

THE LETTER OF PETER PEREGRINUS DE MARICOURT TO
SYGERUS DE FOUCAUCOURT, SOLDIER,
CONCERNING THE MAGNET

This treatise on the magnet contains two parts, of which the first is complete in ten chapters and the second in three. Part I, Chapter I describes the scope of the work; Chapter II shows what an investigator in this subject ought to be; Chapter III pertains to how the stone may be recognized; Chapter IV is on how to find the parts of the stone; Chapter V concerns how to determine the poles in the stone, which pole of the stone is the north and which is the south; Chapter VI tells how one magnet attracts another magnet; Chapter VII is on how iron touched by a magnet turns towards the poles of the world; Chapter VIII describes how a magnet draws iron; Chapter IX concerns why the northern part attracts the southern and conversely; Chapter X is on how the magnet receives the natural virtue which it possesses.

The chapters of the second part are as follows: The first is on the construction of an instrument by which may be ascertained the azimuth of the Sun and the Moon, and of any star on the horizon; the second deals with the construction of another better instrument for the same purpose; and the third is on the art of the construction of a wheel for perpetual motion.

PART I

Chapter I: On the scope of the work—Most intimate of friends, at your request I shall explain in familiar language a certain hidden virtue of the lodestone. For indeed nothing has been pleasing to philosophers without a principle⁶ of knowledge to explain it, because the nature of good things lurks and is obscured in darkness until it is brought to light by public discussion. Out of affection for you, therefore, I shall write down, in simple language, that which is wholly unknown to the majority of students. Nevertheless, we shall communicate in this letter only information regarding the manifest properties of the lodestone, because this information will form part of a treatise in which we shall show how to construct physical instruments. A discussion of the occult properties of this stone involves the art of stone-engraving. And although I venture to call these actions, regarding which you have inquired, manifest, they will be held in no esteem and in the minds of the common people they will be regarded as illusions and fantasmis because they are secrets to the layman. They will, however, be sufficiently manifest to astrologers and naturalists and will be a consolation to them just as they will also be of no small assistance to travelers who have journeyed afar. From the above, therefore, the scope of this work is clear.

Chapter II: On what the investigator of this work should be—Know then, dearest friend, that an investigator of this subject must have an understanding of nature and not be ignorant of the celestial motions. He must also be clever in the use of his hands in order that, by means of this stone, he may produce wonderful effects. For by his carefulness he will be able in a short time to correct an error which in an age he

⁶Some of the codices have *participatione* in place of *principio* thus changing the meaning to "apart from the sharing of knowledge."

could never do by his knowledge of natural sciences and mathematics, if skill were lacking in the use of his hands. For in occult matters we investigate many things by manual industry, and in general without it we are unable to bring anything to completion. Many things, however, are subject to the realm of reason, which we cannot fully investigate by the hand. From the above, therefore, it is clear what qualifications are required in an investigator of this subject.

Chapter III: On the recognizing of the stone—This stone is recognized by four different characteristics, namely, color, homogeneity, weight, and virtue. Its color should be that of iron, livid, mixed with indigo or sky-blue, so that it resembles polished iron tarnished by impure air. I have never seen such a stone that did not have great power. Such a stone, in general, is found in northern regions, and is reported by sailors in all ports⁷ of the northern seas, as for example, of Normandy, Picardy, and Flanders. Now this stone should be homogeneous in substance, since one having reddish spots or holes in places is not the best. Rarely is a magnet found without such defects. A stone, however, which is heavy on account of its homogeneity and the good compactness of its component parts is of greater value. But its virtue is recognized by its strong attraction for iron and its great weight (regarding the manner of attraction, I shall speak below). When, therefore, you find a stone with these characteristics, get it if you can. It is therefore clear by what marks this stone is recognized.

Chapter IV: On the science of finding the parts of the stone—You must know that this stone bears in itself a likeness to the heavens (the method of proving this I shall show below). And just as there are two points in the heavens more noteworthy than all the others because the celestial sphere turns about them as upon axes, one of which is called the arctic or north pole and the other the antarctic or south pole, so also in this stone, you should clearly understand that there are two points, one north and the other south. You may arrive at the general determination of these two points in various ways. One way is to round the stone with an instrument just as crystals and other stones are rounded, and then let a needle or elongated piece of iron, slender like a needle, be placed on the stone, and a line be drawn along the length of the iron dividing the stone in the middle. Then let the needle or iron be placed in another position on the stone and mark the stone with a line in the same manner according to that position. And if you wish you may repeat this in many places or positions, and there is no doubt that all the lines of this (stone) will converge in two points just as all the meridian-circles of the globe meet in the two opposite poles of the world. Know then that one is north and the other south, the proof of which you will find in the following chapter.

There is another better way of finding these points, namely, that you note the place on the rounded stone, as has been described, where the end of the needle or of the iron clings more frequently or with greater force. For this place will be one of the points determined by the method already described.

In order, therefore, that you may determine one point on the stone exactly, break from the needle or iron a little piece which shall be oblong

⁷Hellmann has here *partibus* but *portibus* was adopted by Bertelli in his critical text of 1868.

and about as long as two finger-nails and place it on the spot at which, as already stated, the point has been found, and if it stands perpendicular to the stone, there is no doubt that the place sought is there; if not move it about until it does stand perpendicular. When this has been done mark the point there; and in a like manner you will find the opposite point on the opposite side of the stone. If you do this rightly and the stone is homogeneous and select, the points will be diametrically opposite each other just as are the poles of a sphere.

Chapter V: Regarding the science of finding the poles in the stone; which of them is the north and which the south—Having noted the art of recognizing the poles of the stone in a general way, you will know in the following manner which is the north and which is the south pole. Take a round wooden vessel in the form of a cup or platter and place the stone therein so that the two poles thereof are equidistant from the side of the vessel. Then place the vessel containing the stone in another large vessel filled with water, so that, in the first vessel, the stone may be like a sailor in a ship. Let the first vessel have plenty of room in the second, just like a boat floating in a river, and I insist on plenty of room in order that the free motion of the stone may not be impeded by the contact of the small vessel against the side of the large vessel. For this stone, thus placed, will turn its small vessel about until its north pole will stand in the direction of the northern point of the heavens and the southern in the direction of the southern point. And indeed if it is moved aside a thousand times, it will return a thousand times to its position by the will of God. And since the northern and southern parts are known in the heavens, those in the stone will also be known by them, because each part of the stone will turn towards the corresponding part of the heavens.

Chapter VI: How one magnet attracts another magnet—Having discovered which is the north and which the south pole of the stone, indicate the poles with incisions so that you may recognize them as often as necessary. And if afterwards you wish to see how one stone attracts another, you will arrange two stones, prepared as has been described, in the following manner. Place one in its vessel so that it may float just like a sailor in a ship. Let the points, already found, be equidistant from the horizon or edge of the vessel, which is the same thing. But hold the other stone in your hand. Present the northern part of the stone which you are holding, to the southern part of the stone floating in the vessel; for the floating stone will follow the stone which you hold, as if wishing to adhere to it. And if, on the contrary, you bring the southern part of the stone in your hand, near the northern part of the floating stone, the same thing will happen, namely, the floating stone will follow the one which you will be holding. Know then, as a rule, that the northern part in a stone attracts the southern part in another stone, and the southern part the northern. But if you do the opposite, that is, present the northern part to the northern part, the stone which you hold in your hand will appear to flee the floating stone, and if you present the southern part to the southern, the same thing will happen. And this is because the northern part seeks the southern part; wherefore it will be seen to flee the northern. And in this is a sign that the northern part will finally be united with the southern.

Conversely, however, the same will take place in respect to the other part, that is, the southern part, because if it is presented to the southern part of the floating stone, you will see it flee from it; this, however, would not be the case, as has been said, if the northern part were brought near the southern. This, therefore, refutes the nonsense of certain persons who say that, if scammony^s attracts bile by reason of the similarity between them, a magnet will accordingly attract a magnet more powerfully than iron, a fact which they suppose false, although it is true just as is confirmed by experiment.

Chapter VII: How iron, when touched by a magnet, turns towards the poles of the World—And it is known to all who have tried it that when an oblong piece of iron has touched the magnet and has been attached to a piece of light wood or to a straw and is placed on water, one end will turn towards the star which they call the nautical star, because it is near the pole; the fact being that it does not turn toward the aforesaid star but towards the pole, the proof of which we will present in its own chapter; but the other end will turn towards the opposite part of the heavens. As to which end of the iron turns to which region of the sky, know that that end of the iron which shall have touched the southern part of the stone will turn towards the northern quarter of the sky. The contrary, however, will be the case of the iron which the northern part of the stone shall have touched, because it will turn towards the southern part of the heavens. And it is a wonderful thing for one who does not know the cause of the motions of the iron. But experience of this has proved that we have spoken the truth.

Chapter VIII: How the magnet attracts iron—If, however, you maintain that it is according to the natural appetite of the stone that it attracts iron floating or swimming on the water, take note of the northern part of the iron and bring near it the southern part of the stone, for it will follow the latter; or, conversely, hold the northern part of the stone to the southern part of the iron, for it will attract it without reluctance. If, on the contrary, you bring the northern part of the stone to the northern part of the iron, the iron will be observed to be repelled, until the southern end is attached to the same iron. And, in like manner, you will learn the same regarding the other part.

But if violence is done to the parts, namely, if the southern part of the iron which has been touched by the northern part of the stone be touched with the southern part of the stone; or that part which was touched with the southern part of the stone, which is also called the southern in the iron, be joined to the southern part of the stone, the virtue in the iron will be easily altered, and that will become southern which was previously northern in it, and vice versa. And the cause of this is the impression of the last agent, confounding and changing the virtue of the first.

Chapter IX: Why the northern part attracts the southern and vice versa—The northern part of the stone attracts the southern and vice versa, as has been stated, in which attraction the stone of the stronger virtue is the agent and that of the weaker the patient. I think the cause

^sA plant of the genus *convolvulus*, used as a cathartic. The original text of this sentence is as follows: Ex hoc evacuatur quorundam fatuitas dicentium quod si scamonea choleram, ratione similitudinis, attrahat ergo magnes magnetem, magis quam ferrum, attrahet quod falsum supponunt, cum sit verum sicut patet experimento.

of this phenomenon may be explained in this way; for the active agent strives not only to join its patient to itself but to unite with it, so that out of the agent and the patient there may be made one. And this you can find out in the case of this marvelous stone in this manner. Take one stone which you may call by AD , in which A is the north and D the south point. Divide it into two parts so that two stones are made from it. After this, place the stone which contains A on water so that it may float; you will see that A turns towards the north as before. For breaking does not take away the properties of the parts of the stone, if it is homogeneous. Hence the part of this stone at the point of fracture which is B , must be the south. Let, then, this stone regarding which we have just been speaking be represented by AB ; as to the other stone, which contains D , if it is placed on water, you will see that D is south as at first, because it turns towards the south, if placed on water. But the other part near the fracture, which may be designated by C , will be the northern; this stone will therefore be CD ; let the first stone AB be the agent, CD the patient, and thus you see that the two parts of the two stones which, before the separation, were continuous in one stone, after the separation, were found to be, one the northern and one the southern part. But if the same parts are again brought together, one will attract the other until they are joined together at the point BC , where the break took place. Thus by the natural appetite, they will form one body as at first. An indication of this is that if they are cemented at that point, they will exhibit the same operations as at first.

The active agent therefore, as you see by this experiment, strives to unite its patient to itself, but this is done because of the similitude between them. It is necessary, therefore, when B is united with C , by force of attraction, that there be one line made of the agent and patient, following the order $ABCD$, so that BC is one point. For in this union is retained or preserved the identity of the extreme parts just as they were at first. For A is northern in the whole line, just as it was in the divided line; in the same way D is the south point just as it was in the divided passive part, so is it in the same united: B and C therefore become one and the same.

And in the same manner, it happens that if A is joined with D , that two lines become one, by virtue of the very attraction according to this order $CDAB$, so that DA is one point; then the identity of the extreme parts will remain, just as at first, before they were united; for C will be the northern point, and B the southern, just as B and C were before the separation.

If it should be otherwise, however, this identity or similitude of the parts would not be conserved. For you see that if C be joined to A which is contrary to the truth as discovered, so that from these two lines one line is formed according to the order $BACD$, so that AC is in one point; D (which was the south before they were united) requires in this whole line, that B , the other end, should be the northern which before was southern; and, behold, the original identity or similitude is destroyed. But if you make B southern, as it was before they were united, it is required that D , the other part, should be the northern, although nevertheless it was the southern, and thus here neither identity nor similitude is preserved. For that which has now been converted from two into

one must be in the same species as the agent; this would not be the case, were nature to choose that impossible arrangement. But the same incongruity occurs, if you join *D* with *B*, so that there results one line according to this order, *ABDC*, as is obvious to one who gives the matter his consideration. For nature which tends towards being and acts in the better way, chooses the first order of action in which the identity is better preserved than in the second.

It is, accordingly, evident why the southern part attracts the northern and conversely; and why the attraction of the south by the south and the north by the north is not in accordance with nature.

Chapter X: On inquiry whence the magnet receives the natural virtue which it possesses—Certain inexperienced investigators are of the opinion that the virtue by which the magnet attracts iron, exists in the mineral regions in which the magnet is found, whence they say that though iron moves towards the poles of the world, this is only because a mine of the stone is situated in those regions. These, however, do not know that the aforesaid stone is found in many parts of the Earth, from which it would follow that it would turn towards various places on the Earth—which is false. And, moreover, they do not know that a place under the poles is uninhabitable, because half the year there is daytime and half the year there is night. Hence, it is senseless to think that a magnet could be brought to us from those regions. Besides, since the iron or stone turns to the south as well as to the north, as is obvious from what has been said, we are forced to conclude that the virtue flows into the poles of the stone not only from the north but also from the south, rather than from mineral regions. A clear sign of this is that wherever man has been, he sees that the motion of this stone is to his eye according to the position of his meridian circle. All meridian circles, however, converge in the poles of the world; wherefore from the poles of the world the poles of the magnet receive their virtue. From this it is clearly apparent that the magnetic needle does not point to the nautical star, since the meridian circles do not intersect there but in the poles. For the nautical star is always found outside the meridian circle of any region except twice in a complete revolution of the firmament. From these considerations it is manifest that it is from the poles of the heavens that the poles of the magnet receive their virtue (directive force).

You may rightly conclude that the other parts of the stone receive their influence from other parts of the heavens; so that you may suppose not only that the poles of the stone thus receive influence and virtue from the poles of the world, but also the whole stone does so from the whole heavens. I advise you to test this in the following manner: Let the stone be rounded and its poles located. Then place the stone on two sharp pivots, so that to each pole one pivot is lightly fixed in its socket in the stone, and that the stone may revolve on them without difficulty. When you have done this, ascertain whether the parts (poles) of the stone are equally balanced, by turning it lightly on said pivots, and this you shall repeat several times at different hours of the day with great care (wise industry). When you have done this, place the stone on the meridian circle on its pivots lightly fixed in the poles of the stone, so that it moves in the manner of armillaries in such a way that the elevation and depression of its poles may correspond with the elevation and depression of the poles of the heavens in the region where you may

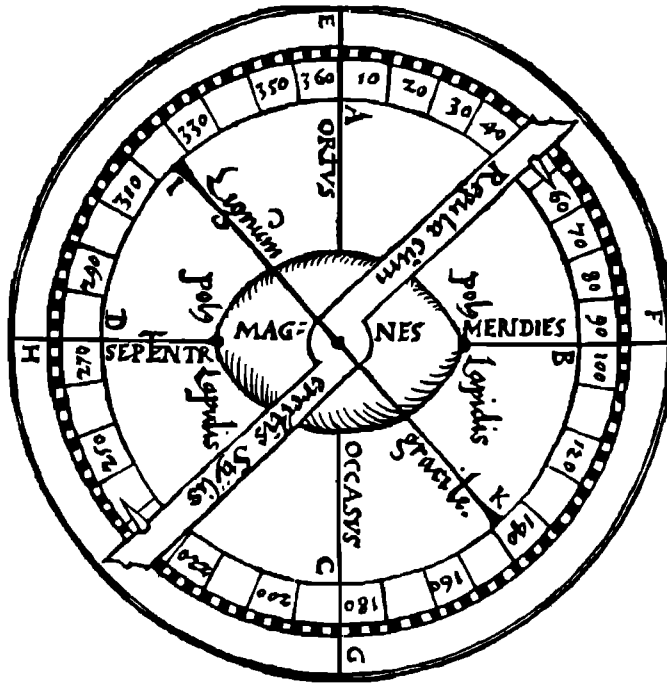
be. And if now the stone is moved according to the motion of the heavens, rejoice that you have discovered a marvelous secret, and if not, let the failure be imputed to your lack of skill rather than to a defect of nature. In this position or manner of placing, I judge that the virtues of this stone are properly conserved, and I think that in the other positions of the sky its virtue is obscured or weakened rather than conserved. By this instrument you will be freed from every kind of clock, for by it you will be able to know the ascendant in whatever hour you may wish, and all the other dispositions of the sky which astrologers seek.⁹

PART II

Chapter I: On the construction of an instrument by which may be ascertained the azimuth of the Sun and the Moon, and of any star on the horizon—Having reviewed the natural phenomena of the magnet, let us now proceed to the inventions which depend on a knowledge of its natural workings. Let a round magnet (terrella) be taken and its poles determined, as has been described, and let it be filed between the two poles on both sides so that the stone may be like a sphere compressed between the poles and thus occupy less space. Let this stone, thus prepared, be enclosed between two capsules (or boxes) after the manner of a mirror. And let these capsules in turn be so joined that they may not be opened later and that no water may enter. Let the capsules be prepared with cement suited to this purpose and let them be of light wood. When this has been done, place the capsules thus prepared in a large vessel full of water on the edges of which the two parts of the world, that is, the south and the north, are found and marked, and let them be indicated by a thread stretched across from the northern to the southern part of the vessel. Allow the capsules to float and let there be above them a slender strip of wood in the position of a diameter. Then move this strip of wood above the capsules until it is equidistant from the meridian line previously determined and indicated by the thread or is in the same line with it. This having been done, according to the position of the strip so situated, draw a line on the capsules; and it will be the perpetual meridional line in all regions. That line, therefore, when cut at right-angles by another, will be divided in the center and will be the line of the east and the west. And thus you will have the four quadrants actually marked on the capsules, representing the four quarters of the world, of which each should be subdivided into 90 parts so that there may be altogether 360 parts (degrees) in the entire circumference of the capsules. And inscribe divisions on it, just as they are usually inscribed on the back of the astrolabe. There shall also be a slender and light ruler above the capsules so inscribed similar to the ruler on the back of the astrolabe. In place, however, of the sights, let there be erected at right-angles two pins at the ends of the ruler.

If, therefore, you desire to have the azimuth of the Sun by day, place the capsules on water and allow them to move about until they settle in their proper position; there hold them firmly with one hand and with the other move the ruler until the shadow of the pin falls along its length; then the end of the rule on the side of the Sun will show the azimuth

⁹Per hoc autem Instrumentum excusaberis ab omni horologio; nam per ipsum scire poteris Ascensus in quacumque hora voleris, et omnes alias celi dispositiones, quas querunt Astrologi.



Reproduction of illustration at end of Chapter I of Part II showing instrument for finding azimuth of Sun, Moon, or any star on the horizon (From "Neudrucke von Schriften und Karten über Meteorologie und Erdmagnetismus," No. 10, by G. Hellmann)

of the Sun. If there should be a wind let the capsules be covered with some vessel until they have assumed their proper position.

At night, on the other hand, you may do the same with the Moon and stars, for you will move the ruler until the tops of the pins and the Moon or star are in the same line. For the end of the rule on the side of the star will indicate its azimuth as before.

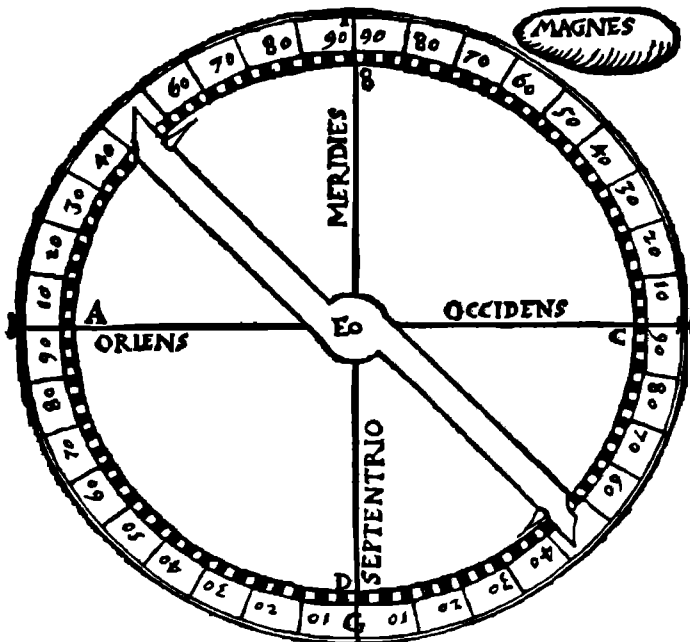
You will know, moreover, by the azimuth, the hours, the ascendants¹⁰ and ascensions, and all things necessary according to the science of the astrolabe. The accompanying figure shows the form of this instrument.*

Chapter II: On the construction of a better instrument for the same purpose—In this chapter we shall tell you the way of constructing another instrument of better and surer effect. Let a vessel be made of wood, brass, or of any solid material that you wish, and let it be turned in the form of a jar not very deep and tolerably wide, and let it

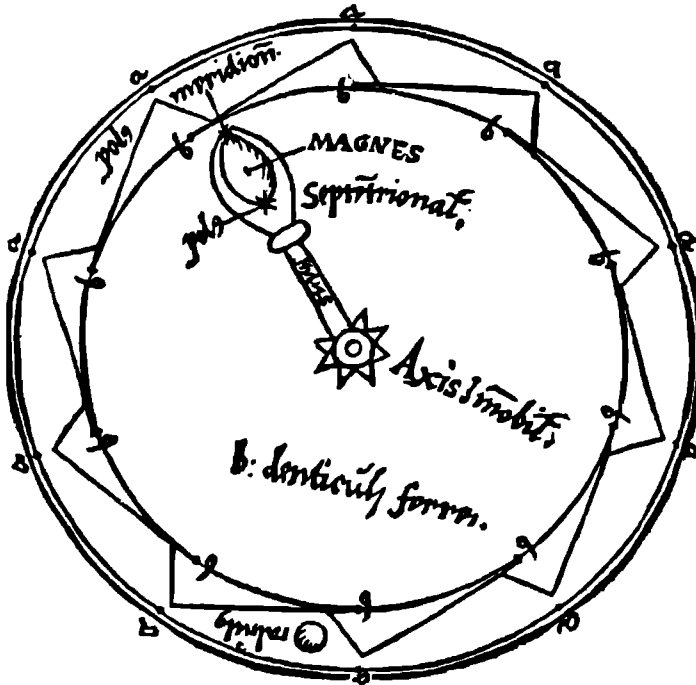
¹⁰Cognosces, autem, per azimuth, horas, et Ascendens, et Ascensiones, et cuncta que oportet, secundum doctrinam Astrolabii, complete. For a discussion of these terms see "A treatise on the astrolabe addressed to his son Lowys" by Geoffrey Chaucer, A. D. 1391, London, published for the Early English Text Society, by N. Trübner and Company (1872).

*Translations of legends on the three illustrations of Peregrinus' "Epistola de Magnete" at ends of chapters I, II, and III of Part II: *Magnes* = magnet; *polus lapidis* = pole of the stone; *regula cum erectis stylis* = ruler with erect pins; *ortus*, *occasus* = east, west; *oriens*, *occidens* = east, west; *septentrio*, *meridies* = north, south; *polus meridionalis* = south pole; *polus septentrionalis* = north pole; *axis immobilis* = fixed axis; *dentaculi ferrei* = iron teeth; *calculus* = pebble; *lignum gracile* = thin wooden strip.

be fitted at the top with a cover of transparent material such as glass or crystal. If the whole vessel should be of transparent material it will be better. Let there be placed in the center of the same vessel, a slender axis of brass or of silver, applying its ends to the two parts of the jar, namely, the upper and the lower. Let then two holes be made in the center of the axis at right-angles to each other, and let a piece of iron wire, similar to a needle, pass through one of the holes, and another wire of silver or of brass pass through the other, crossing the iron one at right-angles. Let the cover first be divided into quadrants and each of the quadrants into 90 parts, as was stated in the case of the other instrument. And let the north, south, east, and west be indicated on it, and let a ruler of transparent material be added to it with wires set upright at each end. You will then bring near to the crystal whatever part of the magnet you wish, whether north or south until the needle moves towards it (the magnet) and receives power from it. Having done this, turn the vessel until one end of the needle stands directly over the north of the instrument, corresponding with the northern quarter of the heavens. When this has been done, turn the rule towards the Sun by day and the stars by night, as above stated. Through this instrument you will be enabled to direct your course towards states and islands, and any places in the world, and wheresoever you may be, on land or on sea, provided that their longitudes and latitudes are known to you.



Reproduction of illustration at end of Chapter II, Part II, showing improved instrument for finding azimuth of Sun, Moon, or any star on the horizon (From Hellmann's "Neudrucke," No. 10)



Reproduction of diagram at end of Chapter III, Part II,
of Peregrinus' wheel of perpetual motion (From Hellmann's
"Neudrucke," No. 10)

How iron is held suspended in air by virtue of the stone, we shall explain in the book on the action of mirrors. This, then, is the description of the aforesaid instrument [see figure].

Chapter III: On the construction of the wheel—In this chapter I shall reveal to you the way to construct a continually moving wheel, of wonderful ingenuity, in the invention of which I have seen many engaged in vain attempts and wearied with much labor. For they did not perceive that they could effect the accomplishment of this by the virtue or power of the lodestone.

For the composition or construction of this wheel, construct a silver case, like that of a concave mirror, embellished with clever workmanship, with carvings and perforations which you will make both for the sake of beauty and of lightening its weight; because the lighter it is the more rapidly it will turn. You will then perforate it so that the eye of the ignorant shall not perceive what is cleverly inserted inside the cases. Let there be inside, however, small nails or teeth of iron, of one weight, inserted in the edge bent towards each other so that the distance separating them is not more than the thickness of a bean or a pea. Let the above-mentioned wheel be uniform in the weight of all its parts, then fix an axis through its center upon which the said wheel may revolve, the axis remaining quite immovable. Let a silver bar be attached to the axis and placed between the two cases, on the end of which let a

magnet be set prepared as follows: Let it be rounded and the poles found, as has been described. Then let it be shaped like an egg, with poles intact, and let it be filed somewhat in two intermediate and opposite parts so that it may be compressed and occupy less space, and that it may not touch the walls through the motion of the wheel. When it has been thus fashioned, let it be placed on the bar like a stone in a ring and let the north pole be somewhat inclined toward the small teeth of the wheel so that its virtue may flow, not diametrically but at a certain angle, into the iron teeth, so that when any tooth comes near to the north pole, and owing to the impetus of the wheel, passes a little beyond, it may approach the southern part which will flee rather than attract it, as is obvious from the rule above given. Thus every little tooth will be in a perpetual state of attraction and repulsion. And in order that the wheel may perform its duty more rapidly, insert between the cases a small round pebble of brass or silver, of such size that it may be caught between any pair of teeth; so that when the wheel is raised, the pebble may fall on the opposite side. Therefore, when the motion of the wheel is perpetual on one side, the fall of the pebble on the opposite side caught between any two of the teeth will likewise be perpetual, because, as it is drawn towards the center of the Earth by its weight, it will prove to be an assistance and will not let the teeth come to rest in a direct line with the stone. Let there be, moreover, spaces between the teeth, conveniently hollowed out, so that they may properly catch the pebble in its fall as the present figure shows. Farewell.

Completed in camp, at the siege of Lucera, in the year of our Lord 1269, eighth day of August. End of the treatise.

LETTERS TO EDITOR

(See also page 28)

SOLAR AND MAGNETIC DATA, OCTOBER TO DECEMBER, 1942, MOUNT WILSON OBSERVATORY

A small magnetic disturbance occurred on October 2-3. Only very small sunspots were visible.

Although an active sunspot-group (Mount Wilson No. 7508) large enough to be seen without a telescope, crossed the central meridian on November 2.8 GMT, 14° from the center of the solar disk, no significant terrestrial-magnetic activity was recorded while the group was visible (October 27-November 8).

Another large active group (No. 7518) crossed the central meridian on November 28.0, 6° from the center of the solar disk. Although it was slightly smaller and less active than group 7508, the Earth's magnetic field was somewhat more active while group 7518 was visible (November 21-December 3) than while group 7508 was visible.