March 22, 1932. H. H. WELCH 1,850,190

COMPOSITE GEM AND JEWEL

Original Filed Aug. 22, 1924 2 Sheets-Sheet 1

Fig. 1.

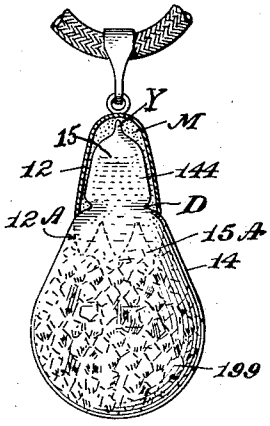


Fig. 2.

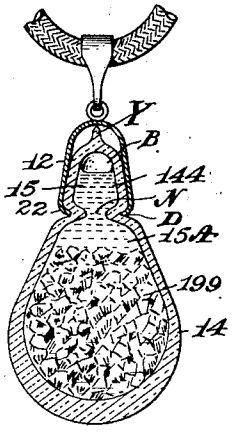


Fig. 2A.

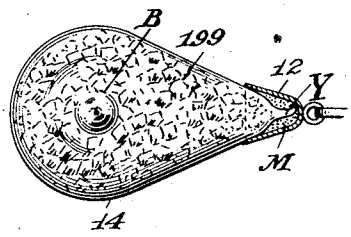


Fig. 3.

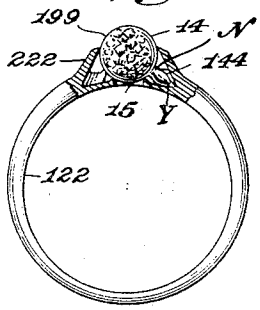


Fig. 4.

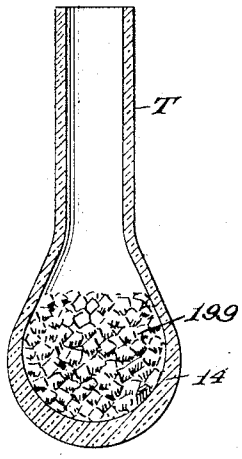


Fig. 5.

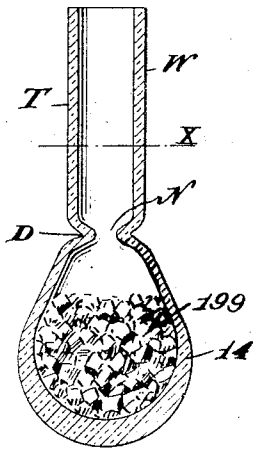
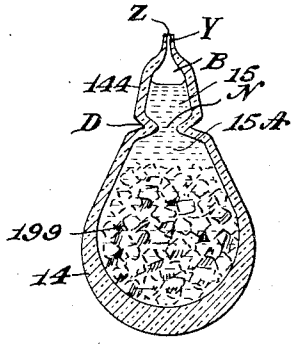


Fig. 6.



INVENTOR
HORACE H. WELCH.
BY
Philip Farnsworth
ATTORNEY

March 22, 1932. H. H. WELCH 1,850,190

COMPOSITE GEM AND JEWEL

Original Filed Aug. 22, 1924 2 Sheets-Sheet 2

Fig. 7.

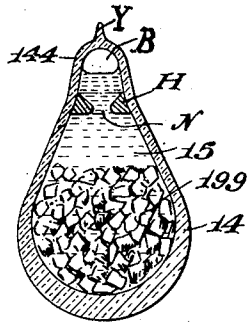


Fig. 8.

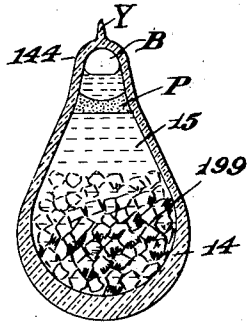
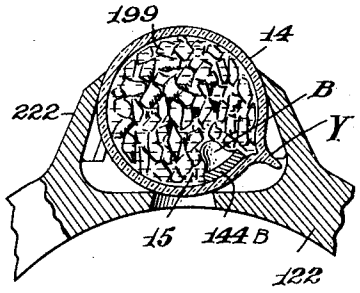


Fig. 9.



INVENTOR
HORACE H. WELCH.
BY
Philip Farnsworth
ATTORNEY

Patented Mar. 22, 1932 1,850,190

UNITED STATES PATENT OFFICE

HORACE H. WELCH, OF NEW YORK, N. Y.

COMPOSITE GEM AND JEWEL

Application filed August 22, 1924, Serial No. 733,472. Renewed February 19, 1931.

This invention relates to composite real gems, and to jewelry comprising such gems combined with settings therefor, the same involving improvements upon the artificial composite gem of the general type disclosed in my prior Patent 1,421,329, dated 27 June 1922. The present invention relates more particularly to my improved type wherein means is provided for taking care of a certain gas bubble which is desirable inside the housing of the composite gem.

While the invention of my prior patent established a new art, the object of the present invention is to improve the construction of my gem in the respects described fully hereinafter with the view particularly of improving its appearance and producing a high grade of composite real gem and jewel of a nature to compete with the ordinary real gem of the prior art used as an article of jewelry for wear on the person, more particularly of women.

The invention consists of the construction, method and product, described herein and illustrated in the drawings, whereby there is provided a composite real gem which is less fragile and more beautiful than prior gems.

The drawings are approximately of double scale in order more clearly to illustrate the construction.

Figure 1 shows a jewel pendant containing my improved gem, the gem being shown in elevation and the setting in vertical section and dotted lines;

Fig. 2 shows the same gem as in Fig. 1, but with the composite gem itself shown in vertical section; and with a modified form of jewel setting or mounting also in section;

Fig. 2A is an explanatory plan view of my gem, shown for convenience in the form of Figs. 1 and 2 as a pendant jewel;

Fig. 3 is a view, partly in section, of a jewel consisting of a finger ring with setting for my improved gem, the gem itself here having a construction similar to that shown in Figs. 1 and 2 as a pendant article of jewelry;

Figs. 4–6 are elevations showing the mode of manufacture of my improved composite gem, in preparation for the application of the jewel-setting, said figures showing the successive order of steps of the process, the details of which may be varied to adapt the gem for the various modified constructions within the scope of the invention, and for the various permissible settings for the various uses, as breast pendants, earrings, finger rings, bracelets, etc.; and

Figs. 7–9 are sectional views of modified forms of my improved composite gem.

The improvements hereof are directed chiefly to the appearance of my composite gem and the jewels comprising it, although said improvements relate to mechanical features concerning the gem itself and including the strength thereof, and to the co-operation with the gem of the jewel setting therefor in respect of producing the most attractive appearance of the composite gem itself.

In my gem as improved over that of my said prior patent, the attractiveness in appearance is materially enhanced, the mechanical setting of the gem is improved, the fragility as compared with prior real gems is very greatly reduced, and means and methods are provided for producing high-grade jewelry at very low cost.

In the present invention, I prefer usually to employ the valuable feature of my said prior patent consisting of the mobility of display elements due to the loose housing thereof in a hollow body, container or housing having walls of sufficient transparency to show the changing hues of the mobile display elements. But in the attempts to produce the results now embodied in the present composite real gem, i. e., a low-cost gem of superior attractiveness and tastefulness, of low fragility, and whether or not embodying the characteristic feature of mobility of loosely housed display elements, various problems were encountered of which the practical solution will be sufficiently clear from the following to enable workers in this new art to make and use the invention.

Fig. 1 shows my composite real gem (double-globular as described hereinafter) embedded in a setting to constitute a jewel which as a whole is adapted for wear as a pendant, and adapted for personal wear as earrings, breast pendants or the like. Fig. 3

illustrates a similar double-globular form of composite real gem, in a setting illustrating a jewel adapted as a finger ring, bracelet or the like.

A portion of the double-globular glass housing or container is shown at 14, Figs. 1 and 2, another globular portion 144 being described later. Housed in container 14 is a group of small gems 199 (such as fracture fragments of much larger original gems), the number of this group of small gems being sufficiently large to fill the interior housing space from one side to the other and lie against the container wall, exending a substantial distance vertically, and thereby presenting to the eye substantially the appearance (see Fig. 1) of a unitary gem; and not only that, but presenting to the eye substantially the appearance (see Fig. 1) of such gem of the size and the external shape of the colorless transparent housing, and masking the existence of the latter as a separate thing. This latter effect (of a size of gem the same as that of the housing) is produced notwithstanding the substantial thickness of the wall of the glass housing, which (Fig. 2) is of the order of three thirty-seconds of an inch, more or less, in order to impart greater strength of resistance to impact than that possessed by the ordinary unhoused unitary gem of the prior art. This effect of over-all resemblance of my glass-housed composite gem to a unitary gem of the same size and shape as the housing is due to the fact that the rays of light, coming to the eye from the multitude of housed small gems, are refracted as they pass through the glass housing and the atmosphere to the eye, causing the small gems next the interior housing-wall to be displaced in appearance or effect so that they appear to extend to the outer surface of the gross structure (Fig. 1), contrary to the fact (Fig. 2) that they lie a substantial fraction of an inch inwardly of such location. Further optical features will be described later. Also, I provide sufficient looseness of the plurality of small housed gems 199 to permit their mobility as independently acting units by movement of the composite gem as a whole, by leaving, within the lower globular portion 14 (Fig. 2) a space which is not occupied by the group of units. This gem-free space is indicated at 15A, Fig. 2, at the upper part of housing 14, it being assumed there that the entire composite gem is at rest, which is very seldom the case when on the wearer's body. This space 15A may be larger or smaller than is shown in Fig. 2.

I have discovered in connection with other aspects of the invention described above and below, that where small gems 199 of Fig. 1 are opals, the most advantageous form of the invention is provided, not only as to appearance but as to cost. As is well known, the opal is a fragile gem, and fracture fragments are common and of low cost. That which I have discovered specifically by my investigations is that opals, small in size, and large in number in proportion to the interior of housing 14, constitute, in combination with the other features of the invention, a most attractive and facinating composite gem. As to the mobility and the environment of such opal fragments 199, I have found also that the general appearance as a unitary opal, of the group of a considerable number of small opals substantially but not wholly filling the housing space 14, is greatly increased by the presence inside the transparent housing, of a viscous transparent liquid such as glycerine in form substantially colorless so as to be indistinguishable from the colorless glass of housing 14, all whereby the substantial visual impression of a unitary opal of the over-all size of housing 14 is given and maintained notwithstanding the more or less slow mobility of the many relatively small opals. That is, in housing 14 (Fig. 1) I place a mixture of the opal fragments 199 and glycerine 15A, the group of opals as shown leaving a substantial opal-free but glycerine-filled space 15A in housing 14 and the glycerine 15 extending up into the other globular portion 144 of the housing. While other liquids or mixtures may be employed, yet the viscosity of the glycerine 15 permits only a slow movement of the small opals in opal-housing 14, preventing excessive appearance of actual motion while yet permitting sufficient movement of the individual small gems to cause ever-changing opal reflections of a much more beautiful character than in an ordinary unitary opal, but as if the reflections emanated from various parts of the surface of a unitary opal of the size of housing 14. The desired object, in an embodiment involving mobility of the small opals, is not merely an appearance of motion, but the production of the resulting extraordinary color-changing effects due to the motion.

Other liquids are far less desirable with opals because they cause far less beautiful color effects, the object of this invention being generally directed to a structure producing the most beautiful effects so as to be superior to prior unitary opals in appearance as well as in reduced fragility. But other colorless transparent liquids may be used, including an aqueous solution of borotungstate of cadmium, which by the water of solution readily may be made to have substantially the same density as the opal fragments and therefore acts as a suspender of the latter so that they may not sink to the bottom but tend, irrespective of movement of the entire composite gem, to be separated from one another for an effect to be described. Also other liquids or mixtures of liquids may be employed. But it is not necessary to have any particular relation of density between the

gem-fragments and the liquids, i. e., it is not necessary that when the composite gem is in a position of rest the small opals should remain suspended in the liquid; for all the desired color effects can be obtained by such structures as Figs. 1—2 above described, when the individual small opals are set in motion, using glycerine as liquid 15, notwithstanding that the group of small opals, when the composite gem is in a position of rest, may sink away from the top of housing 14 as shown in Fig. 2. Even in that position (which is abnormal while the jewel is being worn), the glycerine surrounds the individual small opals and enhances their brilliancy.

The best effect in bringing out the colors (green, blue, pink and red) of the composite opal is that resulting from light reflected from (not transmitted through) the opal fragments, and the fiery reds can be seen only when a strong light falls on this composite gem from a source of light and then is reflected from the gem to the eyes of the observer; and the stronger the incident light rays the more brilliant the colors, sharp lights being more effective than diffused light, and the light from unfrosted electric lamps being more effective than that from frosted lamps.

Referring to Figs. 1 and 2, a further attempt will be made to describe in words the effect of this composite structure as showing how it should be built in order to cause it to produce the effect which is produced according to my invention. In connection with the large number of small opals in housing 14, a function of the glycerine (or other liquid, aside from the other advantages of glycerine as the liquid, particularly with opals), is to separate the small opals from one another, so as to permit vision of those of the opals which are not in positions adjacent the inner wall of the housing but which are in various planes in the interior of the opal-group in the central portion of the interior housing-space. Thus the composite opal is not limited to the presentation of merely the appearance of boundary layers of small opals (as if there were a central core of other material); but notwithstanding that its general appearance is that of a unitary opal, yet the fact is that it is an opal of a kind such that the observer can see the interior of the gem, and there view the reflections which come actually from the various small opals in various planes. This effect is emphasized by the external and internal curvature of the glass housing 14 shown, which is useful not only as a mechanical housing but as a lens which concentrates the incident light at locations (as a spot-light) in the interior housing-space, and magnifies so that the housing is also an optical as well as a mechanical housing for the multiplicity of small gems. Thus, when the entire gem is moved, or turned under observation, the eye receives rays reflected successively from various opals lying in the interior of the opal-group, and it is such rays, reflected from opals in the path of the incident interior spots of light from the lens-housing, which produce the greater beauty of effect additional to the effect from those of the opals which lie directly adjacent the inner wall of the housing. This vision of interior opal fragments, through spaces between the exterior small opals, may be considered as an effect quite distinct from the effect caused by individual movements of the small opals through the liquid; and this effect may be and is present when there is no such movement, as when, for a longer or shorter time, the opal fragments are or appear to be stationary as individuals in the body of liquid serving as the opal-separating means, even if the composite gem as a whole is in motion; in a specific instance, for example, when the conditions and relations of the small gems and the liquid, as of like densities, etc., are such as to cause the small gems to be suspended more or less fixedly in the liquid. But by far the best effect is produced when the conditions are such that not only is there provided the vision of internal parts of the composite gem, but there is also and simultaneously an individual mobility of the small gems through the liquid, whether the composite gem is in motion or at rest; so that, even after the composite gem is held in a position of rest after a movement, there will be for some little time a slowly moving procession of a plurality of small opals, past the spot-lights from the lens housing and across the line of vision, all without destroying the general impression of a unitary opal of the size of the housing, but wherein that most interesting and beautiful phenomenon apparently is occurring, of movement of interior parts of the gem accompanied by the changing color-effects above described.

My composite real gem is shown in Fig. 3 in a jewel consisting of a finger ring 122 wherein only a portion of part 14 of the housing is exposed from the setting, and portion 144 of the housing in its entirety is enclosed within the setting so as to be substantially concealed. This portion 144 (shown also in Figs. 1—2 relates to a means for further improving the appearance of the composite opal, now to be described.

In further perfecting the invention as show in my said prior patent, and in connection with the employment of the small gems of the present invention as the display elements, and particularly in perfecting the combination to include a suitable liquid in the glass housing, I found that as a practical matter it was necessary to provide a condition such that at mean atmospheric temperatures there would be a sufficient portion of the opal-free interior space 15A of the housing which would be free also of liquids,

in order that at higher temperatures the liquid would be free to expand without fracturing the glass housing, notwithstanding the substantial thickness of the housing wall for resistance to impacts. I found also that such air-space was much larger in volume than the minimum necessary air-space involved in sealing-off the glass housing. But the air in such a substantial liquid-expansion space, or a portion of it, will move around the interior surface of the housing wall when the jewel is turned for observing the changing color effects, and will constitute a defect in the range of vision between the eye and the jewel, a defect or flaw which to the mind of the observer of the fascinating color changes is similar to the effect on a bookkeeper of a great blot on a ledger. The vision of such an air-bubble largely destroys the fascinating color effects of the preferably mobile members of the group of opals 199; in fact, the great increase of the fascinating effect of the above improvements is largely discounted and negatived by the presence of such air-bubble. Just as it is impossible adequately to describe in words the beauty of the constantly changing hues and the operation of my composite opal, so it is impossible adequately to describe the marring effect thereon of such air-bubble. This air-bubble effect is indicated in Fig. 2A (plan), so far as is practicable to indicate it by a drawing, where at B is given an indication of the marring effect of the air-bubble in the inferior form of the invention shown in Fig. 2A without any means for preventing the evil appearance of the otherwise useful air-space. This composite opal has the effect of fascination on the wearer herself as well as other observers. At different times of different atmospheric temperature and the changing effect thereon on the degree of viscosity of the glycerine, the movement of the opal fragments differs in velocity and extent,—the gem is "moody"; and the wearer observes the gem as an astrologer his "crystal". Since in observing it, she usually holds it below eye level, and as the bubble B always is at the highest part of the housing in any given angular position of the gem, the bubble, unless handled in accordance with this invention, tends to move toward and come to rest at, a position between the eye and the group of small moving opals (Fig. 2A, plan), the bubble threading its way along the inner surface of the housing and between the opal fragments along the wall until it reaches such position of rest, and always therefore producing an effect, as of ink splashed on a portrait, which most seriously distracts the attention of the observer from the changing colors, and impairs the fascination of observing them. As indicated in Fig. 2, bubble B appears chiefly as a dark-line circle, as if it were a defect in the glass-housing; but because the bubble is movable as are the small opals, its effect is much worse than a fixed defect in the glass. It contrasts not only with the small opals but with the glass of the housing and it tends to give an impression of vision of the housing as a separate entity and tends to impart a sense of the existence of the liquid, all as opposed to the impression otherwise of a unitary opal of the external dimensions of the housing. The vice of the bubble is not in its own appearance, but in the contrasting effect and impressions which it causes.

This free space for liquid expansion (shown also at B, Fig. 2) is not merely the small air volume incidental to sealing off the glass housing, for the latter may be effected without leaving much, if any, air with the glycerine inside the housing; and even if a minute volume of air be left inside as an incident of sealing off, it may adhere in or to the minute interior cavity of the housing at the point of sealing off so as not to affect injuriously the appearance of the gem. I found that the means shown in my prior patent for retaining the air-bubbles of sealing off was inadequate to take care of the size of air-bubble B which is now involved in the production of my gems. One of the advantages of my composite real opal is that it is sturdier than the prior unitary opal, the wall of the container 14 being of comparatively thick strong glass as shown in the double scale section of Fig. 2. But I have found that even such strong transparent housing 14 is liable to breakage by temperature-expansion of the glycerine unless the volume of glycerine 15 is so much less than that of the total space inside the container not occupied by the small opals, as to leave inside also a substantial volume of air B, Fig 2, at mean atmospheric temperature.

A preferred means is shown in Figs. 1–3 for preventing this serious effect of the useful air-bubble. The housing is made in two parts, 14 and 144, by a method shown in Figs. 4–6 to be described. Hollow portion 14 contains all the plurality of small opals 199. They are preferably considerable in number, as many as approximately one hundred in the pendant jewel shown in Figs. 1 and 2; and the individual opals preferably are comparatively small, of the order of size shown in double-scale; that is, irregular fragments generally averaging, say, an eighth of an inch in diameter but permissively of various sizes in a given gem. The group of small opals 199 preferably fills the space inside housing portion 14 except for the looseness usually preferred to permit the motion of the individual fragments, and the group entirely fills a substantial portion of the housing from side to side thereof and extends a substantial distance vertically in housing 14 (or at least the individual opals extend in the group from side to side and vertically), in order to con-

tribute to the appearance of a unitary opal of the over-all size (length and breadth from a given point of observation) of housing 14. While there may be considerable space in housing portion 14 which is not occupied by the large number of small opals, yet the closest approximation of my composite gem to the appearance of the prior unitary gems is presented when the small opals appear to fill housing portion 14 as nearly as is consistent permissive with the desirable space-separation of the individual small gems from one another. The space within housing portion 14 which is not occupied by the small gems contains the glycerine 15, i. e., the glycerine surrounds the display elements 199. The glycerine 15 extends also up into the second housing-portion 144, Fig. 2, leaving a liquid-free or gaseous space B. Bubble-housing 144 preferably is formed integral with opal-housing 14, and the interior spaces in the two housing-portions 14 and 144 are in communication with one another by a constricted passage N. This passage N is short and so small in diameter that while permitting the flow of glycerine 15 from housing-portions 144 to 14 and vice versa, it yet obstructs the flow of the air or other gas from the space B in bubble-housing 144 to the space in opal-housing 14. Thus, upon an increase of atmospheric temperature expanding glycerine 15 in opal-housing 14, the latter is forced up through passage N and decreases the size of space B without putting any undue strain on any portion of the glass wall of the compound housing. Reversely, when glycerine 15 contracts, a part of it within bubble-housing 144 passes down through passage N into opal-housing 14, reducing the liquid level in bubble-housing 144 and increasing the volume of space B therein. But the air or gas in space B does not pass through passage N even when the gem is inverted from the position shown in Fig. 2 so that opal-housing 14 is on top; although, of course, in that case the positions, in bubble-housing 144, of the air in space B and of glycerine 15, are reversed, the air-bubble B rising up against the opening of passage N but not through or beyond it so as to enter into the interior of opal-housing 14. Operative dimensions are as follows. The gem being of, say, half of the general over-all dimensions shown in double scale in the drawings, and glycerine being the liquid 15 in opal-housing 14, then when the widest interior horizontal diameter of bubble-housing 144 of Figs. 1 and 2 is, say, $\frac{3}{16}$ of an inch, the inner diameter of short passage N is $\frac{1}{16}$ of an inch. That is, when the diameter of bubble-housing 144 is as small as herein shown, the diameter of passage N is about $\frac{1}{3}$ thereof; but bubble-housing 144 may have a larger diameter, and in such cases the diameter of passage N may be larger than $\frac{1}{16}$ of an inch, although permissively smaller than $\frac{1}{3}$ of the internal diameter of the entire housing-portion 144. Operative conditions exist when bubble B is air at ordinary pressure and the liquid is viscous glycerine, and when the actual dimensions of the entire composite gem including opal-housing 14 are one-half of those illustrated in double scale. When reference is made herein to the "bubble", it is to be understood as referring to the space B which may contain any gas at any pressure even as low as the most nearly "perfect" vacuum. In practice, and using glycerine as liquid 15 in housing 14, I so provide (as explained later in detail in connection with Fig. 6) that the level of glycerine 15 shown in Figs. 1 and 2 is that for ordinary room atmosphere temperatures. Thus when the temperature of the environment of the jewel is about 200° F. (as in hot water), the expanded glycerine almost, if not quite, completely fills bubble-housing 144; and at very low temperatures the space B is larger than shown although there is yet at least some liquid 15 in bubble-housing 144 (i. e., no bubble in housing 14). The proper proportion of glycerine will be described in connection with the process of Figs. 4–6. While I do not profess to be able to give the correct scientific explanation of the above action of permanently localizing the bubble in housing 144, yet it may be as follows. Generally speaking, a small air bubble, rising through a liquid, tends to assume a spherical form because of the forces in the liquid acting on the bubble. Considerable force is required to alter the spherical form of the air bubble. An obstruction tending to arrest movement of the bubble would actually arrest such movement if considerable deformation of the spherical form of the bubble were required in order to pass the obstruction. In the construction shown in Figs. 1–2, the constricted passage N has a smaller diameter than the bubble of space B. Passage N therefore offers obstruction to a passage of the bubble through it unless the bubble be deformed by reduction of diameter; and when the composite gem is moved, even inverted, I have found that there is insufficient force acting on bubble B to deform it to an extent sufficient to permit it to pass through constricted passage N, particularly against the viscous glycerine in housing portion 14. It may be that the glycerine, used by me to enhance the color effect of the small moving opals, to control their movements, to separate them, and to prevent their deterioration, co-operates with constricted passage N in permanently localizing the air bubble in bubble-housing 144.

Bubble-housing 144, as shown, preferably is much smaller than opal-housing 14, preferably contains no opals, and is enclosed within the jewel setting 12, where the pres-

ence of contrasting bubble B and liquid 15 inside the glass housing 144 does not detract, by making visible the glass and liquid as things separate from the opal, from the fascination of observing the gem. In Fig. 1, showing a pendant jewel, the setting 12, preferably of noble metal as gold, platinum or the like (including parts 12A more or less covering the opal-free space) is secured to bubble-housing 144 by jeweler's cement M in ordinary fashion to cover up and conceal protuberance Y of the seal-off as well as to conceal the contrast between the glass wall of the housing and the liquid therein, otherwise apparent on account of the presence of air-bubble B. The construction of the compound housing 14, 144, provides a shoulder D which, as shown in Fig. 2, may be utilized as a means for holding the setting 12 to the composite gem without cement, as by a bending or spinning of the setting, as at 22 (Fig. 2). In the case of either Figs. 1 or 2, the opaque jewel-setting 12 more or less encloses bubble-housing 144 within it, so as to leave exposed to the eye only the interior of housing portion 14 containing the small opals 199 in the glycerine 15.

By localizing bubble B in opal-free housing 144, the bubble is kept away from the ordinary range of vision of display elements 199, thereby avoiding the effect of contrast between the latter and the bubble. As to the contrasting effect between bubble B and the liquid 15 and the glass of the housing, that yet remains until concealing setting 12 is applied, although that effect is removed from a view of opal-housing 14. Setting 12 prevents vision of the bubble as a thing separate from or contrasting with the housing or the display elements.

In Fig. 3, the finger ring 122 has any usual setting 222 for substantially the same composite gem which forms part of the jewels of Figs. 1 and 2. In this case, only a part of larger opal-housing 14 is fully exposed to the eye from the setting 222, the small opals being visible as a brilliant unitary opal through the exposed part of the larger or opal-housing 14. Said setting also substantially encloses within it, out of plain sight of the observer, the bubble-housing 144. In the jewel of Fig. 3, the gem 14 preferably is shown as spherical as distinguished from the pear-like globular form of the gem of Figs. 1 and 2,—the spherical shape of gem being better adapted to this finger ring form of jewel, as also the size, which is smaller than the pendant jewel of Figs. 1 and 2; although both the size and shape of my composite gem in the finger ring jewel, and in any other jewel, may be varied as desired, the bulb 14 preferably having the curvature for the lens effect.

The small opals in the composite gem in the finger ring jewel are preferably of higher quality as to their ability to show colors by reflected light, and should be selected for that purpose. As shown in Fig. 3, bubble-housing 144 may be so small and be so disposed inside setting 222, as not to detract from the appearance of the jewel which includes the composite gem. Bubble-housing 144 in Fig. 3 is provided, as in Figs. 1 and 2, with the short constricted internal passage N of Fig. 2, not clearly shown in Fig. 3. As in Figs. 1–2, the setting, as 222, conceals seal-off Y and contrast of glass, liquid and air.

The construction of the two-part or compound housing 14, 144 of Figs. 1–3 is shown in Figs. 4–6, in accordance with the following method. A glass tube T with closed lower end is blow to form the globular housing 14 of Fig. 4, or any desired variation of such shape. The closed end as shown, is a hollow sphere which communicates with the interior of the cylindrical tube; said sphere having internal and external diameters which are larger than the diameter of the tube. Also the thickness of the wall of the sphere at its end opposite the tube is greater than the wall thickness of the tube, but progressively decreases toward the tube. This construction of housing increases the resistance to impact on the part of the housing which is not covered by the setting and which is most likely to receive impacts. The small opals or fracture fragments 199 then are dropped down into opal-housing 14 through the open top end of tube T, the upper portion of which tube is to be wasted in process. Next, as shown in Fig. 5, tube T is heated around the circumference at D not far above the top level of opals 199, until the glass is soft, when such soft circumference of the tube is pinched inwardly to form internal passage N of the desired diameter fully described above. This heating and pinching may be done successively at successive points around the circumference or neck D, by heating first at one spot until the glass is red, and then pinching in that spot, then heating at another spot until red and then pinching in that spot, until the circumference is pinched in all the way around. But preferably tube T is held in a carrier as in a lathe and rotated while heating to soften at the periphery D by means of an oxy-acetylene flame, and then the heated and softened glass is pushed or pinched in by a pointed hand tool while the glass is yet rotating and soft. The formation, by pinching, of bubble-housing 144, to form the neck or shoulder at D, is believed to produce increased strength of the housing as a whole. After neck D and passage N are formed in some such manner, tube T is heated at the higher circumference X (Fig. 5) and the waste portion W of the tube above periphery X is pulled out while soft at X, to form bubble-housing 144, Fig. 6. This pulling out of the upper end W of tube T, Fig. 5, results in a small tube, which is

broken off at Y, Fig. 6, to leave a small opening Z for filling the bulb with the glycerine (although the housing-bulb may be liquid-filled and sealed off at any other point of bubble-housing 144). Tube T is preferably composed of the kind of glass known in the market as "pyrex", that being preferred because, as I have found, it does not require annealing after the above applications of heat, as does ordinary glass; an obstacle to annealing being the present of the opals inside the tube.

In the regular manufacture of the composite gem, at ordinary atmospheric temperatures, the glycerine 15 is filled in through the opening Z until its level is part way up in bubble-housing 144, Fig. 6. Then the bulb or compound housing is sealed off, as at protuberance Y, to form the completed gem as shown in the jewels of Figs. 1–3. This liquid level is such that at external temperatures of about twenty degrees below zero Fahrenheit, the level will be lowered while yet remaining above constricted passage N; while at the highest temperatures to which the gem is likely to be exposed (as in cleaning in hot water), the increased volume of the liquid at such temperatures will be no greater than the total internal volume of the two communicating housings 14 and 144 not occupied by the small solids. The described process of filling the compound housing with liquid may be modified by substantially completely filling the total internal space with liquid at the highest temperature to which the gem is likely to be exposed; for it is practicable to seal off such liquid-full housing. Or, with the filled liquid level below the top of housing 144 and the liquid at lower temperature, the bulb may be sealed off while it is in a "vacuum", so that the air bubble B left inside may be at very low pressure indeed. Under any circumstances, the liquid-free space B of Fig. 2 should not extend substantially into opal-housing 14; for, to the extent that it did, there would result a peripatetic air-bubble in opal-housing 14. Finally, setting 12 of Figs. 1 or 2 is applied to bubble-housing 144 and conceals the contrast of glass, liquid and air and also the seal-off Y. And setting-portion 12A of Fig. 1 or an equivalent may be employed for the purpose stated.

In Fig. 7 is shown a modified construction involving means alternative with the product of the above method, for forming a constricted passage N between an opal-housing and a bubble-housing. Here the bubble-housing 144 is formed without the pinching operation of Fig. 5, and with a drawing out of tube T of Fig. 4 while heated and softened in the general vicinity of the top of the portion which is to constitute bubble-housing 144 as X, Fig. 5. But at first that tube need not be fully drawn out, and previous to any or the final drawing off at periphery X, Fig. 5, a washer H (Fig. 7) of cement, or equivalent material adherent to the glass wall, is placed within the neck of the housing as shown, so as to provide the central constricted passage N as the functional equivalent of passage N of Fig. 6, establishing liquid but not air-bubble communication between bubble-housing 144 and opal-housing 14. This is obtained by cementing a plug of the material of H to the interior glass wall of the housing forming a compound housing, and then punching the hole N through the cement while the latter yet is soft, by a sharp instrument having the desired diameter of resulting passage N. If desired, washer H may be of any suitable material other than cement and held in place by one or more dents (not shown) made in the outside surface of the neck of the compound housing in portions of the soft heated glass surrounding washer H, so that the dents cause internal projections into the outer periphery of the washer. The small opals or display elements 199 are put in place in their housing 14 prior to the formation of passage N by any method; but liquid 15 may be put in place either before or after the placing of perforated washer H. Then, Fig. 1, setting 12 is cemented to housing 144 of Fig. 7, concealing the contrast of liquid and glass caused by localized bubble B. Also as in Figs. 1—2 and 7, the setting conceals the sealing-off protuberance Y.

In Fig. 8 is shown another form alternative to the product of Fig. 7, preventing direct vision of the liquid-expansion air-bubble. In this case, the obstruction to the air-bubble in space B consists of a porous plug P inserted in and secured to the glass housing in the location shown (i. e., at the neck of the compound housing, between lower or opal-housing 14 and upper or bubble-housing 144 as in Fig. 7), said porous plug permitting passage of the liquid either way through its constricted passages, but constituting adequate obstruction to the air-bubble in space B. Various forms of porous material may be used, including a rolled-up ball of metal gauze with fairly large pores, permitting the free passage of the liquid when expanded by sudden changes in temperature,—the pores preferably being, however, of smaller diameter than that of passage N of the previous figures. After sealing off, the concealing setting 12 is applied as in Fig. 1, preferably covering Y as well as the contrasting effect of glass and liquid caused by liquid-free space B.

In all the above embodiments, the air-bubble B is localized permanently at a part of the housing which may be sufficiently concealed by the jewel-setting as in the jewels of Figs. 1–3, as pendants, finger rings and the like.

Fig. 9 shows another modification of means for permanently localizing the liquid-expansion air-bubble substantially out of the

ordinary range of vision of opal-housing 14; this means being of the class where the bubble is to be substantially concealed by the jewel-setting, as in Figs. 1–3, 6–8, in its place of localization. Here a substance 144B is permanently fixed to a portion of the interior surface of opal-housing 14, which portion is more or less concealed by the setting, as 222 of the finger ring 122 shown. This substance is such a one as paraffin, the surface of which cannot be wetted by liquid 15 such as glycerine, i. e., there is a repulsion between the molecules of substance 144B and the liquid. The air-bubble B, therefore, will cling to substance 144B even when the jewel is turned through any angle, this being because the repulsion between the liquid 15 and substance 144B will drive air-bubble B to the latter and hold it there. This action will occur even if and after the bubble is detached from substance 114B by the moving opal-units. As shown, the jewel setting 222 will be such, as in Fig. 3, that the permanent bubble-retaining portion 144B of the gem and the bubble B itself will be more or less enclosed within and sufficiently concealed by setting 222 of the finger ring 122, said setting constituting the means for covering the gaseous space from view as a thing separate from or contrasting with the display elements or housing. If substance 144B and its clinging air-bubble B are heavier than an equal volume of the liquid, then substance 144B need not be fixed to opal-housing 14 but may be allowed to sink and mingle with the small opals 199 at the bottom of the group which will be always in a location substantially out of the ordinary range of vision of the opals which is not the unusual observation from below in a vertical range of vision. In Fig. 9, the member 144B constitutes the bubble-localizing means and the setting 222 constitutes the means for covering the bubble from view as a thing separate from the display elements or housing. The practical necessity of some means for keeping the air-bubble out of sight is, of course, due to the fact that it alone is lighter that the liquid, and by itself will rise in the liquid so as to be directly in the line of vision of the opal fragments save in the exceptional case where the point of observation is directly below the composite gem; and when in line of vision it appears as a thing separate from or contrasting with the display elements and the housing and detracts both from the appearance of the composite gem as a unitary gem and from the effect of the color-changes of the small moving opals.

The principal advantages of my composite real gem or opal are that it is a cheaper, stronger (less fragile) and more beautiful gem than a real gem in the form of a single unit of the same size and similar though less beautiful appearance.

The size, shape and general appearance of the portion of the opal-housing exposed from the jewel-setting are of the general order of those of gems as customarily employed in other high-grade jewelry. The settings, of noble metals, preferably conform to the appearance and æsthetic value of the composite gem. The opal-units preferably are sufficiently large in number and fill sufficient of the internal housing-space to prevent a bad appearance of a plurality of independent units. The combination of such gem-group with the glass housing, as in Fig. 2, masks appearance of the housing as a thing distinct from the opal-group. The glycerine contained in the opal-housing corresponds in colorlessness with the glass housing itself, preventing the appearance of distinction between the housing and the space not occupied by the opals, and co-operating with the opal-group in masking the existence of the housing. The group of opals 199 in the housing is sufficiently large to fill the interior housing space from one side to the other and to lie against the glass wall of the housing (or at least the individual opals extend from side to side and extend a substantial distance, vertically in the case of a pendant jewel, and in general, in the direction of gravity), presenting substantially the appearance of a unitary opal of the over-all size of the glass housing and masking the existence of housing and liquid as separate things. The liquid in the form of colorless glycerine very greatly enhances the color effects from the opal-group, especially when the latter are in slow motion as controlled by the viscosity of the glycerine. The glycerine is viscous, causing such slowness of motion, and its degree of viscosity and consequently the color effects from the composite gem, vary with the atmospheric temperature from day to day. The volume of the opal group preferably is less than that of the space filled by both liquid and solids, thereby permitting movements of the housing to cause the desired color effects from the slow movements of the individual opals of the housed group and in the glycerine. The opal units are of considerable number in the group and may be quite small provided that they be sufficiently large to show the opal colors as coming from apparent parts of the apparent surface and interior portions of the apparent unitary opal, the changing opal hues being emphasized by the movements of the fragments, and by vision of interior opals in the spot-lights caused by the curved lens-housing. The mixture of liquid and opals nearly fills the space inside the housing, but leaves a liquid-free space or bubble permitting temperature-expansion of the glycerine without injuring the housing-wall; and the constructions disclosed provide practical means for preventing vision of such bubble. And the setting preferably is given functions above

described to improve the appearance of the jewel in ways additional to the ordinary utilities of gem-settings.

Various terms in the claims, as "glass", "transparent", "opal" and "glycerine", etc., are used as limitations but are intended to include substantial equivalents in all cases of corresponding patentable novelty and utility; for example, some claims including the word "opal" may be patentable by virtue of such precise limitation, but the patentability of some claims using the word may be sufficient to warrant its construction to include other gem material. Various features of the invention may be employed without a liquid or in combination with features other than those disclosed herein.

In Figs. 2A, 3, and 9, the housings are shown as appearing to contain a minimum gem-free space, allowing minimum freedom of movement of the small gems. This showing may be on account of viewing the composite gem directly from above (as in the plan, Fig. 2A), in which case the small gems will be seen as extending entirely from one wall of the housing to the other; whereas the fact as to the number of small gems in the housing may be that they occupy no more proportionate interior housing space than is shown in Figs. 1 and 2; or Figs. 3 and 9 may be taken as elevation views showing an actual extra-small gem-free interior housing-space allowing only limited motion of the small gems.

I particularly point out and distinctly claim the part, improvement, or combination which I claim as my invention or discovery, as follows:—

1. A composite opal including a closed substantially colorless and transparent housing; a substantially colorless and transparent liquid enclosed therein; said housing including two hollow portions rigidly connected together and formed with an interior constricted passage communicating with the hollow interiors of said two housing-portions; a plurality of relatively small opals partially filling the first of said housing-portions and extending from one side to the other and a substantial distance axially thereof; said plurality of relatively small opals in combination with said housing and liquid presenting substantially the appearance of a unitary relatively large opal thereby masking the appearance of the housing and liquid as things separate from the relatively small opals; and the volume of the liquid being sufficient in said first housing-portion for movements thru the liquid of the individual small opals which partially fill said first housing-portion but leaving a liquid-free space containing gas in the second housing-portion for temperature-expansion of the liquid without undue stress on the housing.

2. As an article of jewelry for personal adornment, the combination of a composite gem and a setting therefor, said gem consisting of a closed colorless transparent housing having two intercommunicating hollow portions; a plurality of small solid display elements confined inside one hollow portion; a liquid filling the non-solid-filled space in said hollow portion and partially filling the other hollow housing portion, leaving a gaseous space in the latter permitting temperature-expansion of the liquid without breaking the housing wall; the jewel-setting extending around the gas-containing housing-portion and exposing to view the display-element housing portion and the display elements therein; the wall adjacent the intercommunicating portion of the two housings enclosing a constricted passage permitting the flow of the liquid from either housing portion to the other.

3. A composite gem comprising display elements, a liquid, and a closed glass housing for the display elements and liquid, said housing including two adjacent integral globular portions, a constricted passage formed between the two portions, one globular portion containing the display elements and the liquid, and a gaseous space being left in the other globular portion permitting temperature-expansion of the liquid without breaking the housing and said constriction of passage, in use of the jewel, preventing the passage of the gas in the space to the housing-portion containing the display elements.

4. A composite opal including a closed substantially transparent housing and a substantially transparent body of glycerin enclosed therein; a plurality of relatively small opals immersed in said glycerin but only partially filling the housing; the volume of the glycerin at ordinary temperatures being less than that of the internal volume of the housing interior not occupied by the small opals, thereby preventing undue stress on the housing by temperature-expansion of the glycerin; said housing consisting of two adjacent integral hollow globular portions and being formed with an interior constricted passage constituting an intercommunication between said hollow portions, one of said housing-portions containing the relatively small opals and the greater proportion of the glycerin and the other housing-portion containing the rest of said glycerin.

5. A composite opal including a closed substantially colorless and transparent glass housing having a portion of substantial size, and another portion of reduced size and stationary relative to the first portion, and an integral constriction in said housing defining said relatively stationary portions of differential size; a plurality of opal fragments in said housing-portion of substantial size; a substantially colorless transparent liquid in said housing; and an air space in said

housing portion of reduced size constituting it as an expansion chamber for the liquid.

6. A composite gem including a closed substantially transparent glass housing; means associated with said housing to define a jewel chamber and a relatively stationary air chamber in the housing; a plurality of relatively small gems in said jewel chamber; a sufficient quantity of viscous liquid in said housing to fill said jewel chamber and partially extend into said air chamber; and mounting means secured to the housing and masking the relatively stationary air chamber.

7. The improvement in composite opals of the type comprising a closed glass housing, a plurality of small opals partially filling the housing and extending in it from side to side and a substantial distance axially therein, a liquid having substantially the same color and substantially the same index of refraction as the glass housing and filling part of the housing-space not occupied by the small opals thereby blending vision of the housing and the opals, but leaving a sufficient gas-space to permit temperature-expansion within the housing of the liquid therein, said improvement consisting of an enclosure for the gas-space which enclosure is formed with a restricted tubular portion in communication with the liquid-filled part via a constricted opening.

8. The improvement in composite opals of the type comprising a closed glass housing, a plurality of small opals partially filling said housing and extending in it from side to side and a substantial distance axially therein, a body of glycerine, in viscous, substantially colorless and transparent form filling part of the housing-space not occupied by the small opals, blending the vision of the housing and the opals, but leaving a sufficient gas-space to permit temperature-expansion within the housing of the glycerine therein, said improvement consisting of an enclosure for said gas-space which enclosure is formed with a restricted tubular portion in communication with the glycerine-filled space but checks passage of the gas.

9. A jewel comprising a composite gem and a setting therefor, said gem comprising a two-part glass housing both parts of which are hollow and intercommunicating, and one of which is smaller than the other and extends beyond it; a plurality of display elements housed in the larger part; and said setting being secured around the outside of the smaller of said two housing-parts, leaving the larger part exposed to view as the gem.

10. A composite gem of the type described including in combination a closed substantially transparent housing, a plurality of relatively small gems in said housing; a substantially transparent colorless liquid in the housing and overlying the small gems; a small bubble of air in the housing; and means in fixed position relative to the housing and retaining the air bubble out of the range of direct vision of the small gems in the housing.

11. A housing for a composite gem of the type comprising a housing containing a plurality of individual display elements, a liquid, and a gaseous space permitting temperature-expansion of the liquid, said housing consisting of two globular glass portions, one larger for the display elements and liquid, and the other smaller for the gas and a portion of the liquid; said two housing-portions being joined by a neck having an interior constricted opening permitting passage of the liquid from the larger to the smaller portion but checking passage of the gas from the smaller to the larger portion upon angular movement of the housing.

12. A composite gem comprising a hollow glass housing and a plurality of display elements enclosed therein; said housing consisting of a small tube closed at one end by a substantially spherical hollow portion of larger internal and external diameter than the small tube, the wall of said tube being circumferentially contracted to form a constricted passage between the interiors of the tube and sphere holding the display elements, and the other end of the tube being closed by a seal-off.

13. A composite gem comprising a closed glass housing, a liquid element of the gem within the housing, in combination with means including a smaller glass housing spaced from and in fluid communication with the closed housing retaining in substantially fixed location relative to the housing in all positions of the gem, a gas bubble of sufficient size to permit temperature-expansion of the liquid against the retained gas without undue strain on the housing.

14. A composite gem including a closed hollow housing comprising a chamber-portion of substantial size and substantially colorless and transparent and another chamber-portion substantially smaller interiorly and exteriorly than the first and stationary relative to the first; and a constricted passage-way communicating between said chamber-portions of differential size and located inside the housing; a plurality of relatively small gems in said larger housing-portion; and a substantially colorless and transparent liquid also enclosed in the housing; said smaller housing-chamber enclosing a space and constituting an expansion chamber for said liquid.

15. The combination with a jewel setting, of a composite gem including a closed glass housing, for a liquid element in the housing, said housing including means for localizing, at all positions of the gem, a gaseous space of sufficient volume in the housing at ordinary

temperatures to permit temperature-expansion of the liquid without undue strain on the housing; said housing having a sealing-off protuberance adjacent said space-localizing means; and said jewel setting extending around a portion of the housing which includes said protuberance, and also extending around the portion of the housing which encloses the gaseous space.

16. A composite gem including a closed substantially transparent and colorless hollow glass housing; a constricted passage-way located inside said housing and having a wall which defines both a gem-chamber and a separate but relatively stationary expansion-chamber respectively at different portions of the housing, the passage itself communicating with both said chamber-portions; a plurality of relatively small gems in said gem-chamber; a quantity of glycerin in substantially transparent and colorless condition also located in said gem-chamber filling the same and surrounding said small gems; said expansion-chamber enclosing a space and said constricted passage being traversible by said liquid upon temperature-expansion of the liquid; and a jewel-setting secured to the exterior of the housing masking the boundary between said liquid and the space enclosed in said expansion-chamber.

17. A composite gem including in combination a closed substantially transparent and colorless housing; a plurality of relatively small gems and a substantially transparent liquid enclosed in said housing, the liquid surrounding the gems but leaving a relatively small space inside the housing; and a constricted passage-way traversible by the liquid upon changes of volume thereof by temperature changes but dividing the housing into two relatively stationary chambers in different portions of the housing one of said chambers permanently enclosing said gems and the other normally enclosing said space; said chambers being in communication with one another by way of said passage.

18. As an element of a composite gem, a glass housing for a liquid element of the gem and for display elements therein, in combination with means retaining a sufficiently large gas bubble within the housing to permit temperature-expansion of the liquid therein, and a vision shield preventing contrasting visual effect between the bubble and the display elements.

19. A composite gem comprising a substantially transparent housing; a multiplicity of display elements partially filling said housing; a liquid which at ordinary temperatures fills only a part of the remaining space in the housing leaving a space of sufficiently large volume at ordinary temperatures to permit expansion of the liquid without breaking the housing; and shielding means covering said space from vision as a thing contrasting with the display elements and enclosing a constricted passage permitting liquid but not gas intercommunication between the gas-filled space and the liquid-filled space

20. A composite opal including a closed substantially colorless transparent glass housing having a portion of substantial size, and another portion of reduced size, and an integral constriction in said housing defining said portions of differential size; a plurality of opal fragments in said housing portion of substantial size; a substantially colorless transparent liquid in said housing; and an air space in the housing portion of reduced size providing an expansion chamber for said liquid.

21. A composite gem including a closed substantially transparent glass housing; means associated with said housing to define a jewel chamber and an air chamber in the housing; a plurality of gem fragments in said jewel chamber; a sufficient quantity of glycerine in said housing to fill said jewel chamber and partially extend into said air chamber; and mounting means secured to the housing and masking the air chamber.

22. A composite gem of the type described including in combination a closed transparent vitreous housing; a plurality of gem fragments in said housing; a transparent colorless liquid in the housing and overlying the gem fragments; a bubble of air in the housing; and means associated with the gem fragments, housing and liquid for retaining the air bubble out of optical relation with the said gem fragments.

23. A composite opal including a closed substantially colorless and transparent housing, a substantial number of opal fracture fragments respectively having a plurality of opalescent fracture faces and also located in said housing; a substantially colorless and transparent liquid also inside said housing and surrounding said fragments, the fragments and liquid only partially filling the housing leaving a space therein preventing undue stresses on the housing by temperature-expansion of the liquid; means masking the space inside the housing left by the liquid and opal fragments; said liquid and housing having similar refractive indices masking their appearance as different bodies; the volumes of said liquid and fragments being proportioned for freedom of motion of the fragments thru the liquid in substantially spaced relations to one another; and the liquid being characterized by slow motion of the fragments thru it masking the motion and presenting to view the various opalescent fracture faces of the respective opal fragments.

24. A composite opal including a closed substantially colorless and transparent housing, a substantially large number of opal fracture fragments respectively having a plurality of opalescent fracture faces and also

located in said housing; a substantially colorless and transparent liquid also located inside the housing and surrounding said fragments, the fragments and liquid only partially filling the housing leaving a space therein preventing undue stresses on the housing by temperature-expansion of the liquid; and means masking the space inside the housing left by the liquid and the opal fracture fragments; the volumes of the liquid and fragments being proportioned for freedom of motion in the fragments thru the liquid in substantially spaced relations to one another presenting to view the various opalescent fracture faces of the respective opal fragments.

25. A composite opal including a closed substantially colorless and transparent housing, a substantially large number of opal fracture fragments, respectively having a plurality of opalescent fracture faces and also located in said housing; a substantially colorless and transparent liquid also located inside the housing and surrounding said fragments; the liquid and housing having similar refractive indices masking their appearance as different bodies; the volumes of the liquid and fragments being proportioned for freedom of motion of the fragments thru the liquid in substantially spaced relations to one another; and the liquid being characterized by slow motion of the fragments thru it masking the motion and presenting to view the various opalescent fracture faces of the respective opal fragments.

26. A composite opal including a closed substantially colorless and transparent housing, a substantially large number of opal fracture fragments respectively having a plurality of opalescent fracture faces and also located in said housing; a substantially colorless and transparent liquid also located in the housing and surrounding said fragments; the liquid and housing having similar refractive indices masking their appearance as different bodies; and the volumes of the liquid and fragments being proportioned for freedom of motion of the fragments thru the liquid in substantially spaced relations to one another presenting to view the various opalescent fracture faces of the respective opal fragments.

27. A composite opal including a closed substantially colorless and transparent housing, a substantially large number of opal fracture fragments respectively having a plurality of opalescent fracture faces and located in said housing; a substantially colorless and transparent liquid also located in the housing and surrounding said fragments; the volumes of the liquid and fragments being proportioned for freedom of motion of the fragments thru the liquid in substantially spaced relations to one another; and the liquid being substantially viscous causing slow motions of the fragments masking their appearance of motion and emphasizing the changing opalescence of the separated moving fragments.

28. A composite opal including a closed substantially colorless and transparent housing, a substantially large number of opal fracture fragments respectively having a plurality of opalescent fracture faces and located in said housing; a substantially colorless and transparent liquid also located in the housing and surrounding said fragments; the volumes of the liquid and fragments being proportioned relative to one another for freedom of motion of the fragments thru the liquid in substantially spaced relations to one another; the volumes of the liquid and fragments being proportioned to the volume of the interior to leave a space preventing undue stresses on the housing by temperature-expansion of the liquid; and means masking view of said space.

29. A composite opal including a closed substantially colorless and transparent housing, a substantially large number of opal fracture fragments respectively having a plurality of opalescent fracture faces and located in said housing; and a substantially colorless and transparent liquid also located in the housing and surrounding said fragments; the volumes of the liquid and fragments being proportioned for freedom of motion of the fragments thru the liquid in substantially spaced relations to one another presenting to view the various opalescent fracture faces of the respective fragments.

30. A composite opal including a closed substantially colorless and transparent housing, a substantially large number of opal fracture fragments respectively having a plurality of opalescent fracture faces and located in said housing; and a substantially colorless and transparent fragment-supporting medium also located in said housing and surrounding said fragments, the volumes of said fragments and medium being proportioned for substantially spaced relation of the fragments to one another presenting to view the various opalescent fracture faces of the respective fragments, and said medium supporting the fragments in such spaced relations.

31. A composite opal including a substantially transparent housing, a substantially large number of opal fracture fragments respectively having a plurality of opalescent fracture faces and located in said housing; and a body of substantially transparent glycerin also located in the housing surrounding said fragments, the volumes of the glycerin and fragments being proportioned for freedom of motion of the fragments thru the glycerin in substantially spaced relations to one another presenting to view the various opalescent fracture faces of the respective fragments.

32. A composite opal including a substantially transparent housing, a substantially

large number of opal fracture fragments respectively having a plurality of opalescent fracture faces and located in said housing; and a body of substantially transparent glycerin also located in the housing, said fragments being immersed in the glycerin and said housing having a refractive index similar to that of the glycerin masking the existence of the housing and liquid as separate bodies.

HORACE H. WELCH.