BUFFALO ASTRONOMICAL ASSOCIATION INC.
BUFFALO MUSEUM OF SCIENCE
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# the Spectrum

Editor:
Ernst E. Both

J A N U A R Y - F E B R U A R Y  1 9 7 2

JANUARY MEETING: For our first meeting of the new year (January 14, 1972, 8:00 PM, Buffalo Museum of Science) we are proud to present Dr. Lyle B. Borst, Professor of Physics and Astronomy, State University of New York at Buffalo. Dr. Borst has done important research in many areas of physics and astronomy, including supernovae, the lunar atmosphere, and helium at temperatures close to absolute zero. Recently he has published several papers connecting Christian cathedrals with megalithic henge monuments and in connection with this topic Dr. Borst will present a lecture entitled "Prehistoric Astronomy." It is our great pleasure to welcome DR. LYLE BORST!

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FEBRUARY MEETING: Our second meeting of the new year (February 11, 1972, 8:00 PM, Buffalo Museum of Science) will feature Darwin Christy and Ed Lindberg in an illustrated lecture entitled "Stellafane Pictorial." Since the death of Russell W. Porter, the mentor of amateur telescope makers, Stellafane has become the Mecca of the telescope buff. For the many of us who cannot make this pilgrimage, this lecture should provide an admirable substitute. We welcome with pleasure our own members, DARWIN CHRISTY and ED LINDBERG!

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* DEEP-SKY OBSERVING * By John Riggs

The three Messier clusters in Auriga, M 36, M 37, and M 38, all open clusters, have long been favorites with amateur observers who brave the winter cold. All three are bright and easy to see in binoculars and pose few problems finding in a larger instrument. A quick sweep of the area mid-way between and Aurigae will readily show M 37 and M 36 as small, semi-stellar, fuzzy patches about four degrees apart, with M 37 being the more easterly of the two. M 38 can be found by looking about 2°.5 northwest of M 36 or by searching mid-way between and Aurigae. Once all three have been located in binoculars, bring some higher power to bear on each with a telescope.

M 37 is one of the finest open clusters in the sky and quite spectacular in almost any instrument. Through my 10-inch reflector at 62 X it is like a bright patch of milky way, approximately 25' in diameter, consisting of about 100 stars of 11th magnitude. Near the center there is a 9th mag. star which stands out in contrast to the other, powder-like cluster members.

Resolvable at very low magnification, M 36, though not as rich as M 37, is nevertheless a splendid, bright, and coarse cluster of about 35 stars, ranging from 8th to 11th magnitude. With a 6-inch reflector at 45 X this 20' diameter cluster is a pretty sight indeed, and the easiest of the three to observe through city skies.
(continued on page 6) .....

* POLISHING LAPS * By Darwin Christy
(A Contribution from the Honey-House Observatory)

The subject of this paper is the preparation and use of laps. Most of the laps to be described have been tried in polishing some 14 mirrors at our Honey-House Observatory, ranging in size from 6 inches to 12½ inches.

Before polishing a telescope mirror, one must prepare first a suitable lap. The most common way of making a pitch-lap is to melt the pitch and to pour it into a mold. The pitch is heated in a pan which is immersed in boiling water - DO NOT heat the pitch over an open flame. In this case the tool, used to grind the mirror, becomes the mold. Before pouring the pitch, tie a strip of cardboard around the circumference of the tool, allowing it to extend about ¼ inch above the surface to prevent the pitch from running over the edge. After pouring and while the pitch is still warm, wet the mirror surface with soapy water and gently place the mirror on the lap which should conform to the mirror surface. After it has cooled completely, remove the carboard strip and gently move the mirror over the pitch lap to be sure it does not stick. Next remove the mirror and with a sharp knife trim the edge of the pitch so that the lap is about 1/2 to 1 inch smaller in diameter than the mirror. When the lap has completely cooled and cold-pressed for about one hour, it is ready for channelling, a procedure to be described later.

A second way of producing a lap is the drip method. Stick a heated brass rod into a piece of burgundy pitch and wait until it cools. Use the rod as a handle and with a torch or propane tank heat the pitch until it melts and starts to drip. Hold it over the center of the tool and begin moving it in a spiral motion around the center, working toward the edge and letting the pitch drip onto the tool. No retaining strip of cardboard is necessary with this method. When the first spiral is completed start dripping a second spiral but this time rotate the spiral in the opposite direction. Spaces left upon completion can be filled in at random. The surface obtained by dripping will not be as smooth nor as thick as a poured one, but will work equally well. To rid it of bumps it is only necessary to cold press it for about one hour. Trim the edges as before. Polishing can begin before cold pressing or before channelling but should not continue for more than an hour before the channels are cut.

A third method uses strips of pitch 3/4 to 1 inch wide. To make these, pour the pitch into a suitable wooden mold and let it cool. The resulting bar of pitch is cut into squares using a hot knife. Pre-marking the tool with pencil insures the symmetric placement of the pitch squares. To attach these to the tool, heat the bottom of each square with a candle flame until it melts. It will stick on contact so that it is not necessary to heat the tool. When the lap has been completely covered, place the mirror on the lap and cold press for about an hour. This type of lap does not require channelling so that polishing can begin at once.

The fourth type is the prepared rubber mat grating which is available commercially. Such mats can be obtained in both square and button lap designs. Other types of laps consist of a tool covered with wet resistant paper or silk, or the more recent pebbled plastic. These were used in the early days of telescope making and are still used by some; however, the finish which these produce on the polished mirror is far from smooth and to remove this microripple the mirror still has to be polished with a pitch lap.

After the lap has been produced, it must be channelled, that is, the pitch surface must be cut into channels. We shall discuss several types of cut:

1. The NORMAL cut (Fig. 1). For mirrors 8 inches or smaller, the recommended facet size is 3/4 inch square. For larger mirrors they should be 1 inch square or larger. The cut channels should be 1/8 inch wide and 1/8 to 1/4 inch deep. One way to cut the channels is to wet the lap and to soap the teeth of a cross cut saw. A dry saw will produce chipped edges on the facets. Another way is to use a very sharp "V" cutting tool, but if this is not very sharp, the chipping is so great that the lap has to be remelted. Soaping and wetting of the tool is still very necessary. A third way does not produce very deep channels but is very efficient: place a piece of thin plastic or wax paper on the lap and place over it heavy cord or string in the pattern of fig. 1. Place the mirror on top and let it cold press overnight or up to 24 hrs. The pitch will dent where the cord is placed and facets will form between. The channels so produced are not deep and will fill in rapidly, necessitating more frequent channelling operations. Although the resulting channel walls are slanted, no ill effects are produced in the mirror surface.

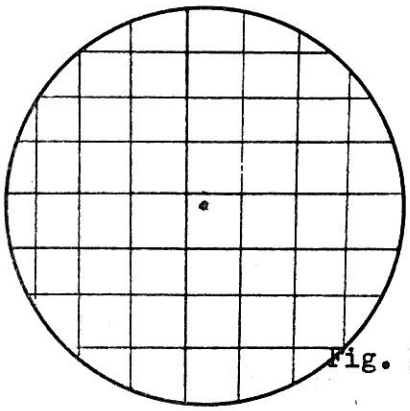


Fig. 1

2. The DIAMOND lap (Fig. 2): the grooves are produced as before, but extreme care must be used to prevent the sharp corners from chipping. Coating the lap with parafin wax will help to prevent chipping but one still must use a soaped saw. The "V" tool is NOT recommended in this case. The string or cord method mentioned above works best in producing this lap.

To prevent some of the deformities, such as raised or depressed zones, two types of channelling can be recommended (based on our own experience): the semi-logarithmic lap and the logarithmic lap.

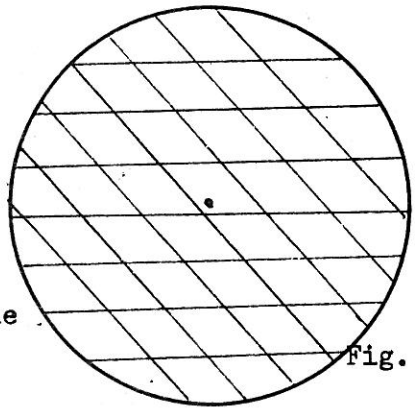


Fig. 2

3. The SEMI-LOGARITHMIC lap (Fig. 3): here the channels are equally spaced in one direction but in the crosswise direction they are spaced in such a way that the channels become narrower logarithmically.

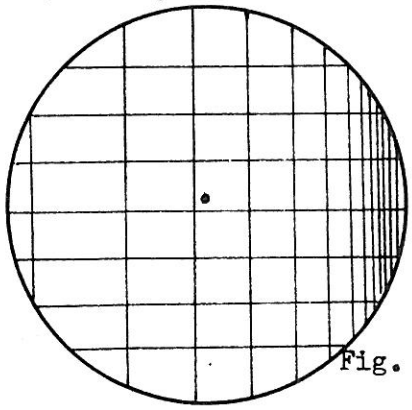


Fig. 3

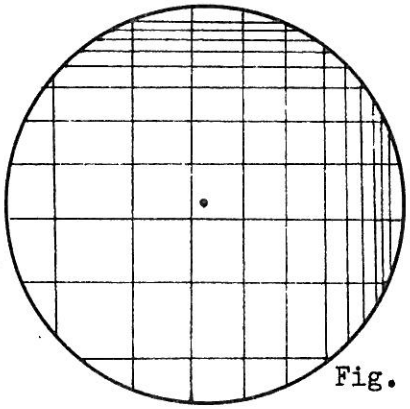


Fig. 4

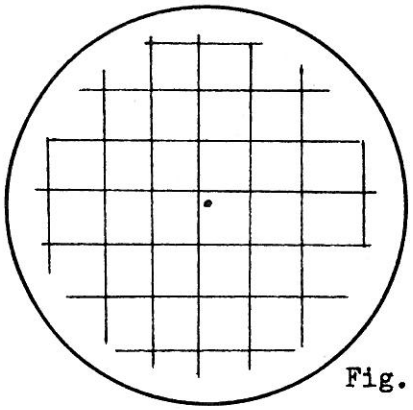


Fig. 5

4. The LOGARITHMIC lap (Fig. 4) is similar except that channels in both directions are spaced logarithmically. Both of these laps may be used in localized polishing to remove defects. In each of the figures presented here the lap center is shown by a dot. To prevent the mirror's center from obtaining a hill (as seen in a Foucault test) the central square or facet should be positioned as shown in the corresponding figure.

5. The CHARGE RETAINER (Fig. 5): In this e the channels are cut much the same

as in a NORMAL lap, but they do not extend to the very edge of the lap. This type tends to retain the polish charge and does not dry out too fast. Turned-up edge is a common error of this lap but it can be corrected by using a longer stroke.

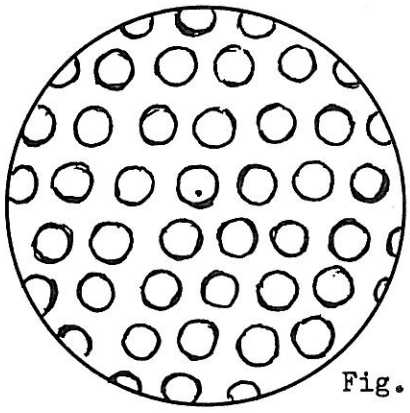


Fig. 6

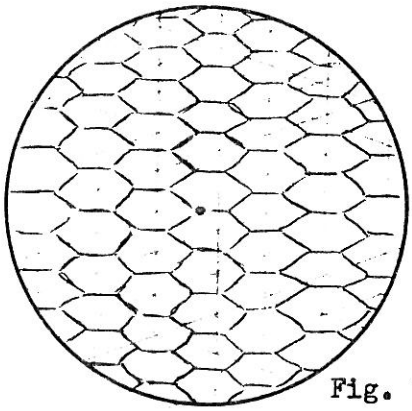


Fig. 7

6. The BUTTON lap (Fig. 6) is a very good type. It can be made by using commercially available pitch circles or in the following manner: using cardboard tubing of the proper diameter, cut a piece about 1 inch long and seal one end. Pour the hot pitch into this mold and after cooling, cut the cardboard to obtain the pitch button. As before, guide lines should be drawn with pencil on the tool and the pitch placed on it as described before. This lap is especially good because of the extra wide channels and small facet, but it requires a slower stroke since the polishing action is very fast. A 1/3 "W" stroke seems to be highly recommended, because straight polishing can produce ringed deformities (my apologies for the rather poor circles in Fig. 6. eeb).

7. HONEY-COMB FOUNDATION lap (Fig. 7) - c a u t i o n ! The action of this lap is extremely fast and can produce poor results. To make this lap, merely lay the honey-comb foundation on a regular pitch lap and cold press for a few hours. It will not conform completely to the surface of the mirror but will be near enough so that it will wear as the mirror is being polished. If a pitch lap is not available, plaster can be used. In this case mix a small amount of plaster, spread it on the tool and allow to set a couple of minutes. Just before it has set completely, press the honey-comb foundation on to the plaster and cold press with the mirror. It is best to run a knife across the honey-comb to produce minute openings between the pockets, allowing the polish charge to flow from one pocket to another and to equalize the mixture. These cuts are represented by the straight cross-lines in Fig. 6. Because beeswax contains palmitic acid, the mirror should not be left on the lap for long periods when not being polished. This acid does etch the glass and if this happens, the mirror has to be returned to grinding. The big advantage of this lap is that it does not wear down like pitch laps and initial polishing time is generally cut in half. But it does produce "dog biscuit" and long shallow valley defects. Smoothing can be done on the NORMAL lap afterwards.

The laps discussed so far were full-sized laps (actually, as mentioned before, the lap diameter is about 1/2 inch smaller than the diameter of the mirror. This is to prevent the pitch from sqeezing up around the outside mirror edge). We shall now turn to subdiameter laps which can be used for almost any polishing purpose for which full-sized laps are used, and they are also useful for both normal as well as well as localized polishing.

The 4-point star (Fig. 8) is usually used for correcting zonal errors only, because of its drastic action. The diameter of the lap is usually 1/3 to 1/2 the

mirror diameter. Errors which can be corrected with this lap are: turned edge, narrow raised zones, and very high central hills. Using it for parabolizing is not recommended. To make this and other subdiameter laps, merely use a piece of 3/4 inch plywood cut to the required diameter. Pour hot pitch on one side and attach a handle to the other side. Cut the pitch to form the type of star desired, and channel it as you would a full-sized lap. To cold press, use heavy lead weights, or if you trust your engineering, support the lap from below in an upright position and place the mirror on top - but don't blame the author if the mirror falls off and breaks.

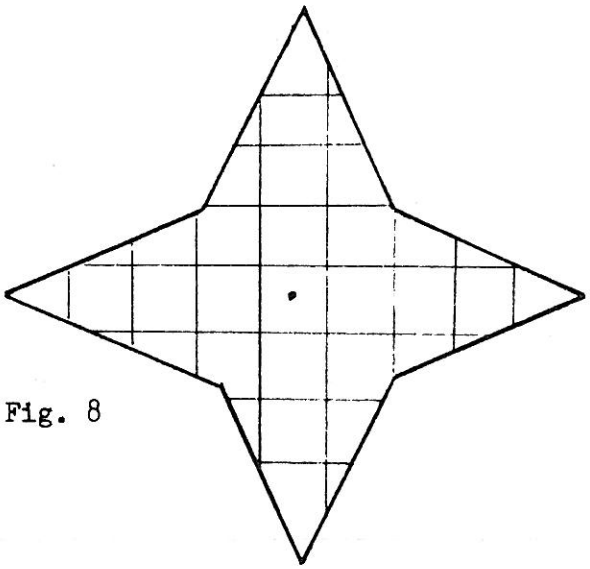


Fig. 8

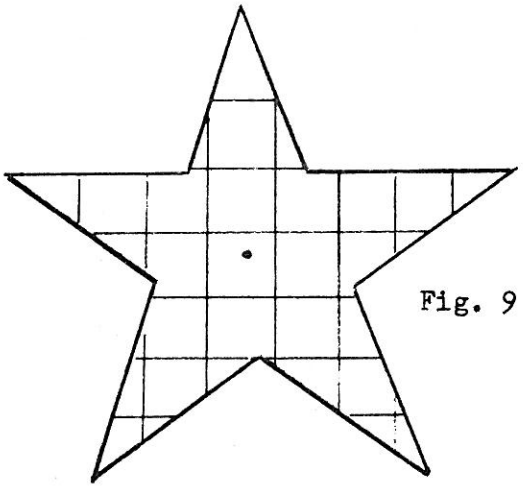


Fig. 9

The 5-point star (Fig. 9) is used to correct zonal deffects similar to those mentioned with the 4-point. Its diameter and action are the same as those in that lap, but it can be used for parabolizing since its points are not spread so far and the localizing action is less. Then too, the center portion of the lap has a larger fill of pitch.

Fig. 10

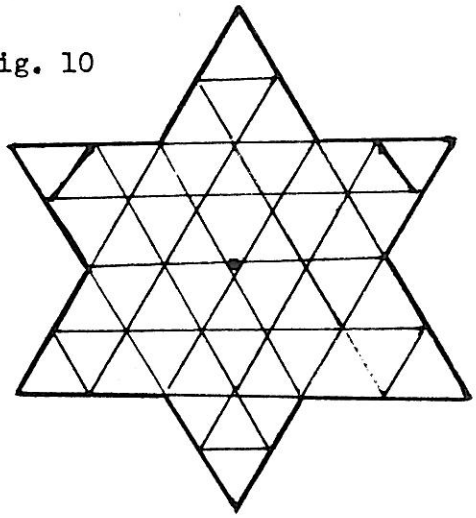
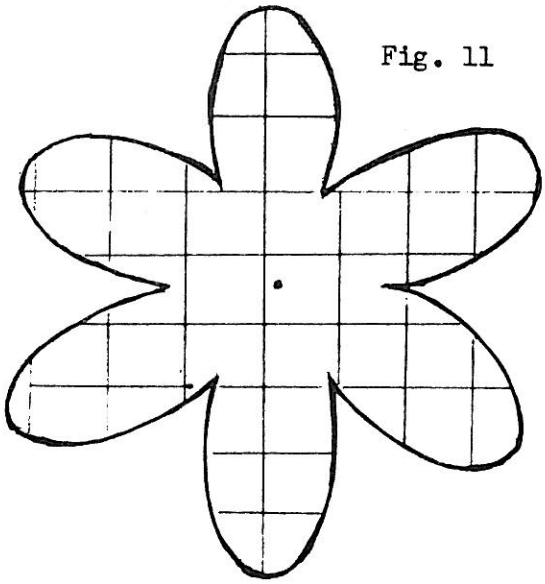


Fig. 11



The 6-point star (Fig. 10) is the most generally used lap in the subdiameter range. Its size varies according to use · localized polishing it may be from 1/3 to 1/2 the mirror's diameter, but for 'izing the recommended size is about 2/3 to 3/4 the diameter of the mirr ·ts are triangular in shape as shown.

The action of this lap is more efficient, but a somewhat slower stroke is recommended to make sure that no "dog biscuits" result in the mirror surface. A lap similar to the 6-point star is the ROSETTE (Fig. 11). It is usually made with 6 points, although 5 points may also be used. Its performance and use are much the same as those of the 6-point star. However, the curving out of the points is a little more advantageous than the straight points of the 6 star. (To be concluded in the March-April issue). * * *

DEEP-SKY OBSERVING (from page 1): The shape of the last Messier cluster in Auriga, M 38, has often been likened to that of a slightly bent cross. Though this feature is noticeable in a 6-inch, the outline of the cross becomes enmeshed in faint stars with the 10-inch and more difficult to see. It is a nice, bright grouping some 20' across, containing 70 stars (mag. 8 to 11), set against a good milky way background.

Half a degree south of M 38 lies a neglected cluster, NGC 1907. Almost on top of the galactic equator, this is mainly an object for moderately sized telescopes, though it is visible in a 6-inch reflector without too much difficulty at 100 X. In my 10-inch at 62 X and 125 X this tight, relatively faint little cluster with a diameter of 4' is quite charming. Its 20 visible members (12th mag.) are at a distance of about 2,000 parsecs, nearly twice as far from us as M 38. The contrast formed by the faint and distant little cluster, and the large and bright Messier object, only half a field of view apart, is most interesting and beautiful.

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TO ALL OUR MEMBERS AND FRIENDS WE WISH A VERY HAPPY NEW YEAR * 1 9 7 2 *

Buffalo Astronomical Association, Inc.
c/o Buffalo Museum of Science
Humboldt Park
Buffalo, N.Y. 14211


FIRST CLASS
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Mr. Eugene Hazel
Mr. Larry Hazel
1234 89th St.
Niagara Falls, N. Y. 14304