MINISTRY OF HIGHER AND SECONDARY SPECIAL EDUCATION
OF THE REPUBLIC OF UZBEKISTAN
TASHKENT INSTITUTE OF TEXTILE AND LIGHT INDUSTRY

DESIGNING OF ENTERPRISE SPECIALIZED TO PRODUCE MEN'S OUTERWEARS

DIPLOMA PROJECT

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INTRODUCTION

Currently, Uzbekistan is the world's fifth largest cotton producer and second exporter him. That country for decades holds such positions, an indication of its comparative advantage in the production of cotton, which are based on climatic and geographical conditions, the ancient traditions, experiences and lasting centuries of specialization in cotton.

Of the country, exporting cotton, Uzbekistan became a state, it successfully processing. This gave further development of light industry and, in particular, the textile sector. In this context, the priorities of structural reforms in the industry has been the development of new technologies and the textile industry began to develop with an emphasis on the growth of domestic processing of cotton fiber and increasing the production of products with high added value. As a result, the domestic textile market holds a significant share in the total industrial production of the country. In the period up to 2015 in the textile industry plans to attract $ 1.7 billion The total amount of foreign investment in the development of the textile industry of the country was about $ 2 billion, including $ 100 million in 2013.

In this sector, according to analysts "Uzbekyengilsanoat" now fixed increase in the proportion of enterprises with modern efficient equipment. This facilitates the attraction of investments, including foreign ones, by which new production, modernization and technical upgrading of existing enterprises. For example, 75 % of its textile production in the country accounts for by the joint ventures and foreign enterprises. Acting as their co-founders, foreign representatives often provide modern equipment from leading manufacturers of textile machinery, which is certainly very important for the rapid development of such industries.

Another important factor for the development of the domestic textile market advocate granted privileges and preferences for local producers, which allowed for a short time to adjust production in the country not only primary - cotton yarn, gray fabrics and knitted fabric, but also ready jerseys, semifinished products for sewing and knitting industry. These products now meet international standards and began to compete with foreign counterparts. Example - JV «Uztex Chirchik». In general,

companies included in the structure UZTEX, stand out for their productivity and competitiveness (JV «Textile Mill Tashkent», a joint venture enterprise «Indorama» and others). Almost all these companies are vertically integrated company with complete production cycle - from cotton processing to finished products.

"The main criteria for the dynamic development of the textile market in the country and the obvious increase its attractiveness became available for our high quality raw cotton enterprises, price incentives to acquire it for producers operating in the country, as well as to ensure the stability of energy, infrastructure," - said one of the exhibition activities at the end of 2013 the first deputy chairman "Uzbekyengilsanoat " Maqsood Mansurov. When this factor of competitiveness of domestic textile products is ensured by reducing the cost of production and thoughtful marketing themselves emphasize the textile market participants and experts HOOK.

Today textile sphere, as domestic light industry as a whole, is becoming one of the most socially significant in terms of employment: it is here most people need. And it is here that employment growth can be traced most. Particularly pronounced intensity of creating textile industries and as a result, employment is traced in Bukhara, Khorezm, Jizzakh, Namangan, Surkhandarya and Karakalpakstan, where the textile sector accounts for more than 50% of the local industrial production.

In its report "Our main goal - resolutely pursue the path of large-scale reforms and modernization of the country" at a meeting of the Cabinet of Ministers, dedicated rated the socio-economic development of the country in 2013 and the most important priorities of economic program for 2014, the President of Uzbekistan Islam Karimov noted the need to "mobilize the capacity that available resources and abilities to not lose us dialed pace of development, reform and modernization of the country." Therefore the major mobilizing priority for 2013 should be to preserve sustained high growth, macroeconomic stability and competitiveness of our economy. This trend is also true for light industry and

textile sector. Especially because in 2013, stressed the President of Uzbekistan, seeks to ensure the growth of the economy by 8% primarily due to the further growth of the industry by 8.4 %. The main source of achieving the goals should be the priority development of high-tech industries, providing growth of products with high added value. Among the other important areas of President Islam Karimov called and light industry.

In Uzbekistan, there are over 2200 light industry, more than 280 of which are part of the State Joint Stock Company "O'zbekyengilsanoat." In accordance with the Program of development of light industry, which runs until 2015, today the industry widely adopted modern technology and the assortment of products annually replenished more than 20 new items. Uzbek textile products exported to more than 40 countries in the world. By 2015, textile exports of Uzbekistan will be on analytical forecasts, more than $ 2 billion market for export of Uzbek textiles provide various nations of the world - Turkey, Germany, China, Iran, Greece, Israel, Britain and the United States, the Arab countries. Marketing services for the development and expansion of the geography of supplies Uzbek textile enterprises have opened more than 40 shopping malls in the CIS countries and the European Union.

Overall, 2015 "O'zbekyengilsanoat" plans to implement 55 investment projects, including in the textile sector. It is estimated that 28 of them in total to more than $ 194.8 million, will ensure the creation of over 3,700 new jobs. According to experts, the main economic indicators in recent years in the textile industry are associated with the transition to domestic processing of cotton fiber increased production and exports, and attracting foreign investment. It is also important that Uzbekistan is among the world's major producers of natural textile fibers, cotton and knitwear.

I. TECHNOLOGICAL PART

I.1 Selection and justification of assortment

Modern knitting production has inexhaustible capacity to manufacture a diverse assortment of clothing. Provides design production, producing products of the men's assortment. Subdivided into types: jackets, coats, sweaters, dresses, suits, etc.

Products men's assortment the extensibility and flexibility , providing a good figure moulding body and does not restrict movement . Thanks formstability knitting fabric expands men's assortment of products, and the use of modern equipment makes it possible to increase and improve the methods and ways of producing these products.

According to the theme of the graduation project of the men's product assortment were selected products "men's sweater " 48 and men's pullover 46 size. Sweaters are designed to wear in winter and autumn and spring seasons. Based on this model, it's possible to make a wide assortment of other products, changing the colors, design, knitting, and other parameters.

1 - assortment: "Men's Sweater"

1 – Front part of sweater, 2 – rear part of sweaters, 3 - sleeve, 4 - border, 5 - belt. (Fig.1)

2 - assortment: "Men's Pullover"

1 – Front part of pullover, 2 – rear part of pullover, 3 - sleeve, 4 - border, 5 - belt. (Fig. 2)

Selected and jastificated men's knitwear products are knit by using of rib and plain structures at double flat knitting machines on semi regular method that has a possibility to decrease of waste percentage till 10-12 %. This method is offered for outerwear products by using of shape knitting.

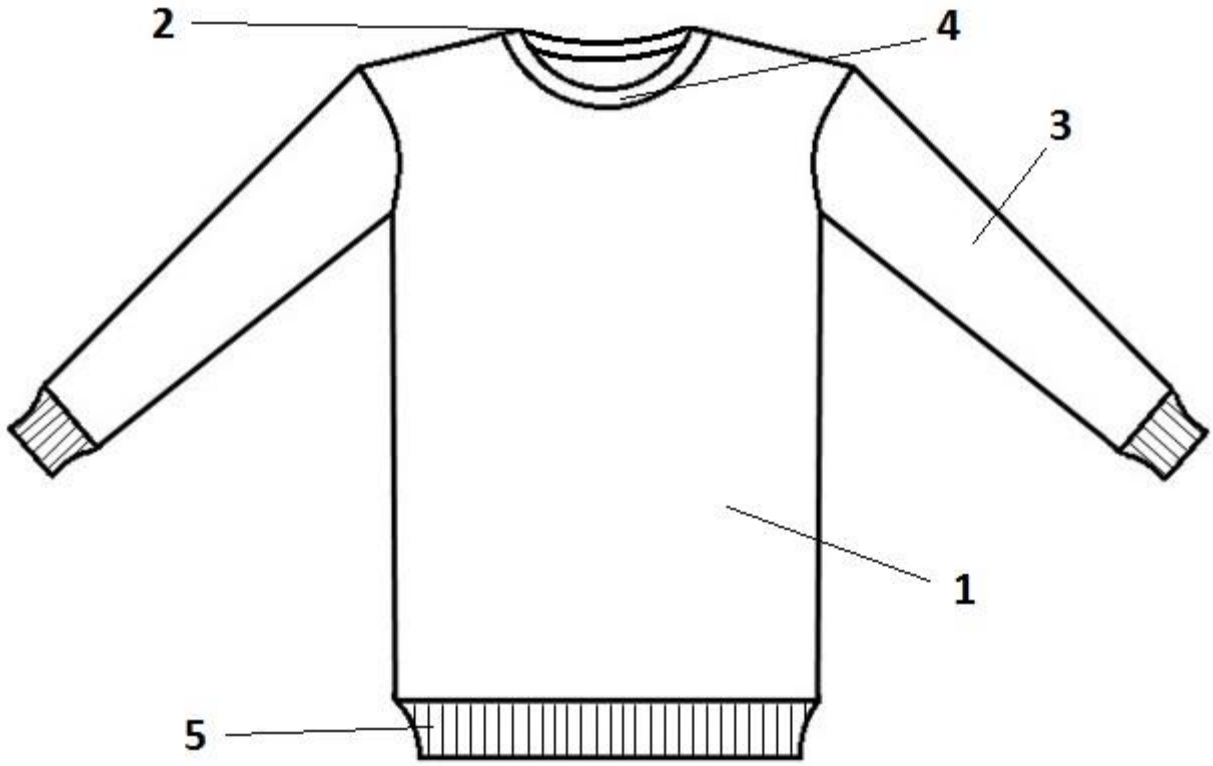


Fig.1 Men's Sweater (size 48)

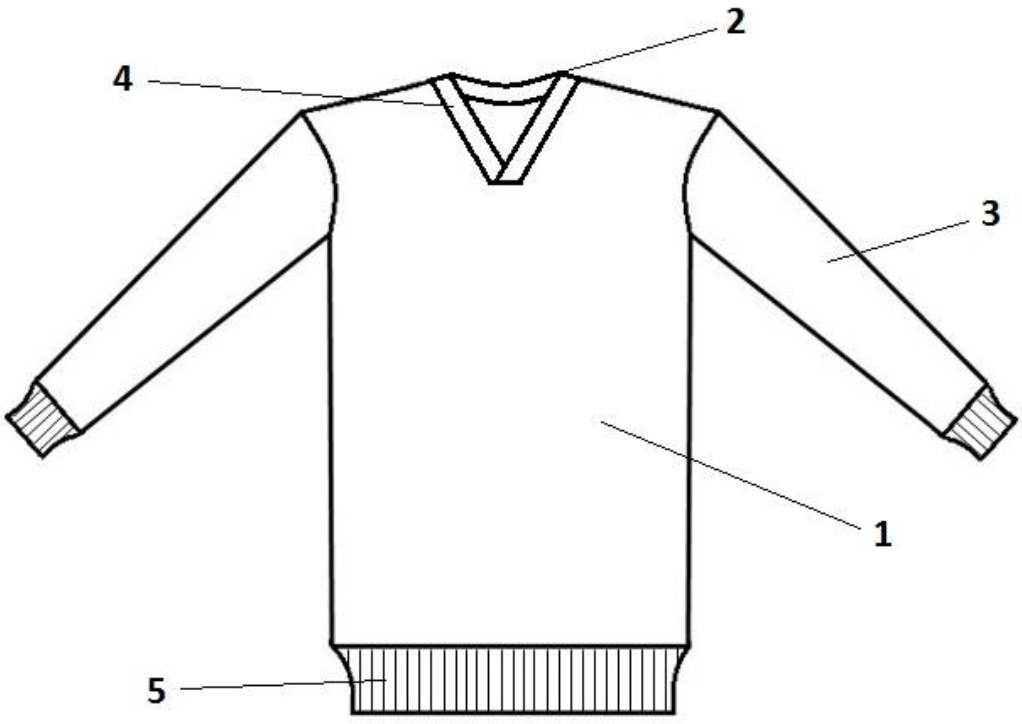


Fig. 2 Men's Pullover (size 46)

I.2 Selection and justification of equipment

«PROTTI»

The typical flat machine has two stationary beds arranged in an inverted V formation.

Latch needles and other elements slide in the tricks during the knitting action. Their butts project and are controlled as they pass through the tracks formed by the angular cams of a bi-directional cam system. It is attached to the underside of a carriage that, with its selected yarn carriers, traverses in a reciprocating manner across the machine width.

The machines range from hand-propelled and -manipulated models to automated, electronically-controlled, power-driven machines.

The classes of flat machines are:

1. the V-bed flat machines, which form by far the largest class;
2. the flat-bed purl machines, which employ double-headed needles;
3. machines having a single bed of needles, which include domestic models and a few hand-manipulated intarsia machines;
4. the unidirectional, multi-carriage (‘Diamant’) machines, which are no longer built.

Flat knitting machines - is a versatile machine to allow for quick refilling at developing a new product type, size and weave and having large fancy opportunities. Latest design equipment can produce an automatic way piece goods, save raw materials and reduce production time by eliminating products sewing operations . Over the past 20 years have seen the rapid development of computing technologies. Arisen on the basis of economic and social transformation have changed all that was in the past.

New generation of equipment is characterized by high technological capabilities through the use of constructive new mechanisms, such as platinum, snatch mechanisms, additional needle beds. Almost all the basic mechanisms of machines have undergone significant changes. For example, a software control mechanisms have evolved from mechanical to electronic ; programmamatically -

from typesetting chains and punched cards to floppy and optical drives for computers, etc. Therefore, it is of interest to consider the design features of the latest knitting machines and their technological capabilities.

Industrial flat knitting machine PROTTI type RT242 equipped with the needle jacks, knitting fabric and linear half jaquarde. RT242 has two separate systems carriages that can work in tandem. Working width 218sm (86 '), equipped with interchangeable border, upper and lower needle transfer to RT242 selects needle jacks, moving to four different positions, plus non-operating position.

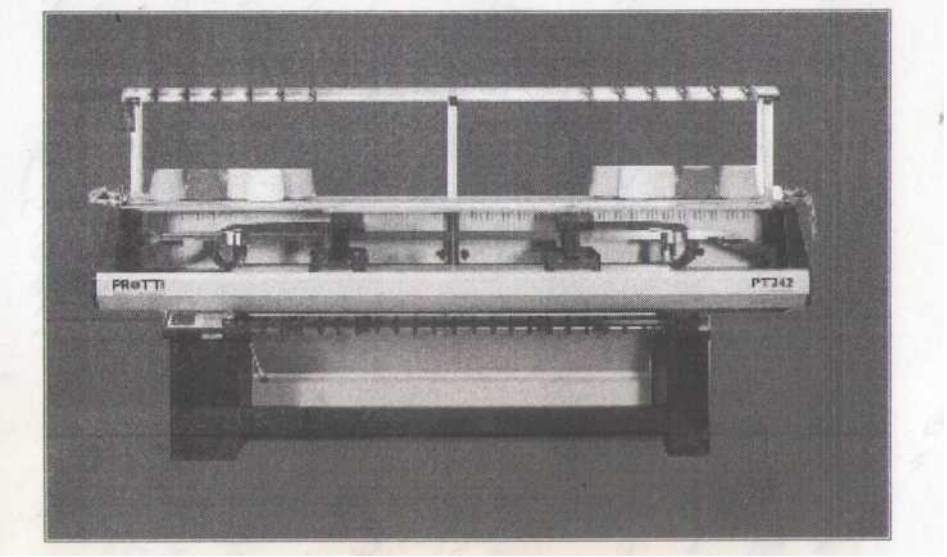


Fig. 3 Flat knitting machine PROTTI

Classes of E7 -8-10-12-14-16 with the transfer needle . Depending on the product model RT242 needles may complete without the possibility of transferring.

Carriages: a system of carriages that can be used in tandem or separately . The procedure for splitting or combining carriages is very simple, takes only a few minutes, and then the machine automatically recognizes the configuration of the carriages. PT 242 has a double transfer for each carriage , moving from the front to the rear and vice versa even during knitting. Choice of knitting and loop transfer can be performed by changing the positions of the needle and the needle jacks. Maybe knit or disable all the needles, knit or disable only the upper needle work only upper butt needles and simultaneously disable the lower needle. It’s possible to transfer loops for all needles or just the upper or lower needles.

In PT jacks 242 in each of four positions, separated or connected to the other can be operated to be disabled , and the transfer can be done while the needles may be in the operative position, and jacks - are disconnected, thereby the five selection options. The needle selection is generally used for the gum, while selection of the pattern intended for the jacks.

Working width with double sliders in one system have a working width of 218 cm, with separate carriages - working width 97cm.

Winding mechanism consists of a main roller with sectors and individually adjustable roller counters; controlled 15 different positions of 0 to 63; equipped with a mechanism that stops the machine in the event that the web curled .

Transporters yarn set on 3 double thread guides. The machine installed 12 holders of yarn, if desired, may install additional. Transporters can work independently or in pairs and are controlled independently for each carriage.

Feed yarn 12 is controlled upper tension levers (optional there may be 44) with a quick dressing and dual control buttons that gently slow down a few moves when the button is pushed in and stopped the carriage, if no button is recessed to the end.

The lateral tension is monitored by means of lateral tension lever 8 , located at each side RT242 models are available ball bearings that reduce the friction forces of yarn. For this purpose , if desired, the machine may equip positive conveying means .

The machine has:

• Various safety devices;

• connected devices cropping, which work in violation of the operation of the machine;

• LEDs indicating the operating status of the machine;

• beeps signaling to stop the machine. RT242 are internally illuminated and front lever that allows you to:

• when you scroll it - start work in the carriage, reduce its speed or set the course with the required intervals;

• lowering the lever down - stop the carriage.

The electronic programming - created with the latest technology, is equipped with a keyboard, LCD display and 1.44 MB floppy drive, designed to record multiple programs. The electronic programming exercises control over the vehicle in the event of power failure, machine also has an automatic diagnosis. Programming the machine does not provide the difficulties is very fast and can be performed on the machine. In that case, if the programming machine is far away from the location of the machine or, if necessary, amend or create a new program without stopping the machine will help software RT External.

Machine specifications PROTTI

Class	10
The width of the needle bar, mm	1800
Length Machine, mm	3000
Machine width, mm	1000
Machine weight, kg	1040

I.3 Selection and justification of knitting structure

Rib has a vertical cord appearance because the face loop wales tend to move over and in front of the reverse loop wales. As the face loops show a reverse loop intermeshing on the other side, 1+1 rib has the appearance of the technical face of plain fabric on both sides until stretched to reveal the reverse loop wales in between.

1+1 rib is production of by two sets of needles being alternately set or gated between each other. Relaxed 1+1 rib is theoretically twice the thickness and half the width of an equivalent plain fabric, but it has twice as much width-wise recoverable stretch. In practice, 1+1 rib normally relaxes by approximately 30 per cent compared with its knitting width.

1+1 rib is balanced by alternate wales of face loops on each side; it therefore lies flat without curl when cut. It is a more expensive fabric to produce than plain and is a heavier structure; the rib machine also requires finer yarn than a similar gauge plain machine. Like all weft-knitted fabrics, it can be unrove from the end knitted last by drawing the free loop heads through to the back of each stitch. It can be distinguished from plain by the fact that the loops of certain wales are withdrawn in one direction and the others in the opposite direction, whereas the loops of plain are always withdrawn in the same direction, from the technical face to the technical back.

Mock Rib is plain fabric knitted on one set of needles, with an elastic yarn inlaid by tucking and missing so that the fabric concertinas and has the appearance of 1 . 1 rib. It is knitted at the tops of plain knit socks and gloves.

Rib cannot be unrove from the end knitted first because the sinker loops are securely anchored by the cross-meshing between face and reverse loop wales. This characteristic, together with its elasticity, makes rib particularly suitable for the extremities of articles such as tops of socks, cuffs of sleeves, rib borders of garments, and stolling and strapping for cardigans. Rib structures are elastic, form-fitting, and retain warmth better than plain structures.

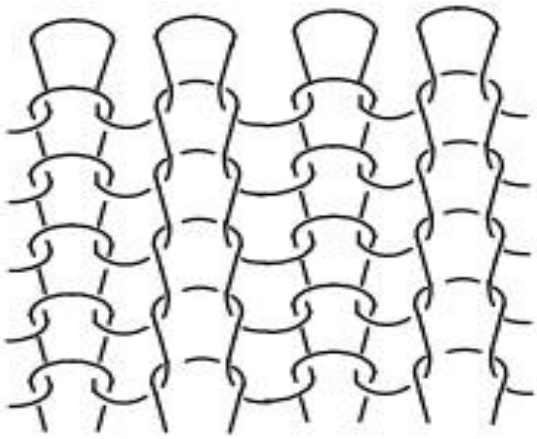


Fig. 4 Rib 1+1 structure

Plain (the stocking stitch of hand knitting) is the base structure of ladies' hosiery, fully fashioned knitwear and single-jersey fabrics. Its use in ladies' suiting was popularised by Lily Langtry (1852–1929), known as the 'Jersey Lily' after her island birthplace. Other names for plain include stockinette, whilst in the USA the term 'shaker stitch' is applied to it when knitted in a coarse gauge of about 31–2 needles per inch (25mm). The term 'plain knit' may be used instead of just 'plain', particularly when the structure has a surface design.

Its technical face is smooth, with the side limbs of the needle loops having the appearance of columns of V's in the wales.These are useful as basic units of design when knitting with different coloured yarns.

On the technical back, the heads of the needle loops and the bases of the sinker loops form columns of interlocking semi-circles, whose appearance is sometimes emphasised by knitting alternate courses in different coloured yarns.

Plain can be unroved from the course knitted last by pulling the needle loops through from the technical back, or from the course knitted first by pulling the sinker loops through from the technical face side. Loops can be prevented from unroving by binding-off.

If the yarn breaks, needle loops successively unmesh down a wale and sinker loops unmesh up a wale; this structural breakdown is termed laddering after 'Jacob's.

Laddering is particularly prevalent in ladies' hosiery, where loops of fine smooth filaments are in a tensioned state; to reduce this tendency, certain ladder-resist structures have been devised. The tendency of the cut edges of plain fabric to unrove.

Expanse - plain stitch weave, purl and face different. On the front side - sticks looped and looped out to the underside of the arc. The front side is smooth and glossy and matte and rough underside. Smooth surface has good elongation, tensile strength in the longitudinal strain.

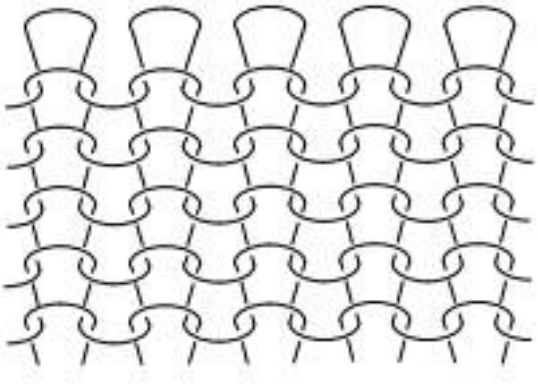


Fig.5 Plain structure

I.4 Selection and justification of raw materials

The quality of raw materials depends largely on the quality of products, operational and consumer properties of knitwear, equipment performance, rhythm of the enterprise, as well as the normal flow of the process. Textile raw materials, no matter how ideal properties it did not possess, may not be suitable for all kinds of the same products. Optimal consumer characteristics when designing the yarn, achieved mainly combined selection and blending fibers of different species and varieties, in order to obtain jerseys given the variety and quality. For this purpose, must have a sufficient assortment of materials possessing the required properties. In addition, raw materials should be prepared to provide in addition to the required quality of products, the normal course of knitting process with maximum use of modern production techniques.

Projected product is made of polyacrylonitrile. However, this is not limited assortment of raw materials from which to develop design models.

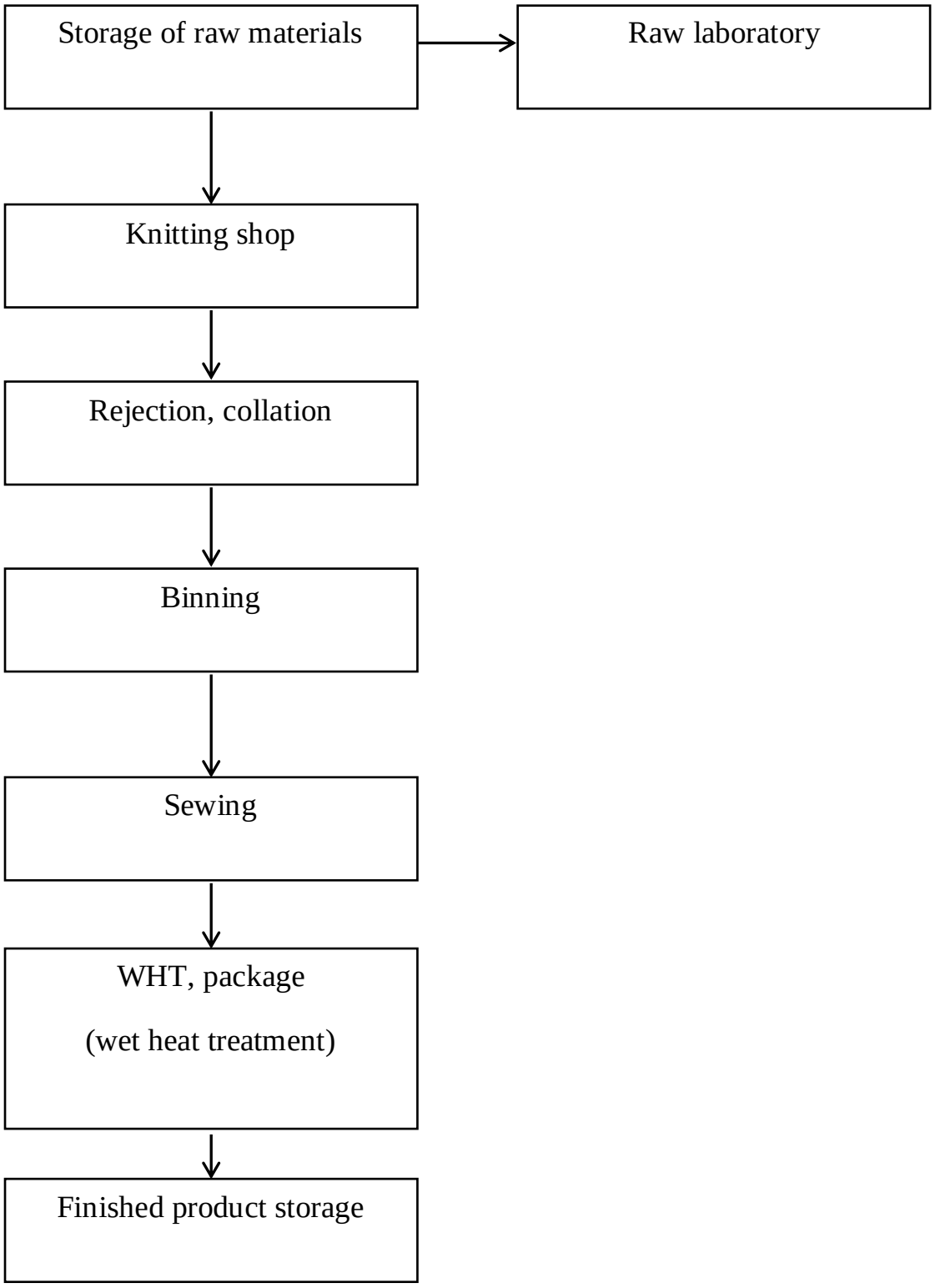
Acrylic - a synthetic yarn, raw material for which is extracted from natural gas. The main properties of acrylic yarn are: strength, thermoplastic and lightfastness. Wonderful yarns obtained by mixing acrylic with wool or mohair. Warm and comfortable things to fewer dumped.

To create good working conditions knitting equipment and get jersey high quality raw materials to meet certain requirements. Even the nicest properties on the yarn, can not be considered satisfactory if it does not meet the requirements of

product produced, or prepared for the processing of the equipment in modern conditions of production.

I.5 Selection and justification of technological process

Process chain for the production of knitted garments



Technological process - a series of interconnected, manufacturing operations occurring in a specific sequence, the processing of raw materials into finished products. Rational process used provides the least amount of time at all stages of production. This should help to study the experience of advanced enterprises, the modern technological level, which allows the introduction of new technology, the use of automated production lines for continuous processing methods, the introduction of modern workshop circle.

Storage of raw materials: raw materials arrive from the supplier to the central storage in bobbins. Reception of raw materials is carried out on the normalized (conditional) mass and stored in boxes on pallets, boxes and bags separately for parties. Stock storage of inventory occurs in an amount necessary for the smooth operation of the shop for 10 days. . " In stock necessary to maintain the required climatic conditions: 22 ° C, humidity 66%. Raw materials issued from the central storage in production in the sealed package of regulatory and unbroken mass under daily limit t subject to partisanship.

Raw laboratory: Yarns and threads made in the production of quality and quantity. Quality is defined by the following indicators: physical and mechanical properties, hidden defects, flaws and defects appearance winding. Quality inspection carried out by workers raw laboratory. Arriving at the storage yarn logged laboratory according to pay-documents and passports and certificates, determining the quality of incoming goods. Sampling for the test, according to state standards to determine the selected defect least 10 packages. The magazine storage fixed date of sampling, the number and weight. Raw laboratory identifies the important physical and mechanical quality of raw materials, according to enterprise specification.

To identify hidden defects, by request laboratory, storage issued yarn and thread for their processing in the control equipment installed. The presence of latent defects is determined by grading generated web. Based on control processing is determined by the possibility of processing raw materials on a particular type of equipment. The result of the processing and determination of physical and

mechanical properties recorded in the log laboratory. Permission to leave the party in the incoming raw material production gives deputy director of quality, based on the vendor's documentation verification and the conclusion of raw laboratory test results.

Knitting shop: Yarn shop with pantry supplied by trucks. Bobbin prior to installation on the machine scans by knitter, in case of detection of defects winding yarn unevenness, or damage the cartridge aside for later return. Refilling is made in accordance with the current specification. Filling machines and semi-finished knitting is carried out on the refueling cards designed E specialists in accordance with the approved model (standard). Fueling card provides release of products on tonnage data and consumption of raw materials, in accordance with regulatory and technical documentation. Checking filling parameters are within 15 minutes after removal of part of the product from the machine. Differences on the density of knitting and the surface density must comply with GOST, and along the length of the loop must not exceed 2%.

Knitter makes collation products by 5,10,15,20 products, then marks set by putting a label with the name and employee number, car number, model number, and article numbers filling, size and growth of product variety, the date of manufacture.

Workers serving modern flat knitting machines must be highly qualified in servicing these machines knitters have to perform various operations. Therefore, the worker should properly plan the sequence of execution of individual techniques in order to efficiently and cost-effectively meet their time. Rhythm of work throughout the working day is essential for high productivity knitters and equipment.

Rejection, collation: During collation product details check the quality of cut and pick one set of parts necessary to manufacture the product. When sorting ignore defects falling into the seam or hem products at a distance of 1-1.5 cm from the upper or lower edge of the product. Collected cut stacked in bundles of 5-10 products. For each major product parts are attached ticket indicating the control room workers, article, size and length of the article.

The main cut staffed finishing details and application materials obtained by request from the site preparation. Upon completion of acquisition cut weighed, counted the number of products on the size and type of product. Waste from cutting rent a storage, while making out the invoice for the surrender.

Binning: In the shop pantry semi product and waste takes weigher receiver which weighs products and produces records generation of knitters. Semifinished product passes binning at least 12 hours. Binning is performed to stabilize the knitting structure and shrinkage semi product. Parts of the product must be stored and transported under conditions which exclude the possibility of contamination and the appearance of puffs.

Sewing products: After binning semi product is transferred to a sewing shop.

The following requirements are sewing product:

• When routing the lines along closed lines (line stitch the sleeves), the ends of lines have to go one after the other not less than 1.5-2 cm;

• color of thread used in sewing designed model should match the color of jersey. For finishing details applied thread color finishes. To perform in hem seams reasonable to use colorless synthetic fibers;

• seams should have smooth lines without gaps stitches. Ends of all lines must be secured all thread ends trimmed;

• to prevent tension in the shoulder seams and the top of the round sleeves must be routed braid.

WHT and package: Dry-heat treatment of the finished designed product is made on the "Trikoset." The machine consists of a chamber, a vertical press for the thermal treatment of products and a section for cooling. On the chain conveyor belt machine reinforced by the holders of 20 forms. One of these forms is located in the service area, nine - in the chamber, one - the area pressed and nine in the cooling zone. Products put on the form, the width of which at 4.5-5 cm greater than the width of the product. Machine size 7.3m, 2.8m, 2.55m, working steam pressure -

about 0.4 MPa. Maximum temperature in the chamber finishes - 130 - 140 ° C, the average finish is 180 seconds.

After the WHT product is tracked in the expanded form for 10-15 minutes. This operation is performed to ensure that finished products are cooled after the WHT, given the excess moisture and do not wrinkle when packed. The product is packed in bags with the logo of the manufacturer. The product can be packed in the package when folded or hung on a hanger and the top covered by special packaging.

Finished product storage: Packed products are sent to the finished product storage, which stores either on racks or on hangers. In the storage room must maintain certain climatic conditions: temperature 22°C, humidity 65-67%.

I.6 The calculation of technological parameters of knitting structure

Calculation of technological parameters of rib 1+1 structure

by method of prof. Dalidovich. A. S.

Type of yarn: Acrylic (polyacrylonitrile)

N 32/2=16

T= $\frac{1000}{16}$ = 62,5 tex

1. Determine the thickness of the yarn:

$$F = \frac{\lambda}{\sqrt{\frac{1000}{T}}} \text{ мм} \qquad \lambda = 1{,}3$$

$$F = \frac{1{,}3}{\sqrt{\frac{1000}{62{,}5}}} = \frac{1{,}3}{4} = 0{,}325 \text{ мм}$$

2. Determine the width of the loop:

$$A = 4 \div 5 * F \ (\text{мм})$$

$$A = 4 * 0{,}325 = 1{,}3 \text{ мм}$$

3. Determine the density of the horizontal:

$$P_г = \frac{50}{A} \text{ (loops)}$$

$$P_г = \frac{50}{1,3} = 38,4 \text{ loops}$$

4. Determine the density of the vertical:

$$P_в = \frac{50}{B} \quad \text{или} \quad P_в = \frac{P_г}{C} \quad \text{loops} \qquad C = 0,7 \div 0,865$$

$$P_в = \frac{38,4}{0,7} = 55 \text{ loops}$$

5. Determine the length of the loop:

$$L = \frac{78.5}{P_г} + \frac{100}{P_в} + \pi * F \quad (\text{мм})$$

$$L = \frac{78.5}{38,4} + \frac{100}{55} + 3,14 * 0,325 = 2 + 1,81 + 3,14 * 0,325 = 4,83 \text{ мм}$$

6. Determine the height of the loop series:

$$B = 0,27 * L - \frac{1,5}{\overline{N}} \quad (\text{мм})$$

$$B = 0,27 * 4,83 - \frac{1,5}{\overline{16}} = 0,27 * 4,83 - \frac{1,5}{4} = 1,30 - 0,375 = 0,925 \text{ мм.}$$

Calculation of technological parameters of plain structure

by method of prof. Dalidovich. A. S.

1. Determine the thickness of the yarn:

$$F = \frac{\lambda}{\frac{1000}{T}} \text{ мм} \qquad \lambda = 1,3$$

$$F = \frac{1,3}{\frac{1000}{62,5}} = \frac{1,3}{4} = 0,325 \text{ мм}$$

2. Determine the width of the loop:

$$A = K * F \quad \text{мм} \qquad K = 5$$

$$A = 5 * 0,325 = 1,625 \text{ мм}$$

3. Determine the height of the loop series:

$$B = C * A \quad \text{мм} \qquad C = 0,865$$

C = factor takes into account the ratio of densities

$B = 0{,}865 * 1{,}625 = 1{,}40$ мм

4. Determine the density of the horizontal:

$$P_г = \frac{50}{A} \text{ (loops)}$$

$$P_г = \frac{50}{1{,}625} = 30{,}7 \text{ loops}$$

5. Determine the density of the vertical:

$$P_в = \frac{50}{B} \text{ (loops)}$$

$$P_в = \frac{50}{1{,}40} = 35{,}7 \text{ loops}$$

6. Determine the length of the loop:

$$L = \frac{78.5}{P_г} + \frac{100}{P_в} + \pi * F \quad (мм)$$

$$L = \frac{78.5}{30{,}7} + \frac{100}{35{,}7} + 3{,}14 * 0{,}325 = 2{,}55 + 2{,}80 + 3{,}14 * 0{,}325 = 6{,}37 \text{ мм.}$$

I.7 The calculation of the raw materials per unit of production

Calculation of consumption of raw materials to the first assortment

SIZE: 48

Knitting: Rib 1+1, plain structure

Type of yarn: Acrylic (polyacrylonitrile)

N 32/2=16

T= 62,5 tex

Technological parameters:

$A_{rib} = 4 * 0{,}325 = 1{,}3$ мм

$$B_{rib} = 0{,}27 * 4{,}83 - \frac{1{,}5}{16} = 0{,}27 * 4{,}83 - \frac{1{,}5}{4} = 1{,}30 - 0{,}375 = 0{,}925 \text{ мм.}$$

$$L_{rib} = \frac{78.5}{38,4} + \frac{100}{55} + 3,14 * 0,325 = 2 + 1,81 + 3,14 * 0,325 = 4,83 \text{ мм}$$

$$A_{plain} = 5 * 0,325 = 1,625 \text{ мм}$$

$$B_{plain} = 0,865 * 1,625 = 1,40 \text{ мм}$$

$$L_{plain} = \frac{78.5}{30,7} + \frac{100}{35,7} + 3,14 * 0,325 = 2,55 + 2,80 + 3,14 * 0,325 = 6,37 \text{ мм.}$$

Calculation of front part raw materials for the 1st assortment (Fig. 6)

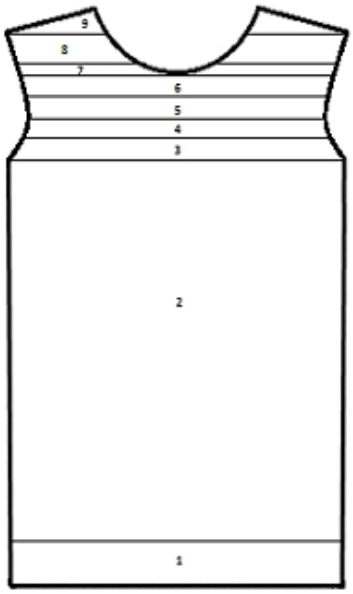


Fig. 6

Front part of sweater

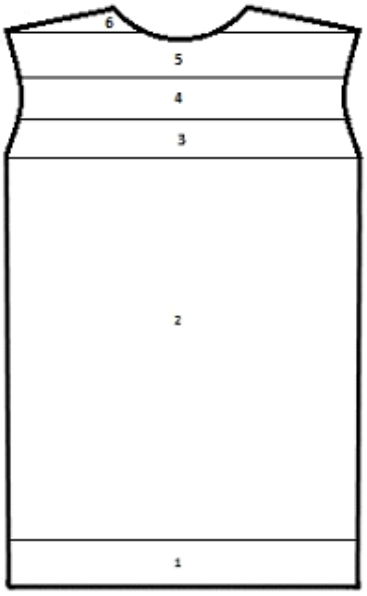


Fig. 7

Rear part of sweter

Fig. 8

Sleeves of sweater

Determine the number of needles: (wales)

$$И = \frac{Ш}{А}; \qquad \text{where:} \quad Ш = \text{width of the section.}$$

$$И_{1\ rib} = \frac{500}{1,3} = 385 \text{ pieces. Needles 1st section.}$$

$$И_{2\ plain} = \frac{500}{1,625} = 308 \text{ pieces. Needles 2nd section.}$$

$$И_{3\ plain} = \frac{500}{1{,}625} = 308 \text{ pieces. Needles third section.}$$

$$И_{4\ plain} = \frac{430}{1{,}625} = 265 \text{ pieces. Needles 4th section.}$$

$$И_{5\ plain} = \frac{420}{1{,}625} = 258 \text{ pieces. Needles 5th section.}$$

$$И_{6\ plain} = \frac{437}{1{,}625} = 269 \text{ pieces. Needles 6th section.}$$

$$И_{7\ plain} = \frac{460}{1{,}625} = 283 \text{ pieces. Needles 7th section.}$$

$$И_{8\ plain} = \frac{180 * 2}{1{,}625} = 222 \text{ pieces. Needles 8th section.}$$

$$И_{9\ plain} = \frac{142 * 2}{1{,}625} = 175 \text{ pieces. Needles 9th section.}$$

1. Determine number of course:

$$Р = \frac{Д}{В}; \qquad \text{where:} \quad Д = \text{height section.}$$

$$Р_{1\ rib} = \frac{55}{0{,}925} = 59 \text{ course. Number of course of the 1st section.}$$

$$Р_{2\ plain} = \frac{385}{1{,}40} = 275 \text{ course. Number of course of the 2nd section.}$$

$$Р_{3\ plain} = \frac{30}{1{,}40} = 21 \text{ course. Number of course third section.}$$

$$Р_{4\ plain} = \frac{30}{1{,}40} = 21 \text{ course. Number of course of the 4th section.}$$

$$Р_{5\ plain} = \frac{70}{1{,}40} = 50 \text{ course. Number of course of the 5th section.}$$

$$Р_{6\ plain} = \frac{45}{1{,}40} = 32 \text{ course. Number of course of the 6th section.}$$

$$Р_{7\ plain} = \frac{11}{1{,}40} = 8 \text{ course. Number of course of the 7th section.}$$

$$Р_{8\ plain} = \frac{41}{1{,}40} = 29 \text{ course. Number of course of the 8th section.}$$

$P_{9\,plain} = \frac{18}{1{,}40} = 13$ course. Number of course of the 9th section.

2. Determine the number of loops of the front part:

$$m = \frac{И * Р}{1000}; \quad \text{(thousand)}$$

$m_{1\,rib} = \frac{385 * 59}{1000} = 22{,}7$ thousand. The number of loops of the 1st section.

$m_{2\,plain} = \frac{308 * 275}{1000}$

$= 84{,}7$ thousand. The number of loops of the 2nd section.

$m_{3\,plain} = \frac{308 * 21}{1000} = 6{,}5$ thousand. The Number of loops third section.

$m_{4\,plain} = \frac{265 * 21}{1000} = 5{,}6$ thousand. The number of loops of the 4th section.

$m_{5\,plain} = \frac{258 * 50}{1000} = 12{,}9$ thousand. The number of loops of the 5th section.

$m_{6\,plain} = \frac{269 * 32}{1000} = 8{,}6$ thousand. The number of loops of the 6th section.

$m_{7\,plain} = \frac{283 * 8}{1000} = 2{,}3$ thousand. The number of loops of the 7th section.

$m_{8\,plain} = \frac{222 * 29}{1000} = 6{,}4$ thousand. The number of loops of the 8th section.

$m_{9\,plain} = \frac{175 * 13}{1000} = 2{,}3$ thousand. The number of loops of the 9th section.

3. Determine the length of the yarn:

$L = m * l * 2;$ (м)

$L_{1\,rib} = 22{,}7 * 4{,}83 * 2 = 219$ м. Length of a thread of the 1st section.

$L_{2\,plain} = 84{,}7 * 6{,}37 * 2 = 1100$ м. Length of a thread of the 2nd section.

$L_{3\,plain} = 6{,}5 * 6{,}37 * 2 = 83$ м. Length of a thread of the 3rd section.

$L_{4\,plain} = 5{,}6 * 6{,}37 * 2 = 71$ м. Length of a thread of the 4th section.

$L_{5\,plain} = 12{,}9 * 6{,}37 * 2 = 164$ м. Length of a thread of the 5th section.

$L_{6\ plain} = 8{,}6 * 6{,}37 * 2 = 109$ м. Length of a thread of the 6th section.

$L_{7\ plain} = 2{,}3 * 6{,}37 * 2 = 29$ м. Length of a thread of the 7th section.

$L_{8\ plain} = 6{,}4 * 6{,}37 * 2 = 81$ м. Length of a thread of the 8th section.

$L_{9\ plain} = 2{,}3 * 6{,}37 * 2 = 29$ м. Length of a thread of the 9th section.

4. Determine the weight of section:

$$Q = \frac{L}{N}; \quad \text{(g)}$$

$Q_{1\ rib} = \frac{219}{16} = 13{,}7$ g. Weight 1st section.

$Q_{2\ plain} = \frac{1100}{16} = 67{,}4$ g. Weight 2nd section.

$Q_{3\ plain} = \frac{83}{16} = 5{,}1$ g. Weight 3rd section.

$Q_{4\ plain} = \frac{71}{16} = 4{,}4$ g. Weight 4th section.

$Q_{5\ plain} = \frac{164}{16} = 10{,}2$ g. Weight 5th section.

$Q_{6\ plain} = \frac{109}{16} = 6{,}8$ g. Weight 6th section.

$Q_{7\ plain} = \frac{29}{16} = 1{,}8$ g. Weight 7th section.

$Q_{8\ plain} = \frac{81}{16} = 5$ g. Weight 8th section.

$Q_{9\ plain} = \frac{29}{16} = 1{,}8$ g. Weight 9th section.

$$Q = Q_1 + Q_2 + Q_3 + Q_4 + Q_5 + Q_6 + Q_7 + Q_8 + Q_9 \quad \text{g}.$$

$$Q = 13{,}7 + 67{,}4 + 5{,}1 + 4{,}4 + 10{,}2 + 6{,}8 + 1{,}8 + 5 + 1{,}8 = 116{,}2 \text{ g}.$$

Calculation of front part waste materials of the first assortment

1. Determine the number of needles: (wales)

$$И = \frac{Ш}{А}; \qquad \text{where:} \quad Ш = \text{width of the section.}$$

$И_{1\ rib}, И_{2\ plain}$ No of waste on site 1 and 2.

$$И_{3\ plain} = \frac{35}{1{,}625} = 22 * 2 = 44 \text{ pieces. Needles third section.}$$

$$И_{4\ plain} = \frac{6}{1{,}625} = 4 * 2 = 8 \text{ pieces. Needles 4th section.}$$

$$И_{5\ plain} = \frac{5}{1{,}625} = 3 * 2 = 6 \text{ pieces. Needles 5th section.}$$

$$И_{6\ plain} = \frac{8}{1{,}625} = 5 * 2 = 10 \text{ pieces. Needles 6th section.}$$

$$И_{7\ plain} = \frac{127}{1{,}625} = 78 \text{ pieces. Needles 7th section.}$$

$$И_{8\ plain} = \frac{91}{1{,}625} = 56 \text{ pieces. Needles 8th section.}$$

$$И_{9\ plain} = \frac{284}{1{,}625} = 175 \text{ pieces. Needles 9th section.}$$

2. Determine number of course:

$$Р = \frac{Д}{В}; \qquad \text{where: } Д = \text{height section.}$$

$Р_{1\ rib}, Р_{2\ plain}$ No of waste on site 1 and 2.

$$Р_{3\ plain} = \frac{30}{1{,}40} = 21 \text{ course. Number of course of the 3rd section.}$$

$$Р_{4\ plain} = \frac{30}{1{,}40} = 21 \text{ course. Number of course of the 4th section.}$$

$$Р_{5\ plain} = \frac{70}{1{,}40} = 50 \text{ course. Number of course of the 5th section.}$$

$$Р_{6\ plain} = \frac{45}{1{,}40} = 32 \text{ course. Number of course of the 6th section.}$$

$$Р_{7\ plain} = \frac{11}{1{,}40} = 8 \text{ course. Number of course of the 7th section.}$$

$$Р_{8\ plain} = \frac{41}{1{,}40} = 29 \text{ course. Number of course of the 8th section.}$$

$$Р_{9\ plain} = \frac{18}{1{,}40} = 13 \text{ course. Number of course of the 9th section.}$$

3. Determine the number of loops of the front part:

$$m = \frac{И * Р}{1000}; \quad \text{(thousand)}$$

$m_{1\ rib}, m_{2\ plain}$ No of waste on site 1 and 2.

$m_{3\ plain} = \frac{44 * 21}{1000} = 0{,}9$ thousand. The Number of loops third section.

$m_{4\ plain} = \frac{8 * 21}{1000} = 0{,}2$ thousand. The number of loops of the 4th section.

$m_{5\ plain} = \frac{6 * 50}{1000} = 0{,}3$ thousand. The number of loops of the 5th section.

$m_{6\ plain} = \frac{10 * 32}{1000} = 0{,}35$ thousand. The number of loops of the 6th section.

$m_{7\ plain} = \frac{78 * 8}{1000} = 0{,}6$ thousand. The number of loops of the 7th section.

$m_{8\ plain} = \frac{56 * 29}{1000} = 1{,}6$ thousand. The number of loops of the 8th section.

$m_{9\ plain} = \frac{175 * 13}{1000} = 2{,}2$ thousand. The number of loops of the 9th section.

4. Determine the length of the yarn:

$$L = \frac{m}{2} * l; \quad (м)$$

$L_{1\ rib}, L_{2\ plain}$ No of waste on site 1 and 2.

$L_{3\ plain} = \frac{0{,}9}{2} * 6{,}37 = 3$ м. Length of a thread of the 3rd section.

$L_{4\ plain} = \frac{0{,}2}{2} * 6{,}37 = 0{,}6$ м. Length of a thread of the 4th section.

$L_{5\ plain} = \frac{0{,}3}{2} * 6{,}37 = 1$ м. Length of a thread of the 5th section.

$L_{6\ plain} = \frac{0{,}35}{2} * 6{,}37 = 1{,}2$ м. Length of a thread of the 6th section.

$L_{7\ plain} = \frac{0{,}6}{2} * 6{,}37 = 2$ м. Length of a thread of the 7th section.

$L_{8\ plain} = \frac{1{,}6}{2} * 6{,}37 = 5$ м. Length of a thread of the 8th section.

$L_{9\,plain} = \frac{2,2}{2} * 6,37 = 7$ м. Length of a thread of the 9th section.

5. Determine the weight of section:

$Q = \frac{L}{N};$ (g)

$Q_{1\,rib}, Q_{2\,plain}$ No of waste on site 1 and 2.

$Q_{3\,plain} = \frac{3}{16} = 0,2$ g. Weight 3rd section.

$Q_{4\,plain} = \frac{0,6}{16} = 0,05$ g. Weight 4th section.

$Q_{5\,plain} = \frac{1}{16} = 0,06$ g. Weight 5th section.

$Q_{6\,plain} = \frac{1,2}{16} = 0,07$ g. Weight 6th section.

$Q_{7\,plain} = \frac{2}{16} = 0,1$ g. Weight 7th section.

$Q_{8\,plain} = \frac{5}{16} = 0,3$ g. Weight 8th section.

$Q_{9\,plain} = \frac{7}{16} = 0,4$ g. Weight 9th section.

$$Q = Q_1 + Q_2 + Q_3 + Q_4 + Q_5 + Q_6 + Q_7 + Q_8 + Q_9 \quad \text{g}.$$

$$Q = 0,2 + 0,05 + 0,06 + 0,07 + 0,1 + 0,3 + 0,4 = 1,18 \text{ g}.$$

Calculation of rear part raw materials for the 1st assortment (Fig. 7)

1. Determine the number of needles: (wales)

$И = \frac{Ш}{А};$ where: Ш = width of the section.

$И_{1\,rib} = \frac{500}{1,3} = 385$ pieces. Needles 1st section.

$И_{2\,plain} = \frac{500}{1,625} = 308$ pieces. Needles 2nd section.

$И_{3\,plain} = \frac{500}{1,625} = 308$ pieces. Needles 3rd section.

$И_{4\ plain} = \frac{441}{1{,}625} = 271$ pieces. Needles 4th section.

$И_{5\ plain} = \frac{460}{1{,}625} = 283$ pieces. Needles 5th section.

$И_{6\ plain} = \frac{163 * 2}{1{,}625} = 201$ pieces. Needles 6th section.

2. Determine number of course:

$P = \frac{Д}{В}$; where: Д = height section.

$P_{1\ rib} = \frac{55}{0{,}925} = 59$ course. Number of course of the 1st section.

$P_{2\ plain} = \frac{385}{1{,}40} = 275$ course. Number of course of the 2nd section.

$P_{3\ plain} = \frac{70}{1{,}40} = 50$ course. Number of course of the 3rd section.

$P_{4\ plain} = \frac{110}{1{,}40} = 78$ course. Number of course of the 4th section.

$P_{5\ plain} = \frac{48}{1{,}40} = 34$ course. Number of course of the 5th section.

$P_{6\ plain} = \frac{17}{1{,}40} = 12$ course. Number of course of the 6th section.

3. Determine the number of loops of the front part:

$m = \frac{И * P}{1000}$; (thousand)

$m_{1\ rib} = \frac{385 * 59}{1000} = 22{,}7$ thousand. The number of loops of the 1st section.

$m_{2\ plain} = \frac{308 * 275}{1000}$

$= 84{,}7$ thousand. The number of loops of the 2nd section.

$m_{3\ plain} = \frac{308 * 50}{1000} = 15{,}4$ thousand. The number of loops of the 3rd section.

$m_{4\ plain} = \frac{271 * 78}{1000} = 21{,}1$ thousand. The number of loops of the 4th section.

$m_{5\ plain} = \frac{283 * 34}{1000} = 9{,}6$ thousand. The number of loops of the 5th section.

$m_{6\,plain} = \frac{201 * 12}{1000} = 2{,}4$ thousand. The number of loops of the 7th section.

4. Determine the length of the yarn:

$L = m * l * 2;$ (м)

$L_{1\,rib} = 22{,}7 * 4{,}83 * 2 = 219$ м. Length of a thread of the 1st section.

$L_{2\,plain} = 84{,}7 * 6{,}37 * 2 = 1100$ м. Length of a thread of the 2nd section.

$L_{3\,plain} = 15{,}4 * 6{,}37 * 2 = 196$ м. Length of a thread of the 3rd section.

$L_{4\,plain} = 21{,}1 * 6{,}37 * 2 = 269$ м. Length of a thread of the 4th section.

$L_{5\,plain} = 9{,}6 * 6{,}37 * 2 = 122$ м. Length of a thread of the 5th section.

$L_{6\,plain} = 2{,}4 * 6{,}37 * 2 = 30$ м. Length of a thread of the 6th section.

5.Determine the weight of section:

$Q = \frac{L}{N};$ (g)

$Q_{1\,rib} = \frac{219}{16} = 13{,}7$ g. Weight 1st section.

$Q_{2\,plain} = \frac{1100}{16} = 67{,}4$ g. Weight 2nd section.

$Q_{3\,plain} = \frac{196}{16} = 12{,}2$ g. Weight 3rd section.

$Q_{4\,plain} = \frac{269}{16} = 16{,}8$ гр. g. Weight 4th section.

$Q_{5\,plain} = \frac{122}{16} = 7{,}6$ g. Weight 5th section.

$Q_{6\,plain} = \frac{30}{16} = 1{,}9$ g. Weight 6th section.

$Q = Q_1 + Q_2 + Q_3 + Q_4 + Q_5 + Q_6$ g .

$Q = 13{,}7 + 67{,}4 + 12{,}2 + 16{,}8 + 7{,}6 + 1{,}9 = 119{,}6$ g.

Calculation of rear part waste materials of the 1st assortment

1. Determine the number of needles: (wales)

$И = \frac{Ш}{А}$; where: Ш = width of the section.

$И_{1\ rib}, И_{2\ plain}$ No waste on site 1 and 2.

$И_{3\ plain} = \frac{30}{1{,}625} = 18 * 2 = 36$ pieces. Needles 3rd section.

$И_{4\ plain} = \frac{16}{1{,}625} = 10 * 2 = 20$ pieces. Needles 4th section.

$И_{5\ plain} = \frac{153}{1{,}625} = 94$ шт. pieces. Needles 5th section.

$И_{6\ plain} = \frac{162}{1{,}625} = 100 * 2 = 200$ pieces. Needles 6th section.

2. Determine number of course:

$Р = \frac{Д}{В}$; where: Д = height section.

$Р_{1\ rib}, Р_{2\ plain}$ No waste on site 1 and 2.

$Р_{3\ plain} = \frac{70}{1{,}40} = 50$ course. Number of course 3rd section.

$Р_{4\ plain} = \frac{110}{1{,}40} = 71$ course. Number of course 4th section.

$Р_{5\ plain} = \frac{68}{1{,}40} = 48$ course. Number of course 5th section.

$Р_{6\ plain} = \frac{17}{1{,}40} = 12$ course. Number of course 6th section.

3. Determine the number of loops of the front part:

$m = \frac{И * Р}{1000}$; (thousand)

$m_{1\ rib}, m_{2\ plain}$ No waste on site 1 and 2.

$m_{3\ plain} = \frac{36 * 50}{1000} = 1{,}8$ thousand. The Number of loops 3rd section.

$m_{4\ plain} = \frac{71 * 20}{1000} = 1{,}4$ thousand. The Number of loops 4th section.

$m_{5\ plain} = \frac{94 * 16}{1000} = 1{,}5$ thousand. The Number of loops 5th section.

$m_{6\,plain} = \frac{200 * 12}{1000} = 2{,}4$ thousand. The Number of loops 6th section.

4. Determine the length of the yarn:

$L = \frac{m}{2} * l;$ (м)

$L_{1\,rib}, L_{2\,plain}$ No waste on site 1 and 2.

$L_{3\,plain} = \frac{1{,}8}{2} * 6{,}37 = 6$ м. Length of a thread of the 3rd section.

$L_{4\,plain} = \frac{1{,}4}{2} * 6{,}37 = 4$ м. Length of a thread of the 4th section.

$L_{5\,plain} = \frac{1{,}5}{2} * 6{,}37 = 4{,}5$ м. Length of a thread of the 5th section.

$L_{6\,plain} = \frac{2{,}4}{2} * 6{,}37 = 7{,}5$ м. Length of a thread of the 6th section.

5. Determine the weight of section:

$Q = \frac{L}{N};$ (g)

$Q_{1\,rib}, Q_{2\,plain}$ No waste on site 1 and 2.

$Q_{3\,plain} = \frac{6}{16} = 0{,}35$ g. Weight 3rd section.

$Q_{4\,plain} = \frac{4}{16} = 0{,}25$ g. Weight 4th section.

$Q_{5\,plain} = \frac{4{,}5}{16} = 0{,}3$ g. Weight 5th section.

$Q_{6\,plain} = \frac{7{,}5}{16} = 0{,}45$ g. Weight 6th section.

$Q = Q_1 + Q_2 + Q_3 + Q_4 + Q_5 + Q_6$ g .

$Q = 0{,}35 + 0{,}25 + 0{,}3 + 0{,}45 = 1{,}35$ g.

Calculation of sleeveless raw materials for the 1st assortment (Fig. 8)

1. Determine the number of needles: (wales)

1. $И = \frac{Ш}{А};$ where: Ш = width of the section.

$$И_{1\ rib} = \frac{100 * 2}{1{,}3} = 154 * 2 = 308 \text{ pieces. Needles 1st section.}$$

$$И_{2\ plain} = \frac{125 * 2}{1{,}625} = 154 * 2 = 308 \text{ pieces. Needles 2nd section.}$$

$$И_{3\ plain} = \frac{150 * 2}{1{,}625} = 185 * 2 = 370 \text{ pieces. Needles 3rd section.}$$

$$И_{4\ plain} = \frac{175 * 2}{1{,}625} = 215 * 2 = 430 \text{ pieces. Needles 4th section.}$$

$$И_{5\ plain} = \frac{200 * 2}{1{,}625} = 246 * 2 = 492 \text{ pieces. Needles 5th section.}$$

$$И_{6\ plain} = \frac{200 * 2}{1{,}625} = 246 * 2 = 492 \text{ pieces. Needles 6th section.}$$

$$И_{7\ plain} = \frac{158 * 2}{1{,}625} = 194 * 2 = 388 \text{ pieces. Needles 7th section.}$$

$$И_{8\ plain} = \frac{138 * 2}{1{,}625} = 170 * 2 = 340 \text{ pieces. Needles 8th section.}$$

$$И_{9\ plain} = \frac{120 * 2}{1{,}625} = 148 * 2 = 296 \text{ pieces. Needles 9th section.}$$

$$И_{10\ plain} = \frac{97 * 2}{1{,}625} = 119 * 2 = 238 \text{ pieces. Needles 10th section.}$$

$$И_{11\ plain} = \frac{60 * 2}{1{,}625} = 74 * 2 = 148 \text{ pieces. Needles 11th section.}$$

2. Determine number of course:

$$\text{P} = \frac{\text{Д}}{\text{В}}; \qquad \text{where: } \text{Д} = \text{height section.}$$

$$\text{P}_{1\ rib} = \frac{55}{0{,}925} = 59 \text{ course. Number of course of the 1st section.}$$

$$\text{P}_{2\ plain} = \frac{95}{1{,}40} = 68 \text{ course. Number of course of the 2nd section.}$$

$$\text{P}_{3\ plain} = \frac{100}{1{,}40} = 71 \text{ course. Number of course of the 3rd section.}$$

$$\text{P}_{4\ plain} = \frac{100}{1{,}40} = 71 \text{ course. Number of course of the 4th section.}$$

$$\text{P}_{5\ plain} = \frac{90}{1{,}40} = 64 \text{ course. Number of course of the 5th section.}$$

$P_{6\ plain} = \frac{20}{1{,}40} = 14$ course. Number of course of the 6th section.

$P_{7\ plain} = \frac{20}{1{,}40} = 14$ course. Number of course of the 7th section.

$P_{8\ plain} = \frac{20}{1{,}40} = 14$ course. Number of course of the 8th section.

$P_{9\ plain} = \frac{20}{1{,}40} = 14$ рядов. course. Number of course of the 9th section.

$P_{10\ plain} = \frac{20}{1{,}40} = 14$ course. Number of course of the 10th section.

$P_{11\ plain} = \frac{10}{1{,}40} = 7$ course. Number of course of the 11th section.

3. Determine the number of loops of the front part:

$m = \frac{И * P}{1000}$; (thousand)

$m_{1\ rib} = \frac{308 * 59}{1000} = 18{,}1$ thousand. The number of loops of the 1st section.

$m_{2\ plain} = \frac{308 * 68}{1000}$

$= 21{,}0$ thousand. The number of loops of the 2nd section.

$m_{3\ plain} = \frac{370 * 71}{1000} = 26{,}2$ thousand. The number of loops of the 3rd section.

$m_{4\ plain} = \frac{430 * 71}{1000} = 30{,}5$ thousand. The number of loops of the 4th section.

$m_{5\ plain} = \frac{492 * 64}{1000} = 31{,}4$ thousand. The number of loops of the 5th section.

$m_{6\ plain} = \frac{492 * 14}{1000} = 6{,}8$ thousand. The number of loops of the 6th section.

$m_{7\ plain} = \frac{388 * 14}{1000} = 5{,}4$ thousand. The number of loops of the 7th section.

$m_{8\ plain} = \frac{340 * 14}{1000} = 4{,}7$ thousand. The number of loops of the 8th section.

$m_{9\ plain} = \frac{296 * 14}{1000} = 4{,}1$ thousand. The number of loops of the 9th section.

$$m_{10\ plain} = \frac{238 * 14}{1000}$$

$= 3{,}3$ thousand. The number of loops of the 10th section.

$$m_{11\ plain} = \frac{148 * 7}{1000} = 1{,}0 \text{ thousand. The number of loops of the 11th section.}$$

4. Determine the length of the yarn:

$L = m * l * 2;$ (м)

$L_{1\ rib} = 18{,}1 * 4{,}83 * 2 = 175$ м. Length of a thread of the 1st section.

$L_{2\ plain} = 21{,}0 * 6{,}37 * 2 = 267$ м. Length of a thread of the 2nd section.

$L_{3\ plain} = 26{,}2 * 6{,}37 * 2 = 334$ м. Length of a thread of the 3rd section.

$L_{4\ plain} = 30{,}5 * 6{,}37 * 2 = 388$ м. Length of a thread of the 4th section.

$L_{5\ plain} = 31{,}4 * 6{,}37 * 2 = 400$ м. Length of a thread of the 5th section.

$L_{6\ plain} = 6{,}8 * 6{,}37 * 2 = 87$ м. Length of a thread of the 6th section.

$L_{7\ plain} = 5{,}4 * 6{,}37 * 2 = 69$ м. Length of a thread of the 7th section.

$L_{8\ plain} = 4{,}7 * 6{,}37 * 2 = 60$ м. Length of a thread of the 8th section.

$L_{9\ plain} = 4{,}1 * 6{,}37 * 2 = 52$ м. Length of a thread of the 9th section.

$L_{10\ plain} = 3{,}3 * 6{,}37 * 2 = 42$ м. Length of a thread of the 10th section.

$L_{11\ plain} = 1{,}0 * 6{,}37 * 2 = 13$ м. Length of a thread of the 11th section.

5. Determine the weight of section:

$$Q = \frac{L}{N}; \quad \text{(g)}$$

$$Q_{1\ rib} = \frac{175}{16} = 10{,}9 \text{ g. Weight 1st section.}$$

$$Q_{2\ plain} = \frac{267}{16} = 16{,}7 \text{ g. Weight 2nd section.}$$

$$Q_{3\ plain} = \frac{334}{16} = 20{,}8 \text{ g. Weight 3rd section.}$$

$$Q_{4\ plain} = \frac{388}{16} = 24{,}2 \text{ g. Weight 4th section.}$$

$$Q_{5\ plain} = \frac{400}{16} = 25{,}0 \text{ g. Weight 5th section.}$$

$Q_{6\,plain} = \frac{87}{16} = 5{,}4$ g. Weight 6th section.

$Q_{7\,plain} = \frac{69}{16} = 4{,}3$ g. Weight 7th section.

$Q_{8\,plain} = \frac{60}{16} = 3{,}7$ g. Weight 8th section.

$Q_{9\,plain} = \frac{52}{16} = 3{,}2$ g. Weight 9th section.

$Q_{10\,plain} = \frac{42}{16} = 2{,}6$ g. Weight 10th section.

$Q_{11\,plain} = \frac{13}{16} = 0{,}7$ g. Weight 11th section.

$$Q = Q_1 + Q_2 + Q_3 + Q_4 + Q_5 + Q_6 + Q_7 + Q_8 + Q_9 + Q_{10} + Q_{11} \quad \text{g}.$$

$$Q = 10{,}9 + 16{,}7 + 20{,}8 + 24{,}2 + 25{,}0 + 5{,}4 + 4{,}3 + 3{,}7 + 3{,}2 + 2{,}6 + 0{,}7 =$$

$= 117{,}5$ g.

Calculation of waste materials sleeves 1st assortment

1. Determine the number of needles: (wales)

$И = \frac{Ш}{А}$; where: Ш = width of the section.

$И_{1\,rib}$ – No waste on site 1.

$И_{2\,plain} = \frac{25}{1{,}625} = 15 * 4 = 60$ pieces. Needles 2nd section.

$И_{3\,plain} = \frac{25}{1{,}625} = 15 * 4 = 60$ pieces. Needles 3rd section.

$И_{4\,plain} = \frac{25}{1{,}625} = 15 * 4 = 60$ pieces. Needles 4th section.

$И_{5\,plain} = \frac{25}{1{,}625} = 15 * 4 = 60$ pieces. Needles 5th section.

$И_{6\,plain} = \frac{42}{1{,}625} = 26 * 4 = 104$ pieces. Needles 6th section.

$И_{7\,plain} = \frac{20}{1{,}625} = 12 * 4 = 48$ pieces. Needles 7th section.

$И_{8\,plain} = \frac{20}{1{,}625} = 12 * 4 = 48$ pieces. Needles 8th section.

$И_{9\,plain} = \frac{23}{1{,}625} = 14 * 4 = 28$ pieces. Needles 9th section.

$И_{10\,plain} = \frac{37}{1{,}625} = 23 * 4 = 92$ pieces. Needles 10th section.

$И_{11\,plain} = \frac{40}{1{,}625} = 25 * 4 = 100$ pieces. Needles 11th section.

2. Determine number of course:

$Р = \frac{Д}{В}$; where: Д = height section.

$Р_{1\,rib}$ – No waste on site 1.

$Р_{2\,plain} = \frac{95}{1{,}40} = 68$ course. Number of course of the 2nd section.

$Р_{3\,plain} = \frac{100}{1{,}40} = 71$ course. Number of course of the 3rd section.

$Р_{4\,plain} = \frac{100}{1{,}40} = 71$ course. Number of course of the 4th section.

$Р_{5\,plain} = \frac{90}{1{,}40} = 64$ course. Number of course of the 5th section.

$Р_{6\,plain} = \frac{20}{1{,}40} = 14$ course. Number of course of the 6th section.

$Р_{7\,plain} = \frac{20}{1{,}40} = 14$ course. Number of course of the 7th section.

$Р_{8\,plain} = \frac{20}{1{,}40} = 14$ course. Number of course of the 8th section.

$Р_{9\,plain} = \frac{20}{1{,}40} = 14$ course. Number of course of the 9th section.

$Р_{10\,plain} = \frac{20}{1{,}40} = 14$ course. Number of course of the 10th section.

$Р_{11\,plain} = \frac{10}{1{,}40} = 7$ course. Number of course of the 11th section.

3. Determine the number of loops of the front part:

$$m = \frac{И * Р}{1000}; \quad \text{(thousand)}$$

$m_{1\,rib}$ – No waste on site 1.

$m_{2\,plain} = \frac{60 * 68}{1000} = 4{,}0$ thousand. The number of loops of the 2nd section.

$m_{3\,plain} = \frac{60 * 71}{1000} = 4{,}2$ thousand. The number of loops of the 3rd section.

$m_{4\,plain} = \frac{60 * 71}{1000} = 4{,}2$ thousand. The number of loops of the 4th section.

$m_{5\,plain} = \frac{60 * 64}{1000} = 3{,}8$ thousand. The number of loops of the 5th section.

$m_{6\,plain} = \frac{104 * 14}{1000} = 1{,}4$ thousand. The number of loops of the 6th section.

$m_{7\,plain} = \frac{48 * 14}{1000} = 0{,}6$ thousand. The number of loops of the 7th section.

$m_{8\,plain} = \frac{48 * 14}{1000} = 0{,}6$ thousand. The number of loops of the 8th section.

$m_{9\,plain} = \frac{56 * 14}{1000} = 0{,}8$ thousand. The number of loops of the 9th section.

$m_{10\,plain} = \frac{92 * 14}{1000} = 1{,}2$ thousand. The number of loops of the 10th section.

$m_{11\,plain} = \frac{100 * 7}{1000} = 0{,}7$ thousand. The number of loops of the 11th section.

4. Determine the length of the yarn:

$$L = \frac{m}{2} * l; \quad (м)$$

$L_{1\,rib}$ – No waste on site 1.

$L_{2\,plain} = \frac{4{,}0}{2} * 6{,}37 = 12$ м. Length of a thread of the 2nd section.

$L_{3\,plain} = \frac{4{,}2}{2} * 6{,}37 = 13$ м. Length of a thread of the 3rd section.

$L_{4\,plain} = \frac{4{,}2}{2} * 6{,}37 = 13$ м. Length of a thread of the 4th section.

$L_{5\,plain} = \frac{3{,}8}{2} * 6{,}37 = 12$ м. Length of a thread of the 5th section.

$L_{6\,plain} = \frac{1,4}{2} * 6,37 = 4$ м. Length of a thread of the 6th section.

$L_{7\,plain} = \frac{0,6}{2} * 6,37 = 2$ м. Length of a thread of the 7th section.

$L_{8\,plain} = \frac{0,6}{2} * 6,37 = 2$ м. Length of a thread of the 8th section.

$L_{9\,plain} = \frac{0,8}{2} * 6,37 = 2,6$ м. Length of a thread of the 9th section.

$L_{10\,plain} = \frac{1,2}{2} * 6,37 = 4$ м. Length of a thread of the 10th section.

$L_{11\,plain} = \frac{0,7}{2} * 6,37 = 2,2$ м. Length of a thread of the 11th section.

5. Determine the weight of section:

$Q = \frac{L}{N};$ (g)

$Q_{1\,rib} -$ No waste on site 1.

$Q_{2\,plain} = \frac{12}{16} = 0,77 * 2 = 1,6$ g. Weight 2nd section.

$Q_{3\,plain} = \frac{13}{16} = 0,81 * 2 = 1,6$ g. Weight 3rd section.

$Q_{4\,plain} = \frac{13}{16} = 0,81 * 2 = 1,6$ g. Weight 4th section.

$Q_{5\,plain} = \frac{12}{16} = 0,75 * 2 = 1,5$ g. Weight 5th section.

$Q_{6\,plain} = \frac{4}{16} = 0,25 * 2 = 0,5$ g. Weight 6th section.

$Q_{7\,plain} = \frac{2}{16} = 0,1 * 2 = 0,2$ g. Weight 7th section.

$Q_{8\,plain} = \frac{2}{16} = 0,1 * 2 = 0,2$ g. Weight 8th section.

$Q_{9\,plain} = \frac{2,6}{16} = 0,16 * 2 = 0,3$ g. Weight 9th section.

$Q_{10\,plain} = \frac{4}{16} = 0,25 * 2 = 0,5$ g. Weight 10th section.

$Q_{11\,plain} = \frac{2,2}{16} = 0,13 * 2 = 0,3$ g. Weight 11th section.

$$Q = Q_1 + Q_2 + Q_3 + Q_4 + Q_5 + Q_6 + Q_7 + Q_8 + Q_9 + Q_{10} + Q_{11} \quad \text{g}.$$

$$Q = 1{,}6 + 1{,}6 + 1{,}6 + 1{,}5 + 0{,}5 + 0{,}2 + 0{,}22 + 0{,}3 + 0{,}5 + 0{,}3 = 8{,}3 \text{ g}.$$

Calculation of raw materials for border 1st assortment

1. Determine the number of needles: (wales)

$$\text{И} = \frac{\text{Ш}}{\text{А}}; \qquad \text{where:} \quad \text{Ш} = \text{width of the section.}$$

$$\text{И}_{rib} = \frac{460}{1{,}3} = 354 \text{ pieces.}$$

2. Determine number of course:

$$\text{Р} = \frac{\text{Д}}{\text{В}}; \qquad \text{where:} \quad \text{Д} = \text{height section.}$$

$$\text{Р}_{rib} = \frac{50}{0{,}925} = 54 \text{ course.}$$

3. Determine the number of loops of the front part:

$$m = \frac{\text{И} * \text{Р}}{1000}; \quad \text{(thousand)}$$

$$m_{rib} = \frac{354 * 54}{1000} = 19{,}1 \text{ thousand.}$$

4. Determine the length of the yarn:

$$L = m * l * 2; \quad (\text{м})$$

$$L_{rib} = 19{,}1 * 4{,}83 * 2 = 184 \text{ м.}$$

5. Determine the weight of section:

$$Q = \frac{L}{N}; \quad \text{(g)}$$

$$Q_{rib} = \frac{184}{16} = 11{,}5 \text{ g.}$$

Calculation table front part for the 1st assortment

1 - Table

Name of section	№ section	Number of course (P)	Number of needles (И)	Number of face loops, thousand. (m)	Length of yarn, м (L)	Weight of section, g (Q)	Waste cutting			
							Number of added needles	Number of loops, thousand	Length of the yarn, м	Weight, g
Belt	1	59	385	22,7	219	13,7	--	--	--	--
Lower part	2	275	308	84,7	1100	67,4	--	--	--	--
Starting armhole	3	21	308	6,5	83	5,1	44	0,9	3	0,2
Armhole	4	21	265	5,6	71	4,4	8	0,2	0,6	0,05
Armhole	5	50	258	12,9	164	10,2	6	0,3	1	0,06
Armhole	6	32	269	8,6	109	6,8	10	0,35	1,2	0,07
Shoulder	7	8	283	2,3	29	1,8	78	0,6	2	0,1
Shoulder	8	29	222	6,4	81	5,0	56	1,6	5	0,3
Sprout	9	13	175	2,3	29	1,8	175	2,2	7	0,4
Total:	--	--	--	--	--	116,2				1,18

Calculation table rear part for the 1st assortment

2 – Table

Name of section	№ section	Number of course (P)	Number of needles (И)	Number of face loops, thousand. (m)	Length of yarn, м (L)	Weight of section, g (Q)	Waste cutting			
							Number of added needles	Number of loops, thousand	Length of the yarn, м	Weight, g
Belt	1	59	385	22,7	219	13,7	--	--	--	--
Lower part	2	275	308	84,7	1100	67,4	--	--	--	--
Starting armhole	3	50	308	15,4	196	12,2	36	1,8	6	0,35
Armhole	4	78	271	21,1	269	16,8	20	1,4	4	0,25
Shoulder	5	34	283	9,6	122	7,6	94	1,5	4,5	0,3
Sprout	6	12	201	2,4	30	1,9	200	2,4	7,5	0,45
Total:	--	--	--	--	--	119,6				1,35

Calculation table sleeves for the 1st assortment

3 – Table

Name of section	№ section	Number of course (P)	Number of needles (И)	Number of face loops, thousand. (m)	Length of yarn, м (L)	Weight of section, g (Q)	Waste cutting			
							Number of added needles	Number of loops, thousand	Length of the yarn, м	Weight, g
Cuff	1	59	308	18,1	175	10,9	--	--	--	--
Extension	2	68	308	21,0	267	16,7	60	4,0	12	1,6
Extension	3	71	370	26,2	334	20,8	60	4,2	13	1,6
Extension	4	71	430	30,5	388	24,2	60	4,2	13	1,6
Extension	5	64	492	31,4	400	25	60	3,8	12	1,5
Sleeve's round	6	14	492	6,8	87	5,4	104	1,4	4	0,5
Sleeve's round	7	14	388	5,4	69	4,3	48	0,6	2	0,2
Sleeve's round	8	14	340	4,7	60	3,7	48	0,6	2	0,22
Sleeve's round	9	14	296	4,1	52	3,2	56	0,8	2,6	0,3
Sleeve's round	10	14	238	3,3	42	2,6	92	1,2	4	0,5
Sleeve's round	11	7	148	1,0	13	0,7	100	0,7	2,2	0,3
Total:	--	--	--	--	--	117,5				8,3

Calculation table border for the 1st assortment

4 – Table

Name of section	№ section	Number of course (P)	Number of needles (И)	Number of face loops, thousand. (m)	Length of yarn, м (L)	Weight of section, g (Q)	Waste cutting			
							Number of added needles	Number of loops, thousand	Length of the yarn, м	Weight, g
Border	1	54	354	19,1	184	11,5	--	--	--	--
Total:	--	--	--	--	--	11,5				--

The total raw materials expenditure for the 1st assortment (g)

5 – Table

Description of parts	Weight coupon	Including		Waste knitting	The total consumption of raw materials
		Net weight of the items	Waste cutting		
Front part	116,2	115	1,18	1,8	118
Rear part	119,6	118,2	1,35	1,8	121,4
Sleeves (two)	117,5	109,2	8,3	2,3	119,8
Border	11,5	11,5	--	0,7	12,2
Total:	364,8	353,9	10,8	6,6	371,4
			2,9%	1,77%	
			4,67%		

100 – 371,4 g

X – 10,8 g

$$100 * \frac{10,8}{371,4} = 2,9\%$$

100 – 371,4 g

X – 6,6 g

$$100 * \frac{6,6}{371,4} = 1,77\%$$

The total consumption of raw materials = 4,67%.

Calculation of consumption of raw materials to the 2nd assortment

SIZE: 46

Knitting: Rib 1+1, plain structure

Type of yarn: Acrylic (polyacrylonitrile)

N 32/2=16

T= 62,5 tex

Technological parameters:

$$A_{rib} = 4 * 0,325 = 1,3 \text{ мм}$$

$$B_{rib} = 0,27 * 4,83 - \frac{1,5}{16} = 0,27 * 4,83 - \frac{1,5}{4} = 1,30 - 0,375 = 0,925 \text{ мм.}$$

$$L_{rib} = \frac{78.5}{38,4} + \frac{100}{55} + 3,14 * 0,325 = 2 + 1,81 + 3,14 * 0,325 = 4,83 \text{ мм}$$

$$A_{plain} = 5 * 0,325 = 1,625 \text{ мм}$$

$$B_{plain} = 0,865 * 1,625 = 1,40 \text{ мм}$$

$$L_{plain} = \frac{78.5}{30,7} + \frac{100}{35,7} + 3,14 * 0,325 = 2,55 + 2,80 + 3,14 * 0,325 = 6,37 \text{ мм.}$$

Calculation of front part raw materials for the 2nd assortment (Fig. 9)

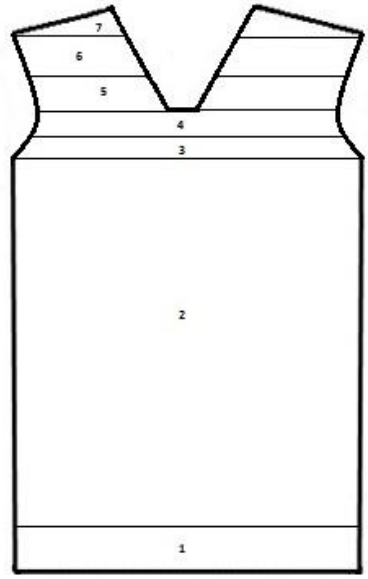


Fig. 9
Front part of pullover

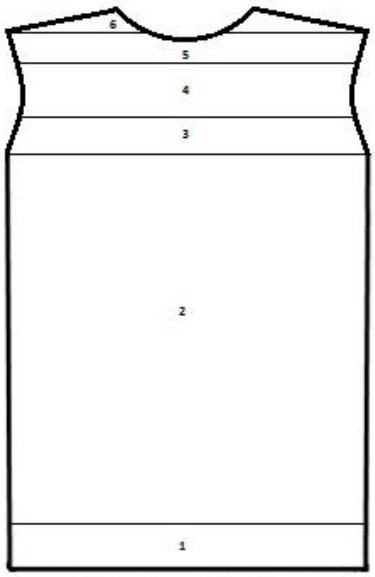


Fig. 10
Rear part of pullover

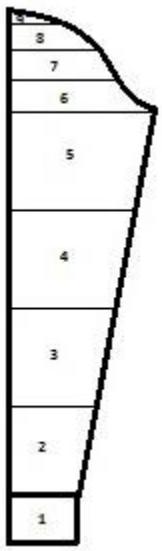


Fig. 11
Sleeves of pullover

1. Determine the number of needles: (wales)

$И = \frac{Ш}{А}$; where: Ш = width of the section.

$И_{1\ rib} = \frac{480}{1,3} = 369$ pieces. Needles 1st section.

$И_{2\ plain} = \frac{480}{1,625} = 295$ pieces. Needles 2nd section.

$И_{3\ plain} = \frac{480}{1,625} = 295$ pieces. Needles 3rd section.

$И_{4\ plain} = \frac{410}{1,625} = 252$ pieces. Needles 4th section.

$И_{5\ plain} = \frac{190 * 2}{1,625} = 234$ pieces. Needles 5th section.

$$И_{6\ plain} = \frac{185 * 2}{1{,}625} = 228 \text{ pieces. Needles 6th section.}$$

$$И_{7\ plain} = \frac{142 * 2}{1{,}625} = 175 \text{ pieces. Needles 7th section.}$$

2. Determine number of course:

$$Р = \frac{Д}{В}; \qquad \text{where:} \quad Д = \text{height section.}$$

$$Р_{1\ rib} = \frac{65}{0{,}925} = 70 \text{ course. Number of course of the 1st section.}$$

$$Р_{2\ plain} = \frac{345}{1{,}40} = 246 \text{ course. Number of course of the 2nd section.}$$

$$Р_{3\ plain} = \frac{30}{1{,}40} = 21 \text{ course. Number of course of the 3rd section.}$$

$$Р_{4\ plain} = \frac{40}{1{,}40} = 25 \text{ course. Number of course of the 4th section.}$$

$$Р_{5\ plain} = \frac{60}{1{,}40} = 43 \text{ course. Number of course of the 5th section.}$$

$$Р_{6\ plain} = \frac{97}{1{,}40} = 69 \text{ course. Number of course of the 6th section.}$$

$$Р_{7\ plain} = \frac{18}{1{,}40} = 13 \text{ course. Number of course of the 7th section.}$$

3. Determine the number of loops of the front part:

$$m = \frac{И * Р}{1000}; \quad \text{(thousand)}$$

$$m_{1\ rib} = \frac{369 * 70}{1000} = 25{,}8 \text{ thousand. The number of loops of the 1st section.}$$

$$m_{2\ plain} = \frac{295 * 246}{1000}$$

$$= 72{,}5 \text{ thousand. The number of loops of the 2nd section.}$$

$$m_{3\ plain} = \frac{295 * 21}{1000} = 6{,}1 \text{ thousand. The number of loops of the 3rd section.}$$

$$m_{4\ plain} = \frac{252 * 25}{1000} = 6{,}3 \text{ thousand. The number of loops of the 4th section.}$$

$$m_{5\ plain} = \frac{234 * 43}{1000} = 10{,}0 \text{ thousand. The number of loops of the 5th section.}$$

$m_{6\,plain} = \frac{228 * 69}{1000} = 15{,}7$ thousand. The number of loops of the 6th section.

$m_{7\,plain} = \frac{175 * 13}{1000} = 2{,}2$ thousand. The number of loops of the 7th section.

4. Determine the length of the yarn:

$L = m * l * 2;$ (м)

$L_{1\,rib} = 25{,}8 * 4{,}83 * 2 = 249$ м. Length of a thread of the 1st section.

$L_{2\,plain} = 72{,}5 * 6{,}37 * 2 = 924$ м. Length of a thread of the 2nd section.

$L_{3\,plain} = 6{,}1 * 6{,}37 * 2 = 78$ м. Length of a thread of the 3rd section.

$L_{4\,plain} = 6{,}3 * 6{,}37 * 2 = 80$ м. Length of a thread of the 4th section.

$L_{5\,plain} = 10{,}0 * 6{,}37 * 2 = 127$ м. Length of a thread of the 5th section.

$L_{6\,plain} = 15{,}7 * 6{,}37 * 2 = 200$ м. Length of a thread of the 6th section.

$L_{7\,plain} = 2{,}2 * 6{,}37 * 2 = 28$ м. Length of a thread of the 7th section.

5. Determine the weight of section:

$Q = \frac{L}{N};$ (g)

$Q_{1\,rib} = \frac{249}{16} = 15{,}5$ g. Weight 1st section.

$Q_{2\,plain} = \frac{924}{16} = 57{,}7$ g. Weight 2nd section.

$Q_{3\,plain} = \frac{78}{16} = 4{,}9$ g. Weight 3rd section.

$Q_{4\,plain} = \frac{80}{16} = 5{,}0$ g. Weight 4th section.

$Q_{5\,plain} = \frac{127}{16} = 8{,}0$ g. Weight 5th section.

$Q_{6\,plain} = \frac{200}{16} = 12{,}5$ g. Weight 6th section.

$Q_{7\,plain} = \frac{28}{16} = 1{,}7$ g. Weight 7th section.

$Q = Q_1 + Q_2 + Q_3 + Q_4 + Q_5 + Q_6 + Q_7$ g .

$Q = 15{,}5 + 57{,}7 + 4{,}9 + 5{,}0 + 8{,}0 + 12{,}5 + 1{,}7 = 105{,}3$ g.

Calculation of front part waste materials of the 2nd assortment

1. Determine the number of needles: (wales)

$И = \frac{Ш}{А}$; where: Ш = width of the section.

$И_{1\ rib}, И_{2\ plain}$ No of waste on site 1 and 2.

$И_{3\ plain} = \frac{35}{1{,}625} = 22 * 2 = 44$ pieces. Needles 3rd section.

$И_{4\ plain} = \frac{7}{1{,}625} = 4{,}5 * 2 = 9$ pieces. Needles 4th section.

$И_{5\ plain} = \frac{32}{1{,}625} = 20 * 2 = 40$ pieces. Needles 5th section.

$И_{6\ plain} = \frac{62}{1{,}625} = 38 * 2 = 76$ pieces. Needles 6th section.

$И_{7\ plain} = \frac{142}{1{,}625} = 87 * 2 = 174$ pieces. Needles 7th section.

2. Determine number of course:

$Р = \frac{Д}{В}$; where: Д = height section.

$Р_{1\ rib}, Р_{2\ plain}$ No of waste on site 1 and 2.

$Р_{3\ plain} = \frac{30}{1{,}40} = 21$ course. Number of course of the 3rd section.

$Р_{4\ plain} = \frac{40}{1{,}40} = 28$ course. Number of course of the 4th section.

$Р_{5\ plain} = \frac{60}{1{,}40} = 43$ course. Number of course of the 5th section.

$Р_{6\ plain} = \frac{98}{1{,}40} = 70$ course. Number of course of the 6th section.

$Р_{7\ plain} = \frac{18}{1{,}40} = 13$ course. Number of course of the 7th section.

3. Determine the number of loops of the front side:

$m = \frac{И * Р}{1000}$; (thousand)

$m_{1\ rib}, m_{2\ plain}$ No of waste on site 1 and 2.

$m_{3\ plain} = \frac{44 * 21}{1000} = 0{,}9$ thousand. The Number of loops 3rd section.

$m_{4\ plain} = \frac{9 * 28}{1000} = 0{,}25$ thousand. The Number of loops 4th section.

$m_{5\ plain} = \frac{40 * 43}{1000} = 1{,}7$ thousand. The Number of loops 5th section.

$m_{6\ plain} = \frac{76 * 70}{1000} = 5{,}3$ thousand. The Number of loops 6th section.

$m_{7\ plain} = \frac{174 * 13}{1000} = 2{,}3$ thousand. The Number of loops 7th section.

4. Determine the length of the yarn:

$L = \frac{m}{2} * l;$ (м)

$L_{1\ rib}, L_{2\ plain}$ No of waste on site 1 and 2.

$L_{3\ plain} = \frac{0{,}9}{2} * 6{,}37 = 3$ м. Length of a thread of the 3rd section.

$L_{4\ plain} = \frac{0{,}25}{2} * 6{,}37 = 0{,}8$ м. Length of a thread of the 4th section.

$L_{5\ plain} = \frac{1{,}7}{2} * 6{,}37 = 5{,}4$ м. Length of a thread of the 5th section.

$L_{6\ plain} = \frac{5{,}3}{2} * 6{,}37 = 16{,}8$ м. Length of a thread of the 6th section.

$L_{7\ plain} = \frac{2{,}3}{2} * 6{,}37 = 7{,}3$ м. Length of a thread of the 7th section.

5. Determine the weight of section:

$Q = \frac{L}{N};$ (g)

$Q_{1\ rib}, Q_{2\ plain}$ No of waste on site 1 and 2.

$Q_{3\ plain} = \frac{3}{16} = 0{,}2$ g. Weight 3rd section.

$Q_{4\ plain} = \frac{0{,}8}{16} = 0{,}075$ g. Weight 4th section.

$Q_{5\ plain} = \frac{5{,}4}{16} = 0{,}335$ g. Weight 5th section.

$Q_{6\,plain} = \frac{16{,}8}{16} = 1$ g. Weight 6th section.

$Q_{7\,plain} = \frac{7{,}3}{16} = 0{,}45$ g. Weight 7th section.

$$Q = Q_1 + Q_2 + Q_3 + Q_4 + Q_5 + Q_6 + Q_7 \quad \text{g}.$$

$$Q = 0{,}2 + 0{,}075 + 0{,}335 + 1 + 0{,}45 = 2{,}1 \text{ g}.$$

Calculation of rear part raw materials for the 2nd assortment (Fig. 10)

1. Determine the number of needles: (wales)

$И = \frac{Ш}{А}$; where: Ш = width of the section.

$И_{1\,rib} = \frac{480}{1{,}3} = 369$ pieces. Needles 1st section.

$И_{2\,plain} = \frac{480}{1{,}625} = 295$ pieces. Needles 2nd section.

$И_{3\,plain} = \frac{480}{1{,}625} = 295$ pieces. Needles 3rd section.

$И_{4\,plain} = \frac{424}{1{,}625} = 260$ pieces. Needles 4th section.

$И_{5\,plain} = \frac{440}{1{,}625} = 270$ pieces. Needles 5th section.

$И_{6\,plain} = \frac{163 * 2}{1{,}625} = 200$ pieces. Needles 6th section.

2. Determine number of course:

$Р = \frac{Д}{В}$; where: Д = height section.

$Р_{1\,rib} = \frac{65}{0{,}925} = 70$ course. Number of course of the 1st section.

$Р_{2\,plain} = \frac{345}{1{,}40} = 246$ course. Number of course of the 2nd section.

$Р_{3\,plain} = \frac{60}{1{,}40} = 43$ course. Number of course of the 3rd section.

$P_{4\ plain} = \frac{130}{1{,}40} = 93$ course. Number of course of the 4th section.

$P_{5\ plain} = \frac{38}{1{,}40} = 27$ course. Number of course of the 5th section.

$P_{6\ plain} = \frac{17}{1{,}40} = 12$ course. Number of course of the 6th section.

3. Determine the number of loops of the front part:

$m = \frac{И * P}{1000}$; (thousand)

$m_{1\ rib} = \frac{369 * 70}{1000} = 25{,}8$ thousand. The number of loops of the 1st section.

$m_{2\ plain} = \frac{295 * 246}{1000}$

$= 72{,}5$ thousand. The number of loops of the 2nd section.

$m_{3\ plain} = \frac{295 * 43}{1000} = 12{,}6$ thousand. The number of loops of the 3rd section.

$m_{4\ plain} = \frac{260 * 93}{1000} = 24{,}1$ thousand. The number of loops of the 4th section.

$m_{5\ plain} = \frac{270 * 27}{1000} = 7{,}2$ thousand. The number of loops of the 5th section.

$m_{6\ plain} = \frac{200 * 12}{1000} = 2{,}4$ thousand. The number of loops of the 6th section.

4. Determine the length of the yarn:

$L = m * l * 2$; (м)

$L_{1\ rib} = 25{,}8 * 4{,}83 * 2 = 249$ м. Length of a thread of the 1st section.

$L_{2\ plain} = 72{,}5 * 6{,}37 * 2 = 923$ м. Length of a thread of the 2nd section.

$L_{3\ plain} = 12{,}6 * 6{,}37 * 2 = 160$ м. Length of a thread of the 3rd section.

$L_{4\ plain} = 24{,}1 * 6{,}37 * 2 = 307$ м. Length of a thread of the 4th section.

$L_{5\ plain} = 7{,}2 * 6{,}37 * 2 = 92$ м. Length of a thread of the 5th section.

$L_{6\ plain} = 2{,}4 * 6{,}37 * 2 = 30$ м. Length of a thread of the 6th section.

5. Determine the weight of section:

$Q = \frac{L}{N}$; (g)

$Q_{1\,rib} = \frac{249}{16} = 15{,}5$ g. Weight 1st section.

$Q_{2\,plain} = \frac{923}{16} = 57{,}7$ g. Weight 2nd section.

$Q_{3\,plain} = \frac{160}{16} = 10{,}0$ g. Weight 3rd section.

$Q_{4\,plain} = \frac{307}{16} = 19{,}2$ g. Weight 4th section.

$Q_{5\,plain} = \frac{92}{16} = 5{,}7$ g. Weight 5th section.

$Q_{6\,plain} = \frac{30}{16} = 1{,}9$ g. Weight 6th section.

$$Q = Q_1 + Q_2 + Q_3 + Q_4 + Q_5 + Q_6 \quad \text{g} .$$

$$Q = 15{,}5 + 57{,}7 + 10{,}0 + 19{,}2 + 5{,}7 + 1{,}9 = 110 \text{ g.}$$

Calculation of rear part waste materials of the 2st assortment

1. Determine the number of needles: (wales)

$И = \frac{Ш}{А}$; where: Ш = width of the section.

$И_{1\,rib}, И_{2\,plain}$ No waste on site 1 and 2.

$И_{3\,plain} = \frac{30}{1{,}625} = 18 * 2 = 36$ pieces. Needles 3rd section.

$И_{4\,plain} = \frac{7}{1{,}625} = 4 * 2 = 8$ pieces. Needles 4th section.

$И_{5\,plain} = \frac{134}{1{,}625} = 82$ шт. pieces. Needles 5th section.

$И_{6\,plain} = \frac{162}{1{,}625} = 100 * 2 = 200$ pieces. Needles 6th section.

2. Determine number of course:

$Р = \frac{Д}{В}$; where: Д = height section.

$Р_{1\,rib}, Р_{2\,plain}$ No waste on site 1 and 2.

$P_{3\ plain} = \frac{60}{1{,}40} = 43$ course. Number of course 3rd section.

$P_{4\ plain} = \frac{130}{1{,}40} = 93$ course. Number of course 4th section.

$P_{5\ plain} = \frac{56}{1{,}40} = 40$ course. Number of course 5th section.

$P_{6\ plain} = \frac{17}{1{,}40} = 12$ course. Number of course 6th section.

3. Determine the number of loops of the front part:

$m = \frac{И * Р}{1000};$ (thousand)

$m_{1\ rib}, m_{2\ plain}$ No waste on site 1 and 2.

$m_{3\ plain} = \frac{30 * 43}{1000} = 1{,}29$ thousand. The Number of loops 3rd section.

$m_{4\ plain} = \frac{8 * 93}{1000} = 0{,}74$ thousand. The Number of loops 4th section.

$m_{5\ plain} = \frac{82 * 40}{1000} = 1{,}8$ thousand. The Number of loops 5th section.

$m_{6\ plain} = \frac{200 * 12}{1000} = 2{,}4$ thousand. The Number of loops 6th section.

4. Determine the length of the yarn:

$$L = \frac{m}{2} * l; \ (м)$$

$L_{1\ rib}, L_{2\ plain}$ No waste on site 1 and 2.

$L_{3\ plain} = \frac{1{,}29}{2} * 6{,}37 = 4$ м. Length of a thread of the 3rd section.

$L_{4\ plain} = \frac{0{,}74}{2} * 6{,}37 = 2$ м. Length of a thread of the 4th section.

$L_{5\ plain} = \frac{1{,}8}{2} * 6{,}37 = 6$ м. Length of a thread of the 5th section.

$L_{6\ plain} = \frac{2{,}4}{2} * 6{,}37 = 7{,}5$ м. Length of a thread of the 6th section.

5. Determine the weight of section:

$$Q = \frac{L}{N}; \quad \text{(g)}$$

$Q_{1\,rib}, Q_{2\,plain}$ No waste on site 1 and 2.

$$Q_{3\,plain} = \frac{4}{16} = 0{,}25 \text{ g.} \quad \text{Weight 3rd section.}$$

$$Q_{4\,plain} = \frac{2}{16} = 0{,}15 \text{ g.} \quad \text{Weight 4th section.}$$

$$Q_{5\,plain} = \frac{6}{16} = 0{,}35 \text{ g.} \quad \text{Weight 5th section.}$$

$$Q_{6\,plain} = \frac{7{,}5}{16} = 0{,}45 \text{ g.} \quad \text{Weight 6th section.}$$

$$Q = Q_1 + Q_2 + Q_3 + Q_4 + Q_5 + Q_6 \quad \text{g .}$$

$$Q = 0{,}25 + 0{,}15 + 0{,}35 + 0{,}45 = 1{,}2 \text{ g.}$$

Calculation of sleeveless raw materials for the 2nd assortment (Fig. 11)

1. Determine the number of needles: (wales)

$$И = \frac{Ш}{А}; \qquad \text{where:} \quad Ш = \text{width of the section.}$$

$$И_{1\,rib} = \frac{90 * 2}{1{,}3} = 138 * 2 = 276 \text{ pieces.} \quad \text{Needles 1st section.}$$

$$И_{2\,plain} = \frac{120 * 2}{1{,}625} = 148 * 2 = 296 \text{ pieces.} \quad \text{Needles 2nd section.}$$

$$И_{3\,plain} = \frac{145 * 2}{1{,}625} = 178 * 2 = 356 \text{ pieces.} \quad \text{Needles 3rd section.}$$

$$И_{4\,plain} = \frac{177 * 2}{1{,}625} = 218 * 2 = 436 \text{ pieces.} \quad \text{Needles 4th section.}$$

$$И_{5\,plain} = \frac{200 * 2}{1{,}625} = 246 * 2 = 492 \text{ pieces.} \quad \text{Needles 5th section.}$$

$$И_{6\,plain} = \frac{200 * 2}{1{,}625} = 246 * 2 = 492 \text{ pieces.} \quad \text{Needles 6th section.}$$

$$И_{7\,plain} = \frac{152 * 2}{1{,}625} = 187 * 2 = 374 \text{ pieces.} \quad \text{Needles 7th section.}$$

$И_{8\,plain} = \frac{120 * 2}{1{,}625} = 148 * 2 = 296$ pieces. Needles 8th section.

$И_{9\,plain} = \frac{60 * 2}{1{,}625} = 74 * 2 = 148$ pieces. Needles 9th section.

2. Determine number of course:

$Р = \frac{Д}{В}$; where: Д = height section.

$Р_{1\,rib} = \frac{65}{0{,}925} = 70$ course. Number of course of the 1st section.

$Р_{2\,plain} = \frac{85}{1{,}40} = 60$ course. Number of course of the 2nd section.

$Р_{3\,plain} = \frac{85}{1{,}40} = 60$ course. Number of course of the 3rd section.

$Р_{4\,plain} = \frac{110}{1{,}40} = 78$ course. Number of course of the 4th section.

$Р_{5\,plain} = \frac{80}{1{,}40} = 57$ course. Number of course of the 5th section.

$Р_{6\,plain} = \frac{25}{1{,}40} = 18$ course. Number of course of the 6th section.

$Р_{7\,plain} = \frac{35}{1{,}40} = 25$ course. Number of course of the 7th section.

$Р_{8\,plain} = \frac{40}{1{,}40} = 28$ course. Number of course of the 8th section.

$Р_{9\,plain} = \frac{10}{1{,}40} = 7$ course. Number of course of the 9th section.

3. Determine the number of loops of the front part:

$m = \frac{И * Р}{1000}$; (thousand)

$m_{1\,rib} = \frac{276 * 70}{1000} = 19{,}3$ thousand. The number of loops of the 1st section.

$m_{2\,plain} = \frac{296 * 60}{1000}$

$= 17{,}7$ thousand. The number of loops of the 2nd section.

$m_{3\ plain} = \frac{356 * 60}{1000} = 21{,}0$ thousand. The number of loops of the 3rd section.

$m_{4\ plain} = \frac{436 * 78}{1000} = 34{,}0$ thousand. The number of loops of the 4th section.

$m_{5\ plain} = \frac{492 * 57}{1000} = 28{,}0$ thousand. The number of loops of the 5th section.

$m_{6\ plain} = \frac{492 * 18}{1000} = 8{,}8$ thousand. The number of loops of the 6th section.

$m_{7\ plain} = \frac{374 * 25}{1000} = 9{,}3$ thousand. The number of loops of the 7th section.

$m_{8\ plain} = \frac{296 * 28}{1000} = 8{,}2$ thousand. The number of loops of the 8th section.

$m_{9\ plain} = \frac{148 * 7}{1000} = 1{,}0$ thousand. The number of loops of the 9th section.

4. Determine the length of the yarn:

$L = m * l * 2;$ (м)

$L_{1\ rib} = 19{,}3 * 4{,}83 * 2 = 186$ м. Length of a thread of the 1st section.

$L_{2\ plain} = 17{,}7 * 6{,}37 * 2 = 225$ м. Length of a thread of the 2nd section.

$L_{3\ plain} = 21{,}0 * 6{,}37 * 2 = 267$ м. Length of a thread of the 3rd section.

$L_{4\ plain} = 34{,}0 * 6{,}37 * 2 = 433$ м. Length of a thread of the 4th section.

$L_{5\ plain} = 28{,}0 * 6{,}37 * 2 = 357$ м. Length of a thread of the 5th section.

$L_{6\ plain} = 8{,}8 * 6{,}37 * 2 = 112$ м. Length of a thread of the 6th section.

$L_{7\ plain} = 9{,}3 * 6{,}37 * 2 = 118$ м. Length of a thread of the 7th section.

$L_{8\ plain} = 8{,}2 * 6{,}37 * 2 = 104$ м. Length of a thread of the 8th section.

$L_{9\ plain} = 1{,}0 * 6{,}37 * 2 = 13$ м. Length of a thread of the 9th section.

5. Determine the weight of section:

$Q = \frac{L}{N};$ (g)

$Q_{1\ rib} = \frac{186}{16} = 11{,}6$ g. Weight 1st section.

$Q_{2\ plain} = \frac{225}{16} = 14{,}0$ g. Weight 2nd section.

$Q_{3\ plain} = \frac{267}{16} = 16{,}7$ g. Weight 3rd section.

$Q_{4\ plain} = \frac{433}{16} = 27{,}0$ g. Weight 4th section.

$Q_{5\ plain} = \frac{357}{16} = 22{,}2$ g. Weight 5th section.

$Q_{6\ plain} = \frac{112}{16} = 7{,}0$ g. Weight 6th section.

$Q_{7\ plain} = \frac{118}{16} = 7{,}4$ g. Weight 7th section.

$Q_{8\ plain} = \frac{104}{16} = 6{,}5$ g. Weight 8th section.

$Q_{9\ plain} = \frac{13}{16} = 0{,}8$ g. Weight 9th section.

$$Q = Q_1 + Q_2 + Q_3 + Q_4 + Q_5 + Q_6 + Q_7 + Q_8 + Q_9 \quad \text{g}.$$

$$Q = 11{,}6 + 14{,}0 + 16{,}7 + 27{,}0 + 22{,}2 + 7{,}0 + 7{,}4 + 6{,}5 + 0{,}8 = 113{,}2 \text{ g.}$$

Calculation of waste materials sleeves 2nd assortment

1. Determine the number of needles: (wales)

$И = \frac{Ш}{А}$; where: Ш = width of the section.

$И_{1\ rib}$ – No waste on site 1.

$И_{2\ plain} = \frac{30}{1{,}625} = 18 * 4 = 72$ pieces. Needles 2nd section.

$И_{3\ plain} = \frac{25}{1{,}625} = 15 * 4 = 60$ pieces. Needles 3rd section.

$И_{4\ plain} = \frac{32}{1{,}625} = 20 * 4 = 80$ pieces. Needles 4th section.

$И_{5\ plain} = \frac{23}{1{,}625} = 14 * 4 = 56$ pieces. Needles 5th section.

$И_{6\ plain} = \frac{42}{1{,}625} = 26 * 4 = 104$ pieces. Needles 6th section.

$И_{7\ plain} = \frac{32}{1{,}625} = 20 * 4 = 80$ pieces. Needles 7th section.

$И_{8\ plain} = \frac{60}{1{,}625} = 37 * 4 = 148$ pieces. Needles 8th section.

$И_{9\ plain} = \frac{60}{1{,}625} = 37 * 4 = 148$ pieces. Needles 9th section.

2. Determine number of course:

$Р = \frac{Д}{В}$; where: Д = height section.

$Р_{1\ rib}$ – No waste on site 1.

$Р_{2\ plain} = \frac{100}{1{,}40} = 71$ course. Number of course of the 2nd section.

$Р_{3\ plain} = \frac{85}{1{,}40} = 60$ course. Number of course of the 3rd section.

$Р_{4\ plain} = \frac{110}{1{,}40} = 78$ course. Number of course of the 4th section.

$Р_{5\ plain} = \frac{80}{1{,}40} = 57$ course. Number of course of the 5th section.

$Р_{6\ plain} = \frac{25}{1{,}40} = 18$ course. Number of course of the 6th section.

$Р_{7\ plain} = \frac{35}{1{,}40} = 25$ course. Number of course of the 7th section.

$Р_{8\ plain} = \frac{40}{1{,}40} = 28$ course. Number of course of the 8th section.

$Р_{9\ plain} = \frac{10}{1{,}40} = 7$ course. Number of course of the 9th section.

3. Determine the number of loops of the front part:

$m = \frac{И * Р}{1000}$; (thousand)

$m_{1\ rib}$ – No waste on site 1.

$m_{2\ plain} = \frac{72 * 71}{1000} = 5{,}1$ thousand. The number of loops of the 2nd section.

$m_{3\ plain} = \frac{60 * 60}{1000} = 3{,}6$ thousand. The number of loops of the 3rd section.

$m_{4\ plain} = \frac{80 * 78}{1000} = 6{,}2$ thousand. The number of loops of the 4th section.

$m_{5\ plain} = \frac{56 * 57}{1000} = 3{,}2$ thousand. The number of loops of the 5th section.

$m_{6\ plain} = \frac{104 * 18}{1000} = 1{,}8$ thousand. The number of loops of the 6th section.

$m_{7\ plain} = \frac{80 * 25}{1000} = 2{,}0$ thousand. The number of loops of the 7th section.

$m_{8\ plain} = \frac{148 * 28}{1000} = 4{,}1$ thousand. The number of loops of the 8th section.

$m_{9\ plain} = \frac{148 * 7}{1000} = 1{,}0$ thousand. The number of loops of the 9th section.

4. Determine the length of the yarn:

$L = \frac{m}{2} * l;$ (м)

$L_{1\ rib} -$ No waste on site 1.

$L_{2\ plain} = \frac{5{,}1}{2} * 6{,}37 = 16$ м. Length of a thread of the 2nd section.

$L_{3\ plain} = \frac{3{,}6}{2} * 6{,}37 = 11$ м. Length of a thread of the 3rd section.

$L_{4\ plain} = \frac{6{,}2}{2} * 6{,}37 = 20$ м. Length of a thread of the 4th section.

$L_{5\ plain} = \frac{3{,}2}{2} * 6{,}37 = 10$ м. Length of a thread of the 5th section.

$L_{6\ plain} = \frac{1{,}8}{2} * 6{,}37 = 6$ м. Length of a thread of the 6th section.

$L_{7\ plain} = \frac{2}{2} * 6{,}37 = 6$ м. Length of a thread of the 7th section.

$L_{8\ plain} = \frac{4{,}1}{2} * 6{,}37 = 13$ м. Length of a thread of the 8th section.

$L_{9\ plain} = \frac{1}{2} * 6{,}37 = 3$ м. Length of a thread of the 9th section.

5. Determine the weight of section:

$Q = \frac{L}{N};$ (g)

$Q_{1\ rib} -$ No waste on site 1.

$Q_{2\,plain} = \frac{16}{16} = 1 * 2 = 2{,}0$ g. Weight 2nd section.

$Q_{3\,plain} = \frac{11}{16} = 0{,}68 * 2 = 1{,}4$ g. Weight 3rd section.

$Q_{4\,plain} = \frac{20}{16} = 1{,}2 * 2 = 2{,}4$ g. Weight 4th section.

$Q_{5\,plain} = \frac{10}{16} = 0{,}6 * 2 = 1{,}2$ g. Weight 5th section.

$Q_{6\,plain} = \frac{6}{16} = 0{,}375 * 2 = 0{,}7$ g. Weight 6th section.

$Q_{7\,plain} = \frac{6}{16} = 0{,}375 * 2 = 0{,}8$ g. Weight 7th section.

$Q_{8\,plain} = \frac{13}{16} = 0{,}8 * 2 = 1{,}6$ g. Weight 8th section.

$Q_{9\,plain} = \frac{3}{16} = 0{,}2 * 2 = 0{,}4$ g. Weight 9th section.

$$Q = Q_1 + Q_2 + Q_3 + Q_4 + Q_5 + Q_6 + Q_7 + Q_8 + Q_9 \quad \text{g}.$$

$$Q = 2{,}0 + 1{,}4 + 2{,}4 + 1{,}2 + 0{,}7 + 0{,}8 + 1{,}6 + 0{,}4 = 10{,}5 \text{ g}.$$

Calculation of raw materials for border 2nd assortment

1. Determine the number of needles: (wales)

$И = \frac{Ш}{А}$; where: Ш = width of the section.

$И_{\,rib} = \frac{740}{1{,}3} = 569$ pieces.

2. Determine number of course:

$Р = \frac{Д}{В}$; where: Д = height section.

$Р_{\,rib} = \frac{50}{0{,}925} = 54$ course.

3. Determine the number of loops of the front part:

$$m = \frac{И * Р}{1000}; \quad \text{(thousand)}$$

$$m_{rib} = \frac{569 * 54}{1000} = 30{,}7 \text{ thousand.}$$

4. Determine the length of the yarn:

$$L = m * l * 2; \quad (м)$$

$$L_{rib} = 30{,}7 * 4{,}83 * 2 = 269 \text{ м.}$$

5. Determine the weight of section:

$$Q = \frac{L}{N}; \quad (g)$$

$$Q_{rib} = \frac{269}{16} = 18{,}5 \text{ g.}$$

Calculation table front part for the 2nd assortment

6 – Table

Name of section	№ section	Number of course (P)	Number of needles (И)	Number of face loops, thousand. (m)	Length of yarn, м (L)	Weight section, g (Q)	Waste cutting			
							Number of added needles	Number of loops, thousand	Length of the yarn, м	Weight, g
Belt	1	70	369	25,8	249	15,5	--	--	--	--
Lower part	2	246	295	72,5	924	57,7	--	--	--	--
Starting armhole	3	21	295	6,1	78	4,9	44	0,9	3	0,2
Armhole	4	25	252	6,3	80	5,0	9	0,25	0,8	0,15
Armhole	5	43	234	10,0	127	8,0	40	1,7	5,4	0,33
Shoulder	6	69	228	15,7	200	12,5	76	5,3	16,8	1,0
Sprout	7	13	175	2,2	28	1,7	174	2,3	7,3	0,45
Total:	--	--	--	--	--	105,3				2,1

Calculation table rear part for the 2nd assortment

7 – Table

Name of section	№ section	Number of course (P)	Number of needles (И)	Number of face loops, thousand. (m)	Length of yarn, м (L)	Weight section, g (Q)	Waste cutting			
							Number of added needles	Number of loops, thousand	Length of the yarn, м	Weight, g
Belt	1	70	369	25,8	249	15,5	--	--	--	--
Lower part	2	246	295	72,5	923	57,7	--	--	--	--
Starting armhole	3	43	295	12,6	160	10,0	36	1,29	4	0,25
Armhole	4	93	260	24,1	307	19,2	8	0,74	2	0,15
Shoulder	5	27	270	7,2	92	5,7	82	1,8	6	0,35
Sprout	6	12	200	2,4	30	1,9	200	2,4	7,5	0,45
Total:	--	--	--	--	--	110				1,2

Calculation table sleeves for the 2nd assortment

8 – Table

Name of section	№ section	Number of course (P)	Number of needles (И)	Number of face loops, thousand. (m)	Length of yarn, м (L)	Weight section, g (Q)	Waste cutting			
							Number of added needles	Number of loops, thousand	Length of the yarn, м	Weight, g
Cuff	1	70	276	19,3	186	11,6	--	--	--	--
Extension	2	60	296	17,7	225	14,0	72	5,1	16	2,0
Extension	3	60	356	21,0	267	16,7	60	3,6	11	1,4
Extension	4	78	436	34,0	433	27,0	80	6,2	20	2,4
Extension	5	57	492	28,0	357	22,2	56	3,2	10	1,2
Sleeve's round	6	18	492	8,8	112	7,0	104	1,8	6	0,7
Sleeve's round	7	25	374	9,3	118	7,4	80	2,0	6	0,8
Sleeve's round	8	28	296	8,2	104	6,5	148	4,1	13	1,6

Sleeve's round	9	7	148	1,0	13	0,8	148	1,0	3	0,4
Total:	--	--	--	--	--	113,2				10,5

Calculation table border for the 2nd assortment

9 – Table

Name of section	№ section	Number of course (P)	Number of needles (И)	Number of face loops, thousand. (m)	Length of yarn, м (L)	Weight section, g (Q)	Waste cutting			
							Number of added needles	Number of loops, thousand	Length of the yarn, м	Weight, g
Border	1	54	569	30,7	296	18,5	--	--	--	--
Total:	--	--	--	--	--	18,5				--

The total raw materials expenditure for the 2nd assortment (g)

10 – Table

Description of parts	Weight coupon	Including		Waste knitting	The total consumption of raw materials
		Net weight of the items	Waste cutting		
Front part	105,3	103,2	2,1	1,8	107,1
Rear part	110,0	108,8	1,2	1,8	111,8
Sleeves (two)	113,2	102,7	10,5	2,3	115,5
Border	18,5	18,5	--	0,7	19,2
Total:	347	333,2	13,8	6,6	353,6
			3,9 %	1,86 %	
			5,76 %		

100 – 353,6 g

X – 13,8 g

$$100 * \frac{13,8}{353,6} = 3,9\%$$

100 – 353,6 g

X – 6,6 g

$$100 * \frac{6,6}{353,6} = 1,86\%$$

The total consumption of raw materials = 5,76%.

Calculation of the norm card for the first assortment

Q = 371,4

1. Determine machine time:

$t_м = \frac{60 * P}{n}$ where: n – number of double carriage moves.

1) Front part: $t_м = \frac{60 * 508}{79} = 385,8$ s.

2) Rear part: $t_м = \frac{60 * 508}{79} = 385,8$ s.

3) Sleeves: $t_м = \frac{60 * 410}{101} = 243,6$ s.

4) Border: $t_м = \frac{60 * 54}{79} = 41$ s.

$t_м = 385,8 + 385,8 + 243,6 + 41 = 1056,2$ s.

2. Determine the theoretical productivity of the machine:

$A_t = \frac{T_{см}}{t_м} = \frac{28800}{1056,2} = 27,3$ details

3. Determine the norm of service:

$H_o = \frac{t_м + t_{нп}}{t_п + t_{нп}} * к_з = \frac{1056,2+144,8}{144,8+222} * 0,85 = \frac{1201}{366,8} * 0,85 = 3$ pieces.

4. Determine the load factor employee on each machine:

$к_з^1 = \frac{t_п + t_{нп}}{(t_м + t_{нп}) * к_з} = \frac{144,8 + 222}{1056,2 + 144,8 * 0,85} = 0,33.$

5. Determine the share of computer time in the operational time:

$К_а = \frac{t_м}{(t_м + t_{нп}) * к_с} = \frac{1056,2}{1056,2 + 144,8 * 1,1} = 0,799.$

6. Determine the proportion of operating time in the change:

$$К_б = \frac{Т_{см} - Т_б}{Т_{см}} = \frac{28800 - 1200}{28800} = 0{,}96.$$

7. Determine the efficiency of the time:

$$КПВ = К_а * К_б = 0{,}799 * 0{,}96 = 0{,}767.$$

8. Determine the norm of productivity of the machine:

$$Н_м = КПВ * А_t = 0{,}767 * 27{,}3 = 20{,}9 \text{ details/hour}$$

On one product 4 details

$$Н_м = 5 \text{ details/hour}$$

9. Knitter's productivity

$$Н_{вр} = Н_м * Н_о = 5 * 3 = 15 \text{ details/hour}$$

Calculation of the norm card for the second assortment

Q = 353,6

1. Determine machine time:

$t_м = \frac{60 * Р}{n}$ where: n – number of double carriage moves.

1) Front part: $t_м = \frac{60 * 487}{79} = 369{,}9$ s.

2) Rear part: $t_м = \frac{60 * 518}{79} = 393{,}4$ s.

3) Sleeves: $t_м = \frac{60 * 403}{101} = 239{,}4$ s.

4) Border: $t_м = \frac{60 * 54}{79} = 41$ s.

$t_м = 369{,}9 + 393{,}4 + 239{,}4 + 41 = 1043{,}7$ s.

2. Determine the theoretical productivity of the machine:

$$А_t = \frac{Т_{см}}{t_м} = \frac{28800}{1043{,}7} = 27{,}6 \text{ details}$$

3. Determine the norm of service:

$$Н_о = \frac{t_м + t_{нп}}{t_п + t_{нп}} * К_з = \frac{1043,7+144,8}{144,8+222} * 0,85 = \frac{1188,5}{366,8} * 0,85 = 3 \text{ pieces.}$$

4. Determine the load factor employee on each machine:

$$К_з^1 = \frac{t_п + t_{нп}}{(t_м + t_{нп}) * к_з} = \frac{144,8 + 222}{1043,7 + 144,8 * 0,85} = 0,33.$$

5. Determine the share of computer time in the operational time:

$$К_а = \frac{t_м}{(t_м + t_{нп}) * к_с} = \frac{1043,7}{1043,7 + 144,8 * 1,1} = 0,799.$$

6. Determine the proportion of operating time in the change:

$$К_б = \frac{Т_{см} - Т_б}{Т_{см}} = \frac{28800 - 1200}{28800} = 0,96.$$

7. Determine the efficiency of the time:

$$КПВ = К_а * К_б = 0,799 * 0,96 = 0,767.$$

8. Determine the norm of productivity of the machine:

$$Н_м = КПВ * А_t = 0,767 * 27,3 = 20,9 \text{ details/hour}$$

On one product 4 details

$$Н_м = 5 \text{ details/hour.}$$

9. Knitter's productivity:

$$Н_{вр} = Н_м * Н_о = 5 * 3 = 15 \text{ details/hour}$$

I.8 The calculation of production volume

1 - assortment

1. Determine the annual output

$$В_{год}^{шт} = М_з * КРО * Н_м * Т_{год} = 16 * 0,96 * 5 * 4178 = 320870,4 \text{ pieces.}$$

where: $М_з$ – tucked machine.

КРО – coefficient of operating equipment.

$Н_м$ – rate of productivity.

$Т_{год}$ – annual fund of working time.

2. Determine the amount of output per day:

$$В^{шт}_{день} = \frac{В^{шт}_{год}}{280} = \frac{320870,4}{280} = 1145 \text{ pieces.}$$

3. Determine the volume of output per shift

$$В^{шт}_{смен} = \frac{В^{шт}_{день}}{2} = \frac{1145}{2} = 573 \text{ pieces.}$$

4. Determine annual consumption of raw materials:

$$В^{кг}_{год} = В^{шт}_{год} * Q_м = 320870,4 * 0,3714 = 119171,3 \text{ kg.}$$

5. Determine the amount of raw material consumption per day:

$$В^{кг}_{день} = \frac{В^{кг}_{год}}{280} = \frac{119171,3}{280} = 425,6 \text{ kg.}$$

6. Determine the amount of raw material consumption per shift:

$$В^{кг}_{смен} = \frac{В^{кг}_{день}}{2} = \frac{425,6}{2} = 212,8 \text{ kg.}$$

7. Determine the number of tucked machines:

$$М_з = \frac{В^{шт}_{год}}{Н_м} * КРО * Т_{год} = \frac{320870,4}{5*0,96*4178} = \frac{320870,4}{20054,4} = 16 \text{ pieces.}$$

2 - assortment

1. Determine the annual output

$$В^{шт}_{год} = М_з * КРО * Н_м * Т_{год} = 16 * 0,96 * 5 * 4178 = 320870,4 \text{ pieces.}$$

where: $М_з$ – tucked machine.

КРО – coefficient of operating equipment.

$Н_м$ – rate of productivity.

$Т_{год}$ – annual fund of working time.

2. Determine the amount of output per day:

$$В^{шт}_{день} = \frac{В^{шт}_{год}}{280} = \frac{320870,4}{280} = 1145 \text{ pieces.}$$

3. Determine the volume of output per shift:

$$В^{шт}_{смен} = \frac{В^{шт}_{день}}{2} = \frac{1145}{2} = 572 \text{ pieces.}$$

4. Determine annual consumption of raw materials:

$$В^{кг}_{год} = В^{шт}_{год} * Q_м = 320870,4 * 0,3536 = 113459,8 \text{ kg}$$

5. Determine the amount of raw material consumption per day:

$$В^{кг}_{день} = \frac{В^{кг}_{год}}{280} = \frac{113459,8}{280} = 405,2 \text{ kg.}$$

6. Determine the amount of raw material consumption per shift:

$$В^{кг}_{смен} = \frac{В^{кг}_{день}}{2} = \frac{405,2}{2} = 202,6 \text{ kg.}$$

7. Determine the number of tucked machines:

$$М_з = \frac{В^{шт}_{год}}{Н_м} * КРО * Т_{год} = \frac{320870,4}{5*0,96*4178} = \frac{320870,4}{20054,4} = 16 \text{ pieces.}$$

I.9 The calculation of the main area and the main storage space

1. Calculation of the area storage of raw materials:

Amount of raw material used in one day

$$В^{тонна}_{день} = \frac{В^{кг}_{день}}{1000} = \frac{830,8}{1000} = 0,8308 \text{ ton.}$$

Stock coefficient - $К_з$=6

Weight per $1м^2$ Н=0,315

КИП = 0,4÷0,7

$$S = \frac{В_{день}^{тонна} * К_з}{КИП * Н} = \frac{0,8308 * 6}{0,5 * 0,315} = \frac{4,9848}{0,1575} = 31,6м^2$$

Accept: 35 $м^2$

2. Calculation of the finished product storage areas:

$$S_{гп} = \frac{В_{день}^{шт} * К_з * К}{800 * КИП} = \frac{2290 * 6 * 1,9}{800 * 0,5} = \frac{26106}{400} = 65м^2$$

К= utilization rate area

Accept: $68м^2$.

I.10 The calculation of sewing aggregate

Calculation of the sewing aggregate for the first assortment

1. Number of products in one session:

$$В_{смен}^{шт} = \frac{В_{день}^{шт}}{2} = \frac{1145}{2} = 573 \text{ pieces. Power 600 pieces}$$

2. Number of threads 1 pieces.
3. Tact of aggregate:

$$\tau = \frac{Т_{см} - Т_б}{В} = \frac{28800 - 1200}{573} = 48,17$$

4. Determination of the number of machines:

1) $n_1 = \frac{40}{48,17} = 0,83$ (tambour)

2) $n_2 = \frac{60}{48,17} = 1,25$ (dial linking)

3) $n_3 = \frac{40}{48,17} = 0,83$ (tambour)

4) $n_4 = \frac{60}{48,17} = 1,25$ (dial linking)

5) $n_5 = \frac{60}{48,17} = 1,25$ (dial linking)

6) $n_6 = \frac{120}{48,17} = 2,49$ (tambour)

7) $n_7 = \frac{120}{48,17} = 2,49$ (tambour)

7 pieces tambour machine

4 pieces dial linking machine

∑ = 11 workers

Calculation of the sewing aggregate for the second assortment

1. Number of products in one session:

$$В_{смен}^{шт} = \frac{В_{день}^{шт}}{2} = \frac{1145}{2} = 573 \text{ pieces. Power 600 pieces}$$

2. Number of threads 1 pieces.
3. Tact of Stream:

$$\tau = \frac{Т_{см} - Т_{б}}{В} = \frac{28800 - 1200}{573} = 48{,}17$$

4. Determination of the number and the number of machines:

1) $n_1 = \frac{40}{48{,}17} = 0{,}83$ (tambour)

2) $n_2 = \frac{90}{48{,}17} = 1{,}9$ (dial linking)

3) $n_3 = \frac{40}{48{,}17} = 0{,}83$ (tambour)

4) $n_4 = \frac{60}{48{,}17} = 1{,}25$ (dial linking)

5) $n_5 = \frac{60}{48{,}17} = 1{,}25$ (dial linking)

6) $n_6 = \frac{120}{48{,}17} = 2{,}49$ (tambour)

7) $n_7 = \frac{120}{48{,}17} = 2{,}49$ (tambour)

7 pieces tambour machine 5 pieces dial linking machine ∑ = 12 workers

II. SPECIAL SECTION

New kinds of combined structures by using of loop transference.

Two kinds of combined structures have been created by using of loop transference. It is a one of the types of loop transfer stitches: Rib loop transfer stitches, produced by transferring a loop from one needle bed to the other. Therefore new structures were produced on V-bed rib machine on the base of rib 1x1 as called basic structure below. The needle set for structure №1: 1 needle with short butt, 1 needle with long butt. Producing way of structure №1 is following (fig.9):

1-course. All needles of both front bed and back bed are working and rib 1x1 structure is knitting.

2-course.In this course all needles of back bad are out of work because of fully withdrawn of raising cam into the cam-plate so that all butts pass undisturbed across the flat surface. In front bed all short butt needles are not working and all long butt needles are working because of partly withdrawn of raising cams into the cam-plate so that they miss the low (short) butts, which pass undisturbed across their surface. Plain structure throw one needle is knit in front bed.

3-course. Plain structure throw one needle is knit in front bed like at 2-course. Then loops of front bed needles 3, 7, 11, 15 etc. are transferred to back bed needles 4, 8, 12, 16 etc. As mentioned above there are some requirements to transference. For example specially-designed latch needles, a delivering needle cam that lifts the needle higher than normal clearing-height.

4-course. All needles of both front bed and back bed are working. After transferring front bed needles 3, 7, 11, 15 etc. are empty and have not old loops, therefore they knit cardigan stitches.

5-course. Knitting process of 1-course is repeated and rib 1x1 structure is knit.

The needle set for structure №2: 1 needle with short butt, 1 needle with long butt. Producing way of structure №2 is following (fig.10):

1-course. All needles of both front bed and back bed are working and rib 1x1 structure is knitting.

2-course.In this course all needles of back bad are out of work because of fully withdrawn of raising cam into the cam-plate so that all butts pass undisturbed across the flat surface. In front bed all short butt needles are not working and all long butt needles are working because of partly withdrawn of raising cams into the cam-plate so that they miss the low (short) butts, which pass undisturbed across their surface. Plain structure throw one needle is knit in front bed.

3-course. Plain structure throw one needle is knit in front bed like at 2-course. Then loops of front bed needles 3, 7, 11, 15 etc. are transferred to back bed needles 4, 8, 12, 16 etc. As mentioned above there are some requirements to transference. For example specially-designed latch needles, a delivering needle cam that lifts the needle higher than normal clearing-height.

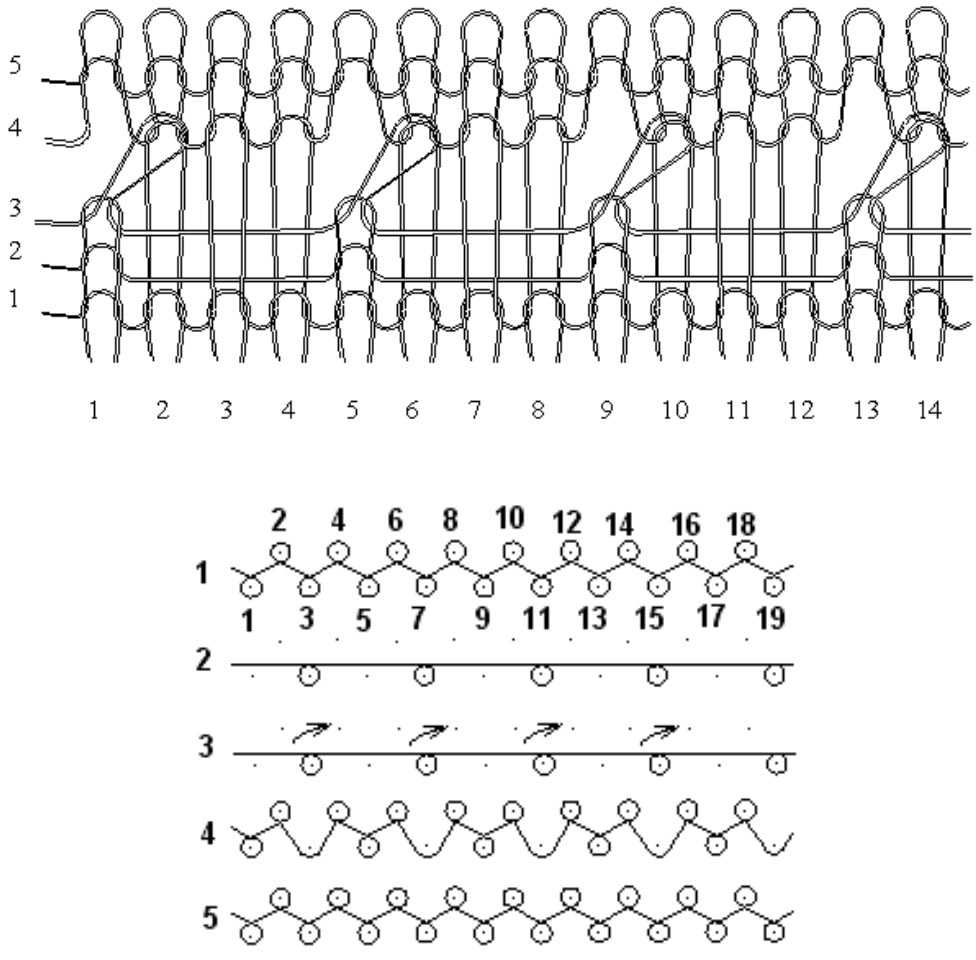


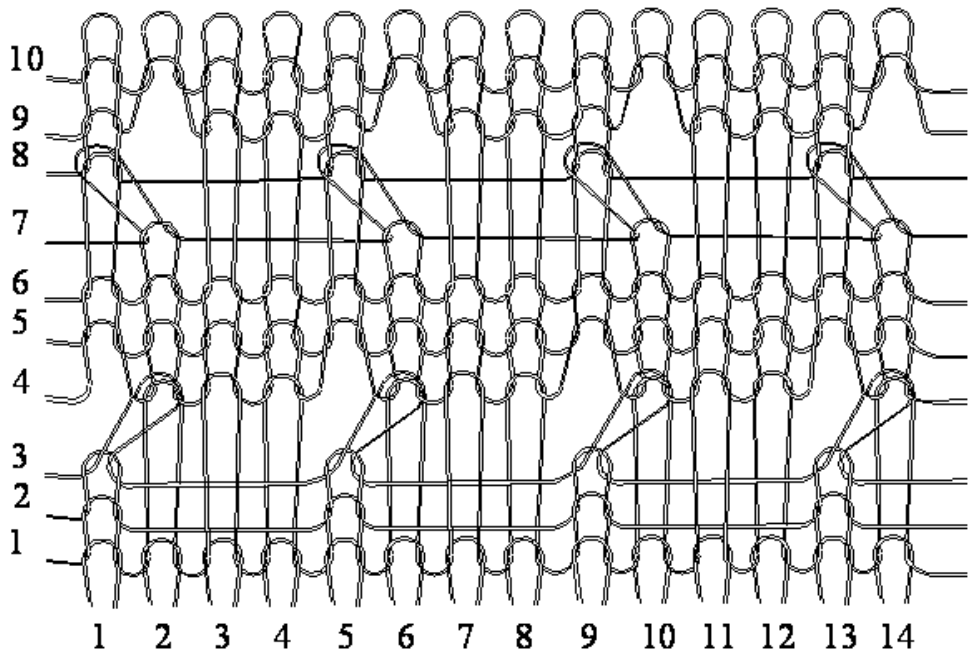
Fig.9. Structure №1.

4-course. All needles of both front bed and back bed are working. After transferring front bed needles 3, 7, 11, 15 etc. are empty and have not old loops, therefore they knit cardigan stitches.

5-course. Knitting process of 1-course is repeated and rib 1x1 structure is knit.

6-course. In this course all needles of front bad are out of work because of fully withdrawn of raising cam into the cam-plate so that all butts pass undisturbed across the flat surface. In back bed all short butt needles are not working and all long butt needles are working because of partly withdrawn of raising cams into the cam-plate so that they miss the low (short) butts, which pass undisturbed across their surface. Plain structure throw one needle is knit in back bed.

7-course. Plain structure throw one needle is knit in back bed like at 6-course. Then loops of back bed needles 4, 8, 12, 16 etc. are transferred to front bed needles 3, 7, 11, 15 etc. As mentioned above at 3-course there are some requirements to transference. For example same as at 3-course specially-designed latch needles, a delivering needle cam that lifts the needle higher than normal clearing-height.



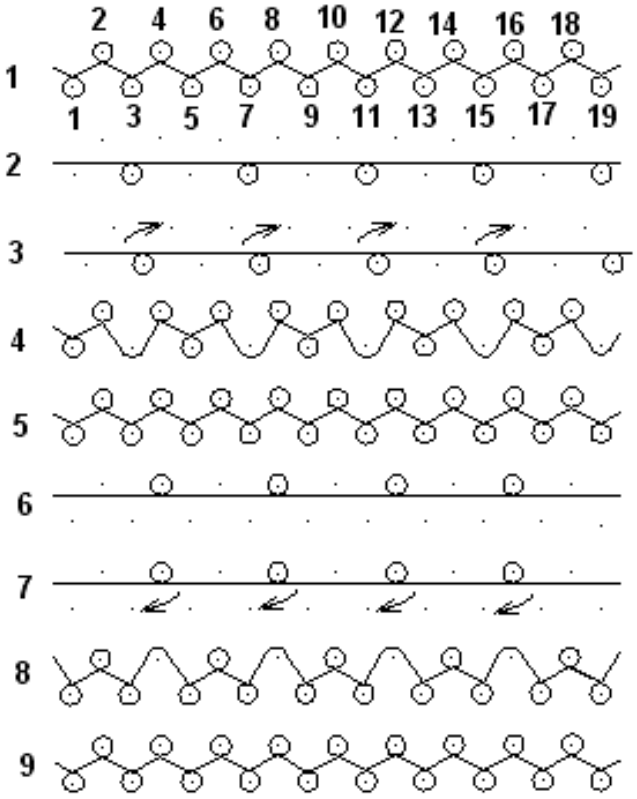


Fig.10. Structure №2.

4-course. All needles of both front bed and back bed are working. After transferring back bed needles 4, 8, 12, 16 etc. are empty and have not old loops, therefore they knit cardigan stitches.

9-course. Knitting process of 5-course is repeated and rib 1x1 structure is knit.

New structures have been created and produced at the "Knitting Technology" Department's laboratory of Tashkent Institute of Textile and Light Industry (TITLI) on the base of rib 1x1 structure. Physical-mechanical properties of that have been investigated in certification Center CENTEXUZ at the TITLI. Results of experimental works of new combined structures are shown at the table №1 and graphs have been built (fig.11). PAN yarn 330 tex (Nm=3) have been used to produce knitting samples.

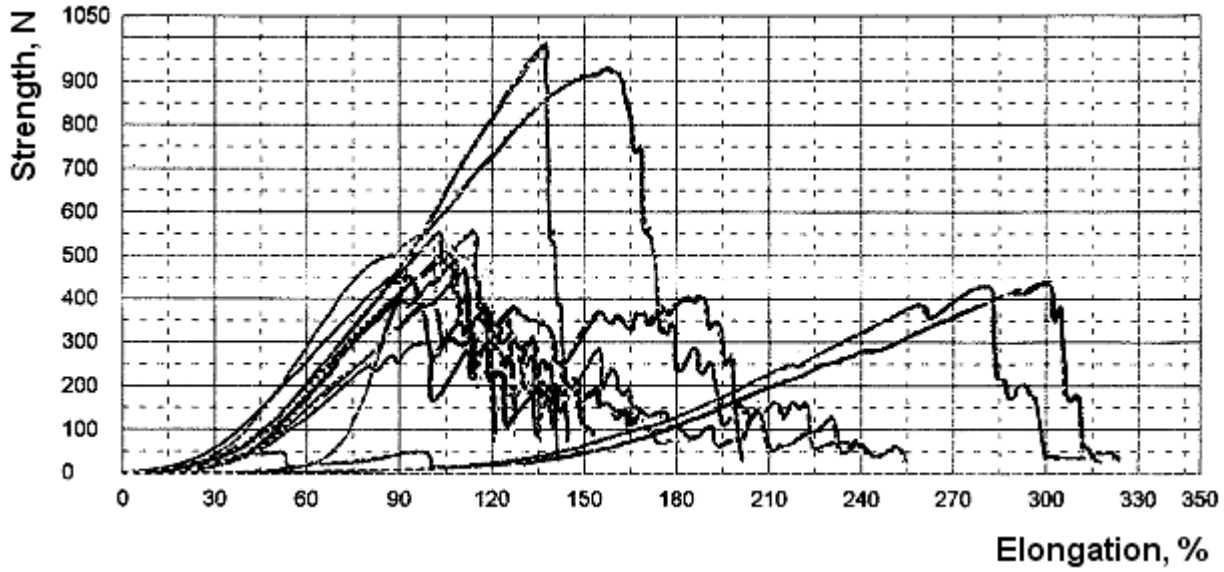


Fig.11. Strength-elongation curve of samples

Table1№1

Technological parameters and physical-mechanical properties of knitting samples

№	Yarn PAN 330 tex (Nm=3)	Surface density, g/m^2	Volume density, mg/sm^3	Thickness, mm	Breakage strength, N		Breakage elongation, %	
					On length	On width	On length	On width
1	Basic structure	830,3	265,27	3,13	961,9	437,0	147,4	290,5
2	Structure №1	438,9	148,27	2,96	535,0	366,3	104,4	157,8
3	Structure №2	650,9	209,29	3,11	516,9	531,3	112,4	105,9

Surface density of basic structure is 830,3 g/m^2, structure №1 - 438 g/m^2, structure №2 - 650,9g/m^2. Difference:

830,3 – 438,9 = 391,4 g/m^2

830,3 – 650,9 = 179,4 g/m^2

It means that surface density of new created structures is less then basic structure and raw material requiring is decreased to produce of them.

Volume density of basic structure is 265,27 mg/sm^3, structure №1 - 148,27 mg/sm^3 , structure №2 - 209,29 mg/sm^3. Difference:

265,27 – 148,27 = 117 mg/sm^3

265,27 – 209,29 = 55,98 mg/sm^3.

It means that volume density of new created structures is less then basic structure and raw material requiring is decreased to produce of them.

Measuring of thickness shows that basic structure has 3,13 mm, structure №1 – 2,96 mm , structure №2 – 3,11 mm. Difference is ≈5% that allows to offer a new created structures as strong knitwear well.

Conclusion

Results of analyses show that offered structures have some advantages to compare to basic structure. On the aim of resource economy technology they give a possibility of raw material expenditure decreasing 22-47%. There is not lost strength parameters. Stabilization of elongation on length and width is possible due to structure and knitwear has more form stability. Structures consist of normal rib loops, plain structure loops, cardigan stitches and elongated loops. These elements are possible to make nice surface design of knitwear like relief pattern and are offering to the manufacture and market as well. Meanwhile they are offered to produce both at simple and modern computerized flat knitting machines like SHIMA-SEIKI, PROTTI, STOLL, UNIVERSAL that have loop transference possibility.

III. LABOUR SAFETY AND ECOLOGY

Sanitary-hygienic norms of women's work in knitwear production

Domestic system of labour protection as part of the overall security of vital activity of more than seventy years were formed and developed in the framework of the planned regulated by the state of the economy. It certainly fulfilled its positive role, allowing to implement multidimensional complex guarantees and measures of protection and social support of the workers. Features of this system was its highly regulated state financing and real management responsibility for the violation of the laws, norms and rules of labour protection.

Occupational hygiene and health protection of women. Occupational hygiene is one of the leading medical disciplines that study the effects on the body working conditions, work organization and the labour process, as well as carrying out the State sanitary inspection, taking into account features of kinds and branches of various production facilities. Considering the above, the conduct of the State sanitary supervision and development of recreational activities, including, and in finishing production of textile industry of Uzbekistan is important, given that the unlimited possibilities of the raw materials base of the Republic (cotton) create favourable conditions for the development of production of natural fibres used in textile production, where mainly women work.

In harmful conditions that do not meet sanitary-hygienic standards, works 21.4% of the total employment in industry (i.e. every fifth). About half of working in harmful and dangerous working conditions are women, which leads to the progression of negative trends in the state of their health, to a high level of occupational disease, the progression of widespread professionally due to common diseases. There is evidence that, in recent years the share of women participating in economic activities on a global scale is increased to 66%, and the forecast for 2010, this index will increase by almost 70%.

The problem of occupational hygiene and health protection of women in the scientific literature given enough attention. In numerous publications shows that the accumulated data about the adverse impact of production factors on the organism of women and offspring substantiate the necessity of improving national systems for the protection of women, including legal, technical and sanitary - hygienic actions providing safe working conditions. Scientific basis for the development of special measures of labour protection of women statistical data on anatomical and physiological and psychological peculiarities of their body and, hence, a reaction to the impact of production conditions, the impact of occupational hazards on the specific function of women, including maternity. Anatomic-physiologic features of a female organism, compared to men, put women in a situation of high priority protection, especially those who are forced to work during pregnancy. The production of material and spiritual values, population reproduction put a woman in a special position in society, from which require guarantees for the preservation of its social and biological well-being. Save the last possible by implementing a broad system of measures of protection of motherhood in General.

In our country the legal basis of labour protection and health. The main Law - the Constitution of the Republic of Uzbekistan (1992) - guaranteed everyone the right to work, to just conditions of work (article 37)

In the Law of the Republic of Uzbekistan "On labour protection" States that State policy on labour protection is based on the principles of "the wide use of achievements of science, engineering and advanced domestic and foreign experience on labour protection".

The Labour Code of the Republic of Uzbekistan emphasized the special state care of persons in need of enhanced social protection (women, minors, and others), legalized additional guarantees and benefits for working women, which contain special rules for the protection of women workers are taken into account physiological features of a female organism and for women to perform the function of motherhood. These special rules can be divided into two groups: norms on

labour protection, which covers all employed women; the norms for labor protection, which establish, as a rule, certain restrictions at work women or additional requirements to their working conditions.

The study of air environment of basic production sections trikotazhnykh workshops showed that the dust content of the air at a knitting sites exceeded MAC in 1,15 times, as the dust has allergenic and fibrogenic actions. The study of microclimatic conditions in which women work major professional groups knitwear production, showed that in the cold period of the year they are exposed to the adverse effects of cooling and warm period of the year - heating microclimate.

It is also established that the modern knitted production in knitting workshops from work knitting machines generates high-frequency noise, with an increase of the diameter of produced canvases noise level increases. Knitting machines, producing knitted fabric 14th diameter, are a source of noise in 85 dBA, 32nd diameter - 106 dBA, knitting machines for manufacturing Rebane and Suprema - 87 dBA. On the other production sites also acknowledged the presence of industrial noise exceeding the remote control for 1 - 3 dBA.

Revealed that the illumination of workplaces in textile industries uneven and insufficient, lower health standards. The most adverse lighting jobs of those production sites, which are located in the hermetic besfonarnyh buildings without natural light.

Labour processes of women's major professional groups differ intense character, repetition, touch significant loads.

The study of working conditions on the severity of labour processes have shown that workers employed in occupations knitter up to 80% of the shift are in the pose of "standing", while they make from 100 to 300 displaced tilt housing more than 30 degrees.

The obtained data allow us to predict the probability of varicose veins in workers who are in ortho - static position at the level of 35 to 38%.

Carried out researches have allowed to establish, that the working conditions of women working in the modern knitwear production, belong to the 3rd class, i.e. according to the "safety classification of conditions of work in terms of hazard and risk factors of production environment, severity and intensity of labour process" (SanPiN of the Republic of Uzbekistan № 0141-03) to harmful labor conditions, characterized by the presence of harmful factors in excess of hygienic standards and adverse affects on the body running and his posterity.

From the beginning to the end of the work shift in the examined workers significantly reduced working capacity and deteriorating performance and emotional condition.

In addition, in the dynamics of the work deteriorates in the indicators of the function attention of working women: a growing number of mistakes made when running transaction test, decreases the actual performance increases with the time spent on the job. In summer period the quality of execution of a transaction samples worsens, indicating a stronger production fatigue.

Thus, working conditions and the nature of the employment processes knitted industries have adverse effects on the functional state of organism of working women. From the beginning to the end of the day they develop changes of physiological reactions of the basic systems of the organism, indicating considerable production fatigue. In the summer, these shifts are exacerbated, and in separate functional systems (Central nervous and neuromuscular), exceed the maximum permissible value of physiological stress. Cardio - vascular system detected changes of hemodynamics at the level of primatologie.

IV. ECONOMIC PART

Company's business plan

Business pl**a**n offers the following issues: the goal of industrial production, the main activity (manufacturing services, trade, etc.); geographical chapels business development.

Business plan - a document that describes all major aspects of the industry and includes the following sections:

• summary;

• general description of the business;

• products and services;

• Marketing Plan;

• the production plan;

• management and organization;

• the legal form of industrial production;

• a financial plan.

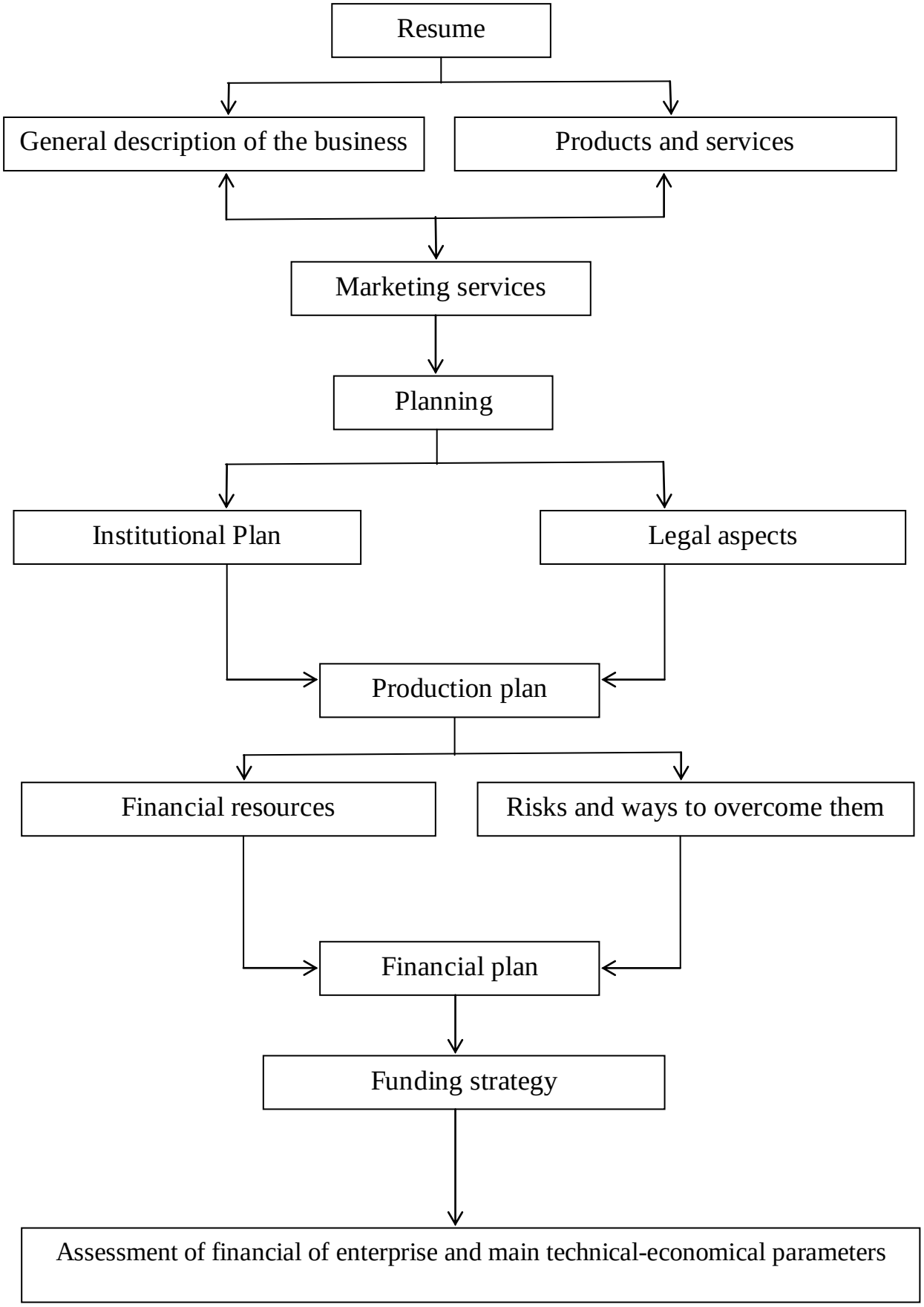
Value of a business plan is determined by the fact that he:

- Allows you to determine the viability of future business in a competitive environment

- Contains guidelines, under which the owner will act on the stage of the enterprise

- Is an essential tool for support from outside investors.

Structure of the business plan



Calculation coefficient of operating equipment (COE)

Norma repair time 120 persons / hour.

Overhaul is held once in two years.

Average repair once a year

2 - change

Duration 8:00 shift.

Determine the percentage breakdowns for major repairs:

$$Д_{час} = \frac{Н_{вр}}{И_р} = \frac{216}{4} = 54 \text{ hours.}$$

I. shift = 8+8+8+8+8+8+6=54 hours

II. shift = 8+8+8+8+8+8=48 hours

$\sum$ =102 hour

$$a_1 = \frac{102 * 1 * 100}{2 * 4178} = \frac{10200}{83564} = 1{,}22\ \%.$$

Determine the percentage of planned downtime average repair:

Fixed time: 48 persons / hour.

Periodic repair: 1 year.

$$Д_{час} = \frac{48}{4} = 12 \text{ hours.}$$

I. shift = 8+4=12 hours.

II. shift = 8 hours.

$$a_2 = \frac{20 * 1 * 100}{1 - 4178} = \frac{2000}{4177} = 0{,}48\ \%.$$

When downtime due to the current repair is equal to 1%

$a_3 = 1\ \%.$

$a_4 =$ calculated only for the warp knitting equipment.

Cleaning equipment is 1 every 2 weeks for 2 hours.

$$a_5 = \frac{1 * 100}{80} = \frac{100}{80} = 1{,}25\ \%.$$

$$a = a_1 + a_2 + a_3 + a_5 = 1{,}22 + 0{,}48 + 1 + 1{,}25 = 3{,}95\ \%$$

$$\text{КРО} = 1 - \frac{3{,}95}{100} = 0{,}96$$

Determine the volume of the finished output

1 – assortment

$$\text{В}_{\text{год}}^{\text{шт}} = \text{М}_{\text{з}} * \text{КРО} * \text{Н}_{\text{м}} * \text{Т}_{\text{год}} = 16 * 0{,}96 * 5 * 4178 = 320870{,}4 \text{ pieces.}$$

2 – assortment

$$\text{В}_{\text{год}}^{\text{шт}} = \text{М}_{\text{з}} * \text{КРО} * \text{Н}_{\text{м}} * \text{Т}_{\text{год}} = 16 * 0{,}96 * 5 * 4178 = 320870{,}4 \text{ pieces.}$$

Total:

$$\text{В}_{\text{год}}^{\text{шт}} = \text{М}_{\text{з}} * \text{КРО} * \text{Н}_{\text{м}} * \text{Т}_{\text{год}} = 32 * 0{,}96 * 5 * 4178 = 641740{,}8 \text{ pieces.}$$

1 – assortment

$$\text{В}_{\text{год}}^{\text{кг}} = 320870{,}4 * 371{,}4 = 119171{,}3 \text{ kg.}$$

2 – assortment

$$\text{В}_{\text{год}}^{\text{кг}} = 320870{,}4 * 353{,}6 = 113459{,}8 \text{ kg.}$$

Total:

$$\text{В}_{\text{год}}^{\text{кг}} = 232631{,}1 \text{ kg.}$$

The production program of knitting

№	Name of product	Name of equipment	The linear density of the yarn	Mode of operation of the enterprise				Number of equipment	Machine hours ready for work	COE	Planned downtime					Machine hours in the work	Productivity of equipment	Output per year	
				Change time	Number of shifts	Number of working days per year	Number of working hours per year				a_1	a_2	a_3	a_4	a_5			Pieces	Kg
1	Men's Sweater	PROTTI	62,5 текс	7,46	2	280	4176	32	133696	0,96	1,22	0,48	1	---	1,25	128348	5	320870,4	119171,3
2	Men's Sweater																	320870,4	113459,8
	Total:																	641740,8	232631,1

The balance of raw materials in the manufacture of knitted

Received production					Retrieved from production				
Name of raw materials	Number of products, kg	percentage contents	Price of 1 kg	Sum, thousand soms	Name of raw materials	Number of products, kg	percentage contents	Price of 1 kg	Sum, thousand soms
Acrylic	232631,1	100%	14000	3256735,4	Men's Sweater	113606		14665-31	1657267,6
					Waste when cutting	3456,0	2,9	2000	6912
					Waste when knitting	2109,3	1,77	2000	4218,6
					Total:	119171,3	100		1668398,2
					Men's Sweater	106924,5		14733-45	1575366,6
					Waste when cutting	2110,4	1,86	2000	4220,8
					Waste when knitting	4424,9	3,9	2000	8849,8
					Total:	113459,8	100		1588437,2
Total:	232631,1	100,0		3256835,4	Total:	232631,1	100,0		3256835,4

The calculation staffing and salaries

Name of professions	Group of workers	Number of machines	Number of workers			Person operating hours	payment system	payment system	Bonus percentage,%	Tariff rates	Time wages	Premium	Hour wages fund
			I shift	II shift	Total:								
I group													
Knitter	0	32	11	11	22	164,12	t/p	IV	80	2021,06	331696	265357	597053
Seamstress (dial linking)	0	9	9	9	18	134,28		IV	80	2021,06	271388	217110	488498
Seamstress (tambour)	0	14	14	14	28	208,88		IV	80	2021,06	422159	337727	759886
instructor	0		1	1	2	14,92		VI	80	2689,46	40127	32102	72229
Total:			35	35	70	522,2					1065370	852296	1917666
II group													
Pommaster	X		1	1	2	14,92	t/p	VI	60	3108,32	46376	27826	74202
Foreman	X		1	1	2	14,92		VI	60	2689,46	40127	24076	64203
Electrician	X		1	1	2	14,92		IV	60	2335,56	34847	20931	55816
Locksmith	X		1	1	2	14,92		III	60	2104,36	31397	18838	50235
Cleaner	X		2	2	4	29,84		III	60	2104,36	62794	37676	100470
Transporter	T		2	2	4	29,84		III	60	2104,36	62794	37676	100470
Total:			8	8	16	119,36					278335	167001	445336
III group													
Assistant			1	1	2	14,92	t/p	VI	60	2689,46	40127	24076	64203
Cleaning woman			2	2	4	29,84		II	60	1640,22	48944	29366	78310
Storekeeper			2	2	4	29,84		IV	60	2689,46	80253	48152	128405
Total:			5	5	10	74,6					169324	101594	270918
Total:			48	48	96	716,16					1513029	1120891	2633920

The calculation of the annual salary fund

The wage fund	Time Foundation, Som	Working days	Sum, thousand soms
Time wages Timephased	1513029 1120891	280	423648 313849
Hour wages fund (HWF)	2633920		737497
Surcharges for intra replaceable the simple (1,5 from HWF)	39508,8	280	11062
Daily wages Fund (DWF)	2673428,8		748559
Payment of the next holidays (10 % DWF)	267342,9	280	74856
The monthly wages Fund	2940771,7	280	823416

The calculation of the number and funds the salaries of managers, professionals and unskilled workers of the shop

Post	The number of employees, persons	Official salary, som	Annual fund, som	Hazard pay 25 %	Premiums		Total annual fund, som
					%	Som	
1	2	3	4	5	6	7	8
Managers specialists							
Head of the shop	1	600000	7200000	9000000	50	4500000	13500,0
Head chem. laboratory	1	500000	6000000	7500000	50	3750000	11250,0
Senior master	1	500000	6000000	7500000	50	3750000	11250,0
Master	2	480000	11520000	14400000	50	7200000	21600,0
Checkman	1	400000	4800000	6000000	50	3000000	9000,0
Ancillary workers							
Cleaners	2	300000	7200000	9000000	50	4500000	13500,0
Total:	8						80100

The calculation of technical and economic indicators of labor

1. Labor productivity: (kg)

$$ПТ_{кг} = \frac{В}{U_ч} = \frac{232631,1}{200544} = 1,16 \text{ kg/per. hours}$$

$$U_ч = \frac{Ч_я * Т}{2} = \frac{96 * 4178}{2} = 200544 \text{ per. hours}$$

2. Labor productivity valuable expression:

$$П = \frac{В_{сум}}{Ч_{сп}} = \frac{3256835,4}{101} = 32245,8 \text{ thousand soms}$$

$$Ч_{сп} = \frac{Ч_я}{1 - \frac{\% \text{ неявок}}{100}} = \frac{96 * 100}{95} = 101 \text{ persons}$$

3. Specific consumption of the labour force:

$$У_р = \frac{U_ч}{О_{мч}} = \frac{200544}{128348} = 1,6$$

4. Labor productivity:

$$П_т = \frac{Н_м}{У_р} = \frac{5}{1,6} = 3,1 \text{ kg/per. hours}$$

5. Labor content:

$$Т = \frac{1}{П_т} = \frac{1}{3,1} = 0,32$$

6. The weight hourly wage:

$$СЧЗП = \frac{ЧФЗП}{\text{the hours fulfilled the person}} = \frac{737497}{200544} = 3677 \text{ soms}$$

7. The daily average wage:

$$ДЗП = \frac{ДФЗП}{Д_{год} * Ч_я} = \frac{748559}{280 * 96} = 27848 \text{ soms}$$

8. The average monthly salary:

$$МЗП = \frac{МФЗП}{U_ч * 12} = \frac{823416}{101 * 12} = 679386 \text{ soms.}$$

The calculation of production cost

I. Production material costs.

1. Costs of raw materials - 3256835,4 thousand soms.

2. Costs of auxiliary materials - 195410,1 thousand soms.

3. Fuel and technological needs - 3208,7 thousand soms.

4. Depreciation of property, productive assets

№	Name of equipment	Number of machines	The price of the machine thousand soms	cost of the machine thousand soms
1	PROTTI	32	50000	1600000
2	Tambour machine	14	7000	98000
3	Dial linking machine	9	6000	54000
4	Steam iron	2	500	1000
	Total:			1753000

$$З_{изн} = \frac{1753000 * 3\%}{100} = 52590 \text{ thousand soms}$$

5. Heating costs of buildings and structures:

$4000 * 11000 = 44000$ thousand soms

6. Costs for repair of buildings:

$4000 * 12000 = 48000$ thousand soms

The costs of all types of energy

A) Motor power

Type of equipment	Number of equipment	Motor power	Total power kW	coefficient of efficiency	KIM	Taking into account the efficiency and KIM	Working hours	Need electricity kilowatt / hour
1. PROTTI	32	6	192	0,95	0,92	167,8	4178	701,1
2. Tambour machine	14	2	28	0,95	0,92	24,5		102
3. Dial linking machine	9	2	18	0,95	0,92	16,6		69,3
4. Steam iron	2	1	2	0,95	0,92	1,7		7,3
Total:								879,7

B) Electricity for lighting

Objects	Area	Norma lighting	The total demand of electric power	COE	Active power	Lighting hours	The total demand of electric power kW
Production area	4000	0,23	920	0,96	883,2	4178	3690
Administrative area	800	0,155	124	0,96	119	1600	190,5
Total:							3880,5

C) Energy for the duty of sanctification

$$Э/э_{д.о} = \frac{3880,5 * 10}{100} = 388,1 \text{ т. kW}$$

D) Electricity for heating, humidification, ventilation

$$Э/э_{ОУВ} = \frac{879,7 * 20}{100} = 175,94 \text{ т. kW.}$$

The estimated cost of electricity

№	Types of electricity	Annual demand т.kW	The price of 1 kW, Som	The cost of electricity, thousand soms
1	Motor power	879,7	103,42	90978,5
2	Electricity for the consecration	3880,5	103,42	401321,3
3	Electricity for the duty of sanctification	388,1	103,42	10437,3
4	Electricity for HHV (heating, humidification, ventilation)	175,9	103,42	18191,6
	Total:			550628,7

Summary table of material costs

№	The name of the costs	Sum, thousand soms
1	Raw material costs	3256835,4
2	The costs of auxiliary materials	195410,1
3	Fuel for technological needs	3208,7
4	Wear low-value inventory	52590
5	Heating costs knowledge	44000
6	The cost of repairs of buildings	48000
7	Energy costs	550628,7
	Total:	4150672,9

II. Wage costs

1. The basic wage: 823416 thousand soms
2. Wages shop personnel: 80100 thousand soms

Total: 903516 thousand soms.

III. Unified social payments (25%) 225879 thousand soms

Depreciation of fixed assets

1. Depreciation of equipment

Name of equipment	Number of equipment	The price of equipment	Cost of equipment t.soms	Installation of equipment t.soms	Full cost t.soms	Depreciation rate	Amortization charges
1. PROTTI	32	50000	1600000			20 %	
2. Tambour machine	14	7000	98000				
3. Dial linking machine	9	6000	54000				
4. Steam iron	2	500	1000				
Total:			1753000	350600	2103600		420720

2. Depreciation of buildings and structures

$4000 * 210 = 840000$ thousand soms

$800 * 180 = 144000$ thousand soms

$$A_з = \frac{984000 * 5}{100} = 49200 \text{ thousand soms}$$

3. Depreciation of vehicles

$$A_т = \frac{420720 * 10\%}{100} = 42072 \text{ thousand soms}$$

Total: 511992 thousand soms

Other costs for production purposes

1. The cost of average and major repairs of equipment

$$З_т = \frac{2103600 * 2}{100} = 42072 \text{ thousand soms}$$

2. The cost of average and major repairs of equipment

$$З_с = \frac{2103600 * 2{,}5}{100} = 52590 \text{ thousand soms}$$

3. The costs for the protection of the district environment

$$З_{о.к.с} = \frac{42072 * 10}{100} = 4207{,}2 \text{ thousand soms}$$

4. The cost of safety and labour protection

$101 * 5000 = 505$ thousand soms

5. Expenses for research, design, streamlining

$57 * 10000 = 570$ thousand soms

Total: 99944,2 thousand soms

The summary table of the cost of production

Cost items	Total cost t.soms	Price per item soms	% of total %
Production material costs	4150672,9		70,4
Wages for production purposes	903516		15,3
Single social payment	225879		3,8
Depreciation of fixed assets	511992		8,7
Other costs	99944,2		1,8
Total:	5892004,1	9181-28	100

The plan product sales

Name of product	Volume of production	Realization		Cost		Profit	Profitability	The cost of 1som TP
		t.soms	Per unit of product	Т.сум	t.soms			
Men's sweater	641740,8	8984371,2	14000	5292004,1	9181-28	2633966,3	20	0,66

Calculation of expenses of the period

$$РП = \frac{823416 * 5}{100} = 41170{,}8 \text{ thousand soms}$$

The name of the costs	%	Sum t.soms
The content of obsevable staff	25	10292,7
Office expenses	7	2882,0
Travel expenses	8	3294
Maintenance of buildings of the factory management	17	6999
The content of obsevable laboratory	12	4940,5
Scientific - research costs	8	3293,7
Expenses on marketing	9	3705,4
Other expenses	14	5763,9
Total:		41170,8
Land tax (3,5%)		108066
Water tax		930,5
Land tax (100 м² 6144 т.сум)		294912
The tax to the Republican road Fund (1,5 %)		134765,6
Total:		579844,9

Financial performance

№	Indicators	Sum t.soms
1	Volume of sales	8984371,2
2	Product cost	529004,1
3	Profit of the enterprise	2633966,3
4	Expenses periods	579844,9
5	Profit from operations	2054121,4
6	Tax on profits 8 %	164329,7
7	Profit after tax	1889791,7
8	Tax on infrastructure development 8%	151183,3
9	Tax to the reserve Fund of the enterprise 5%	94489,6
10	Net profit	1644118,8

Technical and economical performance of the enterprise

№	Name of indicators	Unit of measure	Value
1	Name of equipment	PROTTI	
2	Number of machines	Machinery	32
3	Planned downtime	%	3,95
4	Number of working hours per year	Hour	4178
5	Output	Kg. Pieces	233631,1 641741
6	Productivity of equipment	Products	5
7	Number of industrial production personnel including workers	People	109 101
8	Labor productivity	Thousand soms	82425,4
9	Selling price	Thousand soms	8984371,2
10	Wholesale price	Thousand soms	6350404,9
11	Product cost Including one unit of product	Thousand soms Som	5292004,1 9181-28
12	Average monthly wage	Som	679386
13	Profitability of products	%	20
14	Profitability of the company	%	32,4
15	Investment	Thousand soms	3087600
16	Capital productivity	Som	2-91
17	Payback period of capital investments	Year	1,9

CONCLUSION

DIPLOMA PROJECT consists of consists of four parts: technological, special, ecological and economical. Graphical materials are offered in 4 papers of format A1.

In the DIPLOMA PROJECT on theme “DESIGNING OF ENTERPRISE SPECIALIZED TO PRODUCE MEN'S OUTERWEARS” has been done following:

-assortment of men’s outerwear, rind of knitting machine, rind knitting structure, raw material and consistency of technological process have been selected and justificated;

- technological parameters of knitting structure, raw materials expenditure per unit of production and waste quantity; annual production volume; the main area and the main storage spaces; sewing aggregate have been calculated.

32 flat knitting machines are set and they produce knitting parts that is used to produce knitwear. Average monthly salary 679386 som. Payback period of capital investments 1,9 year.

DIPLOMA PROJECT maybe offered to small business on producing of knitwear products.

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