KIT No. 1336

the Human Eye

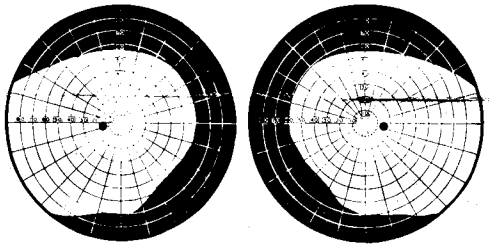
LINDBERG®

HUMAN SCIENCE

THE IMPORTANCE OF SIGHT to a complete understanding of the world around us cannot be over emphasized. The other four senses all play their part, but sight completes and furnishes an answer to the questions or doubts that other senses furnish to our minds.

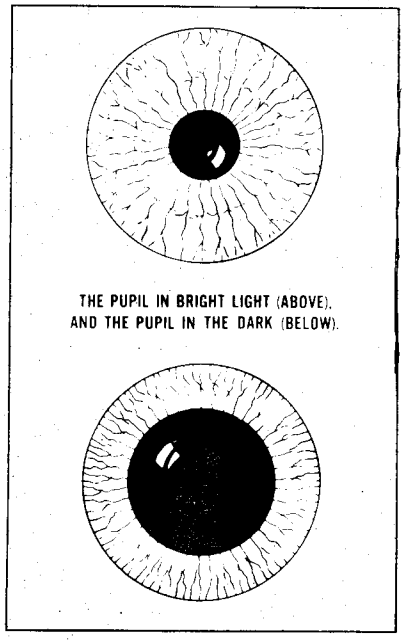
We **feel** a sharp point and we look to **see** what the point is and how to avoid or how to use it; we **hear** a gun shot and we look to **see** where it originated and how its closeness will endanger us; we **smell** a skunk and look to **see** where he is and how to avoid him; we **taste** a sweet and look to **see** its appearance and quality. For untold centuries man has recognized the importance of the eye and sight to his well being and existence. Insurance companies recognize the importance of the eye by considering loss of vision as a total disability.

The position of the human eyes, in the front of the head, is most important. It enables man to see the same object with both eyes, while most animals, having one eye on each side of the head, see an object with only one eye. This gives man the ability to see in depth and with distance perspective, since each eye sees the same object but from a slightly differing angle. Through experience man's brain has learned to blend the two images into one, giving the important impressions of relative size, thickness and perspective. Animals which have eyes on the sides of their heads lack this important quality, and to them the world is a flat world with length and width but no conception of depth. A human who is born with vision in only one eye has this same lack of perception of depth and thickness. Depth perception can be developed with time and training, but individuals with vision in only one eye find it difficult to carry on in vocations requiring that ability



LEFT EYE RIGHT EYE

THE NORMAL FIELD OF VISION OF EACH EYE WHEN LOOKING STRAIGHT AHEAD. THE BLIND SPOT IN EACH EYE IS LOCATED A LITTLE TO THE OUTSIDE AND BELOW CENTER.



THE PUPIL IN BRIGHT LIGHT (ABOVE), AND THE PUPIL IN THE DARK (BELOW).

Vision, whether it be by a fish in a lake, or by man outdoors or in his home, requires two factors — light to see by and the eye to see. In total darkness, despite belief to the contrary, not even a cat can see, and in the bright glare of the desert at high noon, without eyes present to see by, there is no vision. The eye initiates vision, and through its connection with the brain (the optic nerve) forwards sensation leading to action. As the human embryo develops, a part of the section which will become the brain separates away and develops into the eye. The separation is not complete, however, as the eye remains connected to the brain by the optic nerve.

Physically the eye is a small, roundish body, about an inch in diameter, set into a depression, or socket in the skull. It is protected from injury by the bones of the skull forming the brow above, and from the sides and below by the bones forming the nose, cheekbones, and temples. It is connected and held in place, and moves, through use of external muscles, nerves, blood vessels, and tissues. The eyelids close almost instantly to protect the eye from objects seeming to come at it, and it is lubricated and washed by the tear glands with an antiseptic fluid to aid motion and keep the eye refreshed.

Let us now consider the parts of the eye from the front where light enters, to the back where the optic nerve leads to the brain.

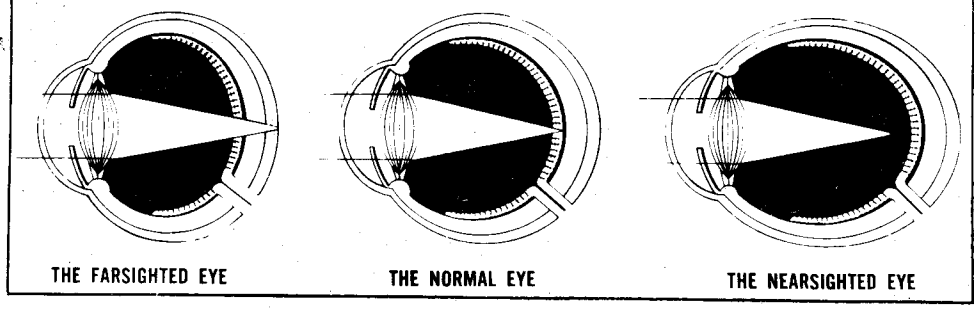
The **CORNEA** is an extremely sensitive, round, and transparent body which functions as a protective shield for the eye. The **AQUEOUS CHAMBER** behind the cornea, holds the **AQUEOUS HUMOR**, a transparent fluid. Next we find the **IRIS**, a membrane that functions as a shutter, contracting or dilating to admit more or less light. It is colored and gives the color, blue, brown, etc., to the eye. In bright light it contracts and in dim light dilates, or opens, to admit more or less light. The black spot, the **PUPIL** of the iris is an opening, and appears to be black since the inside of the eye itself is dark. Immediately behind the iris is a transparent **LENS**, suspended in place by a very thin ligament which attaches to the inner circumference of the eye. The lens is elastic, and through the tension and relaxation of the suspensory ligaments and the **CILIARY MUSCLE**, changes from a flat disc to a thickened one, changing the focus of the eye. This process is called "accommodation" and is done automatically without any conscious thought. This enables us to look at nearby objects, then distant ones, without any adjustment. The Ciliary Muscle, which surrounds the lens and helps make the adjustments, tightens to give a flat shape to the lens for distant objects and relaxes the lens to a more spherical shape for nearer objects. The lens allow us to see and focus clearly.

Filling the bulk of the eye behind the lens, is the **VITREOUS HUMOR**, a transparent, jelly-like material, which helps the eye to maintain its shape, and which will 'give' under the pressure of an accidental blow. Except for the front, the inside of the eye has a lining of nerve elements directly connected to the optic nerve. This lining is called the **RETINA**. The entire eyeball functions to supply and feed the retina and keep it in condition to perform its most important function — translating light into sight. The specialized function of the eye — to distinguish size, shape and details, to distinguish shades and tints of color, to determine if an object is standing still or moving, etc. — is performed in the makeup of the retina.

The retina contains two types of light receptor nerves — **CONES** and **RODS**, so-called because of their shapes. In the exact center of the back of the retina, in an area termed the **MACULA LUTEA**, or yellow spot, the cones are found, crowded together in a small area. This area, containing an estimated seven million cones in the human eye, has the keenest vision, and holds our ability to distinguish fine detail and shape, colors, and sizes. The rods are scattered over the rest of the retina area. There are about twenty times as many rods as cones, and they are more sensitive to light than the cones. They enable us to see under conditions of dim light, and distinguish motion.

At the spot where the optic nerve enters the eye we find an area where there is no visual perception, called the **BLIND SPOT**. The pupil, in contracting and expanding under conditions of bright or dim light, helps to focus on the central Macula, giving sharp definition in bright light, but in dimmer light, when the pupil opens to allow more light into the eye, light spreads into the area where the rods are affected. Thus daylight vision is affected more by the central cone area, and night vision by the peripheral rod area. An envelope of tough white tissue, termed the **SCLERA**, holds all the eye mechanisms. Through it run the blood vessels and nerves which supply the eye.

With as complex and important an organ as the eye it has been impossible here to describe more than the basic characteristics and functions. We hope that this model and text will stimulate your interest in further study. The many excellent texts available at your bookstore, library, or to be found in encyclopedias, will answer any advanced questions and describe in finer detail the functions, malfunctions, and cause and treatment of this most important organ of the body.



THE FARSIGHTED EYE THE NORMAL EYE THE NEARSIGHTED EYE

Before you start to assemble your kit, lay out all the parts to become familiar with them. Each plastic part has a small code number or letters, either on the back or on a small round tab attached to the plastic. **DO NOT REMOVE** tabs A - B - C - D until model is complete. You must refer to the code numbers or letters to help match adjoining parts when cementing your model together.

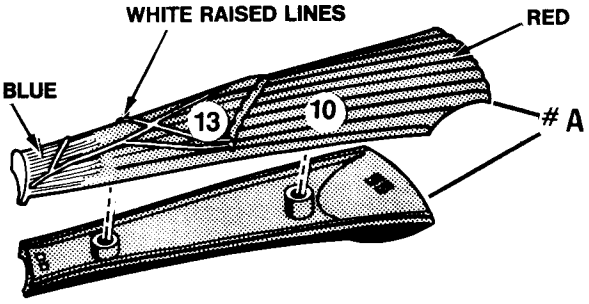
USE POLYSTYRENE CEMENT AND ENAMEL OR PLASTIC PAINTS ONLY. Be sure to follow the directions carefully and cement only the parts indicated. Some parts must be removable, so you can display the inside sections of the eye.

If you do not wish to paint your model, just assemble it carefully and place the gummed round numbers on the correct locations, as illustrated by the numbers in circles, as indicated. A full color painted model, if carefully rendered, will make the best laboratory model. Refer to the illustration on the box top and follow the arrows on the drawings, which indicate where to paint the different colors. Some painting will be easier if done before you assemble the parts.

(1) — SMALL GUMMED NUMBERS

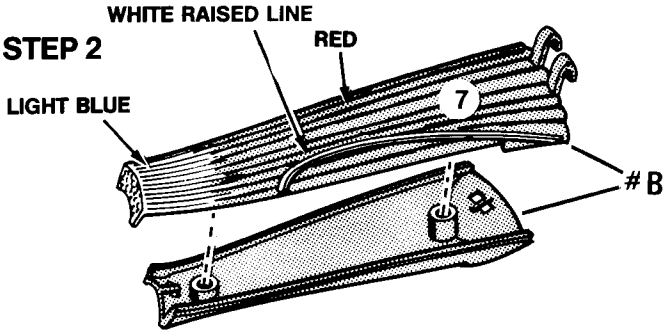
— PART NUMBER OR LETTER

STEP 1



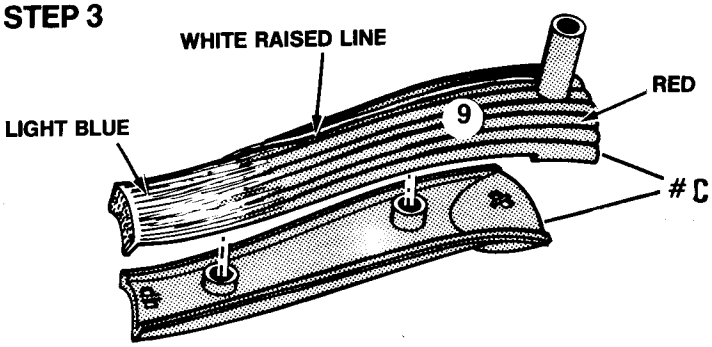
1. Superior Rectus Muscle. Cement A to A.

STEP 2



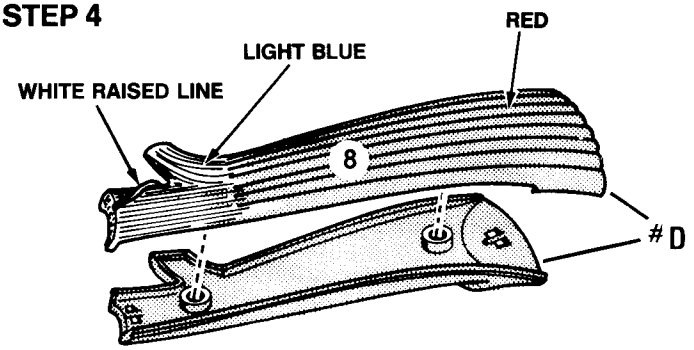
2. Medial Rectus Muscle. Cement B to B.

STEP 3



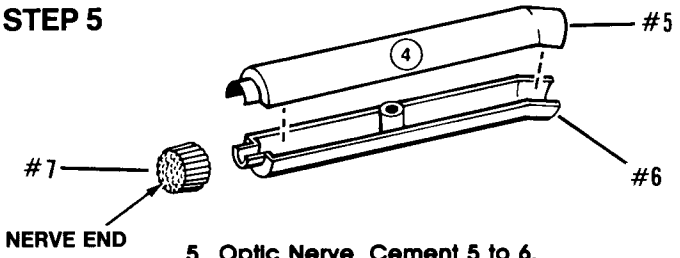
3. Inferior Rectus Muscle. Cement C to C.

STEP 4



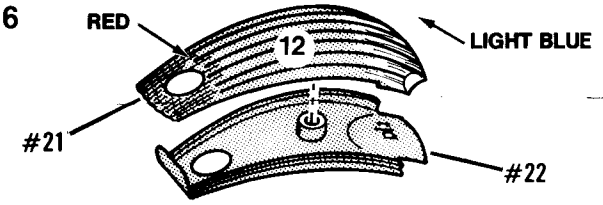
4. Lateral Rectus Muscle. Cement D to D.

STEP 5



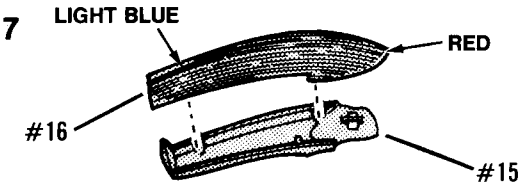
5. Optic Nerve. Cement 5 to 6. Cement Nerve end 7 to end of Optic Nerve.

STEP 6



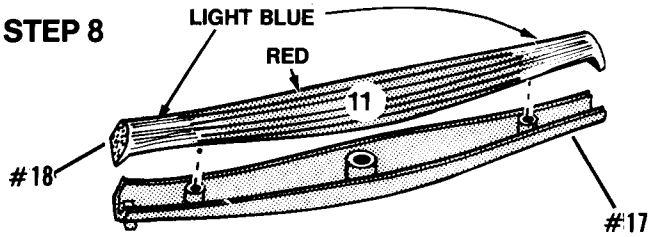
6. Inferior Oblique Muscle. Cement 21 to 22.

STEP 7



7. Branch Superior Oblique Muscle. Cement 15 to 16.

STEP 8



8. Superior Oblique Muscle. Cement 17 to 18.

STEPS 9 — 18

9. Lacrimal Tissue (front). Cement two pins on part 25 into two slots on side of Sclera No. 1.

10. Lacrimal Tissue (rear). Cement two pins on 26 into two slots ont side of Sclera No. 2.

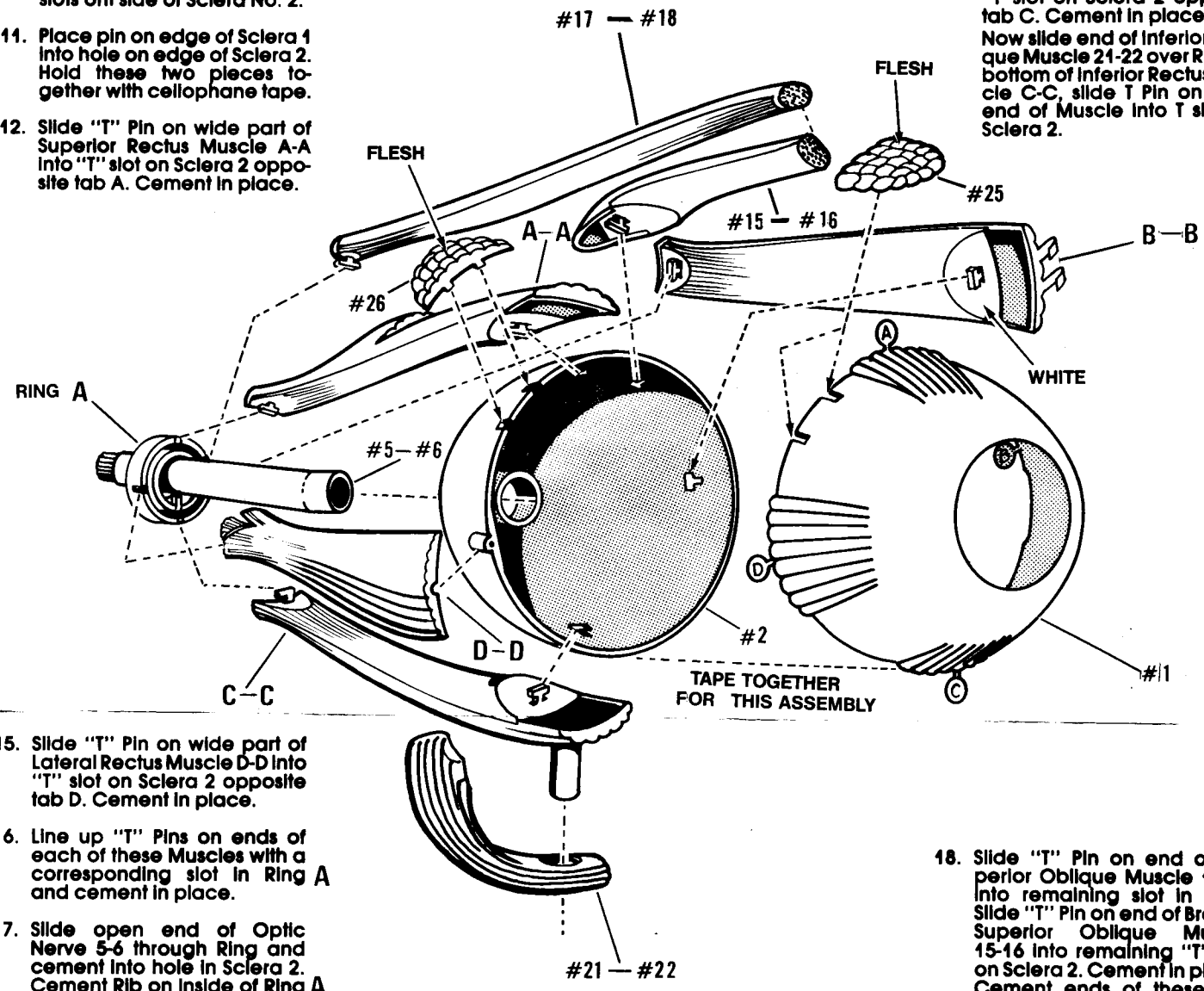
11. Place pin on edge of Sclera 1 into hole on edge of Sclera 2. Hold these two pieces together with cellophane tape.

12. Slide "T" Pin on wide part of Superior Rectus Muscle A-A into "T" slot on Sclera 2 opposite tab A. Cement in place.

13. Slide "T" Pin on wide part of Medial Rectus Muscle B-B into "T" slot on Sclera 2 opposite tab B. Cement in place.

14. Slide "T" Pin on wide part in Inferior Rectus Muscle C-C into "T" slot on Sclera 2 opposite tab C. Cement in place.

Now slide end of Inferior Oblique Muscle 21-22 over Rod on bottom of Inferior Rectus Muscle C-C, slide T Pin on wide end of Muscle into T slot on Sclera 2.



15. Slide "T" Pin on wide part of Lateral Rectus Muscle D-D into "T" slot on Sclera 2 opposite tab D. Cement in place.

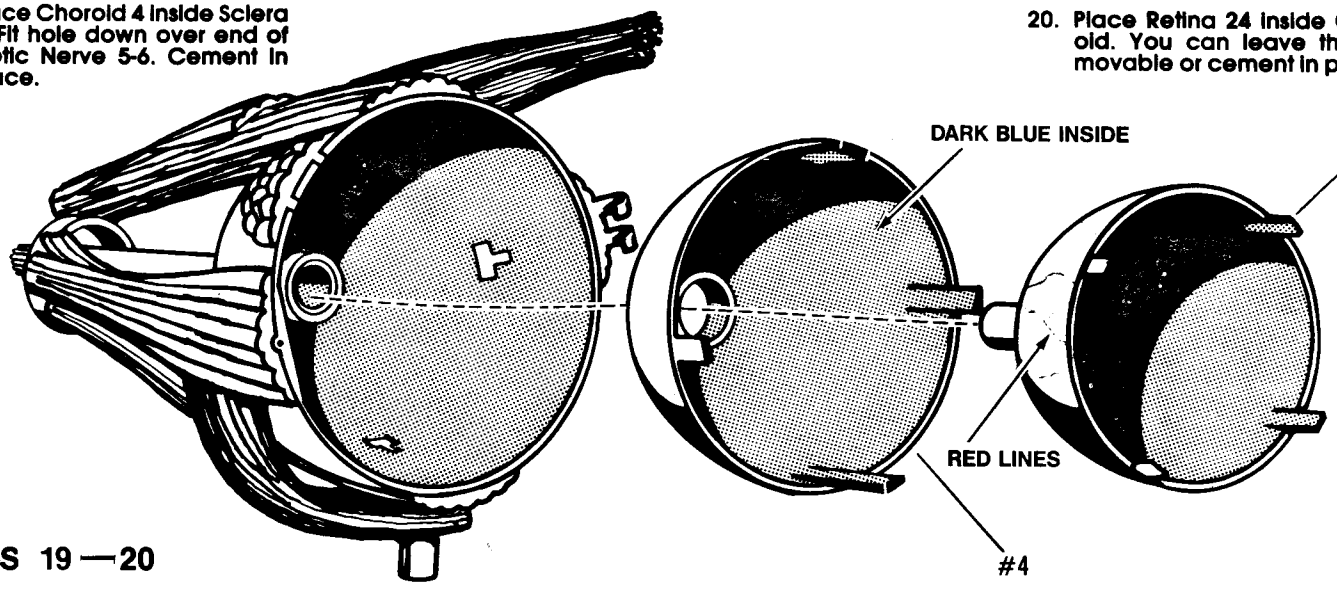
16. Line up "T" Pins on ends of each of these Muscles with a corresponding slot in Ring A and cement in place.

17. Slide open end of Optic Nerve 5-6 through Ring and cement into hole in Sclera 2. Cement Rib on inside of Ring A into slot in Optic Nerve.

18. Slide "T" Pin on end of Superior Oblique Muscle 17-18 into remaining slot in Ring A Slide "T" Pin on end of Branch Superior Oblique Muscle 15-16 into remaining "T" slot on Sclera 2. Cement in place. Cement ends of these two muscles together.

19. Place Choroid 4 inside Sclera 2. Fit hole down over end of Optic Nerve 5-6. Cement in place.

20. Place Retina 24 inside Choroid. You can leave this removable or cement in place.



STEPS 19 — 20

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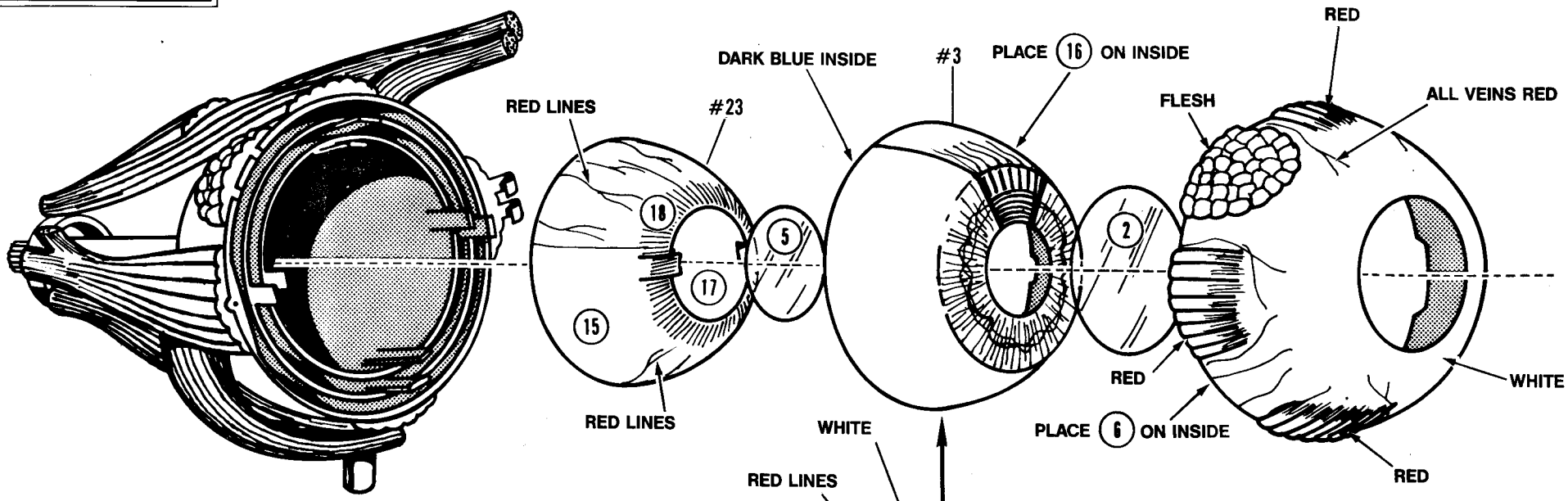
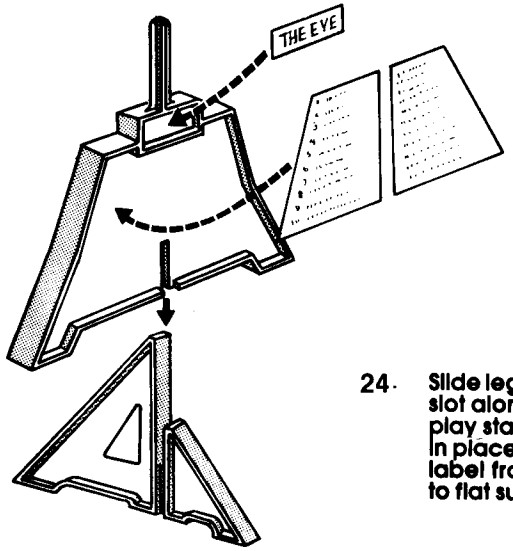
STEPS 21 — 24

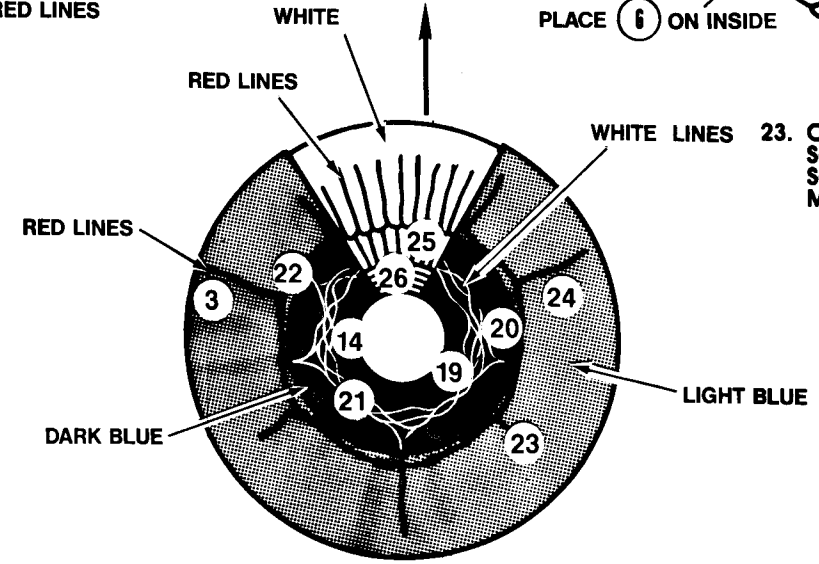
21. Slide Lenz 5 into recess in front of Retina 23, then assemble to Retina 24. Do not cement, this piece must be removable.

22. Assemble Choroid 3 to Choroid 4. Do not cement, this piece must be removable.





24. Slide legs of display stand into slot along center of large display stand. Cement carefully in place — peel identification label from backing and stick to flat surface on stand.



23. Cement Lenz 2 to inside of Sclera 1. Press Pin on edge of Sclera 1 into hinge on edge of Medial Rectus Muscle B-B.

NOTE When ordering missing, damaged or replacement parts for your model, please specify COLOR as well as NUMBER of the part. Also NAME and NUMBER of the kit.