ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 6, Issue 9 , September 2019

A Theoretical Analysis of the Effect of Spike Drums on the Natural Qualitative Indicators of Cotton at its Cleaning

UsmanovKh.S.,Salimov A.M., Abbozov I.Z.,Doliyev A.T., Tangirov A.

PhD department of industry Cotton, Tashkent Institute of Textile and Light Industry
Professor department of industry Cotton, Tashkent Institute of Textile and Light Industry
PhD department of industry Cotton, Tashkent Institute of Textile and Light Industry
Assistant department ofindustry and design in light Industry, Tashkent Institute of Textile and Light Industry
Senior Lecturer department of industry and design in light Industry, Tashkent Institute of Textile and Light Industry.

ABSTRACT: The article discusses the construction of the cleaning machine from small weed impurities and its impact on working of the spike drums on the natural quality indicators of cotton. The results of theoretical studies have determined the spike drums impact force magnitude on the cotton flyings are given. As a result of theoretical studies a sector, where the maximum impact on cotton sticks occurs and short fibers appear, has been determined. The conclusion of the scientific work is the expediency of moving away from the horizontal arrangement of the cleaning sections of the cleaners of small litter.

KEY WORDS: Technology, process, raw cotton cleaning, fine weedy impurities, production line, fine litter cleaner, ring drum, mesh surface.

I.INTRODUCTION

All over the world special attention is paid to the creation of highly efficient technologies for the cleaning of raw cotton from small and large weed impurities. Significant success in the global ginning industry has been achieved in such countries as: USA, Australia, China, India, Uzbekistan, etc. This has led to the improvement of technology, the creation of highly efficient production lines and ensured the competitiveness of cotton fiber in the world market. Scientific researches aimed at improving the technological processes of raw cotton cleaning from small and large weed impurities are conducted in many research centers and laboratories of higher educational institutions.

The analysis results of up-to-date scientific researches in seed cotton cleaning showed that they have been studied in two directions- the seed cotton cleaning from small foreign matters and the seed cotton cleaning from large foreign matters.

Nowadays study problem of the influence have not been studied in the cleaning effect, changing of the distance between saws and the distance between fire-bars in the sections of cotton cleaners from large foreign matters, creation the new resource saving of working parts and determination their technological indicators, catching occasionally having occurred the soft fabrics in the process of cotton cleaning from small foreign matters showed insufficient efficiency of working parts cleaners[1].

II. SIGNIFICANCE OF THE SYSTEM

One of the main factors in the appearance of fibrous waste during cleaning is the impact on cotton of working bodies of cleaners. This problem is still not well understood, which is the main area of research in this article. A study of the literature review is presented in section III, the methodology is explained in section IV, section V covers the experimental results of the study, and section VI discusses the future study and conclusion.

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 6, Issue 9 , September 2019

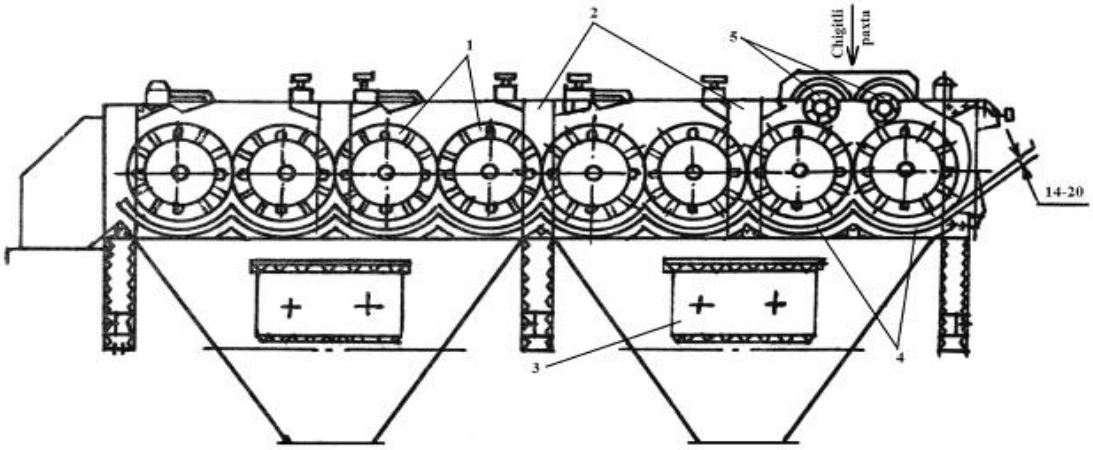
III. LITERATURE SURVEY

Their number has been concerned to U.S. Department of Agriculture, Lummus, USDA Ginning Cotton Research Unit, USDA Agricultural Research Service, Texas Tech University, Samuel Jackson Incorporated (the USA), Cotton research and development corporation (Australia), Central Institute for Research on Cotton Technology, Bajaj Steel Industries Limited (India), National Research Center for cotton processing engineering and technology, China Cotton Industries Limited, Shandong Swan Cotton Industrial Machinery Stock, Handan Golden Lion, Cotton Research Institute of Nanjing Agricultural University Lebed (China), Pakistan Cotton Standards Institute, National Textile University Faisalabad (Pakistan), BusaIndústria e Comércio de MáquinasAgrícolas Limited (Brazil).

During the seed cotton cleaning in the cleaning effect, machinery productivity, seeds damages, falling onto the seed cotton in foreign matters of seed cotton carried out in scientific researches of W.S.Anthony, R.V.Baker, R.M.Sutton, S.I.Hughs, G.W.Laird, E.F.Budin, B.V.Loginov, G.I.Miroshnichenko, G.I.Boldinskiy, P.N.Tyutin, A.E.Lugachev, A.Djuraev, F.A.Saadi, R.Z.Burnashev, B.N.Yakubov, V.N.Arkadakskiy, Yu.S.Sosnovskiy, X.Sidikov and other scientific researches.

Researches connected with fundamental problems of cotton cleaning from small and large foreign matters were tested by W.S.Anthony, R,V.Baker, E.F.Budin, A.E.Lugachev, A.Djuraev, M.Agzamov, V.N.Arkadakskiy, B.N.Yakubov and P.N.Borodin, who received the certain positive results.

Along with above mentioned scientific centers a joint stock company «Paxtasanoatilmiymarkazi» also conduct a wide range of scientific research in this area. As a result of these exploration a number of technological lines and equipment for cleaning raw cotton has been developed in Uzbekistan.



1-EN-178 block of spike drums; 2 - racks; 3 - weed bunker,
4-mesh surface; 5 feeding rollers.

Fig. 1 Scheme of cleaner 1HK.

Examples include cleaners of small litter SCh-02, 1HK (Fig.1) and the unit for cleaning large and small litter UHK, which are a small part of a large number of such technological lines[2].

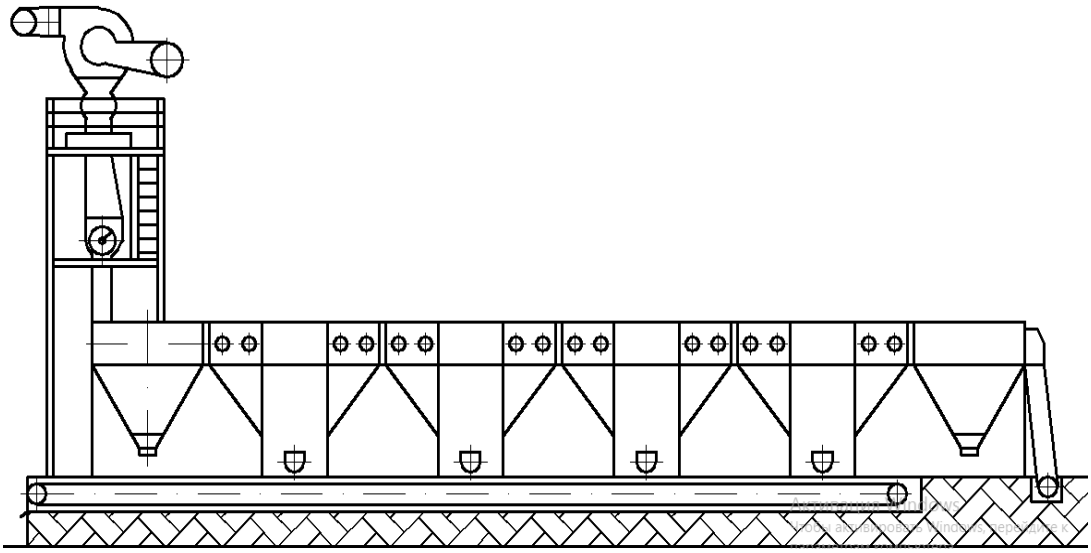
IV. METHODOLOGY

To provide the maximum freedom degree of cotton in the cleaning process, rotation of the spike drum plays an important role. However, an increase in number of revolutions of the spike drums leads to an increase in defects in fiber anda decrease in the cleaning effect of the equipment.In the combined spike-bar drum of the cleaner between each two spike rows around the drum perimeter bars are installed [3,4].

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 6, Issue 9 , September 2019

When the drum rotates, the bars contribute to the appearance of air flow. In turn, the air flow picks up the separated under the action of centrifugal force and arising under the action of the drum's rotation moment, litter from the cotton, which passes through the mesh surface.

In such cleaners, spike drums are arranged sequentially in a row (1) and under each drum there is a mesh surface corresponding to the shape and size of the drum (4). There are feeding rollers with a diameter of Ø 140 mm above the first two spike drums (5). The rollers provide a uniform supply of raw cotton, under each drum there is a



container (3) for the selected litter [5]. The cleaning module usually consists of 8 drum sections. It enters the chain of flow of machines. In a linear flow, the number of spike-bar drums can reach up to 24 units. Such a large number of spike drums leads to a large loss of raw cotton. Studies conducted in the Chelek Cotton Ginning Plant in the Samarkand region have shown that in the last sections of the spike-bar drums with 24 drums, the proportion of cotton fiber in the waste is up to 1.2%. During the season, in the process of cleaning raw cotton from small weed impurities, the damage amounts to 12-14 tons of product [6].

Fig.2 Location of 1HK cleaners in the UHK production line.

From the calculation of force impact of a spike-bar drum on a single cotton flying, it is possible to determine loss magnitude of short fibers during the raw cotton cleaning. Below calculations, scientific and practical recommendations to reduce the loss of short cotton fibers and to improve cleaning plants design are given [7].

V. EXPERIMENTAL RESULTS

In the currently operating machines for the cleaning of raw cotton from small weed impurities, when a spinning spike-bar drum is applied to the flyings of raw cotton, it moves forward due to the speed of rotation of the drum. Here, due to the moment of rotation, the flyings acquire centrifugal force. The friction force of the flyings on different surfaces arises in the opposite direction. Meanwhile the speed of the drum is 450 rpm [8].

$$\vartheta = 2\pi\omega R \tag{1}$$

We know the drum speed is

$$\nu = 450\frac{r}{\min} = 450\frac{r}{60s} = 7{,}5\frac{r}{s}.$$

Wherein

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 6, Issue 9 , September 2019

$$\vartheta = 2 \cdot 3{,}14 \cdot 7{,}5 \cdot 0{,}2 = 9m/s$$

From the equation it can be seen that the linear speed of the drum is 9m / s. The impact of the drum and the friction force between the raw cotton and the metal mesh affect the cotton flying [9].

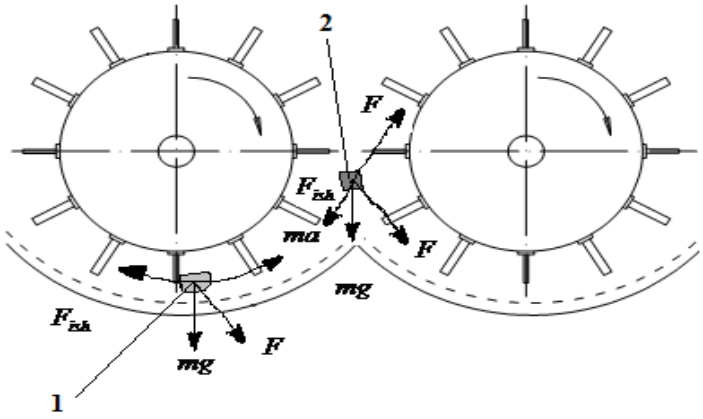


Fig.3. Scheme of forces affecting flyings of raw cotton

The impact of the drum on the cotton flying is determined by the following formula.

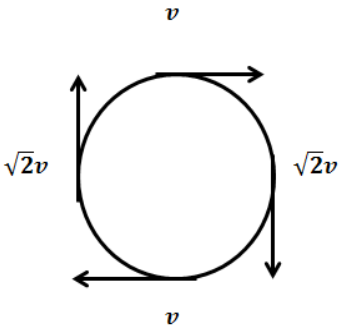
$$F_1 = ma - F_{friction} = ma - \mu mg = m(a - \mu g) = m\left(\frac{\vartheta^2}{R} - \mu g\right) = 6 \cdot 10^{-2}\left(\frac{81}{0{,}2} - 0{,}25 \cdot 10\right) = 2{,}4N \quad (2)$$

μ -friction coefficient between cotton and metal;
m-mass of flyings of raw cotton;
g - acceleration of gravity;
a- acceleration of flyings of raw cotton.

The passed cotton flyings hit the second drum, the forces acting at the point of impact of the cotton flyings on the second drum are as follows.
mg-gravity;
F-force impact of the drum[10].

According to the law of physics, different points of the drum rotate at different speeds. The following is the distribution of speeds with uniform accelerated rotational motion:

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 6, Issue 9 , September 2019



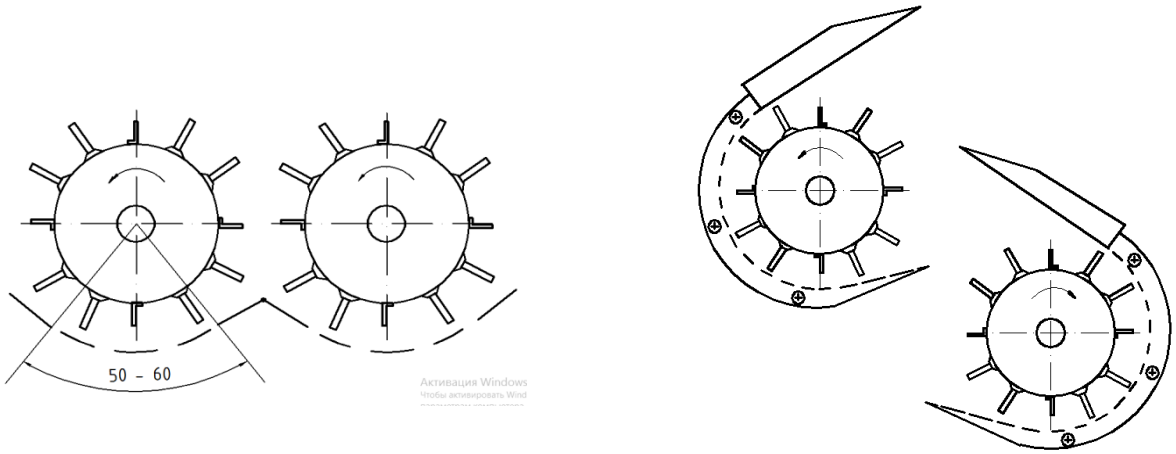
1) 1/4 part circles rotation $\vartheta = \sqrt{2}\ v$
2) 2/4 parts circles rotation $\vartheta = v$
3) 3/4 parts circles rotation $\vartheta = \sqrt{2}\ v$
4) with full rotation $\vartheta = v$
It means that the force acting on the cotton flyings is

$$F = ma + mg \quad (3)$$

here mg is very weak, so this value can be neglected, since the gravity acting on a six-gram flying of raw cotton is negligible [11].
Then the expression of the impact force on the flying of raw cotton takes the form:

$$F_2 = m \cdot a = m \cdot \frac{\vartheta_2^2}{R} = \frac{2m\vartheta_1^2}{R} = \frac{6 \cdot 10^{-3} \cdot 2 \cdot 81}{0{,}2} = 4{,}8N \quad (4)$$

Based on theoretical studies, the author of the article developed a vertical layout of the modernized cleaning section.



а) б)

Fig. 4. Layout design of the upgraded cleaning section.
a) The existing design of the layout of the cleaning section;
b) The modernized design of the layout of the cleaning section.

Unidirectional rotational speed of the annular drums eliminates downhole situations in the machine. A patent for utility model No. FAP 01397 dated November 27, 2017 of the Intellectual Property Agency of the Republic of Uzbekistan [3] was obtained for this layout design of the cleaner. In this case, the angle of girth of the annular drum with a mesh surface is more than 180 °.The above layout of the cleaning sections and the sequential transportation of raw cotton through the conjugated cleaning sections can significantly increase the cleaning effect, while also preserving the natural quality indicators of raw cotton and its components, will eliminate damage to fiber and seeds during transportation by drums, which is the basis for the development of vertical technology peeling cotton.Of particular importance is the installation of a section for cleaning large litter after a section for cleaning small litter, which makes it

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 6, Issue 9 , September 2019

possible to reduce the metal consumption of the structure when fully equipped from 20.0 tons to 8.8 tons compared to the existing design of the purifier unit, and the energy consumption is reduced from 98 kW to 39 kW.

VI.CONCLUSION AND FUTURE WORK

The main conclusion of the theoretical studies is that in order to preserve the natural quality indicators of raw cotton, it is necessary to minimize the mechanical impact on the raw cotton while its processing [14]. The second conclusion of these studies is that when cleaning raw cotton from small weed impurities, there is a need to move away from the horizontal arrangement of the spike drums, in order to eliminate the counter impact effects on the flyings of raw cotton[15].

REFERENCES

[1] KhakimovSh.Sh. Creation of effective technology of cleaning of cotton raw materials from pollution and rational design of cleaning components. // Doctoral dissertation. Tashkent, 2017, page 4.
[2] GI Miroshnichenko «Maintenance of a machine with a perforated obstruction». M. Machinostroenie, 1972, pp. 143.
[3] Lugachev A.E. Adding Easy-to-Read items is a procedure that works with all items in the process. // Diss.kand.texn.nauk. Tashkent, 1981, p.
[4] Patil.P.G., Anap G.R., Arude V.G. These findings are confirmed in the works of foreign authors. In the work of American scientists Cotton pre-cleaner. Agricultural Mechanization in Asia, Africa and Latin America. 2014, ISSN: 00845841.
[5] Carlos B. Armijo, Kevin D. Baker, Sidney E. Hughs, Edward M. Barnes, and Marvis N. Gillum Harvesting pp.158–165.
[6] Mardonov B.M., Usmanov Kh.S., Sirojiddinov F.N., Tangirov A. Karimov A. Theoretical Issues of Development an Innovative Technology of Cleaning Raw Cotton, International Journal of Advanced Research in Science, Engineering and Technology Vol. 6, Issue 3, March 2019, p.p.8285 – 8293.
[7] Abbazov I.Z., Xodjiev M., Alimov O., R.KarimovaThe Composition of Releasing Passion of Dusty in the Process of Pat // International Journal of Engineering and Advanced Technology ISSN: 2249-8958 Volume-8, Issur-3S (2019) –pp. 279-283
[8] Abbazov I.Z., M.Xodjiev, AlimovO., KarimovJ. Fraction Structure of Cotton Cleaning Equipment in Cotton Enterprises and Their Cleaning Effectiveness // International Journal of Advanced Research in Science, Engineering and Technology ISSN: 2350-0328 Vol.6 Issue 1 (2019) –pp. 7983-7988.
[9] Abbazov I.Z.,XodjievM., Mardonov B., Sarimsakov O. Effective Cleaning of Cotton Waste Produced at Cotton Cleaning Factories // American Association for Science and Technology ISSN: 2375-3803. Volume-5, Issur-2 (2017) –pp. 22-28.
[10] Abbazov I.Z., Xodjiev M., Mardonov B., Sarimsakov O. Improving of the technology of cleaning fibrous waste in cotton ginning plants // Science and Beyond Publishing Volume-2, Issur-6 (2017) –pp. 43-47.
[10]Abbazov I.Z., Xodjiev M., Qarshiyev B. Increase of an overall performance of a deduster on cotton ginning enterprises // European science review ISSN: 2310-5577 (2016) –pp. 171-173.
[12] UsmanovKh.S., Mardonov B.M., Salokhiddinova M. Theoretical study of the process of decomposition of wastewater from the flow of cotton on the sloping plane, Scientific and Technical Journal 2018 "Issues of Textile", pp. 16-22.
[13] UsmanovKh.S., Mardonov B.M., Abbazov I.Z. Modeling of the process of cleaning the flow of cotton from the dirt on the conveyor belts with sloping tape, Bulletin of the Tashkent State Technical University, № 4, 2018, pp 137-141. 10.
[14] UsmanovKh.S., Abbozov I.Z., Sirojiddinov F.N. Analysis of factors affecting the efficiency of the innovative vertical cleaner, Fergana Polytechnic Scientific and Technical Journal, 2019, Issue 23, No 44, No. 44 50 pages.
[15] UsmanovKh.S. ilr. New technology for brush making machines for cleaning cotton seeds from major pollution, Scientific and Technical Journal, "Textile Problems" 2018, pp. 30-34.