# INSTALLATION FOR DEFINITION OF SCALE-FORMING AND CORROSIVE WATER PROPERTIES IN THE HARD CONDITIONS OF THERMAL EVAPORATION

**A.F. ALIYEV**
*Azerbaijan Scientific-Research and Designed-Prospection Institute of Energetics LTD*
*Baku, G. Zardabi av., 94*

The installation for investigation of processes of metal scale formation and corrosion in the hard conditions of thermal evaporation of waters of different mineralization has been developed. The investigations on this installation allow us to develop the series of methods of prevention of metal scale formation and corrosion in respect to work conditions of power electric energy installations.

The installation (fig.), allowing to investigate the processes of corrosion and scale formation on the heat-exchange surfaces of water evaporators in the exploitation extreme conditions by express method has been developed by us.

The installation consists of two parts: evaporator 1 and steam generator 2, produced from stainless steel.

The distillated water, which is heated up to necessary temperature by thermoelectric heater 5, having 2 kilowatt power is filled in steam generator. The steam temperature is regulated by pressure gage (PG). The steam gets in the least tube of evaporator spiral 6 and passing through it, returns back to steam generator in the form of condensate through big tube.

The investigated water or water with addition of reagents, which is heated by heat-exchange spiral, is filled in evaporator: water evaporation is carried out at atmospheric pressure and more up to necessary multiplicity.

The water steam, passing through heat exchanger (refrigerator) 4 is dropped in the form of distillate through gate 3 in assembly vessel up to achievement of defined multiplicity of evaporation. Further, the evaporator is sealed and boiling temperature of investigated water is increased up to necessary volume (101-140$^0$C). The temperature mode of installation is supported by contact manometer in the process of experiment.

The active area of surface of heat-exchange spiral is 0,068m$^2$. The hooks for hanger of metal samples are built in upper cap of evaporator. The surface temperature of each turn of heat-exchange spiral is defined in the preliminary experiments by chromel-copel thermocouples, calked on their surfaces.

The scale from surface of heat-exchange spiral is carefully shaved, heightens and analyzed after experiment end.

The control experiment on the crude initial water for result comparison proceeds to each experiment with reagent use.

The experiments, carried out on this installation, allow us to develop the new methods of preventing of scale formation [1,3-9] and corrosion [2] in respect to water evaporators of wide range of mineralization (table).

Table.

The experiment results of new antiscale composition in waters of different mineralization.

| Name of inhibitor of scale formation or antiscale composition or corrosion inhibitor | Optimal doze in waters of different mineralization ($1 \le K_y \le 2;\ 1 \le U_{av}(m/c) \le 2$), mg/l | | | | | |
|---|---|---|---|---|---|---|
| | Fresh, $t^0C$, ~ | | Saltish, $t^0C$, ~ | | Caspian, $t^0C$, ~ | |
| | 100 | 140 | 100 | 140 | 100 | 140 |
| 1-2. Disodium salt of thiocarbonic acid [1,2] | 70 | 90 | 80 | 100 | 140 | 160 |
| 3. Cis-4-cyclogexen-1,2-dicarbonic acid [3] | 140 | 150 | 180 | 200 | 200 | 230 |
| 4. Monoamid cis-4-cyclogexen-1,2-dicarbonic acid [4] | 90 | 100 | 100 | 110 | 120 | 140 |
| 5. N-monoamid chlorendic acid [5] | 120 | 130 | 160 | 180 | 180 | 200 |
| 6. N-maleinmonoamid [6] | 80 | 90 | 100 | 110 | 125 | 140 |
| 7-8. N-oximid tertrahydroftal acid [7,8] | 60 | 80 | 80 | 100 | 120 | 140 |
| 9. Angidrid izomethyl of tetrahydroftal acid [9] | 50 | 70 | 70 | 90 | 100 | 120 |

Designations: $K_y$ is evaporation coefficient,
$U_{av}$ is average velocity of water mobility.

Note: Disodium salt of sulfo-carbonic acid is also corrosion inhibitor of color and black metals in the waters of different mineralization.

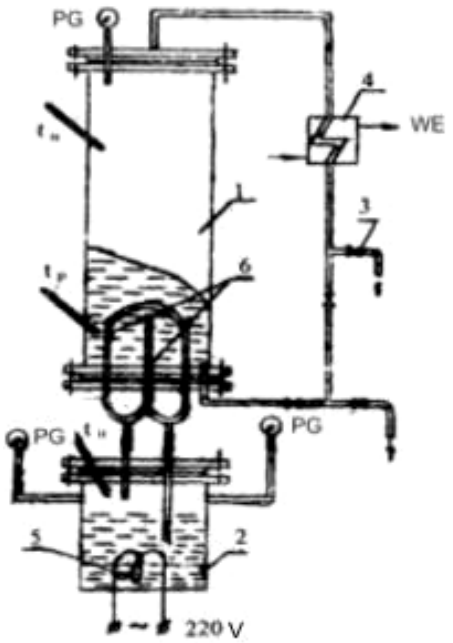


*Fig.* 1. is evaporator. 4. is heat exchanger.
2. is steam generator. 5. is thermoelectric heater.
3. is distillate drop. 6. is heat-exchanger spiral.


[1] *A.A. Abdulla-zade, M.A. Mursalova, A.F. Aliyev i dr.* Ingibitor nakipeobrazovaniya, Avt. Svid. SSSR №565483, 1974, (v otkritoy pechati ne opublikovano). (in Russian)

[2] *M.A. Ashimov, M.A. Mursalova, A.F. Aliyev i dr.* Ingibitor korrozii stali, latuni i alyuminievikh splavov v morskoy vode. Avt. Svid. SSSR №579802, 1974, (v otkritoy pechati ne opublikovano). (in Russian)

[3] *A.F. Aliyev, M.S. Salakhov, N.E. Musayeva*. Sposob predotvrasheniya nakipeobrazovaniya. Avt. Svid. SSSR, 1982, №897718, Byul. izobr. №2. (in Russian)

[4] *A.F. Aliyev, M.S. Salakhov, N.E. Musayeva i dr.* Sposob predotvrasheniya nakipeobrazovaniya. Avt. Svid. SSSR, 1982, №929571, Byul. izobr. №19. (in Russian)

[5] *A.F. Aliyev, M.S. Salakhov, N.E. Musayeva i dr.* Sposob predotvrasheniya nakipeobrazovaniya. Avt. Svid. SSSR, 1982, №948898, Byul. izobr. №29. (in Russian)

[6] *A.F. Aliyev, M.S. Salakhov, N.E. Musayeva i dr.* Sposob predotvrasheniya nakipeobrazovaniya. Avt. Svid. SSSR, 1982, №952769, Byul. izobr. №31. (in Russian)

[7] *A.F. Aliyev, M.S. Salakhov, V.S. Umaeva i dr.* Sposob predotvrasheniya nakipeobrazovaniya. Avt. Svid. SSSR, №1111427, (v otkritoy pechati ne opublikovano). (in Russian)

[8] *M.S. Salakhov, A.F. Aliyev, V.S. Umaeva.* Sposob polucheniya ingibitora nakipeobrazovaniya. Avt. Svid. SSSR, №1317892, (v otkritoy pechati ne opublikovano). (in Russian)

[9] *A.F. Aliyev, M.S. Salakhov, V.S. Umaeva i dr.* Sposob predotvrasheniya nakipeobrazovaniya. Avt. Svid. SSSR, №1178694, Byul. izobr. №34. (in Russian)


**A.F. Əliyev**

## SƏRT TERMOBUXARLANMA MÜHİTLƏRİNDƏ SUYUN ƏRPƏMƏLƏGƏTİRMƏ VƏ KORROZİYA XÜSUSİYYƏTİNİ TƏYİN ETMƏK ÜÇÜN QURĞU

Müxtəlif minerallaşmış suların sərt, termobuxarlanma mühitlərində metallarda ərpəmələgətirmə və korroziya proseslərini tədqiq etmək üçün qurğu işlənib hazırlanmışdır. Bu qurğuda aparılmış tədqiqatlar elektroenergetikada qurğuların işləmə şəraitlərinə tətbiq olunan metalların ərpəmələgətirməsinin və korroziyasının qarşısının alınması üçün bir sıra üsullar işlənib hazırlanmışdır.

**А.Ф. Алиев**

## УСТАНОВКА ДЛЯ ОПРЕДЕЛЕНИЯ НАКИПЕОБРАЗУЮЩИХ И КОРРОЗИОННЫХ СВОЙСТВ ВОДЫ В ЖЕСТКИХ УСЛОВИЯХ ТЕРМОИСПАРЕНИЯ

Разработана установка для исследования процессов накипеобразования и коррозии металлов в жестких условиях термоиспарения вод различной минерализации. Исследования на этой установке позволило разработать ряд способов предотвращения накипеобразования и коррозии металлов применительно к условиям работы установок электроэнергетики.

*Received: 23.12.07*