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CLASSIFICATION OF SCREW RELATIONAL DRUMS

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ABSTRACT

This article develops and presents a classification of screw relational drums for machines. The results of the study are summarized and presented in graphical form in the form of constructions of currently known screw relational drums that ensure the horizontal movement of bulk materials (feed components) and intensify the interaction with each other and from the wall of screw relational drums, which expands the technological capabilities and reduces the size equipment and their mass.

Disciplinary: Mechanical and Machine Engineering.

1. INTRODUCTION

An analysis of the state and prospects for the development of technologies and equipment for the preparation of feeds allowed us to conclude that to increase productivity, feed preparation machines with working bodies are needed in which the feed preparation process would be carried out not only with the volumetric interaction of the particles of the feed components, but also the process itself preparation of feed would occur during the transportation of particles of feed components in an unoriented state in the working organ not a feed preparation machine from loading to unloading (Marchenko, 2020; Timuska & Sundström, 2001).

This work aims to create a progressive process for the preparation of feed, based on the use of continuous machines, with working bodies in the form of screw relational drums.

2. METHOD

The combination of transport and technological functions is ensured by the installation of flat, curvilinear or rod elements along the perimeter of the working body of the feed preparation machines

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(Marchenko, 2009), multidirectional with respect to helical lines along its perimeter, as well as devices with a complex surface around the perimeter and with tension springs fixed inside, in which compound screw effect. We call such aggregates and devices with different configurations relational, as this is a general term that takes in conventions, similarities, relativity from certain conditions, forms, and purposes.

Therefore, they are called screw relational drums.

Changing the layout of flat, curvilinear, or rod elements in screw relational drums allows you to control the complex spatial motion of the flows of particles of the components of the feed, i.e. increase or decrease the performance of feed preparation or regulate the quality of feed.

To impart low-frequency vibrations with a large amplitude of 15-1000 mm or more to the components of the feed components, the spatial shape of the helical relational drums is formed by mounting flat, curvilinear or rod elements around their perimeter. As a result of the studies, classification of relational screw drums was created (Figure 1) and Figures 2-9 which show the designs of screw relational drums:

- cylindrical (RC) - conventional cylindrical shape;

- conical (RK) - conditionally conical shape;

- convex (RVP) —conditionally convex in shape;

- concave (RVG) - conditionally concave shape;

- rod (RP) - mounted from helical rods;

- annular (RKO) —conditionally annular in shape with a conditionally broken outer surface, along the perimeter of which broken or curved helical lines are located.

- spiral (RS) - conditionally spiral form;

- square (RCA) of course square shape.

3. RESULT AND DISCUSSION

Each of these types of relational screw drums includes 7 classes located along the perimeter:

1st class - continuous broken lines;

2nd class - in separate sections of broken helical lines rotated relative to each other;

3rd class - directed towards each other by broken helical lines of the same pitch;

4th class - with four broken helical lines and two broken helical lines of the opposite direction;

5th class - three helical directionals from loading to unloading, and two broken helical lines of the opposite direction;

6th class - broken lines of the same direction;

7th class - smooth helical lines in one direction.

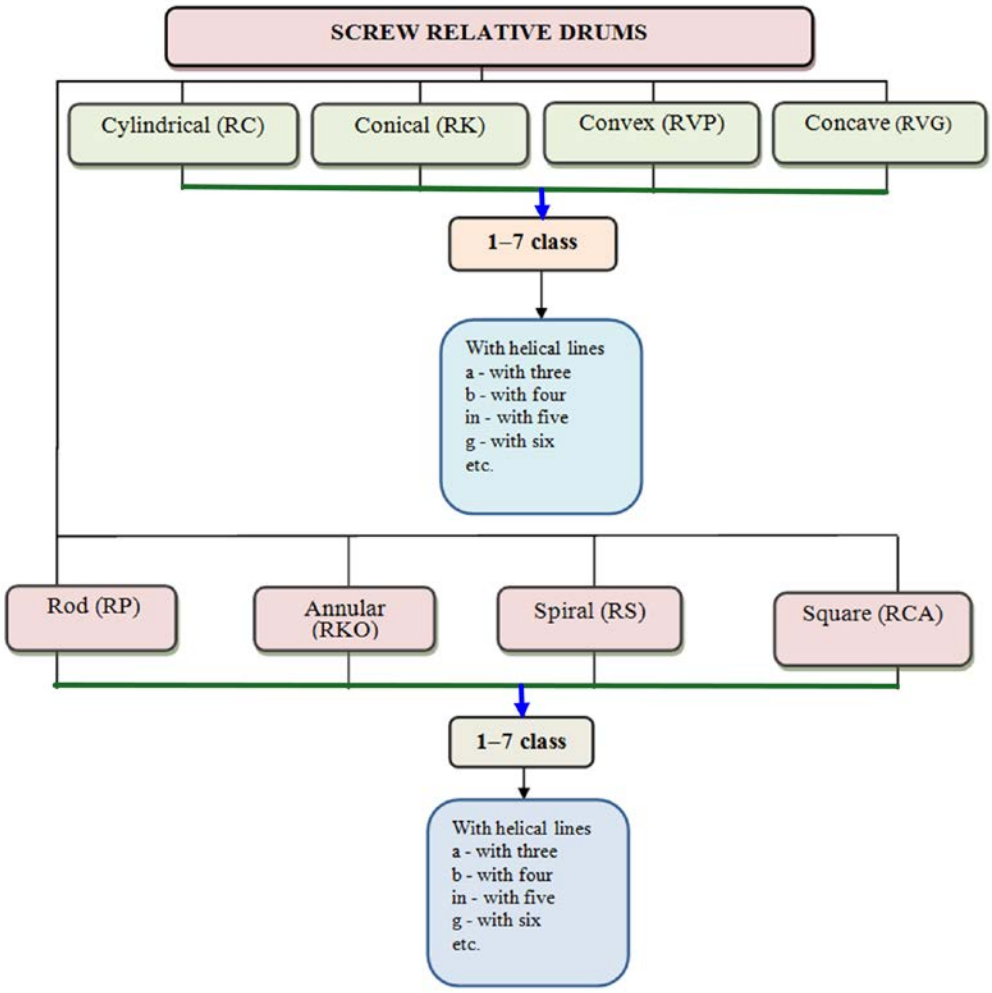

Figure 1: Classification of screw relational drums

Moreover, the classes of all types of screw relational drums can differ in the number of helical or zigzag lines, for example:

subclass a - three (n);

subclass b - four (n + 1);

subclass in - five (n + 2);

subclass g - six (n + 3), etc.

We will try to imagine the movement of the components of the feed, for example, peas (within the material point). In screw relational drums of the 4th and 5th classes, these movements are determined by the ratio of the screw parameters of the step and the number of approaches. In screw relational drums of the 6th and 7th classes, the direction of axial movement is uniquely determined. In screw relational drums of the 1st, 2nd, and 3rd classes, if you think completely abstractly, there should not be axial movement. Therefore, when installing feed preparation machines with screw relational drums of the 1st, 2nd and 3rd classes, a slight (3-7º) slope is created so that due to the acting gravity force to create movements of the feed components in the right direction, to a certain extent, this is facilitated by the intake of feed components, and the multidirectional of the screw surfaces creates a mixing effect.

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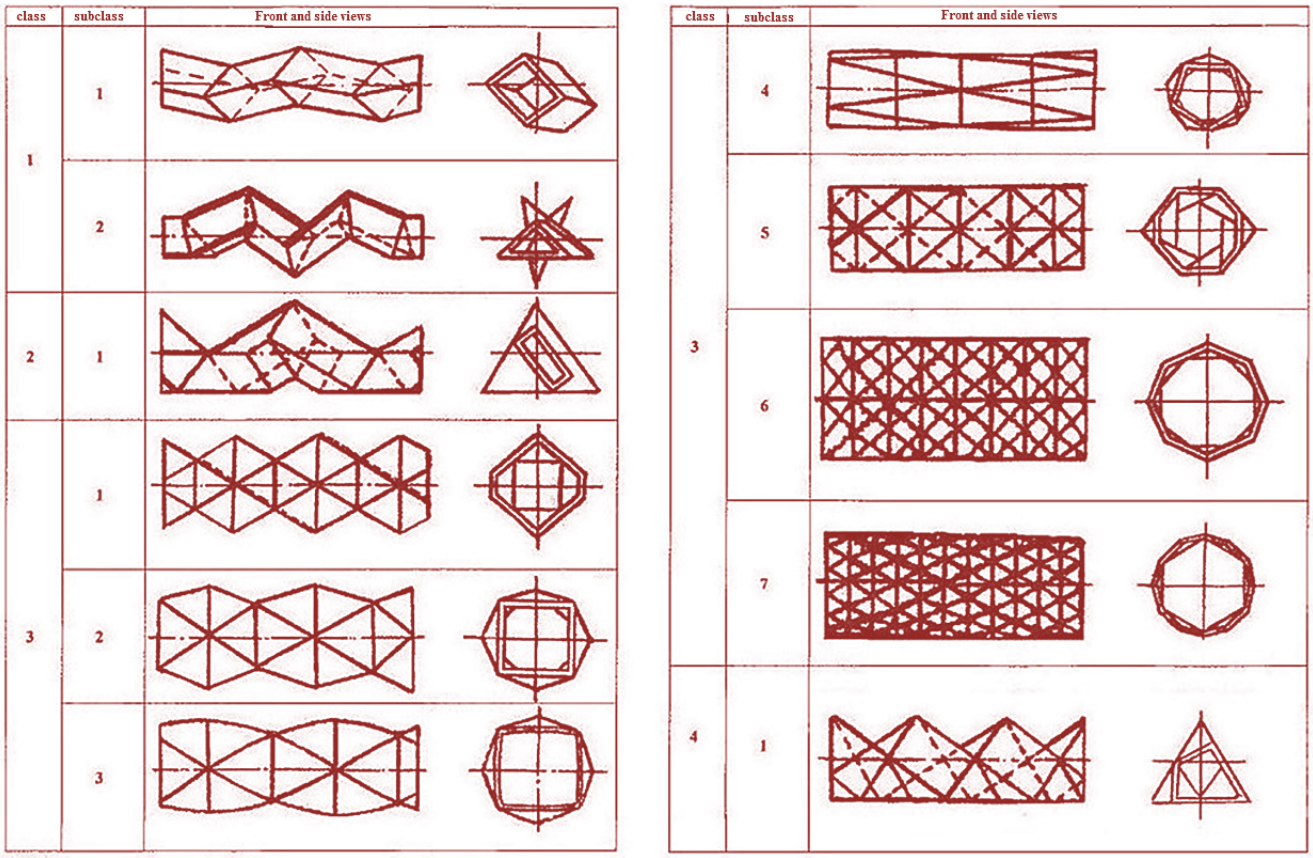

Figure 2: Classification of cylindrical drums of screw relational drums.

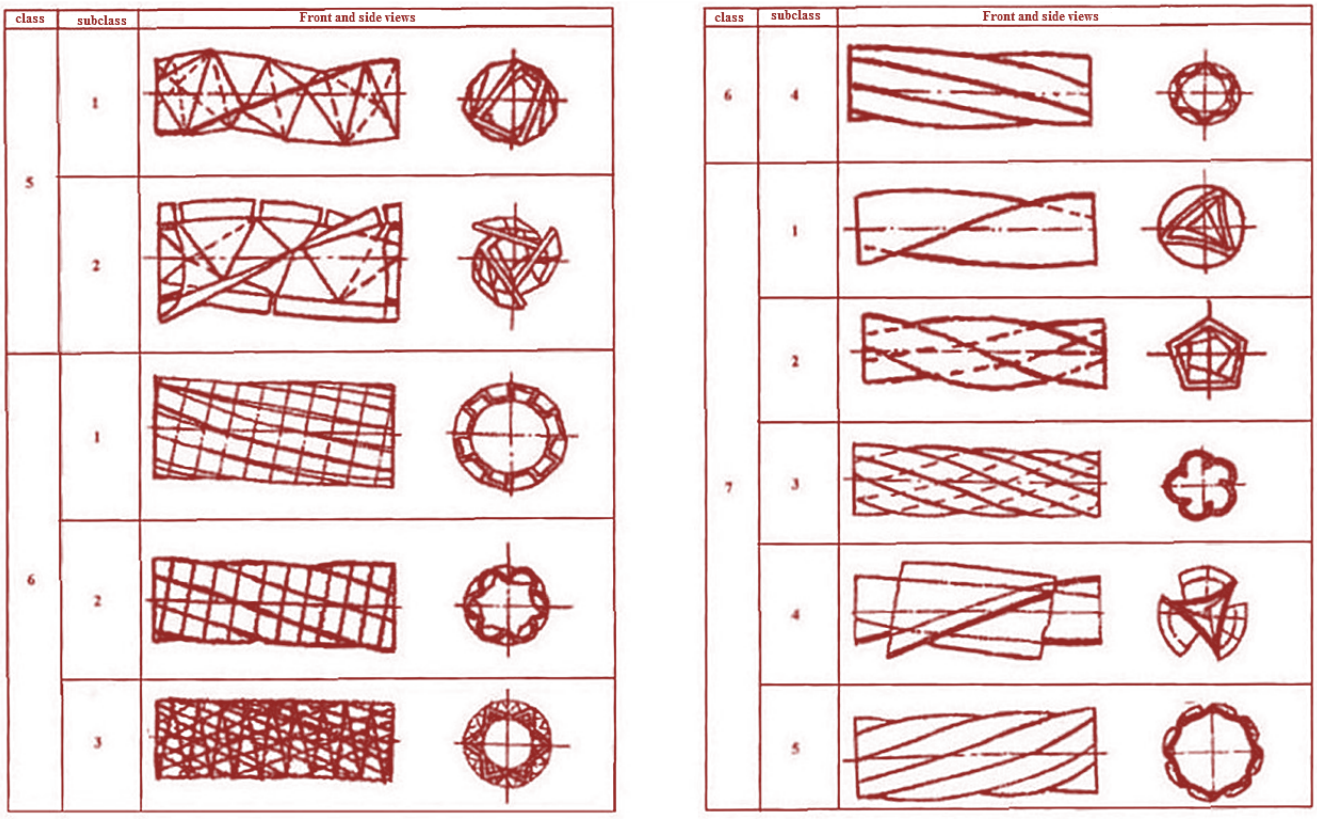

Figure 3: Classification of cylindrical drums of helical relational drums

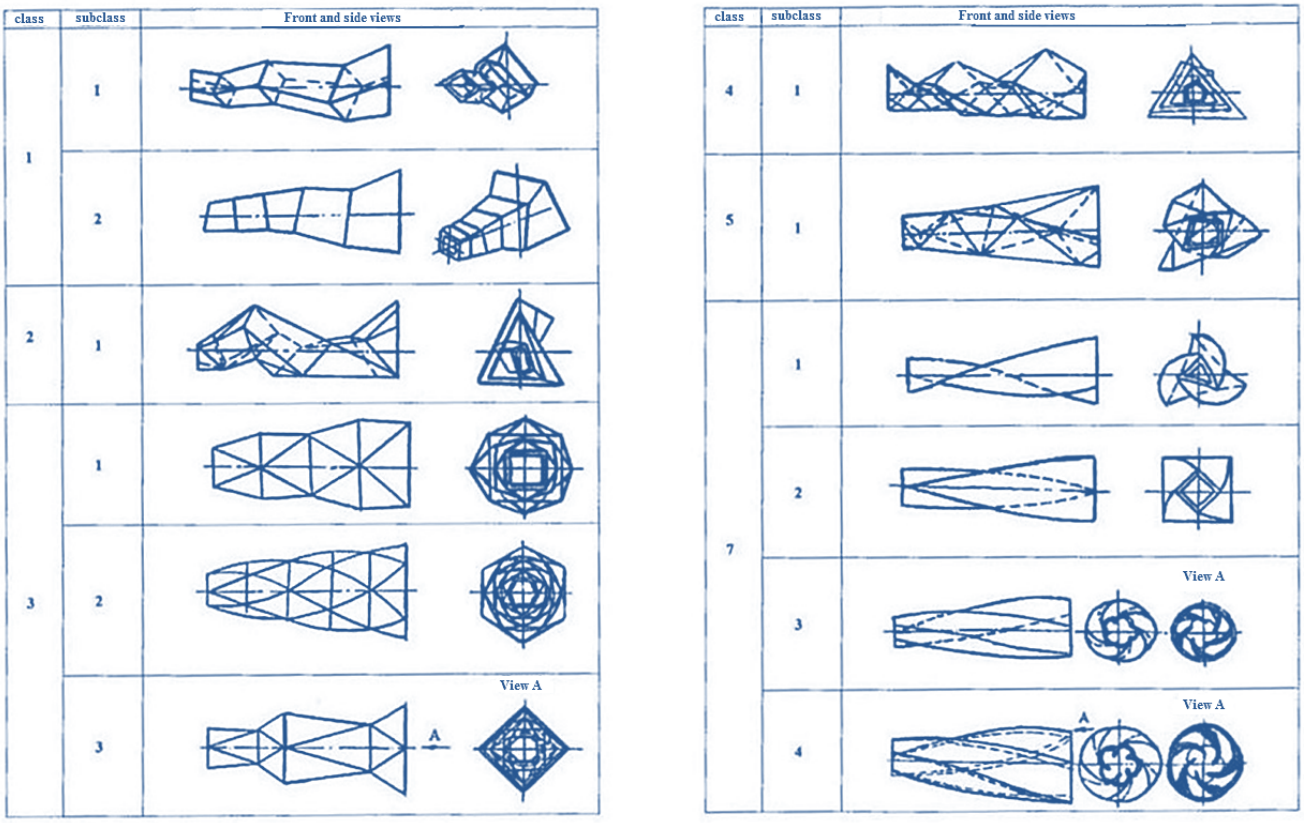

Figure 4: Classification of conical helical relational drums

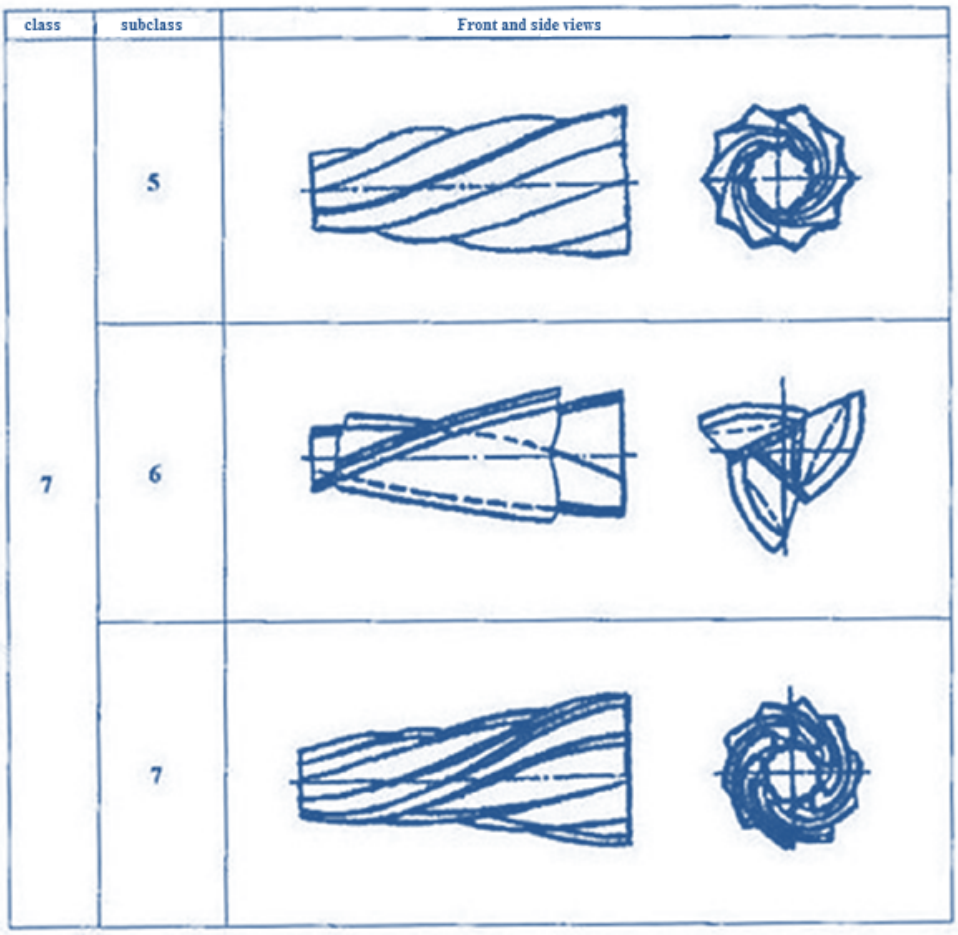

Figure 5: Classification of conical helical relational drums

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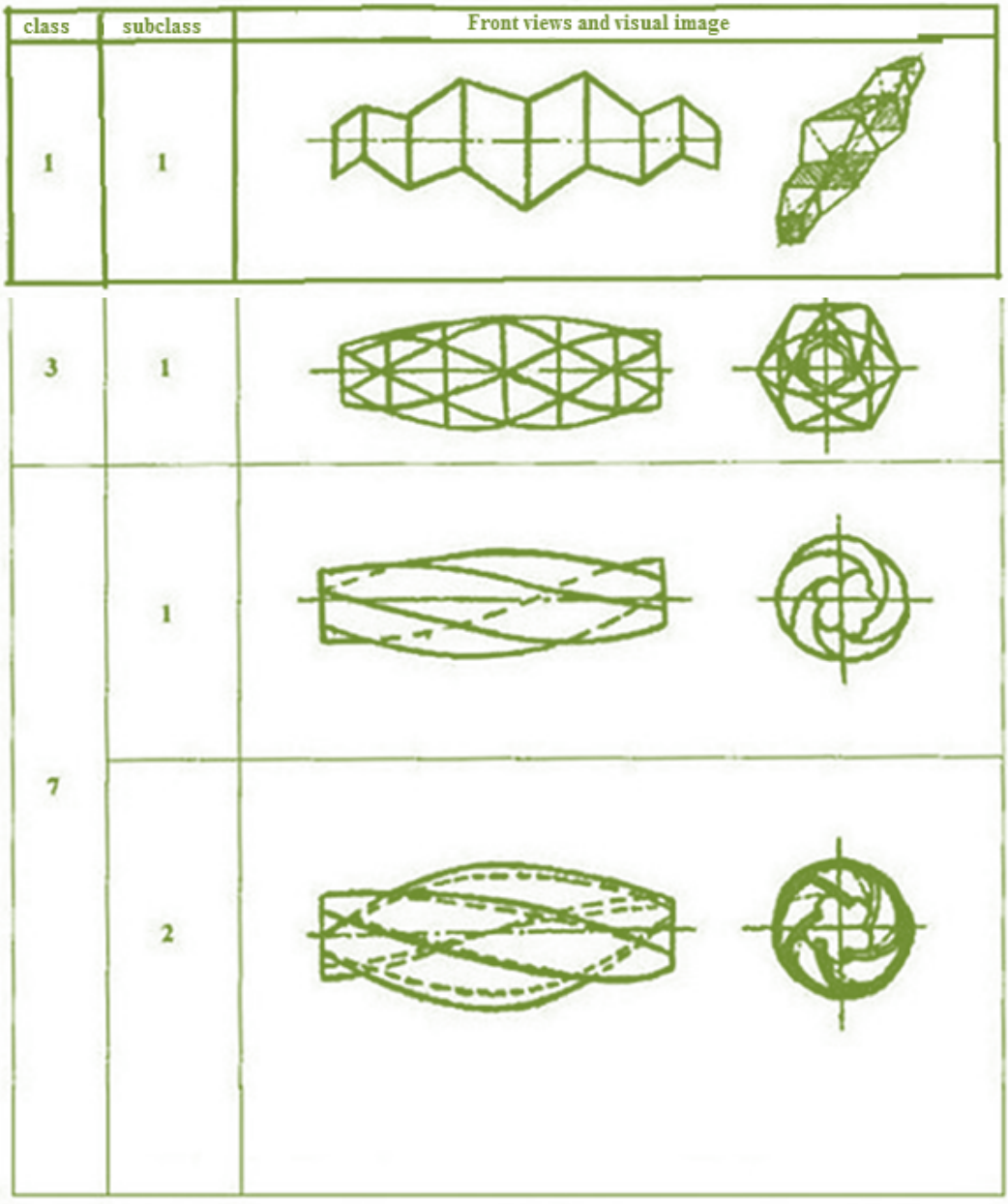

Figure 6: Classification of convex helical relational drums

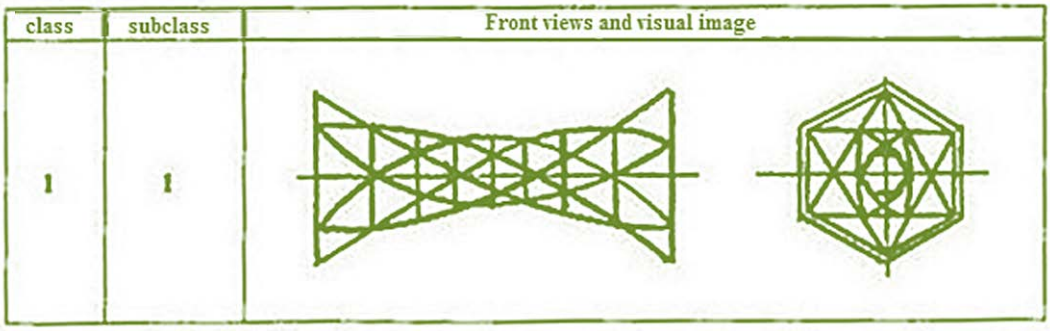

Figure 7: Classification of concave helical relational drums

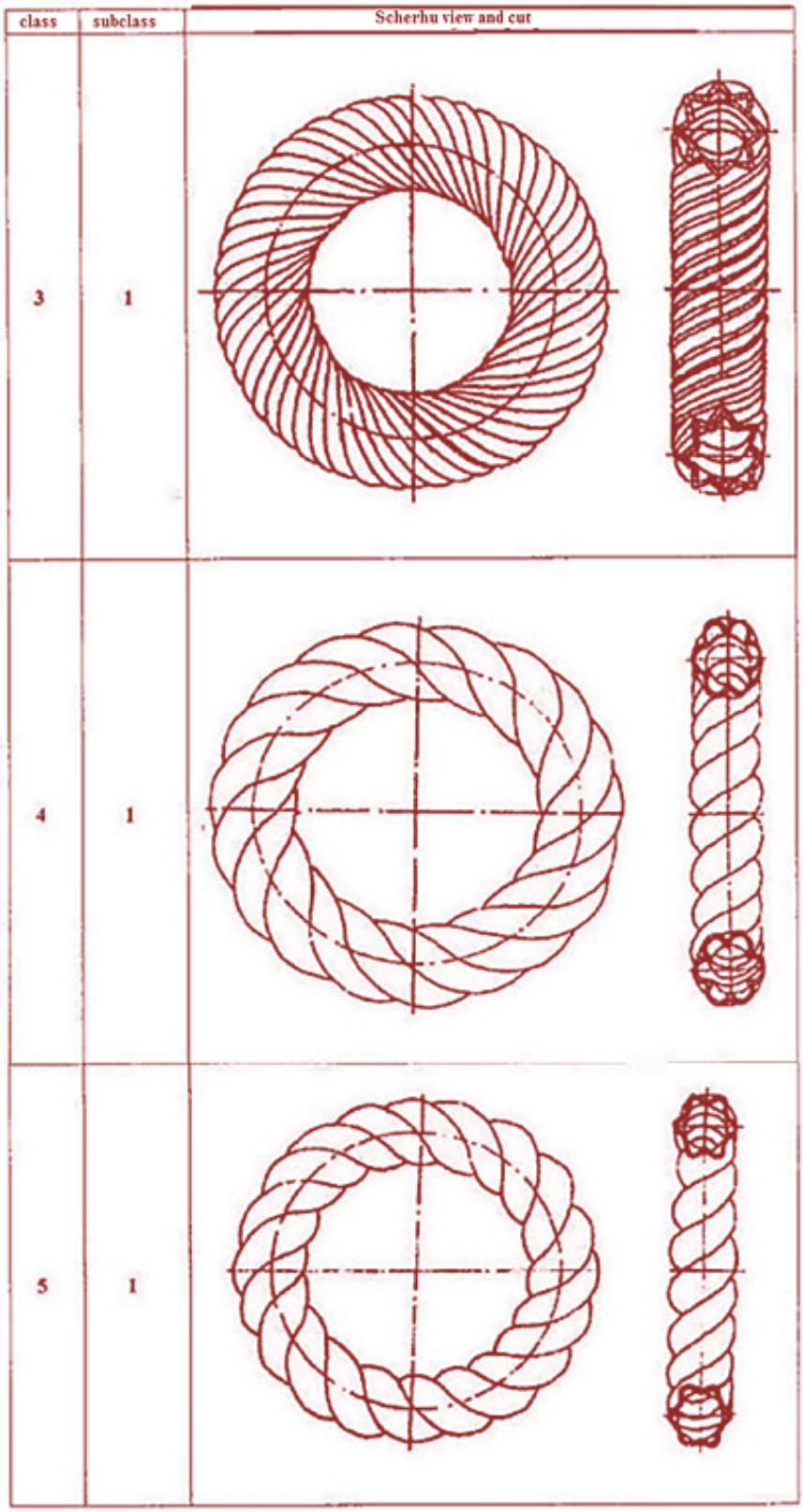

Figure 8: Classification of ring helical relational drums

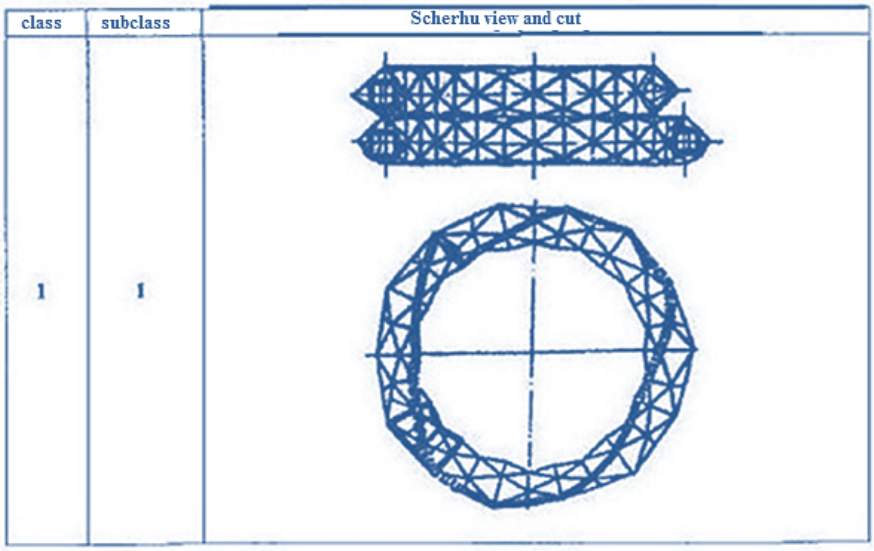

Figure 9: Classification of spiral helical relational drums

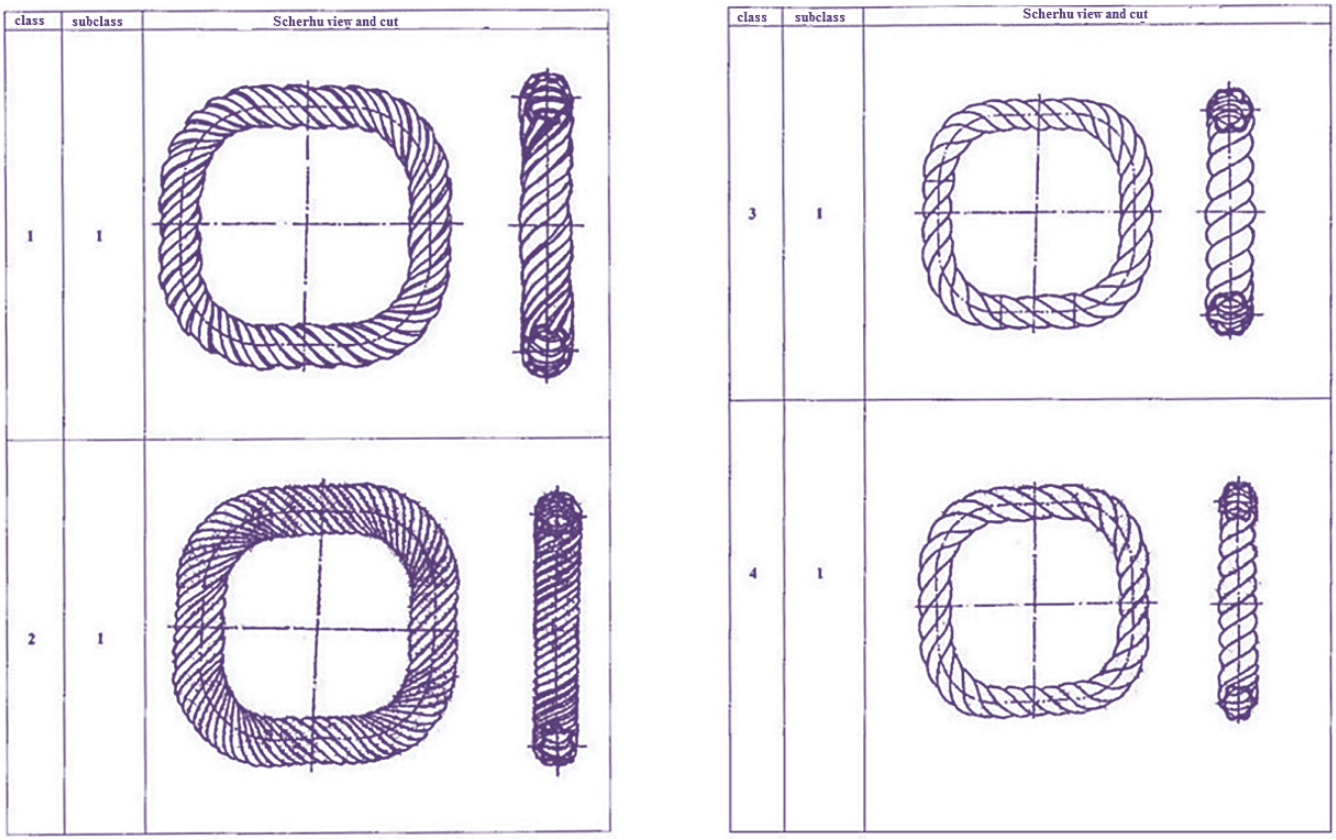

Figure 10: Classification of square helical relational drums

Based on the results of the research, classification of screw relational drums has been created, with the help of which, like a periodic table, it is possible to find new original designs of screw relational drums using the methods known in the classification using descriptive geometry and engineering graphics using the Compass-3D software package.

4. CONCLUSION

The article does not only present a classification of screw relational drums but also outlines ways to optimize the dimensions of the working bodies of equipment in the form of screw relational drums. Varieties of types of screw relational drums, their classes and subclasses are shown, which allow to select the working body of the feed preparation machine with the given parameters according to the characteristics of the feeds, and thus solve the problem of optimizing the designs of feed preparation machines as a whole. The approbation of the classification of screw relational drums was carried out, with the help of which the original designs of screw relational drums were created, the novelty of which was confirmed by 87 patents of the Russian Federation (e.g. Marchenko et al., 2009; 2012).

5. AVAILABILITY OF DATA AND MATERIAL

Data can be made available by contacting the corresponding authors

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