April 17, 1934. D. F. NEWMAN ET AL 1,955,682

REPRODUCER

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Fig. 1.

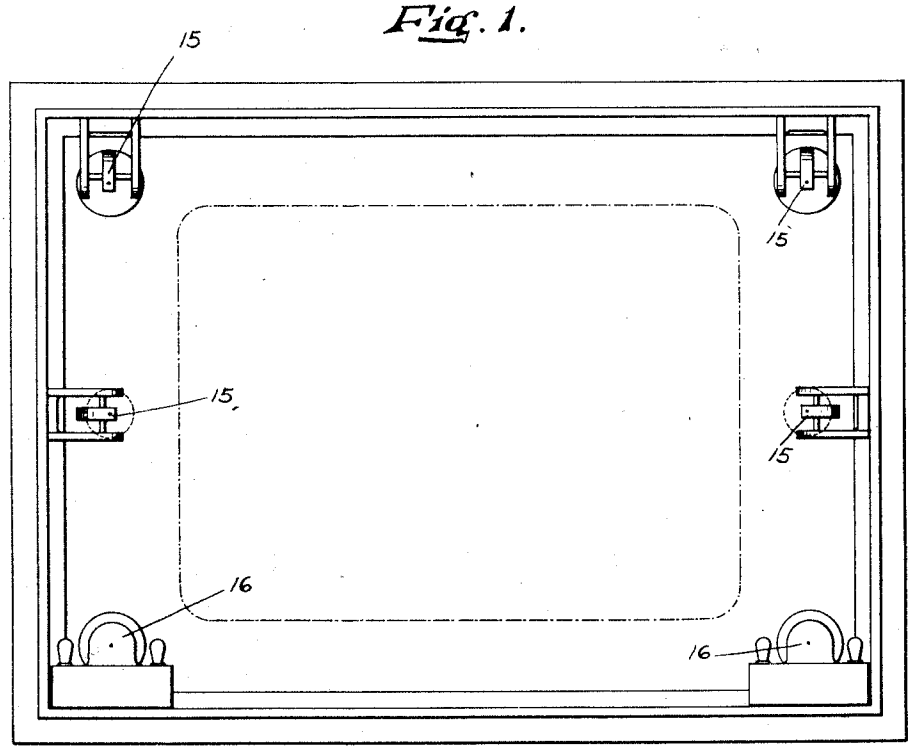
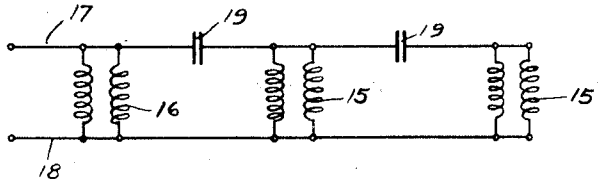


Fig. 2.



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Fig. 3.

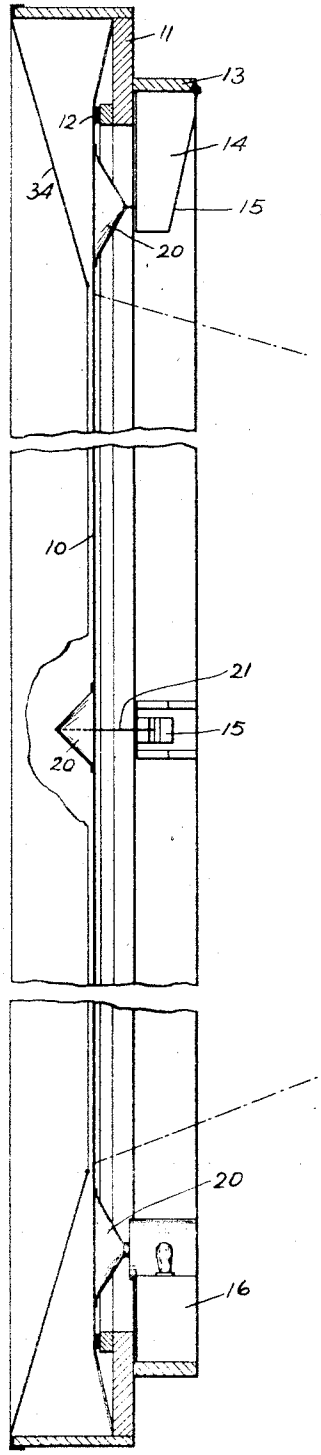


Fig. 4.

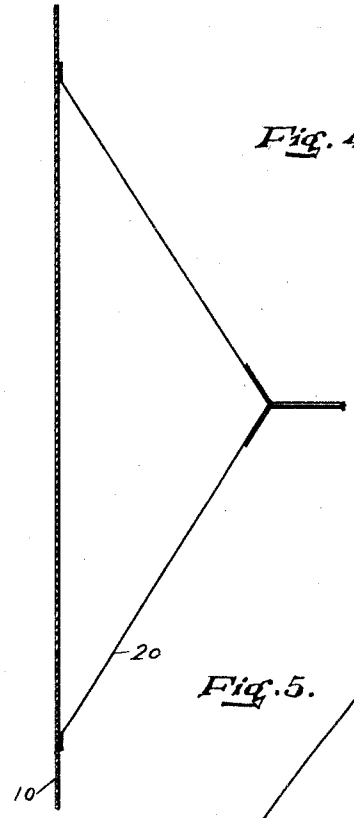
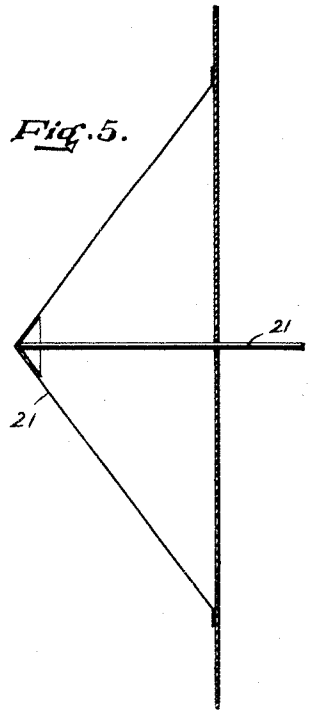


Fig. 5.



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Fig. 6.

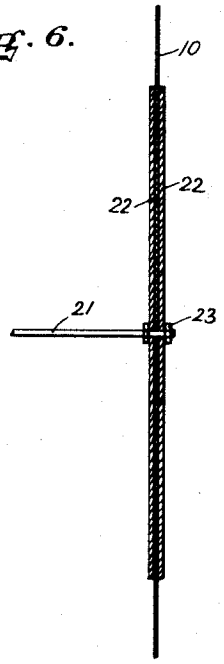


Fig. 7.

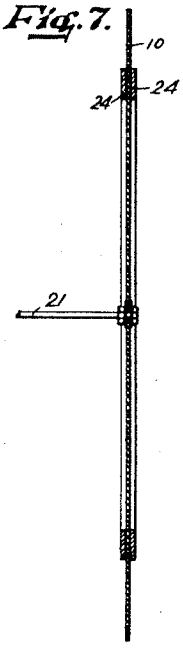
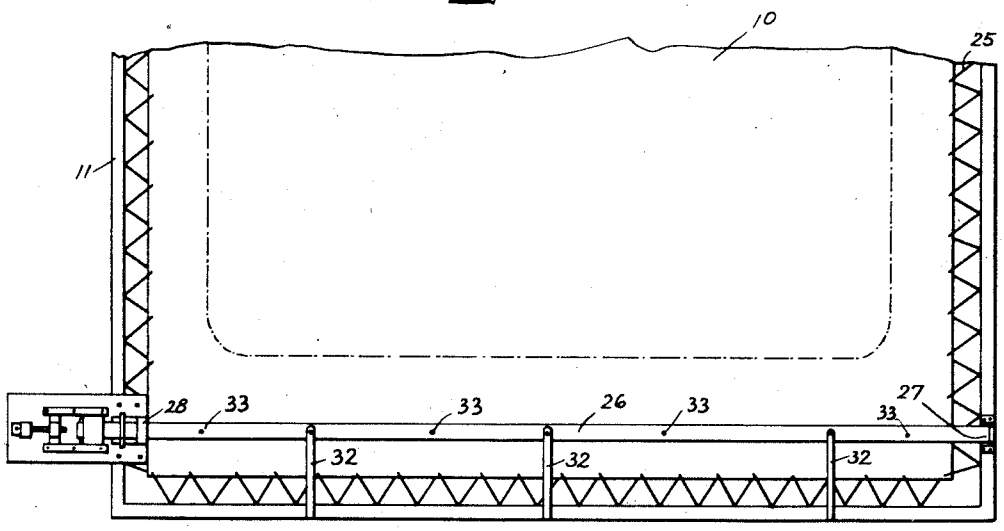


Fig. 8.



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Fig. 9.

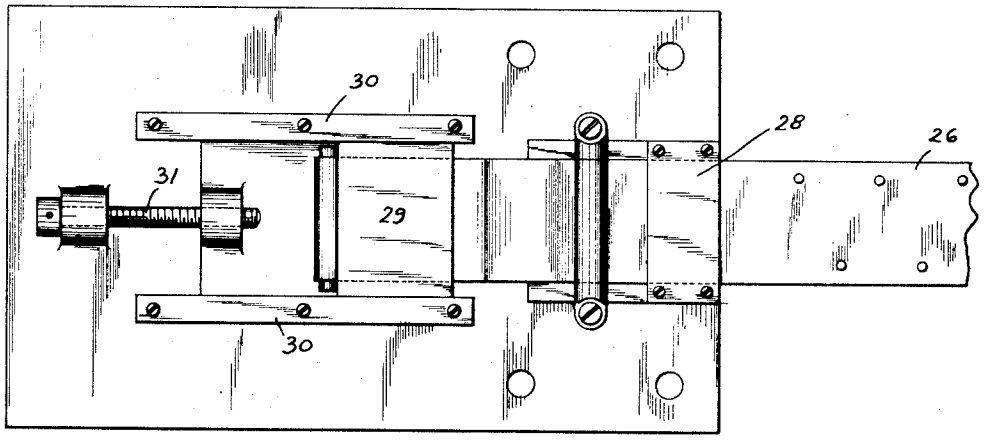
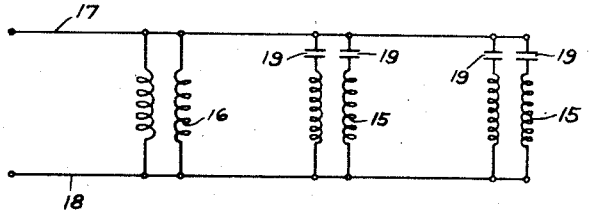


Fig. 10.



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Patented Apr. 17, 1934

1,955,682

UNITED STATES PATENT OFFICE

1,955,682

REPRODUCER

David F. Newman, Freeport, N. Y., and Ralph E. Hantzsch, Springfield, N. J., assignors to Trans-Lux Daylight Picture Screen Corporation, New York, N. Y., a corporation of Delaware

Application July 7, 1930, Serial No. 466,140

9 Claims. (Cl. 88—16.2)

This invention relates to a reproducer having functionally and structurally improved characteristics, and in its more specific aspects, aims to provide an acoustical reproducer primarily intended for employment in connection with light images and particularly moving pictures.

While in this latter association, it may be employed to advantage in many different manners, it is an object of the invention to provide an improved reproducer which will form a part of a light image receiving surface such as a screen. As such, the present invention will provide an apparatus ideally suited for use in connection with so-called talking moving pictures or motion pictures in which there is an acoustical effect.

A further object is that of furnishing a reproducer preferably embodied as part of a light image receiving surface and in which the entire unit thus furnished will be extremely compact and relatively light in weight so that this apparatus will embrace the characteristics of being portable and capable of ready shifting.

A still further object is that of furnishing a screen-reproducer unit which will embody relatively few parts, each individually simple in construction, these parts being capable of ready assemblage and adjustment to operate over long periods of time with freedom from mechanical and electrical difficulties.

Another object is that of constructing a reproducer of the nature stated which will have a non-directional effect and which, moreover, will heighten, to a marked extent—and with any desired volume—the illusion of the sounds emanating from the light images appearing upon the screen. As a consequence, the difficulties heretofore encountered in connection with an auditorium and under the use of horns or trumpets, will be avoided in that there will exist no focal zone or point of concentration of projected sound waves. Additionally, the benefit will occur that the sound waves are dispersed evenly throughout the entire auditorium and subject only to the acoustical limits of such auditorium, the sounds will appear with equal clarity and substantially equal intensity whether the observer is immediately to one side of the reproducer, materially above or below the same, at the rear of the auditorium or immediately in front of the reproducer.

An additional object is that of providing an apparatus of this character which will reproduce tones with maximum fidelity and clarity and throughout the entire acoustical range, and in which, moreover, there will not occur foreign sounds incidental to the operation of the reproducer.

With these and further objects in mind, reference is had to the attached sheets of drawings illustrating practical embodiments of the invention, and in which:

Fig. 1 is a face view of the reproducer-screen unit;

Fig. 2 is a diagrammatic view of the wiring which may be employed;

Fig. 3 is a sectional side view of the apparatus;

Figs. 4 and 5 are enlarged sectional views of the reproducing diaphragms;

Figs. 6 and 7 show alternative forms of diaphragm elements;

Fig. 8 is a fragmentary view of unit construction which may be employed;

Fig. 9 is an enlarged detailed view of one of the portions of such unit; and

Fig. 10 is a view similar to Fig. 2 but showing a slightly different arrangement of the parts.

While the present unit may be employed in numerous different associations as for example in connection with front projection motion pictures, advertising apparatus, television apparatus, etc., it is primarily intended to be employed as part of a rear projection installation. In other words, the unit will be employed to provide a light image receiving surface, the front of which will be viewed by the audience and to the rear of which projecting apparatus is disposed. To this end, while the screen may be made of any desirable material, it is preferably constructed of a material such for example as that disclosed in United States application of David F. Newman, filed April 25th, 1929, Serial No. 358,166. This material is translucent and ideally suited for rear projection work and offers freedom from the objections which have heretofore been noted in connection with rear projection.

Thus, the screen layer is indicated by the numeral 10 and is mounted as for example by having its edges suitably secured to a frame 11. Prior to passing over such frame, it may contact with a bearing strip 12 which may be of felt mounted by the latter, it being understood that in this manner the screen will be maintained irrespective of the amount of moisture of the air in a sufficiently taut condition so that no wrinkles will appear in its body and serve to spoil the quality of the projected light image. As shown, the screen is of an area adequate to accommodate the light image and has a portion beyond the same providing a border.

It is preferred that the sounds to be propa-

gated shall emanate from the area of this border portion, and to this end, the inwardly extending part of the frame may provide a flange 13 to which brackets 14 are attached. These brackets support reproducing units and these units may be of the magnetic and/or dynamic types as has been indicated at 15 and 16 respectively. As shown in Figs. 2 and 10, the units are connected and fed through leads 17 and 18 and within the former condensers 19 are preferably provided, these condensers being of a capacity such that they will act as filters to cause certain of the units to react with maximum intensity to certain frequencies while others of the units react to other frequencies.

In order to provide couplings between these units and the screen, cone elements 20 may be furnished which are secured to the operating stems 21, it being appreciated as shown in the lower portion of Fig. 3 that these operating stems might be minimized to the greatest extent insofar as size is concerned so that there will be no apparent tendency of these parts to react primarily to certain audible frequencies.

However, in most instances, it is desirable, as has been shown in Fig. 3, to have the operating stems of sufficient length and of proper flexible material so that in addition to acting as couplings, they serve to prevent the diaphragm areas of the screen from being subjected to torsional strains with consequent danger to clarity of reproduction. In other words, it will be understood that usually those edges of the areas which are relatively remote from the frame—i. e. extend towards the illuminated area of the screen—will move relatively freely and those area edges which are closely adjacent to the frame will offer maximum resistance to movement while the intermediate edge portions will have greater freedom of movement than the last named area edges, but will ordinarily have not as free a movement as the inner edge portions. Consequently, each of the diaphragm areas will to some extent tend to have uneven or unequal movements insofar as their several portions are concerned, and to prevent any difficulties in this connection, it is preferred that the stems of the unit as afore stated be somewhat resilient so as to assure maximum fidelity of reproduction.

The cones as illustrated in Figs. 4 and 5 may be constructed of any suitable material and may be joined at their apices to the operating stems as for example by cement, their free edges being likewise connected to the screen and preferably within the border portion of the latter, and at this time, it will be observed that the areas of the diaphragms and/or the thickness thereof are preferably so correlated that as shown, the intermediate diaphragms will react primarily to reproduce sound waves of relatively high frequency while the diaphragms of the upper magnetic units will reproduce primarily tones of an intermediate frequency; the diaphragms of the lowest units reproducing with maximum emphasis sound waves of relatively low frequencies. This tuning of the parts may obviously be assisted and emphasized by the construction of the units themselves, the rigidity of the diaphragms, the use of filters, etc., and in this connection, it will be appreciated that the purpose of employing in the embodiment under consideration dynamic units for the reproduction of the lower frequencies is primarily incident to the natural affinity of units of the latter class for such lower frequencies, while the magnetic units—particularly where smaller diaphragm areas are employed—will reproduce high and moderate types with maximum fidelity.

Certain of the cones may be glued or otherwise suitably attached to the rear face of the screen, or, if desired and as shown particularly in Fig. 5, the operating stem 21 may pass through an opening in the screen and be connected to the apex of the cone which in this instance extends from the front screen face. Likewise, in lieu of the cones, disks 22 may be disposed one adjacent each of the screen faces and clamped in position as for example by nuts 23 which are directly secured to the operating stem 21 or other desired portion of the actuating unit. In Fig. 7, a still further and in some respects preferred method of providing a diaphragm has been illustrated. In this view, the operating stem is attached directly or by suitable washer or plates to the screen material and the portion of the latter which is to act as a diaphragm is acoustically isolated from the screen body by clamping the same between rings 24. In both Figs. 6 and 7, the areas defined by the diaphragm portions are of course properly correlated to the frequencies primarily to be reproduced so that these diaphragms and their associated units will operate with maximum efficiency.

Regardless of the type of diaphragms or diaphragm areas employed, it will be appreciated that the screen will serve in certain respects as a modulating or mixing chamber, or it might with propriety be stated that the screen will function as a sounding board which not alone serves to amplify the sounds emanating from the diaphragm areas, but also correlates these trains of frequencies to closely blend the same and resulting in waves non directionally propagated throughout the auditorium with maximum clarity. Obviously, the diaphragm areas—or in fact the entire border portion of the screen—might be suitably treated to contribute materially towards the results desired. For example, according to the present invention, and if screen material of the nature afore indicated is employed, these portions of the screen might have no gelatine or formaldehyde might be applied thereto, the latter serving to harden these areas and increase the acoustical brilliancy thereof. Also that portion of the screen, i. e. the central portion thereof, might be treated to assure maximum results in connection with the sounding board and mixing chamber functions, and returning to the border areas, it will be understood that the material with which they are treated—considering that this is resorted to—might include a pigment rendering them opaque or substantially opaque and thus properly masking the units. At this time, it is also to be understood that the term "sounding board" as hereinafter employed to designate the function of a screen portion or portions is to be regarded as covering the functions of modulation, mixing, harmonizing, blending, secondary diaphragm, reflecting, and radiation.

In certain instances, it may be desired to still further adjust the reproducer as well as to provide for a connection between the screen and operating units which will permit of the coupling of these parts with minimum effort. To this end, and as shown in Fig. 8, the screen may be made in the usual manner or by means of lashings 25 be secured to the frame. Attached to one or both faces of the screen are strips 26 which are of any desired material as, for example, strip

aluminum of light gauge. One end of the strip or strips is secured conveniently as at 27 to the frame, and the opposite end or ends thereof may pass through a guide 28 and be secured to a traveller block 29 moving within rail portions 30, this block being shifted if desired through the medium of a screw 31 so that the band or bands may be subjected to varying degrees of tension.

Under vibration of the band or strip, it will be understood that node points are created, and at these points the areas of the strip or strips are acoustically segregated from each other as for example by brackets 32 attached to the frame and the strip or strips. By having these brackets equal distances apart, the strip or strips are in effect divided into areas reacting primarily to certain and different bands of frequencies, and as a consequence, those portions of the screen which are immediately adjacent thereto and accordingly act as diaphragm portions, will primarily tend to vibrate at such frequencies.

The operating stems or other desired portions of the units are of course connected to the strip as for example at the points 33, these points of connection being preferably intermediate brackets between the node points so that a maximum amplitude of vibration may be effected with minimum resistance to movement.

From the foregoing, it will be found that among others the advantages referred to and preceding the description of the figures, are achieved. Obviously, and as has been particularly shown in Fig. 3, those portions of the screen which provide the border to one side of the area of the light image and to which the reproducing units are connected, may be masked in any desirable manner as for example by utilizing a layer of sound transparent material 34 for this purpose. Additionally, it is apparent that while as shown in Fig. 8 only a single strip is employed that this strip might be duplicated along opposed side edges of the screen or along all edges of the same.

In conclusion, it will be appreciated that numerous changes in construction and rearrangements of the parts might be resorted to without departing from the spirit of the invention as defined by the claims.

Having described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. A reproducer including a body of material to provide a light image receiving surface, a border portion extending beyond the area of the light image surface, a strip secured to the face of said border portion, means for maintaining portions of said strip substantially against movement, and acoustical vibrating units secured to said strip at points beyond said last named means.

2. A reproducer including a body of material to provide a light image receiving surface, a border portion extending beyond the area of the light image surface, a reproducing unit disposed beyond said border portion, a cone attached at its periphery to the rear surface of said border portion, and means for coupling said cone to said unit.

3. A reproducer including a body of material to provide a light image receiving surface, a border portion extending beyond the area of the light image surface, reproducer units, means for coupling said units to said border portion to vibrate the latter, a strip secured to one surface of said border portion for maintaining said body, and means for adjusting the length of said strip whereby said body is maintained under proper tension.

4. A reproducer including a body of material to provide a light image receiving surface, a border portion extending beyond the area of the light image surface, reproducing units coupled to said border portion, certain of said units being of the magnetic type and others being of the dynamic type, and a plurality of condensers of different capacities arranged in said reproducer circuit so as to vary the range of frequencies of each of said units with respect to the others.

5. A reproducer including a body of material to provide a light image receiving surface, a border portion extending beyond the area of the light image surface, a reproducing unit disposed adjacent said border portion, a cone attached at its periphery to the front face of said border portion, and means for coupling said cone to said unit.

6. A reproducer including a body of material to provide a light image receiving surface. a border portion extending beyond the area of the light image surface, a reproducing unit disposed adjacent said border portion, a cone attached at its periphery to the front face of said border portion, and means for coupling said cone to said unit, the material of said border portion extending uninterruptedly across the base of said cone.

7. A reproducer including a body of material to provide a light image receiving surface, a border portion extending beyond the area of the light image surface, a reproducing unit disposed beyond said border portion, a cone attached at its periphery to the rear surface of said border portion, and means for coupling said cone to said unit, the material of said border portion extending uninterruptedly across the base of said cone.

8. A reproducer including a body of material to provide a light image receiving surface, a border portion extending beyond the area of the light image surface, reproducing units disposed adjacent said border portion, cones upon opposite sides of the body attached at their peripheries to the surfaces of said border, and means for coupling said cones to said units.

9. A reproducer including a body of material to provide a light image receiving surface, a border portion extending beyond the area of the light image surface, reproducing units disposed adjacent said border portion, cones attached at their peripheries to the surfaces of said border, and means for coupling said cones to said units, the material of said border portion extending uninterruptedly across the bases of said cones.

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