

N° 2347



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COMPLETE SPECIFICATION.

Improvements in connection with Photographic Lenses.

We, JOHN STUART, Managing Director of Ross, Limited, and WILLIAM BIBLICKE, Mathematician, both of 3, North Side, Clapham Common, in the County of London, do hereby declare the nature of this invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to photographic lenses composed of a front positive combination and a back negative combination, such as are known as telephoto lenses. The said lenses have the image distance, that is, the distance from the last glass surface to the ground glass, or film, short as compared with the equivalent focus of the lens. There are two kinds of telephoto lenses known, one being composed of a positive combination constituting a perfectly corrected photographic objective and a negative combination corrected for spherical and chromatic aberration and the other kind being composed of a positive combination and a negative combination which are not corrected individually for the different aberrations, the aberrations in the compound lens being brought to a minimum by giving to the aberration of the positive combination algebraical signs opposite to those of the negative combination.

Both these kinds of telephoto lenses have the focal length of the positive combination longer to a greater, or lesser, extent, (even approaching equality) than the focal length of the negative combination. The negative aberrations in the negative combination are therefore, considerable and it is necessary to give the positive combination a considerable positive aberration, which causes large spherical zonal aberrations making the lenses unsuited for large apertures.

According to the present invention the correction is obtained in the following manner. We regard the compound lens as one optical system, which has been corrected in the same manner as any other photographic objective, the best results being obtained when the focus of the negative combination is longer than that of the positive combination. The negative combination can therefore be made with very shallow curves which do not cause large negative aberrations and the positive combination can also be made with shallow curves, as the necessary amount of positive aberrations is not very great. We make the positive combination of three component lenses, cemented together, two of these having a negative power and enclosing a lens of positive power, one of the contact surfaces having its convexity and the other its concavity, presented towards the incident rays of light, and we make the negative combination of a double concave lens cemented to a double convex lens, with its surface which is in contact with the double concave lens presented towards the incident rays of light. On this surface the difference of the indices of refraction should be as great as possible and preferably not less than 0.09.

The accompanying drawing is a diagram representing in section a compound lens constructed according to our invention, having the following data of construction for a focal length of 305 millimetres and an aperture of $f/6.8$. All curvatures which are convex towards the incident light are positive.

[Price 8d.]



Stuart and Bielicke's Improvements in connection with Photographic Lenses.

RADIi OF CURVATURES.

R ₁ +	63.0
R ₂ +	42.8
R ₃ -	107.0
R ₄ +	282.4
R ₅ -	59.5
R ₆ +	39.2
R ₇ -	92.3

THICKNESSES OF LENSES AND
DISTANCES OF SEPARATION.

d ₁	4.5
d ₂	13.4
d ₃	3.6
s	50.2
d ₄	3.6
d ₅	16.0

INDICES OF REFRACTION.

	D line	G ¹ line	v
Lens A	1.6124	1.6343	37.0
" B	1.5733	1.5860	57.5
" C	1.5781	1.5966	41.0
" D	1.6118	1.6256	56.8
" E	1.5202	1.5333	51.3

Focal length of front lens + 142.4 millimetres.

Focal length of back lens - 160.6 millimetres.

Having now particularly described and ascertained the nature of our said invention, and in what manner the same is to be performed, we declare that what we claim is:—

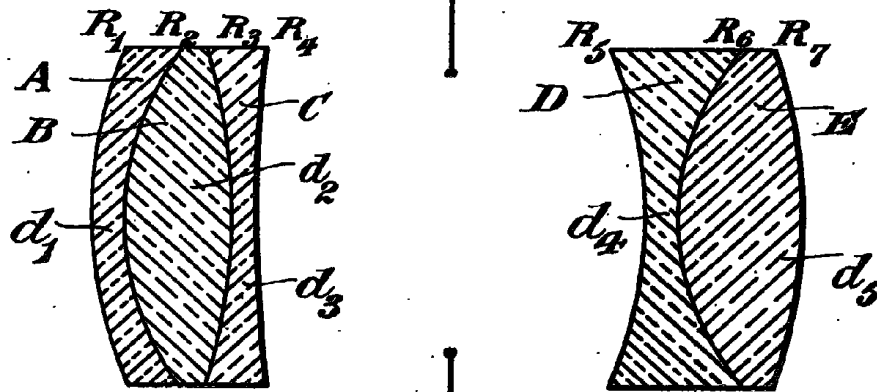
1. A photographic lens of the telephoto lens type the said lens being composed of a positive front combination and a negative back combination of a focal length longer than the focal length of the positive combination.

2. A photographic lens of the telephoto type, the said lens being composed of a positive front combination and a negative back combination of a focal length longer than the focal length of the positive combination, the positive combination consisting of three component lenses, two of negative power enclosing one of positive power, one of the surfaces separating the lens of positive power from that of negative power having its convexity, and the other having its concavity, presented towards the incident rays of light, the negative combination being composed of a double concave lens and a double convex lens with its surface which is in contact with the double concave lens presented towards the incident rays of light, the difference of refraction on this surface being as great as possible as hereinbefore explained.

Dated this 29th day of January, 1912.

JOHNSONS & WILLCOX,
47, Lincoln's Inn Fields, London, W.C.,
Agents.

[This Drawing is a full-size reproduction of the Original.]



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