UDC 621.778.1

High Performance Technology for the Strip Scrap Processing

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Information on industrial realization of processing technology for non-liquid strip scrap is given. This technology includes slitting of initial strip for workpieces and its subsequent multiple drawing in rollers. It is shown that efficiency of the process is determined by quality and volume of supplied scrap for processing and accuracy of work tool manufacturing.

Keywords: STRIP SCRAP, STRIP SLITTING, DRAWING, ROLLERS

Introduction

The issue of rational of metal use is important for any company that produces rolled metal and its products. In the manufacture of the metal strip products in rolls after slitting units non-liquid scrap is formed, utilization of which is now mainly associated with the subsequent remelting of the metal. Such use of scrap often is not justified, because it requires implementation of the full cycle of metallurgical production operations for obtaining new products from the metal, which in turn worsens the ecological environment near the metallurgical enterprise.

Effective use of metal is increased by processing scrap into finished products, such as round wire. Subsequent use of the obtained wire may be different: mesh, nails, binding wire, shaped wire, etc.

Results and Discussion

For solving the problem of efficient resource use in the manufacture of metal products there was created a technological process, providing strip slitting into workpieces of a given width, and their subsequent deformation at a given size of wire by drawing using roller or monolithic dies [1]. Thus, the implementation of the suggested technology involves the creation of the site, which includes two lines: scrap slitting line into flat works of a certain width and a line for the deformation of the workpieces in round wire.

When developing the technological process used by a number of technical solutions for technology and equipment that are protected by Russian Federation patents [2-4]. A set of optional equipment for the wire production is developed, including:

– strip slitting line;

– lines of continuous drawing in roller and monolithic dies;

– pivotal roller dies of two types;

– wire sharpening device.

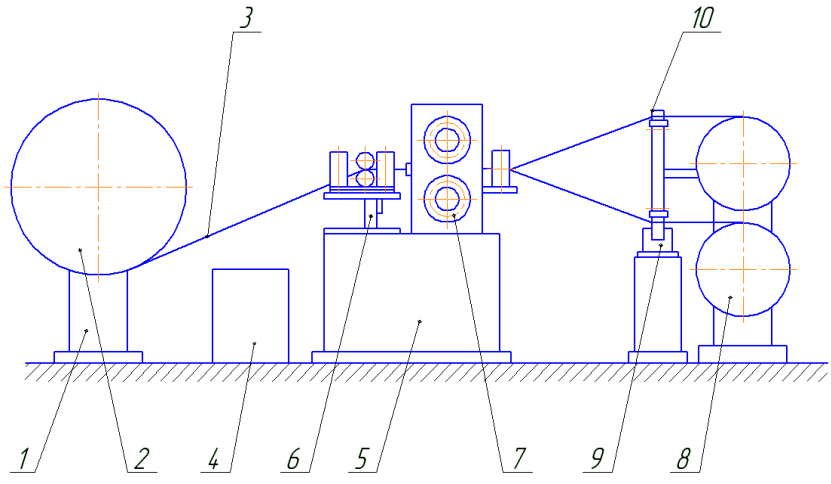

Figure 1. Strip slitting line

Table 1. Technical specification of the slitting lines equipment.

Item	Unit of measurement	Size
View of the original workpiece	in coils and rolls	
Size of cross section: – thickness; – width	 mm mm	 0.5-3.0 under 150
Overall dimensions and coil mass: – external diameter; – internal diameter; – height; – mass	 mm mm mm kg	 under 1200 under 170 under 400 under 400
The minimum width of the slitting workpieces	mm	2.0
Tensile strength of deformed profiles	N/mm2	under 800
The largest number of simultaneous cuts (thickness of the slitting workpiece 1.8 mm)	–	8
Distance between the axes of the shear rolls	mm	160-225
Blade diameter	mm	160-180
Slitting speed (blade diameter 180 mm)	m/s	0.98
Slitting accuracy across the width	mm	±0.15
Slitting lines equipment mass	kg	2400
Overall dimensions of the line – length; – width	 mm mm	 17000 2400
Average hourly productivity of the line	kg/h	170
Total capacity of the line drives	kW	13.1

Since the strip scrap supplied from slitting units usually has a poor condition, and the requirements to the accuracy of the width of the cross and crescent of a flat work are high, slitting line represents a complex set of devices, which have features in setting up and adjustment [3]. Slitting line belt contains (**Figure 1**) 1 decoiling machine, coils 2 with the original belt 3, butt welder 4, arranged on the frame 5 multiroll bridle 6, rotary shears 7, shear driving mechanism in the form of pinion stand with an open cantilever reduction train and motor (not shown), wind-up drum 8, stacker 9 and articulation linkage 10. Technical specification of the strip slitting line is shown in **Table 1**.

Drawing in the roller die [2] was used in the created technological process for the deformation of the workpiece in round wire, in favor of which spoke the following arguments:

- Drawing in the rollers allows using standard equipment with slight modifications, whereas in the case of rolling development of equipment is required, including deformation stands and finished wire receiving unit;

- The process of roller drawing is characterized by large extracts and resistance of the bands in the edging groove compared with the rolling process.

For the implementation of the technology there were developed lines of continuous drawing of "4x200" and "6x250", involving the use of monolithic and roller dies.

As an example, **Table 2** shows the technical specification of the drawing line "6x250".

Equipment complex is designed to produce wire with diameter 1.0-3.0 mm from flat work 0,7-2,0 mm thick in volume of 250-400 t/year (depending on the set of equipment, scrap and finished wire size).

The technological modes for processing low-carbon steel scrap, including zinc coated, stainless

steel, bimetal "steel-brass".

Technology is implemented at a number of enterprises in the production of wire for different purposes. Practice has shown that the most promising area is the processing of low carbon steel scrap with zinc coating into wire to be used for subsequent production of the mesh. An important aspect in this case, is the state of the edge of a flat work after slitting. Developed scheme and the modes of flat work deformation [4] provide the reduction of zinc layer removed from the edge of the strip after slitting. This was confirmed by testing wire samples by holding them in a solution of sodium chloride for 168 hours and subsequent location on the air without washing, as well as microscopic examination of wire templets.

Table 2. Technical specification of the drawing line equipment "6×250"

Parameter	Unit of measurement	Size
The main total parameters of the line		
Dimensions	mm	14000×1200×1275
Mass	kg	2700
Productivity	kg/h	184
Drawing device		
Amount of blocks	–	6
Block diameter	mm	250
Maximum pulling force	kN	1.7
Maximum drawing speed	m/s	1.9
Total drive power	kW	22.5
Maximum mass of the finished wire coil	kg	100
Cross section of the original strip workpiece	mm	0.6-2.0 × 2.0-8.0
Finished wire diameter	mm	1.0-3.0
Tensile strength of the material	N/mm^2	360-800
Roller die		
Amount of rollers	–	4
Roller diameter	mm	90-60
Roller width on the work surface	mm	8-18
Distance between pairs of rollers	mm	36; 46
Maximum drawing force	kN	18
Accuracy of the geometric dimensions of the finished profile	mm	±0.05
Wire sharpening device		
Wire diameter (max/min)	mm	3.3 / 0.65
Rolls diameter/ roll body length	mm	75 / 105
Pass amount	–	12
Butt welder of wire ends – МСС–901 УХЛ4		

Past experience of processing scrap shows that the effectiveness of the technology depends largely on the quality and quantity of supplied scrap, as well as accuracy of manufacturing and available of the working tool. For example, when using a strip with thickness 1.5-2 mm and width 8

mm, supplied from modern slitting units, a scheme of direct scrap processing at the drawing line is possible.

As shown by studies high efficiency of the process is also achieved by processing stainless steel strip scrap, formed, for example, in the manufacture of welded tubes with subsequent manufacture of round wire for meshes and shaped wire for various branches of industry. An example for this can be a technology for manufacturing square wire 1,6 × 1,6 mm and 2,0 × 2,0 mm from steel 12X18H10T, developed jointly with JSC "Uraltrubmash" (Chelyabinsk). The first technology was the use of the original workpiece with diameter 2.2 mm and 2.8 mm, respectively, which was subjected to non-gauge drawing in dies with staggered pairs of rollers with diameter 90 mm for production of wire 1.67×1.67 mm and 2.10 × 2.10 mm. The obtained square wire after heat treatment was calibrated in monolithic dies to the finished size of the cross section for providing specified negative allowance - 0.025 mm and facet size 0.25 mm. The studies of deformation process of a stainless steel flat work showed the possibility of obtaining intermediate sizes of square sections of wire from strip scrap 1.5 mm thick from steel 12X18H10T by slitting it into workpieces 2.8 mm and 4.7 mm thick respectively and subsequent roll drawing in 1-3 passages.

Conclusions

1. The technology and equipment for processing non-liquid strip scrap into round wire is developed and successfully operates.

2. Maximum economic efficiency is achieved by the established technology of processing strip scrap into wire with diameter under 2 mm, stable supply of the non-liquid scrap and high-quality production of the working tool.

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* Published in Russian

Received October 4, 2011

Высокоэффективная технология переработки полосовой обрези

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В статье приведены сведения о промышленной реализации технологии переработки не-ликвидной полосовой обрези, предусматривающей продольную резку исходной полосы на заготовки и их последующее многократное волочение в роликах. Показано, что эффектив-ность процесса определяется качеством и объемом поставляемой на переработку обрези, а также, точностью изготовления рабочего инструмента.