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APPLICATION OF SINTERED POWDER TAPE FOR RESTORATION OF PARTS TYPE "SHAFT" BY THE EKP METHOD

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Annotation
The article presents the results of theoretical studies on the use of sintered flux-cored tape for the restoration of parts of the "Val" type by the EKP method.

Keywords: Contact welding, steel tape, wire, powdered hard alloy, composite powder materials, coating microstructure, testing, strength, welded layer.

At present, the repair production is faced with the task of developing such restoration methods that, with minimal costs and high manufacturability, would ensure the operability of the restored parts equal to or higher than new ones.

At repair enterprises, methods of restoring parts by contact welding of various filler materials are widespread: steel tape, wire, powder hard alloys.

The nomenclature of parts restored by contact welding exceeds more than 400 items. The greatest application among the listed filler materials was obtained by contact welding of a steel strip. The method is the most suitable for restoring parts with wear of seats in the range of 0.3-0.5 mm.

For contact welding of a strip on a part of the "shaft" type, the serial installation 011-1-02 "Rem part" is used. It is used to restore parts 20 ... 200 mm, length up to 1250 mm. The technology of restoration by contact welding includes preparation of parts and tape, welding it and processing of parts after welding.

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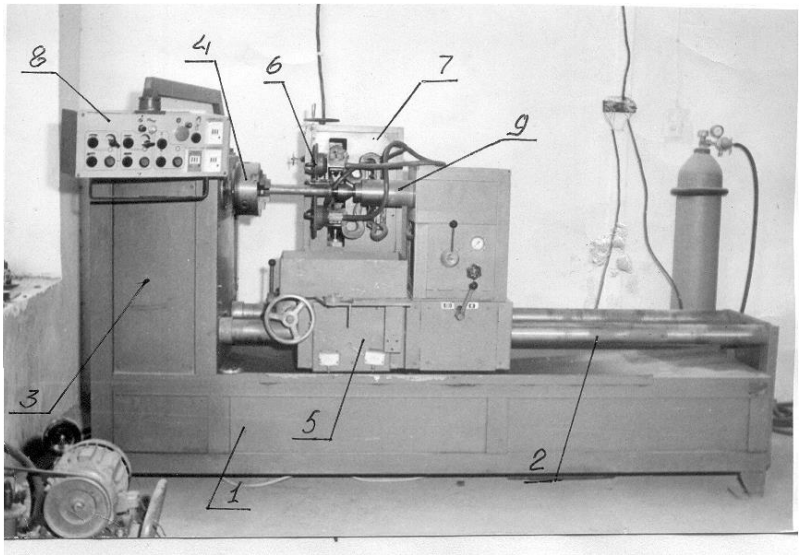
In accordance with the tasks set in the work, it was envisaged to carry out theoretical and experimental studies of the process of restoring worn parts by contact welding of flux-cored strips.[6]

They were carried out in several stages:

1. Development of devices and devices for contact welding of flux-cored strips on the outer surfaces of parts of the "shaft" type, for the study of the welded material, coating.
2. Search for a rational scheme for welding flux-cored strips.
3. Development of laboratory and bench testing methods for studying the properties of the welded material, the process of forming a coating from it, the structure and technological properties of the receiving layer. Justification and selection of composite powder materials for the restoration and hardening of worn parts.
4. Development of a technological process for the restoration of worn out parts of the "shaft" type. Performance testing of remanufactured parts. Calculation of technical and economic efficiency

The studies were carried out on the 011-1-02N "Remdetal" installation for electrocontact welding of a steel strip on the worn surfaces of the shaft journals. When determining the electrical resistance of the sintered-powder material, measurements were carried out using a DC bridge



Pic. 1. General view of the installation 011-1-02N "Remdetal" for restoration of shaft journals

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1-building; 2-guide; 3-post stand; 4-spindle; 5-trolley; 6-welding pliers; 7-welding transformer; 8-control panel; 9-tailstock

Technical characteristics of the unit 011-1-2N "Remdetal" for restoration of shaft journals

Table.1

Parameter	Unitofmeasurement	Parametervalue
Performance	Sm^2/min	60
Thickness of the layer to be welded	Mm	0,15-1,5
Remanufacturedpartsdiameter	Mm	20-200
Distancebetweencenters	Mm	1250
Powerconsumption	kWt	50
Spindlespeed	Min^{-1}	0,15-15
Weldingheadtravelspeed	Mm/min	4,5-450
dimensions	Mm	2730x860x1280
Weight	Kg	900

MO-62 GOST 7165-54. The measurement principle consists in balancing the bridge circuit of the device - to one arm of which the measured resistance is connected, to the control resistances of the device itself on the other arm of the circuit.[7]

The effective value of the welding current when welding the powder material on the 01-1-02 "Remdetal" and MT-2827UHLCh installations were measured using an ASD-1 ammeter and a Rogovsky belt. The ammeter was preliminarily calibrated according to the factory instructions. [8]

Coating adhesion strength measured on a tensile testing machine

R-0.5 GOST 7855-74 and in a special device mounted on a lathe.

The macrostructure and porosity of the coating were examined using an MBS-3 microscope. The microstructure of the coating was investigated on microscopes MMP-2 and MIM-8.

Based on the analysis of a number of works and brochures of powder materials produced by NPO Tulachermet plants, Torez and Brovarsky powder metallurgy plants, the properties of powders were studied in order to select components in a sintered powder material

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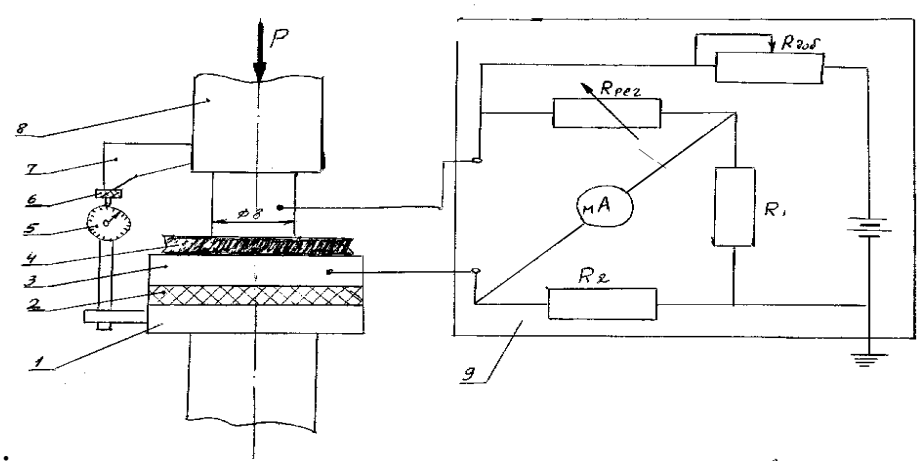

Pic 2. Scheme for measuring shrinkage and electrical resistance powder tape.

1-fixed plate; 2.6-textolite gasket; 3-bronze plate; 4-SPL; 5-indicator device; 7-movable bracket; 8- movable

When choosing, the requirements for increasing wear resistance, adhesion strength, machinability and cost of the coating were taken into account.

The following grades of metal powders were taken for the study: PG-ZS, PG-SR-2, PG-SR-4, PG-S27-M, PG-FBKh-6-2, FKh-800.

Experiments were planned to establish the relationship between the widths of the sintered powder tape being welded on and the resulting layer. [9] According to the obtained dependence Vrol ≥ f (Sp) and set the minimum width of the working part of the roller-electrode;

The elasticity of the flux-cored tape was determined by the radius of curvature of fracture of a narrow tape with a width of 4,6,8,10 mm.

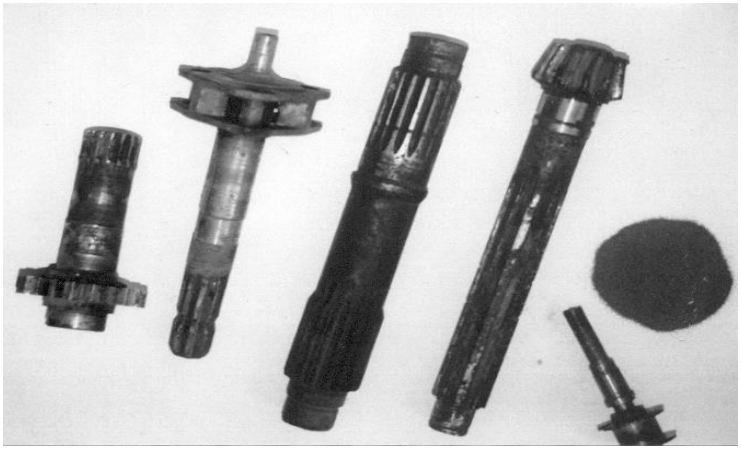

Fig. 3. Sample with welded powder material

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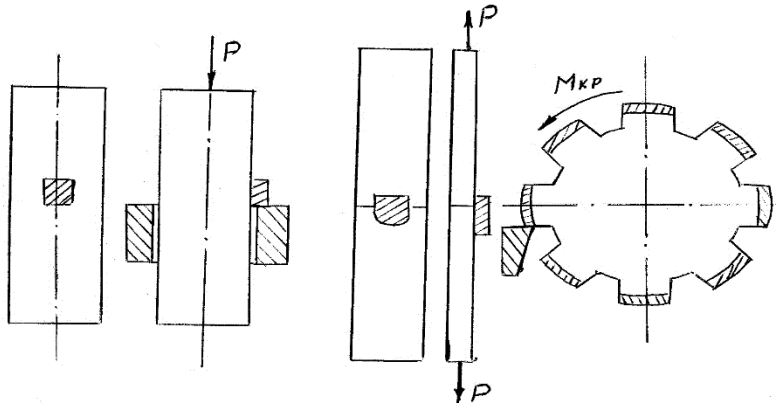
Simultaneously with the study of the compressibility, the electrical resistance of the flux-cored tape was determined on a contact point machine using a MO-62 DC bridge, for this, tape 4 was placed on the lower insulated electrode 1, and the upper electrode 8 was pressed. The diameter of the upper electrode is 8 mm (S50mm^2). [10] The load P was monitored on the scale of the pressure gauge of a point machine, and the amount of deformation was measured with an indicator device 5 with a scale of 0.01 mm. At each stage of loading, the electrical resistance of the powder material was measured. For this, the electrodes of the dot machine were connected to the MO-62 terminals.
The adhesion strength of the welded coating to the plate surface was determined by the formula:

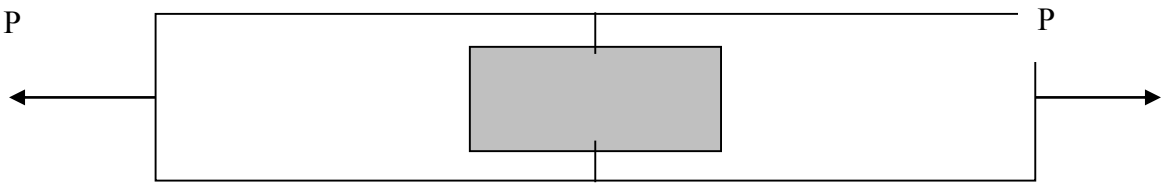
$$\delta_{om} = \frac{P_{om}}{S_{om}}$$

Where$\delta_{от}$ – adhesion strength, Pa;
$P_{от}$ – breakout force, N;
$S_{от}$ – separation area, mm^2.



а) б) в)

Pic. 4. Schemes of samples and tests of the strength of the welded layer with the base



General view of the sample with a welded point

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In case of rupture of the coating, the bond strength was determined by the formula

$$\delta_{om} = \frac{P_{om}}{S_{om}} \rangle \frac{P_{разр}}{S_{разр}}$$

Where$P_{разр}$ – breaking force, N;

$S_{разр}$ – rupture area, mm^2

The bond strength of the particles with each other and with the main part for the sintered flux-cored tape was made in a special fixture mounted on a lathe, according to the method developed by specialists from the Bashkir Agricultural Institute.

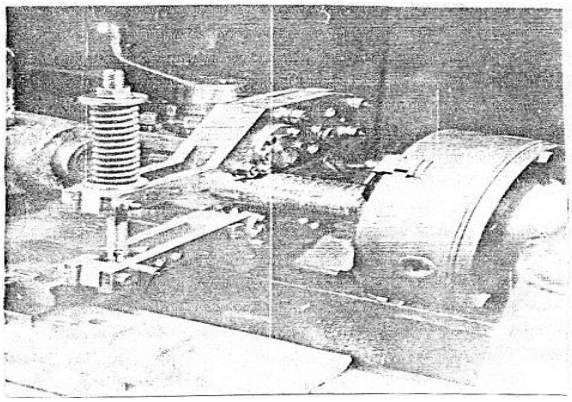
This device is designed for cold rolling with rollers of various profiles on the cylindrical surfaces of remanufactured parts.

Technical specifications:

- diameters of rolled surfaces -20÷60 mm;
- maximum load on the working rollers - (6000 N);
- run-in modes:
- spindle speed - up to 500 rpm;
- longitudinal feed of the support - up to 0.5 mm / rev

It consists of a rack 1, upper 2 and lower 3 clamps and a working spring 4, Deforming rollers 5 are installed between two jaws of the clamps and can rotate freely together with the axles resting on rolling bearings

The working load on the rollers is regulated by a spring 4. The clamps act as levers of the 2nd kind with a shoulder ratio of 3.1, ie. the force is transferred to the rollers 3 times more than the spring develops.



Pic 5. General view of the device for running in samples and parts installed on the sports court of the TK62 screw-cutting lathe

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Assessment of adhesion strength is based on the principle of creating residual compressive stresses in the welded coating, causing the coating to detach from the base metal. Stresses are created in the metal by rolling it with a hardened steel roller during the longitudinal feed of the lathe slide

The rolling was carried out with radial rollers at a spindle speed of 240 rpm and a feed rate of 0.2 mm / rev. Roller load 400kg (4000 N). the width of the rolled surface is 30 mm. The number of passes of the roller was measured at the moment of the beginning of destruction of the metal coating and at the moment of destruction of the coating 15% of the total area.

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