From *Better* Theatres

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Controlling the Stage Lights In Front of the Curtain

A NEW system of controlling the lights of a theatre, involving new and unique principles and minimizing time, labor and valuable space, has been developed by the General Electric Company and installed in the new Chicago Civic Opera House. The lighting director (usually the stage electrician), here-to-fore unseen to the audience but vitally important to the success of the production, now leaves his position back-stage for the first time in theatrical history, and takes his place in front of the curtain along with the prompter and the musical director.

In front of the curtain, the lighting operator will control the stage and house lighting as easily and as intelligently as the orchestra conductor now directs the orchestra. In front and on each side of him will be arranged dials, knobs, tumbler switches, indicating lights, etc. By the mere manipulation of a single knob all the complexities of stage lighting will be controlled, lights of various colors fading and brightening at various points and at the proper moments. Scenes requiring complex lighting effects such as sunsets, sudden thunderstorms, ballets, etc., will require no more effort in their control than is required to flick a lighting switch in the home or to turn a door knob.

The advantages of the new method are manifold. Heretofore, the control of theatre lights was centralized in a switchboard back stage which, in the larger theatres, sometimes was 40 feet long by eight feet high. Arranged on this switchboard were rows upon rows of "dimmers" with large levers whose movement controlled the brightening or dimming of the various lights or groups of lights. The operation of these dimmers required much physical effort and agility, and many elaborate and ingenious mechanical schemes were often resorted to in order to simplify the work. Their manipulation made it necessary for the electrician to be at a point "off-stage" where he could not see, except indirectly, the effects he was producing and where he had to rely on cues of words or sounds to inform him when it was necessary to change the lighting effects. Such a switchboard is no longer necessary.

The new method also follows the modern trend which makes simplicity an essential, especially in theatres. By eliminating the old bulky switchboard in the wings, more space is made available to stage operations, and co-ordination of activities results.

The General Electric control scheme which makes the new method possible involves principally the use of three important devices: the self-synchronous motor, the low-vacuum rectifying tube marketed under the trade name of "thyratron" and a new type of saturated-core reactor. Reactors have been used before in stage lighting but a new type had to be designed to fit the new system.

The selsyn is a device resembling an ordinary electric motor in appearance and general construction. Contrary to the operation of a motor, however, the rotating element does not revolve at a high rate of speed, but moves slowly — rarely more than a complete revolution. When two selsyns are interconnected electrically, the movement of the rotating

element of one produces a corresponding movement of the other rotating element in the same direction and by exactly the same amount. It is by the use of these devices that the operation of the Panama Canal locks is controlled, and they are also used in this country for various purposes including the opening and closing of bridges, operation of elevators, etc.

One side of the voltage supply to each light or group of lights passes through one winding of a saturated core reactor. The other winding of this reactor is fed by direct current in varying amounts from a pair of thyratrons. The amount of rectified current supplied by these thyratrons depends on the electrical relationship between the elements of each tube, and this is determined by the control devices governed by the lighting operator. As the amount of direct current fed by the thyratrons to the reactor varies, the resistance of the reactor to the lighting supply load varies from
a point where the lights are out, to full brilliancy.

The immediate determination of the relationship of the elements of the thyratrons is through the agency of devices called phase modulators. There are two of these for every individual lighting circuit, one for use during the present scene and the other for the purpose of "setting up" the next scene. The operation of the modulators is, in turn, governed mechanically either by the action of a selsyn or by knobs in front of the lighting operator.

By manipulating the knobs on the individual modulators, the lighting operator could control the lights, but it would involve the operation of a possible 141 knobs in the case of the Chicago Civic Opera House, as there are that many lighting circuits on the stage. By the use of the selsyns, however, it is possible to govern all the lighting circuits through one knob, or to split the control into major and minor divisions, depending on color, location and function, each group in turn controllable through the agency of a knob. This is done in the following manner:

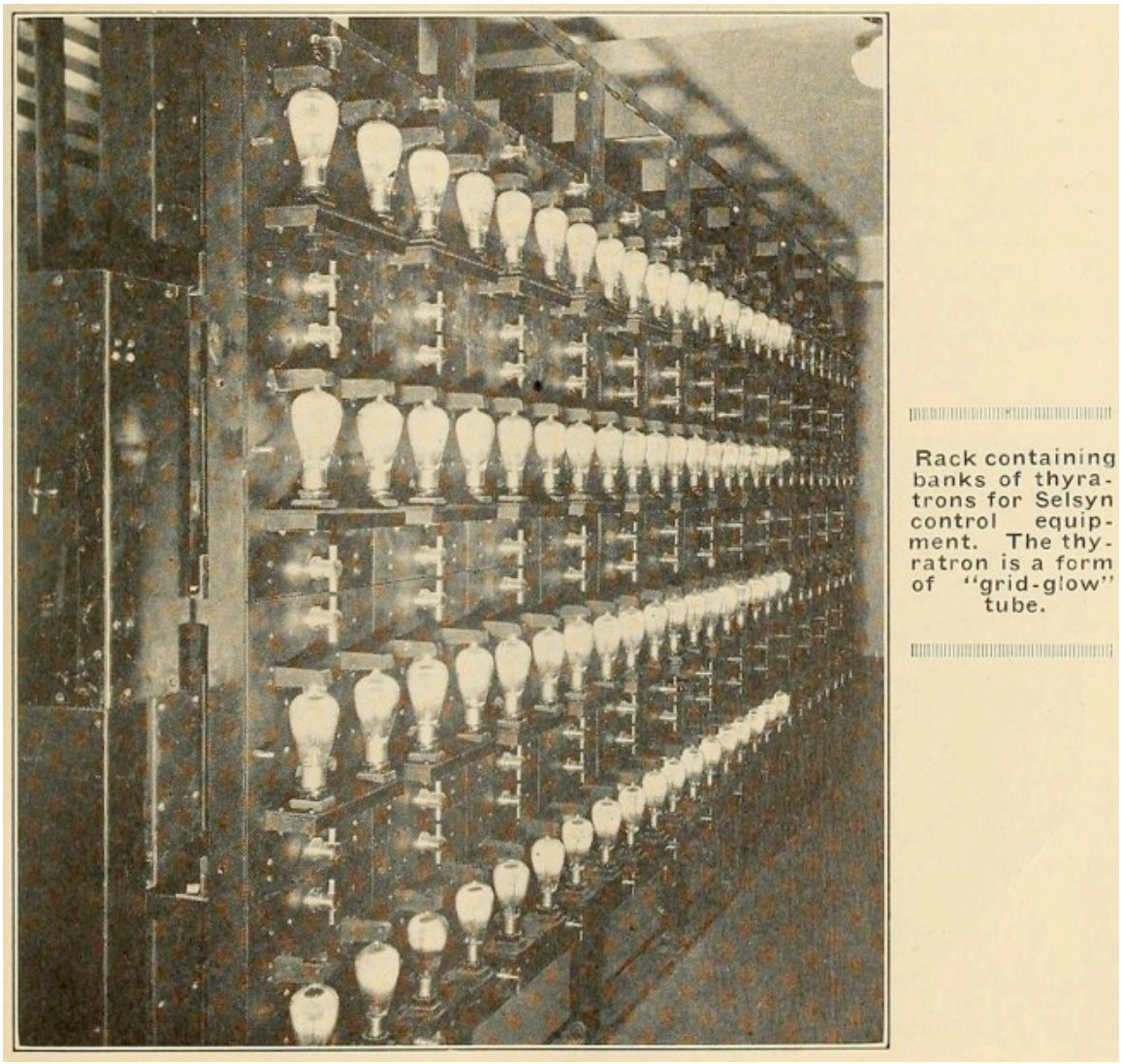
- The grand master knob controlling all the lights on the stage electrically controls the movement of the rotating element of a grand master selsyn. This selsyn is electrically connected with selsyn governing not only the major and minor groups of lights, but also the individual modulators for single lighting circuits. Therefore, movement of the grand master selsyn's control knob causes all the selsyns operating the modulators to move in conformity with it, and the modulators,
preset in accordance with the requirements of the scene, operate to control the lights. If, however, individual control of any major or minor group or individual lighting circuit is desired, the knob in question may be turned and the resulting movement does not interfere with any of the other circuits.

There are 141 individual stage lighting circuits in the new Chicago Civic Opera House. Each of these circuits includes lights of but one of the four colors used on a theatre stage — amber, white, blue and red. A typical circuit may cover the amber lights at one side or the center of the footlights, the red lights in one of the light bridges, or the white lights in one of the "pockets." These individual circuits are grouped under the control of master knobs governing, for example, all the blue lights in the borders and footlights, all the amber in the pocket lights, all the white in the light bridges, etc. In addition, all the lights of each color, no matter where, are controlled by a color master knob. Finally, all the color master knobs can be group controlled by the grand master knob. The same system is followed with the "house" lights of the theatre, but in a much simpler form as the lighting circuits involved

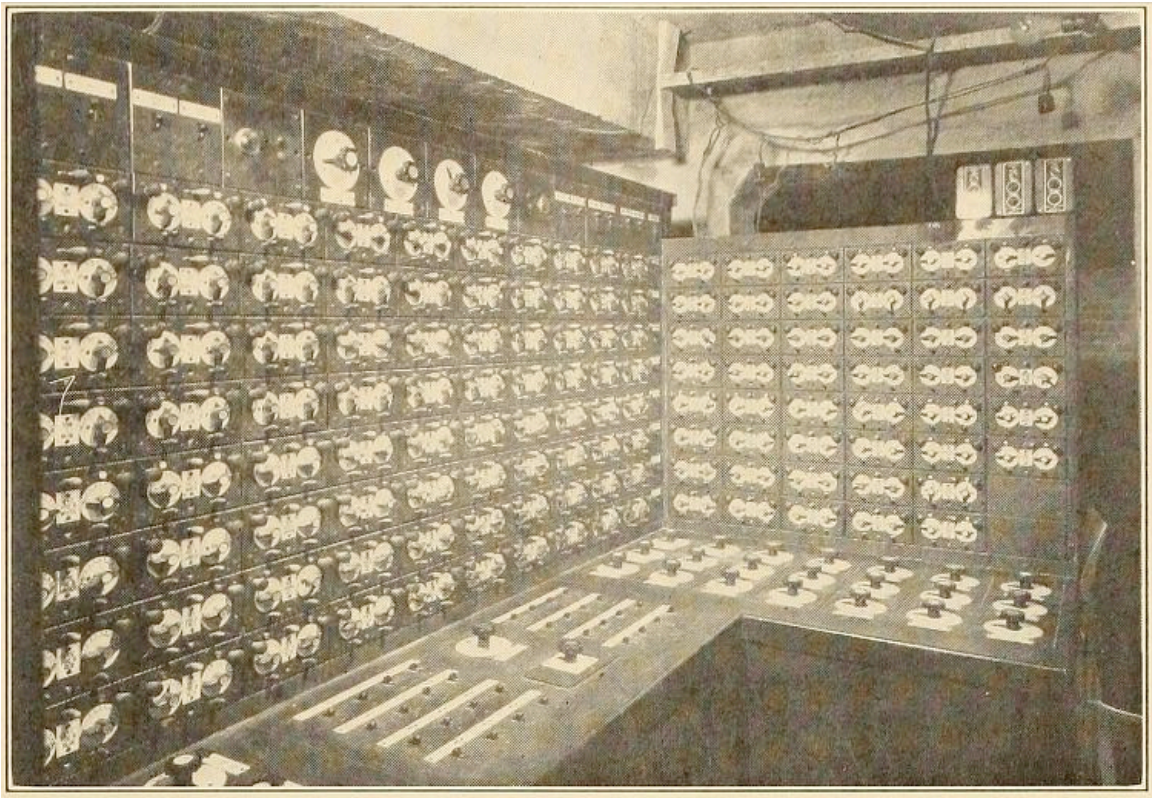
are comparatively few.

The energy involved in the control of any of the individual lighting circuits is approximately one-tenth that consumed by a pocket flashlight. The energy controlled, however, runs as high as 30,000 watts in a given circuit — more than half as great as the power ratings of the largest broadcasting stations in this country.

In actual operation, the lighting operator will preset the individual modulators to create the desired lighting effect in the first scene and, when the performance starts, the modulators will be connected in the circuit by means of a master tumbler switch.



Rack containing banks of thyratrons for Selsyn control equipment. The thyratron is a form of "grid-glow" tube.



Lighting-directors' control board for Selsyn thyratron control equipment for stage and auditorium lighting.

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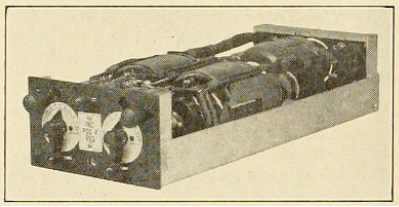

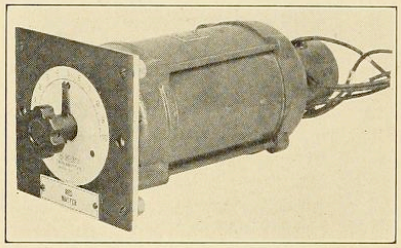

Above: Color master of Selsyn transmitter. Left: Voltage regulator unit of Selsyn receiver. Right: Grand stage master control of Selsyn transmitter.

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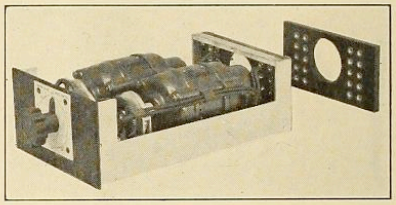
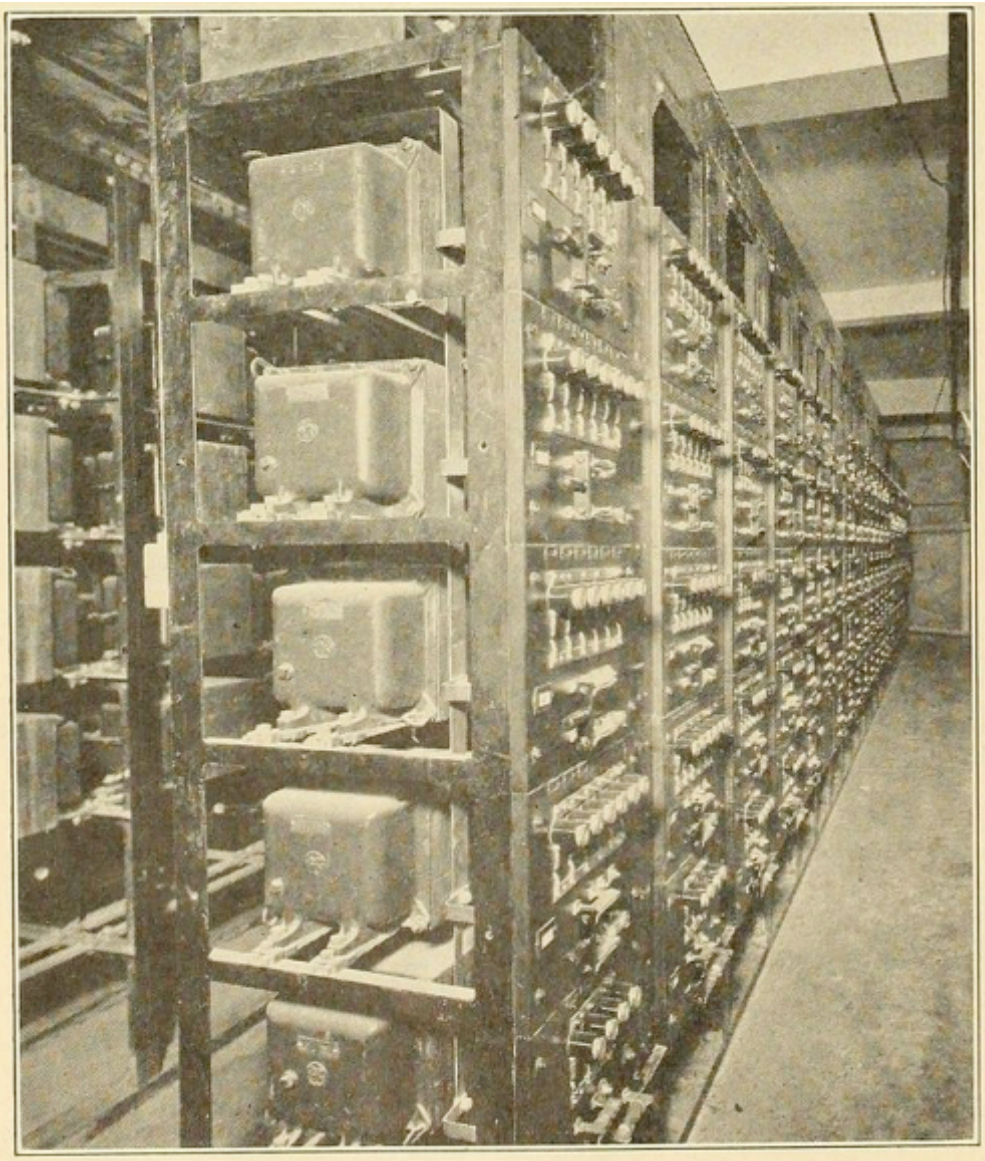
or dimming of the various lights or groups of lights. The operations of these dimmers required much physical effort and agility, and many elaborate and ingenious mechanical schemes were often resorted to in order to simplify the work. Their manipulation





Reactor and disconnecting switch rack for Selsyn thyratron control equipment for stage and auditorium lighting.