Hewittic Rectifiers

for Cinemas

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HEWITTIC ELECTRIC CO., LTD.

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LIST OF ILLUSTRATIONS

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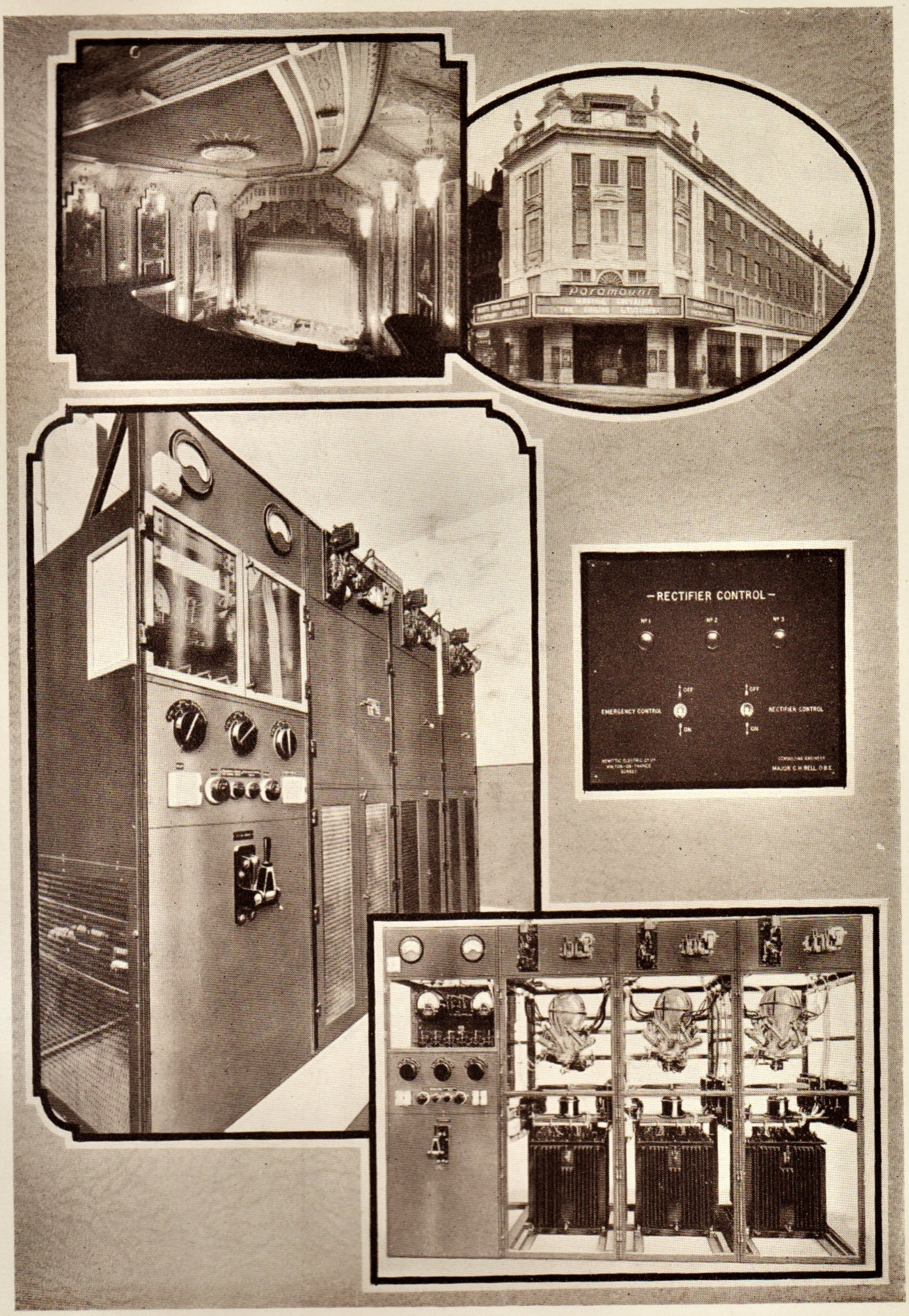


THE PARAMOUNT THEATRE, LEEDS.

Above : View of the Auditorium and Main Entrance to Theatre.

Centre : Hewittic Rectifier Equipment at the above, 600 amp. capacity, fully automatic. Also its Control Panel in the Projection Booth.

Below : The Rectifier Equipment on test at works.

HEWITTIC

BEST PROJECTION

The quality of the projection is one of the most important items which will contribute to the success of a Picture Theatre, and this is one of the main reasons why a Mercury Arc Rectifier is such an asset to a Cinema House.

The only widely used Converters in Cinemas are the Hewittic Mercury Arc Rectifier and Motor Generators, and it is of interest to examine how they compare from this point of view.

In the case of a Motor Generator Set the arc is only indirectly fed from the electric supply which feeds a motor which drives a Generator of just sufficient capacity to cope with the arc load conditions, and the power behind the arc is that of the Generator.

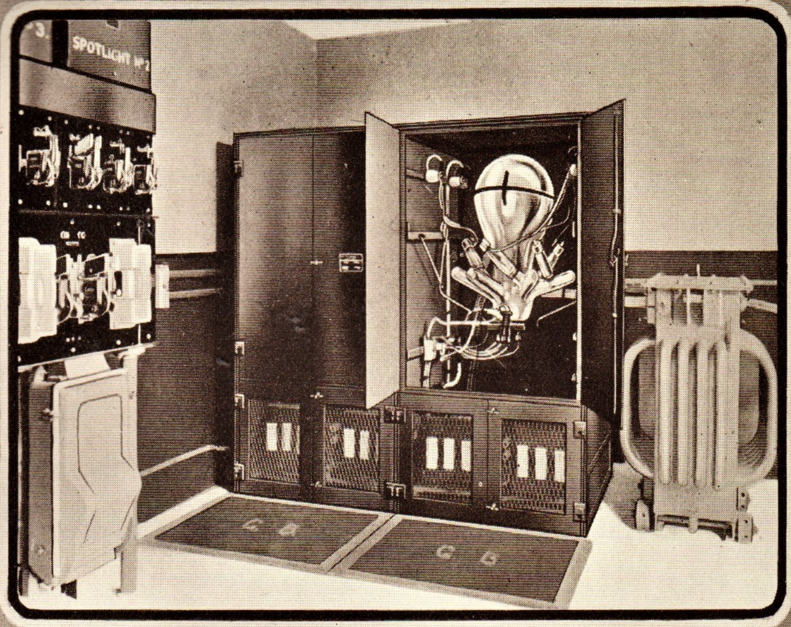
In the case of a Rectifier, the arc is supplied directly with the current from the electric supply, which is simply passed through a one-way valve, and so the power behind the arc is that of the electric supply system which feeds it.

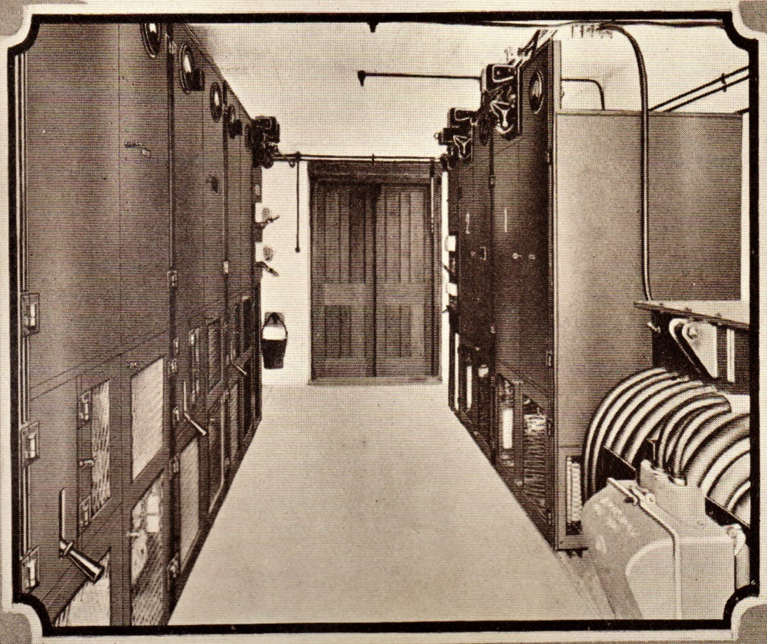
This difference is noticeable at once, and is generally alluded to by operators as the greater punch behind the arcs when they are fed through a Rectifier. The arc burns steadier, a better crater formation is obtained, giving a whiter and flickerless light.

Again, because of this same essential difference between the two forms of equipment, another advantage results in favour of the Rectifier inasmuch as no appreciable voltage drop occurs if a Rectifier is employed when the second arc is brought in, and therefore the same arc intensity is always maintained.

NO VOLTAGE DROP

HEWITTIC





Above : THE GAUMONT PALACE, HAMMERSMITH.
Two 350 Amp. 100 Volt Rectifier units feeding Projector Arcs.
Plant operating off a 3-phase supply.

Below : THE PARAMOUNT ASTORIA, FINSBURY PARK.
Three 250 Amp. 100 Volt Rectifier Units feeding Projector arcs (*left*).
Two 200 Amp. 400 Volt Rectifier Units feeding ventilating motors, etc. (*right*).
Plant operating off a single-phase supply.

HEWITTIC

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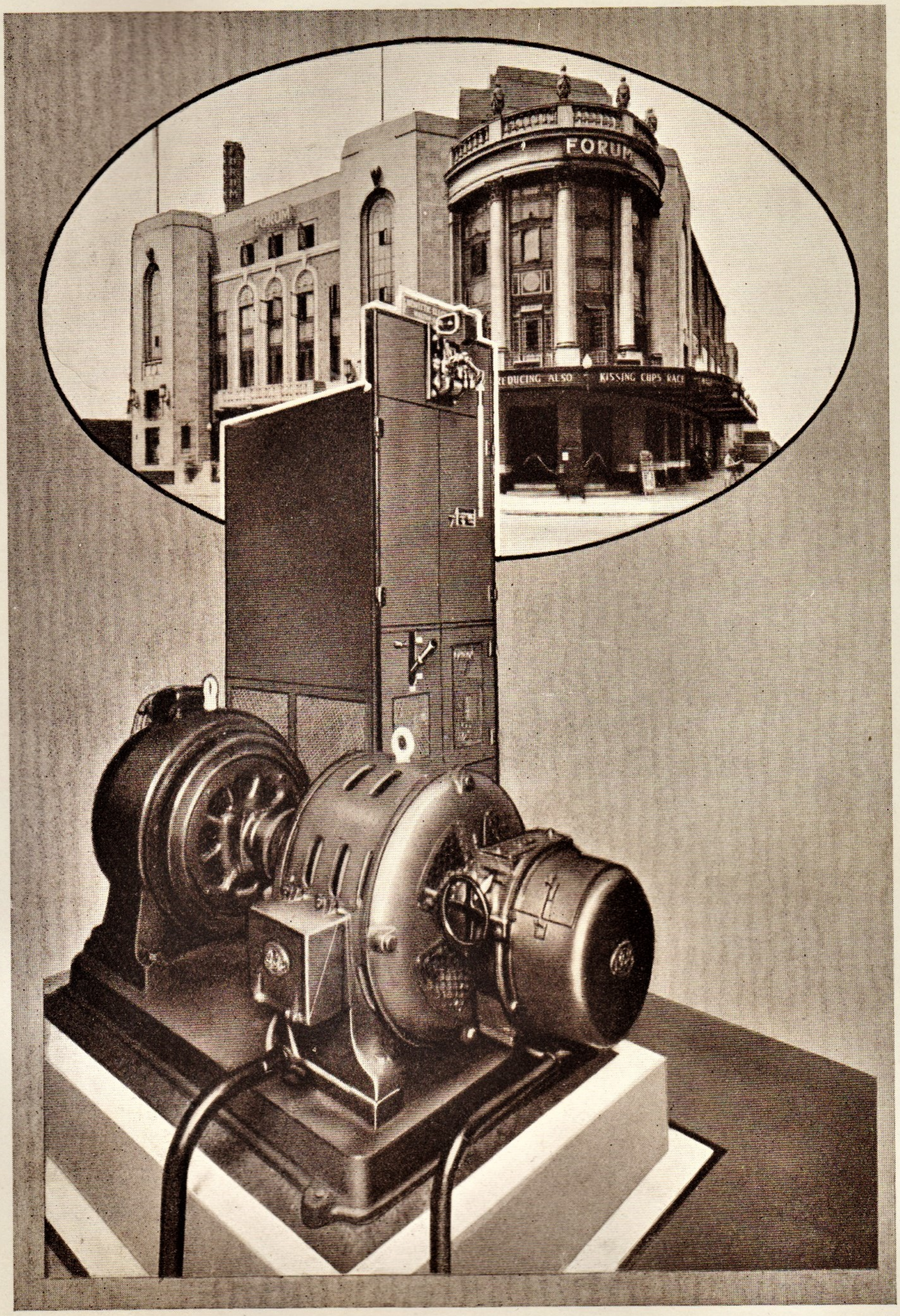


THE FORUM THEATRE,
SOUTH KENSINGTON.

Above : The Entrance on Fulham Road.
Below : 200/300 Amp. Rectifier in background.
Stand-by Generator in foreground.
(Rectifier and Generator adjacent to one another on site.)

HEWITTIC

LOWEST CURRENT CONSUMPTION

The Hewittic type Mercury Arc Rectifier keeps the current consumption not only down to a minimum, but far below that for corresponding rotating machines.

In consequence of this, very considerable economies can be effected in the current bill, these being in fact so great that a Rectifier will pay for itself out of these savings alone within a very short time.

The Rectifier efficiency figures are given on page 23; it will be noted that they are remarkably high particularly at low loads. As a result, the working or average efficiency attained with Rectifiers is generally 20 per cent. to 25 per cent. higher than that obtained from rotating machinery.

The following shows how this affects the current bill; considering as an example an installation with two 75 amp. arcs.

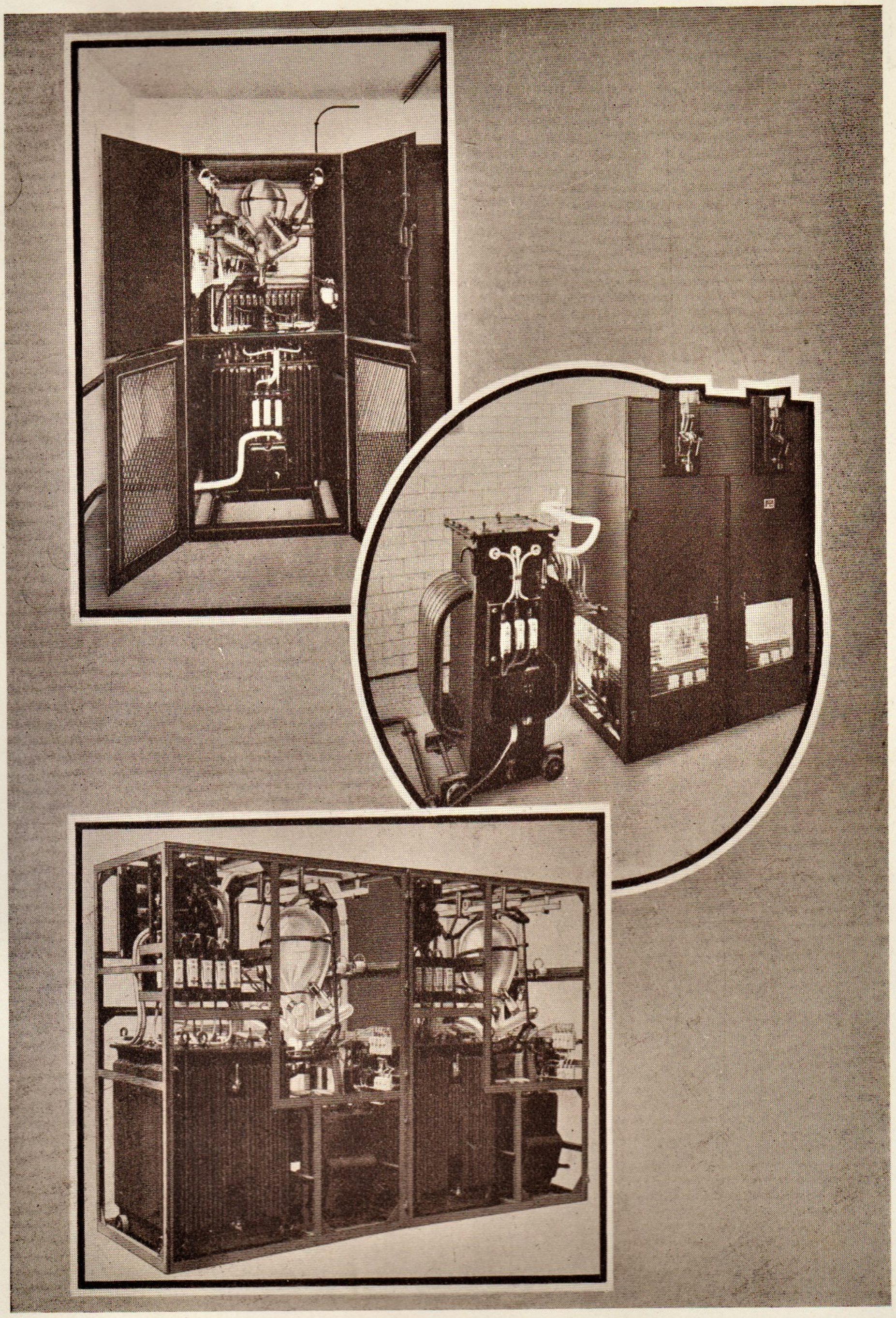
The average D.C. load in such a case would be 100 amps. 100 volts. (allowing for change overs). The A.C. current consumption for such a load would, with the average rotating machine, be about 18 units—with a Hewittic Rectifier (average efficiency 77 per cent.) about 13 units. Actually, the Rectifier consumption can be further reduced because its D.C. voltage output may be reduced from 100 to 80/90 without detriment to the projection.

But in any case, a saving of 5 units per hour results, or 250 units per 50-hour working week, or 13,000 units per annum, which at 1d. per unit represents a saving of over £50.

In short, with 100 ampere average load, and current a 1d. per unit, saving over £50 per annum. In larger installations, or higher tariffs, the saving would be proportionately greater.

HIGHEST EFFICIENCY

HEWITTIC



Above: KING'S THEATRE (GAUMONT-BRITISH) SUNDERLAND.
One 200 ampere 100-volt. Rectifier Equipment feeding Projection Arcs, the plant operating on a three-phase supply.

Centre: REGAL CINEMA, CAMBERLEY.
Two 250 ampere 100 volt. Rectifier Units feeding Projection Arcs, the plant operating on a three-phase supply.

Below: AVENUE CINEMA, NORTHFIELDS.
Two of the Three 300 ampere 100 volt. Rectifier Units supplied for the above. These Equipments are arranged to operate off a single phase as well as a three-phase supply.

HEWITTIC

LOWEST INSTALLATION CHARGES

The Hewittic Rectifier is static, extremely simple in principle, construction and control, and entirely automatic in its operation. Installation and running charges are accordingly extremely low.

In the first place, the Plant requires no foundations. It can be simply placed on any floor. Secondly, it requires no separately mounted control switchgear. The whole Equipment is arranged as a self-contained unit, enclosed in a sheet-steel cubicle, and all the necessary switchgear for its control and protection can be mounted on it.

To start up the plant, close the supply switch, making the Equipment alive, and at once it is in operation ready to take its load as required. It calls for no attendance whatsoever throughout its load run—it is foolproof in its control.

The Hewittic Rectifier is made up essentially of a Transformer and Coils of a similar nature, and a Rectifier Bulb Unit. It is not subject to the wear of continuously moving parts. It has no parts to get out of order and require adjustment. As is well known, a Transformer will go on operating year in year out indefinitely. Hewittic Bulbs also have proved to have a very long life and in fact no definite limit can be assigned for them in this respect as actually, the very great majority of Bulbs supplied over five years ago are still running.

The maintenance charges on a Hewittic Rectifier installation are, therefore, extremely low, and as it calls for no periodical adjustment, and only very infrequent inspection the running or supervision charges are negligible.

LOWEST RUNNING CHARGES

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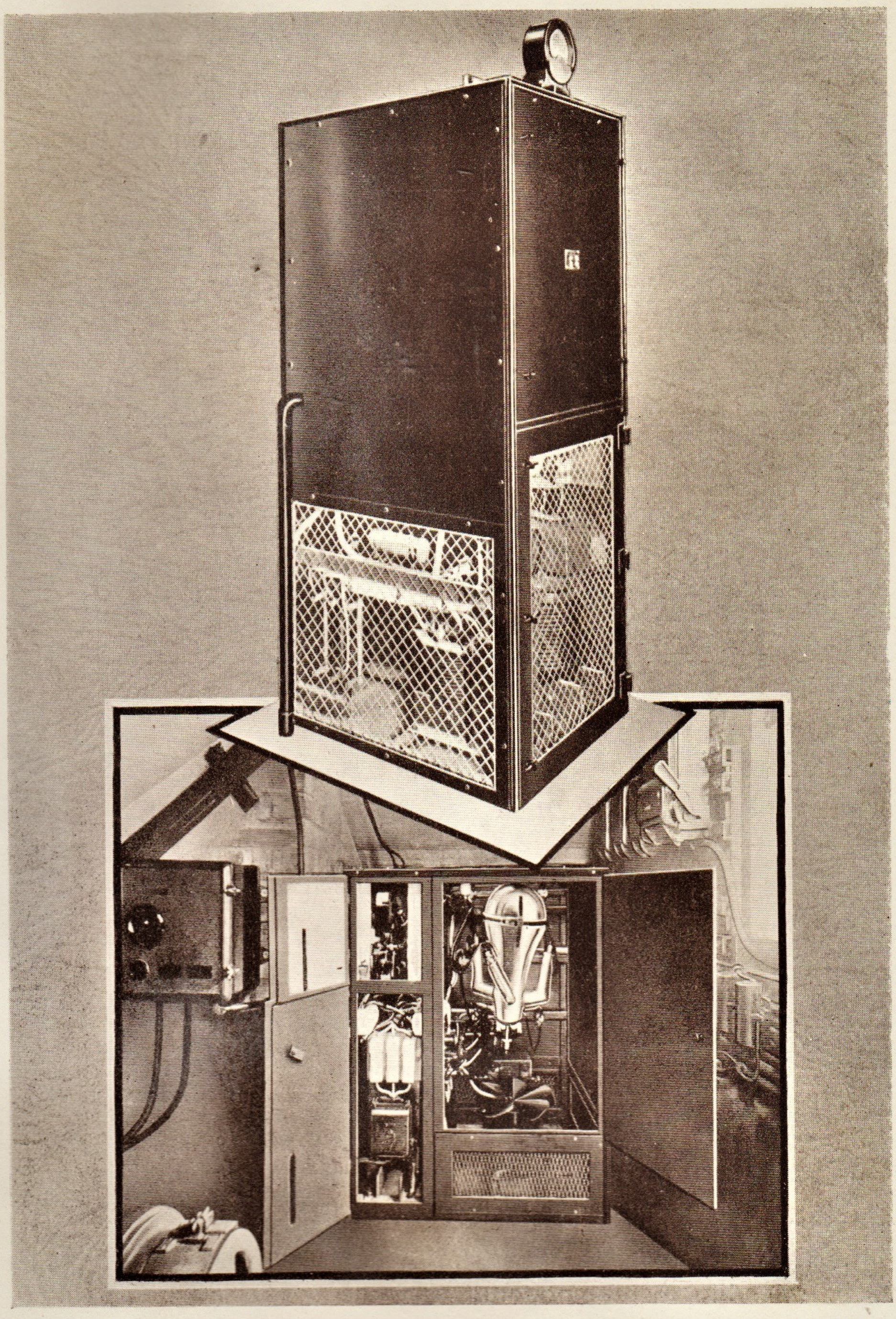


Above : A STANDARD 150 AMP. RECTIFIER AT THE BRUCE GROVE CINEMA, TOTTENHAM.
Dimensions : 2′ 3″ × 3′ 0″ × 6′ 0″ high.

Below : THE RICKMANSWORTH PICTURE HOUSE.
An 80 Amp. Rectifier Feeding Projection Arcs.
Dimensions : 3′ 9″ × 2′ 10″ × 4′ 6″ high.
(Special construction, 2 sections, reduced height.)

HEWITTIC

EASIEST SPACE REQUIREMENTS

A Hewittic Rectifier Equipment can be fitted in anywhere, so small is the floor space taken by it, so flexible is its construction, so free is it from limiting restrictions regarding its place of installation.

In the first place, it may be placed as near to, or as far away from, the Projection Room as space considerations alone may make desirable.

As it is static and, therefore, free from the penetrating note of running machinery, it can be placed quite close to the auditorium, and some Equipments are actually installed in the Projector Room itself.

On the other hand, as the Equipment is automatic it can be satisfactorily installed in any other place, however remote or inaccessible.

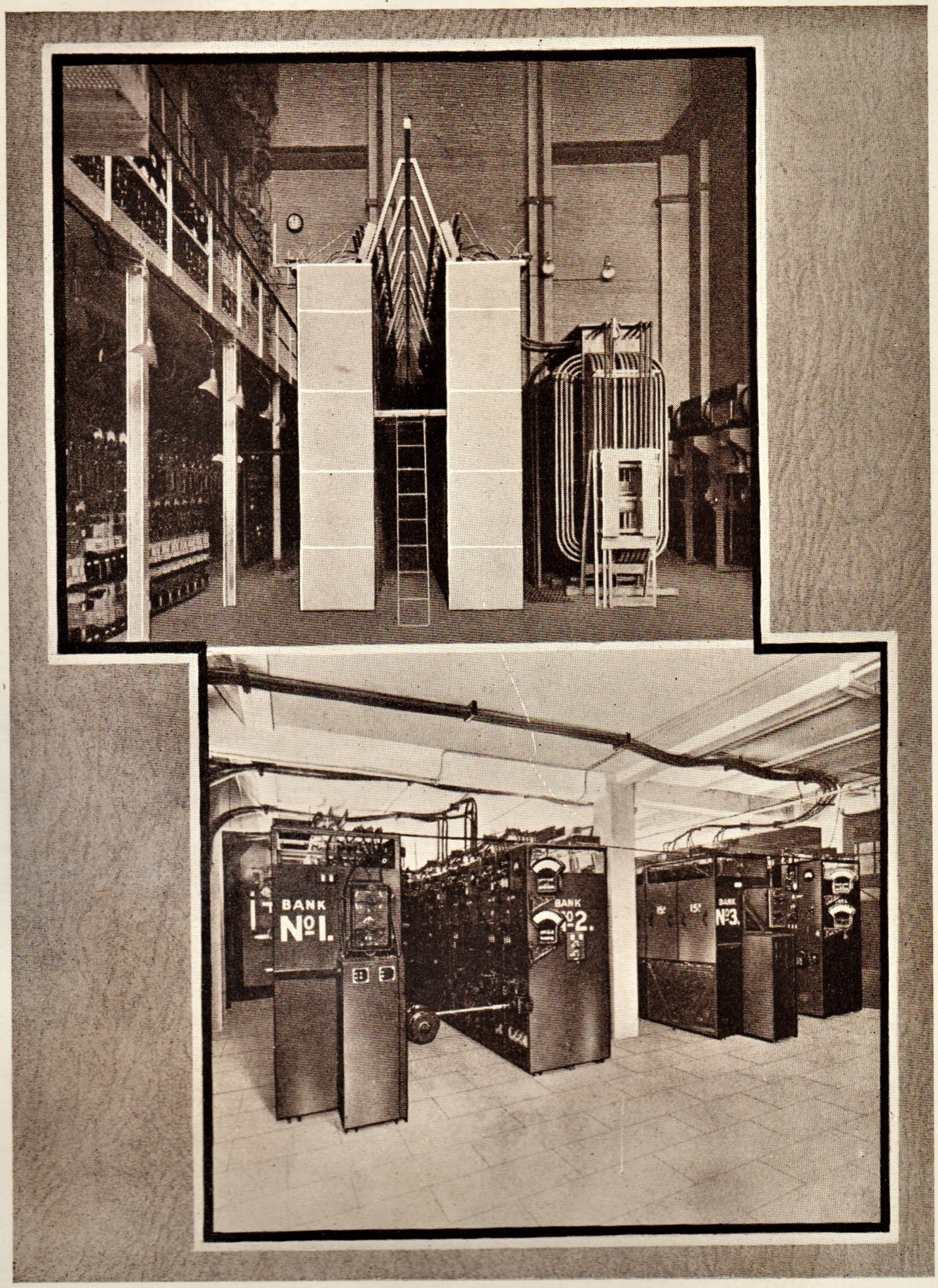
All that is necessary in the latter case is to fit it with a Clapper Switch controlling the incoming supply: this Switch being controlled by a push-button in the operator's box. The Equipment may then be installed away anywhere convenient—it will respond instantly to the push-button control.

The Rectifier Equipments in their standard layout take a very small floor space, as may be judged from the illustration and indicated dimensions given on page 20, the average Equipment taking 3 ft. square floor space, complete with all switch gear, and gangway space required in front only.

To suit special site conditions, the standard dimensions may be altered very considerably, and if necessary the Plant may be built up in sections—so that Rectifier Plant may be installed almost anywhere.

SILENT OPERATION

HEWITTIC



Above : HEARN STREET SUBSTATION, BOROUGH OF SHOREDITCH.
Equipped with Hewittic Rectifiers, capacity 4,000 kw., to be increased to 6,000 kw.

Below : ALDERSGATE SUBSTATION, CITY OF LONDON ELECTRIC LIGHT CO.
Also equipped with Hewittic Rectifiers, capacity 2,000 kw.

HEWITTIC

HIGHEST RELIABILITY

Next to the obtaining of the best projection, or perhaps equally important, is the question of reliability.

Consider the Hewittic Rectifier from this point of view.

Its simplicity ensures reliability—the Equipment is as reliable as its Transformer or its Bulb—both components which cannot get out of adjustment.

But the test of reliability is experience. And in this connection it should be noted that for years Hewittic Rectifiers have been in service on the most important services on Public Supply Work—feeding Light and Power networks and Traction Systems, in Works, in Hospitals, on Lift Installations; in fact, everywhere that Direct Current is wanted from Alternating Current supplies.

And everywhere these Equipments are left unattended, no matter how important the service—no matter how large. (The capacity of these installations varies from small sizes up to 6,000 kw.)

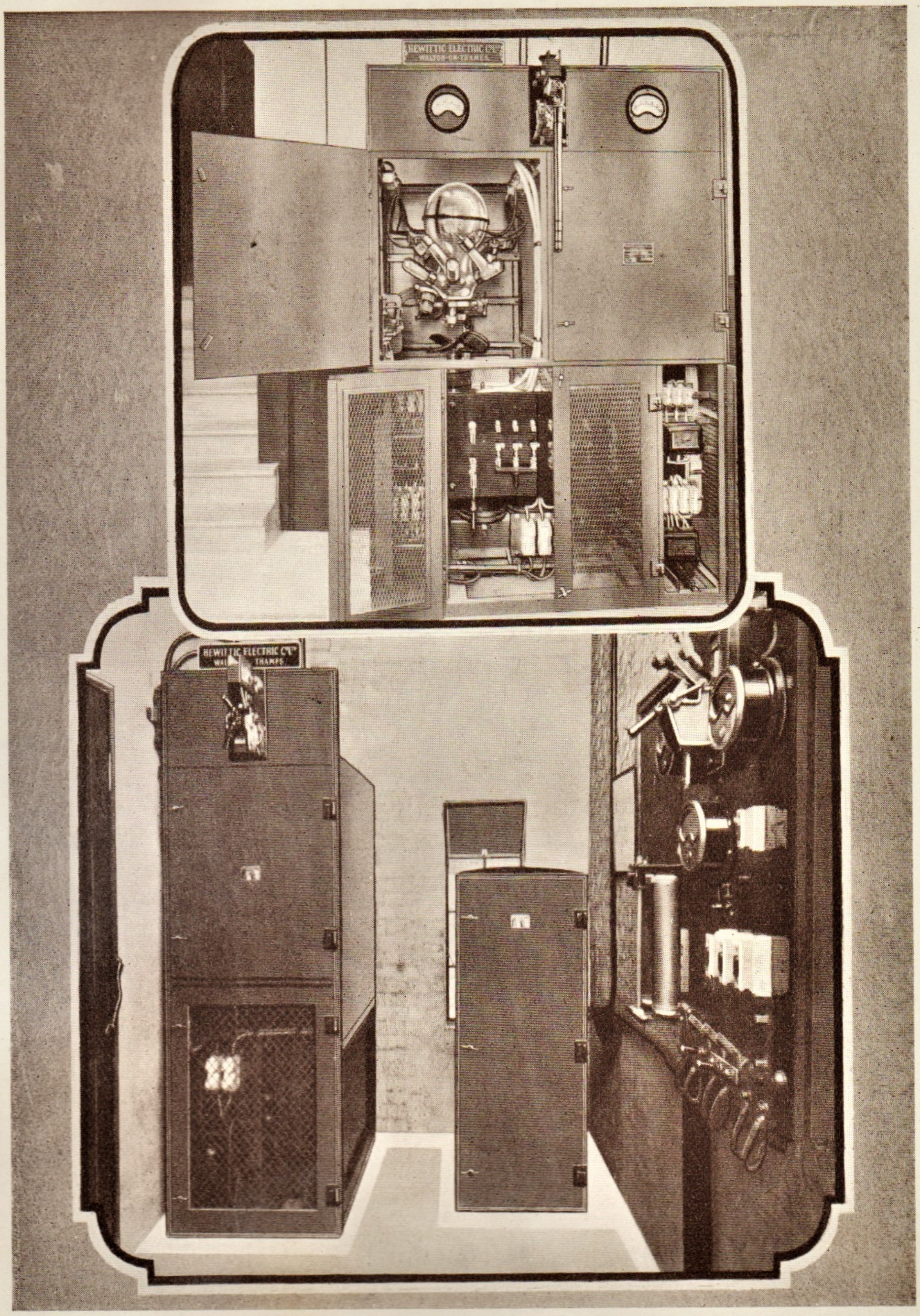
The Hewittic Rectifier as supplied for Cinemas is exactly similar to the Hewittic Rectifier as employed in Public Supply Substations. Actually, the greater capacity wanted in Substation service is met by the grouping of Units in parallel.

Every detail is, therefore, designed to withstand heavy service—the Plant is built on robust lines.

Its control is simple and foolproof. One cannot make a mistake in switching it in. One cannot damage it through accidental misuse for it is fully protected.

NO ADJUSTMENTS

HEWITTIC



Above : THE REGENT THEATRE, ABERDEEN.
Rectifier Equipment with two 200 Amp. Bulb Units.

Below : THE GLOBE THEATRE, CLAPHAM.
One 150 Amp. 100 Volt. Rectifier to feed Projector Arcs (*left*).
One Battery Charging Rectifier (*right*).

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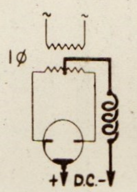
PRINCIPLE OF RECTIFIER

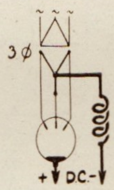
A Rectifier Equipment comprises three main items—a Transformer, a Rectifier Bulb and an Inductance Coil.

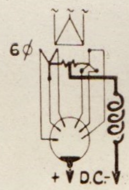
The Transformer steps the voltage to the desired value—the Rectifier Bulb acts as a one-way valve allowing the current to pass out in one direction only—the Inductance Coil smooths out the pulsations of the rectified D.C. current.

The Rectifier Bulb is a highly evacuated vessel, fitted with a number of electrodes (the anodes) and a mercury pool, the cathode. Its action as a one-way valve is due to the unidirectional flow of electrons which takes place in vacuo from the mercury cathode pool to the anode graphite electrodes.

As a result, the Mercury Vapour arc in the Bulb offers a very low resistance path to the current in one direction (when the anode is positive in respect to the cathode) allowing the current to flow freely in that direction ; but an extremely high resistance in the reverse direction, so that current cannot flow back from cathode to anode.







In this way the positive half cycles induced in the secondary of the Transformer pass through the Rectifier Bulb—by suitably arranging the components of the secondary of the Transformer full wave rectification is obtained. The above diagrams show the connections for single, three, and six phase equipments.

UTMOST SIMPLICITY

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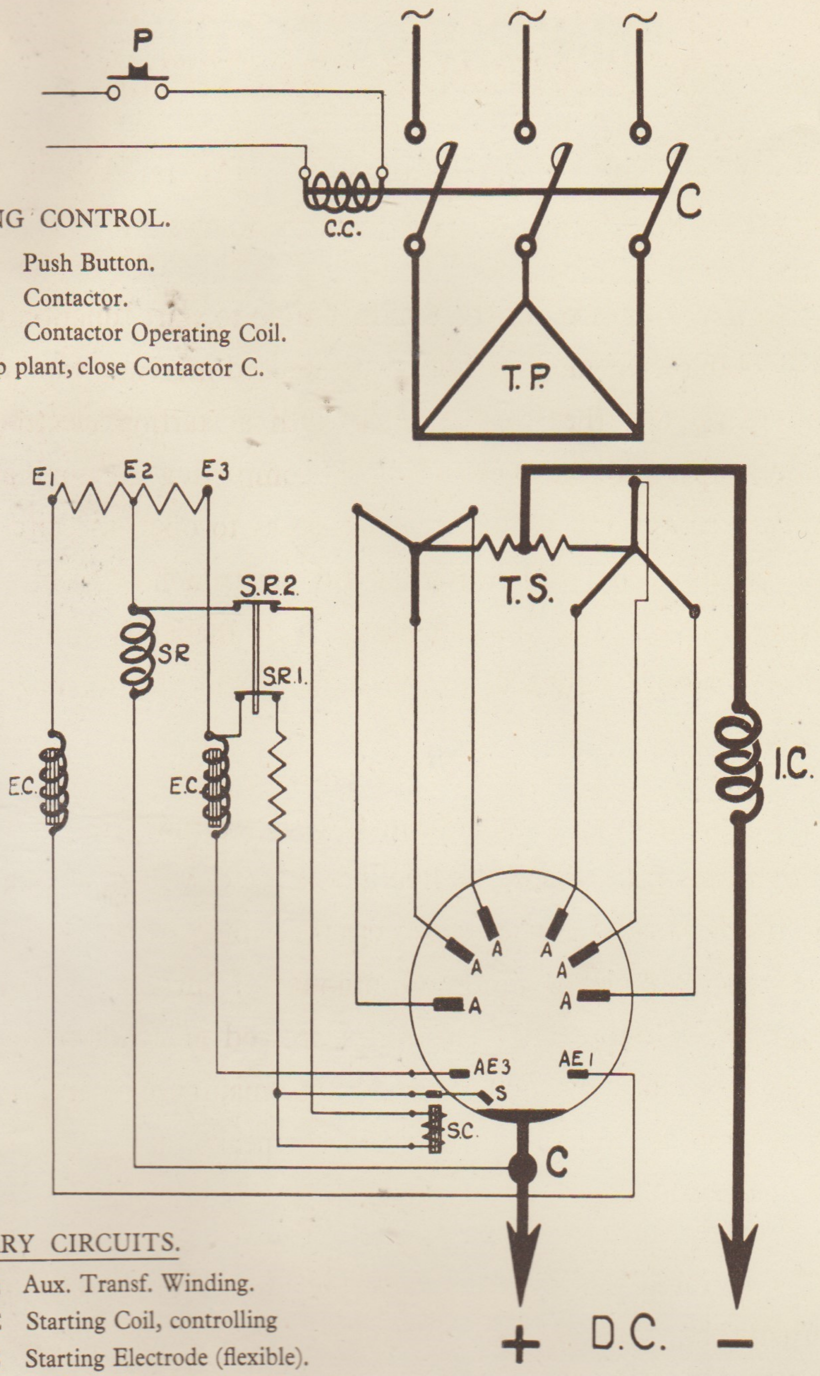
CONNECTION DIAGRAM.



STARTING CONTROL.

P Push Button.
C Contactor.
CC Contactor Operating Coil.

To start up plant, close Contactor C.

AUXILIARY CIRCUITS.

E1, E2, E3	Aux. Transf. Winding.
SC	Starting Coil, controlling
S	Starting Electrode (flexible).
SR	Starting Relay, contacts SR1, SR2.
EC, EC	Exciter Inductance.
AE1, AE2	Exciter Electrodes.

Current passing from E1, E3 via EC through AE1, AE2 through C and on to E2, maintains requisite electron emission from Cathode C.—Also starting circuit, having functioned is disconnected by operation of SR.

MAIN CIRCUITS.

TP	Transformer Primary.	
TS	Transformer Secondary.	
Midpoint of Transformer Secondary		— D.C.
A, A A	Rectifier Anodes.	
C	Rectifier Cathode	+ D.C.
IC	Inductance Coil.	

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OPERATION OF RECTIFIER

The principle of the Rectifier has been referred to in the previous page, and its operation is as follows :—

In the first place, for the Rectifier Bulb to start functioning as a conductor it must be filled with ionised mercury vapour ; and to do this the Bulb is fitted with a starting electrode which dips into the mercury pool, completing an auxiliary current circuit and is then released so as to open the circuit and cause an arc, thus initiating the electron flow from the cathode pool. The starting electrode is made to dip and spring back as required by the action of an electro magnet clamped to it.

To maintain an adequate emission of electrons irrespective of the load on the Plant, the Rectifier is fitted with an auxiliary circuit designated as the exciter circuit, which passes through the cathode pool the minimum amount of current necessary for this. These exciter electrodes are fed at a low voltage so as to reduce the losses due to this maintaining arc, and the current is limited and adjusted by means of a choke coil in this circuit.

The foregoing explains how the Rectifier operates internally, but as far as external control is concerned all that is required is to make the Equipment alive by closing the control switch and everything else follows automatically.

ENTIRELY AUTOMATIC

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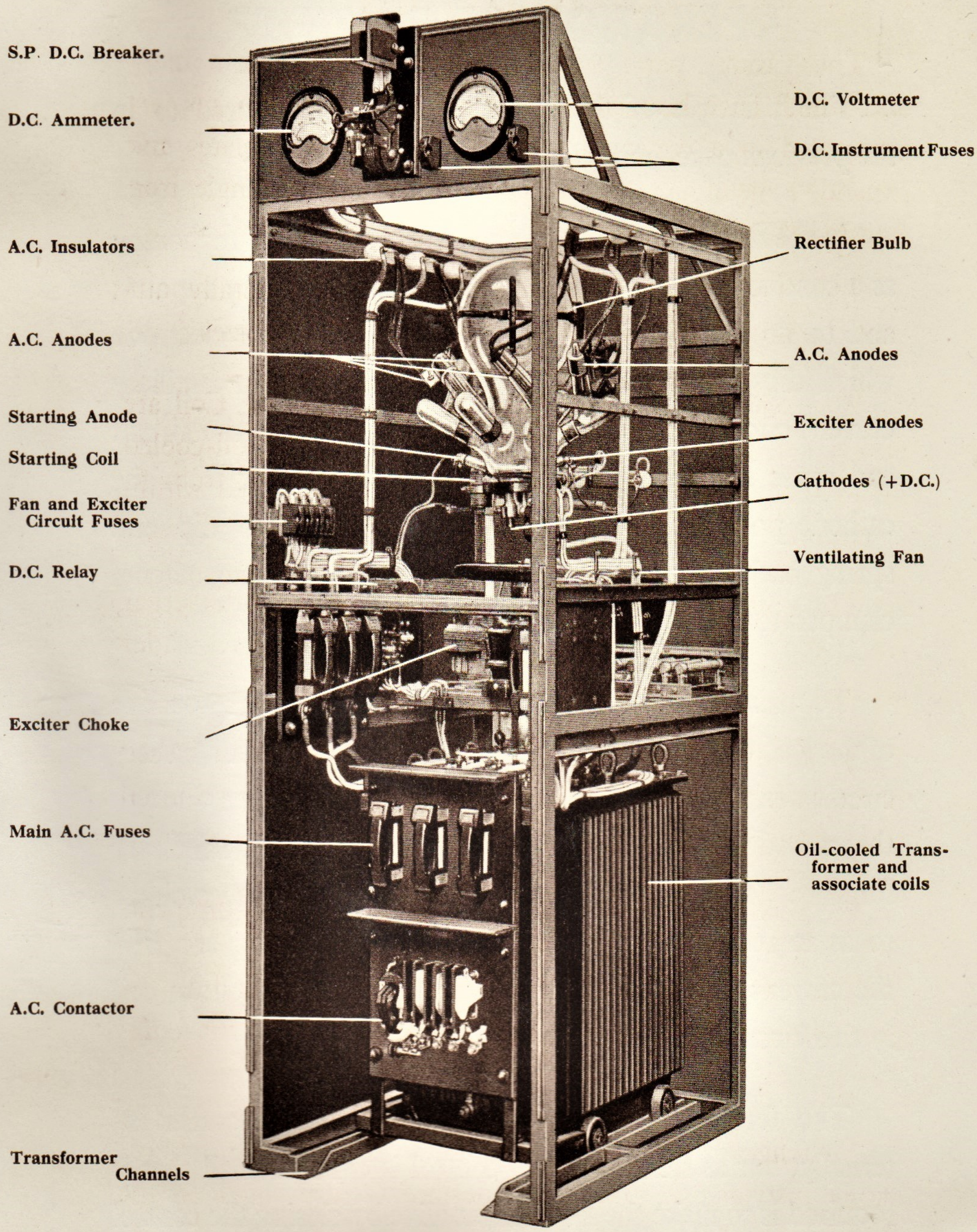

TYPICAL CINEMA RECTIFIER.

Dimensions :

Complete Rectifier with Transformer.		Separate Rectifier and Transformer.		
30/50	Amps. 27″ × 30″ × 54″ high.	200	Amps. 30″ × 30″ × 54″ high.	27″ × 27″ × 34″ high.
60/80	Amps. 27″ × 33″ × 69″ high.	250/300	Amps. 33″ × 36″ × 60″ high.	30″ × 27″ × 43″ high.
100/130	Amps. 27″ × 33″ × 72″ high.	350	Amps. 40″ × 40″ × 78″ high.	33″ × 39″ × 44″ high.
150	Amps. 27″ × 33″ × 78″ high.	400	Amps. 40″ × 40″ × 84″ high.	36″ × 43″ × 48″ high.
200	Amps. 33″ × 36″ × 78″ high.	500	Amps. 40″ × 40″ × 87″ high.	40″ × 46″ × 52″ high.

If D.C. Breakers included, height increased by 15″

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CONSTRUCTION

The various parts which make a Rectifier Equipment and which have been alluded to in the foregoing pages, are assembled in a cubicle made up of sheet steel plates and expanded metal guards, mounted on substantial angle iron framework.

The Transformer and Reactor Coil are generally air-cooled up to 15 kw. capacity—oil-cooled for larger sizes.

When air-cooled, the Transformer and Reactor Coil are always assembled in the Rectifier Cubicle. When oil-cooled up to about 25 kw., they may be similarly assembled within or mounted separately externally as desired.

The Bulb is fitted on a cradle, and in the cases of the larger sizes, 300 amperes upwards, the cradle is fitted on a slider carrier.

A fan driven by a small squirrel cage motor, is placed immediately under the Bulb when artificial cooling is required (this is the case for Equipments above 60 amperes capacity).

Protective Fuses are fitted on every Rectifier Equipment.

The Cubicle is provided with doors in front, and all the gear within the cubicle is accessible from these, so that gangway space is only required in front.

Switchgear (A.C. switch and D.C. breaker) and/or indicating instruments may be, if desired, incorporated on the Rectifier Cubicle.

FLEXIBLE & COMPACT

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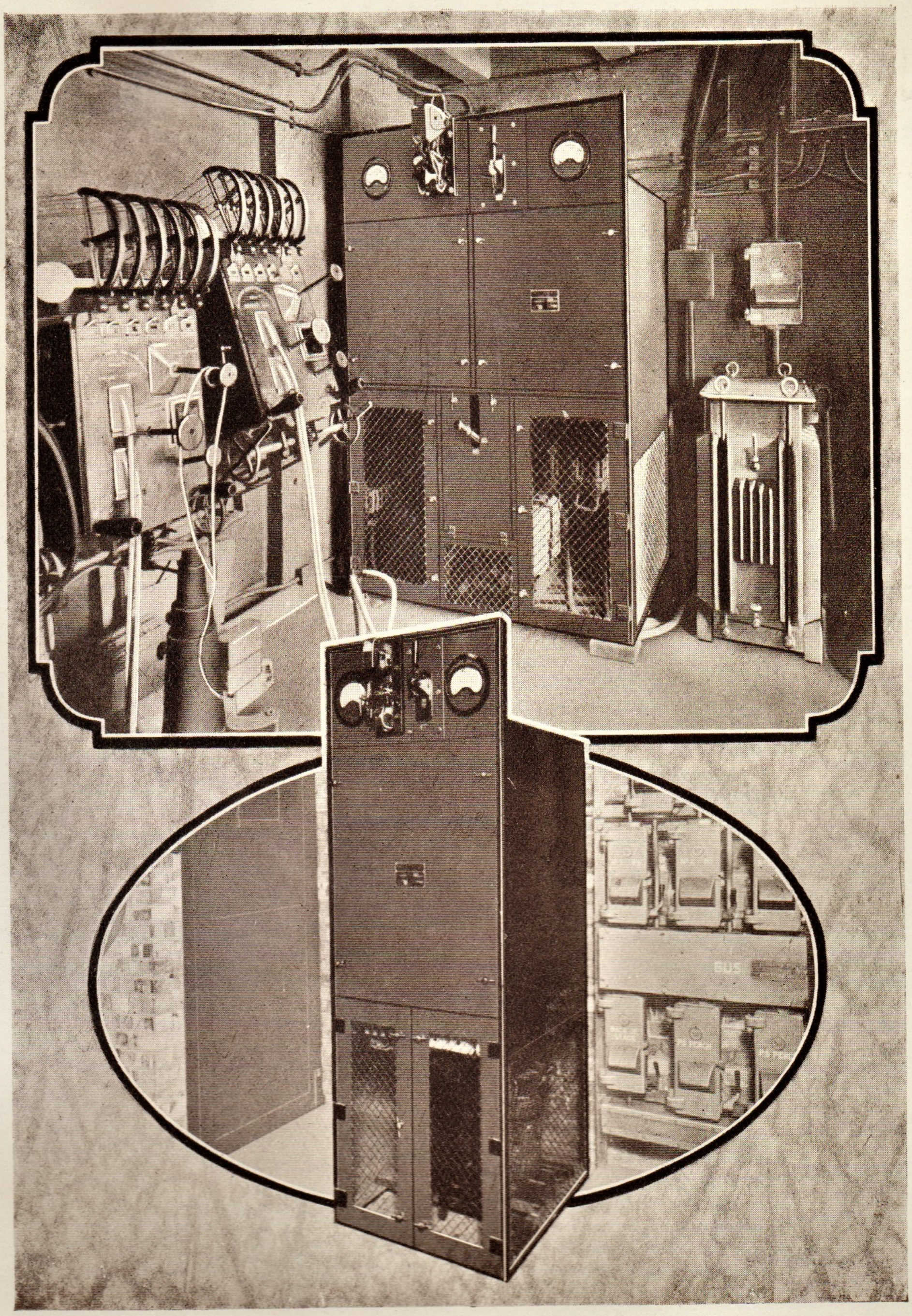

TWO HEWITTIC RECTIFIER EQUIPMENTS
AT THE DOMINION THEATRE (LONDON).
Above: 300 Ampere Set installed in the Spot Booth.
Below: 150 Ampere Set installed under the Stage.

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HIGH ELECTRICAL PERFORMANCE

The overall efficiency figures obtained with Hewittic Rectifiers of various sizes, arranged for outputs of about 100 volts D.C. as required for Cinema work are as follows :—

CAPACITY.	30/60.	100/150.	200/250.	300/400 Amps.
5/4 load	76	77	78	80
4/4 load	76	77.5	79	81
3/4 load	77	78	79.5	81
2/4 load	75	77	78	80
1/4 load	70	74	75	77

The Power Factor is also of a high order ; and, as in the case of the overall efficiency, remains at approximately the same value from half-load to 25 per cent. overload. It varies according to the supply and connections, the following being the respective figures :—

Single-phase supplies 0.86

Three-phase supplies (three-phase connections up to 150 amps.) 0.83

Three-phase supplies (six-phase connections 200 amps. upwards) 0.93

Another feature of interest is the high overload capacity of the Hewittic Rectifier. Reference has been made to its robust mechanical construction, and this is also characteristic of its electrical design, which provides for the following overloads :—

Nominal rating ... ... Continuously.
25 per cent. overload ... 2 hours.
or 50 per cent. overload ... 10 minutes.
100 per cent. overload ... Momentary.

HIGH OVERLOAD CAPACITY

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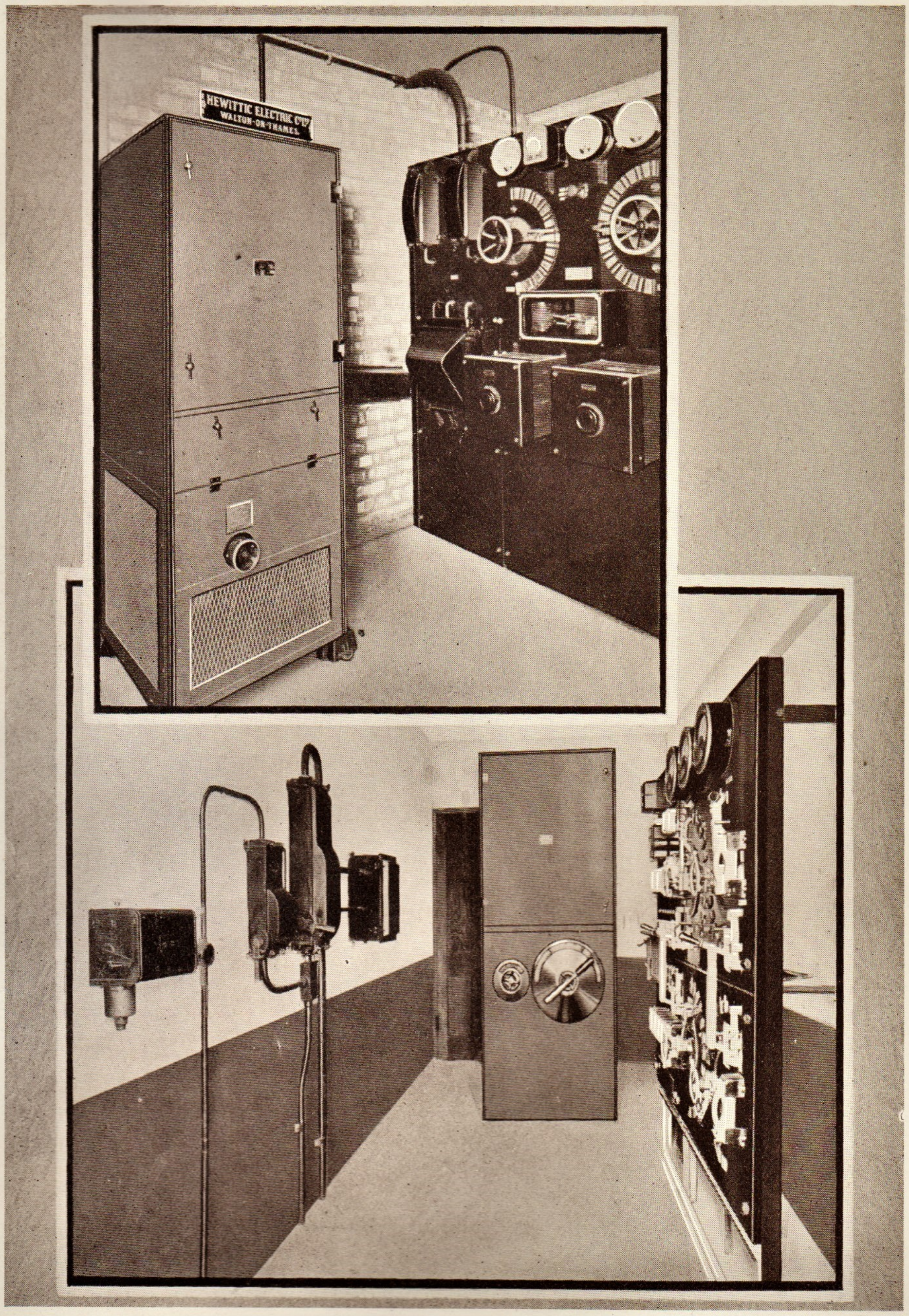

TWO HEWITTIC RECTIFIER BATTERY CHARGING EQUIPMENTS.

Above : The Carlton Cinema, Islington.

Below : The Commodore, Hammersmith.

HEWITTIC

FOR STAND-BY BATTERIES

Another duty for which Converting Plant is required in a Cinema is for the charging of stand-by batteries

For this work, just as for feeding projection arcs, the Hewittic Rectifier shows the same many advantages over other forms of converting plant, providing the most reliable and efficient plant for the purpose.

A Rectifier is suitable to trickle charge the battery, or to give it a quick charge, and can carry on all its functions automatically—it is absolutely foolproof as it cannot feed back—if the supply fails, rectifier stops working and goes on again as soon as the supply is resumed.

A D.C. Motor gives the best results as regards silent running and speed control, as required for ventilating gear and lift installations, and this again offers another field where the Hewittic Rectifier solves the problem in the simplest of ways and with the best results.

Hewittic Rectifiers are employed on Lift installations throughout the country, and wherever D.C. Motors are desirable. This is particularly the case where the available supply is single-phase, and of course, where the supply to existing D.C. installations is changed over to A.C. in accordance with the national programme.

FOR MOTOR LOADS

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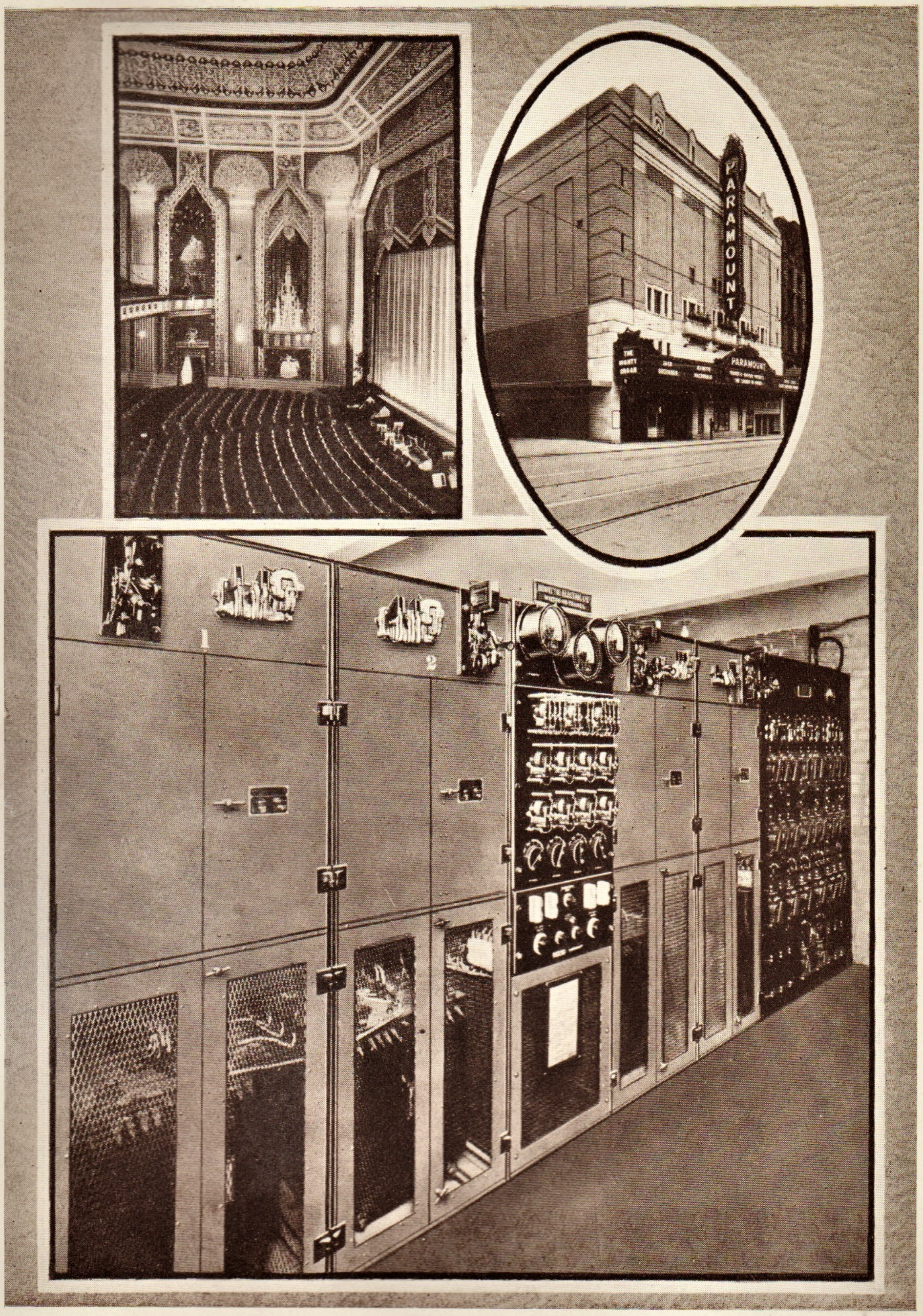

THE PARAMOUNT, NEWCASTLE.

Above : View of the Auditorium and Main Entrance.

Below : View of Rectifier Bank and Distribution Switchboard. Four 200 Amp. sets—arranged for Remote Control from Projection Booth.

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CONCLUSION

In the foregoing pages some of the main advantages offered by Hewittic Rectifiers for Cinema service have been outlined.

They interpret the experience of users of Hewittic Plant, and will be confirmed by any user.

These points all lead to one conclusion.

To instal a Rectifier Equipment is to solve once for all the Converting Plant problem in any Cinema. Once installed it can be practically forgotten and it will go on working year in and year out unnoticed and unattended.

But this is not all. It is not only a solution of the converting problem, eminently satisfactory as it is in this respect It is, moreover, a very paying investment, for from the day a Hewittic Rectifier is installed, one gains directly, because the current bill drops considerably straight away; and indirectly, because best projection will be obtained.

It is therefore of interest to everyone concerned with a Cinema where the input supply is A.C., to have a Rectifier Equipment installed and to run on it whenever possible.

And this is well worth the consideration even of those who already have existing rotating machinery in service; for, whereas in such cases the converting requirements may be considered as already adequately filled, the installing of a Rectifier may be regarded in the light of a wise investment, which will show a good dividend in the form of a reduction in running costs and enhanced projection leading to improved box office results.

AN INVESTMENT FOR EVERY CINEMA

HEWITTIC

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GRID CONTROL OF MERCURY RECTIFIERS

By R. HOWARD CRICKS, A.R.P.S.

WHEN some months ago I was down at Hewittic's Walton-on-Thames works, John Cleeves, after swearing me to secrecy, outlined some experiments which were then in hand, which would enable the D.C. output of a mercury rectifier to be varied at will without loss of efficiency, and further would eventually enable a bulb to be used as a D.C. to D.C. converter.

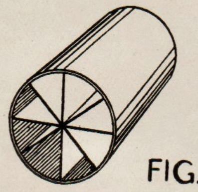

FIG. 1

Anode Grid

The latter especially seems very foreign to the normal functioning of a mercury rectifier; but it is relatively simple in principle, and was fully explained to me on a recent visit to the works.

The whole system is based upon the use of a grid such as is used in an ordinary thermionic valve. We all understand the functioning of this device—how the grid hinders the flow of electrons from the filament or cathode to the anode, to a varying degree according to the amount of negative potential with which it is charged.

Exactly the same principle is used in the case of the new type rectifying bulbs. The principle underlying mercury rectification is that a stream of electrons is released from the hot-spot on the mercury pool and completes the circuit to the anode, allowing current to flow in one direction but not in the other.

How the Grid Operates

When one considers it, it is quite obvious that a negatively-charged grid will control the flow of electrons in a mercury bulb just as easily and effectively as in a wireless bulb. Here is the principle; it only remains to work out its applications.

On the Hewittic rectifier each graphite anode is, of course, carried on a separate extension arm from the main bulb. In this arm, between anode and mercury, is placed the grid—a short tube with internal divisions, as seen in the sketch. The stream of electrons from the mercury on their way to the anode has to pass through this grid, and if the grid happens to be negatively charged their passage will be obstructed, and they will never reach the anode.

This rather remarkable development has many valuable uses. The first which I saw was its use as a cut-out or circuit breaker.

A 400-amp. bulb, running on its exciting anodes only, suddenly had its main D.C. output terminals short-circuited. When it was protected by an ordinary circuit-breaker, an appreciable period of time—actually I was told one-fifth of a second—elapsed before the rather heavy mechanism of the circuit-breaker functioned (splashing oil all around) and broke circuit.

Rapid Circuit-Breaker

When, however, a little relay carrying a matter of milli-amps., at a pressure of 200 volts, was added to the grid circuit, and the D.C. output terminals were similarly short-circuited, the ordinary circuit-breaker had no chance to work—quicker than the eye could see, this little relay had given the grids their negative charge, and had cut out the main load entirely in a period of under half a cycle of the supply—one-hundredth of a second.

It strikes one as rather amazing that a little relay, which could be made extremely compact, carrying a wattage insufficient to light a flash-lamp bulb, could control with such effectiveness a load which may have been anything from 10 to 40 kilowatts.

Output voltage control by means of the grids is effected not by increasing the negative potential of the grid, but by altering the phase relationship between the grids and their respective anodes.

This delays the point at which the anode comes into circuit; for as long as the grid is negative in relation to the cathode, the respective anode which the grid controls cannot commence to operate—the later the anode commences to operate the lower its mean output voltage.

Various methods have been devised to achieve this, and one is described below.

The Three-anode Bulb

We will for the moment consider the simple 3-phase 3-anode bulb (most commercial 3-phase bulbs work on 6 phases, but the principle is identical).

The anodes are fed from the usual 3-phase star-connected transformer secondary. Another transformer winding supplies a minute current to a form of phase advancer —for experimental work an ordinary 3-phase slip-ring motor has been used, the stator windings being connected to the auxiliary transformer windings, and the rotor slip-rings to the three grids, phase adjustment being effected by moving the rotor by means of a worm and worm-wheel, so giving very fine adjustment.

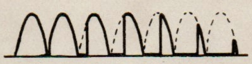

FIG. 2

Reduction of Voltage by Grid Action

It is easy to understand that while the grid potential is in phase with the anode potential, and there is consequently no phase displacement, the grid will have no effect. But immediately the phase of the grid is retarded and it becomes of negative potential in relation to the cathode, the grid will start to function by delaying the starting of its respective anode.

In practice this control is exceedingly efficient. The grids, be it mentioned, are still carrying a negligible current; yet I saw a 250-amp. bulb changing its output voltage from zero to 250 volts, with a current varying likewise from zero to full load. Further, unlike a resistance or choke, there was absolutely no loss of efficiency in so varying the voltage, if one excepts the few milli-amps. carried by the grid.

For Battery Charging

The most commonly used application so far of this method of regulation is in battery charging, where the output voltage can be regulated either to trickle-charge the battery, or when desired to give a boosting charge at any desired current, the charging voltage being steadily increased as the back-voltage rises.

Already a large amount of equipment is in use employing this method of control. In three London theatres—Gaumont Palace, Lewisham, New Victoria, and Victoria Palace—it is used for charging stand-by batteries, while, in addition, rectifiers having a total capacity of some 2,000 k.w. are under construction for public supply work, including 600 kw. for East Africa.

Converting to A.C.

Still another application of this ubiquitous principle is in converting from D.C. to A.C. Supposing the positive pole of a D.C. system is connected to the centre tapping of the primary winding of a transformer, the free ends of which are connected to two anodes of the bulb fitted with grids, and the cathode of the bulb is joined to the negative D.C. pole.

The grids are given an alternating frequency by any suitable means—an existing A.C. supply or a valve oscillator—and the D.C. will flow alternately through one and the other anode, creating an alternating flux in the transformer core. An A.C. supply is accordingly induced in the secondary winding of the transformer, the value of the A.C. output voltage depending on the transformer ratio chosen.

Tests so far made show that the wave form is a little squarer than the true sine curve, but this is, no doubt, capable of improvement if required. On this principle we can go a step farther. Suppose the A.C. output obtained for the secondary winding of this transformer is then put back into the bulb through two other anode arms and rectified to D.C. We shall have a comparatively simple static apparatus for transforming D.C. voltages, just as we do A.C.

The connections for this arrangement are shown in Fig. 3, where the D.C. is shown connected to the centre of the primary of a transformer and to the mercury cathode; the outers of the transformer are connected to the two anodes. By means of the grids, the D.C. supply is inverted to A.C. in the way indicated above, and the A.C. current induced in the secondary of the transformer is fed back into the bulb by means of the lower anodes, and is rectified in the normal way.

If this ingenious system proves to be as successful in practice as it has in experiments, an enormous step forward will have been made in electrical technique. High-tension transmissions of direct current will become practicable, and will, in fact, prove more economical than transmitting A.C.

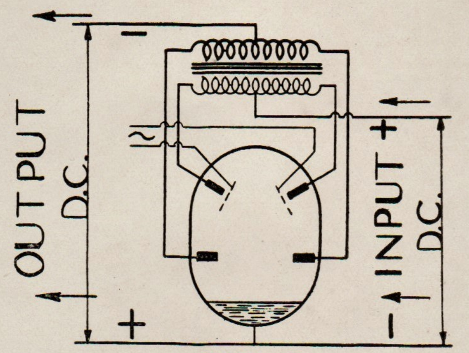

FIG. 3

Diagram of connections of D.C.—D.C. apparatus

Coming to the requirements of our own trade, the exhibitor who has a D.C. supply will find himself on the same footing as his competitor on A.C., in that he can instal a simple static device to step this line voltage down to the pressure required by his arcs. The applications of this principle are in short boundless, and I shall look forward with interest to seeing its commercialisation.