

## **YANTRAS OR MYSTIC DIAGRAMS: A WIDE AREA FOR STUDY IN ANCIENT AND MIEVEAL INDIAN MATHEMATICS**

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As an appliance, *yantra* may be an astronomical or surgical instrument, or a machine or mechanical device. In religion and mysticism, *yantra* is a diagram containing geometrical drawing and mystical symbols including *mantras*, letters, numbers, and other figures. These mystic diagrams are used in worship, meditation and ritual practices. They have been also used for protection against ill-effects of evil spirits, diseases and planets, and even for *abhicāra* (malefic practices). Mathematical magic squares (*aṅka-yantras*) and other magical figures are also included in them.

The present paper deals with various aspects of *yantras* including traditional views, classification, and technical terminology along with appropriate historical remarks. The famous and profound *śrīyantra* has been given special attention. Other *yantras* discussed include Gaṇeśa, Durgā, Rudra, Bhauma (related to planet mars) and the beautiful *Sarvatobhadra-yantra*.

Detailed discussions of *yantras*' construction and of the mathematics involved are there in the paper. Full references to original Sanskrit texts and profuse illustrations are included here. There is a list of one hundred important *yantras* (with references) and a glossary of technical terms. It is hoped that this general study of *yantras* will motivate further studies and research and will serve to draw attention of scholars to the somewhat hitherto neglected area of the history of ancient and medieval science in India.

**Key words:** Ancient and Medieval Indian geometry, religious mathematics, *śrīyantra* and other *yantras*, technical glossary.

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### 1. INTRODUCTION: *YANTRAS* IN GENERAL

Regarding the Sanskrit word *yantra*, quite a few etymological connections and explanations are found in different works. Apte<sup>1</sup> gives the root *yantr* which means to check, restrain or fasten etc. from which the verbal forms *yantrati*, *yantrayati* follow. According to Monier-Williams<sup>2</sup>, the root *yantr* (*Dhātupāṭha* XXXII.3) itself is rather a nominal verb from the word *yantra*. In general *yantra* is said to mean that which checks or restrains etc.

According to *Vācaspatyam*<sup>3</sup> and Sanskrit *Dhātu Sāgara Taraṇiḥ*<sup>4</sup>, the word *yantra* is connected to the root *yatri* (to curb or check). It has been also connected with the root *yam* which is used in somewhat similar sense<sup>5</sup>. Rao<sup>6</sup> gives derivation of *yantra* from *yam* as well as from the above two verbal forms. Thus the Sanskrit word *yantra* usually means any appliance or apparatus, contrivance, or device, engine or machine, implement or instrument in general. Depending on the context, it may specifically denote an object of any of the above type in different areas of Indian sciences in a broad sense.

In *gaṇita-jyotiṣa* (mathematical astronomy), the astronomical instruments have been called *yantras* in general. Yukio Ohashi's doctoral work<sup>7</sup> *A History of Astronomical Instruments in India* is very comprehensive on such *yantras*. The earliest of these are the *nara-yantra* or *śaṅku* (gnomon) and the *ghaṭikā* or *ghaṭī-yantra* which is also called *jala-yantra* (clepsydra).

The traditional Siddhāntas (Sanskrit works on astronomy) deal with a number of astronomical *yantras* including the *gola-yantra* (celestial globe or armillary sphere). The staff-type instruments were *yaṣṭi-yantra*, *nalaka* or *nālakā*, *śalākā*, *śakaṭa*, etc. Under the round-type are put *cakra*, *dhanur* or *cāpa*, *turya* (quadrant), *bhagaṇa* or *nāḍīvalaya*, *kartarī*, *kapāla*, *pīṭha*, and Āryabhaṭa's *chatra-yantra*.<sup>8</sup> Bhāskara II's *phalaka-yantra* (board-instrument) is his own invention and his *dhī-yantra* is called *buddhi-yantra* by Muniśvara.<sup>9</sup> The *yantrarāja* (astrolabe) was indeed 'king' among *yantras*.

List of other Indian astronomical instruments include the *dhruvabhrama-yantra*, *diksāadhan-yantra* (Padmanābha), *kaśā-yantra* (Hema), *pratoda* or *cābuka-yantra*, and *sudhīrañjana* (Gaṇeśa). The Sanskrit manuscript *Yantra-prakāra* (in City Palace, Jaipur) is said to list more than a dozen astronomical instruments including *jayaprakāśa*, *krānti-vṛtta*, *palabhā-yantra*, *diagaṃsa-yantra*, *śara-yantra*, *agrā-yantra*, *yāmottara-bhitti*, *rāśi-valaya* and *Sudas Phakarī* (= *suds fakhrī*) also called *ṣaṣṭhāṃśa* (sextant).<sup>10</sup>

The Jaipur Observatory is the biggest and best preserved among the five observatories of Jai Singh and has two dozen instruments. According to *Zij-i Muhammad Shāhī* (1733/1738 AD), Jai Singh himself invented the *Jayaprakāśa-yantra* (named after himself), *Rāmaprakāśa-yantra* (named after his grand-father Rāmasiṃha), and *Samrāṭ-yantra* (named after his guru Jagannātha Paṇḍita).<sup>11</sup>

In ancient and medieval times, mathematics was intimately connected with astronomy and the twin mathematical sciences contributed significantly to their mutual development. The theory and construction of astronomical *yantras* involved a lot of mathematics. So a study of the works on such *yantras* (instruments) and analysis of the principles on which the *yantras* were based, cannot be neglected while dealing broadly with the history of mathematics of the time in India.

Since our concern here is more about the mathematics involved in some specific type of *yantras*, so a few other type of *yantras* are only briefly mentioned now. In the traditional *Rasāyana-śāstra*, different type of apparatus used in processing of medicines (*auśadha*) and other preparations (*rasas* etc.) were called *yantras*. Dozens of such *yantras* are known such as *dola-yantra*, *ḍeki-yantra* (for distillation), *bhūdhara-yantra*, *vidyādhara*, *ḍamarū*, *nālikā*, *ghaṭa-yantra*, etc.<sup>12</sup> In ancient Indian system of surgery (*śalya*), the term *yantra* was applied to the surgical instruments. The *Suśruta Saṃhitā* mentions many such *yantras* such as *śālākya-yantra*, *tāla-yantra*, *saṃdaṃśa-yantra*, *nādi* (tubular), and there were also *upa-yantras* (accessory appliances).<sup>13</sup>

Among the various mechanical devices which were called *yantras*, mention may be made of the *kūpa-yantra* (for drawing water), *taila-yantra* (for extracting oil), and *dāru-yantra* (wooden puppets). The *Yantra-Sarvasva* of Bhāradvāja (manuscript at Baroda) is said to describe a few *yantras*.<sup>14</sup>

## 2. MYSTIC DIAGRAMS

For certain meditation and ritual practices (especially in Buddhism and Tantric Hindusim), frequent use is made of a variety of diagrams with mystic and magical designs. These mystic diagrams (or figures) comprise of some sort of graphical representations involving geometrical drawings and designs and are called *yantras*. Usually they contain a few particular numbers, letters, or words which may form some *mantras* (mystic formulas) or their symbolic representations. Often figures and symbols representing objects and ideas which have religious,

mystical, and philosophical significance are also included in such *yantras*. Examples of such objects are the so frequently used lotus (*padma*) which is a symbol of purity, trident (*triśūla*) which represents the vector of energy, and *vajra* which is Indra's divine weapon and which is also a symbol of highest intellectual power in the Vajrayāna Buddhist School.<sup>15</sup>

These mystic diagrams (*yantras*) may be broadly classified into several categories such as *pūjana yantras*, *mantra yantras*, *rakṣā yantras* and a type which are called malefic *yantras*. Of course the employment of *yantras* for a variety of objectives and other various purposes is so wide and divergent that it will be difficult to have an exhaustive and non-overlapping classification.

The *pūjana yantras* are used in worshipping or actualizing divinities. They are deity-specific i.e. each divine form is associated with a *yantra* of its own. Thus *Durgā yantra* and *Kālī yantra* are different. Even minor deities have their separate *yantras*. Often more than one version of *yantra* is associated with a deity, more so when the purpose of the *yantra* is different. A *dhyāna-yantra* may serve as a visual aid for the concentration of mind in meditation.

The *rakṣā yantras* are meant to provide protection for a variety of ills and dangers. Their wearing is said to pacify the troubles arising out of diseases and destroy the evil effect produced due to unfavourable position of astrological planets (*grahas*). When such *yantras* are worn by a person on his body (as amulet or talisman), they are called *dhāraṇa yantras*. For a deity, the *pūjana* and *rakṣā yantras* may be different but it is often feasible to combine them.

The malefic *yantras* are used for *abhicāra* ("destructive magic") such as sorcery, witchcraft, and black magic. Usually they are used for seven specific objectives: *stambhanam* (arresting the movement or speech of opponent), *mohanam* (attracting affection by coercion), *uccāṭanam* (upsetting enemy by occult influence), *vasī karaṇa* (controlling by magic and hypnotism), *jṛmbhaṇam*

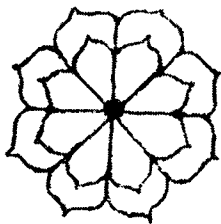


Fig. 1 (double lotus)

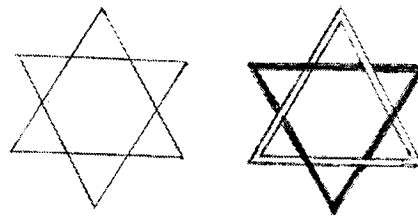


Fig. 2 (Hexagram and Solomon's seal)

(terrorising opponent), *vidveṣaṇam* (causing enmity among friends), and *māraṇam* (causing death).

To take a simple example, the *Puraścaryārṇava*<sup>16</sup> contains the statement *aṣṭadala-kamala-dvayātmakaṃ candrayantram*. 'The Moon mystic diagram consists, of the figure of double eight-petalled lotus'. This is shown in Fig. 1 which should be, as usual, enclosed by a decorated square called *bhūpura*, and which is comparable to the *yantra* of the Sun.<sup>17</sup>

The hexagram (Fig. 2) is called *Ṣaṭkoṇa* ('six-angled') in Tantric literature and is the basic figure in many mystic diagrams especially for the malefic *yantrās*.<sup>18</sup> It is interesting to note that Solomon's seal of the hexagram form has been used in the western culture also as an amulet against fever etc.<sup>19</sup>

*Maṇḍala* is another important term in connection with *yantras*. A simple figure consisting of square inscribed by a circle (which itself has an inscribed equilateral triangle) is called *kalaśasthāpanā maṇḍala*.<sup>20</sup> The term *maṇḍala* is also applied to special type of mystic diagrams which consists of concentric circles interwoven with lotus petals. *Maṇḍala* (*dkil-dkhor* in Tibetan) as a mystic diagram is one of the most important objects of Lamaist meditation and worship.<sup>21</sup> The Tibetan *Śrīcakra-sambhāra maṇḍala* is dedicated to god Heruka who is personified as *Nirvāṇa*.<sup>22</sup>

Many of the *yantras* were in the form of what are now called Latin and Magic squares. They were called *aṅka-yantras* (numerical diagrams). The *Ṇamokāra yantra* (Fig. 3) is basically a Latin square.<sup>23</sup>

1	2	3	4	5
2	3	4	5	1
3	4	5	1	2
4	5	1	2	3
5	1	2	3	4

Fig. 3

The use of magic squares of order three for pacifying the astrological nine planets (*navagrahas*) has been prescribed by the legendary writer Garga. The nine magic squares for the purpose are shown in Fig. 4 concisely from which *yantras* associated with sun, moon, mars, mercury, jupiter, venus, saturn, *rāhu* and *ketu* can be obtained by taking  $x = 0$  to 8 respectively. In the *Bṛhaddaivajñārañjana*<sup>24</sup>, the verses containing these magic squares and credit to Garga etc. are quoted from *Yantra-cintāmaṇi*<sup>25</sup>.

$6+x$	$1+x$	$8+x$
$7+x$	$5+x$	$3+x$
$2+x$	$9+x$	$4+x$

Fig. 4

Among the 4th order *anka-yantras*, the available evidences show that the Indian had an early interest in pandiagonal magic squares<sup>26</sup>.

The *anka-yantras* of Fig. 5 was possible used by Varāhamihira (5th century AD)<sup>27</sup> and that of Fig. 6 was carved on the lintel of an 11th century temple at Dudhai (then in Jhansi district) and is still found in an inscription at the famous Khajuraho (100 miles east of Jhansi).<sup>28</sup> It seems that early peoples were astonished to find the peculiarly wonderful arrangements of numerical figures in the form of magic squares. They were influenced, and attributed some magical powers to the arrangements. Hence they were frequently employed as *yantras* (mystical diagrams).

10	3	13	8
5	16	2	11
4	9	7	14
15	6	12	1

Fig. 5

7	12	1	14
2	13	8	11
16	3	10	5
9	6	15	4

Fig. 6

But soon the properties of magic squares attracted mathematicians both as a source of recreational mathematics and as a branch of pure mathematics (combinatorics). By now the subject of these *anka-yantras* is vast and their

genesis and growth form a significant part of history of the development of mathematics.

### 3. SOME TRADITIONAL VIEWS AND *Yantras*

In ancient India, arts and sciences were hand-maiden of religion. Almost all the sciences have been attributed a divine origin. This attitude (and practice) automatically attaches a hoary past to the genesis and beginning of those sciences. It also puts a stamp of unquestionable authority on the so-called *apauruṣeya* works i.e. those works which are attributed to ancient sages although they are composed by ordinary human beings.

Thus the exposition of chapter 54 (on astronomy and mathematics) in the *Nārada-purāṇa* commences with the line<sup>29</sup>

ज्योतिषाङ्गं प्रवक्ष्यामि यदुक्तं ब्रह्मणा पुरा।

(*jaytiṣāṅgaṃ pravakṣyāmi yaduktam brahmaṇā purā*).

“(Sanandana says) I shall now set out the *Jyotiṣa* portion which was enunciated in antiquity by (god) Brahmā.”

The *ghaṭīyantra* is attributed to the same god:<sup>30</sup> *mukhyaṃ tvamaṣi yantrānāṃ brahmaṇā nirmitaṃ purā*.

Nārāyaṇa Paṇḍita begins chapter on magic squares in his *Garita-kaumudī* (1356AD) by stating that the subject was taught to Manibhadra by Lord Śiva.<sup>31</sup> In fact all *yantras* or mystic diagrams, as explained by Mahīdhara in his auto-commentary on *Mantra-mahodadhī* (XX.1, p. 180),<sup>32</sup> were told by Lord Śiva to his consort Gauri.

Another characteristic of religious domination of Indian history and culture is to trace the beginning of every thing to Vedas which are taken to be the fountain-head of all knowledge whether past, present, or future. And since Vedas themselves are regarded to be God’s words, the origin of all *vidyās* (arts and sciences) whether sacred or secular are attributed a divine origin. Nīlakaṇṭha Caturdhara (17th century AD) has claimed that the practice of generating *aṅka-yantras* (magic squares) is hinted in certain *Ṛg-vedic* verses.<sup>33</sup>

The Vedic tradition of construction and mensuration of plane geometrical figures existed in India since quite ancient times in connection with the erection of śrauta (i.e. Vedic) *agnis* and *citis* (fire-altars) which are dealt and discussed in

the *Śulba-sūtras* in great details. Later on the mathematics of the plane geometrical diagrams is also met in the construction and calculation related to *kuṇḍas* (fire-pits) and *maṇḍapas* of the *smārta* tradition which became somewhat more popular and practical in medieval India. Thus the mathematics needed for the construction of the *tāntric cakras*, *maṇḍalas* and *yantras* may be considered as a continuation and extension of the earlier traditions. It involved the application of the Indian geometrical knowledge related to plane figures including circles, triangles, polygons, lotuses, and other flowery designs obtained by combining these figures in various ways. Such diagrams have specifically direct relevance to the history of geometrical knowledge in broad terms and reflects an aspect of application of ancient and medieval Indian mathematics in a field different from astronomy.

Most of the mystic diagrams to be considered here in detail are the *pūjana-yantras* used in worshipping various divinities. Their importance is clearly stated in the fact that<sup>34</sup>

विना यन्त्रेण चेत् पूजा देवता न प्रसीदति

(*vinā yantraṇa cet pūjā devatā na prasīdati*)

“A worship without *yantra* does not please the deity.”

Correctness in forms as laid down and of dimensions as prescribed is significant while drawing the geometrical diagrams whether they are related to the *śrauta* or *smārta* or tantric rituals. Otherwise desired objective may not be achieved and even adverse effects might be caused. For instance, regarding the area of a *kuṇḍa*, a warning reads<sup>35</sup>

मानाधिक्ये भवेद् रोगो, मानहीने दरिद्रता।

(*mānādhikye bhaved rogo, mānahīne daridrata*)

“When the area is more (than the prescribed amount), there will be disease; when in deficit, there will be poverty”.

Similarly for drawing (or engraving) a mystical diagram, the straight lines must be made perfectly otherwise poverty may be caused instead of *lakṣmī* (wealth) as is reflected in the statement<sup>36</sup>

ऋजु लेखे भवेल्लक्ष्मी, वक्र रेखे दरिद्रता।

(*rju lekhe bhavellakṣmī, vakra rekhe daridrata*)



Interestingly, it is also said that a *yantra* (music diagram) is to be drawn by free hand and not by the use of instruments.<sup>37</sup>

A noted attitude of Indian mind which affected the speedy growth and propagation (transfer and transmission) of all branches of ancient knowledge was the practice of *gopanīyatā* or protected and hidden secrecy. An astronomical correction, called *Bīja-saṃskara*, was found in some manuscripts (which were used by its commentators Raṅganātha and Viśvanātha) of the *Sūrya-siddhānta*, the most famous Indian work on astronomy. The correction is stated to be *gopanīyam* as it is to be taught only to a well-tested pupil and not to others.<sup>38</sup> The sacred and mystic sciences of *tantra*, *mantra*, and *yantra* are given such treatment of well-guarded protection more strictly. The *Ṣaḍakṣarī Vidyā* is not to be given to others even if one has to sacrifice his “state (*rājyam*), son, wife, life, etc.” so says the *Nārada-pañcarātra*.<sup>39</sup>

The recitation or muttering (*japa*) of a *mantra* (formula of prayer) is a significant Hindu method of worshipping any deity. Some of these *mantras* are to be written down (or engraved) on suitable plates of suitable materials. The resulting documents are called *Mantra-yantras* (mystic diagrams of *mantra*) which are also used for the worship of the *mantras* themselves. The importance of *mantras* is clear from the ancient saying that “*Siddhavaidyastu-māntrikaḥ*” which implies that *mantras* were believed to have some role in medical treatment. In fact the triple path or means of *tantra*, *mantra*, and *yantra* was used for sacred as well as secular objectives.

Although *mantras* are not to be translated, their original forms must be written and pronounced correctly. Incorrectly written *mantras* or their *bījākṣaras* (mystic or seed letters which serve as algebraic symbols) on the *yantras* may lead to adverse results. We need not only to have a correct understanding of construction of *yantras* but to know the correct meaning of the technical terms used. The language and symbology used in *tāntric* tradition of writing, worshipping, and performing rituals is quite complicated. A handy glossary is required for reference.

#### 4. TECHNICAL TERMS AND SYMBOLS

Every art and science has its own terminology and symbology. Without a knowledge of relevant technical terms and symbols used in any specific area of study, a clear understanding of its various topics and matters is not possible. Some simple examples will be mentioned here for illustration taking the specific case of the technical term ‘*manu*’ for expository clarification.

Scholars of History of Science are familiar with the usual various systems of expressing numbers using Sanskrit words and letters of alphabet. These include the popular *bhūta-saṅkhyās* (word-numerals), Āryabhaṭa I's special alphabetic system, and the famous *Kaṭapayādi-nyāya* so frequently used in ancient and medieval Indian mathematical sciences.<sup>40</sup>

In Indian mythological history, mention is made of 14 successive progenitors and sovereigns of Earth who are called Manus. So, as a *bhūta-saṅkhyā*, the Sanskrit word *manu* is used for 14, just as *agni* (fire) stands for 3, *veda* for 4, etc.

Thus in a description of the famous *Śriyantra* (see next section), we come across the line

मन्वस्रनागदल संयुत षोडशारम्

[*manvasra (=manu+asra)-nāgadala saṅyuta ṣoḍaṣāram*]

“(The *yantra*) has 14 corners with (lotuses) of 8 (*nāga*) and 16 petals”.

One of the usual meaning of the word *manu* is *mantra* (formula). *Mantra Mahodadhi* X. 71 of Mahīdhara (1588AD)<sup>41</sup> has the line

वेदरूद्राक्षरोमनुः

(*vedarudrākṣaro-manuḥ*)

“A *mantra (manu)* of 114 letters.”

(Here 114 comes from *veda*=4 and *rudra*=11 written from right to left according to convention).

As a technical term *manu* is also used as a big period of time, there being 14 such *manus* in the bigger astronomical period called *Kalpa*. Āryabhaṭa-I (born 476 AD) puts the equation as

काहो मनवो ढ

(*kāho manavo ḍha (Āryabhaṭīya, I.5)*)

“A day of Brahmā (or a *Kalpa*) has *ḍha* or 14 (*ḍha* = 14 according to Āryabhaṭa's system) *manus*”.

It may be mentioned that at present we are living in the period of the 7th Manu (called *Vaivasvata*). In the above equation, Brahmā is denoted by the

single letter *ka*. But in the vital word *Om* (= a + u + m) which is symbol of Hindu Trinity, he is denoted by *ma*<sup>42</sup>. Also it may be noted that, as a combination of letters *ma* and *nu*, the phrase *manu* will denote the number 200025 according to Āryabhaṭa I's alphabetic system, but will stand for the number 05 according to the well known *Kaṭapayādi* system.

For Tantric literature and for matters related to *tantra-mantra-yantra* in general, a special type of glossary is also needed. Various *mantras* (mystic formulas) are almost invariably inscribed on different *yantras* (mystic diagrams). Due to want of space, these *mantras* are frequently given in abbreviated forms which are usually called *bīja-mantra* and *bījākṣara* (seed or algebraic letters). These letters are evolved by certain syncopation and other processes. In fact we have works like *Māṭṛkā-nighaṇṭu*, which are a sort of *ekākṣara koṣa* (dictionary of one-letter words). For example words *bhṛguḥ* and *haṃsaḥ* both denote letter *sa*, and the letter *ha* is denoted by *nabhaḥ* (sky) and its synonyms.<sup>43</sup>

The set of five monograms or mystic letters representing germ or seed of *mantra* for the five metaphysical elements (*panca mahā bhūtas*) are *laṃ* for *kṣiti* (earth), *vaṃ* for *jala* (water), *raṃ* for *agni* (fire), *yaṃ* for *vāyu* (wind), and *haṃ* for *gagana* (sky, ether, or space) as mentioned above. Complicated *tāntric* expressions are often used (especially for poetic use) to denote *bījas* and *bījamantras*. For example, take the phrase<sup>44</sup>.

अग्नीन्दु शान्ति युग्वियत्

(*agnimdu-sānti-yugviyat*)

which literally means “sky with fire, moon, and peace”, but whose actual contextual meaning is entirely different. It is as follows: Here *agni* (fire) stands for the seed letter *r* (*reph*), *indru* (moon) for *anusvāra*, *sānti* (for vowel *ī*), and *viyat* (sky) for *h*. So the above phrase means “The letter *h* with *r*, *mātrā ī*, and *anusvāra*”

That is, the *śakti-bīja* “*hrīṃ*” (ह्रीं).

This highly technical (sacred and secret) symbology must be noted in tantric context. Otherwise as the usual word-numerals, *agni* denotes 3, *indru*, 1, and *viyat* 0.

As another example take the phrase<sup>45</sup>

भृगुवहनीन्दु युङ्मनुः

(*bhṛgu-vahnīṇḍu yurīmanuḥ*)

The actual meaning of this is:

“Letter *s* with *r*, vowel *au* and *anusvāra*”, i.e. *sraum* (स्रौ) *bīja*.

Here the Sanskrit word *manu* stands for the vowel *au* (औ). A possible explanation is that *au* is the 14th *mātrā* in the set of 16 *svaras* (vowels) of Devanāgarī alphabet.

The historians of science should also note some technical terminology and symbology regarding geometrical figures related to mystic diagrams. The usual isosceles (including equilateral) triangle with vertex upwards (Fig. 7a) is called *agni* (fire) or *Śiva* triangle. It is stated that<sup>46</sup>

*agnirūrdhvamukham trikoṇam*

“Fire is represented by an upward triangle.”

It may be pointed out that the Greek Pythagoreans represented the metaphysical element fire by a pyramid whose symbolic form can be taken to resemble Fig. 7a. The reverse triangle i.e. the one with vertex downwards (Fig. 7b) is called *Śakti* or *yoni* triangle. The symmetrical combination of two equilateral triangles one of which is *Śiva* and the other is *Śakti*, gives us the *ṣaṅkoṇa* (hexagram of Fig. 2) which is taken to represent the universe (produced from the primordial energy).

The figure of *svastika* is considered auspicious in India. Its use has been noticed even in the Indus Valley motifs in antiquity. The figure of *svastika* has been used in constructing some *yantras* (mystic diagrams). The *Vṛhat Sarvatobhadra yantra* made from *svastikas* (Fig. 8)<sup>47</sup> yields a beautiful floor design which can be used for mathematically symmetrical tiling. Nārāyaṇa Paṇḍita

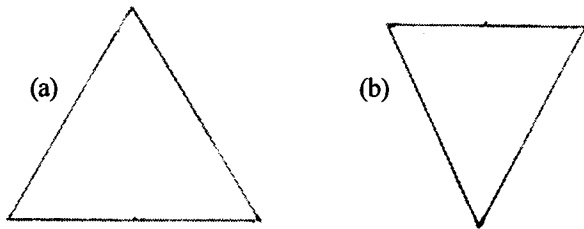


Fig. 7

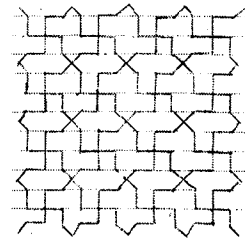


Fig. 8

in his *Gaṇita Kaumudī* (1356 AD) has given the name 'sarvatobhadra' to magic figure (*anka-yantra*) which is obtained by filling (in Fig. 9) the 64 triangles by numbers 1 to 64 to obtain magically constant sum.<sup>48</sup>

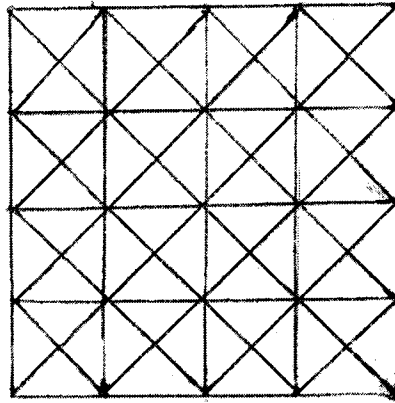


Fig. 9

*Yantras* or mystic diagrams are frequently enclosed or surrounded by what is called *bhūpura* (Earth-city or world-place) which is a square with openings on all the four sides or cardinal directions (Fig. 10).

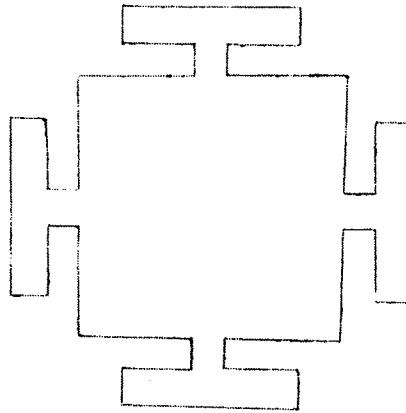


Fig. 10

A very common figure on *yantras* is that of lotus (*padma*) with a number of petals, the most frequent number being 8 (representing the 8 cardinal directions and corner-directions). Petals are usually of three types namely (i) round (Fig. 11), (ii) simply-pointed (Fig. 12) and (iii) ogee-form or inflectional (Fig. 1) in

which each side of a petal has a point of inflection where the curvature changes (sign). Some other symbols depicted on mystic diagrams include those for *triśūla* (trident), *vajra*, etc. It is often maintained that mystic language and symbols are needed to express the higher and deeper inner experience of the *yogic*, *tāntric*, and spiritual mind.

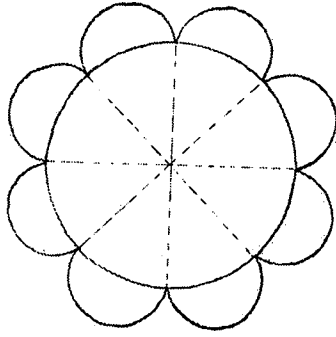


Fig. 11

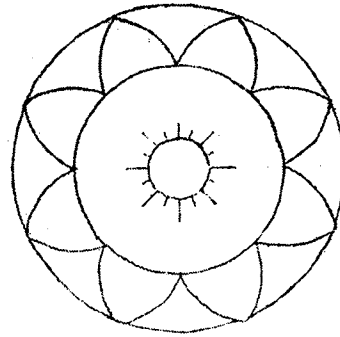


Fig. 12

### 5. ŚRĪYANTRA, THE FAMOUS MYSTIC DIAGRAM

According to the anonymous Sanskrit work *Yantroddhāra Sarvasva*<sup>49</sup>, there are as many as 10000 *yantras* or mystic diagrams. Among these the Śrīyantra is found to be most important and popular. It is the one which has drawn the widest attention of scholars. Indeed it is the profoundest *yantra* and is significant from various points of view.

As a basic geometrical diagram, the usual and most commonly depicted Śrīyantra is the plane (two-dimensional) type shown in Fig. 13 which shows its line diagram. The diagram consists of a central *bindu* (dot) surrounded by a bilaterally symmetrical figure composed of a set of nine interwoven primary isosceles triangles four of which are Śiva (vertex upwards) and five Śakti (apex downwards). The vertices of all the 9 triangles lie on the East (taken upwards) to West line of symmetry, and their bases and tops run from North to South.

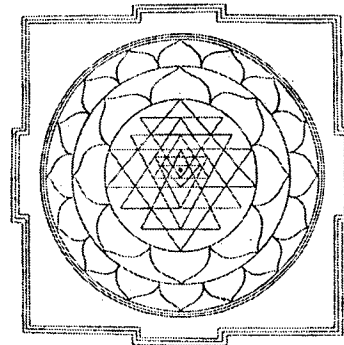


Fig. 13

The central design of the traingular complex is usually enclosed in a circle and surrounded by a lotus figure of 8 petals and then by another lotus of 16 petals situated similarly and symmetrically all around. Then a triplet of concentric circles is often made to surround the lotuses. Finally the whole pattern is enclosed in a three lined square-boundary (called *bhūpura*) with a gate on each of the cardinal side.

It is clear from the diagram that mathematically the most complicated part of Śrīyantra is the inner triangular complex. Among the traditional constructions (*uddhāra-prakāra*), a well-known classical method is that of Kaivalyāśrama which is given in his commentary on famous *Saundarya Laharī* attributed to Śaṅkarācārya. This may be briefly described as follows.<sup>50</sup>

Draw a circle (see Fig. 14) of desired size and divide the vertical diameter EW into 48 equal parts or units. Starting from E, draw 9 parallel chords of the circle (all perpendicular to EW) at respective distance of 6, 12, 17, 20, 23, 27, 30, 36 and 42 units. These are marked as  $A_1, B_1, A_2B_2$ , etc. to  $A_9B_9$ , serially. Leaving out the third and seventh chords as they are, delete (or rule off) 3, 5, 16, 18, 16, 4 and 3 units of length at both ends of the 1st, 2nd, 4th, 5th, 6th, 8th, and 9th chords respectively. By this, these seven shortened chords become the line segments ( $C_1D_1, C_2D_2, C_4D_4, C_5D_5, C_6D_6, C_8D_8$  and  $C_9D_9$  symmetrically placed on the EW line (for completeness we may say  $C_3D_3$  is  $A_3B_3$  and  $C_7D_7$  is  $A_7B_7$ ).

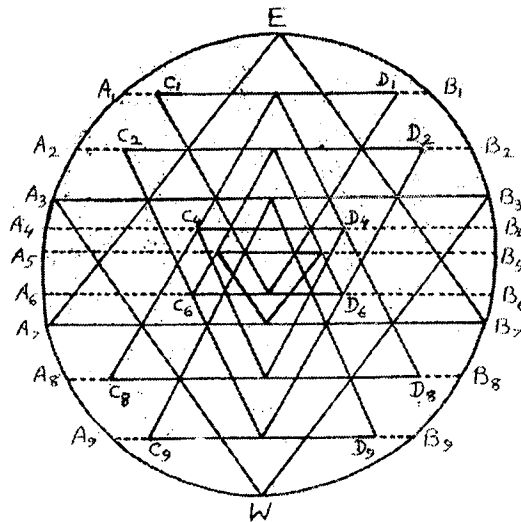


Fig. 14

Now the nine basic triangles of the triangular complex are formed as follows:

- (i) Ends of the 1st segment  $C_1D_1$  are joined to the midpoint of  $C_6D_6$ .
- (ii) Ends of the 2<sup>nd</sup> segment  $C_2D_2$  are joined to mid points of  $C_9D_9$ .
- (iii) Ends of the chord  $A_3B_3$  are joined to west point W.
- (iv) Ends of segment  $C_4D_4$  are joined to mid point of  $C_8D_8$
- (v) Ends of  $C_5D_5$  are joined to midpoint of  $C_7D_7$
- (vi) Ends of  $C_6D_6$  to midpoints of  $C_2D_2$
- (vii) Ends of  $A_7B_7$  to east point E.
- (viii) Ends of  $C_8D_8$  to midpoint of  $C_1D_1$
- (ix) Ends of  $C_9D_9$  to midpoint of  $C_3D_3$

It may be noted that the midpoints of the segments  $C_4D_4$  and  $C_5D_5$  are not used in forming any of the nine above primary triangles.

A slightly different version of the construction of Śrīyantra is found in *Tantra-samuccya* (śilpabhāgam)<sup>51</sup> in which the kaṭapaya system is used to specify the distances of the paralel chords from E, and for giving the amounts fo deletion at their ends. In this version the amount of deletion is 4 units (instead of 5) for the 2nd chord and 19 units (instead of 18) for the 5th chord.

Recently the author (RCG) of the present article has found a new version of the construction which the chosen diameter is divided into 42 parts (instead of 48) and distances of the chords from E are taken to different. In this version the deletion of 8th and 9th chords are given to be 8 and 6 units. If these are taken as total deletions, then at one end of the said two chords, the deletion will be 4 and 3 units which are same as in Kaivalyāśrama's version.<sup>52</sup>

Lakṣmīdhara, another commentator of Saundraya Laharī, calls the above construction of Kaivalyāśrama to be one of *saṃhāarakrama* (order of destruction).<sup>53</sup> He has another construction which is called to be of *ṣṣṭi-krama* (order of creation). In this, we start from the centre (i.e. with the construction of the small innermost śakti triangle around the bindu (dot) and then move outwards to construct other triangles to complete the desired set of 9 primary traingles.<sup>54</sup>



The method in the order of destruction is also said to be found in the *Tantrarāja* and that of creation in *Jnānārṇava*. Further<sup>55</sup>, there is mention of a third method called that of *sthiti-krama* (order of sustenance or protection) which is to be found in the work *Śubhagodaya*. These three orders match or correspond to the three stages of creation, protection, and destruction (*pralaya*) in Hindu cosmological science (*śṛṣṭi-vijñāna*).

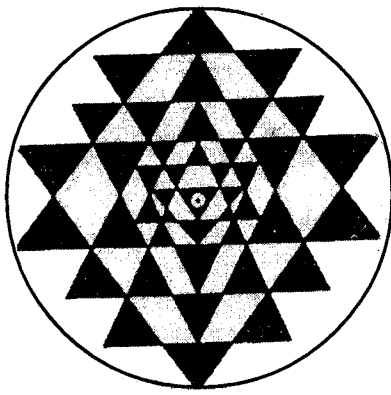


Fig. 15

The mutual intersections of the nine basic primary triangles in the *saṃhāra*-order construction given above (Fig. 14) results in the formation of 43 smaller secondary triangles (Fig. 15). The inner most central Śakti triangle, containing dot (*bindu*, as a symbol of single unseparated form of śiva and śakti), is surrounded by an enclosure (*āvaraṇa*) formed by 8 triangles arranged in a symmetric polygonal figure called *aṣṭakoṇa* (eight-angled) or *aṣṭāra*. The outer boundary of this enclosure

(Fig. 16a) of 8 small triangles forms the figure of a reentrant polygon with 8 angles (Fig. 16b).

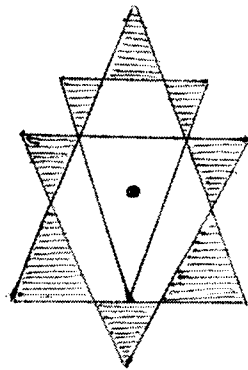


Fig. 16a

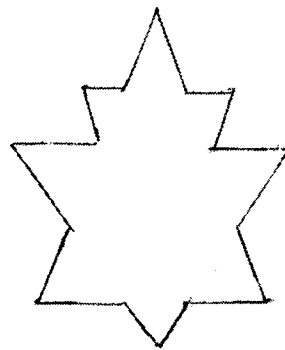


Fig. 16b

The figure 16a itself is important and is called *navakonamaka* mystic diagram. It is often used to form other *yantras*. After the enclosure of 8 small triangles, three more successive such enclosures or garlands are formed. They contain 10, 10 and 14 secondary triangles respectively (see Fig. 15).

Thus the total number of secondary triangles:

$$= 1+8+10+10+14 = 43$$

as already mentioned above.

For the geometrical constituents (*avayavas*) of the Śrīyantra (Fig. 13), the following classical verse from *Rudrayāmala Tantra* is frequently quoted<sup>56</sup>

बिन्दु त्रिकोण वसुकोण दशारयुग्मं,  
मन्वस्त्रनागदलसंयुत षोडशारम्।  
वृत्तत्रयं च धरणीसदनत्रयं च,  
श्री चक्रराजमुदितं परदेवता याः॥

(*bindu-trikoṇa-vasukoṇa daśāra-yugmaṃ,*  
*manuvasra-nāga dala-saṃyuta ṣoḍaśāram /*  
*vṛttatrayam ca dharaṇī-sadana-trayaṃ ca,*  
*śricakrarājamuditaṃ paradevatāyāḥ ॥*)

“The great Śrīyantra of the supreme deity consists of a *bindu* (dot), a central triangle, then enclosures formed of 8, 10, 10, and 14 triangles, and then surrounded three circles and three *bhūpuras*”.

The above Sanskrit verse is also said to be found in the *Tripuropaniṣad*.<sup>57</sup> Due to its importance, the Śrīyantra is discussed in many ancient works especially tantric texts and related works. But it appears that a large variety of forms and constructions of this great *yantra* are available. This is not surprising for a vast country like India which has a continuous history and culture of thousands of years. Some differences arise from different interpretations of the Sanskrit technical terms.

Out of the ten components or constituents of Śrīyantra mentioned above, the enclosure formed by the triplet of circles (*vṛtta-trayaṃ*) is not accepted by some schools (e.g. Hayagrīva school). The remaining 9 constituents are usually called the nine *cakras* of the mystic diagram. But the term or word *cakra* is used in other senses also e.g. even the 9 triangles of the triangular complex of the Śrīyantra have been called 9 *cakras*.<sup>58</sup>

The *Mantra-mahodadhī*<sup>59</sup> gives the construction of the Śrīyantra as follows:

बिंदुगर्भं त्रिकोणं तु कृत्वा चाष्टारमुद्धरेत्॥  
दशारद्वयमन्वस्त्राष्टार षोडश कोणकम्॥

(*biṇḍugarbhaṃ trikoṇam tu kṛtvā cāṣṭāramuddharet//  
daśāradvaya-manvasrāṣṭāra ṣoḍaśa-koṇakam/*)

The accompanying figure in the edition used here by us shows that the word *āra* has been interpreted in the sense ‘petalled lotus, and therefore the central innermost triangle (with *bindu* inside) is surrounded by three lotuses of 8, 10 and 10 petals (instead of angled polygons of Fig. 15). This interpretation is similar to that of the famous tantric or yogic *sahasrāra*, ‘the 1000-petalled lotus’. Also the *ṣoḍaśa-koṇakam* is drawn as a lotus with 16 angular petals. So we have a different Śrīyantra here which have toothed wheels.

In the Kaivalyāśrama’s construction of Śrīyantra (given earlier in this very section) some small imperfections are found at a few intersections of lines which form the 43 secondary triangles. Of course, by drawing the mystic diagram on a smaller scale and with a little sleight of hand in drawing it, the imperfections become practically undetectable. The mathematical aspect in attaining precision in the construction of theoretically ideal Śrīyantra has been discussed by Kulaichev.<sup>60</sup>

A technique for drawing a nearly perfect Śrīyantra within a square has been given by Bolton and Macleod who also mention that Alan West of the University of Leeds has produced a scheme to construct the *yantra* without any error.<sup>61</sup> A Nepalese version (dated 1700AD) of Śrīyantra is reported to illustrate the occurrence of the mysterious pyramid angle of 51°51’ in the largest triangles of the *yantra* thereby showing geometrical relationships involving the famous constant  $\pi$  (ratio of circumference to diameter in any circle).<sup>62</sup> The Tibetan ‘Śrīcakra sambhāra maṇḍala’ diagram consists of a series of circles and lotuses.<sup>63</sup>

From the point of view of architectural construction, the *Gaurīyāmala Tantra* mentions four types of Śrīyantra as follows:<sup>64</sup>

चातुर्विध्यं हि चक्रस्य प्रस्ताराश्च भवन्ति हि।  
भूकूर्म पद्मप्रस्तारा मेरुश्चापि तथा विधः॥

(*cāturvidhyaṃ hi cakrasya prastārāśca bhavanti hi /  
bhū-kūrma-padma prastārā meruścāpi tathāvidhaḥ //*)

“There are four *prastāras* (architectural forms) of Śrīyantra, namely *bhū*, *kūrma*, *padma*, and *meru*.”

The *bhū* version is the plane version in which the full diagram lies in a horizontal plane. In the *kūrma* form (resembling the back of a tortoise), the

triangular complex is drawn on the spherical surface with the help of spherical triangles. In the *meru* version, different constituents or enclosures (counted from outermost) lie in different horizontal planes at different heights like the mythical mount Meru. The *padma* (lotus) form does not seem to be popular.

The history of Śrīyantra is claimed to go to Vedic times and it is found mentioned in Buddhist inscriptions of Sumatra (7th century AD).<sup>65</sup> Verse no. 11 of *Saundarya-laharī* (attributed to Ādi-Saṅkarācārya)<sup>66</sup> is taken to refer to the Śrīyantra.

Elementary mathematics is involved in the solution of primary triangles formed by Kaivalyāśrama's method (Fig. 14). Let  $x$  be the distance, from  $E$ , of the chord along which the base or top of such a triangle lies. If  $k$  is the deletion on either end of the chord, then the length of the base or top of the triangle will be given by

$$b = 2 (\sqrt{x(2R-x)} - k)$$

where  $R$  is the radius of the circle (Fig. 14). If  $y$  is the distance of the chord on which the apex of the triangle lies, then the apex angle will be given by

$$\theta = 2 \tan^{-1} (b/2|x-y|), \text{ here } |x-y| \text{ is modulus of } (x-y).$$

For example, for the Śakti triangle of top  $C_1D_1$  (lying along  $A_1B_1$ ) and apex on  $C_6D_6$ , we have  $R = 24$ ,  $x = 6$ ,  $y = 27$ , and  $k = 3$ .

Using above formulas, we get  $b = 25.75$  and  $\theta = 63^\circ$  nearly. Thus the innermost triangle (Fig. 15) which contains the *bindu*, is nearly equilateral.

The high mathematical theory of the spherical type of Śrīyantra is reportedly found in the doctoral thesis on Plane and Spherical Triangular network by Dr. C.S. Rao (I.I.T., Bombay, 1993).<sup>67</sup> Also the Śrīyantra as an "Ancient Instrument to Control, the Psychophysiological State of Man" has been discussed in a joint paper by Kulaichev and Ramendic.<sup>68</sup> In fact, the *yantra* is regarded to be a complicated object whose study requires efforts by specialists from different fields of knowledge. Indeed Śrīyantra is rightly called *yantrarāja*, the king of mystical diagrams.

## 6. OTHER SELECTED Yantras

As already mentioned, the total number of *yantras* or mystical diagrams is practically very large, and theoretically without any limit if we include the *anka-*

*yantras* (magic squares and other magic figures) also. The writer of the present article believes that for the authenticity and genuineness of a *yantra* found anywhere, the name of the ancient work and mention of the relevant Sanskrit text should be ensured. The *Jainendra Siddhānta Kośa* (ref. 23 at the end) contains a large number of *yantras* but neither the source nor the Sanskrit/Prakrit text is found there. Similar remark applies to the *Saundarya-laharī* which we consulted (ref. 66) and which is supplemented with a large number of *yantras*. Huge collections of *yantras* are also found in several modern works<sup>69</sup> but original Sanskrit lines for their ancient *uddhāra* (construction and description) are generally missing.

The author (RCG) of the present article has collected a number of mystical and magical diagrams with relevant Sanskrit verses from various sources. A sample list of these is given in Appendix For illustration, a few of typical *yantras* are described in this section. For a broader panorama, the selection below is made full of variety. Abbreviations used are as follows:

*MM* = *Mantra-Mahodadhi* (1588 AD) of Mahīdhara with Auto-commentary, Bombay, 1988

*PC* = *Puraścaryārṇava* (1775), edited by M. Jha, Delhi, 1985 (see ref. 16)

*YCD* = *Yantra-cintāmaṇi* of Dāmodara (17th Century), ed. by H-G Turstig, Stuttgart, 1988.

### (i) *Gaṇeśa yantras*

According to the Hindu tradition of ‘*Ādi pūjyo gaṇeśvaraḥ*’, the God Gaṇeśa is to be worshipped first in all religious work to avoid any hurdle (*vighna*) during the period. For this his Vighnarāja (‘controller-king of hurdles’) may be selected. The corresponding *yantra* is described in the *Merutantra* as follows (*PC*, p. 1140):

चतुर्द्वारयुतं कुर्याच्चतुरस्रत्रयं शुभम् /  
तन्मध्येऽष्ट दलं कार्यं पूजापीठं गणेशितुः //

(*caturdvārayutaṃ kuryāccaturasra-trayaṃ śubham /*  
*tanmadhye ṣṭa dalaṃ kāryaṃ pūjāpīṭhaṃ gaṇeśītuḥ //*)

“For worshipping Lord Gaṇeśa, make an auspicious triple square (i.e. *bhūpura*) with four gates and in its middle make a lotus of eight petals.”

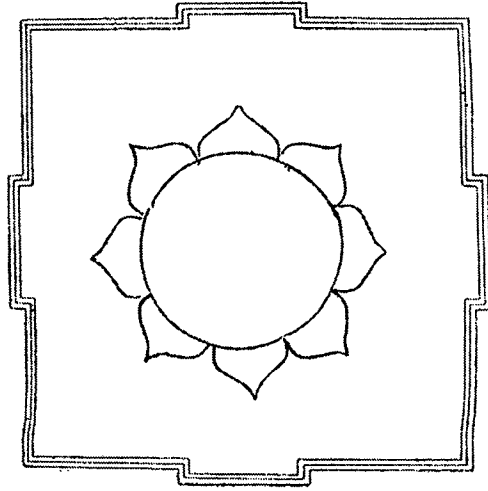


Fig. 17

The mystical diagram for the Śakti and Virañci forms of Gaṇeśa is said to be same. In the case of Mahāgaṇapati, the *karṇika* (pericarp) of the lotus contains a hexagram which itself has a triangle (PC, p. 1140), and with slight modifications, we get a few other forms.<sup>70</sup>

(ii) *Janana Yantra*

The total number of *mantras* is said to be seven crore (MM, p. 224). But they all have some *doṣa* (lacuna). The number of various type of *doṣas* is fifty. For pacification of ill effects caused by the *doṣas* and for curing them, ten *saṃskāras* are prescribed. The first of which is called *Janana*. The mystical diagram used for the purpose is called *Janana yantra* (Fig. 18). MM, XXIV. 98-100 (p. 224) describes its method of construction as follows:

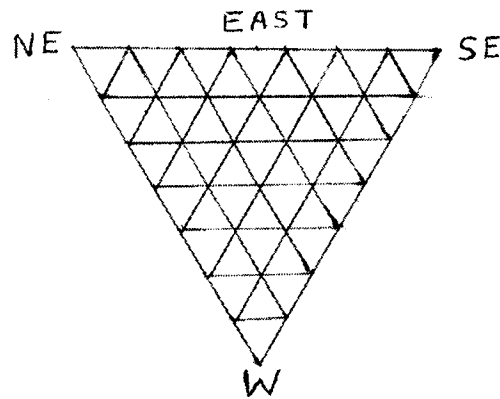


Fig. 18

*bhūrjapatre likhetsamyaktrikoṇam rocanādibhiḥ //98//*  
*vāruṇaṃ koṇamarabhya saptadhā vibhajetsamam /*

*evamiśāgni koṇābhyāṃ jāyaṃte tatrāyonayaḥ //99//*  
*navavedamitāstatra vilikhonmāṭṛkāṃ kramāt /*  
*akārādi hakārāṃtāmīśādi varuṇavadhi //100//*

“Make an equilateral triangle on birch paper with yellow ink etc. Starting with the west corner (taken downward) divide it sevenfold by equi-distant lines. Carry out similar division from NE and SE corners thereby generating 49 triangular cells (*yonis*) in which should be written the alphabet from *a* to *ha* serially from NE corner to the west corner.”

Thus the original equilateral triangle is divided into 49 small triangles by 18 equidistant lines (6 each parallel to the three sides). The cells are filled with 49 letters (16 vowels and 33 consonants) of the Sanskrit alphabet (not shown in Fig. 18). If we count the cells, we have (starting from W)

$$1+3+5+7+9+11+13 = 49$$

which leads easily and geometrically to

$$1+3+5+ \dots + (2n-1) = n^2$$

It may be mentioned that Sanskrit alphabet were scientifically devised separating vowels and consonants which were further classified scientifically according to place of pronunciation. In fact, India's linguistic sciences were quite advanced relatively.

### (iii) *A Māraṇa Yantra*

Astrology is a pseudo-science, but astrology of ancient times is significant for a study of history of astronomy. Similarly, association of magical properties with *yantras* may be superstitious and claims of their efficacy may be ridiculous. Yet here we are concerned with them only as ancient geometrical diagrams. A *māraṇa yantra* is mentioned in the *YCD* (p. 45) as follows:

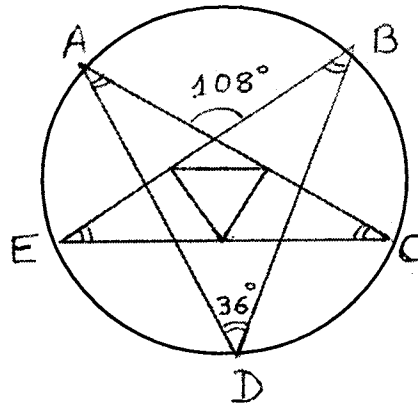


Fig. 19

साध्यनाम लिखेन् मध्ये स्तम्भस्तम्भेति सम्पुटम् //33//

तत्रस्त्रिकोणं सम्वेष्ट्य पञ्चकोणं तथोपरि /

(*sādhyānāma likhen madhye stambhastambheti sampuṭam //*

*tatastrikoṇaṃ samveṣṭya pañcakoṇaṃ tathopari /*)

“Write the intended name between the coupled word *stambasambha*, enclose it in a triangle and surround the whole by a pentagram.”

That is, we get a diagram of Fig. 19 in which the writing of the phrase is omitted. The usual figure of a pentagram is shown with an apex at the top (i.e. at highest point). It was the emblem of the Greek Pythagorean school. The figure may be drawn with the help of a regular pentagon ABCDE or by making angles on a line EC etc. Did the Indians know to divide a circle into five equal parts? What is the nature of the inscribed triangle?

#### (iv) *Bālā Pūjana Yantra*

This is described in *MM*, VIII.17 (p. 58) as

नवयोन्यात्मकं यत्रं वहिरष्टदलावृतम् /

भृगृहेणपुनर्वीतं पूजनाय लिखेत्सुधीः //17//

(*navayonyatmakam yantram vahirastadalavrtam /*

*bhugrheṇa-punarvītam pūjanāya likhetsudhīḥ //17//*)

“For worshipping the deity, the *Navayony ātmaka yantra* should be written and it should be surrounded by an eight-petalled lotus which should be enclosed further by *bhūpura*.”

Thus the mystical diagram consists of a *navakoṇātmaka yantra* (Fig. 16a) surrounded by the usual lotus and *bhūpura*.

The geometrical diagram of the *Bālādhāraṇa yantra* (*MM*, VIII. 74-76; p. 62) is same except that the outermost single *bhūpura* is to be replaced by two *bhūpurās* with different orientations.

As explained in the *MM* commentary (p. 62) the *bhūpura* pair here consists of two squares one of whose vertices (or corners) lie along cardinal directions and those of the other along the intermediary directions (Fig. 20a).



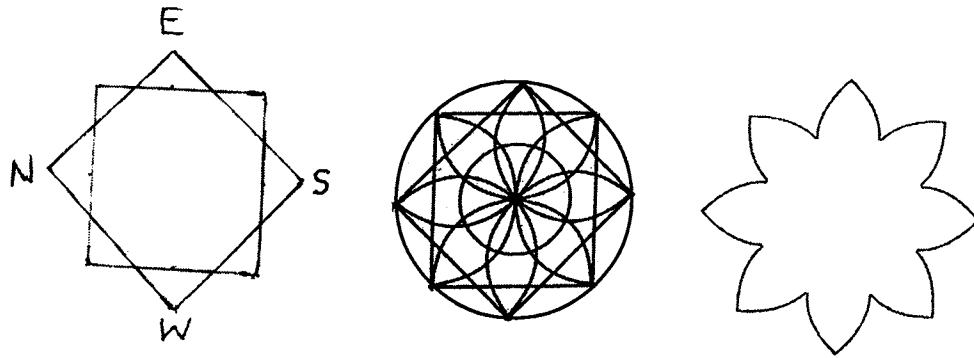


Fig. 20 a,b,c

Incidentally, if eight semicircles are described on the eight equal sides of the squares inwardly, we get a flowery design (Fig. 20b) and finally an eight-petalled *padma* with simply pointed petals by mathematical method (Fig. 20c) (after deleting superfluous portions).<sup>71</sup>

(v) *Other Yantras Based on Navakoṇaka Yantra*

The *Navakoṇātmaka* (=navakoṇaka) yantra was introduced above in section 5 as part of Śrīyantra. It consists of (see Fig. 16a) one central *tri-koṇa* (triangle) and eight surrounding outer triangles or outward angles (*koṇas*). It is also called *navayonyātmaka* (9-triangled) yantra, and may even be called a mini *śrīyantra*. Since this type of mystical diagram forms the main part in several other yantras, a simple construction was evolved for it. In a circle of desired size (Fig. 21), the equilateral triangle ABC with vertex upwards is inscribed. An isosceles triangle UMV is then constructed with apex.

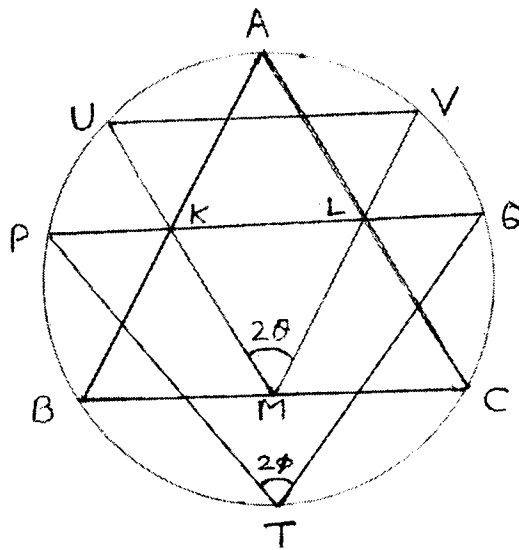


Fig. 21

M is at the midpoint of BC. These two triangles intersect at K and L also. The third inscribed triangle PQT is formed by producing KL both ways and joining the ends to the lowest point T of the circle.

Let  $r$  be the radius of the circle and  $2a$  the side of the triangle ABC. If  $2\theta$  and  $2\phi$  are the angles at the apexes M and T of the other triangles, the following mathematical relations can be easily found.

$$\begin{aligned} \text{Height of P above T} &= PT \cos\phi \\ &= (AT \cos\phi) \cdot \cos\phi = 2r \cos^2\phi \end{aligned}$$

$\therefore$  Altitude of the triangle KBM

$$\begin{aligned} h &= 2r \cos^2\phi - MT = 2r \cos^2\phi - (2r - \sqrt{3}a) \\ &= \sqrt{3}a - 2r \sin^2\phi. \end{aligned}$$

But from  $\Delta KBM$ , we also have

$$h \cot 60^\circ + h \cot (90^\circ - \theta) = BM = a$$

Putting above value of  $h$  in this and using  $r = 2a/\sqrt{3}$ , we finally get, on simplification,

$$(3 - 4 \sin^2\phi) (1 + \sqrt{3} \tan\theta) = 3$$

For the usual value  $2\theta = 60^\circ$ , we get  $2\phi = 76^\circ$ .

In addition to the *Bālā yantras* already mentioned, the mystical diagram of Fig. 21 is the central figure in the *Tripura Bhairavī* and *Dhanadā Devi yantras*.<sup>72</sup> The *PC* (pp. 1154-1155) quotes the Sanskrit verse for the *Tripura Bhairavī yantra* but interprets *navayonis* as 9 concentric triangles (see *PC* plate 12) instead of *navayonis* of Fig. 21. One form of *Durgā Pūjana yantra*<sup>73</sup> also is based on Fig. 21 (see below). For the Sanskrit text of *Dhanadā devi yantra*, see *PC*, p. 1215.

#### (vi) *Durgā Yantras*

Goddess Durgā is a popular deity. The construction of her *yantra* is described in the *Merutantra* as follows (*PC*, p. 1159):

अष्टपत्राम्बुजद्वन्द्वं चतुरस्रत्रयावृतम् /

चतुर्धरं समायुक्तं कुङ्कुमादिरुद्धरेत् //

(aṣṭapatrāmbuja-dvandaṃ caturasratrayāvṛtam /  
caturdvāra-samāyuktaṃ kuṅkumādibhiruddharet //

“Construct, with *kuṅkuma* (saffron) etc. a pair of 8-petalled lotuses surrounded by three squares each with four gates.”

That is, the *Durgā yantra* accordingly to the *Meru-tantra* consists of an usual double lotus (Fig. 1) enclosed in a triple *bhūpura*.

The *Durgā yantra* which is used in the *śatacaṇḍī* ceremony is usually called *Durgā-saptaśatī-mahāyantra*. It consists of a *śakti* equilateral triangle (apex downward) circumscribed by a hexagram (Fig. 2), and then enclosing the latter in 8-petalled lotus surrounded by a *bhūpura*.<sup>74</sup> But the Sanskrit text (*MM*, p. 167), *tattvapatrāvṛta-tryasra-ṣaṭkoṇāṣṭadalānvite*, asks us to draw a 24-petalled lotus also (before *bhūpura*).<sup>75</sup>

Another form of *Durgā yantra* consists of the *Navakoṇaka* diagram (Fig. 21) surrounded by a triplet of circles and then by the usual lotus and *bhūpura*.<sup>76</sup> A beautiful rendering or modification of Fig. 21 is found in *Durgā yantra* designed by Penny Lea Morris Serferovich (Fig. 22).<sup>77</sup> The complex has 9 lines and 18 points of intersection (including vertices). The importance of the basic diagram was increased by Michael Keith by making it an *aṅka yantra* also. He filled the 18 points of intersection by consecutive numbers 1 to 18 in such a way that the sum along each of the 9 lines comes magically the same namely 41 (the magical constant).

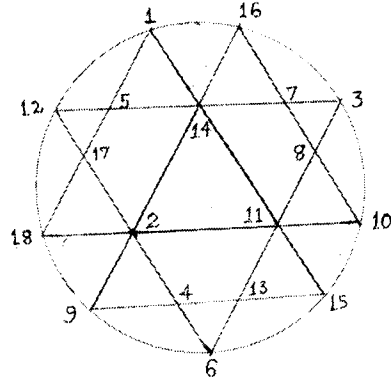


Fig. 22

#### (vii) Rudra Yantra

This is described in *MM*, XVI. 78-79 (p. 143) as follows:

अष्टपत्रषोडशारं चतुर्विंशति पत्रकम् //

दंतं पत्रंततः कुर्याच्चत्वारिंशद्दलंततः //

तद्वहिर्भूपुरं कुर्यात्त्रिरुद्रंप्रपूजयेत् //

(aṣṭapatraṃ-ṣoḍaśāraṃcaturviṃśati patrakam //  
 daṃṭapatraṃ tataḥ kuryyāccatvāriṃśad-dalaṃ tataḥ /  
 tadbahirbhūpuraṃ kuryattatra-rudraṃ prapūjayet //

“Make lotuses (successively) of 8, 16 and 24 petals, then of 32, and then of 40 petals. Outside them make the *bhūpura*. In that *yantra*, the God Rudra should be worshipped”

Thus we have the Rudra mystical diagram as shown in Fig. 23. The same is said to be found in the *Skanda Puraṇa*.<sup>78</sup> It may be noted that number of petals in the *yantra* form the arithmetical progression 8, 16, 24, 32, 40.

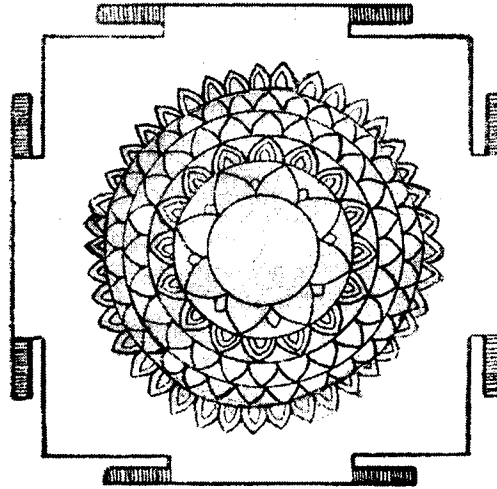


Fig. 23

There are *yantras* in which the number of petals in the successive lotuses form a geometrical progression. One such diagram is the *Vidyarājñī yantra* (*MM*, V. 32-33; p 39) in which we come across the set 8, 16, 32, and 64.

(viii) *Svayaṃvarakalā yantra*

This is a sort of *ākaraṣana yantra* (claimed to help in attaining the goal of marriage!). It is taken here to illustrate that often some what complicated mathematical figures are prescribed. *MM*, VI. 60-61 (p.47) describes the *yantra* as follows:

*trikoṇa-caturasrāṅga-koṇāṣṭadala-digdalam /*  
*dikkalā-dantapatrāṇi-catuṣṣaṣṭi-dalaṃ-punaḥ //*  
*vṛttatrayaṃ-caturdvāra-yuktaṃ-dharaṇi-ketanam /*

The above Sanskrit lines simply give a list of the mathematical objects which one has to construct to get the *yantra* for doing the *pūjā* for coersion. They are successively, triangle, square, hexagram (*āṅgaḥ* = *ṣaṭaḥ*); then lotuses of 8, 10 (*dik*), 10, 16 (*kalā*), 32 (*danta*), and 64 petals; then three circles, and finally the *bhūpura* (*dharaṇi-ketana*) with four gates.

Knowledge of elementary mensurational geometry is needed to draw the diagram. E.g. for making square inscribed in the hexagram (Fig. 2), one has to draw a square in the hexagon space inside it (Fig. 24). If  $2a$  and  $2b$  are the sides of the hexagon and square in Fig. 24, it be shown that  $b = (3-\sqrt{3})a$ . By considering angles, a square can be circumscribed by hexagon.

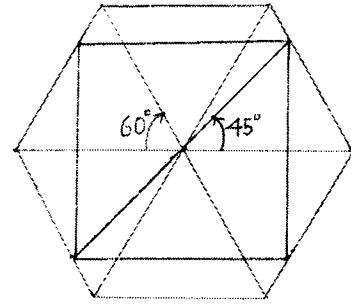


Fig. 24

**(ix) Bhauma Yantra**

The *aṅka-yantras* (magic squares) associated with the nine ancient astrological planets have been already mentioned in Section 2 above (see Fig. 4). Similarly, there is a mystical diagram for each of the *navagrahas*. Some details on the subject have been already published by the present writer (see ref. no. 17 at the end). The mystical diagram of planet Mars is peculiar and is called *Maṅgala* or *Bhauma yantra*. It is briefly described here for illustration.

The planet Mars has been associated with triangle and this played role in the evolution of its *yantra* (Fig. 25).<sup>79</sup> The *MM*, XV. 51 (p. 133) knows that it consists of 21 triangular cells.

The full details of the construction of the Mars *yantra* are described in the *Merutaṅtra* whose verses are quoted in *PC*, p. 1158. The Sanskrit text and its translation

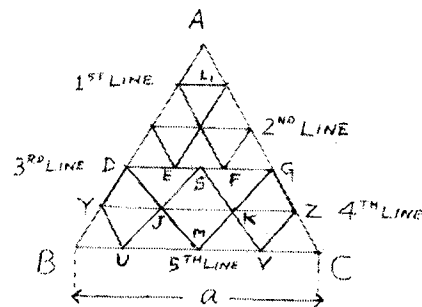


Fig. 25

can be found in present author's paper mentioned above. Here we give a new translation as follows:<sup>80</sup>

“First construct an equilateral triangle (ABC) and then divide it into five parts (by equidistant lines parallel to the base). Mark the third line (DG) by points (E and F) of three equal division. Join (crossly) the ends of the first line to these points (E and F) of the third line. Join directly the ends of the second line to the same points. The already connected third line be bisected (at S), and the fourth and fifth lines be divided by two (J and K) and three (U, M, V) points. Join the ends (D and G) of the third line to the midpoint (M) of the fifth line, and the ends (Y and Z) of the fourth to its other points (U and V). The wiseman should supply the pair of lines (SU and SV) for forming figure of two fishes (joined back to back at SM). Thus we get twenty one cells.”

In this way the Mars *yantra* (Fig. 25) is obtained. Some involved crucial mathematics related to the construction is already published.<sup>81</sup> If DM and SU intersect on YZ at J, the BU will be  $a/5$  and YJ will be  $a/4$ , where  $BC=a$ .

#### (x) *Sarvatobhadra Yantra*

The Sarvatobhadra mystical diagrams (*cakras, yantras, maṇḍalas*) are symmetrical from all the four sides. They are indeed architecturally beautiful and considered auspicious. For constructing them, a big square is subdivided into a large number of small square cells like the chess board or ordinary graph paper often with cross lines (Fig. 9).

A few Sanskrit texts for making the *Sarvatobhadra yantras* are quoted in the *Vacaspatyam*.<sup>82</sup> The text for the elaborate diagram of Fig. 26 is given from *Hemadri (Skānde)* as follows:

*prāgudīcyāṅgatā rekhāḥ kuryā  
dekona-viṃśatim /*

*khaṇḍendustripāda koṇe, śṛṅkhalā  
pañcabbiḥpadaiḥ //1//*

*ekādasapadā vallī bhadrantu navabbiḥ padaiḥ /*

*Caturviṃśatpadā vāpī paridhir-viṃśatyā padaiḥ //2//*

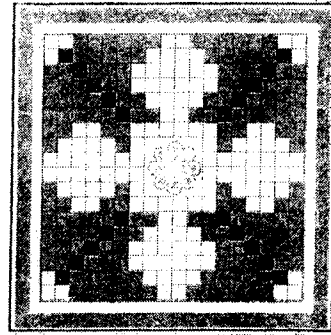


Fig. 26

*madhye ṣoḍaśabhiḥ koṣṭhaiḥ padmamaṣṭadalaṃ /*  
*śvetenduḥ śṛṅkhalā-kṛṣṇāṃ vallīṃ nīlena pūrayet //3//*  
*bhadrāruṇā sitāvāpī paridhiḥ pītavarṇakaḥ /*  
*bāhyantara-dalaiḥ svetaḥ karṇika pītavarṇika //4//*

The last three lines mention the colours of the various regions of the *yantra*. Based on the above text, its construction can be concisely explained as follows:

Draw 19 equidistant lines from east to west and from north to south (These will form a square network of 18×18 or 324 small square cells). In the space of central (*madhya*) 16 cells, a *padma* (pink lotus) of 8 petals be made with yellow *karṇikā* (pericarp). Around it a square yellow belt (called *paridhi* or periphery) of 20 cells is made. Just outside this belt and on each of its 4 cardinal sides, a *vāpī* (like a square *kuṇḍa* with steps) of 24 white cells be constructed.

Starting from each corner of the *paridhi*, a chain (*śṛṅkhalā*) of 5 black cells is laid down along outward diagonal direction. At the end of each chain, angled tromino (*khaṇḍendu*) of 3 white cells is placed. Closely juxtaposed on each side of every *śṛṅkhalā* (chain), is a *vallī* (stepped creeper) constructed from 11 blue cells. (So far 252 cells out of 324 have been filled). The remaining eight spaces (two on each side) are called *bhadrās* (pyramid type nonaminos). On each side, the two *bhadrās* are between *vāpī* and its adjacent *vallīs*. *Bhadrās* are red (*aruṇa*), and each has 9 cells. The space between lotus and *paridhi* is white. Finally the whole figure of 324 cells is to be surrounded by three square belts of white, red, and black colours (these three squares may be said to form *bhupura*).

#### APPENDIX I: Yantra ŚATAKA

(List of 100 *yantras* or mystic geometrical diagrams)

Abbreviations used are: *MM*= *Mantra-Mahodadhi* (ref. 32); *PC*= *Puraś-caryarṇava* (ref. 16); *YCD* = *Yantra-Cintāmaṇi* of Dāmodara (ref. 18); Mishra (ref. 69); Varni (ref. 23); etc. (see References at the end).

1. *Agni Pūjana Yantra* (*MM*, I. 113, p. 7).
2. *Agni Stambhana yantra* (*YCD*, No. 35, p. 37).

3. *Annapūrṇā yantra* (PC, p. 1157) (from *Merutantra*).  
Cf. *Annapurṇeśvarī yantra* (MM, IX. 9, p. 68)
4. *Bagalāmukhī Pūjana yantra* (MM, X. 7, p. 78; PC, p. 1156).
5. *Bagalāmukhī Stambhana yantra* (MM, X. 25-26, p. 79).
6. *Bālā Pūjana yantra* (MM, VIII. 7, p. 58). Also see section 6 above.
7. *Bālā Dhāraṇa yantra* (MM, VIII. 74-76, p. 62); Section 6 of this paper.
8. *Bandhamokṣa-karam yantra* (MM, XX. 118-119, p. 188).
9. *Bhauma yantra* (from *Merutantra*) (PC, p. 1158); Sec. 6 of this paper.
10. *Bhavānī yantra* (PC, p. 1146).
11. *Bhūtalipi yantra* (PC, p. 1148) (from *Śāradātilaka-ṭīka*).
12. *Bhuvaneśvarī yantra* (PC, p. 1154) (from *Śāradā-tilaka*).
13. *Brahma yantra* (PC, p. 1158).
14. *Brāhmī yantra* (*Ibid*).
15. (Lord) *Buddha yantra* (PC, p. 1145).
16. (Planet) *Budha yantra* (PC, p. 1158).
17. *Caitanya Bhairavī yantra* (from *Jñānārṇava*) (PC, p. 1155).
18. *Cāmuṇḍā-Mahālakṣmī yantra* (PC, p. 1158).
19. *Cāmuṇḍā (Navadurgātmaka) yantra* (PC, p. 1158).
20. *Candra (Moon) yantra* (PC, p. 1158).
21. *Chinnamastā pūjana yantra* (MM, VI. 12, p. 45).
22. *Chinnamastā yantra* from *Rudra-Yāmala* (PC, p. 1155).
23. *Dakṣiṇa-murti yantra* (from *Merutantra*) (PC, p. 1145).
24. *Dattatreya yantra* (see *Kalyāṇa* Vol. 42, 1968 i.e. ref. 39; plate facing p. 544).
25. *Devamaṭṛka yantra* (YCD, No. 30, p. 34).
26. *Dhanadā Devi yantra* (PC, p. 1215; Mishra, p. 193).
27. *Dhūmāvātī yantra* (PC, p. 1156).
28. *Dūramāraṇam yantra* (YCD, No. 47, p. 44).
29. *Durga yantra* (I) (PC, p. 1159). See Sec. 6 of the paper.
30. *Durgā yantra* (II). This is called *Caṇḍī yantra* (MM, p. 167 and its figure no. 49). Also cf. Sec. 6 and Mishra, p. 79.



31. *Gaṇeśa yantras* (PC, p. 1140 and Sec. 6 of present paper).
32. *Garuḍa yantra* (PC, p. 1146 and Mishra, pp. 61-63):
33. *Gāyatrī yantra* (see A. Avalan, *Isopaniṣad*, Madras, 1952).
34. *Guhyakālī yantra* (I) (PC, pp. 1149-1150) (from Mahakalasanghita).
35. *Guhyakālī yantra* (II) (Mishra, pp. 125-126).
36. *Hanumat Pūjana yantra* (PC, p. 1147).
37. *Hanumat Dhāraṇa yantra* (MM, XIII. 46-53, p. 116).
38. *Hayagrīva yantra* (PC, p. 1145).
39. *Indra yantra* (PC, p. 1158).
40. *Janana yantra* (MM, XXIV. 98-101, p. 224). see Sec 6.
41. *Jayadam yantra* (MM, XX. 53-57, p. 184).
42. *Jvaraharaṇa yantra* (YCD, No. 60, p. 50; MM, p. 188).
43. *Kālarātri Dīpasthāpana yantra* (MM, XVIII. 39, p. 158).
44. *Kālarātri Pūjana yantra* (MM, XVIII. 13-14, p. 157).
45. *Kālī yantras* (from *Kālītantra* etc) (PC, pp. 1148-1149 mentioning other works also; MM, III. 11, p. 23).
46. *Kalki yantra* (PC, p. 1145).
47. *Kāmakālā yantra* (from *Mahākālā saṃhitā*) (PC, p. 1150).
48. *Kāmya yantras* (from *Merutantra*) (PC, pp. 1146-1147).
49. *Kārtavīrya Dīpasthāpana yantra* (MM, XVII. 64-81, pp. 153-154).
50. *Kārtavīrya Pūjāyantra* (MM, XVII. 21-22, p. 150) (= *Arjuna yantra*).
51. *Kaumārī yantram* (PC, p. 1158).
52. *Krodha-śamana yantra* (YCD, No. 18, p. 27).
53. *Kṛṣṇa yantra* (I) (PC, p. 1145, and Mishra, p. 66).
54. *Kṛṣṇa yantra* (II) (from *Gautamiyantra*) (Mishra, pp. 65-66).
55. *Kubera yantra* (PC, p. 1158).
56. *Kubjikā yantra* (PC, p. 1157).
57. *Kūrma yantra* (PC, p. 1141, and p. 476 for *cakra*).
58. *Laghuśyamā yantra* (MM. VIII. 121, p. 66).
59. *Lakṣmī yantras* (PC, p. 1157, and Mishra, p. 189).

60. *Lalitā yantra* (MM, XX. 74-79, p. 185).
61. *Mahāgaṇapati yantra* (from *Merutantra*) (PC, p. 1140).
62. *Mahāmohana yantra* (YCD, No. 1, p. 20).
63. *Mālā yantra* (?) (PC, p. 1158).
64. *Māraṇa yantras* (YCD, No. 49, p. 45; MM, XX. 97-98, p. 187). Also see Sec. 6 of present paper.
65. *Mātāṅgī yantra* (MM, VII. 72, p. 55; PC, pp. 1156-1157).
66. *Mātṛkā yantra* (from *Saradatilaka*) (PC, p. 1148).
67. *Matsya yantra* (PC, p. 1141).
68. *Mṛtyuñjaya yantra* (MM, XX. 38-39, p. 183; YCD, No. 6, p. 22).
69. *Ṇamokāra yantra* (Varni, p. 353, see Fig. 3 in Sec. 2).
70. *Navakoṇātmaka yantra* (see Sec. 6 of this paper).
71. *Nigada mocana yantra* (YCD, No. 78, pp. 57-58).
72. *Nṛsiṃha yantra* (PC, p. 1141; MM, XIV. 7-8, p. 121).
73. *Paraśurāma yantra* (PC, p. 1142).
74. *Pavitrayajana yantra* (MM. XXIII. 51-54, pp. 214-215).
75. *Rāma Pūjana yantra* (PC, p. 1142).
76. *Rāma Dhāraṇa yantra* (PC, pp. 1142-1144).
77. *Rudra yantra* (MM, XVI. 78-79, p. 143). See Sec. 6 in paper.
78. *Śānti yantras* (MM, XX. 105-111, p. 187; Varni, pp. 361-363).
79. *Śarabha yantra* (PC, plate 14 at the end).
80. *Sarasvatī yantra* (PC, p. 1157; cf. Mishra, p. 161).
81. *Sarvatobhadra yantra* (See Section 6 of present paper).
82. *Ṣaṅkūṭā Bhairavī yantra* (PC, p. 1155).
83. *Siddhilakṣmī yantra* (PC, p. 1151).
84. *Śītalā yantram* (PC, p. 1139 and plate 10).
85. *Śīva yantras* (PC, p. 1145) (from *Prapancaśāra* etc.).
86. *Smara* (cupid) *yantra* (PC, p. 1147).
87. *Śmaśānakālī yantra* (PC, p. 1150; Mishra, p. 122).
88. *Śrīyantra* (see Section 5 of the present paper).

89. *Sumukhī Pūjāyantra* (MM, III. 56, p. 26).
90. *Sūrya yantras* (PC, pp. 1140-1141; MM, X. 28, p. 131).
91. *Svapnavārāhī Pūjā yantra* (MM, X. 41, p. 80; PC, p. 1158).
92. *Svayaṃvarakalā yantra* (MM, VI. 60-61, p. 47; Sec. 6 above).
93. *Tārā yantra* (PC, p. 1151; MM, IV. 87, p. 34).
94. *Tripura Bhairavī yantra* (PC, pp. 1154-1155; Mishra, p. 100).
95. *Vāmana yantra* (PC, p. 1141).
96. *Varāha yantra* (from *Prapañcasāra*) (PC, p. 1141).
97. *Vardhamāna yantra* (Varni, p. 359).
98. *Vārtālī Pūjana yantra* (MM, X. 76-78, pp. 82-83).
99. *Vidyārājñī yantra* (MM, V. 32-34, p. 39).
100. *Viṣṇu yantra* (PC, p. 1141).

#### APPENDIX II: SELECT GLOSSARY

For details of references, see at the end e.g. *MM* (= *Mantra-Mahodadhi*) in ref. no. 32.

*Adhara* (lip): number 2 (used in *Kālacakra-tantrarāja*).<sup>83</sup>

*Aditya* (sun): number 1 and 12 (see *Ekādisaṃkhyakośa*, Jodhpur, 1964).

*Agni*: A Hindu god; vedic *citi* (altar); number 3; a metaphysical element – *bhūta* q.v.; consonant r.

*Agni-bīja*: *raṃ* (MM, p. 2 gives *vahni-bījam* = *raṃ*)

*Agni-priyā*: *svāhā*

*Agni-trikoṇa*: a triangle with apex upwards.

*Akaśa*: number 0; consonant *h*; a *bhūta* q.v.

*Antya*: *kṣa* (last consonant in *tantras*, see *MM*, p. 63, 2391).

*Anugraha*: vowel *au*.

*Ara, āra*: corner, angle, spoke, petal.

*Aṣadhī*: consonant *t*.

*Aṣṭa-dala* (or *patra*): 8-petalled lotus.

*Bālah*: *vaḥ*

*Bhaga*: vowel *e* (MM, pp. 31, 45, 237).

*Bhṛgu*: consonant *s*.

*Bhū* (earth): number 1; a gross element (*bhūta*); *la*.

*Bhūpura*: a decorated square with 4 gates (see Fig. 10).

*Bhūta*: a gross or meta physical element, see *Pañca-mahābhūta* for 5 such elements.

*Bija* (seed): mystic root syllable (of a *mantra* etc.)

*Cakra*: astrological diagram; mystic diagram (*yantra*); a mystical nerve plexus, wheel weapon of Viṣṇu.

*Candra* (moon): number 1: vowel *aṃ* or *anusvāra bindu*; consonant *s* (*MM*, p. 239).

*Candra-bijam*: *ṭhaṃ*.<sup>84</sup>

*Damodara*: vowel *ai* (*MM*, pp. 58, 237).

*Daṇḍi*: consonant *th* (*MM* pp. 53 and 238).

*Daśa-mahā-vidyās*: ten *tāntrika* goddesses.<sup>85</sup>

*Dhruvam*: the syllable *om* (*MM*, pp. 38 and 237).

*Dik* (direction-cardinal): number 8 (*MM*, p. 121) or 10 (usually).

*Gadi*: consonant *kh* (*MM*, pp. 35 and 237).

*Gagana*: synonym of *ākāśa* q.v.

*Gajapūrva*: number 7 (used in *Śrutabodha*, see ref. 2, p. 643).

*Gaṇanayaka* (Gaṇeśa): letter *ga* or *bīja gaṃ*.

*Govinda*: vowel *i* (*MM*, pp. 27 and 237).

*Gupta*: number 7 (used in *Mānasāra*).<sup>86</sup>

*Hali*: consonant *c* (1st in *cavarga*).

*Haṅsa*: consonant *s* (*MM*, pp. 5, 33, and 239).

*Harabija*: mercury (chemical element).

*Hariḥ*: *tah* (*MM*, pp. 27, 52, and 238).

*Indra*: letter *la* (*MM*, pp. 42 and 239).

*Indu*: synonym of *candra* q.v.

*Jala*: letter *va*; a gross element (see *Pañca-mahābhūta*).

*Jhintiśa*: vowel *e* (*MM*, pp. 17 and 237).

*Kaḥ*: Brahmā of the Hindu Trinity.

*Kala* (time): number 3 (see Ref. no. 83, Appendix I).

*Kālībija*: *kriṃ* (MM, p. 25 and ref. 85, p. 40).

*Kamikā*: letter *ta* (MM, pp. 14, 37 and 238).

*Karṇa* (ear): diagonal; hypotenuse; vowel *u* or *ū* (*u* is right ear and *ū* is left ear, MM, p. 237).

*Kesari* (lion): number 24 (used by *Pūjyapada*).<sup>87</sup>

*Kesava*: vowel *a* (MM, pp. 50 and 237)

*Kham*: synonym of *ākāśa* q.v.

*Koṇa*: corner; angle; planet Saturn number 4 (used in *Mohacūdottara*, see Ref. 3, p. 2080).

*Kriyā*: letter *la* (MM, pp. 23 and 239).

*Krodhabija* : *huṃ* (MM, p. 32).

*Kṣiti* (earth): synonym of *bhū* q.v.; letter *la*.

*Kūṭabija*: the phoneme *kṣa* (ref. 85, p. 46).

*Lakṣmībija*: *śrīṃ*

*Laṃgalī*: letter *tha* (MM, p. 238; ref. 16, p. 1148).

*Lotus*: Its botanical name is *Nelumbo nucifera*, Gaertn, and the red, pink, blue, and white flowers are called *kamala*, *padma*, *utpala*, *puṇḍarīka*.

*Madana* (cupid): number 13 (ref. 83, Appendix I).

*Mahābhūta* (gross elements): see *Pañca-mahā bhūta*.

*Mahāśūnya* (great vacuity): a mental condition of *yogin*.

*Maṇḍala*: mystical or symbolic diagram.

*Manu*: *mantra*; number 14; etc. (see Sec. 4 of the paper).

*Mātrkā*: alphabet; *varṇas a* to *kṣa* (MM, p. 5).

*Māyābija*: *hrīṃ* (Ibid.).

*Mṛtyuḥ* (death): letter *śaḥ* (MM, pp. 31 and 239).

*Nabha*: synonym of *ākāśa* q.v.

*Nāḍitrayam*: *iḍā*, *piṅgalā*, and *suśumnā*.

*Nandaja*: letter *ṭha* (MM, pp. 26 and 238).

*Netra* (eye): number 2; vowel *i* (right eye) or *ī* (left eye).

*Pañca-mahābhūta*: 5 gross or metaphysical elements viz. *bhū* (earth), *jala* (water), *agni* (fire), *vāyu* (air), *ākāśa* (sky or ether).

*Pañca-makāra*: *madhya*, *māṃsa*, *mīna*, *mūdrā* and *maithuna*.

*Pavana*: synonym of *vāyu* q.v.

*Pradakṣiṇā*: going round (clock wise) a deity etc.

*Pṛthivi* or *Pṛthvī*: synonym of *bhū* q.v.; letter *la*.

*Sahasrāra*: 1000-petalled lotus supposed to exist in the head.

*Śaktibija*: *hriṃ* (*MM*, p. 3)

*Śakti-trikoṇa*: triangle with apex downwards (ref. 16, p. 1149).

*Śanti* (peace): vowel *i* (*MM*, p. 25, 27, 37 and 237).

*Saptamatṛika*: 7 universal mothers, see ref. 69, p. 30 for names.

*Ṣatkoṇa* (six-angled): hexagram (see Fig. 2).

*Śiva-trikoṇa*: triangle with apex upwards.

*Surpatlocana*: number 1000 (from Indra's eyes).<sup>88</sup>

*Taraḥ*: the sacred syllable *om* (*MM*, pp. 5 and 237)

*Tattva* (element): number 5 (cf. *bhūta*), or 24 (in *Mahābhārata* of *MM*, p. 167), or 25 (usual in *sāṃkhya*).

*Ṭha*: number 0 (according to *Ekākṣaranāma-koṣa*).

*Ṭhadvayam*: *svāhā* (*MM*, pp. 9 and 32).

*Trika*: trinity of *Brahmā*, *Viṣṇu*, and *Maheśa*; or of Śiva, Śakti, and Nara; etc.

*Tri-pancāra yantra*: a special mystic diagram (ref. 69, p. 126).

*Trirekhāpuṭam*: triangle (see *Rāmapurvataṭpini Upanisad*); (on page 237 of *MM*, *trikoṇaka* means e !)

*Vahni*: synonym of *agni* q.v.

*Varāha* (boar): letter *ha* (*MM*, pp. 23 and 239).

*Vasu*: letter *ra* (*MM*, p. 69).

*Vāyu* (air): letter *ya* (*MM*, p. 239); a *bhūta* q.v.

*Vedadi* (origin of *Veda*): sacred syllable *om* (*MM*, p. 237).

*Viyat*: synonym of *ākāśa* q.v.

*Yantra-gayatrī*: *Gāyatrī mantra* for *yantras*.<sup>89</sup>

*Yoni-trikoṇa*: same as *śakti-trikoṇa* q.v.; triangle.

*Yoni-yugma*: same as *ṣatkoṇa* q.v. (ref. 85, p. 105).<sup>90</sup>

## NOTES AND REFERENCES

1. V.S. Apte, *The Student's Sanskrit-English Dictionary*, Reprinted, Delhi, 1965; p. 454.
2. M. Monier-Williams, *A Sanskrit-English Dictionary*, Reprinted, Delhi, 1972; p. 845.
3. Taranatha Bhattacharya, *Vācaspatyam* (1884), Reprinted in six volumes, Varanasi, 1990; Vol. VI, p. 4771.
4. M. Sripathi Sastri (compiler), *Sanskrit Dhātusāgara Taraṇiḥ*, Madras, 1968; pp. 113-114.
5. Apte, *op. cit.* (see reference no. 1 above), p. 454; Ishvarchandra Vidyasagar's *Subodha Sanskrit Vyākaraṇa Kaumudī*, edited by Ram Sundar Sharma, Ranchi, 1964; p. 251. *Yantra* word comes from *yam* via 'tran' *pratyaya*.
6. S.K. Ramachandra Rao, *The Yantras*. Sri Garib Dass Oriental Series No. 48, Delhi, 1988; p. 10.
7. Ph.D. Thesis, Lucknow University, 1990.
8. For details of all these *yantras*, see Ohashi's Thesis (ref. 7 above), pp. 157 and 344 etc.
9. *Ibid*, p. 344.
10. *Ibid*, pp. 366-367.
11. *Ibid.*, pp. 370-371. Also see Bapudeva Shastri's *Mānamandira Observatory of Kāśī* edited and translated by S.D. Sharma, Kurali, 1982; p. xiv.
12. For details of these *yantras*, see Satya Prakash, *Prācīna Bhārata me Rasāyana kā Vikāsa* (in Hindu), Lucknow, 1960, pp. 500-518.
13. Rao, *op. cit.* (ref. 6 above), pp. 10-11.
14. References to the use of many mechanical *yantras* are found in ancient classical works such as *Mahābhārata* (see *Sabhāparva*, 5.10, and *Śāntiparva*, 58.65).
15. R.P. Anuruddha, *An Introduction into Lamaism*, V.V.R.I., Hoshiarpur, 1975; p. 142.
16. See *Puraścaryārṇava* (of Pratapa Simha Sahadeva, fl. 1775AD) ed. by Murlidhara Jha, Chowkhamba Pratisthan, Delhi, 1985; p. 1158.
17. For details of *yantras* of Sun, Moon, and other ancient planets, see R.C. Gupta, "Mystical Mathematics of Ancient Planets", *IJHS*, 40.1 (2005) 31-53.
18. For example see the *Yantracintāmaṇiḥ* of Damodara edited by Hans-Georg Turstig, Franz Steiner, Stuttgart, 1988; *Yantra* No.s 4 and 23.
19. *Webster's Seventh New Collegiate Dictionary*, Indian edition, Calcutta, 1971; p. 831.
20. Rao, ref. 6 above, p. 46.
21. Anuruddha, ref. 15, pp. 103-105.

22. *Ibid.*, p. 108.
23. Jinendra Varni, *Jainendra Siddhānta Kośa*, Part III, Delhi 1997; p. 353.
24. *Bṛhaddaivañja-rañjanam* of Rāmadīna (1897AD) published from Venkatesvara Press, Bombay, 1987; pp. 96-97.
25. But the quoted verses are not found in the above mentioned (ref. 18) *Yantra-cintāmaṇi*.
26. See R.C. Gupta, "Early Pandiagonal Magic squares in India," *Bulletin of Kerala Mathematics Association*, 2.2 (2005). 25-44 for full details.
27. T. Hayashi, "Varahamihira's Pandiagonal Magic Square of Order Four", *Historia Mathematica*, 14 (1987) 159-166.
28. S. Cammann, "Islamic and Indian Magic Squares, Part II", *History of Religion*, 8 (1969) 271-299; p. 272.
29. See the *Nārada-purāṇa* ed. by Shriram Sharma, Bareilly, 1971; Part II, p. 318. In the second verse of the chapter, the *Jyotiṣa* science is said to contain 4 lakh verses.
30. See *Jyotiṣa-śabdakāśah* by Mukund Sharma, Amola (Garhwal), 1967; p. 112 where the quoted *mantra* is given.
31. *Gaṇita-Kaumudī* ed. by Padmakar Dvivedi, Part II, Benares, 1942, p. 353.
32. *Mantra Mahodadhi* with commentary, Venkatesvara Press, Bombay, 1988; p. 180.
33. For details, see the recent paper of R.C. Gupta mentioned above (ref. 26), pp. 27-32.
34. See *Puraścaryārṇava* (ref. 16), p. 524.
35. R.C. Gupta, "Agni-Kuṇḍas — A neglected area of study in the history of ancient Indian mathematics, *IJHS*, 38.1 (2003) 1-15; p. 6.
36. See *Puraścaryārṇava* (ref. 16), p. 525.
37. According to Rao (ref. 6), p. 31.
38. See the *Sūryasiddhānta* (with commentary of Raṅganātha) ed. by B.P. Mishra, Bombay, 1956, pp. 300-301.
39. See the *Kalyāṇa* (Hindi Monthly), vol. 42, No. 1 (Upāsana-Number), 1968, p. 355.
40. For details of the various Indian systems, see e.g. B. Datta and A.N. Singh, *History of Hindu Mathematics*, Single Vol. edition, Bombay, 1962; Part I, pp. 53-85.
41. *Mantra Mahodadhi* (ref. 32 above), p. 82. Here *rudra*=11.
42. See Apte's *Dictionary* (ref. 1), p. 1 where *a* is said to denote *Viṣṇu* and *u* stands for *Maheśvara*.
43. See the *Mātrkā Nighaṇṭu* (*Kośa*) at the end of *Mantra Mahodadhi* (ref. 32), pp. 237-239.



44. *Ibdi.*, p. 27 (of ref. 32).
45. *Ibid.*, p. 42.
46. *Puraścaryārṇava* (ref. 16), p. 1149.
47. See *Jinendra Siddhānta Kośa* (ref. 23), p. 365.
48. See *Gaṇita-Kaumudī* (ref. 31), p. 397. For construction details and arrangement of numbers see *Gaṇita Bhāratī*, vol. 24 (2002) 86-88.
49. See Rao (ref. 6 above), p. 14.
50. N.J. Bolton and D.N.G. Macleod, "The Geometry of the Śrīyantra", *Religion*, vol. VII (1) (1977) 65-85; pp. 68-69. Also Vaishampayam, "Sri-Chakra", *Dilip*, Vol. I, No. 5 (1974) 6-7.
51. P. Ramakrishnan, *Indian Mathematics Related to Architecture*, Ph.D. Thesis, Cochin University of Science and Technology, 1998; pp. 120-123.
52. For other details see R.C. Gupta, "A Little Known Text and Version of Śrīyantra", *Gaṇita-Bhāratī*, 25 (2003) 22-28.
53. See Bolton and Macleod (ref. 50 above), p. 68.
54. *Ibid.*, pp. 76-76 contain the details.
55. *Kalyāṇa* Special Issue on Śakti Upāsana, Gorakhpur, 1987, pp. 255-256.
56. See *Puraścaryārṇava* (ref. 16), p. 1152; *Vācaspatyam* (ref. 3), vol. VI, p. 5154; also the next reference.
57. See *Kalyāṇa Śakti Upāsana* Issue (ref. no. 55 above), p. 255.
58. See Rao (ref. 6 above) p. 53 for a Sanskrit verse and the figure of the complex.
59. *Mantra-mahodadhi*, XI. 53b-54a (ref. 32, p. 93).
60. A.P. Kulaichev, "Śrīyantra and Its Mathematical Properties", *IJHS* 19.3 (1984) 279-292.
61. Bolton and Macleod (ref. 50 above), pp. 71-79.
62. *Ibid.*, p. 74, and R.C. Gupta, "Ancient Egyptian Pyramids, Pyramidology and Pi", *Gaṇita-Bhāratī*, 27 (2005) 1-14.
63. Anuruddha (ref. 15 above), p. 108.
64. *Puraścaryārṇava* (ref. 16), p. 525.
65. See Kulaichev (ref. 60 above), p. 279.
66. See *Saundarya-laharī* ed. by V.K. Subramaniam, Delhi, 1990; pp. 6-7. It may be pointed out that a commentator of the above work attributes it to Prabarasena, see *Tāntrika Sāhitya* (in Hindi) by Gopinath Kaviraj, Lucknow, 1972, p. 712.
67. See *IJHS*, 33 (1998) 227.
68. Same journal, Vol. 24 (1989) 137-149.

69. A recent good book is the *Camatkārī Fifty-five Pūjā Yantra* (in Hindi) by Kulapati Mishra, Randhir Prakashan, Hardwar, 2004.
70. See above book, pp. 35-38, and *PC*, p. 1140. However, the Jaina *Vināyaka yantra* is different (ref. 23, p. 360).
71. See Mitali Dev (editor), *Kuṇḍaratnāvalī of Rāmacandra-dīkṣita* (1868), Varanasi, 2003, p. 116.
72. See K. Mishra, *op. cit.* above (ref. 69), pp. 100 and 193. There is an error in drawing the top line of the third triangle on p. 100 (line PQ is not drawn along KL).
73. *Ibid.*, p. 79.
74. *Ibid.*, p. 76; *Kalyāna — Śakti Upāsana* Issue (ref. 55 above), plate facing p. 38.
75. *MM* commentary (p. 167) takes 'tattva' equal to 24. Also cf. (*Upāsana-Number* (ref. 39), p. 405).
76. See K. Mishra's book (ref. 69), pp. 79-81. He calls Fig. 21 as *nava-koṇa cakra* but does not quote any text.
77. C.A. Pickover, *The Zen of Magic Squares, Circles, and Stars*, Universities Press, Hyderabad, 2002, pp. 339-340. Also see plate xvii in the *Album of Yantras* (in Hindi) by R. Mishra, Delhi, *s.a.*
78. See the *Grahaśānti Prayogaḥ* edited with Daulata Ram Gaud's commentary, Varanasi, 2001, p. 155 where *bhūpura* is shown as triple-lined and some other variants of *Rudra yantra* are mentioned.
79. For details see R.C. Gupta's paper (ref. 17 above) especially pp. 36-38 and 45-48.
80. The new translation has been suggested by Dr. Takao Hayashi in a personal letter.
81. See R.C. Gupta (ref. 17), pp. 46-48.
82. *Vācaspatyam* (see ref. 3 above), vol. VI, pp. 5258-5259.
83. See *Śrī Kālacakratantra-rāja* ed. by Biswanath Banerjee, Asiatic Society, Kolkata, 1985, Appendix I.
84. See *Vācaspatyam* (ref. 3 above), vol. VI, p. 4686.
85. *A Glossary of Tantra, Mantra, and Yantra*, Delhi, 1995, p. 22; K. Mishra, ref. 69, pp. 28-29.
86. LXI. 32-33, see P.K. Acharya, *Hindu Architecture*, p. 279.
87. See Ganitanand (=R.C. Gupta), Hindu Gods on the Gateway fo a Mosque and Some World-Numerals", *Gaṇita-Bhāratī*, 23 (2001), 120-121, for details and more such nos.
88. *Ibid.* The expression *surpatlocana* (God Indra's eye) is found in a mosque inscription of 1587 AD.
89. Rao (ref. 6, p. 30) gives it as follows: *Yantra-rājāya vidmahe; mahāyantraya dhī mahi; tanno yantraḥ pracodayāt.*
90. In Indian geometry forms and figures (e.g. *yonikuṇḍa*) which resemble a leaf of the *pippal* tree of fig family (*Ficus Religiosa*) are also usually called *yoni* figures.