HIGH INTENSITY

This booklet –

containing reproductions from original photographs, various charts and measurements, etc., has been issued for the purpose of placing before Projectionists the comparative results obtainable with the new Ship British High Intensity Carbons.

If, in the course of time, these co-ordinated results should prove of assistance to those daily engaged in projection work, or in turn result in our receiving the suggestions and co-operation of Projectionists, this booklet will have more than achieved its object.

LIGHT. "More light on the screen, please, and still more light," are to-day's constant demands on the Projectionist. Why?

Because the public have been educated up to expect the standard of illumination associated with the opaque or silver screen so generally used in silent film work.

Now that they are presented with the "talkies" projected upon the semi-transparent type of screen so essential to the efficient reproduction of sound from the loud speaker behind it, they expect and demand the same intensity of screen illumination to which they have always been accustomed.

They are not interested in the fact that a screen which will let through sound waves will obviously pass, instead of reflecting, light waves, nor do they know anything of the losses in intensity of illumination occasioned by colour pictures, dense films, or heavy atmospheres.

They merely ask for more light.

It is for this reason that a greater light intensity must be provided at the source, and for this reason, too, that the High Intensity Lamp is now recognised and accepted as one of the most important accessories in modern "talkie" equipment.

The object of this booklet is to cover briefly the use of "High Intensity" for Theatre projection work.

TO commence at the beginning, it is a well known fact that White Flame A.C. Carbons form two craters, due to the frequency of the circuit, whereas "Kino" Carbons on D.C. circuits form one crater, on the positive carbon only.

With standard D.C. Kino lamps and carbons arranged at an angle of 65° relative to the condensers, most of the crater illumination is utilised for projection.

The crater illumination is obtained by the consumption of the shell of the carbon becoming highly incandescent under the influence of an electric arc, the core serving principally to centralise and hold the arc to the centre of the positive carbon and thus enable a crater to be formed.

With A.C. Carbons the crater temperature is much lower than it is in the case of the equivalent D.C. circuit, therefore the illuminating value is less. Highly incandescent mineral salts are therefore introduced into the cores of the carbons, and these have the effect, during burning, of producing a luminous gas which increases enormously the crater temperature. The resultant illumination is thus obtained from one crater and from the incandescent radiation set up by the consumption of the salts in the arc.

NATURALLY, the results obtained in practice, both with D.C. and A.C. arcs, quickly led to experiments with flame salt impregnated carbons on direct current circuits, and at first appreciable difficulties were experienced in "holding the arc."

Necessity being the mother of invention, it was not long before mechanical control apparatus was available, and whilst these early attempts may have appeared complicated to the uninitiated, in recent years vast improvements have been made, and the High Intensity rotating lamp of to-day is a simple and beautiful piece of mechanism fit and worthy to receive—the Ship Carbon—the quality of which is the lamp's very life, and upon which its existence depends.

The illumination given by a High Intensity carbon is principally from a ball of highly and intensely iridescent matter resting within the shell and immediately in front of the core, having a temperature of about 4000° C, the direct C.P. of which is practically immeasurable.

THERE are three types of H.I. Lamp:—

(*a*) H.I. lamp with rotating positive carbon arranged with the crater facing the condensers and in co-axial alignment with the optical axis.

(*b*) H.I. lamp with rotating positive carbon and mirror reflector.

(*c*) H.I. Mirror Reflector lamp with stationary positive carbon. An example of each of these types of lamp is shown in Figs. I, II and III, respectively.

Many advantages are claimed for the lamp illustrated in Fig. I, viz., crater in alignment with the optical axis, fixed optical centre, definite rotation of positive carbon, feed by arc voltage control, total and substantial current contact immediately behind crater, relatively low "gate" temperature, etc.

This type of lamp is designed for use with positive carbons having hard inlaid cores carrying a very high salt content and for its satisfactory operation it is essential that such carbons alone be used. With any other type of core maximum illumination cannot be obtained and the pitting of the rear condensers will be found excessive and costly.

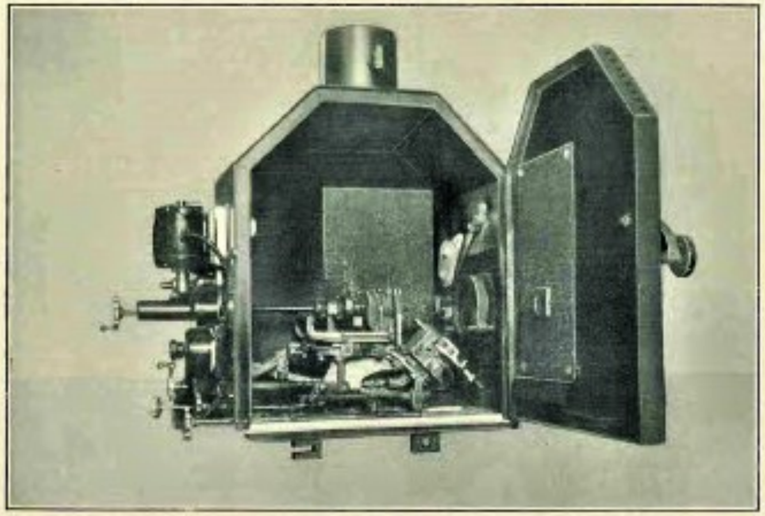


FIG. I.

CONTRARY to general belief the iridescent ball of flame forming the source of illumination *does not rotate*, the flame remains steady and constantly held in position by the tip of the negative. The periphery of the shell rotating around the light source passes in and out of the flame zone so that a relatively cooled section of the shell is always being brought into action, thus permitting perfect arc formation with consequent absence of shell flick due to "wandering arc."

The high arc voltage at which this lamp burns allows almost constant screen illumination and colour to be maintained.

The old saying that "cleanliness is next to godliness" applies particularly to this type of lamp and the Projectionist who makes a practice of cleaning the jaws daily and is always certain that feed wheels and other moving parts are free, guides clean and the tension on grub screw and jaws just right, will, in the long run, save time, trouble and annoyance.

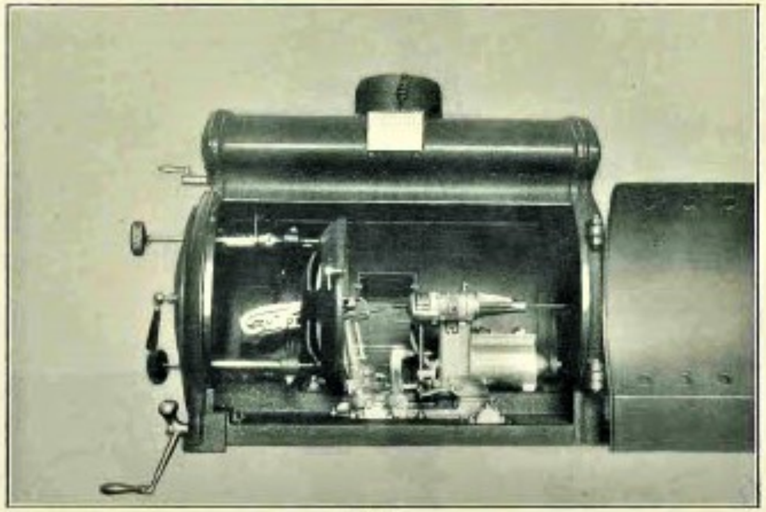


FIG. II.

The H.I. lamp illustrated by Fig. II combines a rotating positive carbon with a reflecting mirror. The arc is struck automatically, and several mechanical devices are most ingeniously employed.

The control mechanism is arranged in the base, but outside the lamp house, away from the heat generated by the arc and most easily accessible. Feed is by arc voltage control and substantial electrical contact for the positive carbon is provided for immediately behind the crater.

It is essential for the efficient and satisfactory operation of this lamp that perfectly matched carbons only should be used, otherwise some difficulty will be found in maintaining the correct focus. In using the hand adjustment provided care should be taken to revert to automatic control as quickly as possible in order to maintain perfect crater formation. In other respects the foregoing remarks on carbons for this type of arc (rotating) apply generally.

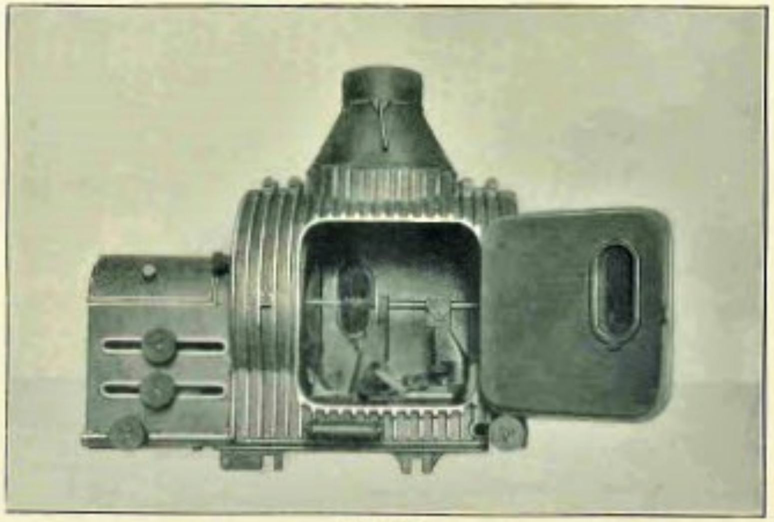


FIG. III.

The H.I. lamp illustrated by Fig. III carries a stationary positive carbon and will perhaps be more familiar to most readers in that it follows in general design the better quality of mirror type of reflector lamp with adjustments permitting H.I. carbons being used.

It is essential in order to obtain the best general results possible with a stationary H.I. positive carbon to take several factors into consideration. Providing the circuit conditions are suitable the hard inlaid cored carbon will give the best results.

An ideal circuit would be 110 volts or more in the line 32-35 volts across the arc, 75-78 volts drop across the rheostats, current flowing at 70 amperes and an arc gap of about $\frac{3}{8}$ in. These conditions with a hard inlaid cored carbon will however, produce a tail to the flaming arc that may cloud the top of the mirror if the lamp base has to be fixed at too great an angle.

WHERE the endeavour to obtain the best possible results must be sacrificed, to existing conditions, or for economic reasons, a squirted core H.I. carbon should be used—this type of core containing far less mineral salts will lend itself better to shorter arc burning conditions and in some instances will, depending largely upon the individual merits of each installation, prove generally more adaptable.

With this type of lamp current is usually carried to the positive carbon by paralleled carbon holders and constant care must be exercised to see that the front spring contact is *always clean and making good electrical contact*. Where automatic feed is installed some improvement in screen illumination is noticeable, and the Projectionist is relieved of the necessity of constant hand feeding. However, it should never be overlooked that when the automatic feed is *not* controlled by arc voltage regulation—the arc must be watched continuously, as even a slight generator surge may cause the carbons to feed too fast and "freeze" together.

FIG. IV.
Illustrates the burning of a rotating H.I. carbon arc.

FIG. V.
Illustrates the burning of a stationary H.I. carbon arc.

FIG. VI.

Illustrates the burnt end and crater formation of rotating carbons.

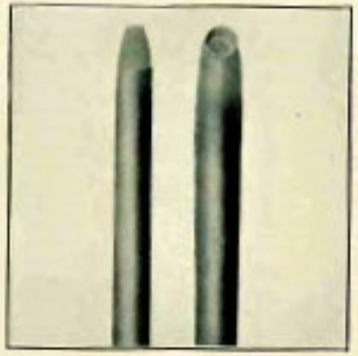


FIG. VII.

Illustrates the burnt end and crater formation of stationary carbons.

SHIP High Intensity Carbons are made in various diameters as standard from 6 m/m to 18 m/m, and we specialise in those most suitable for Theatre projection and studio work.

Two distinct types of H.I. positive carbon are manufactured :—

(1) Ship No. 90, suitable for rotating carbon arcs. This carbon contains heavily impregnated hard inlaid specially pressed core, super highly finished shell, a clean, hard, smooth burning carbon, ground dead straight and true. Gives a pure white light of intensive penetrating brilliancy. The finest quality product obtainable.

(2) Ship No. 91, suitable for stationary carbon arcs. This carbon contains a hard squirted core, super highly finished shell—a clean hard smooth burning carbon of extreme flexibility. Prepared with special metallic salts giving an exceptionally steady constant arc at high current, having hydraulically inserted core that will not pitt.

(3) Ship No. 95. A negative for use with either No. 90 or 91 positive carbons. Specially produced for High Intensity work. Cored and copper coated—of exceptionally high conductivity with ample safety factor for high current carrying capacity.

Each batch of Ship High Intensity Carbons is carefully tested for :—

(a) Hardness ;
(b) Porosity ;
(c) Density ;
(d) Resistance ;
(e) Flexibility ;
(f) Ash content ; and
(g) Conductivity.

Each Ship High Intensity Positive carbon is individually :—

(h) Gauged for correct diameter ;
(i) Gauged and checked for straightness.

Each Ship High Intensity Negative carbon is individually :—

(j) Measured for conductivity ; and
(k) Its copper coated thickness checked.

A " let down " or " stop " with the New Ship product is almost inconceivable. The care and thoroughness taken in manufacture and inspection enables us to give : **An unequivocal guarantee to every single piece of Ship Carbon.**

We are indebted to the " Illuminating Engineer " for their courtesy in permitting us to reproduce some of the tabulated matter and screen measurements taken personally by their Engineering correspondent and published in the Journal, July, 1930.

The following results were recorded with the different types of lamp referred to, when burned under various conditions with both the new Ship High Intensity Carbons and the best known competitive brands.

Measured illumination obtained from different pattern carbon film projection arc lamps of most recent construction, burning various makes of high intensity carbon. Screen of fine matt white coating on plaster background at 37 ft. from the " gate." Picture surface 6 ft. high, 8 ft. wide.

TEST SERIES A.—H.I. Rotating Carbon Projection Arc Lamp.

Positive Carbon 13.6 m/m dia. Negative 11 m/m dia.

Amperes.	Arc Volts.	Foot Candles on Screen.		
		British make.	American make.	Continental make.
100	57	55	50	55
110	57	85	70	70
120	58	110	100	95
130	59	130	125	115
140	59	170	150*	150‡
150	62	220	†	170§
Linear carbon consumption when burning at the maximum rated current.		Inches per hour.		
Positive		10¾	15	12-13
Negative		2	4½	2¾

NOTES.—The carbons were all rated for 130 amperes maximum current.

* The carbons with this current commenced throwing off minute particles of unburnt matter and the positive core started intermittent blowing, causing irregularity in the constancy of the illumination.

† The blowing of the cores was so constant that the arc was extinguished at very short intervals making light measurements impossible.

‡ The arc had become irregular owing to blowing and the size of crater had commenced to diminish.

§ The inconstancy of the arc became inconveniently noticeable and the size of crater had further diminished owing to spindling. The temperature at the gate was about 120° C.

TEST SERIES B.—H.I. Automatic Mirror Reflector Rotating Arc Lamp.

Positive Carbon 9 m/m dia. Negative Carbon 8 m/m dia.

Amperes.	Arc Volts.	Foot Candles on Screen.	
		British make.	American make.
50	49	75	45
55	50	98	70
60	50	120	100
65	52	150	110
70	54	180	140
75	60	230	170*
80	60	250	200†
Linear carbon consumption when burning at the maximum rated current.		Inches per hour.	
Positive		9½	9¾
Negative		3	3¼

NOTES.—The carbons were all rated for 70 amperes maximum current.

* Irregularity of illumination and sooting had commenced.

† The irregularity and sooting had become most pronounced and reduction in crater diameter was apparent.

The temperature at the gate was somewhat in excess of 540° C.

TEST SERIES C.—Mirror Reflector (Stationary Carbon) H.I. Arc Lamp.

Positive Carbon, 13.6 m/m dia. Negative 9 m/m dia.

On this pattern arc a slightly different series of tests was conducted in view of the :—

(*a*) Stationary carbons; (*b*) Hand feed: (*c*) Relatively low arc volts at which this type of lamp must be run, *i.e.*, 30-32 volts across the carbons.

To obtain the best comparative results, the arc was in each instance fed to its pre-determined voltage, at various currents, and then left without adjustment for a given period and the differences in screen illumination measured. The following results were obtained :—

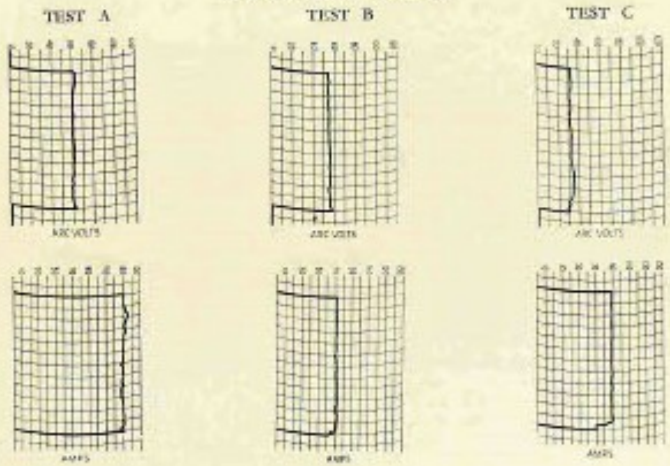
	Amperes.	Feeding Point.	Foot Candles on Screen at Seconds.					
			15	30	45	60	75	90
British ...	100	140	110	100	100	60	40	30
	85	90	90	75	65	55	45	45
	70	65	60	45	35	30	25	20
Continental ...	100	65	50	50	40	35	30	20
	85	60	55	45	45	40	40	40
	70	60	50	45	20	20	20	20

The temperature at the gate was in excess of 500° C.

It will be noticed that when the current density is reduced, which in effect is under-running the high Intensity carbons, the British carbon even then shows slight advantage, but at the correct and higher densities a marked superiority was obtained.

The measurements were all made on the same instruments, a Holophane Lumeter being used for determining the illumination, consequently the results are strictly comparable.

SHIP High Intensity Carbons Volt Ammeter Charts for normal circuits automatically recorded simultaneously with the tests tabulated under Test Series A, B and C.



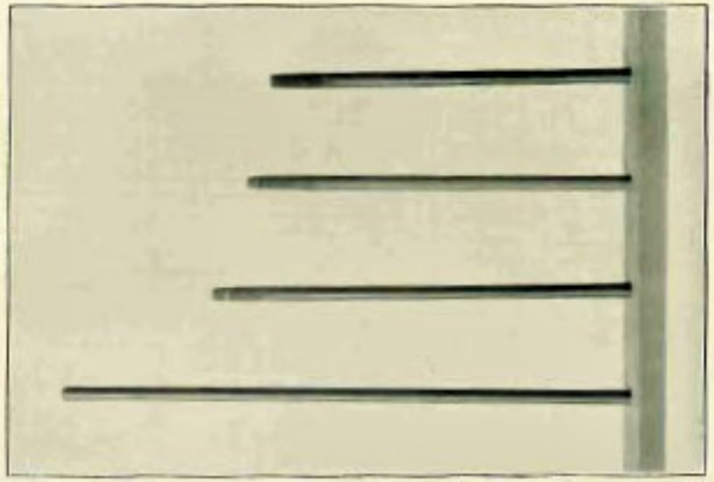


FIG VIII.

What does burning rate mean?

Upon the opposite page is an illustration, Fig. VIII, shewing an unburnt 20 in. carbon and a

(1) Ship H.I. Carbon;
(2) Continental Carbon;
(3) American Carbon,

all after burning half an hour in a rotating H.I. lamp at 130 amperes, 59 arc volts.

The consumption registered in inches per hour was:—

(1) Ship: 10¼.
(2) Continental: 13.
(3) American: 15.

shewing the consumption of Continental Carbon as 27 per cent. more than Ship, and the American 46 per cent. more than Ship.

This proves that the consumption of Ship Carbons is only 1.54 in. of positive carbon for 1,000 ft. of film, whereas the consumption of competitive positive carbons equals 1.95 in. per 1,000 ft. and 2.25 in. per 1,000 ft. respectively.

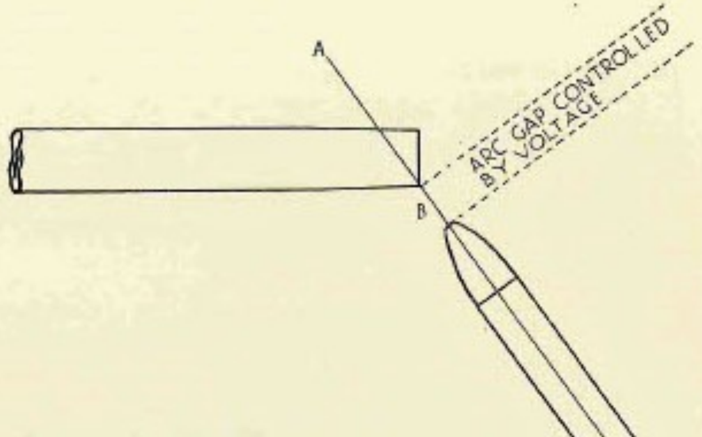


FIG. IX.

HOW TO OBTAIN THE BEST SCREEN RESULTS

To obtain the best results with H.I. rotating arcs, Fig. I and II, it is of primary importance to:

(1) Run the carbons at the current carrying capacity recommended, viz. :—

Positive.	Negative.	Amperes.	Arc Volts.
8 m/m	7 m/m	50	50
9 m/m	8 m/m	70	50-55
11 m/m	9 m/m	75	50-55
13.6 m/m	10 m/m	100-120	55-60
13.6 m/m	11 m/m	120-140	60-65
16 m/m	12 m/m	150	60-65

The arc voltage and current ratings given are essential and easily maintained when the generator line voltage is 100 or more. Modern theatre equipment includes generators of this pressure, which permits sufficient voltage being absorbed in the ballast resistances to keep high current arcs of this nature steady.

The ratings can also be maintained even with a generator delivering current at 85 volts provided suitable resistances are installed to permit correct arc volts.

(2) Maintain for arcs of the type illustrated by Fig. I the approximate carbon position as shewn in Fig. IX. The centre line AA, through the core of the negative carbon should cut the lower lip of the positive at B.

To obtain the best results with H.I. Stationary Arcs, Fig. III :—

(1) Run the carbons at the current carrying capacity recommended, i.e. —

Positive.	Negative.	Amperes.	Arc Volts.
8 m/m	6 m/m	30	30-32
9 m/m	7 m/m	40	30-32
11 m/m	8 m/m	50-60	30-32
11 m/m	9 m/m	60-70	30-32
13.6 m/m	9 m/m	80-100	30-32

The arc voltage must be maintained but the current ratings given are subject to greater latitude.

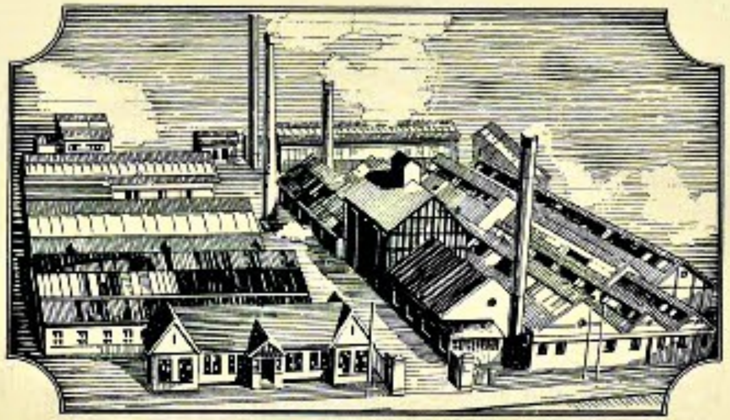
(2) The relative positions of positive to negative may be with the centre line of each in alignment or with the centre line through the negative slightly lower than the centre line through the positive. The latter position will cause the positive to burn with a lip but with less "flame." The relative position selected will largely depend upon the angle at which the lamp is inclined.

(3) Endeavour to maintain an even arc gap. Close feeding causes excessive burning of the core resulting in great loss of light until the shell is burnt back to correct position. Feeding at intervals of 1 to $1\frac{1}{2}$ minutes will give you a diversity factor on your screen illumination of from 2 to 3 whereas steady feeding at intervals of 5 to 15 seconds will keep a constant light on the screen.

(4) The use of an automatic feed now fitted by some manufacturers unquestionably produces more even screen illumination. The perfect adjustment of an automatic feed with hard inlaid cored-carbons gives an appreciably better result.

GUARANTEE

We Guarantee, either in our laboratory or in your theatre, with any equipment provided under any conditions laid down by you, to give better results with Ship Carbons than you can produce with any competitive carbon under the same comparative conditions.



The new Ship British Carbon Plant at Chadwell Heath embodies the accumulated experience of some 45 years of carbon manufacturing — our research and testing laboratories are the most modern and elaborate extant — we specialise in carbon manufacture and make nothing else. We are equipped to give exceptional technical and sales service. It is not our policy to supply what we think you should have. We can give you generally what you want from stock or will manufacture specially to your requirements.

You are cordially invited to avail yourself of the exceptional facilities our free service places at your disposal.