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PRODUCTION ROTARY WORK-PIECE FROM STEEL SEAM TUBES WITH METHOD DEFORMATION CONTRACT

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ABSTRACT

Process to shape contraction of ends tube elements from steel seam tubes is begin from need of maximum to use material for production rotary elements. Design decision tool secure contraction tube elements of change thichness wall diameter D_s = 56mm, on value diameter d_{s1} = 19mm. For reason larger relation contraction, reference to big value force contraction shape is not bee possible lead out in one phase.

KEY WORDS : deformation constrict, reduction of diameter, meridian voltage

1. INTRODUCE

Like starting article preparative for shrinking formation serve previously cold calibrated welded tube, made at pulling bank for calibrated with next dimensions :

- medial diameter tube element D_{sr}=56,5mm
- wall thickness s_o = 3,5mm
- article is Č.0361 or St 37-2 with size

R_m = 370 – 450 N/mm^2
R_{eH} = 240 N/mm^2
A_5 = 25 %

At rudiment of known, size of preparation, is need to determine for search aspect and dimension rotacion element (Picture 1.), power of deformation like as size length tube element whom provide dimension size ready production.

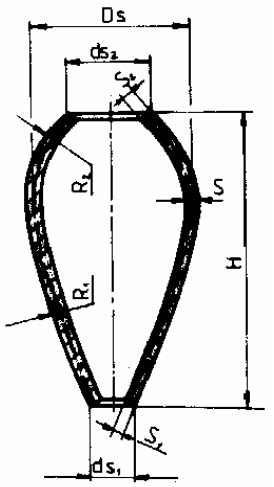

Fig 1. Search aspect of ready product

2. DESCRIPTION PROCEDURE OF SIZING

Ending reduction of tube is realize in two phases at that way in order to cilindric element in first fazes (Picture 2.) by means of thrust-mashine narow from shape cilindric tube element in shape who corresponding ready product.

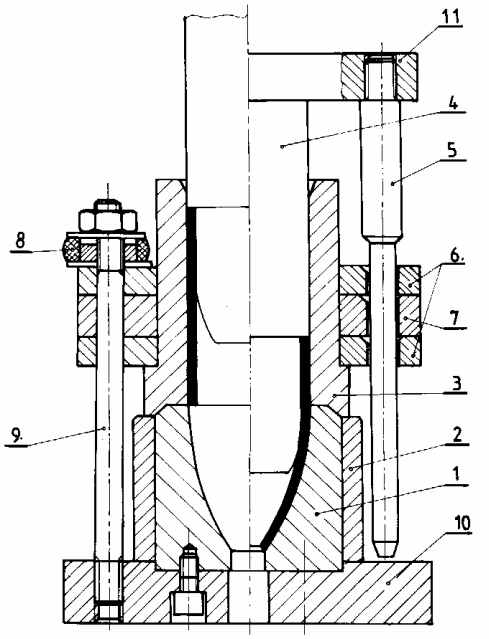

Fig 2. Tool for first phase of contraction

In secondly phase (Picture 3.) is produce contraction of second corner.

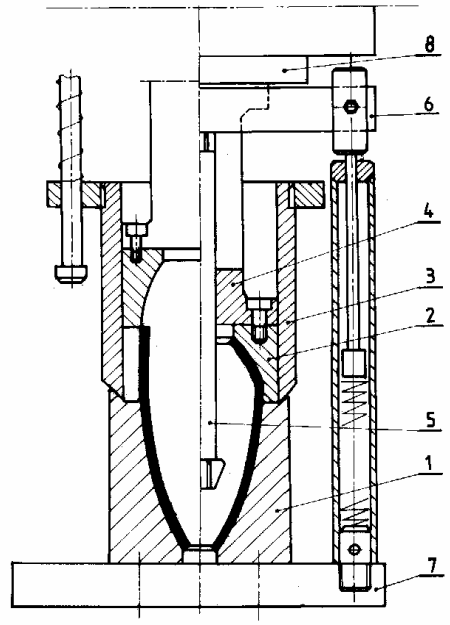

Fig 3. Tool for second phase of contraction

First solutions of configured are been in some phases either contractions what is show in contributed case for object size of reduction, in other words, rating deformation imposible (Picture 4.).

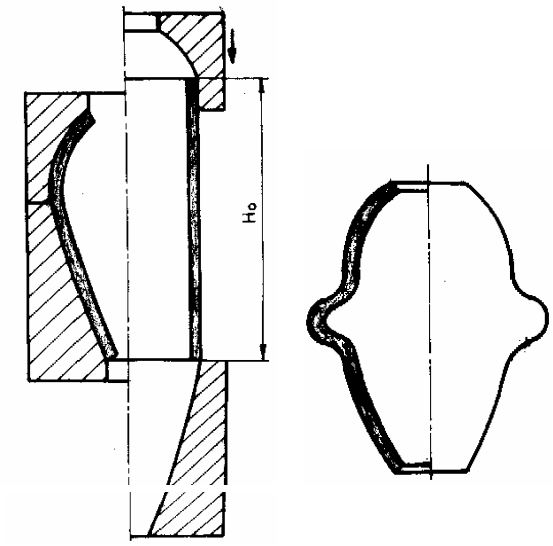

Fig 4. Contractions either corner of element in one phase.

Experimental formatting are bring at sense that is in constructional solution necessarily provide prosecution materiel , in other words, neutralize uncontrolable deformation, therefore pull-mashine for first phase formatting is had part of thorn, in other words calibrator from inside.

Deformation formatting are derived with tool showed at pictures 2. and 3. of hydraulic compress mashine PYE 100 s/1 :

- nominal forces 1000 KN
- work speed 14m/s
- walk of piston 500 mm

install in "Unis" Factory of tubes, Derventa.

2.1. TENSION STATUS ACROSS AREA DEFORMATION FORMATTING

Observing previously engraved network at prepared tubes element afterwards deformation formatting, is noticable distortion element volume (Picture 5.), and this is explain separate size of tension respective parts in diametral section, what feeding by change of direction and speed lissoming (fluidity materiel) in deformation area, in other words overbear shearing tension in area because discontiinuity of speed deformation.

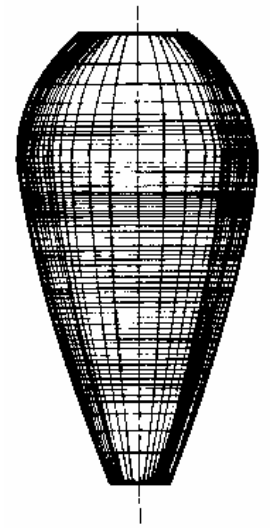

Fig 5. Distortion engraved network

At maximum size of rating deformacion which materiel may submit without destruction, aboard materiel properties tributary and tension status along deformation area (Picture 6.) Providing this in case we shall carry on that also along good plastic properties of steel Č.0361, who shaping in this case, we must apply to realise good shema of general tension and thereat get needed configuration.

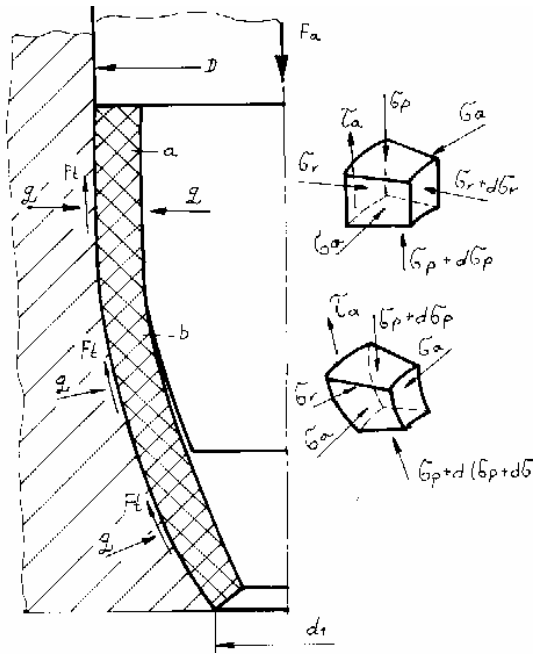

Fig 6. Tension status along deformation area.

In area deformation statistic (a) (contact area), tensions status of element volume, is need to provide deformation formatting of work fragment, shrinking from diameter (D at d_1).

- max circular measure deformation in contraction is :

$$\sum_Q \max = 1 - (d_{s1}/D_s) = 1 - (19/56{,}5) = 0{,}66$$

D_s and d_{s1} – medial diameters beginning and supremely shape.

From of curves harding $k = k(A_5)$ for example materiel,

$$A_{5sr} = \sum_{Qsr} = \tfrac{1}{2} \sum_Q \max = 0{,}33.$$

Mediali deformation opposition for example materiel according to calculated medial deformation show in diagram : $k_{sr}=k(A_{5sr})=k(0{,}33)=510–700$ N/mm^2, $k_{sr}=700$ N/mm^2. Apprehend maxim value at reason what is materiel previously deformation formatted, est. we have deformation harden. Largest absolte value of meridial tension on cause of contraction, extended with equalize factor impact of moment free warping on limit og deformation area by E.A.Popovu, is :

$$\sigma \cdot \rho_{max} = \frac{k_{sr}}{2}\left[1 - \left(\frac{d_{s1}}{D_s}\right)\right](1 + \mu ctg\alpha)\left(1 + \sqrt{\frac{D_s}{d_{s1}}}\right)(3 - 2\cos\alpha) = k_{sr} \cdot \xi \cdot t \cdot n \cdot \sum Q_{max}$$

, where is,

t – factor contact friction between outward side piece and work side of ring for shrinking.

Example tube element is before phase shrinking chemical preparation (phosphated, dip into soap) accordin as coefficient of friction reduce.

$t = 1+\mu \operatorname{ctg}\alpha = 1+0{,}1 \operatorname{ctg} 20^0 = 1{,}275$

ξ – compensator factor impact of change wall thichness,

$$\xi = 1/2\left(1+\sqrt{\frac{D_s}{d_{s1}}}\right) = 1/2\left(1+\sqrt{\frac{56.5}{19}}\right) = 1.362\,.$$

m – moment of free warping on line at deformation area (addition meridial tension),

$m=3-2\cos\alpha =3-2\cos 20^0=3-2\,(0{,}9396)=1{,}12.$

Replacement calculated value we get numeric value highest meridial tension.

$\sigma\,\rho\,\max = ks'_1 \sum a\,\max \cdot \xi \cdot t \cdot m = 700\text{N/mm}^2 \cdot 0{,}66 \cdot 1{,}275 \cdot 1{,}362 \cdot 1{,}12 = 898{,}560\ \text{N/mm}^2$

Contract force

$F_a = (A_o \cdot \sigma\,\rho\,\max)/(1000\cos\alpha) = (\pi \cdot D_s \cdot s_o \cdot \sigma\rho\max)/(1000\cos 20^0) = 594{,}06$ KN.

Reading presure on manometer on hydraulic system is 141 bar, what calculated accros side of piston provide force of 872,20 KN. We see value difference of calculated force from norm with contraction force and value measure with presure in hydraulic system.

Like this case calculated we have value of contraction force second end rotation piece and we get value of F = 246,6 KN, and measure presure in hydraulic system we have force 356,25 KN, where we see a difference.

2.2. ANALYSIS MECHANICAL ATTRIBUTIVE

Of exemplar configured product realization, we tested mechanical properties:

stingily measuring and metal-graphic definable microstrusture on longitudinal and diametral intersection, visibly is as that reduction of diameter tube side effect change wall thickness, large in aspect of size compensator factor derived calculated

$\xi_{\text{really}} / s_o = 5{,}056/3{,}5 = 1{,}45.$

With change wall thickness on longitudinaly intersection there are and change hardness of materiel. Metal-graphic search microstructure, side on intersection are visable picture destruct of structure, or presence microshake, what is caused reinforce, or materiel stiffen to line ductility, what is been theme for next usage object product.

2.3. DIMENSION ANALYSIS

In procedure of tentatively formatting one of problem is define needs height tube element H_o, who provide dimensions of product at all events. Out from condition permanency volume before and after formatting we had:

$V = \pi \cdot D \cdot H_o \cdot s_o = \pi \cdot D_{sr} \cdot s_{sr} \cdot H$

Measuring diameter value and wall thickness on intersection (Picture 7.), we get values : D_{sr}=45,95 mm and s_{sr}=5,056 mm, there are that first height is H_o=173,5 mm.

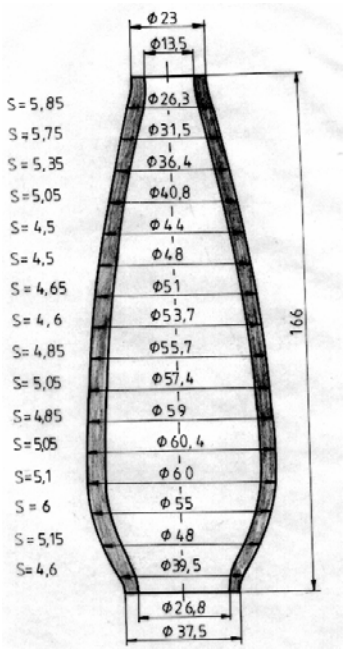

Fig 7. Measure value dimenzions on aboard intersection.

Calculated value length of tube element is not get needed size made product. Variation we have value H_o=195 mm, wheter in completeness provise dimensionals size.

3. CONCLUSION

Contraction diameter of end zone on tube element is one of payable cases making revolving elements similarity shape. In dependence as from size reduction diameter tube, deformation contraction is servitude a number of parametar which prestige on stability cause formatting. Experimental formatted we have size contraction on objectively production, and that is impossible bring in practice without scaled prosecution tube element on inside.

4. LITERATURE

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