NOTES ON THE PONS-BROOKS' COMET.

BY H. C. WILSON.

The following notes are given just as they occur in my observing book, except that the measures are corrected and sidereal times are reduced to mean solar. I have also inserted some explanations in brackets. The instruments employed were: The 11-inch equatorial, with eye-pieces magnifying 90, 150, 230, and 450 times; the 2½-inch finder of the equatorial, magnifying power 30; an opera-glass, magnifying power 2.5. The eye-piece 90 was generally used with the equatorial.

September 5, 1883.—10 to 10:30. Comet was so faint that scarcely any illumination of the micrometer wires was possible.

Sept. 6.—9:15 to 9:45. Comet very faint.

Sept. 10.—13:55 to 14:55. Comet very faint, but condensed in the center. Transits were a little uncertain. Could not see it near the wires with the least illumination. Not visible in the finder.

Sept. 26.—8:30 to 9:40. The comet is much brighter than it was on the 10th. Easily visible in the finder. Has no tail. It is nearly round, strongly condensed in the center, and I thought I could see at times a distinct nucleus of about the ninth magnitude, but was not certain.

Sept. 28.—9 to 10. The nucleus was not distinct, so that it was hard to get the exact times of transit. At times there seemed to be two condensations.

Oct. 8.—8:05 to 8:40. Comet faint in moonlight, but nucleus visible,—equal 9th magnitude star, *Moon* at first quarter.

Oct. 30.—8:15 With power 90 the nucleus is nearly equal in brightness to star *b* [an anonymous star, estimated magnitude 9.5.] A short tail is suspected, but not certainly seen. With power 450 the nucleus is at least one magnitude fainter than star *b*, but is longer. Part of the tail can be seen. [A pencil sketch shows a hazy nucleus, surrounded by an oval coma, and a short spreading tail. The star *b* is placed just at the apex of the head.]*

Oct. 31.—8 to 9. Appearance of the comet is the same as last night.

Nov. 1.—9:30 to 10:10. Appearance not perceptibly changed from last night. With power 450 the nucleus does not appear at all stellar, but is very dense in the center.

Nov. 2.—8:50 to 9:20. [Position observed but no notes, therefore nothing peculiar.]

Nov. 12.—7:55 to 8:25. Comet is very faint in moonlight. Strongly

*Sketches referred to on pages 137, 138, 140 and 141 will be found on page 139.

condensed in the center, so that its position can be quite accurately determined.

Nov. 16.—7:05 to 7:25. [No notes.]

Nov. 17. 7:00 to 7:30. Nucleus almost stellar, tenth magnitude. Coma round, fading equally in all directions from the nucleus.

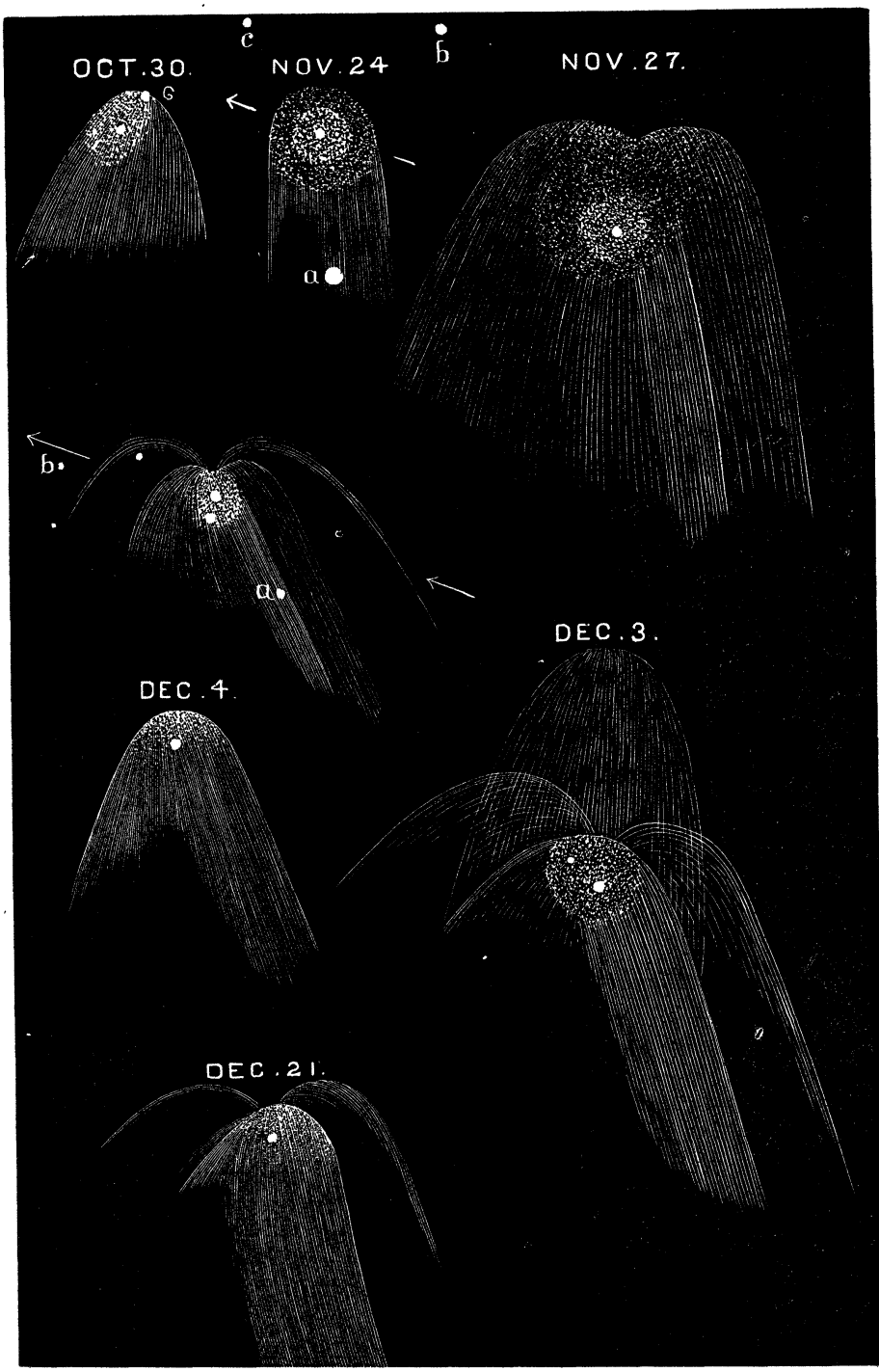
Nov. 19.—7 to 7:35. Comet is a little brighter than on the 17th, and shows more of a tail. The nucleus is dense and almost stellar in appearance. Looked at comet with powers 230 and 450, but could not see it distinctly. Sky a little hazy.

Nov. 24.—9 to 10. Comet is in a group of three stars. [A sketch made with power 90, shows a bright nucleus, round coma, and short faint tail. The three stars are: a=Dm 48° 2652, b=Dm 48° 2655, c=Dm 48° 2651. Magnitudes 6.5, 7.5 and 8.3.] In the finder nucleus is, about as bright as c. In power 90, it is much fainter than c, not brighter than a 9.5 magnitude star. Coma round, bright, fading gradually from the nucleus. Tail is plainly visible to star a. Looked at comet with power 450, but sky being a little cloudy, I could not make out much. The nebulosity is very bright close to the nucleus.

Nov. 26.—7 to 7:40. Comet is considerably brighter than on the 24th. In the finder it is brighter than the comparison star, [Dm 47° 2608 (8.0 mag.)]. It is equal to star b [Dm 48° 2669 (6.7 mag.)] in brightness. With power 450, the nucleus seems a little elongated in approximately the direction of the tail. The nebulosity is most abundant in P. A. 150° roughly.

Nov. 27.—7:40 to 8:50. Comet is of about the same brightness as last night. I examined the nucleus with powers 90, 150, 230 and 450. Nucleus is stellar with each. With 450 it is a little blurred, but much brighter than the surrounding nebulosity. [A sketch with power 450 shows the apex of the head indented.] The apex is certainly not round. The outlines can only be seen by moving the telescope back and forth. Both nucleus and coma seem to change frequently in brightness. Nucleus is very minute, not more than 12th magnitude. At times the nebulosity close to it becomes so bright as to make it appear equal to 9th magnitude. With power 90 nucleus is larger and brighter, equal 9.5 magnitude, and at times 9th magnitude. P. A. of the bright streak in the tail 25°.1.

Nov. 28.—6:50 to 8. Estimated magnitude of nucleus, power 90, 10.0. P. A. of right edge of tail 17°.2 roughly. Right edge can be distinguished to diameter of field [18′], by moving telescope in right ascension. Left side cannot be seen more than ⅓ as far from the nucleus. Outline is about the same as last night. The apex is not convex. [A sketch with power 90 shows three parts to the tail: the first bright and narrow, of about the same width as the coma, the second enveloping the first, and four or five times



broader, faint but distinctly visible, the third enveloping the second and only seen with averted vision or by moving the telescope. The apexes of the second and third parts are indented.] There is an 11th magnitude star very near the nucleus. It's light is not at all dimmed by the coma. With power 450 there is a faint stellar nucleus, as on last night. The nebulosity is fainter, owing to the haziness of the sky. It appears to be densest in about P. A. 240°.

Nov. 30.—7:10 to 7:40. Comet is brighter than on the 28th. Tail can be distinguished to one diameter of the field of the finder. The outlines of the head, with power 90, are the same as on the 28th. I am not so sure of seeing the faint outer curves as then. With power 450 the nucleus is stellar and the nebulosity fades away from it equally on all sides. P. A. of wires parallel to right side of tail, power 90, 29°.2. Clouded up suddenly.

Dec. 1.—7:15 to 8:35. Comet is about the same in brightness as on last night. Tail can be traced to nearly one diameter of finder. Outlines of brighter part in power 90, are the same as on the 28th. The fainter outlines cannot be certainly seen. I think there is faint nebulosity extending toward the *Sun* to about 6′ from nucleus. This is so faint as to be very uncertain. It can only be seen by moving the telescope in right ascension. P. A. of wires parallel to right side of tail 32°.4. Estimated magnitude of nucleus 9.5.

Dec. 3.—7:15 to 8:10. Comet is visible to naked eye. I saw it also last night with naked eye. Tail can scarcely be seen at all in the finder, however, moonlight, and sky a little hazy. [A sketch with power 90, shows the outlines of the head similar to those on Nov. 28th, with also an extension of light toward the *Sun*.] A very faint extension can be seen toward the *Sun* to about ⅓ the diameter of the field. Nucleus is stellar with powers 90 and 230. Blurred with 450. It is much brighter than the nebulosity immediately surrounding it. No indication of jets yet. With 450 the outlines are the same as with 90. P. A. of brightest part of tail 31°.7. Very uncertain as I cannot illuminate the wires and see the tail distinctly at the same time. There is no good comparison star near enough to measure position.

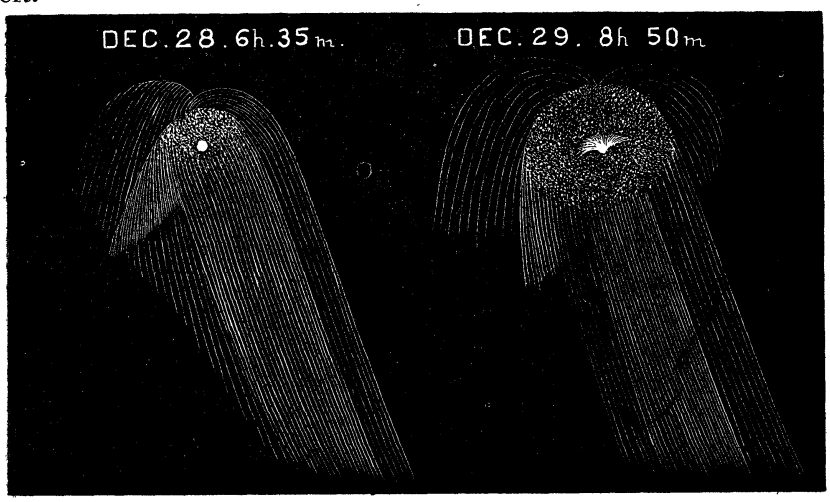
Dec. 4.—6:50 to 8. Nucleus brighter than on last night, and still stellar. Tail can scarcely be seen at all, on account of the moonlight. P. A. of brightest part of tail 34°.2. With wires slightly illuminated, power 90, the appearance was something like this [Sketch shows the inner and brighter parts of the tail.]

Dec. 5.—7 to 7:40. P. A. of right edge of tail 40°.2.

Dec. 8.—7:20 to 7:50. No notes.

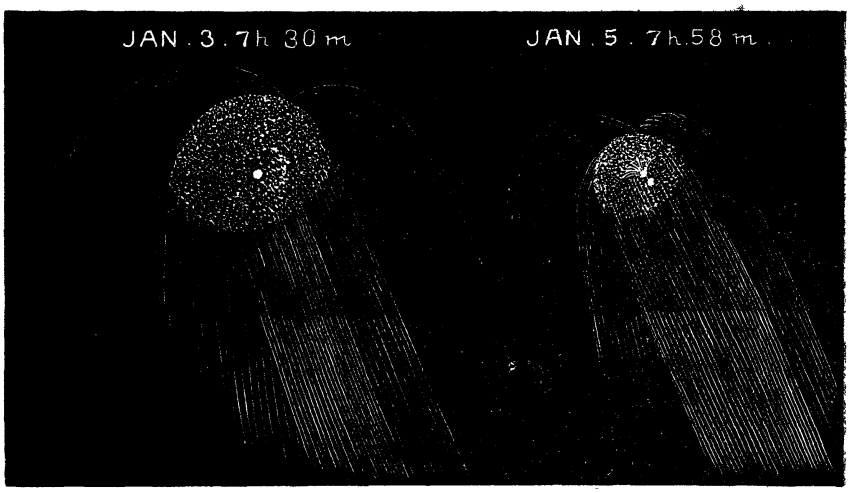
Dec. 11.—7:05 to 7:50. In the finder the comet is brighter than the comparison star, [Dm 42° 337 (6.8 mag.)]. In power 90, the nucleus is very minute, but bright like a star, about 10th magnitude.

Dec. 21.—8:10 to 9:30. Nucleus is 1 magnitude brighter than star *b* [Dm 35° 4157 (9.5 mag.)] in power 90. With 450, nucleus and *b* are nearly equal in brightness, but nucleus has twice as large a disc as star. P. A. of tail with nucleus at edge of field [18′], power 90, 31°.1. width 300″. [The sketch shows that these measures were of the brighter portion of the tail.] Outer curves could not be seen with illumination, power 90, or with power 450. 9:30.—The nucleus will soon pass near a 10th magnitude star. The latter is now in the coma just east of the nucleus, and is visible with power 90, whether on account of the haze of the comet or that of the sky near the horizon. I cannot tell. With 450 the star is yet visible. The nucleus seemed at first to leave a slight pink tinge. It is now almost straw color. There are no jets. In the finder the tail can be traced to nearly one diameter of the field of view [1°.5], and is perceptibly curved, being concave on the right side. That side is much better defined than the left.



Dec. 28.—6:30. [A sketch with the finder shows the tail extending to and a little beyond the star, Dm 29° 4419. Slightly convex on the right side. Nearly uniform in width, except near the head where there is a short faint projection on the left side.] The tail is not yet plainly visible to the naked eye. In the finder I can trace it to two diameters of the field [3′]. In power 90 I can trace it to five diameters [90′]. The nucleus is brighter than any of the stars in the field of the finder, but not quite so bright as *Zeta Cygni*. The nucleus seems of a pink or fire color with power 90. With higher powers the color seems less brilliant, but still is quite noticeable. With 450 the nucleus has a perceptible size, but is quite hazy, although very distinct from the surrounding nebulosity. P. A. of tail with nucleus at the edge of the field, power 90, 40°.7. 6:35.—[Sketch of the head.]

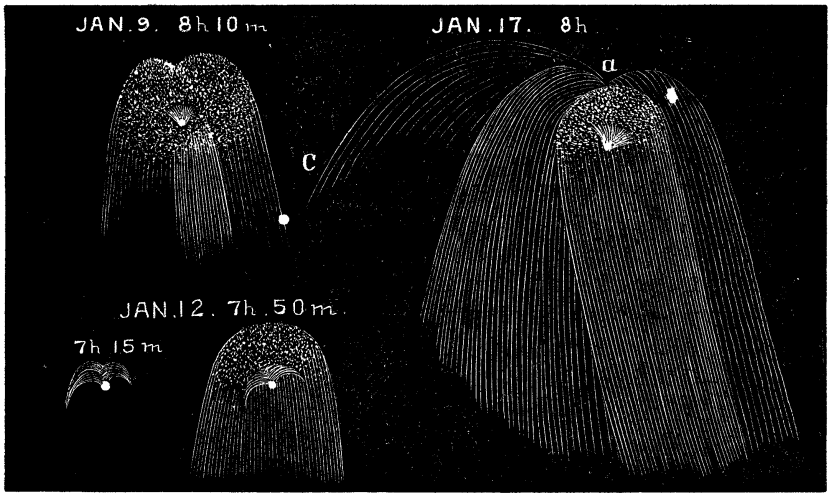
Dec. 29.—7:30 to 9. The nucleus is larger but not quite so bright as last night. A fan is visible toward the *Sun*. This has no well defined boundaries, but seems to be continually changing,—flashing out sometimes to the heighth of 1′ or more, then again almost invisible. The nucleus is pink or flesh color, less brilliant than last night. With power 450 the nucleus is large and very hazy. With the finder it is brighter than any of the stars in the field of view. 8:00.—[A sketch with the finder shows the tail to a length of two diameters of the field (3°). Slightly convex on right side. Passes centrally over stars Dm 27° 4104; Dm 28° 4140 and Dm 28° 4147]. Could be traced nearly two diameters farther before clouds came over. 8:50.—[Sketch with power 90]. P. A. of wires including bright part of tail, with nucleus at edge of field, 40°.7. [A sketch with the opera-glass shows the tail very narrow, slightly curved toward the north, the south edge grazing the stars *Pi Cygni* and 31 *Pegasi* and extending a little to the north of *Pi Pegasi*.] This sketch is drawn from memory, the sky having clouded over. To the naked eye the head of the comet seemed midway in brightness between *Zeta Cygni* and *Kappa Pegasi*, With the opera-glass the comet was equal to *Zeta Cygni*. With the eye the tail could be traced to 31 *Pegasi*, and with the opera-glass to a distance equal to that of *Pi Pegasi* from the nucleus.



January 3, 1884.—7:15 to 8. [A sketch with the finder shows the tail broader but shorter than on the 29th. The right (*i. e.* south edge) extends to the star Dm 20° 5103. Sketch with power 90 shows the outlines of the head similar to those on the 29th.] P. A. of bright part of tail 37°.2. Estimated magnitude of nucleus 7.5. The sky was quite hazy and the *Moon* shining brightly, so that but little of the tail could be seen in the telescope, and the limits of the head as sketched

are quite doubtful. The nucleus had the same appearance as when last observed, a slight pinkish tinge of color. There was no fan or jets, and the nebulosity seemed to fade off gradually and equally in all directions. The bright part of the tail was narrower than the coma) giving the head a bulbiform appearance at moments, when the fainter parts could not be seen. The nucleus and the comparison star seem to be about equal in size, but the light of the star is much more intense, and whiter than that of the nucleus. With powers 230 and 450, the nucleus is enlarged, but no definite disc is revealed. It is very much brighter than the nebulosity immediately surrounding it. To the naked eye the comet appears as a star a little fainter than *Zeta Cygni*, and brighter than *Kappa Pegasi*. At 6 P. M. I looked at the comet with an opera-glass, and could trace the tail to *o Pegasi*, and perhaps a little beyond. A slight curvature was noticeable, the left (south) side being convex.

Jan. 5.—7:20 to 8:30. $7^h\ 58^m\ 7^s$. The nucleus is within 5″ of a 9.5 magnitude star, but will not occult it. P. A. of middle of fan 238°.2. P. A. of brightest part of tail 24°.2. Comet is faint in moonlight. Nucleus is very bright. There seems to be a stellar point within it, and a faint fan or brush of light in the above P. A., and about 100° wide. Nucleus is pink color and the fan pinkish. Coma is very faint; bluish



drab color. In the finder the tail is very faint, and can be traced scarcely more than one diameter of the field. Nucleus is brighter than any of the stars in the field of view. [Sketch in finder shows the tail much broader than before. Extends to the stars Dm 16° 4727 and 4728. Sketch with power 90 shows three parts of the head similar to the sketches on preceding nights.] This sketch was drawn from memory after leaving the dome. The star, although passing so near

the nucleus, did not grow perceptibly fainter. With power 450 I estimated the shortest distance between the star and nucleus at 5″. With this power the nucleus was quite large and blurred. The fan seemed to be flashing and varying continually, but its central direction was apparently constant, and at a considerable angle with the direction of the tail. To the naked eye the head of the comet appeared equal in brightness to *Lambda Pegasi*. The tail was invisible, except near the nucleus.

Jan. 9.—7:15 to 8:15. [Sketch with opera-glass shows the tail extending ¼ its length beyond *Sigma Pegasi*. The north edge just grazethat star.] Comet is fainter than *Zeta Pegasi*, equal to *Xi Pegasi*, and brighter than *Rho* or *Sigma Pegasi*. 7:32.—P. A. of brightest part of tail, power 90, 35°.7. P. A. of middle of fan 219°.8. Estimated magnitude of nucleus 7.0. [Sketch with power 90.] With higher powers scarcely anything can be seen but the nucleus, and that is blurred and indistinct. In the finder the tail cannot be traced at all, although the nucleus and coma are bright. The sky is quite hazy and the moonlight bright.

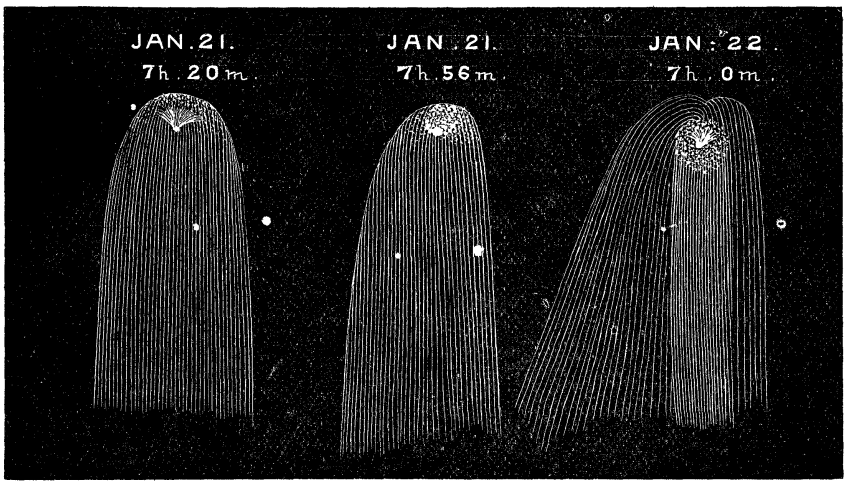
Jan. 11.—7 to 8. Sky hazy and moonlight bright. Tail of comet cannot be seen at all, with either naked eye or telescope. There seems to be a very faint "fan" which flashes out one moment and is invisible the next. It is impossible to determine its direction accurately. It is of course on the side toward the *Sun*. Nucleus is bright and planetary in appearance. P. A. of tail, power 90, 40°.7. This is little better than an estimate. It was obtained by turning the light off and fixing in my eye the direction of the tail, then suddenly turning the light on and putting the wires in that direction. Three other measures in the same manner give: 36°.4. 40°.4, 36°.4. Wires moved in opposite direction for each successive measure. With powers 230 and 450 the nucleus is not stellar, but is still quite small. The coma is round and fades off almost equally in all directions. The light is a little stronger on the side toward the *Sun*. The nucleus is pinkish in color, while the coma is almost blue.

Jan. 12.—7:10 to 8:10. P. A. of middle of fan, power 90, 225°.0. Sides can be seen to re-curve to-night for the first time. [Sketch shows only the fan.] This much can be seen plainly, with moderate illumination. 7:50.—P. A. of bright part of tail 27°.7, 27°.7, 30°.0, 27°.0; taken in the same manner as on last night. P. A. of right edge of tail 37°7; [Sketch shows the brighter part of the head.] The visible diamete' of the head is not more than 3′, and the length of the tail, easily seen. not more than 8′. In the finder the tail cannot be traced to any star, The nucleus is brighter than any star in the field of view. With power 90, the nucleus is equal in magnitude to the comparison star [Dm 2°, 4619 (8.2 mag.)] but its light is much less intense. With power 450,

nucleus is much fainter than the star, but apparently of about the same size. The fan and coma are almost invisible. To the naked eye the comet equal to *Gamma Piscium*. In the finder it is at least one magnitude fainter than this star.

Jan. 13.—6:10. [Sketch with opera-glass shows the tail extending to a point about 1-5 distance from *Iota Piscium* to *Zeta Piscium*.] Comet equal in brightness to *a Pegasi*. Tail can hardly be seen beyond 12 *Piscium*.

Jan. 17.—8 to 8:15. The head was much brighter than hitherto. The faint outer curves could be seen distinctly. The bright part appeared a little wider and brighter than usual. The fan was bright but not re-curved. Its central direction was not exactly opposite that of the bright part of the tail, but was turned at least 45° to the right. [Sketch drawn from memory on the morning of the 18th.]



Jan. 21.—7 to 8:10. [Sketch with opera-glass shows the tail extending to 44 *Ceti*. Convex on south side.] Comet equal *Tau Ceti* in brightness. [Sketches with power 90, show a great change in the appearance of the head. The bright part has increased in width and brilliancy, and the faint outer curves are entirely invisible.] 7:17.—P. A. of axis of tail 64°.2 P. A. of brightest direction of fan 20°.2. Distance of apex from nucleus 116″. Distance from nucleus to right side of head 204″. Distance from nucleus to left side of head 215″. One half of the width of the tail, opposite the star *Lalande* 46929, 304″. 7h 34m 10s.—The star is now just in the edge of the tail; power 230. 7:56.—[Sketch with power 230 shows the fan less distinctly, and the head is more flattened.] With power 230 the nucleus seems more hazy than with 90, but there is a small bright point in the center. Power 450 produces a similar effect. With 90, the whole head is quite

brilliant, nearly even in all parts except the fan. Perhaps the axis of the tail is a little the brightest, but very little. The nucleus has a flesh color. 8:08.—[A sketch in the finder shows the tail extending to the star *Weisse* 23^h 1228.]

Jan. 22.—6:55 to 7:30. [Sketch in finder shows the tail extending to a point about ¼ distance from *Weisse* 0^h, 12 to 46.] Through thin clouds. With power 90, the appearance is quite different from last. The central part of the tail is by far the brightest. The fan is scarcely visible. I can see that it is there but cannot define its outlines. 7:08.—Clouded up. 7:25.—Break in clouds. Middle direction of fan 218°.7. Bright part of tail 72°.7. Cloudy again.

Jan. 24.—6:34. [Sketch with opera-glass shows the tail extending to 35 *Ceti.*] 6:48.—[Sketch with finder; tail extends over star. *O. Arg. S.* 133 to *O. Arg. S.* 148.] 7:01.—The fan is quite indistinct, owing to the haze and smoke over the city. The nucleus is almost white, and a blaze of pink light seems to flash out opposite the bright part of the tail. The head fills the whole field of view, power 90. The outlines are similar to those on the last night observed. 7:11.—P. A. of bright part of tail 62°.7. P. A. of right edge 81°.2 P. A. of left edge of bright part 63°.7. P. A. of left edge of tail 28°.7. Middle direction of fan 230°.9; determined with bright illumination. 7:20.—[Sketch with power 90.] Sky is clear at intervals. 7:50.—P. A. of bright part of tail 64°.7. Central direction of fan 218°.8.

Jan. 25.—6:50. [Sketch with opera-glass; tail extends to 57 *Ceti*, passing over *O. Arg.* S. 343 and 397.] Comet midway in brightness between β and η *Ceti.* 7:12.—[Sketch with finder; tail extends to stars W. M. C. Z. (206) 47 and *O. Arg. S.* 198.] 7:17.—[Sketch with power 90; appearance similar to that on the preceding night.] P. A. of middle of fan 211°.7. Right side of tail 74°.7. Middle of tail 58.2.

Jan. 26.—6:59. [Sketch with finder; tail is only traced two degrees. Sketch with opera-glass;tail extends to 61 *Ceti.* The axis passes over 33 *Ceti.* The north edge touches *Beta Ceti.*] Faint in haze. Nucleus is distinct however. 7:36.—P. A. of tail 79°. No fan is visible.

Feb. 1.—6:55 to 7. Too indistinct in haze, near the horizon. The nucleus is bright but blurred. Before commencing the position observation, I traced the tail 4° or 5° with the opera-glass. In the finder the tail is very faint, and can be traced only ½ diameter of field. In the large telescope the tail is not at all visible, and the head is round.

THE HARTFORD HIGH SCHOOL TELESCOPE.

It is a pleasure to call attention to the recent step taken by the authorities of the Hartford High School, in securing an equatorial telescope of 9½ inches, clear aperture, a neat cut of which appears on the next page. Its focal length is 11 feet 4 inches; its declination circle is graduated on silver to 15′ and by vernier reads to 1′. The hour circle is graduated to single minutes, and reads by vernier to five seconds. It is mounted on a rectangular iron column, having a broad base projecting to the north, so as to bring the center of gravity, near the center of the base, which is below the floor of the observing-room for convenience. The driving-clock is placed in the opening near the top of the column, and is protected by glass doors. It is controlled by a double conical pendulum, the two balls of which are so connected together that each does its work in governing the movement of the telescope. When the clock is running, a continuous friction is given by leather pads pressing on a hardened steel disc. The friction is diminished or increased, as more or less resistance is given to the movement of the telescope. The pendulum balls are not attached to the levers operating the friction pads, but are, at all times, free to take their theoretical position, thus giving a uniform motion to the telescope under varying resistances. The clock communicates with the polar axis, by means of a worm, and a continuous worm gear, so that no trouble is caused by the worm running out, as is the case when only a segment is used. The driving weights are inside the column. For convenience in setting the instrument, each axis is geared one to four, to the handles shown in the cut, which being near the circles, enable the observer to direct the telescope to any star without touching the tube. Two handles extend to the eye-end of the tube, one communicating with the declination axis, and the other with the polar axis. To clamp the polar axis, the large part of the first handle shown in cut, is given a partial revolution. The slow motion in declination is then obtained by turning the small part of the handle.