

# OPTIMALIZING LABORATORY ELECTROLYZER

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## ABSTRACT

This article stripping construction and constructional parts laboratory electrolyzer. Tendency is develop laboratory electrolyzer that would have optimal parameter from standpoint high effectivity electrolysis, safeness running, simplicity manufacturing, price availability and easy assembly and servicing. Using those electrolyzer is planned for accumulation electric energy from solar panels by force of hydrogen cycle. Hydrogen cycle represents dissociation of water by electrolyze, storage of hydrogen in floater container and new utilization of hydrogen power in fuel cell or for direct combustion.

## 1 INTRODUCTION

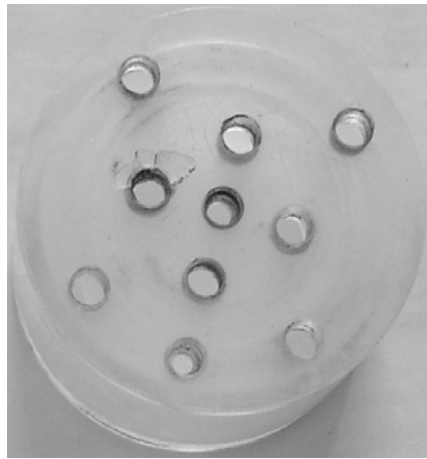
First model laboratory electrolyzer was on institution UEEN developed already some years ago and is used in laboratory parts education subject unconventional changes seat power control energy. Students on him they may mete electric and charge image effectivity. Since skirt most of his parts definite changes. Electrolyzer is built - up of these part bushing for electrode and levy flow, vessel and himself electrodes. Develop fumes are from electrolyzer exhaust air by the help of silicon rubber hose. In hydrogen parts is before float tank yet registered dreslerova cupping - glass on the ground of safeness and indication production hydrogen. Hose on conscription oxygen is plumb guidee perhaps 50 cm above vessel electrolyzer and at the end procuration funnels. It results in an that no happens to sputtering and driftage electrolyte develop bubbles oxygen. Conscription oxygen so serves to refilling electrolyzer essential water.

## 2 BUSHING

First used bushing were brass Fig. 4A how is with picture perceptible their disadvantage was that oxidized and were corrosion electrolyte. Now's used plastic bushing Fig. 4B that are simply washable paint and aren't affect electrolyte. Their production is essentially easier and cheapen. K stuffing bushing is used silicon rubber packing compared to original rubber which aged and crackled.

### 3 VESSEL

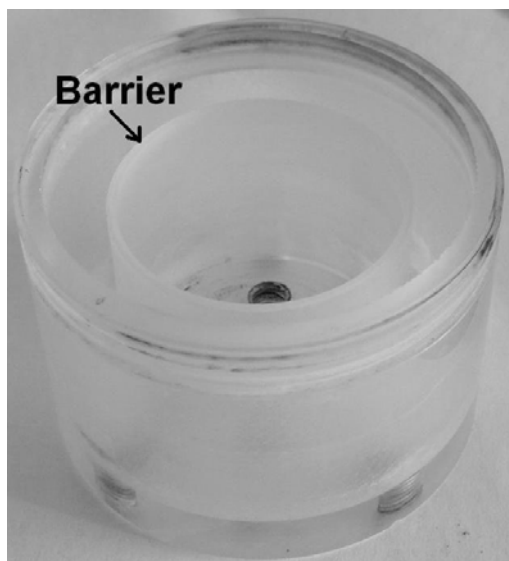
Vessel piles from two parts personal vessel Fig. 1 and gout Fig. 2. Plastic bottom is procuration thread and screwings on bottom vessel. Stuffing is again effected silicon rubber packing. Personal vessel is made of a piece full transparent acrylyl. Inside is divided barrier on two electrode premises Fig. 3. Barrier thickness 2 mm ends 1 cm above day vessel and separate both electrode premises. Must flat independent to electrolyte level was always above lower margin septa and electrode this barrier not exceed otherwise would could reach the mixing flow and to development explosive mixtures. All vessel has average 11 cm as well as with day is high 8 cm. Wall thickness is 1cm. Like electrolyte is used 30 – 35 % KOH which has of all accessible alkalic and acid electrolyte highest conductivity. Optimum concentration was intended experimentally see [5]. Electrolyte level is trim perhaps 1 cm below upside vessel whereby will originate elbow - room on develop fumes and their fluent conscription without driftage droplets electrolyte. Content of both electrode space is approximately same  $141 \text{ cm}^3$ .



**Fig. 1:** *Vessel*



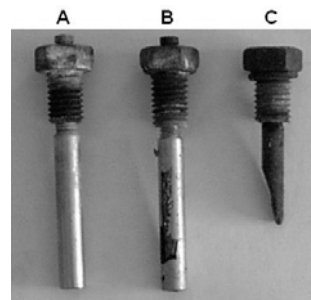
**Fig. 2:** *Gout*



**Fig. 3:** *Barrier*



**Fig. 4** *Bushing*



**Fig. 5:** *Stump electrode*

## 4 ELECTRODE

Electrode must flat from material that is of resistant to used electrolyte to no happen to rust. Further would have had have big conductivity. Like optimal shows jack and platonic metals silver, nickel, activated carbon which among others functions and like calorifiers and speed courses response on electrodes. Since are platonic calorifiers very expensive employs for electrode for example Raneyauv nickel. Is it alloy containing 50 % Ni and 50 % Al. After corrosion concentrated lye displaces aluminum and will be left nickel considerable lacunae, which presents big surface for catalytical suit. Other options is nickel - coated cheapen metal copper, brass. Electrode would have had be highly porous. Whereby will increase their surface and thanks that will reduce to current density unit surface electrode. It results in an decrease tension on electrodes thereby well - built operation electrolyzer. Advantage porous electrodes is that at same surface seat long way currency seats than classical electrode. Development enjoyment electrodes in laboratory model electrolyzer:

### 4.1 STUMP ELECTRODE

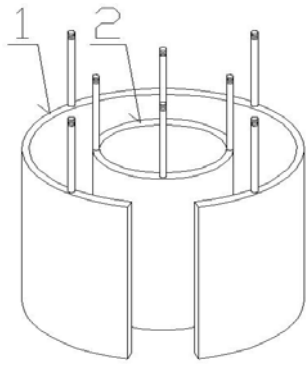
Warren Was used 4 couple of electrodes about average 7 mm and longitude 47 mm from cinder screwed assembly with brass bushing. These electrodes below by effect high turbojet densities and electrolyte crush and break down Fig. 5C. Modification was made these electrodes from brass and resulting nickeling Fig. 5AB attained slight extension service life, but in the same way progress time happen to eat away nickel strata and defoliate aground vessel. Out at elbows vessel of these distributed the rest formed conductive deposit which at sufficient tension functioned like bipolar electrode and could happen to development oxygen in hydrogen space and production explosive mixtures. Next disadvantage these electrodes was small surface 41 cm<sup>2</sup>. In light of safeness, service life and big turbojet densities these electrode forbore use.

### 4.2 BELT ELECTRODE

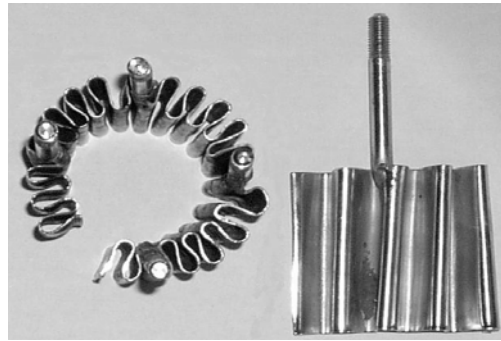
Belt electrode are made with brass metal plate latitude 47 mm whereto are solder on incoming bacilli unit is then nickel - coated fig. 6. These electrode already function perhaps 4 years and meanwhile wasn't watched underbitten nickel surface. Only upkeep is after definite time washability sediments with surface electrodes. Surface these electrodes is 180 cm<sup>2</sup>. To the next increasing surface electrodes was used undulation metal plate Fig. 7. Surface these electrodes is 360 cm<sup>2</sup>. This modification unworkable since curly metal plate considerably spring and at assembly probably get to craze nickel strata which had behind consequence resulting eat away. Next disadvantage those modification was that in lamellae consequence capillary coaming happen to restraint bubbles flow which had behind consequence decrease surfaces electrodes and virtually unmaintainable altitude surface.

### 4.3 WARREN ELECTRODE

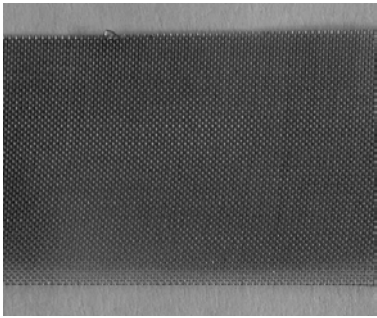
For others increasing surfaces electrodes was used brass grating Fig. 8 (average wire 0,1 mm size eye 0,25 mm). Since soldering incoming sticks get to considerable heat erosion materials grating which had behind consequence after nickel - coated and resulting assembly snap grating from bacilli was elect way mechanical screwed assembly grating and bacilli. These electrode are meanwhile into service perhaps 1 month and meanwhile no display no inadequacies allude near previous electrodes. Every electrode is totalled zone 1 m long and 3cm wide that is of spiral twisted to the electrode space. Surface electrode is 755 cm<sup>2</sup>.



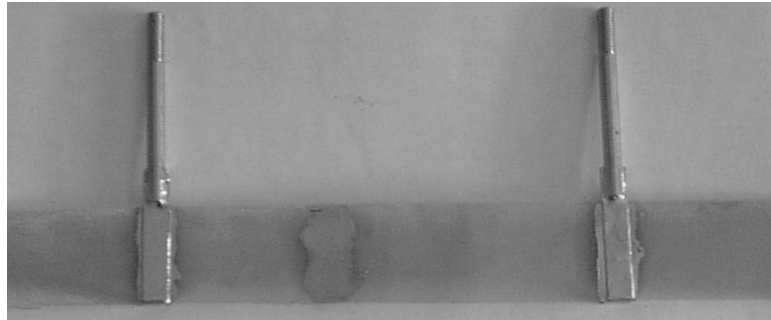
**Fig. 6:** Belt electrode



**Fig. 7:** Undulation electrode



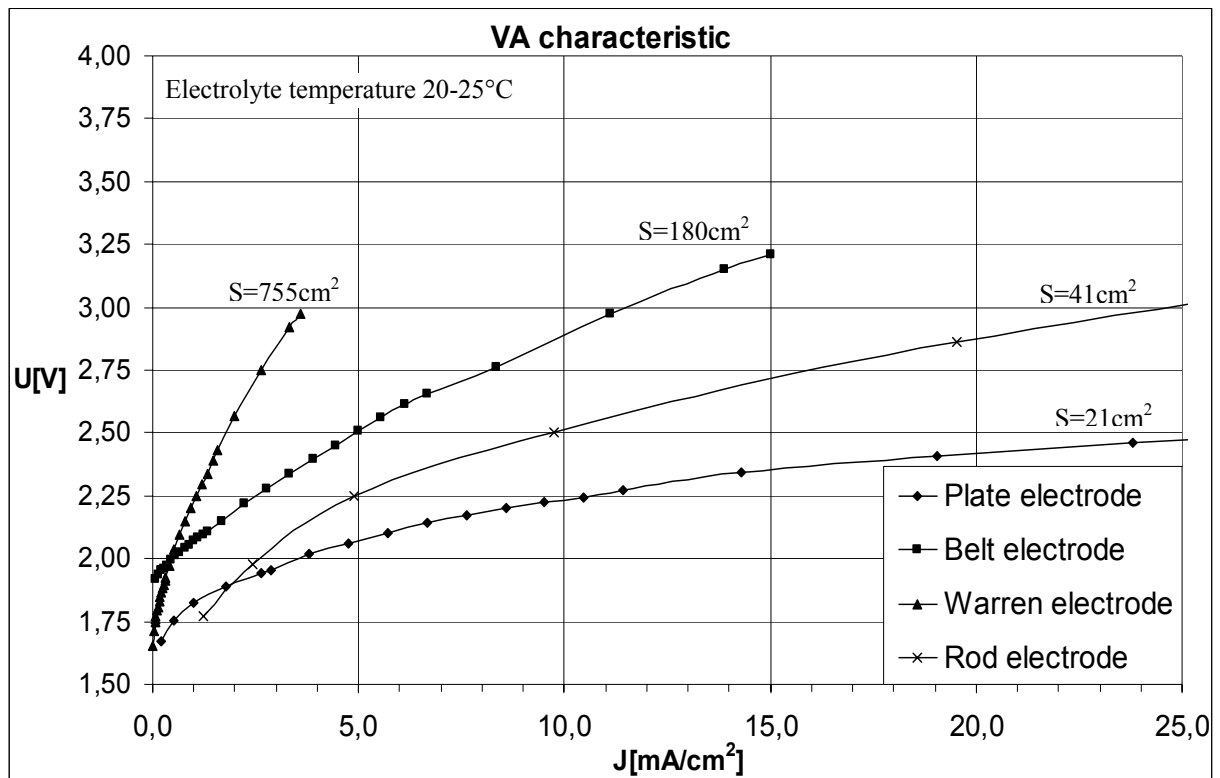
**Fig. 8:** Brass grating

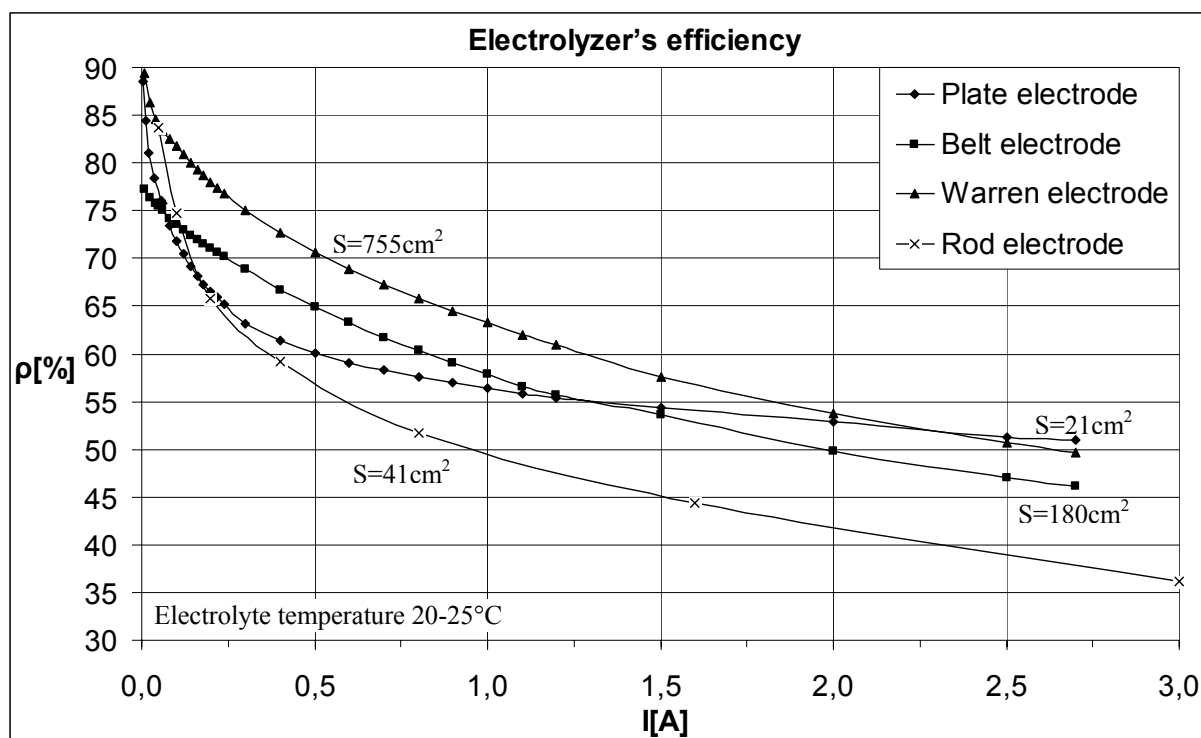


**Fig. 9** Warren electrode

#### 4.4 PLATE ELECTRODE

These electrode forms nickel - coated copper laminae 3x7 cm surface 21 cm<sup>2</sup>. Wasn't used right in vessel electrolyzer, but in beaker with electrolyte distance between them was 14 mm. Mentioned are on the ground of comparison come into operation so is planned development bipolar electrolyzer near whose meanwhile isn't solve fulfilment dissociative membrane since unrecommended eat salamander's hair





## 5 CONCLUSION

Characteristics volt-ampere and operation weigh against individual electrode in light of electric parameters. It is perceptible that efficient running of those construction electrolyzer is perhaps to the 1 A then already operation diminishes below 50 % whereas best shows Warren electrode. Further it is perceptible that near electrodes belt and Warren no how much notably do not manifest agglomeration of their surfaces even if they were in every step duplication. This is mannerly conductivity electrolyte that is of hour - glass barrier. Herein is grande turbojet density analogous to on stump electrodes and happens to considerable decreases tension. To the by - and - by plans truncation those septa about 1 cm whereby will extend conductive channel and while using Warren electrodes will barrier henceforth exceed electrode which will ensure safety in service.

## ACKNOWLEDGEMENTS

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