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무마찰 상하작동 축에 의한 유체차단 밸브에 관한 연구

(A Study on the Fluid Interception Valve According to Non Rubbing Top and Bottom operation Shaft)

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요 약

액체 밸브는 실린더 부분과 액체부분으로 분리 또는 일체형 구조로 되어 있으며, 불소수지 Packing에 STS(stainless) 축을 삽입하여 실린더 머리에 연결된 구조로 되어있어 액체를 주입과 차단시 상하왕복 작동으로 인해 불소수지 패킹과 STS 축 사이에 마찰로 인해 액체의 누설로 인해 작업 환경 저하와 각 부품교체로 인한 작업능률의 저하로 생산성이 목표치에 이르지 못하고 있다. 이에 따라 액체밸브 설계에서부터 재질, 구조변경 등의 필요성이 있으며, 설계, 재질선택, 구조변경 등을 연구하였다.

본 논문은 기존의 문제점을 근본적으로 해소하고자, 피스톤과 연동되는 진동의 개발로 피스톤이 쉽게 마모되는 것을 방지하여 장 수명을 충족시키고 누설방지를 제공하는데 목적이 있다. 액체 토출후 노즐 팁에 액체가 잔류하는 것을 방지할 수 있도록 피스톤이 후퇴 시 이를 흡입시킬 수 있는 기능을 부가하여 방울 맺힘을 방지함을 목적으로 하고 있다.

Abstract

Liquid valve is divided into cylinder and liquid part, or composed of a single body structure. It becomes a connected structure to cylinder head after inserting stainless(STS) shaft to Teflon packing. In injecting and intercepting fluid, working efficiency becomes low because of the top and bottom round trip operation, the friction between Teflon packing and STS shaft, fluid leakage, decline of working environment, and each part replacement. And so target value is unattainable in productivity. liquid valve design, quality, and structure change are studied.

In this paper, designed to solve the existing problems basically, to prevent friction of Piston by developing diaphragm linked with piston, to satisfy long life, and to provide the prevention of leakage. The objective of the study is also to prevent remaing fluid at nozzle tip after dispensing fluid, and bell close with the suction function in piston retreating.

Keywords : Stainless, Teflon, Viton, Polyurethane, Poly tetra fluoro ethylene

I. Introduction

Using liquid valve adhesives or lubricant, attacking with fire medicines, article of food, cosmetics, various liquids of medicine and so on at if error occurs in fixed quantity pouring in because residual quantity remains in nozzle tip region of liquid valve at fixed quantity pouring in specially various adhesives type works high speed work by cause of death phenomenon difficult and need to improve because work efficiency that authoritativeness by badness of product drops falls. Because liquid leakage occurs between packing and shaft is Teflon that is sealing part by round trip operation of liquid valve shaft, because various types problem such as work damage by seal exchange is risen, it became development target, and industrial circles is used generally by importance parts that liquid valve uses epoxy, moulding of polyurethane and so on and gasoline, lubricant of grease and so on, various attacking with fire medicines, article of food, liquid of medicine and so on at fixed quantity pouring in. Existing liquid valve is by separation or all style structure to cylinder part and liquid part, and productivity is not reaching in desired value by working environment

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decline by liquid leakage by attrition and decline of operation efficiency by each parts replace between packing and stainless shaft is Teflon by top and bottom round trip operation when intercept liquid with pouring in being by structure that is linked in cylinder top inserting stainless shaft to packing is number of Teflon. Accordingly, there is necessity of quality of the material, structure alteration etc. from liquid valve design, it studied layout, quality of the material selection, structure change etc.[1]

In this paper, to solved existent problem fundamentally, satisfy chapter life because preventing that piston is been worn away easily to development of diaphragm that is wormed with piston and there is the purpose to provide leakage prevention also, is doing by purpose that prevent bell that is close adding function that can do to inhale this when piston retreats so that can prevent that liquid remains behind in nozzle tip after liquid dispensing.[2]

Ⅱ. Theoretical ancient temple of system

1. Teflon

Can speak that begin from general industry because application extent that Teflon is very wide and use extent does in truth unlimitedly until up-to-dateness semi-conductor, universe Airline industry.

Form of Teflon that have various properties of matter that form poly tetra fluoro ethylene(PTFE), flourinated ethylene prophylene(FEP), three form of per fluoro alkoxy(PFA), and add special procurements organic compound among others and increase hardness durability of abrasion etc. plain already commercialize.

Teflon coating is non tack by spray, powder electrostatic coating, dry, heating, process of small success to iron, stainless, aluminium, copper, glass, rubber, ceramic, existing material such as plastic coating, and number of superior Teflon that use unique special quality is number of Teflon such as recessive, chemical resistance, durability of abrasion, electric insulation stamp speak.[3-5]

Teflon coating characteristic non tack (almost material does non stick to Teflon), metaphorical (because liquid or oil does non stick well on the coating surface of Teflon cleaning easy and much case automatically cleanliness keep), heat resistance (PTFE disjointing is impossible in 260 [℃] lows, and because disjointing in 205 [℃]~290 [℃] is slight degree, special care is no necessity, and inter current use is possible in 290 [℃]~310 [℃]), patient chemistry (usually is not influenced hardly in chemical environment without being number of Teflon, and is constructing efficiently according to special quality of your company chemistry process as various quality of the material of Teflon command by product that can bear to high heat resistance and some strong acid, alkali and solvent), that coefficient of friction (number of tribometer of Teflon is load, the speed of glissement, extent of about 0.05~0.20 according to type of used Teflon), low temperature durability (is number of most Teflon coating even low temperature extremely the physical special quality perdure and is kept). Use at low temperature of below -270 [℃] that is Teflon consider can be, and show very high insulation, the low damage rate, and superior surface resistivity over frequency band of wide area that is number of electrical special quality Teflon .

Teflon by particular technology Is used to conductivity coating of static electricity prevention purpose.

2. Viton

Quality of the material symbol of Viton is KM (ASTM1418), FPM (DIN/ISO 1629) and chemistry name (viton) is Fluoroelastomer, Fluorinated Rubber, Fluorocarbon Rubber, Teflon Rubber. Trade name of Viton is Fluorel, Dyneon, Technoflon, service temperature - 40 [℃]~+ 260 [℃] be.

Usually, Viton takes precautions at continuous duty at temperature more than 200 [℃], and lowest use temperature is different according to Viton R type and because of C-F union that binding energy is big inactivity geometry, heat resistance, patient chemistry has excellent resistivity in oil, fuel oil, lubricant, local beef or pork hock, family of direction hydrocarbon,

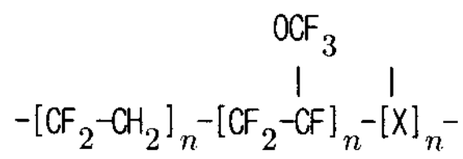

그림 1. 불소고무의 결합구조
Fig. 1. Union structure of Viton.

hydrocarbon solvent etc. excellent most next to perfluoroelastomer among rubber material that is put to practical use present.[6-7]

Acid-proof plasticity, patient sunshine, patient gas permeability are good and patient smell, patient ozone while encourage, youth is being difficult and have magnetic antiphlogistic because is being the best and contain much Teflon and compression decrease lastingness rate is low and patient aging is superior.

Limitations of Viton had better unuse to Oxygenated Solvents, enrichment alkali, Ester of that molecular weight, Ether, Ketone type, partial Amine type, chloride sulfanilic acid. Viton goods is used special o-ring and Gasket etc. heat resistance (400 [℃]), oil resistance, acid-proof, durability of abrasion, flame retardancy are superior.

3. Polyurethane

Because composition of polyurethane uses Diisocyanate and Diol because Otto Bayer applies Carothers' nylon composition in 1937, composition of polyurethane is same with figure 2.

Reaction of alcohol (R ' - OH) and Isocyanate (R-N = C = O) was appearing in figure 3, and had been informed from the mid 1800 year by Wurtz.

Other composition method of polyurethane is same

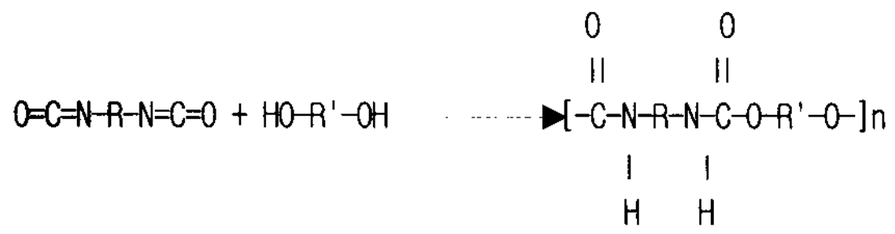

그림 2. 폴리우레탄의 합성
Fig. 2. Composition of polyurethane.

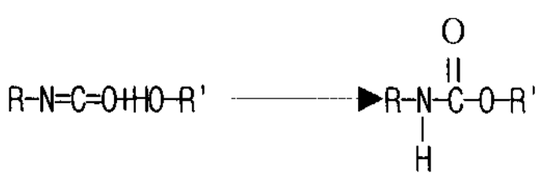

그림 3. 알코올 과 Isocyanate의 반응
Fig. 3. Reaction of Alcohol and Isocyanate.

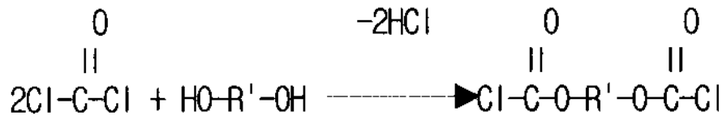

그림 4. 비스클로로포메이트의 반응
Fig. 4. Reaction of Bischloroformates.

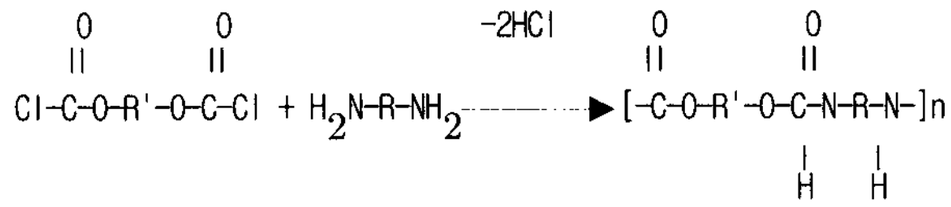

그림 5. 디아민의 반응
Fig. 5. Reaction of demean.

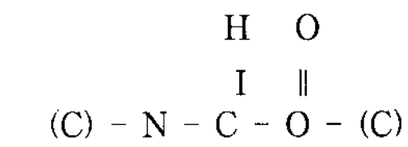

그림 6. 우레탄의 결합구조
Fig. 6. Union structure of Urethan.

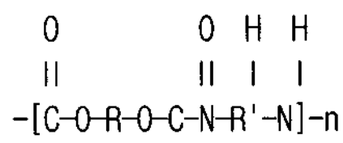

그림 7. 폴리우레탄류의 결합구조
Fig. 7. Union structure of polyurethane type.

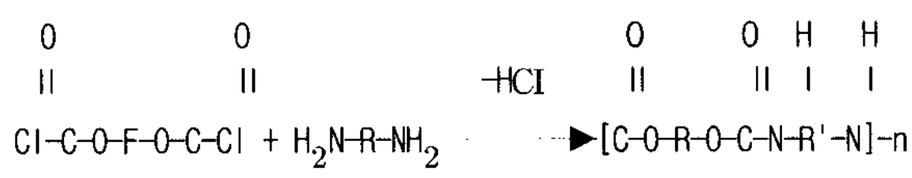

그림 8. 디아민류와 비스 클로로포메이트의 반응
Fig. 8. Reaction of demean type and vis chloroformmate.

그림 9. 폴리우레탄류의 반응
Fig. 9. Reaction of polyurethane type.

with figure 4 reaction of Bischloroformates, and reaction with demean is same with figure 5.

Union of polyurethane have, and unions that appear under and oligo-ether or oligo-esoteric frame segment adjoins. Chemical special quality appears by other ingredient of chain, and collapse of chain that is hydrolyze shows after do macromolecule to hydrolysis for a long time. That is origin that Urethan union causes molecule softness, is being thought, and use from much polyurethanes to elastic body by this nature. But, Urethan geometry is same with figure 6 in material special quality of whole macromolecule of Urethan contiguity part because make ether, Ester, local beef or pork hock hydrocarbon, family of direction ring denomination

그림 10. 이소시아네이트과 디올의 합성된 반응
Fig. 10. Composition reaction of Diisocyanate and Diol.

impose own special quality to macromolecule.[8]

Geometry of polyurethane type is appearing in figure 7, and feedback which it in figure 9 appear and in melting state or solution behave, and adding Diol to Diisocyanate compose that polyurethane type reacts because demean type and vis chloroformmate react in figure 8 is appearing in figure 10.

Polyurethane type is used extensively as elasticity fiber, promulgation rubber and coating emperor.

Ⅲ. Liquid dispenser of existent

1. Control system of existent

Composed by timer, solenoid, relay, silencer for prevention of noises, operation pressure adjustment regulator of liquid valve etc. and Shot Air (control unit-vacuum indication wealth) that is exhausted through solenoid valve because do to open the interception ball that is connected directly at watch of the Ox when operate connecting to upper part Air Fitting of liquid valve liquid to do dispensing, and air does to intercept the interception ball if setting time is ended connecting in side dispensing speed control ordinary times. Pressure of air regulator regulates according to pressure tank pressure from lowest 2 [*kgf*/㎠] to best 4 [*kgf*/㎠]. Because action mode of timer uses ⊖ types screwdriver or 6 each lenz, right side top portion selection of timer conversion and action function by 4 steps conversion and each mode is marked by A, B, C and D in indication department. Unit and rate time do right side lower column and left Action mode

Ⓐ : ON-delay operation
Ⓑ : Flicker operation
Ⓒ : Signal ON/OFF - delay operation
Ⓓ : Signal OFF - delay operation

Was consisted of operation and unit is divided by sec, min, hrs, 10[h] during time.
Rate time

0.5 (0-0.1-0.2-0.3-0.4-0.5)
1 (0-0.2-0.4-0.6-0.8-1.0)
5 (0-1-2-3-4-5)
10 (0-2-4-6-8-10)

Is segmentalized side lower column selection conversion during time.

2. Liquid valve of existent

Air that turn in controller vacuum part to superior office of valve, connect public organ to do side dispense speed control chapter of valve in air out part and did each liquid so that can control on-off. Liquid hose that is linked with pressure tank connects in liquid In part of valve. Dispensing liquid point must select necessary nozzle according to dispensing amount shape of product and mucus area.

3. Pressure tank of existent

Act role that is put liquid of epoxy and so on of pressure tank that air-conditioner that can regulate dispensing amount transfer pressure is attached and open liquid out ball valve after set point degree and pressure according to dispensing amount and pressurize to liquid valve. Though circle pressure keeps high about 1.5 [*kgf*/㎠] always than working pressure of tank, dispensing amount change does not occur.

If get into pressure more than 5 [*kgf*/㎠], did by pass through relief valve to be done, and lock ball valve that is linked to circle pressure when do to discharge pressure of tank and open valve for air discharge slowly and air pressure does so that "0" becomes. Is safe though enforce when open lid of pressure tank or when refill dispensing liquid when pressure of tank becomes "0" always.

Ⅳ. Experiment method and result

1. Experiment method

Circuit composition of figure 11 does to be composed and sets action mode selection of control unit time to "A" and power switch to do ON air pressure of control unit by 4 [kg/㎠] set by control unit, pressure tank and fluid interception valve. Open

dispensing way out ball valve of pressure tank and pressure as long as is rapidly later automatic/passivity switch in "MAN" and is operated and stop as time that is set at time if follow Foot switch. After stop as set time if exchange timer to "B" mode and do as "Automatic" when wish to apply automatically, again dispensing continuous control action becomes possible because being done and action is possible as "Passivity" (do by passivity when is intercepted) this time this time Foot switch step on must and is intercepted if stop signal. Dispensing amount establishment order is decided being proportional between needle inside diameter, pressure of tank and dispensing launch, and needle dispensing amount, point of material is decided because considering mucus area and pressure of tank sets dispensing amount ratching from low pressure after establish necessary pressure and do not apply high pressure from first this time and do air pressure as "0" as do air conditioning chapter.

When use liquid, after lock drain valve and dispensing way out ball valve and put dispensing material, close lid and go alternately for diagonal line direction and tighten Flange Bolt and connect air Quick Coupler Socket to plug of do air conditioning chapter. After open dispensing way out ball valve and confirm dispensing as connect main air circle and ratch pressure of tank according to viscosity of material and connect liquid hose if dispensing is confirmed and confirm dispensing again by same trick, lock cock. Liquid valve air hose of controller air out "A" to superior office of valve, speed control that connect hose of "B" to middle Fitting and is attached to valve superior office breaking speed.

Middle part connects liquid hose that is linked on tank regulating the dispensing speed in valve lower column goods to aid in a funeral liquid, and point of material solves and attach needle holder choosing necessary needle according to dispensing amount.

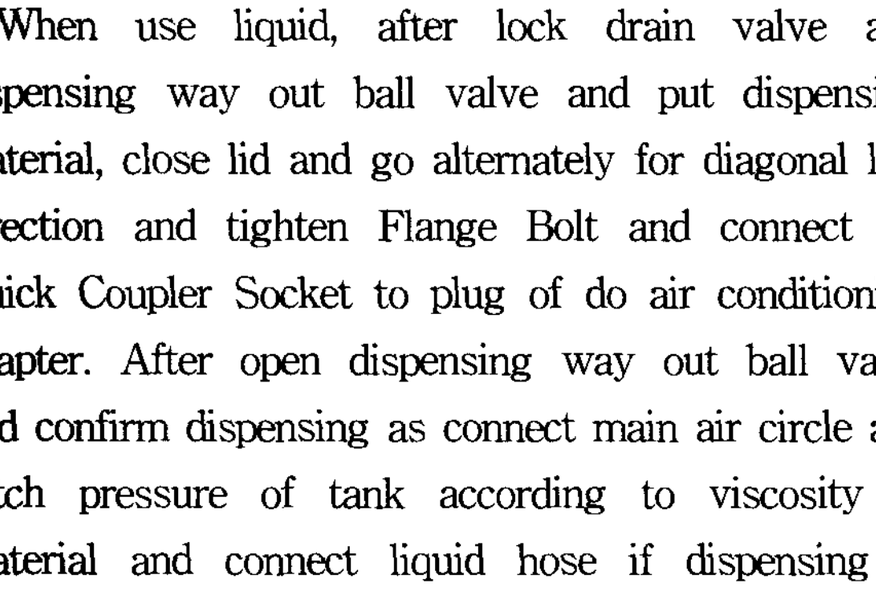

그림 11. 무마찰 상하작동 축의 유체차단 밸브
Fig. 11. Fluid interception valve of non rubbing top and bottom operation shaft.

2. Experiment result

Divide an action special quality experiment by normalcy action area and ailment action area and non action area Teflon diaphragm, Viton diaphragm, polyurethane diaphragm, Phosphorus Bronze Copperstrip diaphragm to liquid valve thread is result about action special quality by each pressure is as following by time zone rate.

(1) Action special quality of Teflon balance is appearing in figure 12.

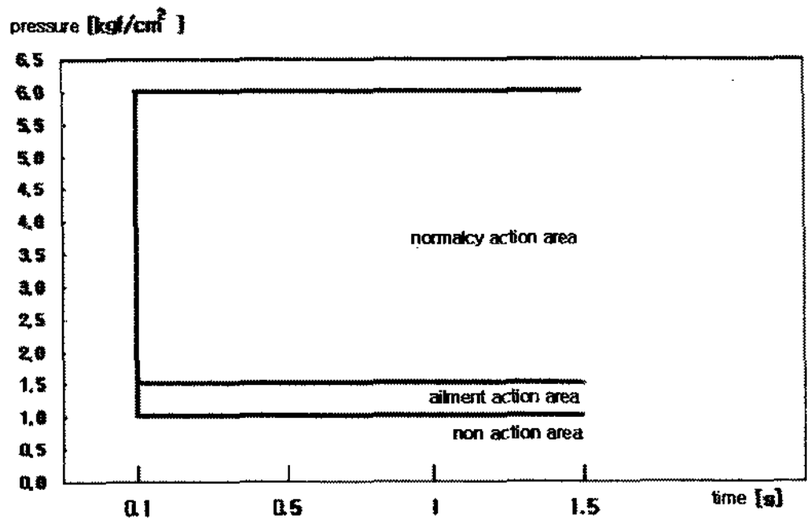

그림 12. 불소수지의 동작 특성
Fig. 12. Action special quality of Teflon.

(2) Action special quality of Viton is appearing in figure 13.

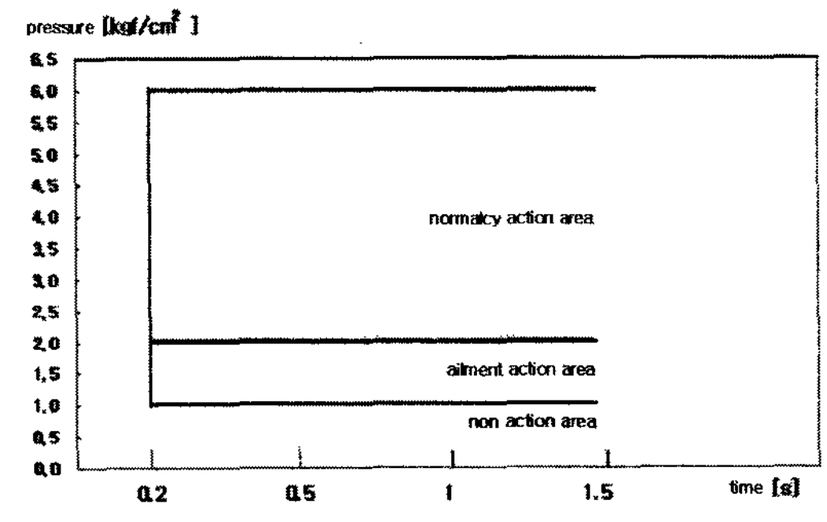

그림 13. 불소고무의 동작 특성
Fig. 13. Action special quality of Viton.

(3) Action special quality of polyurethane is appearing in figure 14.

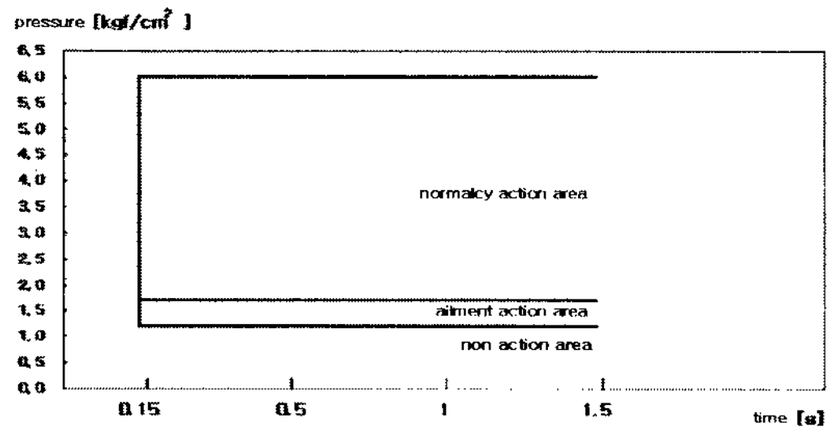

그림 14. 폴리우레탄의 동작 특성
Fig. 14. Action special quality of polyurethane.

(4) Action special quality of Phosphorus Bronze Copperstrip is appearing in figure 15.

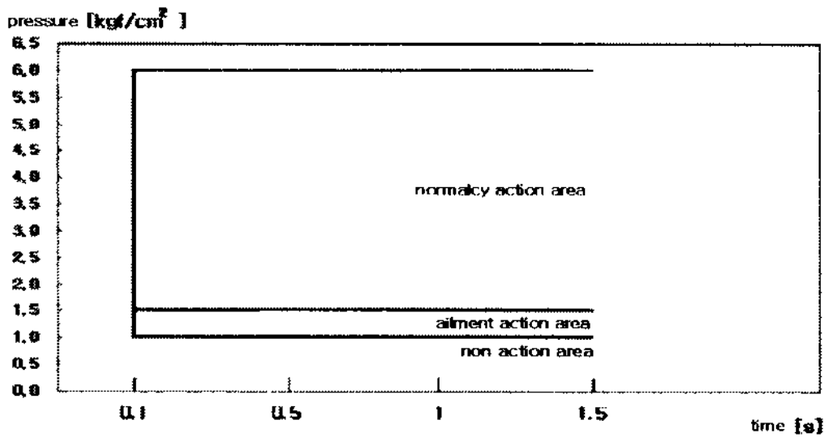

그림 15. 인청동의 동작 특성
Fig. 15. Action special quality of Phosphorus Bronze Copperstrip.

V. Conclusion

In this paper, analyzes special quality of liquid valve that use diaphragm way and use this and prevent leakage that occur increase and axis and packing of operation withdrawal and develop the interception ball by revers interception way, bell did that is close to prevented phenomenon and unuse do special vacuum device thereby and is inhaled by balloon at the same time interception.

Detail with target operation withdrawal of each diaphragm type result about suction function is as following.

표 1. 액체밸브 진동종류의 목표작동회수와 미세 흡입에 대한 결과
Table 1. Detail with target operation withdrawal of liquid valve diaphragm type result about suction.

Development quality of the material	Target operation withdrawal [withdrawal]	Target rise rate[%]	Weight[%]
Diaphragm of Teflon	700,000	230	20
Diaphragm of viton	1,000,000	330	25
Diaphragm of polyurethane	1,000,000	330	20
Diaphragm of Phosphorus Bronze Copperstrip	1,000,000	330	20
Detail suction	Suction distance : 1 [mm] Hose nozzle : Inside diameter 2[mm], Vescosity : 1[cps], Tank pressure : 0.2[kgf/cm]		15
Rise rate indication is indication that compare with operation limit withdrawal 300,000[withdrawal] of existing valve			

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