Oct. 10, 1939. A. B. HURLEY 2,175,434

SOUND-REPRODUCING AND LIGHT-REFLECTING MOTION PICTURE SCREEN

Filed Jan. 15, 1937

Fig. 1.

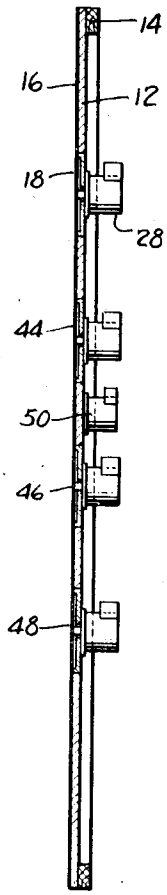


Fig. 2.

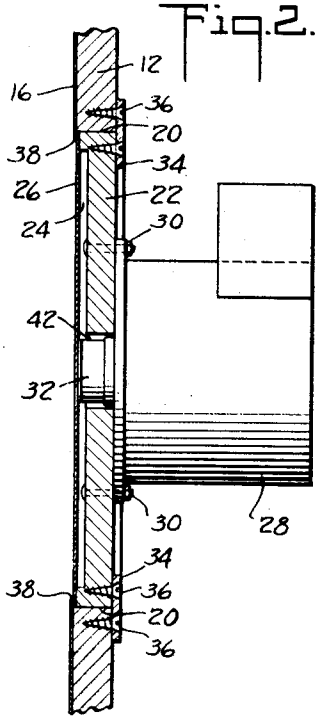
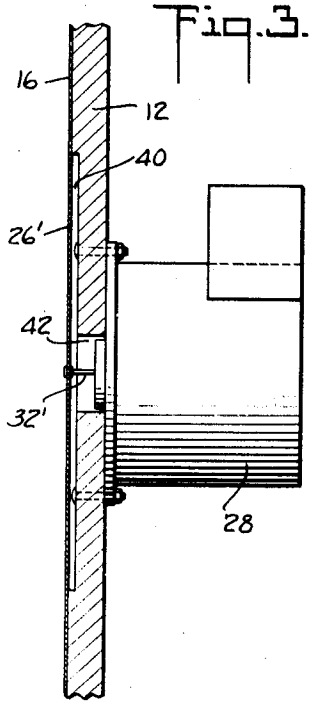


Fig. 3.



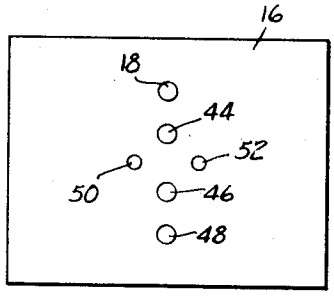
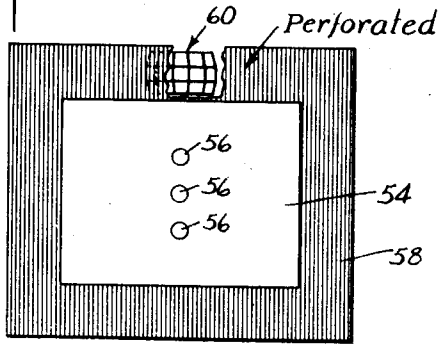


Fig. 4.

Fig. 5.



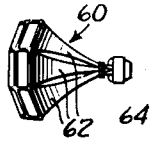


Fig. 6.

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SOUND-REPRODUCING AND LIGHT-REFLECTING MOTION PICTURE SCREEN

Albert B. Hurley, Huntington, N. Y.

Application January 15, 1937, Serial No. 120,661

2 Claims. (Cl. 88—16.2)

This invention relates to motion picture screens, and more particularly to a sound-reproducing screen for use with sound motion pictures.

The primary object of my invention is to generally improve sound motion picture screens. More particular objects are to eliminate the necessity for perforating the screen, thus improving the light-reflecting properties thereof; to eliminate the use of cones, horns, and the like, for sound reproduction; and to eliminate the use of special baffle boards independent of the screen and associated with the loud speakers. A further object of my invention is to provide a screen which is backed up by a large, flat, solid board which lends structural rigidity to the screen and supports the same in a true plane, thus avoiding distortion of the picture image. Still another object is to prevent sound reproduction from the back of the speaker system, while at the same time avoiding damping of the vibration of the speaker diaphragms. Other objects reside in the provision of a screen and sound reproducing apparatus which is compact in a direction perpendicular to the screen, thus requiring but little stage space in back of the screen, and which so reproduces the desired sound waves that the sound appears to come directly from the characters on the screen.

To the accomplishment of the foregoing and such other objects as may hereinafter appear, my invention consists in the sound reproducing screen elements and their relation one to the other, as hereinafter are more particularly described in the specification and sought to be defined in the claims. The specification is accompanied by a drawing, in which:

Fig. 1 is a section taken in elevation through a screen embodying features of my invention;

Fig. 2 is an enlarged section through one of the speakers;

Fig. 3 is a similar section through a modification;

Fig. 4 is a front elevation of a screen showing one of a number of possible arrangements for disposition or grouping of the speakers;

Fig. 5 is a front elevation of a modification using a special speaker system for reproduction of high-frequency tones; and

Fig. 6 is a side elevation of the said speaker system.

Referring to the drawing, and more particularly to Figs. 1 and 4, the screen comprises a comparatively thick and structurally rigid backboard 12 reinforced if desired, by an appropriate number of suitably disposed frame members 14. The board 12 may be made of wood pulp composition, or strawboard composition, or asbestos board, or any other suitable material. The board extends over the entire area of the screen, and functions to hold the same in perfectly flat or plane condition, thus avoiding distortion of the reflected image.

A lamination 16 of suitable light-reflecting material is applied to and secured directly on the front of board 12. The lamination 16 is preferably an imperforate and non-porous material such as a good quality of relatively stiff paper or thin fibre board. The lamination may also be made of or may have incorporated therein a quantity of asbestos. Other materials may also be used, the material either being an efficient reflector of light or else having a light-reflecting material or pigment coated on the surface thereof.

The board 12 is cut away or recessed at selected localized areas, these areas preferably being circular, as indicated at 18 in Fig. 4. The arrangement may be described with reference to Fig. 2, in which it will be seen that backboard 12 is cut away on the line 20. The cut-away part is replaced by a circular backboard 22 which is so disposed as to provide a space 24 behind lamination 26. A loud speaker motor 28 is secured to the board 22 in any suitable fashion, as by means of bolts 30. The motor is connected to diaphragm 26 by means of a suitable connection 32. The resulting loud speaker assembly is mounted in place as by the use of metal ring 34 and bolts or screws 36.

The diaphragm 26 is made from exactly the same material as the lamination 16, and is preferably cut from the same body of stock so as to provide an absolutely perfect color match. The lamination is, of course, exaggerated in thickness on the drawing, and in practice no perceptible line of division is visible at 38. Perfect match of color and material is essential in order to avoid detection or patch-work appearance when the brilliant illumination of the projector is thrown on the screen without any picture.

If desired, a single uninterrupted sheet of material may be used, and such an arrangement is shown in Fig. 3 of the drawing, referring to which it will be seen that the backboard 12 is continuous and is cut away at the diaphragm 26 only in the sense that it is recessed as shown at 40, thus freeing a circular area of lamination 16 for vibration, this area acting as a loud speaker diaphragm 26'. The speaker motor 28 is secured directly on backboard 12 and is connected to the speaker diaphragm 26' by a suitable connection 32'.

It will be understood that the arrangements of Figs. 2 and 3 are identical in function and operation, and are substantially identical in construction, the only difference being that in Fig. 2 a section of the backboard is cut away and then replaced after reducing the same in thickness, while in Fig. 3 the thickness is reduced while leaving the backboard intact.

The backboard behind the speaker diaphragm functions to effectually prevent appreciable sound propagation from the rear of the diaphragm. This is desirable in order to prevent conflict between the sound propagating from the front and the rear of the diaphragm. However, adequate clearance is provided around the connection **32**, as is indicated at **42**, in order to provide sufficient communication with the air in back of the screen to prevent damping of the vibration of the diaphragm. The backboard of the screen thus functions, first, as a baffle board for the speakers, this baffle board being as extensive as the screen, this function being fulfilled by the backboard outside the speakers; and second, as means to prevent rearward propagation of sound, this function being fulfilled by that part of the backboard located behind the speaker diaphragms.

Reverting to Fig. 4, it will be seen that in addition to the speaker at **38**, there are further speakers **44**, **46**, **48**, **50** and **52**. The speakers **38**, **44**, **46** and **48** differ from the speakers **50** and **52** in that the former are intended to predominantly reproduce low frequency tones, whereas the latter are predominantly intended to reproduce high frequency tones. The speakers may be distributed on the screen in any desired manner, and the number of speakers depends upon the volume of sound needed for the theatre.

Referring now to Figs. 5 and 6, I show a modification of the invention in which the screen **54** is provided with vibratile areas or speakers **56**, said speakers being intended predominantly for the reproduction of low frequency tones. The screen is surrounded by a preferably black fabric mask **58**, the fabric being either extremely porous or being perforated with a relatively large percentage area of perforations. Inasmuch as the mask is not used for light reflection, the perforations may be made substantially greater in area than would be feasible when providing the same directly through the screen. Behind the mask, I provide a suitable speaker system **60** intended predominantly for the reproduction of high frequency tones. The speaker here illustrated is a multi-cellular horn of known commercial construction. It consists of a group of exponential horns **62** leading from a common source of sound **64**. It will be understood that other types and other locations for the high frequency speakers may be used, the essential feature of the present modification of the invention being that the screen is imperforate and non-porous and therefore excellent in light-reflecting qualities, and localized areas of the screen are vibrated for the production predominantly of low frequency tones. The screen is structurally rigid and backed by solid board. A speaker system predominantly for the production of high frequency tones is disposed adjacent but outside the screen, it being concealed in any desired fashion, as by the use of an adequately perforated mask.

In connection with Figs. 4 and 5, it may be explained that these figures are deceptive in showing the diaphragm areas of the screen as visible circles. Actually, the surface of the screen remains unmarred, and is entirely uniform and continuous, it being impossible for the theatregoer to detect the speaker construction.

It is believed that the construction and operation of my improved sound motion picture screen as well as the many advantages thereof, will be apparent from the foregoing detailed description thereof. It will also be apparent that while I have shown and described my invention in preferred forms, many changes and modifications may be made in the structures disclosed without departing from the spirit of the invention defined in the following claims. In the claims, the expression that the backboard is "cut away" at the speaker diaphragm, is intended to be generically applicable to either complete cutting away of the board or to recessing of the board.

I claim:

1. A screen for use with sound motion pictures, said screen comprising a large rigid flat backboard, a lamination of imperforate and non-porous light-reflecting material, said lamination being secured directly to and supported by the backboard, one or more selected localized areas of the backboard being cut away whereby at the aforesaid areas the light-reflecting lamination may be vibrated for use as a loudspeaker diaphragm, and a speaker motor secured to the rear side of said backboard at each of the aforesaid areas, said motor being connected to the lamination in order to vibrate the same as a loudspeaker for predominantly reproducing low frequency tones, a perforated black mask outside the screen, and a speaker system for predominantly reproducing high frequency tones disposed in back of said mask.

2. A screen for use with sound motion pictures, said screen comprising a large rigid flat backboard, a lamination of imperforate and non-porous light-reflecting material, said lamination being secured directly to and supported by the backboard, one or more selected localized areas of the backboard being recessed rearwardly whereby at the aforesaid areas the light-reflecting lamination may be vibrated for use as a loudspeaker diaphragm, a speaker motor secured to the rear side of said backboard at each of the aforesaid areas, said motor being connected to the lamination in order to vibrate the same as a loudspeaker for predominantly reproducing low frequency tones, the portion of the backboard disposed behind the speaker diaphragm functioning to prevent effective sound propagation from the rear of the diaphragm, said portion being apertured or provided with sufficient clearance around the aforesaid motor connection to prevent damping of the vibration of the speaker diaphragm, a perforated black mask outside the screen, and a speaker system for predominantly reproducing high frequency tones disposed in back of said mask.

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