It is the object of this paper to describe some of the principles used in the new Rife Microscope in obtaining its peak of magnification and source of illumination, both of which have in the past created much comment and criticism among critics.

Among these are many with little or no knowledge of the optical principles used in microscopy and are utterly incapable of judging the faults or merits of the ordinary simple compound microscope.

It is an undisputed fact that any amount of enlargement can be obtained by the method of projection. Quite true, but this with a decided loss of detail. The conventional compound microscope carries the standard optical tube length of 160 milimeters. That is, it has 160 milimeters of projection from the master lens of the objective to the optical point of the ocular. However, in this instrument we have 350 milimeter of tube length or its equal, and the greatest distance of projection between lens units being 30 milimeters. The source of light passes through 17 intercepting lenses and prisms in the body tube, which does not include the lens units of the objectives and oculars. This method greatly increases the depth of focus and almost entirely eliminates chromatic and spherical abberation, as the field of this instrument is flat and sharp from the center to the extreme edge.

So by applying this system optics and diminishing projection to a maximum of 30 milimeters, it is possible to use objective lenses as oculars. In the objective we have a more highly corrected lens system than it is possible to obtain in any standard type of ocular.

The revolving nose piece of this instrument carries a 1/12 (one twelfth) dry lens, a 1/16 (one sixteenth) water immersion, a 1/18

oil immersion, and a 1/25 (one twenty-fifth) oil immersion.

The occulars are composed of three matched pairs of 10 milimeter, 7 milimeter, and 4 milimeter objectives in short mounts. This gives a peak magnification of 17,000 (seventeen thousand) times.

The illuminating unit is composed of 14 lenses and prisms; Three (3) in the lamp unit, four (4) rotating wedge prisms of the Risley type, and the seven (7) units of the applonatic condenser which has a numerical apperture of one-forty (1.40). The entire system of lenses and prisms of this illuminating unit, as well as the lens and prism system of the body tube are made from block crystal quartz, thus allowing a greater volume of light passage than crown or flint glass.

The prisms of the body tube are adjusted and held in alignment by micrometer screws of 100 threads per inch in special racks built of magnelium, with ground surfaces checked for surface accuracy by Joe Hansen gauges.

The base of this instrument is a plate of nickel cast steel eleven by fifteen inches, and one and three-eighths inches in thickness accurately surfaced, and is equipped with three leveling screws and two spirit levels set at 90 degree angles.

The complete rotating and oscillating stage is supported in the center of this plate by substantial columns. The body tube and its lens system are supported on a 2-inch steel pillar post, 12 inches in height placed directly in back of the stage. The body tube is controlled in its course adjustment by a block-thread screw of forty threads to the inch, and slides in a one-and one-half (1-1/2) inch dovetail with gibs. The tube assembly can be manipulated in a horizontal movement with a duplicate control, and can also be tilted through an arc of 45 degrees, plus or minus, from dead center. The body tube is also equipped with spirit levels and an angle meter.

The intermediate adjustment is placed at the lower end of the body tube, and carries only the weight of the quadruple nose piece and its objectives.

The fine adjustment acts directly on the upper segment of the stage, with an action of two microns, plus or minus from zero. This is accomplished by hydraulic principle. There is a six-gauge screw with 100 threads per inch working through a gland into a hollow post which is filled with glycerine. As this screw is turned clock wise the glycerine is displaced through two small jets into an outer moat surrounding the center post. This moat is also filled with glycerine and has an oil tight gland with steel tension behind it. As the [illegible] screw is turned anti-clock wise, the spring forces the glycerine from the outer moat through the jets, into the inner post, so that with a five to one ratio on this lead screw, we have an equivalent of 500 threads to the inch, and the hydraulic action produces a movement free from drag and inertia, which is decidedly essential at high magnification.

The source of illumination used on this instrument is a more predominating factor in identifying the filter passing form or cycle of micro-organisms than the high magnification. The color volume is intensified and the differentiating value greatly enhanced, if a magnification of 6,000 or 8,000 times is used. It is to be understood that the source of illumination applied to this instrument is in no wise true polarized light (that is, no nickel prisms are used), but is a monochromatic beam of variable angles of incidents passed through the direct transmitted light, refracting different colors according to the chemical composition of the organism under observation. This principle of light control reveals the organism in its own particular color in a brilliantly illuminated field.

This instrument differs in many ways from the old microscope which was used at Pasadena in November, 1931, on preliminary work with Dr.Arthur I Kendall on the filetr passing B. Typhosus. As this old instrument has been in use for over 12 years, many of its faults have been eliminated in the designing and construction of this new instrument.

It should be understood that I have in no way made statements or claims to the effect that this microscope is superior in any way to the excellent instruments manufactured by our A-Grade Optical Companies. However, it has answered the purpose of others, as well as myself, in the special work we have called on it to perform.

I wish to make it perfectly clear that I am not in the business of manufacturing, and have nothing to sell. I have built this microscope, as well as many other instruments and devices used in this laboratory, solely for the advancement of Science and the results they may possibly accomplish for the benefit of mankind.