Pedal crank — maximum range.
   c. Seat position — adjusted according to requirements.
   d. Speedometer/Odometer — assists with rhythmical smooth work.
   e. Quick pedalling for mobility.
4. **Muscle tone and strength**
   a. Pedal crank — adjust for range.
   b. Seat position — adjust for power application, in flexion or extension.
   c. Application of braking system.
   d. Slow pedalling for strength.
5. **Psychological Participation**
   a. Pedal crank — large as possible.
   b. Seat position — maximum comfort and efficiency.
   c. Back rest — correct postural position for comfort.
   d. Saw/drill units — driven either mechanically or electrically.
   e. Visual or Audio aids — using 6-Volt or 240-Volt supply sockets, as required.

Notes:-

1. Short pedal crank gives smaller turning circle, but requires more effort.
2. Back rest for prevention of compensatory movements, aids balance and co-ordination.
3. Table height and emplacement — correct for postural positioning, prevents eyestrain, etc.
4. Seat tilt — upward tilt for flexion movements, downward tilt for extension movements.

RECORDING PROGRESS

A record sheet should always be kept for each patient and all relevant points noted systematically and regularly. It will generally be found that all columns will need to be initially completed for every patient, but that only selected columns will require continuous attention, dependent upon the disability of the patient and the aims of the treatment Fig (7).

Note: It is recommended that the Sagittal Frontal Transverse Rotation system of joint motion be used for all recordings and that the affected side should be compared with the opposite side to obtain a 'normal' standard.

Suggested size of record sheet = A5 (148mm x 210mm).

RECORD SHEET **Ref:** OT 697

Name: J Smith

Disability: Stiff Rt knee following immobilisation POP

Aim of Treatment: Mobilisation of Rt knee

Initial Limitation of Movement: S 0° 5° 10°

Final Range of Movement: Full range S 10° 0° 135°

Date Commenced: 12th August **Date Completed:** 2nd Sept

Treatment Sessions: 2 x weekly, Tues, Fri - 14.00 hrs

	Seat	Seat	Pedal	Table	Table	Speed	Odometer			Brake
Date	height	Distance	Length	height	Emplacement		Start	Finish	Duration	Setting
12th Aug	10	8	2	10	7	10	677.5	679.1	10 min	/
—										
—										
—										
—										
—										
—										
—										
2nd Sept	3	2	8	3	2	15	965.7	973.2	30	250

FUNCTIONAL ACTIVITIES	Date of Change	Comments
Drill/Saw:		
Medi./Electric Drive:		
6v/240v Outlet:	- 12th Aug. 6v Stroke projector - 17th Aug. Saw Electric Drive - 2nd Sept. Saw & Drill Mech drive & Brake	

Figure 7

PROGRESSIVE DEVELOPMENT FROM MINIMUM TO MAXIMUM POTENTIAL

In the early stages of treatment when the patient has diminutive muscular activity, is nervous and rather apprehensive — particularly with the elderly — it is often helpful if the therapist actively assists in acquiring the rotational pattern of pedal movement.

Having positioned the seat cradle in relationship to the machine unit and securely fastened them together with the patient's feet strapped to the pedal boards, the therapist should fully release the brake to free the pedal movement and then holding one of the pedals with one hand, press downwards onto the patient's knee with the other hand, thereby assisting the patient to develop the movement required. It is very important that before commencing any movement, the following points are carefully checked:-

1. The **brake** is **fully disengaged.**
2. The **drive selector lever** is in the **electric position.**
3. The **motor switch** (on the instrument panel) is **off.**
4. The **drill/saw selector** is at **neutral.**

Whilst acquiring a steady, rhythmical cycling pattern, the patient should watch the indicator lights and try to pedal so that the amber light will cease to glow, and the green light remains constantly bright without flickering, achieved at approximately a speed of 5-7 mph.

It should be noted that a short radius pedal crank i.e. pedal nearest the centre hub, will make the pedal action harder, due to a reduction of the mechanical advantage experienced with a full radius crank. Therefore, it is always advisable to try, if circumstances permit to work with the longest radius possible. However, the equipment is so designed that there is minimal resistance inherent within the machine's structure without the presence of initial inertia experienced with a flywheel or cable drive mechanism in the primary drive, so that even a patient with minimal muscular function should be capable of operating the machine.

As soon as a continuous rhymical pedalling action has been developed, psychological participation in the rehabilitation progress should be encouraged through the use of visual or audio aids (utilising the accessory electric sockets), or the drill/saw mechanism.

1. The 6-Volt socket (no electrical mains connection needed) enables a low-power rear-projection photographic slide viewer to be used, or any other low-voltage equipment, such as a hot-wire polystyrene tile cutter, etc.
2. The 240-Volt socket (mains lead from the machine connected to an independent mains electrical power source) increases the scope of activities that can be incorporated; such as a record player, cassette recorder, or forward-projecting slide/film equipment.

In both these situations, there is no additional effort required by the patient, and all the activities will cease as soon as the pedalling action is discontinued.

3. The drill/saw mechanism (mains lead connected with the drive selector lever in the ELECTRIC position and the motor switch "ON") can also be engaged, as the constant-speed electric motor will operate the two units

without affecting the effort required to perform the pedalling action. It will be appreciated that because the patient is now actively participating in an additional physical as well as a psychological activity, there will be extra stress placed upon the muscles of skeletal control in preserving balance and posture.

4. Range of movement, speed of operation (speedometer) and duration of treatment (chronometer) all having been established, the braking system can now be incorporated with any of the above activities. The brake should be increased very gradually (see also Section, "Mounting and operating machine") until a reading of approximately 200 lb per square inch is achieved.

5. At this stage the braking system can be continued if either the 6-Volt or 240-Volt power sockets are being utilised, but as the resistance achieved is now approximately synchronous with the mechanical drive to the drill/saw mechanism, it may be desirable to change over the selector lever to **mechanical,** in which case, the brake should be returned to its Zero rating. It is, however, possible to continue with the brake on the electrical drive if required.

6. The initial resistance of the machine is now at a higher level with the introduction of the mechanical drive and the braking potential will at the same time be proportionally greater.

Braking should now be continued until the desired strength and stamina relationships have been accomplished.

GUIDING PRINCIPLES FOR VARIOUS DISABILITIES

MOBILISATION

Hip Joint — Guiding Principles

With restricted movements of the hip joint, the commencing position will be dependent upon the degree of mobility and orientation of the femur to the pelvis. The seat should be raised and moved forward as far as is comfortable for the patient who operates the machine, the pedal crank length being as long as possible. (See Section — "Mounting and Operating the Machine".)

As hip extension is an essential pre-requisite for unsupported walking, every effort will be made to develop hip movements of extension beyond the Zero standing position. Full hip extension will be obtained when the centre of the seat is vertically above the centre of the pedal hub, and the pedal crank extended see Fig (8). It will be appreciated that in this position, the postural spinal muscles are being used to maintain balance and posture and it is important that the erecta spinae muscles are developed to a high degree before attempting this particular pedalling position.

The backrest is a valuable aid in limiting unwanted compensatory movements within the pelvic girdle and spine and if the therapist stands on the seat cradle platform it is possible to reach over the steering handles and feel the patient's iliac crests to determine the amount of movement occuring.

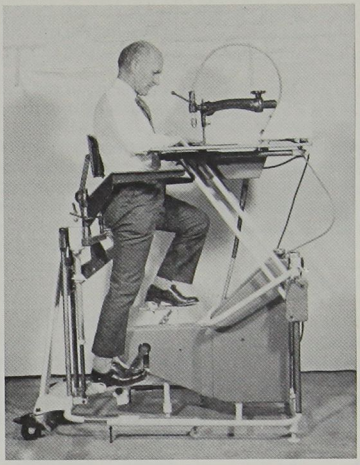

Figure 8

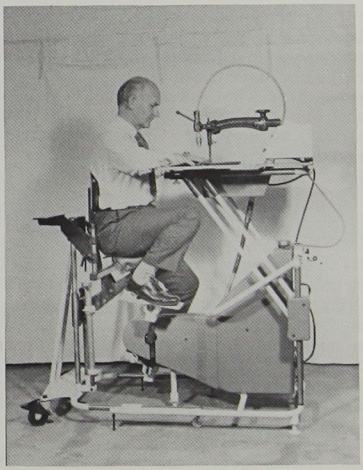

Figure 9

Adjustment of the angle of seat tilt may also be advantageous when the seat is vertically over the centre hub, (See Seat Cradle, Paragraph 1 — "Description of the Machine"), being altered to a downward tilt of approximately 5 degrees.

Flexion of the hip will be achieved by a lowering of the seat, but it should be moved back so that the front edge is now vertically over the centre hub (fig (9).

Cases involving prosthetic joints do exceptionally well on this type of equipment, as they can obtain movement without the disadvantage of too-early weight-bearing activities. (Application of braking to develop muscle tone and stamina will be introduced after the range of desired movement has been obtained by gradual progression.)

Summary: Hip Joint

Hip Extension
Seat Cradle — closed
Seat Height — raised
Seat Tilt — downward (if required)
Backrest — supportative
Pedal Crank — extended
Work Table — raised
Brake — gradual

Hip Flexion
Seat Cradle — closed
Seat Height — lowered
Seat Tilt — as desired
Backrest — as required
Pedal Crank — extended
Work Table — lowered
Brake — gradual

Knee Joint — Guiding Principles

When flexion of the knee joint is restricted to about 10 degrees of movement, as may be found in cases of patelectomy, menisectomy, fractured condules, or following prolonged immobilisation of the knee, etc., it will be necessary to place the seat in the raised and extended position, with the pedals set at their minimum range. The backrest should be positioned so that it rests within the natural lumber curve, with the patient sitting erect. This is particularly important, as the backrest assists in preventing pelvic tilt and lumber flexion, and so restricts movement to actual knee flexion. In the initial stages of movement, it may be necessary for the therapist to actively assist the patient in turning the pedals, particularly where gross loss of muscular movement is involved. The pedals should first be moved gently in a forward and backward motion, until full pedal rotation is achieved.

All adjustments to seat height, cradle position, and pedal length **must be made gradually** in order to receive maximum benefit, as any rapid alteration is likely to cause muscular spasm, especially in cases involving muscle shortening, arising from disuse, or when scar tissue is present. To facilitate the increased range of movement, the seat height adjustment should be carried out whilst the patient IS ACTUALLY OPERATING THE MACHINE. Once the seat has been lowered gradually by stages through a distance of 25mm (1in.), which may require one or more treatment sessions, the patient should then stop pedalling, whilst the seat is raised again to its original position and then the seat cradle is moved forward one section 25mm (1in.). This procedure maintains the newly-arrived range of movement and is continued throughout

the treatment, alternating between the lowering of the seat and bringing it nearer to the machine, until the front edge of the seat is approximately 5cm from a vertical line passing through the centre of the pedal hub. The work table emplacement must simultaneously be moved away from the patient towards the rear of the machine.

The seat is then finally lowered to that position which is concomitant with the patient's full knee flexion. A comparison of movements of the affected knee with the non-affected knee gives an indication of return to full function (see also "Recording Progress"). The pedal crank is likewise extended gradually at the commencement of each treatment session, dependent upon the progress made during the previous session and continuing until the maximum pedal crank length is obtained. Both pedal cranks should be adjusted at the same time and to the same length in order to stimulate a good cortical pattern and the development of full reciprocal innovation, especially in cases of muscle wastage and weakness. If the pedal crank of the affected leg only is altered, then a sense of imbalance will occur, with resultant cortical disharmony. It should be noted that as the pedal crank is extended, so the distance between the patient's knee and the work table will be decreased. Therefore, care should be taken to adjust the table height accordingly. As full knee flexion is restored and the pedal crank lengthened, the brake may be applied gradually, until full development of muscular tone and strength is achieved.

Summary: Knee Joint

1. **All alterations** to be made GRADUALLY whilst patient is operating the machine — as therapeutically indicated.
2. Raise or lower the seat height.
3. Open or close the seat cradle.
4. Close or extend the pedal crank.
5. Adjust table height and emplacement to suit correct postural position.
6. Alter brake as required.

Knee flexion
Seat Height — Lowered
Seat Cradle — Closed
Seat Tilt — Normal
Pedal Crank — Extended
Work Table — Lower and alter Emplacement

Knee Extension
Seat Height — Raised
Seat Cradle — Open Out
Seat Tilt — Normal
Pedal Crank — Extended
Work Table — Raise and alter Emplacement

Ankle Joint: Guiding Principles

All treatment of the feet and ankles is best undertaken in stocking feet, or thin plastic disposable shoes, with a felt or sponge pad placed on the footboard, thus allowing full, free activity of the intrinsic muscles of the foot, which are otherwise restricted by a normal shoe. A piece of felt placed underneath the fastening strap will also be helpful in preventing any possible irritation from the strap pressing against the stocking feet.

In order to obtain dorsi-flexion of the ankle joint, it is preferable not to use the ankle strap, but to remove the heel-piece altogether by sliding it off the foot board. The toe strap should still, however, be used and placed as close to the centre of the foot board as possible. This will prevent the foot from slipping forward and so decreasing the angle of joint movement, or the foot being lifted off the pedal at the extremity of each revolution of the pedal. In the terminal stages of treatment, it is even helpful if the patient's toes are positioned as close to the centre of the footboard as possible, but on no account should this latter adjustment be attempted in the early stages of treatment.

To obtain plantar-flexion of the ankle joint, the heel piece is gradually moved closer to the centre of the footboard, with both heel and toe straps in their relative positions. The seat is then gradually raised until full plantar-flexion has been achieved. In both cases of dorsi and plantar-flexion, the pedal crank is extended to suit individual requirements.

In the early stages of treatment of a Potts Fracture and/or immobilisation of the ankle joint in P.O.P. (with or without a rocker), the foot strap can be crossed and interlocked with each other to secure the foot to the footboard.

Summary: Ankle Joint

Stocking feet (preferable)

Work Table: Adjust for height and emplacement

Dorsi-flexion

Footboards — (Early stages) remove heelpiece, toestrap close to centre
(Later stages) transfer toestrap to heel position.

Pedal Crank — Extended

Seat Height — Lowered

Plantar-flexion

Footboards — Heelpiece closed to centre

Pedal Crank — Extended

Seat Height — Raised

Note: Brake as required.

Amputees — Guiding Principles

Amputees will find that the machine helps in maintaining muscle tone and joint mobility above the injury, develops strength in the stump muscle, and psychologically assists the patient to prepare for, and accept, a future prosthesis. A temporary prosthesis of the bucket type, lined with polyurethene or sponge rubber, is required, but care must be taken to see that pressure is not placed upon the terminal of the stump. The end of the prosthesis is secured to a footboard either by criss-crossing the footboard straps around the end of the prosthesis, or by making an appropriate terminal block which can in turn be strapped to the footboard. Care must be taken to see that the length of the prosthesis is concomitant with that of the sound limb. The length of the pedal crank will be the same as is normal for any particular age, as mentioned previously.

Summary: Amputees

Alterations: consistent with normal movements.

Footboards: use straps to secure prosthetes.

Pedal Cranks: equal lengths.

Brakes: increase as strength improves.

Hemiplegia — Guiding Principles

The footboards are invaluable in cases of hemiplegia, where plantar-flexion combined with marked inversion is a noticeable complication, the feet then being securely strapped to the footboards. It is advisable to set the patient's foot as far backwards on the footboards as possible, to help overcome the plantar-flexion already present. Strapping the foot in position prevents it falling off the pedal during rotation, helps with reciprocal innovation, and enables the non-affected leg to give some passive assistance to the affected leg. It will be realised that the affected leg must in fact work actively, otherwise it would be impossible for the non-affected leg to work the machine alone.

The backrest is again important in helping to maintain posture and in giving the patient support and confidence, especially when the patient is apprehensive. The affected hand should be placed in the hand hold provided on the work table, as this helps to preserve balance and at the same time it will be found that in this position the hand tends to relax. To prevent the hand slipping out of position, a backslab splint, extending as far as the metacarpal phalangeal crease should be used. The fingers are placed in the hand hold of the work table and the front end of the splint brought underneath the front end of the work table. It is beneficial if the fingers and wrists be hyper-extended before application of the splint.

Braking can be introduced very gradually as progress is maintained, but should be immediately relaxed or even discontinued if any irregularity occurs at the top dead centre of the pedalling stroke, or any sign of spasm in the muscle groups is detected.

The 6-Volt outlet socket used in conjunction with a rear projection slide transparency visual aid is of incalculable benefit in stimulating active psychological participation in the therapeutic programme. This is especially helpful when the dominant hand has been affected, with resultant difficulty in undertaking creative projects. When sawing and drilling, the electric selector drive mechanism can, however, be chosen to engage the motor-assisted drive, if the patient's own muscular power is inadequate.

Summary: Hemiplegia

Alterations — consistent with normal movements.
Footboards — heel well back and straps securely fastened.
Backrest — adjust for spinal support.
Work Table — Correct height and emplacement for good posture. Hand hold for affected hand in conjunction with back slab splint.
Brake — very gradually, as required.
6-Volt Socket — psychological participation.

Osteo and Rheumatoid Arthrosis — Guiding Principles

In cases of osteo and rheumatoid arthrosis it is necessary to find the optimum position of working within the range of pain tolerance and joint mobility. Quick pedalling combined with rhythmical work leads to an improvement in circulation and joint function.

Summary: Rheumatoid Arthrosis

Alterations — Consistent with normal range of movement with pain tolerance.

Pedal Cranks — Extend to maximum range possible.

Brakes — As necessary but not excessive.

Speed — Even rhythm important.

Cerebral Palsy — Guiding Principles

The footboards and straps should be used to prevent the feet slipping off the pedals, especially with cases of adducta-spasm, as found in spastic cerebral palsy. The speedometer should be watched carefully to ensure that the patient pedals at a uniform rhythmical speed. This helps in the formation of a good cortical control and in the establishment of walking patterns. The extensors of the hip and knee and the plantar flexors of the foot are used to depress one pedal, whilst the extensors of the other leg relax and the flexors lift the leg, prior to the foot being moved forward in readiness for the next process of depressing the alternate pedal. The establishment of a uniform rhythm also helps in general relaxation, with resultant decrease in spasm and involuntary movement. As large a pedal crank as is in keeping with the patient's age and ability should be used.

During the initial stages of treatment it may be necessary for one or two therapists to actively assist the patient in making a clear, precise revolution of the pedals, but it will soon be found that the patient will be able to undertake this with ease.

It will be noted that the work steady of the saw is particularly useful in preventing the work undertaken from bouncing about on the work table.

With children in particular, it has been found that not only does the machine help in co-ordinating the brain, eyes, hands, and feet, but that hand dexterity in the manipulation of work against the saw or with drilling techniques, with or without the aid of jigs, is greatly increased. The sense of achievement obtained from being able to make worthwhile objects, is also a factor which renders the machine invaluable. The additional features provided through audio and visual aids utilising either the 6-Volt or mains voltage outlet socket adds considerably to the efficiency of the machine and to the stimulation of mental attitudes.

Summary — Cerebral Palsy

Alterations — consistent with normal function.

Footboards — feet securely strapped in position.

Speed — even rhythm important.

Pedal Crank — extend within the patient's range, according to age.

Work Table — adjust height and emplacement for best posture hand holds for confidence.

T.B., Bronchial and Cardiac Conditions — Guiding Principles

Where strenuous hand or arm operations, such as sawing and planing are contra-indicated, as in the case of tuberculosis, bronchial or cardiac conditions, the machine will be found useful in the building up of gradual

work tolerance. The speedometer and odometer should be used for checking the rate and amount of work accomplished. The drive selector lever should be set at "Electrical," with the mains switch "On',, so that the drill/saw mechanism is operated by means of the mains electric motor, thus reducing the physical effort required by the patient. An extended pedal crank will ensure that the easiest work possible is undertaken and the seat cradle will provide a comfortable resting place at the onset of any sign of fatigue. Much more varied and interesting work can be undertaken than would be possible if the patient were restricted to sedentary occupations, which can be very demoralising for people who have previously undertaken skilled craftsmanship or manual work. The added potentiality for using audio or visual aids, etc., making the machine an even greater asset.

Summary: T.B., Bronchial and Cardiac Conditions

Speedometer/Odometer — Check for work tolerance and achievement.
Speed — even and rhythmical.
Brake — if and when required.
Pedals — extended.
Work Table — adjust for height and emplacement for correct posture (very important).
Drive Selector Lever — electrical and motor switch "ON".

Psychological — Guiding Principles

The need for physical activity is equally necessary when dealing with cases of mental sickness, as when undertaking rehabilitation from traumatic injuries. The machine will, therefore, provide a way of obtaining this necessary exercise whilst still allowing for full therapeutic supervision. Not only will it provide the means for stimulating general body tone and well-being, but also absorb the patient's mental activity, especially through the application of audio and/or visual aids, utilising the 6-volt or mains supply socket outlets. The brake will be useful in building up muscle tone and providing adequate daily exercise. The necessity for altering the positions of the pedal cranks will not, of course, apply to the same extent as when dealing with physical disabilities. Generally the pedal cranks will be set and left in the normal working position, i.e. No. 5 for children and short people and Nos. 8 or 9 for adults. The seat height, table height and emplacement would, however, be adjusted in the normal manner to ensure good body posture whilst working.

Because of its sturdy construction, the machine will stand up to the most vigorous of handling, as may be encountered with manic conditions, etc., whilst the saw guard provides a safety measure which will ensure the minimum of risk of the patient inflicting any personal injury. Concentration will be much improved by the absorbing detailed work that can be undertaken, as in the cutting of intricate shapes and patterns, and the drilling of specifically marked holes in pieces of wood, as, for instance, with a cribbage board, and also through the use of the audio and visual aids, etc.

Initiative and self-expression can be developed, whilst an outlet for excessive energies is readily available, particularly if the braking is combined with a target set upon the speedometer and odometer.

Inner Tension is relieved by the active work available with the machine and in cases of depression, the ability to succeed can be quickly established with

the aids of guides and jigs, which will facilitate the accomplishment of easily-completed tasks. Self control will also be encouraged if work of a responsible nature is asssigned to suitable patients.

Summary: Psychological

Alterations — consistent with body stature.
Saw Guard — secure in position.
Speed — consistent.
Odometer — set a target.
Pedal Cranks — consistent with age requirements.
Brake — build up to resistance required.
Guides and Jigs — use as applicable.
Auxillary Sockets (6v and 240v) — beneficial with Audio and Visual Aids.

Mentally Handicapped — Guiding Principles

With mentally handicapped and chronic patients, there is often a need for easily accomplished repetitive work, which can be undertaken with a minimum of supervision. Guides and jigs will again be of immense help and comparative readings of the odometer will enable the therapists to determine the amount of work being undertaken at any given time. The cutting out and construction of simple mail boxes or basketry bases, with the resultant drilling and finishing, provide some useful occupations. These, together with the cutting of shapes in polystyrene sheets with a hot wire cutter for decoration and mobiles, etc., give much varied work. The 6-volt or mains supply outlet sockets operating a record player or slide projector also provide a very valuable contribution to the development of mental concentration.

Summary: Mentally Handicapped

Alterations — according to physical development
Work Table — height and emplacement important
Auxiliary Sockets (6v and 240v) — audio and visual aids, wire cutter, etc. helpful
Jigs and Guides — necessary for accurate work

Whilst having endeavoured to give as wide a picture as possible of the potentialities of the Machine, it will be appreciated that it is almost an impossible task to deal with each and every aspect of the treatment and conditions that will be encountered. It is hoped, however, that all occupational therapists and others who may use the Machine may find the foregoing helpful in dealing with the ever-present problems of rehabilitation.

The Seat Cradle as an Independent Unit

The seat cradle can be used independently of the rest of the machine, and as such is of great benefit in both occupational therapy and physiotherapy departments, as well as in rehabilitation units, workshops, offices, and domestic situations, where an adjustable type of seat is required.

When the end of the arm rests are brought into close proximity to each other in front of the patient, a useful walking frame is provided, to encourage the development of walking patterns. Fig (10). The seat should be lowered to allow for free movement of the patient's legs on either side of the seat. The

Figure 10

seat then provides an essential resting place at the onset of any sign of fatigue. Patients suffering from Anterior Poliomyelilitis, Cerebral Palsy, or disseminated Sclerosis, etc., will find that when the seat cradle is used in the foregoing manner, it will enable them to be completely independent in getting about the workshop or kitchen, etc., without the necessity of requiring other assistance. The cradle may also be used as an early non-weight bearing walking frame, when the seat should then be lowered until the patient's feet rest comfortably on the floor whilst still sitting on the seat, movement of the cradle is then obtained by pushing the feet against the floor. As weight-bearing is reinstituted, so the seat is lowered, and the patient should then stand up, holding onto the arm rests.

Having propelled themselves to a work bench, the seat height is readjusted to the height of the patient's groin and is now used as a prop against which to press the top of the leg, the backrest being moved horizontally forward to give complete spinal support as and when required. The rear wheels must have the brakes applied in order to prevent any backward movement of the cradle.

The seat cradle may also be used as a stool, when the adjustability of the seat height will enable work to be undertaken at a lathe, vertical drill, or other situation which would otherwise be extremely difficult or even impossible.

The range of work available to the severely disabled can also be greatly increased by the addition of a tray of approximately 60 cm by 40 cm. To hold the tray to the seat cradle, it should have two parallel slotted bars, projecting forward from the edge of the tray, and being securely fastened under the tray. The slots would then fit the T-angle arm rests which have already been set parallel and level to each other. The tray can be used as a writing table, a drawing board, or with a small clamp or vice as a miniature work bench, enabling work to be undertaken which might be difficult at a normal table.

It will be quickly realised that even when using the seat cradle as a walking frame, such a tray would also be useful in enabling a patient to carry objects, even though they still need to hold onto the cradle arm rests for support.

The patients should rest their feet on the side rails of the cradle frame, or on an easily constructed footboard. The board being the width of the cradle frame and having safety stops screwed at either end. The cradle can then be manipulated easily by the Therapist, using the steering handles at the rear end of the seat column. Particularly with cases of Quadriplaegia, etc., this is a great advantage in conveying patients from the machine to their next workplace or therapy department, without the necessity of transferring them to some other type of conveyance, with resultant strain and fatigue to both the patient and Therapist. A continuous progression of treatment is thus enabled to take place with the minimum of fatigue, an essential factor in a carefully planned programme.

As the seat cradle has four fully directional castors, it is very manoevrable and can be moved at right angles from a stationary position, instead of requiring a large turning circle, this being especially important when negotiating work benches, machinery and in confined spaces.

It is appreciated, however, that whilst the seat cradle is being used in any of the foregoing manners, that the machine itself cannot be put into full operation. In order to cover such contingencies, it would seem advisable to have at least two seat cradles to each saw and pedal unit, depending upon the requirements of individual departments.

ACTIVITIES AND PROJECTS WHICH CAN BE UNDERTAKEN ON THE MACHINE.

Activites

1. Audio and visual aids — record players, slides and films etc. (using auxillary 6v, 240v sockets).
2. Hot wire cutters — 6 volt supply.
3. Soldering and engraving — power sockets.
4. Sawing — mechanical or power drive — fine, medium and course blades.
5. Drilling — mechanical or power drive — vertical or horizontal operation.
6. Sanding, polishing, grinding — variable positions.
7. Flexible drill chuck — infinitely adjustable, for engraving, etc.

Projects

1. Aids and appliances for the disabled.
2. Basketry bases, book ends, bath seats, etc.
3. Coffee tables, cupboards and cabinets, cheese boards, cribbage boards, etc.
4. Discs, made from metal or wood for wood-turning or copper beating, Domino sets, etc.
5. Jig-saw puzzles, etc.
6. Mobiles. (Polystyrene tiles using hot wire cutter) etc.

7. Splint making, soldering.
8. Toys, templates, table mats, etc.

Application

With the introduction of an independent electrical power source the machine is much more versatile than with previous models and enables pre-project activity to be undertaken. The patient's attention is aroused immediately by the primary oscillation of the amber light to the green light together with the facility to use visual and/or audio aids, etc., (such as slide rear projectors, music, record players etc.) during the first treatment session. The ability to actuate such auxiliary equipment by their own physical motivation is a great stimulus to patients and quickly leads to greater participation as it becomes evident that progressive activity in time duration and scope of occupation is possible. Patients will also willingly help with the sorting of photographic slides, etc., between treatment sessions.

The projects undertaken with the machine can be many and varied, ranging in extent from sawing with wood of up to 32mm in thickness, to drilling both vertically and horizontally, sanding, grinding and polishing. Splint making in perspex, aluminium, or any other media is a useful adjunct in an orthopaedic department, whilst the undertaking of various aids such as trays for wheelchairs, folding bath seats and other appliances are always in great demand. The making of basketry bases entailing sawing, drilling and sanding, provides a useful addition to the department's resources and provides a quick and easy occupation in times of pressure.

Difficulty is sometimes experienced in thinking of articles to be made on the machine, but a little careful thought will soon help to overcome this obstacle. Apart from the usual jig-saw puzzles and book-ends, quite large articles can be completed, such as four-tier cake stands, needlework boxes, bathroom cabinets and coffee tables, etc. If the work is first sectionalised into small components, the amount of work undertaken at any one time can be carefully supervised to fit in with the prescribed treatment period. This can then be combined with active periods at the work bench, when the marking out of the work, the trimming of the joints and the finishing with paints and polishes, are undertaken. With Hemiplegic patients for example, it has been found beneficial if periods of treatment on the machine are followed by periods at the workbench, when emphasis can be laid upon treatment of the arm whilst resting the leg. As previously mentioned, the affected arm will be more relaxed and so active work in planing, etc., can be undertaken, the back slab splint being used this time to hold the hand on to an extended handle or knob at the front of a plane. Similarly with other conditions, alternative periods of work at a bench and then on the machine will provide a well planned rehabilitation scheme and at the same time prevent the formation of a queue when other patients are waiting to use the machine.

Jigs and Guides

Jigs and guides will be found to be an advantage in producing repetitive pieces of work of the same size and shape, such as strips of wood and circular pieces. An adjustable saw guide can be made for the cutting of uniform strips of wood.

The wood to be cut is held against the saw guide and gently pushed against the saw blade, with care being taken that the wood is not, however, pushed too hard or the blade will be forced out of alignment, with resultant irregularity, or the blade may even get broken. If four ¼in. holes are drilled through the top of the worktable, two on either side of the saw, a guide can then be positoned for use with either the right or the left hand.

Circles can be cut with the aid of a circle cutting pin, made from a gramophone needle and a thick washer. Only the point of the needle should protrude through the washer and then it should be let into the top of the worktable at a distance from the saw equal to the radius of the circle required. If a number of set positions are prepared at right angles to the saw then known sizes of circles can quickly be obtained using either hand. The wood to be cut is pressed on to the pin with one edge of the wood firmly against the side of the saw blade, care is taken not to push the blade out of alignment and then the wood is rotated against the saw, whilst maintaining an even rhythmical speed. The speedometer is a useful adjunct and should be used to gauge a speed of approximately 10-15 miles an hour, or alternatively the electric power drive could be utilised. The circular pieces of wood are smoothed off after cutting with the aid of a sanding disc mounted into the drill chuck, which in turn is placed in the horizontal position. A sanding platform is strongly recommended for all such operations and can easily be made and clamped to the worktable. When the drillhead is being used in the horizontal position for sanding, grinding or polishing, or even in the vertical position for drilling, it may be found to be of advantage if the saw work steady is first dropped down on to the worktable and secured to support the overhead arm, thus helping to minimise any vibration which might be set up by the action of the drillhead. This manoeuvre is not practicable however, when undertaking the drilling of large pieces of wood, which have to pass directly underneath the overhead arm; in which case the work steady should be raised to clear the material involved.

Joints

Joints of various types can be made with the machine, using both the saw and the drill heads. It is very important to see that all joints are clearly marked before any cutting is undertaken and that all the saw cuts are made on the "waste side of the line", the waste pieces also being clearly marked with a large "X."

Box Combing Joints

Box combing joints are one of the easiest joints to undertake, as the waste wood can be removed entirely with a sawing action. An alternative method can be used in which a hole is first drilled in one corner of the waste piece, with a saw cut then being made along the side opposite to the hole. This is followed by a saw cut along the side into the hole, then the work can be turned to allow the saw to cut along the base of the waste piece which is removed as a whole unit.

Mortice and Tenon Joints

The saw is used for cutting the cheeks, shoulders and haunches of the tenon, whilst through mortices will first require a hole drilling at each end so that the waste can then be removed with the saw. Stub mortices, i.e. those only going part way through the wood, as in a leg of a stool, will need the bulk of the waste removing by consecutive drillings and the sides of the mortice trimming with the chisel at the work bench.

Dovetail Joints

Dovetail joints can have the "tails" cut directly from the saw, but the "pins" need to be cut out square with the narrow side of the waste piece uppermost. The taper is then removed with either a file or chisel at the work bench. Alternatively, a wedge-shaped board of the correct dovetail angle can be placed underneath pins when cutting, which will enable the sides of the pins also to be cut direct with the saw. The end crosspiece of the waste must, however, be removed whilst the wood is flat on the work table. (Ill. 24).

Dowel Joints

Dowel joints are made entirely with the use of the drillhead, into which is fitted a suitable drill according to the size of dowel available and the thickness of wood being used. The pieces of wood to be drilled should be very carefully marked together and then supported against the saw guide and sanding platform, according to which hole is being drilled. The correct alignment of all holes is absolutely essential.

NOTES ON MAINTENANCE

The machine has been constructed so that the minimum of maintenance is needed.

Before commencing any activity check:

Each Treatment

1. The patient is correctly positioned.
2. The worktable is at the correct postural height and emplacement.
3. All switches are at the correct settings.
4. Control levers are in their relative correct positions.
5. Tighten all locking screws on the worktable etc.

Daily

1. Empty sawdust receptacle.
2. Keep work surface clean.
3. Replace any broken saw blades.
4. Switch OFF mains supply at the end of each treatment session.

Weekly

1. Wipe off any surplus oil around the hydraulic jack system.
2. Use thin machine oil at all oiling points.
3. Check and tighten any loose nuts or fittings etc.

Monthly

1. Oil all oiling points, especially (1) seat cradle castors, (2) pedal hub, (3) pedal spindles.
2. Check and tighten any loose fittings.
3. Check the footboard straps for wear, renew if necessary.

Yearly

Have an annual overhaul, comprising:—

1. General inspection of the machine for loose or worn parts.
2. A replacement of defective items.
3. Correct lubrication of all moving components.
4. Adjustment and setting of all variable controls, e.g. chain/belt drives, etc.
5. Checking of working efficiency.

Note: Any electrical fault should be attended to **immediately at all times.**

POSSIBLE DIFFICULTIES AND THEIR REMEDIES

Panel lights will not glow.

1. Check to see that vibration has not loosened any lamp.
2. Replace any defective bulb.
3. Check wire connections, tighten if loose.

Electric Motor will not function.

1. Check that the motor switch (on the instrument panel) is "On."
2. Check electric/mechanical selector lever is engaged in electrical position.
3. Check drill/saw lever is engaged in its respective position.
4. Check the mains supply socket is switched on (a red light will glow on the instrument panel).

If the saw will not cut or keep to a straight line.

1. Check that the saw is not working at too slow a speed, if necessary increase the rate of pedalling or change to the electric drive.
2. Check that the blade is not blunt, if it is, renew it.
3. Check that the blade has the correct number of teeth in contact for the work that is being undertaken.
4. Check that the teeth of the saw blade are pointing downwards.
5. Check that the saw blade is not twisted.
6. Check that too great a pressure is not exerted against the blade, which might cause its misalignment, jamming, or breakage.
7. Check that the work steady is not pressing too heavily on to the work, thus preventing the work from sliding on the worktable.

If the drill chuck becomes loose, or stops turning, or the drill will not cut.

1. Check to see that the drill chuck is turning in a clockwise direction.
2. Check that the drill head is not being pressed down too quickly against the work, thus jamming the drill. Holes should be drilled by degrees of depth in short bursts, taking the drill in and out of the hole in order to clear away the waste wood or swarf.

If the drillhead vibrates when sanding, etc.

1. Check that the work steady is used to support the overhead arm.
2. Check that the sanding disc does not exceed a maximum of 6in. or 15cm in diameter.
3. Check that a constant speed is used throughout the drilling operation by watching the speedometer or using the electric drive mechanism.

SPARE PARTS

In the event of any spare parts being required from the manufacturers, quote the machine number and an exact description of the items.

History and Development

A bicycle type of fret-saw machine has always been of great value in many occupational therapy departments for the treatment of patients suffering from disabilities involving the lower limbs, but in its conventional form, it had many limitations, especially in the treatment of spastic paralysis, flexion contractures of the knees and hips, and also in severe osteo-arthritis, etc. Often, with such disabilities, the only way in which the patient could receive this particular form of therapy was by being lifted onto a machine, with resultant strain both to the patient and therapist.

In 1950, at Langthorne Geriatric Hospital, London, a machine which was more adjustable, with a greater versatility and providing better security for the patient, was conceived. The basic concept was to provide a machine with two separate units, namely:

1. A saw and pedal unit
2. A seat unit

The main factor to be considered was that there should be no obstruction preventing a patient passing between the saw unit and the seat unit: the seat itself being adjustable both vertically and horizontally, thus enabling a patient to be raised or lowered whilst actually operating the machine. A brake was also included to increase the power and effort required by the patient, the saw being removable so that a drill could be used in its place.

Later, in 1957 at the Central Middlesex Hospital, it was evident that due to the growing needs of modern rehabilitation in an industrial area, a new machine was required which would stand up to considerable stress and allow for variations in the heights and strength of patients, from young children to tall adults.

So, in July 1958 at the National Association for the prevention of Tuberculosis Conference, held at the Festival Hall, London, the first prototype machine was presented for public exhibition.

Then in August of the same year, at the Occupational Therapy Second International Congress at Copenhagen, the machine was again shown and demonstrated. Previous appraisals were reaffirmed, following which steps were taken to produce this machine for distribution on a world basis. Messrs. Nottingham Medical Equipment Company, specialist supplier throughout the world for educational, rehabilitation and occupational therapy purposes, undertook distribution of the machines. The first production model was despatched in November, 1958.

August 1959 saw the introduction of a Mark II Machine, incorporating minor modifications and improvements, as well as the addition of stay level pedals, an improved saw guard, and simplified drill change.

In February 1965, the machine was re-designed by the author to overcome the problem of initial inertia within the flexible drive experienced in earlier models. The Mark III Machine incorporated a completely new belt-drive mechanism which gave easier pedalling in the earliest stages of treatment by even the most severely disabled patient, reduced vibration and mechanical sound, whilst still allowing a full progressive rehabilitation programme. The drill head and saw units were interchangeable with no appreciable alteration in resistance, yet capable of drilling through half-inch mild steel, and of sawing 2in. thick timber. A direct resistance brake operated at the pedal hub and was calibrated in pounds and kilogrammes, which gave added facilities for the build-up of muscle tone and power.

The year 1969 saw a further change, incorporating a hydraulic jack for the seat elevation and also a hydraulically-operated brake, with pressure gauge, for recording purposes. These two innovations in no way detracted from the original concept of the machine, but greatly enhanced the ease of operation and recording for the therapist.

Major structural changes in 1975 include for and aft emplacements of the work table, with increased vertical elevation of both the table and the seat, which assist greatly in the correct postural positioning of the patient, at the same time allowing the seat to be moved forward over the centre of the pedal hub, with resultant increased range of hip extension. Accessibility for the necessary adjustments to the pedal cranks is also enhanced. The introduction of variable arm rests gives increased comfort and confidence to the patient and the machine frame has additional stabilising bolts and self-levelling feet.

A new therapeutic concept, introducing low and high voltage outlet sockets enables audio and visual aids, interalia, to be used as part of the treatment programme, whilst a constant speed electric motor, selected as required, means that even the weakest patient can utilise the saw and drill units with ease.

The brake mechanism being also improved with the hydraulically-operated external semi-circular drum brake, allows for variations in resistance at **all** stages of treatment, with the added facility of locking the pedals for adjustment when mounting or dismounting from the machine.

A chronometer and records/accessories compartment are incorporated in a new control panel, adding to the aesthetic appearance of the machine, whilst predominant features of all previous models are carefully preserved. Oliver Rehabilitation machines are being used in many types of hospitals and rehabilitation centres, as well as schools for physically handicapped children, in countries all over the world, including:

Australia, Austria, Belgium, Burmah, British Isles, Canada, Cuba, Denmark, France, Germany, Greece, Holland, Hong Kong, India, Israel, Japan, Kuwait, Netherlands, Newfoundland, New Zealand, Norway, Philippines, Poland, Portugal, Rhodesia, South Africa, South America, Southern Ireland, Spain, Sweden, Switzerland, U.S.A.

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