

THE AMBAR CHARKHA



Published By :

ALL INDIA KHADI & VILLAGE INDUSTRIES BOARD
(Ministry of Production)

POST BOX 482 : BOMBAY-1

Price : 4 Annas

AMBAR CHARKHA

1. Brief History of the Charkha

OF the many and varied gifts of Gandhiji to India, the Charkha or the hand-spinning wheel is the greatest. On the political plane, it rallied the different sections of the population to the nation's call for Purna Swaraj; and on the economic and social plane, it was the symbol of the nation's determination to achieve economic salvation and social regeneration. To Gandhiji the Charkha was an effective instrument not only for attaining total self-sufficiency in cloth through the utilization of wide-spread knowledge and skill in hand-spinning and hand-weaving and consequently total independence from foreign imports but also for inculcating the lessons of self-help and profitable use of enforced leisure to secure relief from crushing poverty. In his opinion, such an instrument, therefore, deserved universal introduction to ensure economic uplift of the people.

2. During his very early efforts in Ahmedabad, Gandhiji paid relatively greater attention to hand-weaving

as the means to ensure the economic uplift of the people. He soon realized that if hand-weaving was to be revived and developed as an effective means of relieving the wide-spread distress of the people, the dependence on the mill supply of yarn must cease. In his search for an effective method of ensuring the decentralized supply of yarn to suit the needs of a decentralized handloom industry in the country, he came upon the spinning wheel or the Charkha. His knowledge of the prevalence of many types of Charkhas in the country, on the one hand, and of the limited but continued use of it by the people, on the other, led him to advocate handspinning in 1919 and to initiate the search for a better and more effective Charkha that could be universalized in the country. In his considered view, the universalization of the Charkha, and an effective integration of handspinning with handweaving alone would provide the true basis for an effective revival of India's indigenous, decentralized cotton textile industry. Consequently, during the twenties he carried on a systematic propaganda to familiarise the country with the economic, social, moral and political significance of the Charkha.

3. Although the Charkha was satisfactory from the point of view of its employment-potentiality, capacity to ensure self-sufficiency in cloth and ease of manufacture and service by the village artisan with local raw materials, Gandhiji desired to have a Charkha with higher productive capacity so as to ensure the spinner a higher wage to enable him to raise his standard of living. He, therefore, advocated, encouraged and offered specific incentives for the manufacture of a more efficient Charkha.

II. The Search for an improved Charkha

4. In 1923 he offered a prize of Rs. 5,000 for effective research in evolving a better and more efficient Charkha. To be acceptable for his purpose a Charkha must be capable of being introduced and operated in the smallest of India's cottages; must produce yarn of good quality of a definite quantity to assure the spinner a living wage; and above all, must be capable of being manufactured and serviced by the village artisan in his village. Thus began the nation's search for a Charkha of his dreams to attain the purpose that he so dearly cherished and so ardently advocated.

5. This offer aroused interest not only within the country but also without. During the following years, many indigenous and foreign models were submitted to him for acceptance. But a careful and objective scrutiny of each of these showed that as spinning instruments they were poorer than the prevalent indigenous Charkha.

6. Among the several models that were submitted to him for acceptance during this period, mention may be made of the German and Turkish models of Charkhas. These were, however, found unsatisfactory either because of their cost or mechanism or their constructional difficulties. The models that attracted most attention and came closest to his criteria were Shri Purushotam Das's one-spindle "Jevan Charkha" and Shri Kale's two-spindle and six-spindle Charkhas. These also did not pass the rigid test of Gandhiji. The two inventors were, however, requested

to continue their efforts to evolve a more effective model. Political events of this period claimed the greater portion of Gandhiji's time and attention and consequently, despite his deep interest in this research, he could not give it sufficient time or attention, as he desired.

7. In 1929, however, with the wide-spread distress in the country owing to the unprecedented world economic depression, Gandhiji once again offered a prize, this time [of Rs. 1,00,000 for the invention of a Charkha which satisfied his conditions, except that of price, which in his opinion, could go up to Rs. 150 per Charkha.

8. Political events, such as the Dandi March, Salt Satyagraha etc. of this period once again claimed Gandhiji's time and attention; and although work was being carried on at Sabarmati, Wardha, and other places, research as such received only secondary attention.

9. Chief among the various models that were constructed during this period was Shri Kale's improved ten-spindle Charkha, manufactured in 1937. Although on this Charkha, yarn of good quality according to specifications and conditions, could be spun, and its productivity was satisfactory, it was found unacceptable because it was not capable of being manufactured in the villages; it was too large to be set up in all the small huts of the villages and its price was beyond the means of the average villager.

10. Revival of sustained interest in technical research in all aspects of Khadi in general and a determined drive to

evolve a technically superior Charkha came only during the second half of the World War II. Thanks to the zeal of Shri Krishnadas Gandhi, who convened several conferences to discuss questions of technical improvement of the Charkha and Khadi, research-mindedness as such received fresh impetus. The interest in research aroused by these Conferences was reflected in the decision of the A. I. S. A. during this time to send a delegation at a cost of Rs. 40,000 to Japan and China, which were reported to have devised small spinning units. Before the delegation left, however, a model of the Japanese spinning unit became available in the country for critical examination, and the trip to Japan was, therefore, cancelled.

11. The foreign model of the spinning unit was, however, found to be unsatisfactory, because its output was lower than that of even the ordinary Charkha and its price was prohibitive. Besides, the mechanism of the model was intricate and obviously beyond the capacity of the village artisan to maintain, let alone manufacture. Above all, its productivity and quality were each poorer than the models constructed in the country itself. The final rejection of the Japanese model paved the way for reconsideration of the indigenous models of Charkhas, such as the Rajagopalan Charkha, constructed during the thirties, and the Nagindas Charkha made in 1947. Although each of these was comparatively superior to the foreign model, they failed to satisfy the criteria of Gandhiji, and consequently, it was decided to continue the search for the Charkha of Gandhiji's dreams.

III. The Ambar Charkha

12. Of the many different types of models that were constructed during the period, the most successful was the two-spindle wooden Charkha, invented in 1949 by Shri Ekambaranathan of Papankulam in Tirunelveli District of Tamil Nad. It was a small Charkha, embodying the ring-spinning technique, with a special apparatus for drawing tubular slivers. It was equipped with two-ring spindles and was fitted with two-horn rollers, which were weighted by springs. The rotation of a large hand-wheel, linked to the smaller wheels by cotton bands provided the drive. The productive capacity of this early model was slightly more than one hank per hour. Although the yarn spun on it was satisfactory in strength, it was not uniform. The mechanism of the Charkha, its productive capacity as well as the ease of its manufacture led the A.I.S.A. to consider that as a first attempt it was good and deserved to be taken up for further research. Shri Ekambaranathan was rewarded for his enterprise, and was also provided adequate research facilities to improve his model. He worked on this model first at Kovilpatti and afterwards at Tiruppur.

13. In 1950-51, Shri Ekambaranathan, assisted by Shri Nandlal Patel, constructed a considerably improved model Charkha. Wholly made of wood, it was a four-spindle Charkha. The main hand-rotated wheel was linked to quite a large number of small-sized, grooved pulleys that provided the drive to the self-winding spindles. The introduction of the multi-grooved pulleys was to regu-

late the counts of yarn spun from tubular slivers of cotton, which were to be made separately. In the hands of an expert spinner, this four-spindle wooden Charkha yielded 16 hanks of good quality yarn in 6 hours. Although, from the point of view of productivity, it was an altogether satisfactory model, operational problems were many: the number of multigrooved pulleys was large, and the number of both cotton and leather bands that needed adjusting prior to operation was equally large. Moreover, to get the Charkha ready for operation took, on an average, two hours due wholly to the number of bands that needed accurate adjustment.

14. To reduce the number of hands and pulleys, and to avoid the loss of time involved, gear-wheels were introduced. The introduction of machine-made metal parts for one purpose gradually led to the construction of a wholly-metal-made Charkha in August 1953, demonstrating thus that the search for an efficient Charkha suffered from no prejudice and was motivated wholly by technical consideration.

15. Among the many, wholly metal-made Charkhas the most satisfactory was the four-spindle Charkha, based on the original model of Shri Ekambaranathan, constructed at Bombay by Sarvashri Varkedi and Keshavlal Gandhi at the instance of Sarva Seva Sangh. The Charkha was first tried with only two spindles and the operation was easy and the output averaged two hanks an hour, during a continuous operation of 24 hours. The yarn was good in quality and strength. But when all the four-spindles were fitted,

operation of the Charkha was found to be hard and physically strenuous. Moreover, the price of the Charkhá estimated at Rs. 300/400, was too high for the conditions in the country. Once again the search was towards a wooden model, which at once eliminated the defects of the metal Charkha and the very first wooden model of Shri Ekambaranathan.

16. Based on the first wooden model Charkha, Shri Nandalal Patel constructed in December, 1954, another four-spindle wooden Charkha with one pair of gear wheels and a few bands. The Charkha was easy to operate, cheap to manufacture and satisfactory in performance and consequently was taken up for further development:

17. Of the many improvements made on Shri Nandalal Patel's model, the most important from the point of view of efficient spinning was the evolution of the paper bobbin. The primary difficulty in the operation of most multi-spindle Charkhas was the standardization of spindles to obviate oscillation. Ordinary spindles could not be efficiently operated on wooden bobbins. The substitution of the wooden bobbin by a paper bobbin, devised by a workshop assistant in November 1954, provided an effective solution of the principal problem. The operation of the Charkha with paper bobbins yielded $3\frac{1}{2}$ hanks of yarn per hour.

18. There were several similar improvements which were effected through patient research and trial. These were all motivated by the need to ensure ease of operation and

efficiency of performance and production. Thus, the Ambar Charkha, on which the Board has based its development programme, is the result of sustained and continuous research to evolve an instrument, cheap, efficient, productive and easy of manufacture by the village artisan in the village.

III. Description of Ambar Charkha

19. The Ambar Charkha, which the Board desires to introduce on a large-scale throughout the country, is a four-spindle, hand-operated wooden spinning wheel, 21 inches long, 16 inches broad and 21 inches high, weighing 26 lbs. Apart from the frame made of seasoned wood, there are three wooden multi-grooved pulleys, one with four grooves, another with three and the third with two, each of which is connected with the main hand-operated wheel by cotton bands. The iron parts of the Charkha consist of four-spindle rings, four fluted rollers, one pair of gear wheels, harwar boss, travellers and springs. Besides these, there are four pairs of rubber rollers over the metal-fluted rollers, about $1\frac{1}{4}$ inches broad.

Spinning Process

20. The specially made tubular slivers, which are kept in a bundle on the off-side of the Charkha, are delivered through the fluted rollers into a small wire ring, and get twisted due to the fast-revolving spindles. The winding of the yarn is made automatic through the traveller and the

spinning ring. The revolutions of the spindles average between 7000 to 9000 per minute depending on the number of revolutions of the main wheel, which is linked to the spindles through cotton bands. The counts of yarn can be varied by shifting the band from one groove to another of the grooved pulleys and also by variations in the size of the tubular slivers used for spinning.

21. The present rated capacity of the Ambar Charkha is to spin counts of yarn from 12s to 40s, although counts of 40s and above can be spun, depending on the types of cotton and slivers made therefrom. In fact counts of 130s have been spun on the Charkha as an experimental measure. Though high count yarns have thus been spun on it, the Ambar Charkha is mainly directed to produce coarse and medium counts of yarn. The record of spinning shown in the table below brings out its potentialities. Though

Spinning Data

| Cotton | Time Hrs. | Count | No. of hanks | Remarks |
|---------|-----------|-------|--------------|--------------------|
| Surti | 6 | 19 | 24 | Only spinning |
| „ | 8 | 19 | 12 | Cotton to Spinning |
| Jarilla | 10 | 23 | 25 | Only spinning |
| „ | 2-10 | 21.5 | 12 | -do- |
| Rosia | 8-30 | 13.3 | 22.5 | -do- |

winding in each case was separate productivity per working day has considerably exceeded 20 hanks of yarn, as shown above, the rated or average capacity of the Charkha is taken at 8 hanks per day of 8 hours from cotton to spinning, or 16 hanks of yarn taking only spinning. Winding of yarn in each case in separate.

22. The Ambar Charkha, as it has been evolved, is simple in structure and mechanism, and all its parts, except the traveller, are either locally available or can be easily made locally. Experience in its manufacture shows that after initial training, the village carpenters are capable of assembling the Charkha and servicing it efficiently. While the wooden frame can be easily made to standard size, all iron and rubber parts need to be made at factories. Arrangements have already been made for the large-scale manufacture of those replaceable parts and their distribution to the manufacture-cum-assembling centres in the country. The price of the Ambar Charkha today is estimated at Rs. 40.

IV. Accessories of the Ambar Charkha

23. As was observed above, the Ambar Charkha requires tubular silvers of different thickness in accordance with the counts of yarn desired. To supply these slivers as well as to card the cotton required for them, wooden carding and slivering machines have also been devised.

(a) The Dhunai Modia

24. The Dhunai Modia or the carding machine consists of a large wooden wheel, which is linked by cotton band to a grooved pulley, which rotates a fluted feel roller of about $3/8$ " in diameter and about 3" long. The fluted roller delivers the lint to the wooden cylinder, 3 inches in breadth and about 2 inches in diameter, fitted with tin-spikes. The fluted roller as well as the wooden cylinder are closed, except for an opening at the bottom to facilitate the falling of trash. Connected with this wooden cylinder is a small wire-cage, 6 inches wide and 18 inches long and 8 inches high. The cylinder revolves at high speed when the main wheel is operated. The fibres are thrown out by centrifugal force into the cage. The cost of a Dhunai Modia, inclusive of the case, is estimated at Rs. 35.

(b) The Belni

25. The loose, opened-out fibres collected in the wire cage attached to the Dhunai Modia are removed and tubular slivers are prepared on the Belni, which is a specially prepared wooden machine. In length, height and width the Belni is identical with the Ambar Charkha. It consists of two pairs of steel drawing rollers about 7 inches long and $7/8$ inches in diameter weighted by springs. The lower rollers are fluted and the upper rollers are covered by rubber. The loose cotton fibres are drawn through these rollers a

few times and then are formed into roving by a funnel and collected in a small tin cylinder. The tin cylinder is 8 inches in height and 5 inches in diameter, with a ring fixed at its centre. The cylinder is revolved by a grooved pulley, which is banded with the main hand-wheel. The revolution of the cylinder twists the roving. The drawing-cum-slivering machine or the Belni, which is principally made of wood, a tin-cylinder and two pairs of iron rollers and rubber bushings, can also be manufactured and serviced by the village carpenter after some initial training. Its estimated cost is Rs. 25.

26. An Ambar Charkha set thus consists of a carding and a drawing machine besides the Charkha, collectively estimated to cost Rs. 100. The arrangements to manufacture replaceable parts at selected central factories are expected to bring down the cost by Rs. 10/20 to Rs. 90/80 per Charkha set. Thus, the present four-spindle wooden Ambar Charkha evolved from the original model of it constructed by Shri Ekambaranathan, satisfies almost all the criteria prescribed by Gandhiji.

V. Comparative Data

27. Since the standardization of the present Charkha, various experiments and tests have been carried out on the counts, quality, and strength of its yarn. It may be mentioned here that experiments carried out at Wardha and Nasik show that although it is possible to spin $3\frac{1}{2}$ to 4 hanks of

yarn per hour, the average output per hour is 2 hanks or, on an average; 16 hanks of yarn of 20's per day of 8 hours on the Ambar Charkha, as against the average of $\frac{1}{2}$ a hank of yarn per hour or $3\frac{1}{2}$ hanks of yarn of 16's per day of 8 hours on the ordinary Charkha.

28. The counts of yarn that can be spun on the Ambar Charkha are in the range of 12's to 40's, depending on the quality and staple of the cotton used. At Wardha with temperature at 111° , in summer, yarn of 130's counts was spun from Buri cotton. The same count of yarn was spun also at Islampur. At Wardha and Nasik, during summer which is both hot and dry at both places, counts ranging from 32's to 40' were spun from Jarilla, 52's from Surti and 12's from Kanpuri. Trainees at Nasik Central Vidyalaya today spin counts of yarn in the range of 20s to 52s and villagers in Mungrot, where an experimental centre was recently opened, are now able to spin, on an average, 16's on the Ambar Charkha.

29. Comparative analysis of the yarn spun on the Ambar and ordinary Charkhas shows that the yarn on the Ambar Charkha has a tensile strength of 70 to 100 per cent

as against an average of 60 to 70 per cent of the yarn on the ordinary Charkha. Thus quantitatively as well as qualitatively, the Ambar Charkha yarn is superior to the yarn on the ordinary Charkha inasmuch as it enables a spinner to spin on an average 16 hanks of 20's per day of 8 hours as against an average of 3½ hanks of 16's per day of 8 hours on the ordinary Charkha.

Weaving Experience

While the comparative study of the Ambar Charkha yarn with that of the ordinary Charkha yarn has been satisfactory, it has not yet been possible to collect similar comparative data on weaving. The Board is now initiating a pilot programme to collect necessary data on weaving with Ambar yarn and the experience of the weavers both of Khadi and mill-yarns. The limited experience that has been gained is set out in the Table below :

| Place | Width | Texture | Count of Yarn | Yds. | Time Hours |
|------------|-------|---|---------------|------|------------|
| Billimoria | 45" | 50x50 | 19 | 15.5 | 8.5 |
| " | 45" | " | 19 | " | 9.08 |
| Gurl Hosur | - | Coloured and deigned bordered sarees | 28 | 6.0 | 6.0 |

The data set out above lend strength to the belief that the Ambar Charkha may provide the key to the revival and development of India's traditional decentralized, cotton-textile industry, that once placed her as the leading manufacturing country in the then known civilized world.

Printed at TREND PRINTERS
Swadeshi Mills Estate, Girgaum, Bombay-4.