

明 細 書

電子管用熱変形部材とそれを用いたカラー受像管、 および電流制御器用熱変形部材とそれを用いた遮断器

技術分野

本発明は、カラー受像管等の電子管に用いられる熱変形部材とそれを用いたカラー受像管、および過電流保護器等の電流制御器に用いられる熱変形部材とそれを用いた過電流保護器に関する。

背景技術

シャドーマスク型のカラー受像管において、電子ビームを通過させる多数の細孔を有するシャドウマスクは、パネルの内面に形成された蛍光面に対して所定の間隙で対向配置されている。シャドウマスクの外周には、マスクフレームが固着されている。マスクフレームとパネルとの間には、フレームホルダが配置されている。

シャドウマスクの細孔を通過する電子ビームは、通常電子銃から照射された電子ビームの 20%程度である。残りの 80%程度の電子ビームは、シャドウマスクやマスクフレームに衝突して吸収される。この電子ビームの衝突によりシャドウマスクやマスクフレームが熱膨張を起こすと、シャドウマスクの細孔と蛍光面に形成されたドットとの相対位置が変位して、色純度が劣化してしまう。

そこで、シャドウマスクはFe-Ni系合金等の低熱膨張合金で構成することが一般的である。一方、通常マスクフレームは、強度等の関係から一般的なFe系材料で構成されている。このため、マスクフレームの熱膨張を吸収するように、フレームホルダの一部には弾性変形するバネ材が用いられている。

このような構成においては、電子ビームが衝突した際のシャドウマスクとマスクフレームの熱膨張が異なることから、単にバネ材でマスクフレームの熱膨張を吸収しただけでは色純度の劣化が生じる。そこで、フレームホルダの一部にはバネ材とは別に、マスクフレームの熱膨張方向とは逆方向に変形する熱変形部材が用いられている。このようなフレームホルダの一部となる熱変形部材には、通常、

Fe-Ni-Cr系合金からなる高熱膨張部材と、Fe-Ni系合金からなる低熱膨張部材とを積層した、いわゆるバイメタルが用いられている。

また、配線用遮断器等の過電流保護器においても、接点を開いて過電流を遮断するために熱変形部材が使用されている。過電流保護器において、熱変形部材は過電流が流れた際に、それ自体のジュール発熱により変形する。あるいは、抵抗体（ヒータ）に過電流が流れ、この抵抗体の発熱により熱変形部材が変形する。回路は熱変形部材の変形により遮断される。過電流保護器用の熱変形部材としては、Fe-Ni-Cr系合金やFe-Ni-Mn系合金からなる高熱膨張部材と、Fe-Ni系合金やFe-Ni-Co系合金からなる低熱膨張部材とを積層した2層積層材、あるいは中間にNiやCu-Zr合金等を介在させた3層積層材が用いられている。

Fe-Ni-(Cr, Mn)系合金からなる高熱膨張部材とFe-Ni系合金からなる低熱膨張部材とを用いたバイメタルにおいては、必要とされる熱変形率に応じて、高熱膨張部材と低熱膨張部材の板厚比が設定されている。また、材料強度や長期信頼性を確保し得る総板厚が設定されている。例えば、カラー受像管等に用いられるバイメタルには、材料強度や長期信頼性を確保し得るように、例えば0.7mm以上程度の総板厚が必要とされている。

しかしながら、従来のバイメタルは、高熱膨張部材および低熱膨張部材のいずれにもNi含有量が多い合金、すなわちFe-Ni-(Cr, Mn)系合金およびFe-Ni系合金が用いられているため、製造コストが高いという問題を有している。このようなバイメタルの製造コストを低減するためには、高熱膨張部材および低熱膨張部材の板厚を共に減少させることが考えられる。しかし、バイメタルの総板厚を減少させると、カラー受像管用熱変形部材や過電流保護器用熱変形部材としての強度や長期信頼性が損われてしまう。さらに、Fe-Ni-

(Cr, Mn)系合金やFe-Ni系合金は、いずれも鋼材等の一般的なFe系材料に比べて加工性に劣るという問題を有している。

なお、特開平7-234292号公報には、Fe-Ni-Cr系合金からなる高熱膨張部材とFe-Ni系合金からなる低熱膨張部材とを用いたバイメタルに、電気抵抗の調整を目的として、Ni、Ni合金、Zr-Cu合金を中間層として介在さ

せることが記載されている。また、特開平 3-13889号公報には、高熱膨張部材が異なるが、Cu、Niまたはこれらの合金からなる中間部材を介したクラッド材が記載されている。さらに、特開昭47-13209号公報には、上述したカラー受像管等に用いられるバイメタルと用途が異なるため、高熱膨張部材にMo-Cu-Ni系合金を用いた集成恒温槽材料が記載されている。この公報にはバイメタル構造の集成恒温槽材料において、外側層に比べてコストが低く、かつ集成材料の抵抗性およびたわみ性が不適当にならない範囲で種々の鉄合金を、中間層として使用し得ることが記載されている。

このように、電気抵抗の調整を目的とした中間層を有するバイメタルや、低コストの鉄合金を中間層として有するバイメタル構造の集成恒温槽材料は、既に提案されている。しかし、カラー受像管や過電流保護器に用いる熱変形部材において、それらに要求される適度な湾曲係数を有しつつ、かつコストの削減を可能にしたものはいまだ見出されていない。

本発明の目的は、強度や長期信頼性を損なうことなく、製造コストの低減および加工性の向上を図った電子管用熱変形部材、およびそれを用いたカラー受像管を提供することにある。本発明の他の目的は、強度や長期信頼性を損なうことなく、製造コストの低減および加工性の向上を図った電流制御器用熱変形部材、およびそれを用いた過電流保護器を提供することにある。

発明の開示

本発明の電子管用熱変形部材は、熱膨張率 α_1 を有する第1の部材と、前記第1の部材とは異なる熱膨張率 α_2 を有する第2の部材と、前記第1の部材と第2の部材との間に介在され、 $\alpha_1 > \alpha_3 > \alpha_2$ を満足する熱膨張率 α_3 を有する中間部材とを具備し、前記第1の部材、前記中間部材および前記第2の部材は積層されていることを特徴としている。

本発明のより具体的な電子管用熱変形部材は、Fe-Ni-Cr系合金からなる高熱膨張部材と、Fe-Ni系合金からなる低熱膨張部材と、前記高熱膨張部材と前記低熱膨張部材との間に介在され、Fe、AlおよびCuから選ばれる1種の金属、または前記金属を含む合金からなる中間部材とを具備し、前記高熱

膨張部材、前記中間部材および前記低熱膨張部材は積層されていることを特徴としている。

本発明のカラー受像管は、電子ビームを照射する電子銃と、前記電子銃から照射された電子ビームが衝突する蛍光面を有するパネルと、前記蛍光面と所定の間隙をもって対向配置され、前記電子ビームを通過させる多数の細孔またはスリットを有するシャドウマスクと、前記シャドウマスクに固着されたマスクフレームと、上記した本発明の電子管用熱変形部材からなる熱変形部と弾性部とを有し、一端が前記パネルに固定されると共に他端が前記マスクフレームに固着されたフレームホルダとを具備することを特徴としている。

また、本発明の電流制御器用熱変形部材は、熱膨張率 α_1 を有する第1の部材と、前記第1の部材とは異なる熱膨張率 α_2 を有する第2の部材と、前記第1の部材と第2の部材との間に介在され、 $\alpha_1 > \alpha_3 > \alpha_2$ を満足する熱膨張率 α_3 を有する中間部材とを具備し、前記第1の部材、前記中間部材および前記第2の部材は積層されていることを特徴としている。

本発明のより具体的な電流制御器用熱変形部材は、Fe-Ni-(Cr, Mn)系合金からなる高熱膨張部材と、Fe-Ni系合金からなる低熱膨張部材と、前記高熱膨張部材と前記低熱膨張部材との間に介在され、Fe、AlおよびCuから選ばれる1種の金属、または前記金属を含む合金からなる中間部材とを具備し、前記高熱膨張部材、前記中間部材および前記低熱膨張部材は積層されていることを特徴としている。

本発明の過電流保護器は、過電流が流れたときに、それ自体のジュール発熱、または接触配置された抵抗体の発熱により変形する、上記した本発明の電流制御器用熱変形部材からなる熱変形部と、前記熱変形部の変形に応じて回路を開く接点とを具備することを特徴としている。

本発明の電子管用熱変形部材および電流制御器用熱変形部材において、中間部材は高熱膨張部材と低熱膨張部材の中間の熱膨張率を有しているため、熱変形部材としての熱変形量等を高熱膨張部材と低熱膨張部材の熱膨張率およびこれらの板厚比によって決定することができる。従って、中間部材として低コストでかつ加工性に優れた材料を採用することによって、目的とする熱変形度合を得ると共

に、強度や長期信頼性に影響を及ぼす総板厚を確保することができる。その上で、中間部材の板厚分だけ高熱膨張部材および低熱膨張部材の板厚を削減することができる。これらによって、電子管用熱変形部材および電流制御器用熱変形部材の全体として製造コストを低減することができ、さらに加工性を向上させることが可能となる。

本発明のカラー受像管は、フレームホルダの熱変形部を上述したような電子管用熱変形部材で構成している。従って、シャドウマスクやマスクフレームに熱膨張が生じた場合においても、パネルに形成された蛍光面とシャドウマスクの細孔やスリットとの相対位置の変位に伴う色純度の劣化を防止した上で、製造コストの低減を図ることが可能となる。また、本発明の過電流保護器は、過負荷電流や短絡電流等の過電流が発生した際の回路の保護特性を確保した上で、製造コストの低減を図ることができる。

図面の簡単な説明

- 図1は本発明の電子管用熱変形部材の一実施形態の構成を示す斜視図、
- 図2は従来のバイメタルの構成を示す斜視図、
- 図3は本発明の一実施形態によるカラー受像管の要部構成を示す断面図、
- 図4は図3に示すカラー受像管の要部拡大図、
- 図5は本発明の電流制御器用熱変形部材の一実施形態の構成を示す斜視図、
- 図6は本発明の一実施形態による過電流保護器の要部構成を示す図である。

発明を実施するための形態

以下、本発明を実施するための形態について説明する。

図1は、本発明の電子管用熱変形部材の一実施形態を示す斜視図である。同図に示す電子管用熱変形部材1は、まず熱湾曲のような熱変形の基本的性能に寄与する第1の部材と第2の部材、すなわち高熱膨張部材2と低熱膨張部材3とを有している。ここで、高熱膨張部材2および低熱膨張部材3は、相対的に熱膨張率が異なればよく、これらの熱膨張率の絶対値に限定されるものではない。

高熱膨張部材2および低熱膨張部材3は、上述したように特に材質が限定され

るものではないが、大きな熱湾曲率（湾曲係数）が得られることから、高熱膨張部材2にFe-Ni-Cr系合金を用いると共に、低熱膨張部材3にFe-Ni系合金を用いることが好ましい。高熱膨張部材2（板厚 t_1 ）と低熱膨張部材3（板厚 t_2 ）の板厚比（ $t_1 : t_2$ ）は、目的とする熱湾曲率に応じて設定される。例えば、上記したような合金を用いたカラー受像管用の熱変形部材（バイメタル）1では、板厚比 $t_1 : t_2$ は55 : 45～45 : 55の範囲内で設定することが好ましい。

高熱膨張部材2として用いるFe-Ni-Cr系合金としては、15～30重量%のNiと2～10重量%のCrを含み、残部が実質的にFeからなる合金が挙げられる。NiおよびCrの添加量が上記した範囲外であると、いずれの場合にも熱膨張率が低下してしまう。また、低熱膨張部材3として用いるFe-Ni系合金としては、30～50重量%のNiを含み、残部が実質的にFeからなる合金が挙げられる。Ni含有量が30重量%未満であっても、また50重量%を超えても、いずれも熱膨張率が増大してしまう。言い換えると、Ni含有量が30～50重量%の範囲において、良好な低熱膨張性が得られる。

上述した高熱膨張部材2と低熱膨張部材3との間には、高熱膨張部材2の熱膨張率 α_1 と低熱膨張部材3の熱膨張率 α_2 との中間の熱膨張率 α_3 （ $\alpha_1 > \alpha_3 > \alpha_2$ ）を有する中間部材4が介在されている。これら各層2、3、4を積層および張り合わせることによって、電子管用熱変形部材1が構成されている。電子管用熱変形部材1は、3層構造のクラッド材（3層積層材）からなるバイメタルとすることができる。これら各層2、3、4間の張り合わせには、一般的なクラッド法を適用することができる。具体的には、各層2、3、4間を例えば熱間圧延により張り合わせる。

中間部材4の板厚 t_3 は、基本的には電子管用熱変形部材1の強度や長期信頼性等に必要とされる総板厚Tの範囲内で適宜設定可能である。ただし、実用上は高熱膨張部材2および低熱膨張部材3の熱変形、特に高熱膨張部材2の熱変形が中間部材4に拘束されて熱湾曲率が低下するおそれがあることから、中間部材4の板厚 t_3 は総板厚Tの80%以内とすることが好ましい。これは各層2、3、4の構成材料によっても異なる。また、中間部材4の熱膨張率 α_3 が高熱膨張部材

2および低熱膨張部材3の熱膨張率 α_1 、 α_2 のいずれかにより近い場合には、この熱膨張率が近い部材(2または3)の板厚を減らして、電子管用熱変形部材1の熱湾曲率を所期の値に設定するようにしてもよい。

中間部材4の具体的な材質は、高熱膨張部材2および低熱膨張部材3の材質に応じて適宜選択すればよい。例えば、高熱膨張部材2としてFe-Ni-Cr系合金を用い、かつ低熱膨張部材3としてFe-Ni系合金を用いる場合には、これら合金より安価であると共に加工性に優れる、Fe、AlおよびCuから選ばれる1種の金属、あるいはこれら金属を含む合金を中間部材4として用いることが好ましい。中間部材4の構成材料には熱湾曲特性や加工性等の点から、Fe、Alまたはこれら金属を基とする合金がより好ましく用いられる。特に、製造コストの削減に対して有効な鋼材は望ましい材料といえることができる。中間部材4に用いる鋼材としては、Cが0.3重量%以下、Pが0.05重量%以下、Sが0.05重量%以下で、残部がFeおよび不可避不純物からなる鋼材SS 400(JIS G 3101に規定されるSS 400)が挙げられる。

ここで、中間部材4は高熱膨張部材2(α_1)と低熱膨張部材3(α_2)の中間の熱膨張率 α_3 を有しているため、電子管用熱変形部材1の熱湾曲率は高熱膨張部材2および低熱膨張部材3の熱膨張率 α_1 、 α_2 、およびこれらの板厚比($t_1 : t_2$)によって決定される。従って、例えば図2に示す従来のバイメタル5の高熱膨張部材2と低熱膨張部材3の板厚比($t_1' : t_2'$)と、この実施形態による電子管用熱変形部材1の高熱膨張部材2と低熱膨張部材3の板厚比($t_1 : t_2$)が等しければ、ほぼ同等の熱湾曲率を得ることができる。

この際、図2に示す従来のバイメタル5では、総板厚 T' を高熱膨張部材2の板厚 t_1' と低熱膨張部材3の板厚 t_2' で確保しなければならない。一方、図1に示す本発明の電子管用熱変形部材1では、中間部材4の板厚 t_3 分だけ高熱膨張部材2および低熱膨張部材3の板厚 t_1 、 t_2 を削減することができる。これらの板厚を削減しても、上記したように本発明の電子管用熱変形部材1は従来のバイメタル5とほぼ同等の熱湾曲率を有している。言い換えると、高熱膨張部材2および低熱膨張部材3の板厚 t_1 、 t_2 を削減し、さらに従来のバイメタル5とほぼ同等の熱湾曲率を得た上で、強度や長期信頼性等に必要とされる総板厚

Tを確保することができる。

上述した電子管用熱変形部材1のいくつかの具体例の湾曲係数を表1に示す。これら各具体例は、高熱膨張部材2としてFe-22重量% Ni-4.5重量% Cr合金を用いると共に、低熱膨張部材3としてFe-36重量% Ni合金を用いたものである。中間部材4としては各種板厚の鋼材SS 400を用いた。高熱膨張部材2と低熱膨張部材3の板厚比は1:1とし、電子管用熱変形部材1の総板厚Tは2.5mmとした。表1の比較例は、図2に示す従来のバイメタル5（カラー受像管用バイメタル）である。比較例の高熱膨張部材2と低熱膨張部材3の構成材料、これらの板厚比、および総板厚T'は上記実施例と同一とした。

表1

	実施例1	実施例2	実施例3	比較例
中間材（鋼材） の板厚構成比(%)	30	50	60	—
湾曲係数 ($\times 10^6 / K$)	14.0	13.5	11.3	14.2

表1から明らかなように、各実施例においては鋼材SS 400からなる中間部材4の構成比が大きくなるほど、湾曲係数が低下する。しかし、上記構成の電子管用熱変形部材1においては、中間部材4の板厚構成比が60%程度であれば十分にカラー受像管用バイメタルとして使用できることが分かる。Fe-22重量% Ni-4.5重量% Cr合金やFe-36重量% Ni合金に比べて、鋼材のコストは1/4程度である。従って、従来のバイメタル5に比べて各実施例の電子管用熱変形部材1は、全体として30～40%程度製造コストを削減することができる。さらに、Fe-22重量% Ni-4.5重量% Cr合金やFe-36重量% Ni合金に比べて鋼材は加工性に優れる。よって、各実施例の電子管用熱変形部材1によれば、従来のバイメタル5に比べて加工性を向上させることができる。

上述したように、この実施形態の電子管用熱変形部材1においては、所期の熱湾曲率と強度や長期信頼性に影響を及ぼす総板厚Tを、高熱膨張部材2および低熱膨張部材3の板厚 t_1 、 t_2 を低減した上で得ることができる。従って、高熱膨張部材2および低熱膨張部材3として、製造コストが高く、かつ加工性に劣る

Fe-Ni-Cr系合金やFe-Ni系合金を用いる場合に、これらより低コストでかつ加工性に優れる中間部材4を配置することによって、所期の熱湾曲率を得た上で、電子管用熱変形部材1全体として製造コストを低減することができると共に、加工性を向上させることが可能となる。

次に、本発明のカラー受像管の一実施形態について、図3および図4を参照して説明する。

図3は、本発明の一実施形態によるカラー受像管の要部構成を示す断面図である。同図において、11は内面に図示を省略した蛍光面が形成されているパネルである。このパネル11の開口部近傍の内周面には、パネルピン12が設置されている。パネル11の内側には、その内面に形成された蛍光面に対して所定の間隙をもってシャドウマスク13が対向配置されている。

シャドウマスク13には、図示を省略した細孔またはスリットが多数形成されており、これら細孔やスリットを通過した電子ビームが蛍光面に衝突するように構成されている。なお、電子ビームは図示を省略した電子銃から照射される。電子銃は、パネル11にファンネル（図示せず）を介して接続されたネック（図示せず）内に配置される。

シャドウマスク13は、Fe-Ni合金等の低熱膨張合金により形成されている。シャドウマスク13の外周縁部には、鋼材等のFe系材料からなるマスクフレーム14が固着されている。マスクフレーム14には、フレームホルダ15の一端が固着されており、フレームホルダ15の他端部はパネルピン12に係合固定されている。このようにして、シャドウマスク13はフレームホルダ15を介して、パネル11に弾性的に保持されている。

上述したフレームホルダ15は、例えばステンレスバネ材からなる弾性部15aと、前述した実施形態で説明した本発明の電子管用熱変形部材1からなる熱変形部15bとを有している。弾性部15aは、パネル11側に配置されており、シャドウマスク13やマスクフレーム14が熱膨張した際に、それを吸収するようなバネ性（弾性）を有している。一方、熱変形部15bは、図4の拡大図に示すように、電子管用熱変形部材1の低熱膨張部材3がマスクフレーム14側に位置し、中間部材4を介して高熱膨張部材2がパネル11側に位置するように、電

子管用熱変形部材 1 を配置して構成されている。すなわち、シャドウマスク 1 3 やマスクフレーム 1 4 が熱膨張した際に、熱変形部 1 5 b はその熱膨張方向とは反対方向に変形する。

シャドウマスク 1 3 とマスクフレーム 1 4 の熱膨張率が異なる際に、これらが電子ビームの衝突により熱膨張しても、上述した弾性部 1 5 a および熱変形部 1 5 b を有するフレームホルダ 1 5 によって、パネル 1 1 の内面に形成された蛍光面のドットとシャドウマスク 1 3 の細孔やスリットとの相対位置が変位することが防止できる。そして、この変位防止は前述した実施形態で説明したように、従来のバイメタルに比べて安価で加工性に優れ、かつ強度や長期信頼性に影響を及ぼす総板厚を確保した、本発明の電子管用熱変形部材 1 により実現している。従って、カラー受像管の製造コストの低減を図ることができると共に、加工性の向上に伴ってカラー受像管の信頼性を高めることが可能となる。

次に、本発明の電流制御器用熱変形部材の実施形態について説明する。

図 5 は、本発明の電流制御器用熱変形部材の一実施形態を示す斜視図である。同図に示す電流制御器用熱変形部材 2 1 は、前述した電子管用熱変形部材 1 と同様に、熱変形の基本的性能に寄与する高熱膨張部材（熱膨張率 α_1 ）2 2 と低熱膨張部材（熱膨張率 α_2 ）2 3、さらにこれらの間に介在され、これらの中間の熱膨張率 α_3 （ $\alpha_1 > \alpha_3 > \alpha_2$ ）を有する中間部材 2 4 を有している。これら各層 2 2、2 3、2 4 を積層および張り合せることによって、3 層構造のクラッド材からなる電流制御器用熱変形部材 2 1 が構成されている。

これら各層 2 2、2 3、2 4 間の張り合せ、高熱膨張部材 2 2 と低熱膨張部材 2 3 の板厚比（ $t_1 : t_2$ ）、中間部材 2 4 の板厚 t_3 （総板厚 T に対する比率）等は、前述した電子管用熱変形部材 1 と同様とすることが好ましい。すなわち、各層 2 2、2 3、2 4 間の張り合せには、例えば熱間圧延のような一般的なクラッド法を適用することができる。高熱膨張部材 2 2 と低熱膨張部材 2 3 の板厚比（ $t_1 : t_2$ ）は、55 : 45 ~ 45 : 55 の範囲内とすることが好ましい。中間部材 2 4 の板厚 t_3 は総板厚 T の 80% 以内とすることが好ましい。これらの規定理由は前述した通りである。さらに、電流制御器用熱変形部材 2 1 についても、電子管用熱変形部材 1 と同様な各種の形態を適用することができる。

高熱膨張部材22、低熱膨張部材23および中間部材24には、基本的には電子管用熱変形部材1と同様な材料を使用することができる。ただし、高熱膨張部材22としては、Fe-Ni-Cr系合金に限らず、Fe-Ni-Mn系合金を使用してもよい。Fe-Ni-Mn系合金はFe-Ni-Cr系合金と同様な高熱膨張率を有している。高熱膨張部材22として用いるFe-Ni-(Cr, Mn)系合金としては、15~30重量%のNiと2~10重量%のCrおよびMnから選ばれる少なくとも1種を含み、残部が実質的にFeからなる合金が挙げられる。Niおよび(Cr, Mn)の添加量が上記した範囲外であると、いずれの場合にも熱膨張率が低下してしまう。

低熱膨張部材23には、電子管用熱変形部材1と同様に、30~50重量%のNiを含み、残部が実質的にFeからなるFe-Ni系合金が好ましく用いられる。中間部材24には、上記した高熱膨張部材22や低熱膨張部材23の構成材料より安価であると共に加工性に優れる、Fe、AlおよびCuから選ばれる1種の金属、あるいはこれら金属を含む合金が好ましく用いられる。特に、Fe、Alまたはこれら金属を基とする合金、さらに鋼材（例えばSS 400材）は中間部材24の構成材料として好適である。このような材料を用いた電流制御器用熱変形部材21の具体的な熱変形量は前述した通りである。

本発明の電流制御器用熱変形部材21では、前述した電子管用熱変形部材1と同様に、従来のバイメタルとほぼ同等の熱湾曲率を得た上で、中間部材24の板厚 t_3 分だけ高熱膨張部材22および低熱膨張部材23の板厚 t_1 、 t_2 を削減することができる。すなわち、所期の熱湾曲率と強度や長期信頼性に影響を及ぼす総板厚 T を、高熱膨張部材22および低熱膨張部材23の板厚 t_1 、 t_2 を低減した上で得ることができる。従って、高熱膨張部材22および低熱膨張部材23として、製造コストが高く、かつ加工性に劣るFe-Ni-(Cr, Mn)系合金やFe-Ni系合金を用いる場合に、これらより低コストでかつ加工性に優れる中間部材24を配置することによって、所期の熱湾曲率を得た上で、電流制御器用熱変形部材21全体として製造コストを低減することができる。さらに、電流制御器用熱変形部材21の加工性を向上させることができる。

本発明の電流制御器用熱変形部材21は、配線用遮断器や熱動継電器等の過電

流保護器の熱変形部材（バイメタル）として好適である。またこれら以外にも、電流制御器用熱変形部材 2 1 中に負荷電流を流し、過負荷電流や短絡電流等の過電流が流れた際に、電流制御器用熱変形部材 2 1 自体の抵抗発熱（ジュール発熱）に基く変形によって、電流を制御（例えば遮断）する電流制御器に適用することができる。電流制御器用熱変形部材 2 1 の変形は、負荷電流が流れる抵抗体（ヒータ）の発熱に基づくものであってもよい。

次に、本発明の過電流保護器を適用した配線用遮断器の一実施形態について、図 6 を参照して説明する。

図 6 は本発明の過電流保護器を適用した一実施形態の配線用遮断器の概略構成を示す図である。同図において、3 1 はヒータである。ヒータ 3 1 は負荷電流が流れるように配線に接続されている。ヒータ 3 1 の近傍には熱変形部として、前述した実施形態で説明した本発明の電流制御器用熱変形部材 2 1 が接触配置されている。

電流制御器用熱変形部材 2 1 は、中心軸により回転可能とされたトリップ杆 3 2 に固着されている。トリップ杆 3 2 はさらに、固定鉄心 3 3 と対向配置された可動鉄片 3 4 の支持棒 3 5 に接続されている。可動鉄片 3 4 はその移動に基づいて、図示を省略した接点を開閉するように構成されている。なお、図中 3 6 はラッチ 2 3 である。

電流制御器用熱変形部材 2 1 は、高熱膨張部材 2 2 がトリップ杆 3 2 側に位置し、中間部材 2 4 を介して低熱膨張部材 2 3 がラッチ 3 6 側に位置するように配置されている。トリップ杆 3 2 は、電流制御器用熱変形部材 2 1 の熱変形により回転するよう構成されている。このトリップ杆 3 2 の回転動作に伴って、可動鉄 3 4 は固定鉄心 3 3 側に移動する。

このような配線用遮断器において、ヒータ 3 1 を流れる負荷電流が定格内の場合には、電流制御器用熱変形部材 2 1 は正規の形状を維持している。従って、可動鉄片 3 4 により開閉される接点は閉じられている。一方、負荷側に過負荷電流や短絡電流が発生し、ヒータ 3 1 に過電流が流れると、ヒータ 3 1 が所定の温度まで発熱して、電流制御器用熱変形部材 2 1 はトリップ杆 3 2 側に変形（図中矢印で示す）する。この電流制御器用熱変形部材 2 1 の変形に伴ってトリップ杆 3 2

が回転し、さらに可動鉄片 3 4 が固定鉄心 3 3 側に移動して、図示を省略した接点が開けられる。すなわち回路が遮断されて、負荷が過電流から保護される。

上記した実施形態の配線用遮断器による回路遮断機能は、前述した実施形態で説明したように、従来のバイメタルに比べて安価で加工性に優れ、かつ強度や長期信頼性に影響を及ぼす総板厚を確保した、本発明の電流制御器用熱変形部材 2 1 により実現している。従って、配線用遮断器の製造コストの低減を図ることができると共に、加工性の向上に伴って配線用遮断器の信頼性を高めることが可能となる。

なお、上記した実施形態はヒータ 3 1 に負荷電流を流すようにした配線遮断器である。本発明の過電流保護器はこれに限らず、電流制御器用熱変形部材 2 1 に直接負荷電流を流すようにした配線遮断器、さらにはヒータもしくは電流制御器用熱変形部材に負荷電流を流すようにした熱動継電器等、種々の過電流保護器に適用することができる。

産業上の利用可能性

以上の実施例からも明らかなように、本発明の電子管用熱変形部材および電流制御器用熱変形部材は、低コストで加工性に優れると共に、優れた強度や長期信頼性を有している。従って、カラー受像管や過電流保護器用の熱変形部材として有用である。本発明の熱変形部材をフレームホルダの一部として用いた本発明のカラー受像管によれば、低コスト化を図った上で、良好な色再現特性や信頼性を得ることが可能となる。本発明の熱変形部材を用いた過電流保護器によれば、良好な過電流保護機能を維持した上で、低コスト化することができる。



請 求 の 範 囲

1. 熱膨張率 α_1 を有する第1の部材と、
前記第1の部材とは異なる熱膨張率 α_2 を有する第2の部材と、
前記第1の部材と第2の部材との間に介在され、 $\alpha_1 > \alpha_3 > \alpha_2$ を満足する熱膨張率 α_3 を有する中間部材とを具備し、
前記第1の部材、前記中間部材および前記第2の部材は積層されている電子管用熱変形部材。
2. Fe-Ni-Cr系合金からなる高熱膨張部材と、
Fe-Ni系合金からなる低熱膨張部材と、
前記高熱膨張部材と前記低熱膨張部材との間に介在され、Fe、AlおよびCuから選ばれる1種の金属、または前記金属を含む合金からなる中間部材とを具備し、
前記高熱膨張部材、前記中間部材および前記低熱膨張部材は積層されている電子管用熱変形部材。
3. 請求項2記載の電子管用熱変形部材において、
前記高熱膨張部材の熱膨張率を α_1 、前記低熱膨張部材の熱膨張率を α_2 としたとき、前記中間部材は $\alpha_1 > \alpha_3 > \alpha_2$ を満足する熱膨張率 α_3 を有する電子管用熱変形部材。
4. 請求項2記載の電子管用熱変形部材において、
前記中間部材は、FeおよびAlから選ばれる1種の金属、または前記金属を基とする合金からなる電子管用熱変形部材。
5. 請求項4記載の電子管用熱変形部材において、
前記中間部材は、Cが0.3重量%以下、Pが0.05重量%以下、Sが0.05重量%以下で、残部がFeおよび不可避不純物からなる電子管用熱変形部材。
6. 請求項2記載の電子管用熱変形部材において、
前記高熱膨張部材と前記低熱膨張部材との板厚比が55:45～45:55の範囲であり、かつ前記中間部材の板厚が前記熱変形部材の総板厚の80%以内である電子管用熱変形部材。



7. 請求項2記載の電子管用熱変形部材において、

前記Fe-Ni-Cr系合金は、15～30重量%のNiと2～10重量%のCrを含み、残部が実質的にFeからなり、かつ前記Fe-Ni系合金は、30～50重量%のNiを含み、残部が実質的にFeからなる電子管用熱変形部材。

8. 電子ビームを照射する電子銃と、

前記電子銃から照射された電子ビームが衝突する蛍光面を有するパネルと、

前記蛍光面と所定の間隙をもって対向配置され、前記電子ビームを通過させる多数の細孔またはスリットを有するシャドウマスクと、

前記シャドウマスクに固着されたマスクフレームと、

請求項1または請求項2記載の電子管用熱変形部材からなる熱変形部と、弾性部とを有し、一端が前記パネルに固定されると共に、他端が前記マスクフレームに固着されたフレームホルダと

を具備するカラー受像管。

9. 熱膨張率 α_1 を有する第1の部材と、

前記第1の部材とは異なる熱膨張率 α_2 を有する第2の部材と、

前記第1の部材と第2の部材との間に介在され、 $\alpha_1 > \alpha_3 > \alpha_2$ を満足する熱膨張率 α_3 を有する中間部材とを具備し、

前記第1の部材、前記中間部材および前記第2の部材は積層されている電流制御器用熱変形部材。

10. Fe-Ni-(Cr, Mn)系合金からなる高熱膨張部材と、

Fe-Ni系合金からなる低熱膨張部材と、

前記高熱膨張部材と前記低熱膨張部材との間に介在され、Fe、AlおよびCuから選ばれる1種の金属、または前記金属を含む合金からなる中間部材とを具備し、

前記高熱膨張部材、前記中間部材および前記低熱膨張部材は積層されている電流制御器用熱変形部材。

11. 請求項10記載の電流制御器用熱変形部材において、

前記高熱膨張部材の熱膨張率を α_1 、前記低熱膨張部材の熱膨張率を α_2 としたとき、前記中間部材は $\alpha_1 > \alpha_3 > \alpha_2$ を満足する熱膨張率 α_3 を有する電流



制御器用熱変形部材。

12. 請求項10記載の電流制御器用熱変形部材において、

前記中間部材は、FeおよびAlから選ばれる1種の金属、または前記金属を基とする合金からなる電流制御器用熱変形部材。

13. 請求項12記載の電流制御器用熱変形部材において、

前記中間部材は、C 0.3重量%以下、P 0.05重量%以下、S 0.05重量%以下で、残部がFeおよび不可避不純物からなる電流制御器用熱変形部材。

14. 請求項10記載の電流制御器用熱変形部材において、

前記高熱膨張部材と前記低熱膨張部材との板厚比が55:45～45:55の範囲であり、かつ前記中間部材の板厚が前記熱変形部材の総板厚の80%以内である電流制御器用熱変形部材。

15. 請求項10記載の電流制御器用熱変形部材において、

前記Fe-Ni-(Cr, Mn)系合金は、15～30重量%のNiと2～10重量%のCrおよびMnから選ばれる少なくとも1種を含み、残部が実質的にFeからなり、かつ前記Fe-Ni系合金は、30～50重量%のNiを含み、残部が実質的にFeからなる電流制御器用熱変形部材。

16. 過電流が流れたときに、それ自体のジュール発熱、または接触配置された抵抗体の発熱により変形する、請求項9または請求項10記載の電流制御器用熱変形部材からなる熱変形部と、

前記熱変形部の変形に応じて回路を開く接点と
を具備する過電流保護器。

図 1

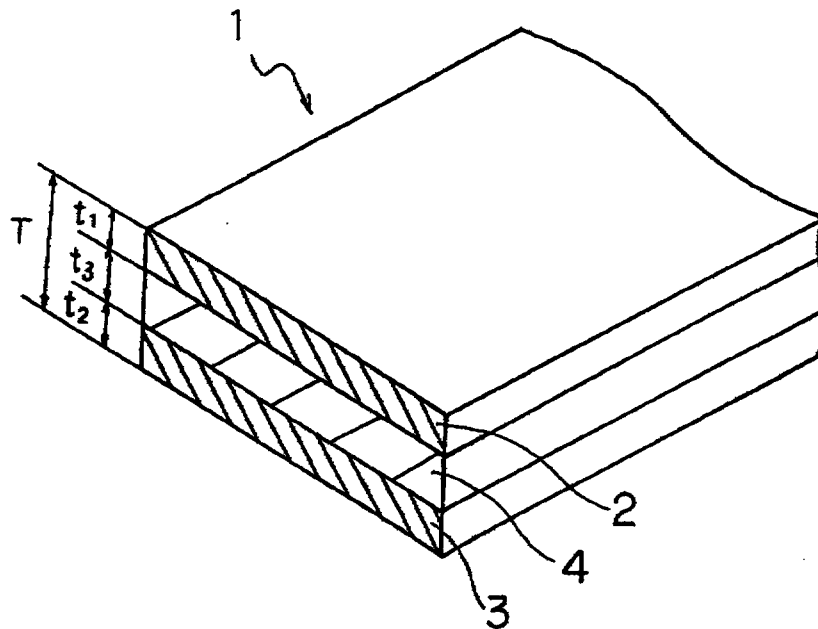


図 2

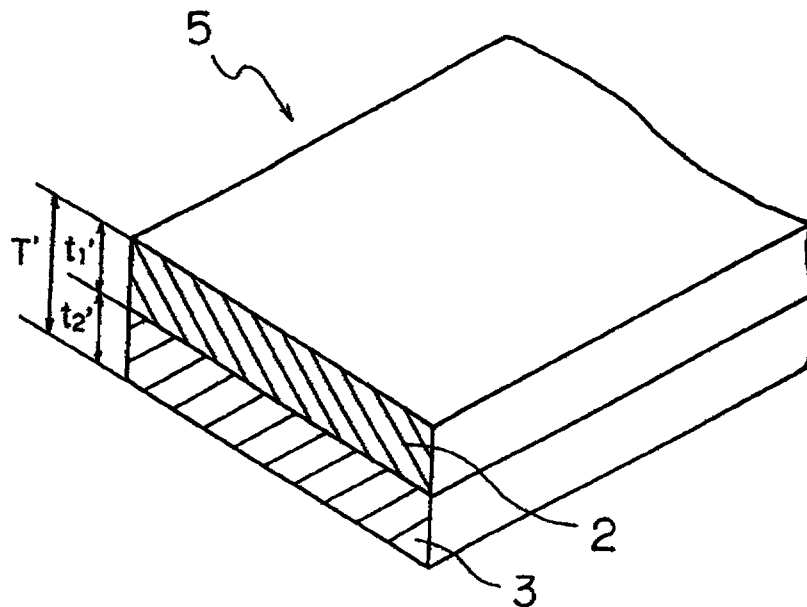


図 3

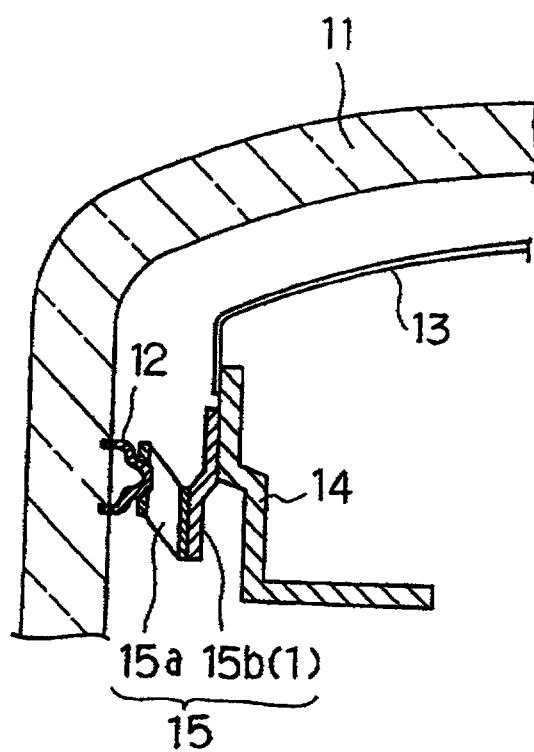


図 4

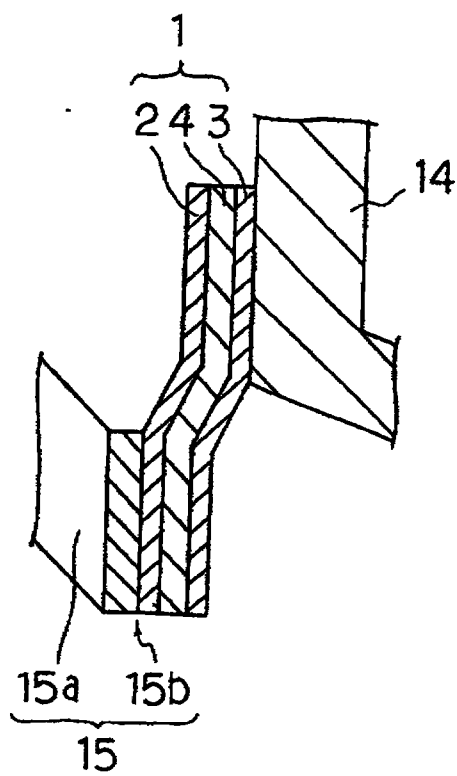


図 5

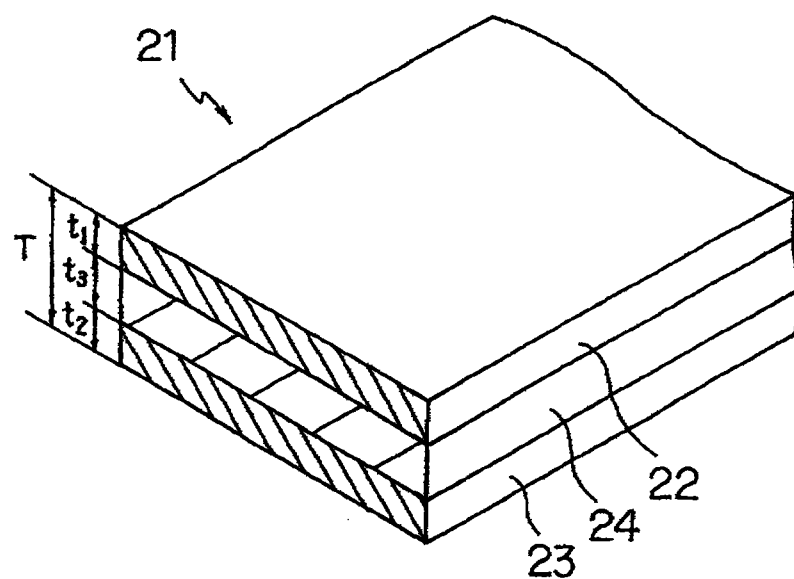
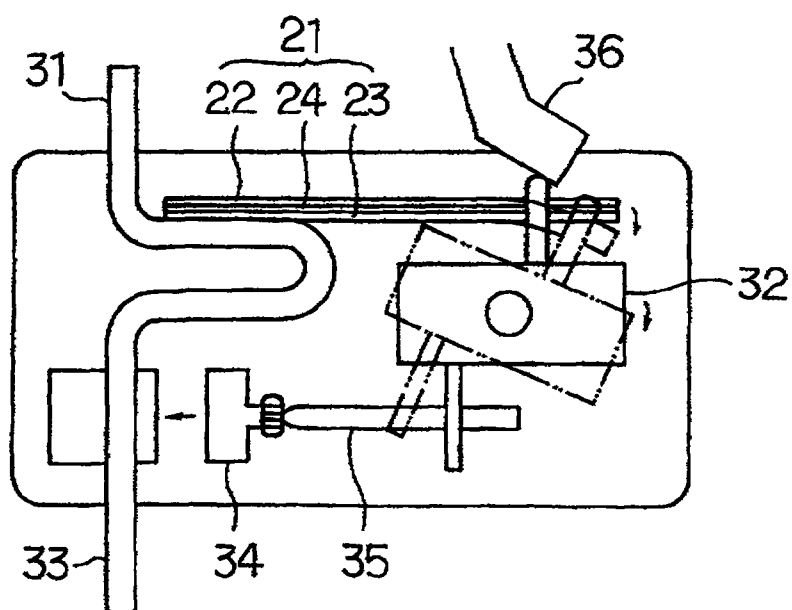


図 6



Thermal Deformation Member for Electron Tube and Color Picture Tube using Thereof , and Thermal Deformation Member for Electric Current Control and Circuit Breaker using Thereof

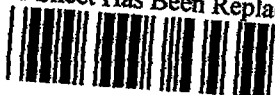
5 Technical Field

The present invention relates to a thermal deformation member for an electron tube such as a color picture tube and the like and a color picture tube using thereof, and a thermal deformation member for an electric current control such as an overcurrent protection and the like and an overcurrent protection using thereof.

Background Art

In a color picture tube using a shadow mask, the shadow mask which has lots of fine holes transmitting an electron beam is disposed in an opposite relation with respect to a phosphor layer formed inside a panel with a predetermined spacing. Surrounding an outer periphery of the shadow mask, a mask frame is fixed. A frame holder is disposed between the mask frame and the panel.

The electron beam which passes through the fine holes of the shadow mask is usually only about 20 % of the total electron beam emitted from an electron gun. Remaining about 80 % of the electron beam is absorbed by colliding with the shadow mask and the mask frame. When the shadow mask or the mask frame is thermally expanded by collision of the electron beam, the fine holes of the shadow mask and the dots formed in the phosphor layer are relatively shifted in their relative positions to result in degradation of color purity.



Therefore, the shadow mask is generally formed of a low thermal expansion alloy such as an Fe-Ni based alloy and the like. Besides, the mask frame is conventionally formed of a generally used Fe based material from the view point of strength and the like. Therefore, in order to absorb thermal expansion of the mask frame, a spring material which is capable of deforming elastically is employed for a part of the frame holder.

In such a construction, since there is difference in the thermal expansions of the shadow mask and the mask frame when the electron beam is collided, absorption of the thermal expansion solely by the spring material is not enough to result in degradation of the color purity. Thus, a thermal deformation material which deforms in an opposite direction relative to the direction of thermal expansion of the mask frame is used for a part of the frame holder, aside from the spring material. For the thermal deformation member forming a part of such a frame holder, a so-called bimetal obtained by laminating a high thermal expansion member such as an Fe-Ni-Cr based alloy and a low thermal expansion member such as an Fe-Ni based alloy is conventionally used.

In addition, in an overcurrent protection such as a molded-case circuit-breaker and the like, a thermal deformation member is used to break overcurrent by opening a contact point. In the overcurrent protection, the thermal deformation member deforms due to its own Joule heat when the overcurrent flows. Otherwise, the overcurrent flows a resistor (heater) to induce a thermal deformation due to heating of the resistor. A circuit is broken due to deformation of the thermal deformation member.

For the thermal deformation member for the overcurrent protection,
a 2-layered laminate material obtained by laminating a high
thermal expansion member such as an Fe-Ni-Cr based alloy or an
Fe-Ni-Mn based alloy and a low thermal expansion member such as
5 an Fe-Ni based alloy or an Fe-Ni-Co based alloy , or a 3 layered
laminate material obtained by interposing Ni or a Cu-Zr alloy and
the like as an intermedium is used.

In a bimetal using a high thermal expansion member such as
an Fe-Ni-(Cr, Mn) based alloy and a low thermal expansion member
10 such as an Fe-Ni based alloy, according to a required thermal
deformation rate, a ratio between plate thicknesses of the high
thermal expansion member and the low thermal expansion member is
determined. Further, a total thickness of the laminate plate for
securing material strength and long term reliability is
15 determined. For example, for a bimetal for a color picture tube
and the like, to make possible to secure the material strength
and the long term reliability, a total plate thickness of 0.7 mm
or more is required.

However, in the conventional bimetal, since the high Ni
20 content alloys such as an Fe-Ni-(Cr,Mn) based alloy and an Fe-Ni
based alloy are used for both of the high thermal expansion and
low thermal expansion members, there is a problem that
manufacturing cost is high. To reduce such a high manufacturing
cost of the bimetal, it is considered to reduce concurrently the
25 thicknesses of both of the high thermal expansion member and the
low thermal expansion member. However, due to decrease of the
total thickness of the bimetal, material strength and long term
reliability as a thermal deformation members for both of a color

picture tube and an overcurrent protection are deteriorated. Further, both of the Fe-Ni- (Cr,Mn) based alloy and the Fe-Ni based alloy are poor in its workability compared with a generally used Fe based alloy.

5 In addition, in Japanese Patent Laid-Open Application No. HEI 7-234292, a technology to interpose Ni, Ni alloy, a Zr-Cu alloy as an intermediary layer in order to adjust electric resistance of a bimetal which uses a high thermal expansion member consisting of the Fe-Ni-Cr based alloy and a low thermal expansion member
10 consisting of the Fe-Ni based alloy is disclosed. Further, in Japanese Patent Laid-Open Application No. HEI 3-13889, a clad material which, though its high thermal expansion member is different, is obtained by cladding Cu, Ni, or an alloy formed therebetween as an intermediary member is disclosed. Further,
15 Japanese Patent Laid-Open Application No. SHO 47-13209 discloses a technology in that, because its usage is different from the above described bimetal for a color picture tube, a high thermal expansion member such as a Mo-Cu-Ni based alloy is used for a composite thermostat material. In this patent application, it
20 is disclosed that, in a composite thermostat material having a bimetal structure, various kinds of Fe alloys, which can be manufactured at a low cost compared with the outer side layer, can be used as an intermediary layer in the range that does not make inadequate resistance and flexibility of the composite
25 material.

Thus, a bimetal having an intermediary layer for adjusting electric resistance and a composite thermostat material of bimetal structure having low cost Fe alloy as an intermediary

layer were already proposed. However, in a field of the thermal deformation member used for a color picture tube and an overcurrent protection, no proposal has been made that make possible, while satisfying requirement of adequate bent
5 coefficient, to attain cost reduction.

An objective of the present invention is to provide a thermal deformation member for an electron tube which manufacturing cost is reduced and workability is improved without adversely affecting its strength and long term reliability, and a color
10 picture tube using thereof. Another objective of the present invention is, without adversely affecting its strength and long term reliability, to provide a thermal deformation member for an electric current control which manufacturing cost is reduced and workability is improved, and an overcurrent protection using
15 thereof.

Disclosure of Invention

A thermal deformation member for an electron tube of the present invention comprises the first member of thermal expansion
20 coefficient α_1 , the second member of thermal expansion coefficient α_2 different from that of the first member, and an intermediary member which is interposed between the first member and the second member and possesses thermal expansion coefficient of α_3 satisfying relationship of $\alpha_1 > \alpha_3 > \alpha_2$, wherein the first
25 member, the intermediary member, and the second member are laminated.

A more specific thermal deformation member for an electron tube of the present invention comprises a high thermal expansion

member such as an Fe-Ni-Cr based alloy, a low thermal expansion member such as an Fe-Ni based alloy, and an intermediary member which is interposed between the high thermal expansion member and the low thermal expansion member and is composed of one kind of metal selected from a group of Fe, Al, and Cu, or an alloy including these metals, wherein the high thermal expansion member, the low thermal expansion member, and the intermediary member are laminated.

A color picture tube of the present invention comprises an electron gun irradiating an electron beam, a panel having a phosphor layer to which the electron beam irradiated from the electron gun collides, a shadow mask disposed in an opposite relation with respect to the phosphor layer with a predetermined spacing and possessing a lot of fine holes which transmit the electron beam, a mask frame fixed to the shadow mask, a thermal deformation portion formed of the thermal deformation member for an electron tube of the present invention and an elastic portion, and a frame holder one edge thereof being fixed to the panel and the other edge thereof being fixed to the frame holder.

Further, a thermal deformation member for an electric current control of the present invention comprises the first member possessing thermal expansion coefficient α_1 , the second member possessing thermal expansion coefficient α_2 , different from that of the first member, and an intermediary member interposed between the first member and the second member and possessing thermal expansion coefficient α_3 , satisfying relationship of $\alpha_1 > \alpha_3 > \alpha_2$, wherein the first member, the intermediate member, and the second member are laminated.

A more specific thermal deformation member for electric current control of the present invention comprises a high thermal expansion member composed of an Fe-Ni-(Cr, Mn) based alloy, a low thermal expansion member composed of an Fe-Ni based alloy, and
5 an intermediary member interposed between the high thermal expansion member and the low thermal expansion member and composed of one kind of metal selected from a group of Fe, Al, and Cu, or an alloy including the above mentioned metals, wherein the high thermal expansion member, the intermediate member and the low
10 thermal expansion member are laminated.

An overcurrent protection of the present invention comprises a thermal deformation portion consisting of a thermal deformation member for an electric current control of the above described present invention which, when overcurrent flows, deforms due to
15 its own Joule heat, or due to heat generated by resistor disposed in contact, and a contact point which opens circuit according to the deformation of the thermal deformation portion.

In a thermal deformation member for an electron tube and a thermal deformation member for an electric current control both
20 of the present invention, since the intermediary member possesses the thermal expansion coefficient located between those of a high thermal expansion member and a low thermal expansion member, thermal deformation and the like as a thermal deformation member can be determined depending on the thermal expansion coefficients
25 of the high expansion member and the low expansion member and plate thickness ratio therebetween. Therefore, by adopting a member less expensive and excellent in their workability as an intermediary member, thermal deformation degree to be aimed can

be obtained and the total plate thickness which influences strength and long term reliability can be secured. In addition, the plate thickness of both of the high thermal expansion member and the low thermal expansion member can be reduced by the
5 identical thickness as that of the intermediary member. Thereby, the manufacturing cost of the thermal deformation member for an electron tube and the thermal deformation member for an electric current control can be reduced as a whole and, further, the workability can be improved.

10 The thermal deformation portion of the frame holder of a color picture tube of the present invention is constructed with the above described thermal deformation member for an electron tube. Therefore, even when the shadow mask or the mask frame are thermally expanded, while preventing deterioration of color
15 purity accompanying displacement of relative position between the phosphor layer formed inside the panel and the fine holes of the shadow mask or the slit, reduction of the manufacturing cost can be made possible. Further, the overcurrent protection of the present invention, while securing protection property of the
20 circuit due to the occurrence of the overcurrent such as over load current or short-circuit current, reduction of the manufacturing cost can be attained.

Brief Description of Drawings

25 Fig. 1 is a perspective view showing a construction of one embodiment of a thermal deformation member for an electron tube of the present invention.

Fig. 2 is a perspective view showing a construction of a

conventional bimetal.

Fig. 3 is a sectional view showing an essential construction of a color picture tube according to one embodiment of the present invention.

5 Fig. 4 is a diagram showing enlargement of the essential portion of the color picture tube shown in Fig. 3.

Fig. 5 is a perspective view showing a construction of one embodiment of a thermal deformation member for an electric current protection of the present invention.

10 Fig. 6 is a diagram showing an essential construction of an overcurrent protection according to one embodiment of the present invention.

Best Mode for Carrying Out the Invention

15 In the following, embodiments for implementing the present invention will be explained.

Fig. 1 is a perspective view showing one embodiment of a thermal deformation member for an electron tube of the present invention. The thermal deformation member for an electron tube
20 1 shown in Fig. 1 comprises the first member and the second member contributing to fundamental property of thermal deformation such as thermal bent, that is, a high thermal expansion member 2 and a low thermal expansion member 3. Here, the high thermal expansion member 2 and the low thermal expansion member 3 can just
25 as well be relatively different in their thermal expansion coefficient and are not necessarily restricted to absolute values of their thermal expansion coefficients.

Although the high thermal expansion member 2 and the low

thermal expansion member 3 are not particularly restricted in their material as described above, since a large thermal bent curvature (bent coefficient) can be obtained, an Fe-Ni-Cr based alloy and an Fe-Ni based alloy are preferably employed as the high thermal expansion member 2 and the low thermal expansion member 3, respectively. The plate thickness ratio ($t_1 : t_2$) of the high thermal expansion member 2 (plate thickness t_1) and the low thermal expansion member 3 (plate thickness t_2) is determined according to the aimed thermal bent curvature. For example, in a thermal deformation member (bimetal) 1 for a color picture tube employing an above described alloy, the plate thickness ratio $t_1 : t_2$ is preferable to be set in the range of from 55 : 45 to 45 : 55.

As an Fe-Ni-Cr based alloy employed for the high thermal expansion member 2, an alloy comprising from 15 to 30 weight % of Ni, from 2 to 10 weight % of Cr, and the balance essentially consisting of Fe can be cited. When the addition quantity of Ni and Cr is outside the above described range, both cases lead to lowering of the thermal expansion coefficient. Further, as an Fe-Ni based alloy for the low thermal expansion member 3, an alloy containing from 30 to 50 weight % of Ni and the balance essentially consisting of Fe can be cited. When the Ni content is either below 30 weight % or over 50 weight %, the thermal expansion coefficient becomes large. That is, in the range of from 30 to 50 weight % of Ni content, good thermal expansion can be obtained.

Between the above described high thermal expansion member 2 and the low thermal expansion member 3, the intermediary member 4 is interposed, the intermediary member 4 possessing an intermediate thermal expansion coefficient α_3 ($\alpha_1 > \alpha_3 > \alpha_2$) located

between the thermal expansion coefficient α_1 of the high thermal expansion member 2 and the thermal expansion coefficient α_2 of the low thermal expansion member 3. By laminating and sticking these each layer 2, 3, 4, the thermal deformation member for an electron tube 1 is formed. The thermal deformation member for an electron tube 1 can be said to be a bimetal consisting of a clad material of 3 layered structure (3 layer laminated member). For laminating these each layer 2, 3, 4, the generally used cladding method can be employed. Specifically, between each layer 2, 3, 4 can be stuck by, for example, hot rolling.

The plate thickness t_3 of the intermediary member 4, basically, can be appropriately determined in the range of the total thickness T which is required for securing strength or long term reliability of the thermal deformation member for an electron tube 1. However, since the thermal deformation of the high thermal expansion member 2 and the low thermal expansion member 3, in particular, the thermal deformation of the high thermal expansion member 2 tends practically to deteriorate under restriction of the intermediate member 4, it is preferable that the plate thickness t_3 of the intermediate member 4 is below 80 % of the total plate thickness T . This thickness can vary according to the constituent materials of each layer 2, 3, 4. In addition, if the thermal expansion coefficient α_3 of the intermediary member 4 is close to either one of thermal expansion coefficients α_1 , α_2 of the high thermal expansion member 2 and the low thermal expansion member 3, by reducing the plate thickness of the member (2 or 3) the thermal expansion coefficient of which is close to this thermal expansion coefficient, the thermal bent curvature

of the thermal deformation member for an electron tube 1 can be made to be set at the desired one.

The specific material of the intermediate member 4 can be appropriately selected considering the material of the high thermal expansion member 2 and the low thermal expansion member 3. For example, when an Fe-Ni-Cr based alloy is used for the high thermal expansion member 2 and an Fe-Ni based alloy is used for the low thermal expansion member 3, it is preferable to use one kind of metal selected from Fe, Al, and Cu or an alloy including these metals as the intermediate member 4, wherein Fe, Al, and Cu are excellent in workability and less expensive than these alloys. For the constituent material of the intermediate member 4, from the view point of the thermal bent property and the workability, Fe, Al or an alloy containing these metals as base can be preferably used. In particular, steel can be said a desirable material effective in manufacturing cost reduction. As the steel to be used for the intermediate member 4, steel material SS 400 (SS 400 as defined in JIS G 3101) comprising 0.3 weight % or less of C, 0.05 weight % or less of P, 0.05 weight % or less of S, and the balance of Fe with inevitable impurities can be cited.

Now, since the intermediate member 4 possesses the thermal expansion coefficient α_3 placed between those of the high thermal expansion member 2 (α_1) and the low thermal expansion member 3 (α_2), the thermal bent curvature of the thermal deformation member for an electron tube 1 can be determined by the thermal expansion coefficients α_1 , α_2 of the high thermal expansion member 2 and the low thermal expansion member 3, and the plate thickness ratio

$(t_1 : t_2)$ between the plate thicknesses of these members.

Therefore, if the plate thickness ratio $(t_1' : t_2')$ of the high thermal expansion member 2 and the low thermal expansion member 3 of a conventional bimetal, for example, shown in Fig. 2, and the plate thickness ratio $(t_1 : t_2)$ of the high thermal expansion member 2 and the low thermal expansion member 3 of the thermal deformation member for an electron tube 1 according to the present embodiment are identical, nearly equal level of the bent curvature can be obtained.

Now, in the conventional bimetal 5 shown in Fig. 2, the total plate thickness T' has to be secured by the plate thickness t_1' of the high thermal expansion member 2 and the plate thickness t_2' of the low thermal expansion member 3. On the contrary, in the thermal deformation member for an electron tube 1 of the present invention shown in Fig. 1, the plate thicknesses t_1 , t_2 of the high thermal expansion member 2 and the low thermal expansion member 3 can be reduced by the plate thickness t_3 of the intermediate member 4. Even after reduction of these plate thicknesses, the thermal deformation member for an electron tube 1 of the present invention has a nearly identical thermal bent curvature as the conventional bimetal 5 does. In other words, while reducing the plate thicknesses t_1 , t_2 of the high thermal expansion member 2 and the low thermal expansion member 3 and attaining nearly equal thermal bent curvature, the total plate thickness T required for strength or the long term reliability can be secured.

Bent coefficients of several specific examples of the above described thermal deformation member for an electron tube 1 are

shown in Table 1. In each specific example, an Fe-22 weight % Ni-4.5 weight % Cr alloy and an Fe-36 weight % Ni alloy are used for the high thermal expansion member 2 and for the low thermal expansion member 3, respectively. For the intermediary member 4, steel material SS 400 of various plate thicknesses are used. The plate thickness ratio between the high thermal expansion member 2 and the low thermal expansion member 3 was set at 1 : 1 and the total plate thickness T of the thermal deformation member for an electron tube 1 was 2.5 mm. A comparative example shown in Table 1 is for the conventional bimetal 5 (bimetal for a color picture tube) shown in Fig. 2. In the comparative example, constituent material of the high thermal expansion member 2 and the low thermal expansion member 3, the plate thickness ratio therebetween, and the total plate thickness T' were set identical as the above described embodiments.

Table 1

	Embodiment 1	Embodiment 2	Embodiment 3	Comparative Example
Plate Thickness Constitution Ratio (%) of Intermediary Member (steel)	30	50	60	-
Bent Coefficient ($\times 10^6 / K$)	14.0	13.5	11.3	14.2

As evident from Table 1, in each embodiment, as the

constitutional ratio of the intermediate member 4 formed of the steel material SS 400 becomes large, the bent curvature decreases. However, if the plate thickness constitutional ratio of the intermediate member 4 is about 60 %, it can be understood that the thermal deformation member for an electron tube 1 of the above described constitution can be satisfactorily used for the bimetal of a color picture tube. Compared with the Fe-22 weight % Ni-4.5 weight % Cr alloy or the Fe-36 weight % Ni alloy, the cost of the steel material is about one fourth. Therefore, when compared with the conventional bimetal 5, the manufacturing cost of the thermal deformation member for an electron tube 1 of each embodiment can be reduced in total by about 30 - 40 %. Further, the steel material is excellent in its workability compared with that of the Fe-22 weight % Ni-4.5 weight % Cr alloy or the Fe-36 weight % Ni alloy. Therefore, the thermal deformation member for an electron tube 1 of each embodiment can be improved in its workability compared with that of the conventional bimetal 5.

As described above, in the thermal deformation member for an electron tube 1 of the embodiments, the total plate thickness T which affects the desired thermal bent curvature and strength or long term reliability can be obtained while reducing the plate thicknesses t_1 , t_2 of the high thermal expansion member 2 and the low thermal expansion member 3. Therefore, when the Fe-Ni-Cr based alloy or the Fe-Ni based alloy which are expensive in the manufacturing cost and inferior in the workability are used for the high thermal expansion member 2 and the low thermal expansion member 3, by disposing the intermediate member 4 which is less expensive and superior in its workability to those, while

obtaining the desired thermal bent curvature, the manufacturing cost of the thermal deformation member for an electron tube 1 can be reduced as a whole and its workability can be enhanced.

Next, one embodiment of a color picture tube of the present invention will be explained with reference to Fig. 3 and Fig. 4.

Fig. 3 is a sectional view showing a construction of an essential portion of a color picture tube according to one embodiment of the present invention. In the figure, numeral 11 shows a panel inside which a not shown phosphor layer is formed. Along an inner circumference surface in the neighborhood of an opening of the panel 11, a panel pin 12 is disposed. Inside the panel 11, a shadow mask 13 is disposed in an opposite relation with respect to the phosphor layer formed inside the panel with a predetermined spacing.

In the shadow mask 13, a lot of fine holes or slits not shown in the figure are formed and an electron beam past through these fine holes or slits collides with the phosphor layer. An electron beam is irradiated from an electron gun not shown in the figure. The electron gun is disposed inside a neck (not shown) connected to the panel 11 through a funnel (not shown).

The shadow mask 13 is formed of a low thermal expansion alloy such as an Fe-Ni based alloy. At the outer periphery portion of the shadow mask 13, a mask frame 14 consisting of Fe based material such as the steel material and the like is fixed. To the mask frame 14, one edge of a frame holder 15 is fixed and the other edge portion of the frame holder 15 is fixed in an engaging manner to the panel pin 12. Thus, the shadow mask 13 is elastically supported by the panel 11 through the frame holder 15.

The above described frame holder 15 has an elastic portion 15a consisting of such as a stainless spring material and a thermal deformation portion 15b comprising the thermal deformation member for an electron tube 1 of the present invention which is explained in the above described embodiments. The elastic portion 15a is disposed on the panel 11 side and, when the shadow mask 13 or the mask frame 14 is expanded thermally, its spring property (elasticity) can absorb this expansion effect. Besides, the thermal deformation portion 15b, as shown in Fig. 4 in enlarged manner, is constituted by disposing the thermal deformation member for an electron tube 1 in such a manner that the low thermal expansion member 3 of the thermal deformation member for an electron tube 1 is placed on the mask frame 14 side and the high thermal expansion member 2 is placed on the panel 11 side through the intermediate member 4. That is, when the shadow mask 13 or the mask frame 14 is expanded thermally, the thermal deformation portion 15b deforms in an opposite direction to that of the thermal expansion.

When the thermal expansion coefficients of the shadow mask 13 and the mask frame 14 are different each other, even if these are expanded thermally by collision of an electron beam, through the frame holder 15 possessing the elastic portion 15a and the thermal deformation portion 15b, relative position between the dots of the phosphor layer formed inside the panel 11 and the fine holes or the slits of the shadow mask 13 can be prevented from dislocating. Further, this dislocation prevention, as explained in the above described embodiments, is materialized by the thermal deformation member for an electron tube 1 of the present invention

which is less expensive and excellent in workability compared with the conventional bimetal and can secure the total plate thickness which influences strength or long term reliability. Therefore, in addition to realization of the manufacturing cost reduction
5 of a color picture tube, reliability of a color picture tube can be enhanced accompanying the improvement of its workability.

Next, an embodiment of a thermal deformation member for an electric current control of the present invention will be explained.

10 Fig. 5 is a perspective view showing one embodiment of a thermal deformation member for an electric current control of the present invention. A thermal deformation member for an electric current control 21 shown in the figure possesses, as identical as the above described thermal deformation member for an electron
15 tube 1, a high thermal expansion member (thermal expansion coefficient α_1) 22 and a low thermal expansion member (thermal expansion coefficient α_2) 23 contributing fundamental property of thermal deformation, and an intermediate member 24 possessing an intermediate thermal expansion coefficient α_3 ($\alpha_1 > \alpha_3 > \alpha_2$) and
20 disposed therebetween. By laminating and sticking each layer 22, 23, 24 one another, a thermal deformation member for an electric current control 21 formed of a 3 layered clad material can be constructed.

Lamination between these each layer 22, 23, 24, plate
25 thickness ratio ($t_1 : t_2$) between the high thermal expansion member 22 and the low thermal expansion member 23, and plate thickness t_3 of the intermediate member 24 (ratio to total plate thickness T) and the like are preferable to be set identical as the case

of the above described thermal deformation member for an electron tube 1. That is, for laminating between each layer 22, 23, 24, the generally used cladding method such as hot rolling can be employed. The plate thickness ratio ($t_1 : t_2$) of the high thermal expansion member 22 and the low thermal expansion member 23 is preferable to be in the range of from 55 : 45 to 45 : 55. The plate thickness t_3 of the intermediate member 24 is preferable to be not exceeding 80 % of the total plate thickness T. The reasons for providing these are as mentioned above. Further, even for the thermal deformation member for an electric current control 21, various types of modifications can be employed as identical as the case of the thermal deformation member for an electron tube 1.

For the high thermal expansion member 22, the low thermal expansion member 23 and the intermediate member 24, basically, the identical materials as for the thermal deformation member for an electron tube 1 can be employed. However, for the high thermal expansion member 22, without limiting to the Fe-Ni-Cr based alloy, an Fe-Ni-Mn based alloy can be used. The Fe-Ni-Mn based alloy possesses high thermal expansion coefficient identical as that of the Fe-Ni-Cr based alloy. As an Fe-Ni-(Cr, Mn) based alloy for the high thermal expansion member 22, an alloy comprising from 15 to 30 weight % of Ni and from 2 to 10 weight % of at least one member selected from Cr and Mn, and the balance essentially consisting of Fe can be cited. When the content of Ni and (Cr, Mn) goes outside the above described range, any case can lead to deterioration of the thermal expansion coefficient.

For the low thermal expansion member 23, as identical as the

thermal deformation member for an electron tube 1, an Fe-Ni based alloy comprising from 30 to 50 weight % of Ni and the balance essentially consisting of Fe is preferred. For the intermediate member 24, one kind of metal selected from Fe, Al and Cu, which
5 are all excellent in their workability and less expensive than the constitutional materials of the above described high thermal expansion member 22 or low thermal expansion member 23, or an alloy including these metals can be employed preferably. In particular, Fe, Al or an alloy based on these metals and the steel material
10 (for example, SS 400) are preferable as the constitutional material of the intermediate member 24. The specific thermal deformation of the thermal deformation member for an electric current control 21 which uses these materials is as described above.

15 In the thermal deformation member for an electric current control 21, as identical as the above described thermal deformation member for an electron tube 1, while attaining the thermal bent curvature nearly identical as that of the conventional bimetal, the plate thicknesses t_1 , t_2 of the high
20 thermal expansion member 22 and the low thermal expansion member 23 can be diminished by the thickness t_3 of the intermediate member 24. That is, the total plate thickness T , which influences the predetermined thermal bent curvature and strength or the long term reliability, can be obtained while diminishing the plate
25 thicknesses t_1 , t_2 of the high thermal expansion member 22 and the low thermal expansion member 23. Therefore, when, for the high thermal expansion member 22 and the low thermal expansion member 23, the Fe-Ni- (Cr, Mn) based alloy or the Fe-Ni based alloy,

which are expensive in their manufacturing cost and less excellent in their workability, is employed, by disposing an intermediate member 24 excellent in its workability and less expensive than the above described alloys, while attaining the predetermined thermal bent curvature, the manufacturing cost of the thermal deformation member for an electric current control 21 can be reduced as a whole. Further, the workability of the thermal deformation member for an electric current control 21 can be enhanced.

10 The thermal deformation member for an electric current control 21 of the present invention can be preferably employed in a thermal deformation member (bimetal) of an overcurrent protection such as a molded-case circuit-breaker or a thermal overload relay. Further, other than these devices, it can be applied in an electric current control which controls (for example, breaks) electric current by deformation based on resistance heating (Jule heat) of the thermal deformation member for an electric current control 21 itself when load current is flew through the thermal deformation member for an electric current control 21 and overcurrent such as overload current or short-circuit current flows. The deformation of the thermal deformation member for an electric current control 21 may depends on the heat of a resistor (heater) in which the load current flows.

25 Next, one embodiment of a molded-case circuit-breaker in which an overcurrent protection of the present invention is employed will be described with reference to Fig. 6.

Fig. 6 is a diagram showing an outline construction of the molded-case circuit-breaker of one embodiment in which an

overcurrent protection of the present invention is applied. In the figure, numeral 31 is a heater. The heater 31 is connected to wiring so as for the load current in to flow. In the neighborhood of the heater 31, as a thermal deformation member, a thermal deformation member for electric current control 21 of the present invention which is explained in the above described embodiment is disposed making a contact.

The thermal deformation member for an electric current control 21 is fixed to a trip bar 32 which is made possible to rotate by a central axis. The trip bar 32 is, further, connected to a supporting bar 35 of an armature 34 disposed in an opposed manner to a fixed iron-core 33. The armature 34 is constituted in such a manner that it opens or closes a contact point not shown in the figure according to its movement. Numeral 36 in the figure is a latch 23.

The thermal deformation member for an electric current control 21 is disposed in such a manner that the high thermal expansion member 22 is placed on the trip bar 32 side and the low thermal expansion member 23 is placed on the latch 36 side through the intermediate member 24. The trip bar 32 is constructed to rotate by the thermal deformation of the thermal deformation member for an electric current control 21. Accompanying the rotation of the trip bar 32, the armature 34 moves towards the fixed iron-core 33.

In such a molded-case circuit-breaker, when the load current which flows the heater 31 is within the rating, the thermal deformation member for an electric current control 21 maintains its normal shape. Therefore, the contact point which is opened

or closed by the armature 34 is closed. Besides, if the overload current or short-circuit current occurs on the loading side and overcurrent flows through the heater 31, the heater 31 is heated up to a predetermined temperature and the thermal deformation member for an electric current control 21 deforms towards the trip bar 32 side (shown in the figure with an arrow). Accompanying the deformation of the thermal deformation member for an electric current control 21, the trip bar 32 rotates, further the armature 34 moves towards the fixed iron-core 33 side, thereby the contact point not shown in the figure is opened. That is, circuit is broken and the load is protected from the overcurrent.

Circuit breaking function according to the molded-case circuit-breaker of the above described embodiment, as explained in the above described embodiment, is materialized by the thermal deformation member for an electric current control 21 of the present invention which is less expensive than the conventional bimetal and excellent in its workability and secures the total plate thickness which influences strength or long term reliability. Therefore, in addition to realization of the reduction of the manufacturing cost of the molded-case circuit-breaker, reliability of the molded-case circuit-breaker can be enhanced accompanying the improvement of the workability.

The above described embodiment is a molded-case circuit-breaker in which overcurrent flows through the heater 31. The overcurrent protection of the present invention can be applied, not limiting in this, in various types of overcurrent protections such as a molded-case circuit-breaker in which load current is directly flew through the thermal deformation member for an

electric current control 21, and a thermal overload relay in which overcurrent is flew through the heater or the thermal deformation member for an electric current control.

5 Industrial Applicability

As evident from the above described embodiments, a thermal deformation member for an electron tube and a thermal deformation member for an electric current control of the present invention have, in addition to low cost and excellent workability,
10 excellent strength or long term reliability. Therefore, they are effective as a thermal deformation member of a color picture tube or an overcurrent protection. According to a color picture tube of the present invention in which the thermal deformation member of the present invention is employed as a part of a frame holder,
15 while realizing low cost, excellent color reproduction property or reliability can be materialized. According to an overcurrent protection in which the thermal deformation member of the present invention is employed, while maintaining excellent overcurrent protection function, cost reduction can be materialized.

☐ Description : paged to paged
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☐ Drawing(s) : paged to paged
☐ Abstract : paged to paged

What is claimed is:

1. A thermal deformation member for an electron tube, comprising:

a first member of thermal expansion coefficient α_1 ;

5 a second member of thermal expansion coefficient α_2 different from that of the first member; and

an intermediary member which is interposed between the first member and the second member and possesses thermal expansion coefficient of α_3 satisfying $\alpha_1 > \alpha_3 > \alpha_2$,

10 wherein the first member, the intermediary member, and the second member are laminated.

2. A thermal deformation member for an electron tube, comprising:

15 a high thermal expansion member composed of an Fe-Ni-Cr based alloy;

a low thermal expansion member composed of an Fe-Ni based alloy; and

20 an intermediary member which is interposed between the high thermal expansion member and the low thermal expansion member and is composed of one kind of metal selected from a group of Fe, Al and Cu, or an alloy comprising the metal,

wherein the high thermal expansion member, the low thermal expansion member, and the intermediary member are laminated.

25 3. The thermal deformation member for an electron tube as set forth in claim 2:

wherein, when thermal expansion coefficient of the high thermal expansion member is α_1 and thermal expansion coefficient of the low thermal expansion member is α_2 , the intermediary member



possesses thermal expansion coefficient α_3 , which satisfies $\alpha_1 > \alpha_3 > \alpha_2$.

4. The thermal deformation member for an electron tube as set forth in claim 2:

5 wherein the intermediary member is composed of one kind of metal selected from Fe and Al or an alloy comprising the metal as base.

5. The thermal deformation member for an electron tube as set forth in claim 4:

10 wherein the intermediary member consists of 0.3 weight % or less of C, 0.05 weight % or less of P, 0.05 weight % or less of S, and the balance of Fe and inevitable impurities.

6. The thermal deformation member for an electron tube as set forth in claim 2:

15 wherein plate thickness ratio between the high thermal expansion member and the low thermal expansion member is in the range of from 55 : 45 to 45 : 55 and the plate thickness of the intermediary member does not exceed 80 % of the total plate thickness of the thermal deformation member.

20 7. The thermal deformation member for an electron tube as set forth in claim 2:

wherein the Fe-Ni-Cr based alloy consists essentially of from 15 to 30 weight % of Ni and from 2 to 10 weight % of Cr, and the balance of Fe, and the Fe-Ni based alloy consists essentially
25 of from 30 to 50 weight % of Ni and the balance of Fe.

8. A color picture tube, comprising:

an electron gun irradiating an electron beam;

a panel having a phosphor layer which is collided by the





electron beam irradiated from the electron gun;

a shadow mask which is disposed in an opposite relation to the phosphor layer with a predetermined spacing and possesses a lot of fine holes or slits transmitting the electron beam;

5 a mask frame solidly fixed to the shadow mask; and

a frame holder which has a thermal deformation member comprising the thermal deformation member for an electron tube as set forth in claim 1 or claim 2, and an elastic portion, one edge of the frame holder being fixed to the panel and the other
10 edge being fixed to the mask frame.

9. A thermal deformation member for an electric current control, comprising:

a first member of thermal expansion coefficient α_1 ;

a second member of thermal expansion coefficient α_2 different
15 from that of the first member; and

an intermediary member which is interposed between the first member and the second member and possesses thermal expansion coefficient α_3 satisfying $\alpha_1 > \alpha_3 > \alpha_2$,

wherein the first member, the intermediary member, and the
20 second member are laminated.

10. A thermal deformation member for an electric current control, comprising:

a high thermal expansion member composed of an Fe-Ni-(Cr, Mn) based alloy;

25 a low thermal expansion member composed of an Fe-Ni based alloy; and

an intermediary member which is interposed between the high thermal expansion member and the low thermal expansion member and





is composed of one kind of metal selected from Fe, Al and Cu, or an alloy comprising the metal,

wherein the high thermal expansion member, the low thermal expansion member, and the intermediary member are laminated.

5 11. The thermal deformation member for an electric current control as set forth in claim 10:

wherein, when thermal expansion coefficient of the high thermal expansion member is α_1 and thermal expansion coefficient of the low thermal expansion member is α_2 , the intermediary member
10 possesses thermal expansion coefficient α_3 which satisfies $\alpha_1 > \alpha_3 > \alpha_2$.

12. The thermal deformation member for an electric current control as set forth in claim 10:

wherein the intermediary member is composed of one kind of
15 metal selected from Fe and Al or an alloy comprising the metal as base.

13. The thermal deformation member for an electric current control as set forth in claim 12:

wherein the intermediary member consists of 0.3 weight % or
20 less of C, 0.05 weight % or less of P, 0.05 weight % or less of S, and the balance of Fe and inevitable impurities.

14. The thermal deformation member for an electric current control as set forth in claim 10:

wherein plate thickness ratio between the high thermal
25 expansion member and the low thermal expansion member is in the range of from 55 : 45 to 45 : 55 and the plate thickness of the intermediary member does not exceed 80 % of the total plate thickness of the thermal deformation member.





15. The thermal deformation member for an electric current control as set forth in claim 10:

wherein the Fe-Ni-(Cr, Mn) based alloy consists essentially of from 15 to 30 weight % of Ni and from 2 to 10 weight % of at least one kind selected from Cr and Mn, and the balance of Fe, and the Fe-Ni based alloy consists essentially of from 30 to 50 weight % of Ni and the balance of Fe.

16. An overcurrent protection, comprising:

a thermal deformation portion composed of the thermal deformation member for an electric current control as set forth in claim 9 or claim 10 which, when overcurrent flows, deforms due to its own Joule heat or heat of resistor disposed in contact; and a contact point which opens circuit according to deformation of the thermal deformation portion.

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FIG. 1

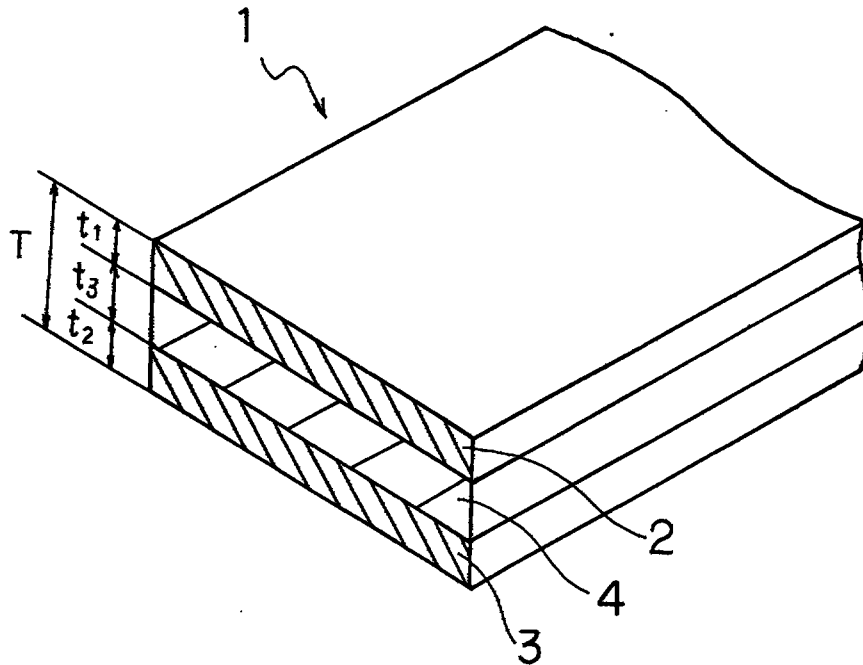


FIG. 2

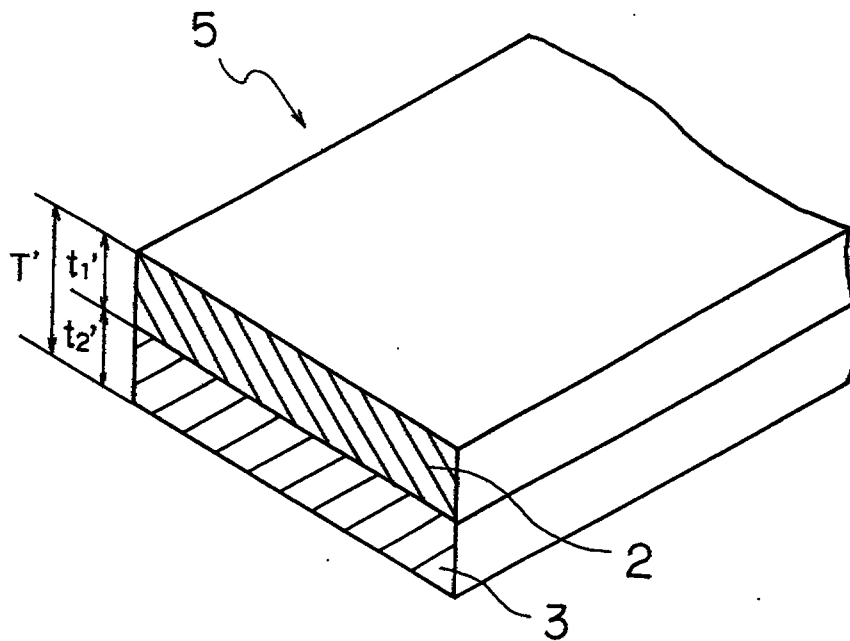


FIG. 3

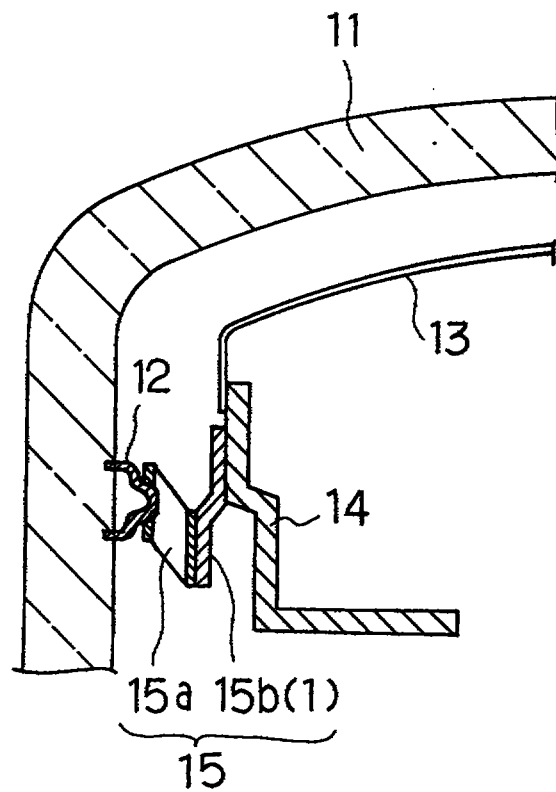


FIG. 4

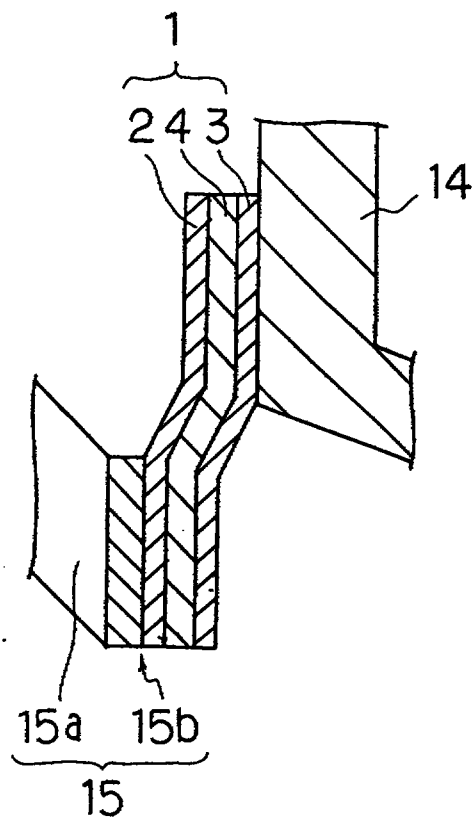


FIG. 5

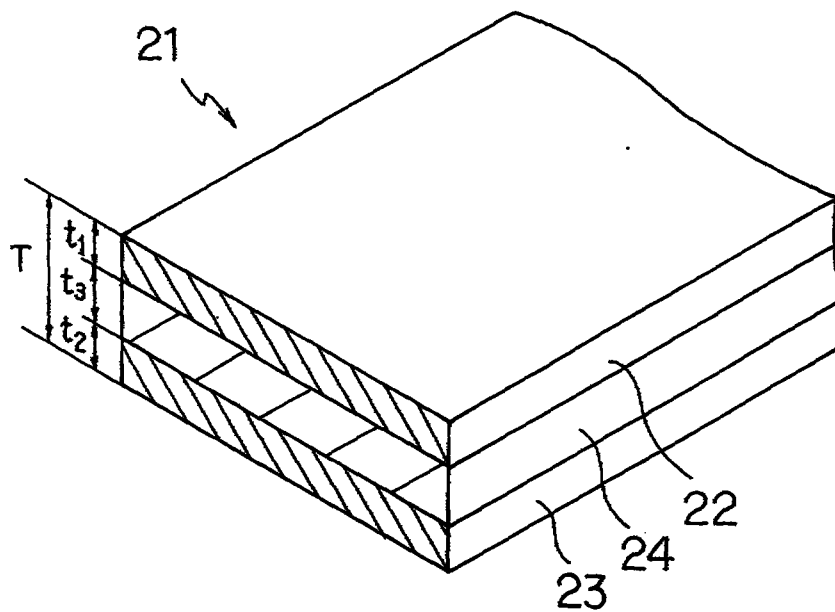
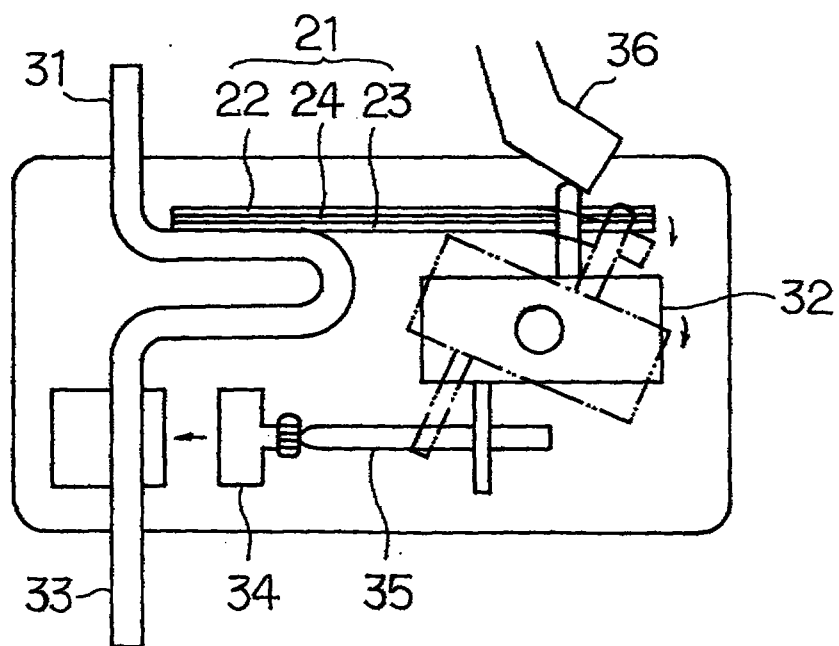


FIG. 6





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CLAIMS

1. A thermal deformation member for an electron tube, comprising:

a high thermal expansion member composed of an Fe-Ni-Cr based alloy;

a low thermal expansion member composed of an Fe-Ni based alloy; and

an intermediary member which is interposed between the high thermal expansion member and the low thermal expansion member and is composed of one kind of metal selected from a group of Fe, Al and Cu, or an alloy comprising the metal,

wherein the high thermal expansion member, the low thermal expansion member, and the intermediary member are laminated, plate thickness ratio between the high thermal expansion member and the low thermal expansion member is in the range of from 55 : 45 to 45 : 55, and the plate thickness of the intermediary member does not exceed 80 % of the total plate thickness of the high thermal expansion member, the intermediary member, and the low thermal expansion member.

2. The thermal deformation member for an electron tube as set forth in claim 1:

wherein the plate thickness of the intermediary member is in the range of from 30 to 60 % of the total plate thickness.

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3. The thermal deformation member for an electron tube as set forth in claim 1 or claim 2:

wherein, when thermal expansion coefficient of the high thermal expansion member is α_1 and thermal expansion coefficient of the low thermal expansion member is α_2 , the intermediary member possesses thermal expansion coefficient α_3 which satisfies $\alpha_1 > \alpha_3 > \alpha_2$.

4. The thermal deformation member for an electron tube as set forth in any one claim of from claim 1 to claim 3:

wherein the intermediary member is composed of one kind of metal selected from Fe and Al, or an alloy comprising the metal as base.

5. The thermal deformation member for an electron tube as set forth in any one claim of from claim 1 to claim 4:

wherein the intermediary member consists of 0.3 weight % or less of C, 0.05 weight % or less of P, 0.05 weight % or less of S, and the balance of Fe and inevitable impurities.

6. The thermal deformation member for an electron tube as set forth in any one claim of from claim 1 to claim 5:

wherein the Fe-Ni-Cr based alloy consists essentially

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of from 15 to 30 weight % of Ni and from 2 to 10 weight % of Cr, and the balance of Fe, and the Fe-Ni based alloy consists essentially of from 30 to 50 weight % of Ni and the balance of Fe.

7. A thermal deformation member for an electric current control, comprising:

a high thermal expansion member composed of an Fe-Ni-(Cr, Mn) based alloy;

a low thermal expansion member composed of an Fe-Ni based alloy; and

an intermediary member which is interposed between the high thermal expansion member and the low thermal expansion member and is composed of one kind of metal selected from Fe, Al and Cu, or an alloy comprising the metal,

wherein the high thermal expansion member, the low thermal expansion member, and the intermediary member are laminated, plate thickness ratio between the high thermal expansion member and the low thermal expansion member is in the range of from 55 : 45 to 45 : 55, and the plate thickness of the intermediary member does not exceed 80 % of the total plate thickness of the high thermal expansion member, the intermediary member, and the low thermal expansion member.

8. The thermal deformation member for an electric current control as set forth in claim 7:

wherein the plate thickness of the intermediary member is in the range of from 30 to 60 % of the total plate thickness.

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9. The thermal deformation member for an electric current control as set forth in claim 7 or claim 8:

wherein, when thermal expansion coefficient of the high thermal expansion member is α_1 and thermal expansion coefficient of the low thermal expansion member is α_2 , the intermediary member possesses thermal expansion coefficient α_3 which satisfies $\alpha_1 > \alpha_3 > \alpha_2$.

10. The thermal deformation member for an electric current control as set forth in any one claim of from claim 7 to claim 9:

wherein the intermediary member is composed of one kind of metal selected from Fe and Al, or an alloy comprising the metal as base.

11. The thermal deformation member for an electric current control as set forth in any one claim of from claim 7 to claim 10:

wherein the intermediary member consists of 0.3 weight % or less of C, 0.05 weight % or less of P, 0.05 weight % or less of S, and the balance of Fe and inevitable impurities.

12. The thermal deformation member for an electric current control as set forth in any one claim of from claim 7 to claim 11:

wherein the Fe-Ni-(Cr, Mn) based alloy consists

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essentially of from 15 to 30 weight % of Ni and from 2 to 10 weight % of at least kind selected from Cr and Mn, and the balance of Fe, and the Fe-Ni based alloy consists essentially of from 30 to 50 weight % of Ni and the balance of Fe.

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THERMAL DEFORMATION MEMBER FOR ELECTRON TUBE AND THERMAL
DEFORMATION MEMBER FOR CURRENT CONTROLLER

5 Technical Field

The present invention relates to a thermal deformation member for an electron tube such as a color picture tube and the like and a color picture tube using thereof, and a thermal deformation member for an electric current control such as an overcurrent protection and the like and an overcurrent protection using thereof.

Background Art

In a color picture tube using a shadow mask, the shadow mask which has lots of fine holes transmitting an electron beam is disposed in an opposite relation with respect to a phosphor layer formed inside a panel with a predetermined spacing. Surrounding an outer periphery of the shadow mask, a mask frame is fixed. A frame holder is disposed between the mask frame and the panel.

The electron beam which passes through the fine holes of the shadow mask is usually only about 20 % of the total electron beam emitted from an electron gun. Remaining about 80 % of the electron beam is absorbed by colliding with the shadow mask and the mask frame. When the shadow mask or the mask frame is thermally expanded by collision of the electron beam, the fine holes of the shadow mask and the dots formed in the phosphor layer are relatively shifted in their relative positions to result in degradation of color purity.



PCT

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(51) 国際特許分類6 H01J 29/02, H01H 37/52, G12B 1/02	A1	(11) 国際公開番号 WO97/49110 (43) 国際公開日 1997年12月24日 (24.12.97)
(21) 国際出願番号 PCT/JP97/02101 (22) 国際出願日 1997年6月19日 (19.06.97) (30) 優先権データ 特願平8/160200 1996年6月20日 (20.06.96) JP (71) 出願人 (米国を除くすべての指定国について) 株式会社 東芝 (KABUSHIKI KAISHA TOSHIBA) [JP/JP] 〒210 神奈川県川崎市幸区堀川町72番地 Kanagawa, (JP) (72) 発明者; および (75) 発明者/出願人 (米国についてのみ) 松本俊治 (MATSUKI, Toshiharu) [JP/JP] 〒245 神奈川県横浜市戸塚区原宿町252-20 Kanagawa, (JP) 土生 悟 (HABU, Satoru) [JP/JP] 〒252 神奈川県藤沢市亀井野3249-19 Kanagawa, (JP) 中島 均 (NAKAJIMA, Hitoshi) [JP/JP] 〒658 兵庫県神戸市東灘区甲南町1-3-17-616 Hyogo, (JP) (74) 代理人 弁理士 須山佐一 (SUYAMA, Saichi) 〒101 東京都千代田区神田多町2丁目1番地 神田東山ビル Tokyo, (JP)		(81) 指定国 GB, JP, SG, US. 添付公開書類 国際調査報告書
(54) Title: THERMAL DEFORMATION MEMBER FOR ELECTRON TUBE, COLOR PICUTRE TUBE USING THE SAME, THERMAL DEFORMATION MEMBER FOR CURRENT CONTROLLER AND CIRCUIT BREAKER USING THE SAME (54) 発明の名称 電子管用熱変形部材とそれを用いたカラー受像管、および電流制御器用熱変形部材とそれを用いた遮断器 (57) Abstract A thermal deformation member (1) for electron tubes or current controllers composed of a multilayer body formed by stacking a high thermal expansion member (1) made of, for example, an Fe-Ni-Cr alloy, an intermediate member (4) made of one kind of metal selected from among Fe, Al, and Cu or an alloy containing some of the metals, and a low thermal expansion member (2) made of, for example, an Fe-Ni alloy. The coefficient of thermal expansion α_3 of the intermediate member (4) is greater than that α_2 of the low thermal expansion member (2) and smaller than that α_1 of the high thermal expansion member (1) ($\alpha_1 > \alpha_3 > \alpha_2$). The intermediate member (4) reduces the manufacturing cost and improves the workability without deteriorating the strength and long-term reliability of the members. A color picture tube is manufactured using the above-mentioned thermal deformation member for electron tubes in the thermal deformation section of a frame holder one end of which is fixed to a panel and the other end of which is firmly stuck to the mask frame of a shadow mask. An overcurrent protector is manufactured using the above-mentioned thermal deformation member for current controllers in the thermal deformation section which opens a contact.		

(57) 要約

例えばFe-Ni-Cr系合金からなる高熱膨張部材1と、Fe-Ni系合金からなる低熱膨張部材2との間に、Fe、AlおよびCuから選ばれる1種の金属やこれら金属を含む合金からなる、高熱膨張部材（熱膨張率 α_1 ）1と低熱膨張部材（熱膨張率 α_2 ）2の中間の熱膨張率 α_3 （ $\alpha_1 > \alpha_3 > \alpha_2$ ）を有する中間部材4を介在させ、これらを積層した電子管用熱変形部材1、または電流制御器用熱変形部材である。中間部材4は、熱変形部材の強度や長期信頼性を損うことなく、製造コストの低減および加工性の向上に寄与する。カラー受像管は、パネルに一端が固定され、他端がシャドウマスクのマスクフレームに固着されたフレームホルダの熱変形部に、上述した電子管用熱変形部材が用いられている。過電流保護器は、接点を開く熱変形部に、上述した電流制御器用熱変形部材が用いられている。

参考情報

PCTに基づいて公開される国際出願のパブリック第一頁に記載されたPCT加盟国を特定するために使用されるコード

AL	アルバニア	ES	スペイン	LR	リベリア	SG	シンガポール
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BB	バルバドス	GH	ガーナ	MD	モルドヴァ共和国	TD	チャード
BE	ベルギー	GM	ガンビア	MG	マダガスカル	TG	トーゴ
BF	ブルキナ・ファソ	GN	ギニア	MK	マケドニア共和国	TJ	タジキスタン
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CA	カナダ	IS	アイスランド	MX	メキシコ	UG	ウガンダ
CF	中央アフリカ共和国	IT	イタリア	NE	ニジェール	US	米国
CG	コンゴ	JP	日本	NL	オランダ	UZ	ウズベキスタン
CH	スイス	KE	ケニア	NO	ノルウェー	VN	ヴェトナム
CJ	コート・ジボアール	KG	キルギスタン	NZ	ニュージーランド	YU	ユーゴスラビア
CM	カメルーン	KP	朝鮮民主主義人民共和国	PL	ポーランド	ZW	ジンバブエ
CN	中国	KR	大韓民国	PT	ポルトガル		
CU	キューバ	KZ	カザフスタン	RO	ルーマニア		
CZ	チェッコ共和国	LC	セントルシア	RU	ロシア連邦		
DE	ドイツ	LI	リヒテンシュタイン	SD	スーダン		
DK	デンマーク	LK	スリランカ	SE	スウェーデン		
EE	エストニア						