E. H. PHIPPS.

VAULT AND SAFE DOOR.

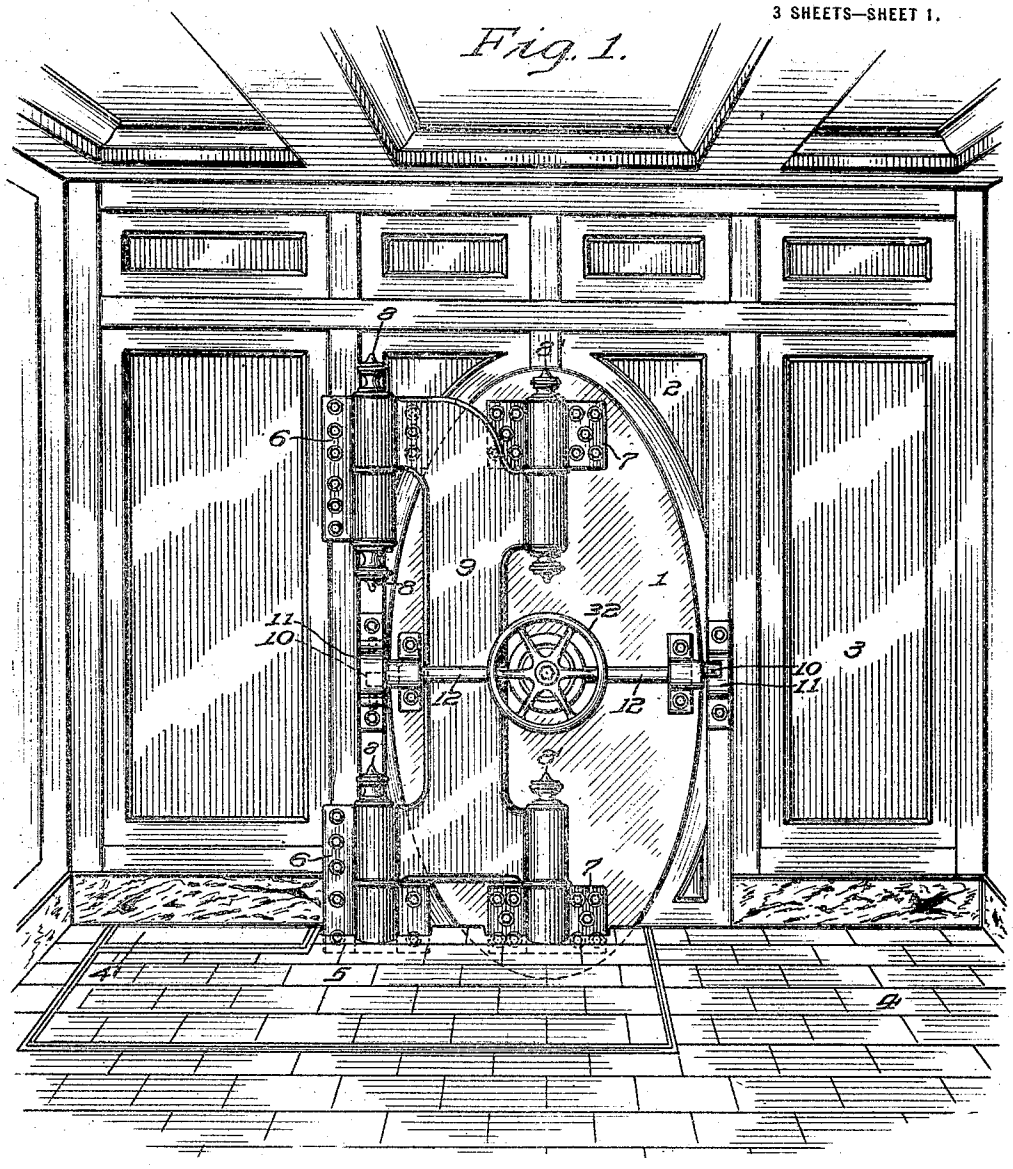
APPLICATION FILED MAY 15, 1918.

1,376,355.

Patented Apr. 26, 1921.

3 SHEETS—SHEET 1.

Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 2.

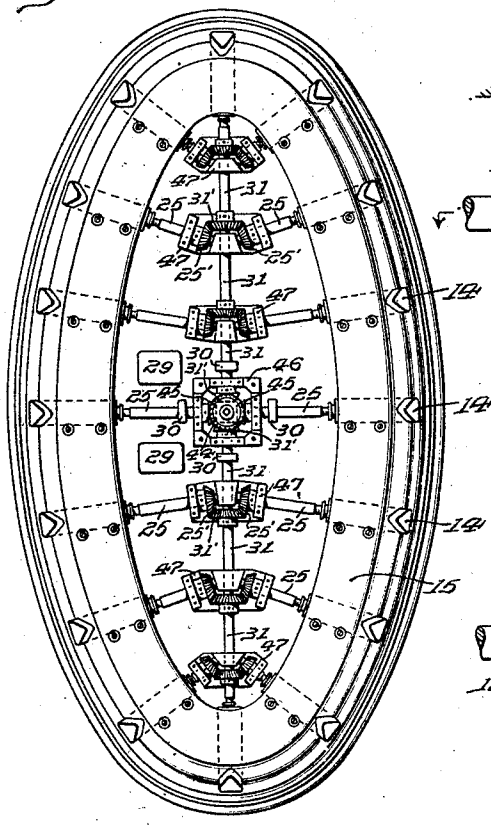


Fig. 3.

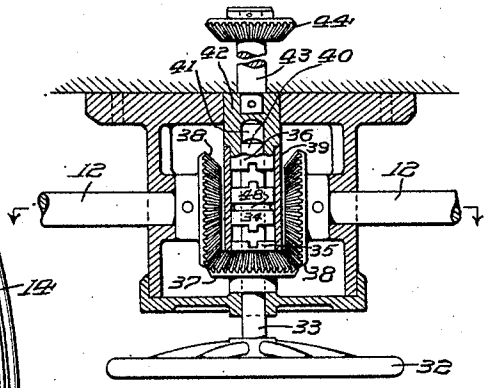


Fig. 4.

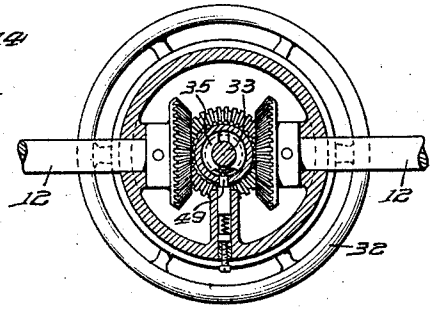


Fig. 5.

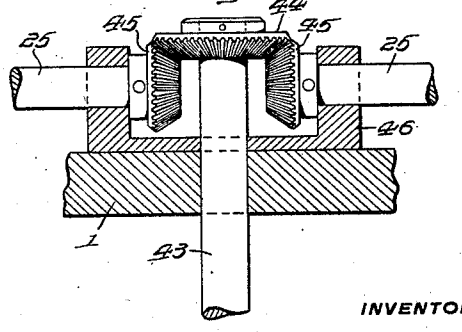
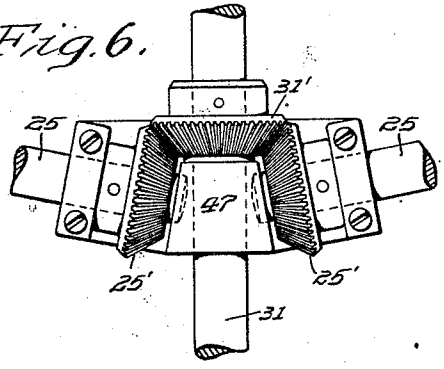


Fig. 6.



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3 SHEETS—SHEET 3.

Fig. 7.

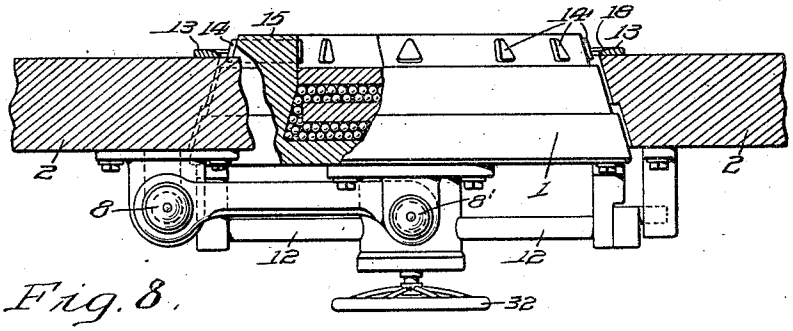


Fig. 8.

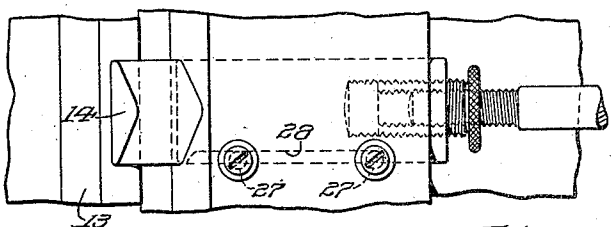
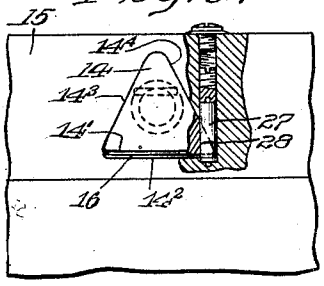


Fig. 9.

Fig. 10.



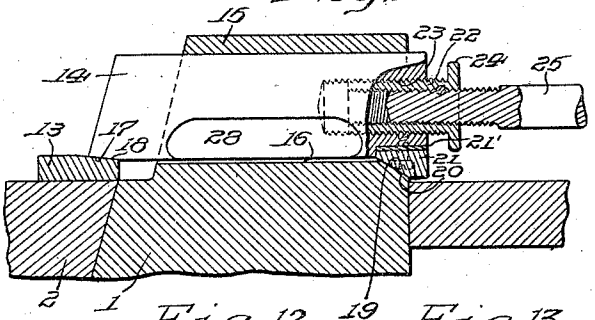
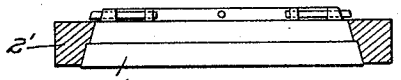
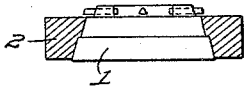


Fig. 11.

Fig. 12.

Fig. 13.





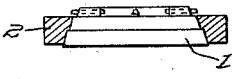
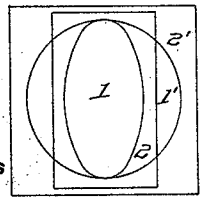
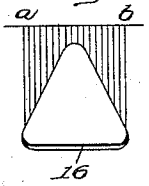


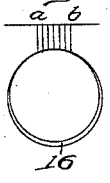
Fig. 14.

Fig. 15.

Fig. 16.







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VAULT AND SAFE DOOR.

1,376,355. Specification of Letters Patent. Patented Apr. 26, 1921.

Application filed May 15, 1918. Serial No. 234,786.

To all whom it may concern:

Be it known that I, EDWARD H. PHIPPS, a citizen of the United States, and a resident of Philadelphia, county of Philadelphia, State of Pennsylvania, have invented certain new and useful Improvements in Vault and Safe Doors, of which the following is a specification.

The invention relates to an improved means on a closure of a safe or vault for locking said closure to said safe or vault and for maintaining said closure locked.

An object of the invention is to construct a safe or vault with new and improved means for efficiently closing and maintaining closed said safe or vault and for rendering the same as nearly proof against unauthorized access thereto as is possible.

Another object is to provide a special form of locking means for the door which comprises bolts and sockets of special shape, preferably of triangular shape, whereby increased strength as well as an increased area of contact between the contacting surfaces are obtained.

A still further object is to provide a means by which the door may be quickly and accurately wedged into place and which will hold the door in constantly tight contact without any play between the jambs of the door and the vault after the bolts are shot into place. Inasmuch as the sockets must always be larger than the bolts they are provided with a requisite clearance space for practical and ready insertion of the bolts thereinto, and it is obvious, therefore, that unless some special provision be made to prevent it, the door must always have a certain amount of movement relative to the vault when locked, due to the clearance mentioned. This, therefore, permits the injection of a high explosive, such as nitro-glycerin, which may be used to force the door open, or even the insertion of a tool which may be manipulated to a sufficient extent to start the prying open of the door, and such particularly, is what the present invention aims to avoid and in fact prevents.

Another object is to provide means for reducing the friction between the bolts and their sockets and means for more efficiently operating the same.

Another object is to provide means for operating the locking devices and the compressor bar from a single hand wheel, provision being made for selectively connecting the one or the other as desired and also placing said hand wheel into a neutral or ineffective position when the same is not in use.

My invention comprehends more particularly the use of a door of generally oval form, and preferably of an elliptical form, which door may be of the same height (along the major axis of the ellipse) and strength as a circular door (with a diameter equal to that of the major axis aforesaid) now generally in use, or a rectangular or square form of door of equal height occasionally found in use, with the resultant saving of considerable weight and material in the door as well as in the cost of the latter. By using the oval or elliptical form of door economy in space and material in the vault structure as well as floor space outside of the vault, is also obtained. Where a circular door is used, the central passage or the space between the vault boxes or drawers is substantially of a width equal to the diameter of the door but in case of using an elliptical door this space has a width merely equal to the minor axis of the oval or ellipse and consequently since the stacks of the vault boxes are thus located nearer to each other, the vault is accordingly narrower and less material obviously is necessary in building a vault of equal capacity to that having a circular door. This is particularly advantageous where banks are limited in space, as in crowded portions of large cities. In addition to the above advantages, in the use of an oval or elliptical form of door, it is also evident that the latter also presents a more attractive appearance than any other form of door heretofore used.

Another advantage arising from the use of an oval or elliptical form of door is that in installations of vaults where a lowering platform is utilized, this form of door permits of the use of a corresponding smaller platform.

A still further advantage is obtained from the use of triangular sockets and bolts in the locking means whereby there may be an in-

creased surface of contact between them and an increased strength of the socket for a certain given cross-sectional area of the triangular bolt used.

A still further advantage is present in the use of the triangular bolts in lieu of the usual round or cylindrical forms in that for the same cross-sectional area thereof, a triangular bolt is stronger under a lateral stress than a circular bolt. Consequently a triangular bolt of equal strength to that of a circular bolt contains less material, and, therefore, is not as heavy. Further economy of material as well as cost thereof is therefore secured.

A still further advantage is obtained by providing rollers upon which the bolts are guided, thereby reducing to a minimum the friction between the socket walls and the bolt surfaces as the latter are drawn out of or shot into place in the sockets.

A still further advantage is obtained in that the difficulties accompanying broaching processes which are usually necessary for providing a proper clearance in the bolt sockets for the practical insertion of bolts and for the proper contact of the usual cylindrical surfaces of the bolts and sockets, are wholly avoided in the form of device constituting the subject matter of this invention by merely making the socket and the bolt of exactly the same shape, the latter only being smaller than the former in order that it may be inserted therein.

Other objects and advantages will become apparent from the following specification and appended claims.

In the accompanying drawings, Figure 1 is a front view in elevation of a bank vault and an elliptical form of door used therewith; Fig 2 is a rear elevation of the door and the bolt operating mechanism; Fig. 3 is a horizontal section of the hand wheel mechanism for operating the bolt operating mechanism as well as the compressor means; Fig. 4 is a transverse section taken on line 6—6 of Fig. 3; Fig. 5 is a detail of the housing and gearing of the bolt operating means; Fig. 6 is a detail vertical view of the gears and bearings for the bolt rods; Fig. 7 is a fragmentary longitudinal section of a door and vault chamber showing one form of internal construction of the door that may be used; Fig. 8 is a fragmentary detail elevation of one of the bolts and its connection; Fig. 9 is a transverse view thereof, partly in section; Fig. 10 is a longitudinal view, partly in section, of a bolt and its socket; Fig. 11 is a horizontal section of a conventional circular form of door; Fig. 12 is a similar section of an oval or elliptical form of door with the material thereof of the same thickness as that in the conventional form of door shown in Fig. 11. Fig. 13 is a section of an elliptical form of door with less material than that shown in Fig. 12 but of equal strength to the conventional round door shown in Fig. 11; Fig. 14 is a diagrammatic view of a round door and an elliptical door with their respective vault chambers superposed one upon the other for the purpose of comparison; Fig. 15 is a diagrammatic view showing the advantage gained in the increased area of the socket and in the effective contact area of the surface when the triangular form of bolt and socket is utilized; Fig. 16 is a diagrammatic view showing in comparison the objectionable conditions in the use of the round bolt and socket.

Referring now more particularly to the drawings, the door 1 of this invention is preferably of the elliptical form and is shown in place in Fig. 1 in the vestibule 2, the latter forming a part of the vault structure 3 of a bank or similar institution. In front of the vault is shown a floor 4, a portion 5 of which forms the floor of a lowering platform which, when the door is opened, may be lowered and later brought back to the level of the floor in order that passage may be made over the floor 4 as well as the floor 5 into the vault without necessity of mounting or descending steps. A portion 4′ of the elevator floor is so connected that, as the vault door 1 is swung back into its complete open position, it is caused to be lowered to clear a space for the open position of the vault door 1 and is adapted, when the door 1 is closed and the elevator for the lowering platform is raised, to be returned to its normal position relative to the floors 5 and 4. Inasmuch as the structure of the elevator for the lowering platform 5 and its connection thereto do not form a part of the invention herein disclosed, it is deemed unnecessary to more particularly describe the same as any suitable form of elevator, many of which are at present well-known, may be used in connection with the platform herein referred to. The narrow space that is left between the edge of the elevator floor and the vault floor when the door 1 is open may be covered by a foot bridge or filled with a spacer, which may be located in place by hand as desired. The door 1, as shown, is supported upon a crane 9 pivoted upon hinged members 6 by the pins 8 and further by means of the hinged straps 7 fixed to said door and pivoted upon the crane by means of the pins 8′. The opening of this door is accomplished in the usual manner. The axes of the pins 8′ lie in a plane which is perpendicular to the door and which includes the major axis thereof.

The door is also provided with the usual form of compressor bar 12, at the outer ends of which are provided the cams 10 adapted

to coöperate in the brackets 11 fixed to the vault 3. The inner ends of the bars 12 are provided with miter gears 38 in mesh with miter gear 37 secured to the hand wheel shaft 33 by which the compressor bars may be rotated for the purpose of causing the cams 10 to bear against the brackets 11 and preliminarily force or jam the door into a tight position.

This compressor system, it will be noted, is similar to those in use on vault doors in general but with the exception that fewer compressor bars are necessary on account of the reduced width and perimeter of the oval form of door. Far less power is required to force such door to a tight position.

After the door has been properly seated under the action of the compressor cams the locking of the door is accomplished by forcing a series of bolts 14 through the sockets of the bolt ring 15 against a locking ring 13. For this purpose the rear of the door is provided with a ring 15 of elliptical form located adjacent to the periphery of the door. This ring is provided with a plurality of sockets of a preferably triangular form within which the bolts 14 are adapted to fit and move. To the bolts 14 are connected threaded rods 25, which are provided at an end thereof with miter gears 25′ in mesh with miter gears 31′ secured to the main driving shaft 31 and at the other end thereof with a threaded portion for connection with an adjusted sleeve 22 which is in connection with the threaded portion 23 of the bolt 14. The threads upon the rods 25 and the sleeve 22 are of opposite pitch, as is clearly shown in Fig. 8. By providing these parts with threads of opposite pitch it is possible to make relative adjustment of the parts for properly positioning the bolts for their locking functions as well as for taking up for any wear that may occur during said functioning. After an adjustment is made, a locking pin may be inserted in a boring that may be made through the sleeve 22 and the rod 25 for the purpose of permanently locking the parts in their adjusted position. The adjusting sleeve 22 may also be provided with a knurled rim 24 by which the adjusting sleeve may be operated during its adjusting operation.

On the jamb of the vestibule and adjacent the edge thereof is located an elliptical locking ring 13 provided with a beveled face 17 against which the end of the bolt 14 is adapted to engage, the latter being provided at the end with a beveled face 18 corresponding to and adapted to coöperate with the beveled face 17.

At the rear end of the bolt 14 is provided an insert of hard metal 21 which may be secured in any manner desirable to the bolt 14. This insert member 21 is provided with a beveled face 20 which corresponds to and is adapted to engage with a similar beveled face 19 provided upon the jamb of the door 1. The beveled faces 17 and 18 as shown, are of different inclination than that of 19 and 20. The purpose of this is that as the bolt 14 is moved into locking position, that is in a direction to the left as shown in Fig. 12, the beveled face 18 first engages with the beveled face 17 whereby the forward end of the bolt 14 is moved relatively to the socket in the ring 15 against the inclined walls of said socket (see Fig. 9) and just as the bolt has nearly completed its limit of throw to the locking position, the beveled faces 19 and 20 then come into contact and quickly cause the rear end of the bolt 14 to rise in the socket and bring the contacting surfaces into parallel and contacting position. The purpose in first laterally moving the forward end of the bolt and then quickly bringing the rear end of the bolt into parallelism with the faces of the socket at the end of its throw is to reduce the friction between the bolt and the socket as the locking operation is carried out.

Another reason for this peculiar movement is for the purpose of so placing the bolts in the sockets that the load thereon will be equally distributed. Ordinarily in the conventional form of locking means, the bolt from the start of its locking movement to its termination is practically in full frictional engagement with the socket. It is desired by my invention to overcome as far as is practical all of the friction arising therein. In addition to the above features I have also provided in each socket a roller bearing 27 which is inserted in the socket ring, as is clearly shown in Fig. 9. Each of the bolts is provided with a face 28 adapted to engage said rollers both in its longitudinal movement during the locking and withdrawing operation and in its lateral movement from the socket walls as the inclined walls of the bolt are caused to engage with or disengage from the walls of the socket. This latter movement is more clearly hereinafter disclosed in connection with the clearance features. A shim 21′ may be provided between the insert member 21 and the bolt 14 for the purpose of taking up for wear that may arise between the contacting surfaces 19 and 20.

Clearance is always an important feature in connection with all bolts. The round bolts usually have a very slight clearance, just sufficient to avoid excessive friction, but however slight the clearance may be it is nevertheless sufficient to divert the bolt from its parallel relation with the socket wall in its locked position and, therefore, has a tendency to reduce the resisting surface to the smallest possible area. The triangular

bolt, however, takes advantage of the clearance space to release itself of all friction the instant it is moved, in unlocking operation, the weight of the bolt being transferred immediately to the friction rollers. The adjustable wedge or inclined means at the rear end of the bolt maintains the bolt parallel with the resisting surfaces of the socket with the advantage of an equally distributed contact of the resisting surfaces throughout the length of the bolt rather than at a particular point on the bolt.

It will be noted that the sockets are made of exactly the same form as the bolt but of slightly larger dimension which latter is for the purpose of permitting the bolt to readily enter into and withdraw from the socket. The difference in the cross sectional area of the socket and the bolt, as clearly shown in Fig. 9, provides a clearance space 16 for the purpose given above, which clearance space is shown, when the bolt is in locked position, below the same, as viewed in Fig. 9. When the bolt is withdrawn it will be caused, by reason of the inclined surfaces 17 and 18 as well as surfaces 19 and 20, to move laterally over the roller 27 and at the same time longitudinally over said roller. In this operation the inclined surfaces of the bolt will part from the corresponding surfaces of the sockets and produce new clearance spaces 14^3, 14^4. As the bolts rest upon the rollers 27 there is little tendency of the face 14^1 of the bolt 14 contacting with the face 14^2 of the socket. In case they should contact the same is but slight and the area of the contact is far less than the area of the surfaces at 14^3 and 14^4 and the friction is accordingly reduced.

It is to be understood, however, that my invention is not to be considered limited to the particular form of bolt shown and described herein but that it also comprehends the idea of the use of bolts of any cross-sectional form suitable to meet the requirements enumerated above in connection with the triangular form.

Referring now more particularly to Figs. 1 and 2 to 6, inclusive, which disclose the operating means for moving the bolts, a single hand wheel 32 has been provided for the purpose of performing the various functions mentioned. The hand wheel is secured to a shaft 33 rotatably and slidably supported in the housing secured to the front of the door 1. The inner end of the shaft has a bearing 40 which is adapted to rotate, as well as slide longitudinally, in a bearing socket 41 of the coupling sleeve 42. The coupling sleeve 42 is mounted so as to be able to rotate in the rear portion of the housing mentioned above and is also secured by any suitable means, to the shaft 43 leading to a miter gear 44. On the shaft 33 is fixed a double jaw clutch member 34, which is provided on opposite sides with jaws adapted to coöperate with clutch jaws 35 and 36. The clutch jaw 35 is secured to a miter gear 37, loosely fitting over shaft 33 and which gear is enmeshed with the gears 38 of the compressor bars 12. The compressor bars 12 also have bearings in the housing aforesaid. (See Fig. 3). The clutch jaw 36 is located on the opposite side of the clutch members 34 and is fixed to the end of the coupling sleeve 42 in coaxial relation therewith and with the shaft 33, the end of the latter passing loosely through the jaw 36 for fitting in the socket 41. A sleeve 39 is fixed at one end to the inner end of the coupling sleeve 42 and houses the clutch 34 and clutch jaws 35 and 36, as well as the shaft 33, in coaxial relation. The clutch 34 is, therefore, adapted to longitudinally slide therein when the shaft 33 is shifted as described below. The other end of the sleeve 39 abuttingly bears against the inner face of the gear 37. (See Fig. 3.)

In the operation of the hand wheel when the same is moved inwardly in the housing from the position shown in Fig. 3, the clutch jaw on the clutch 34 nearest to the clutch jaw 36 will engage with the latter and any rotation given the hand wheel 32 and shaft 33 will be imparted to the jaw 36 and sleeve 42, as well as shaft 33 and gear 44. Inasmuch as gear 44 is in mesh with gears 45 secured to the ends of the rods 25, the latter will rotate accordingly and by reason of the threaded connection 23 between the sleeves 22 and the bolts 14, the latter will be caused to be fed or moved longitudinally in the sockets of the socket ring 15 to a locking position or by reverse movement the same may be withdrawn from the said locking position.

In the event of withdrawing the hand wheel and shaft outwardly from the housing aforesaid, the clutch member 34 will be disengaged from the clutch 36 and brought into engagement with the clutch 35 whereby upon any rotation given the hand wheel 32, the gear 37 will be caused to operate the compressor bars 12 as well as cams 10 to perform the function of preliminarily jamming the door to its closed position. In the clutch member 34 is provided a groove in which is adapted to project a detent 49 (see Fig. 4) normally pressed into position by a spring with sufficient force to maintain the clutch member in mid position out of engagement with either clutch jaw 35 or 36 but not with sufficient force to prevent the detent slipping out of said groove when the shaft 33 is forcibly moved inwardly or outwardly for the purposes above described. The purpose of the detent is merely to maintain the hand operating means nor-

mally in neutral or inoperative position and engages in the groove with merely sufficient engagement to prevent any accidental operation of the clutch members.

Referring more particularly to Figs. 2, 3, 5 and 6 of the drawing, the shaft 43, is shown as secured to the coupling sleeve 42 in a suitable manner, as by means of a pin. The shaft leads to a gear 44 secured thereto at the end thereof, which gear meshes with the gears 45 mounted upon the end of the horizontal rods 25 and also meshes with two of the gears 31′ mounted at various intervals upon the vertical shaft 31. The remaining gears 31′ in turn engage with the gears 25′ mounted upon the ends of the inclined and vertical shafts 25.

Upon the rear of the door is mounted a set of time locks 29 of any suitable form. These locks may be connected to suitable cams 30 mounted upon the main shaft 31 for the purpose of locking and releasing the same at predetermined times.

From the above it will be seen that motion communicated through the hand wheel 32 is transmitted from the shaft 33, to the clutch member 34, and, in the case of preliminarily forcing the door to closed position, to the clutch jaw 35, gear 37, gears 38, shafts 12 and cams 10 to operate the latter, and in the case of driving the locking bolts, to the clutch 36, clutch sleeve 42, shaft 43, gear 44 gears 45 and 31′ and the shafts 25 whereby the locking bolts 14 are moved into locking position in the manner hereinbefore described.

At the rear of the door is provided a gear frame 46 which serves the purpose of supporting the various gears completing the connection from the shaft 43 to the shafts 25 and 31.

Referring to Fig. 7, it will be seen that the door may be constructed of sheet metal providing a space within the door in which is disposed a plate or similar member of hard metal around which is also disposed a large number of loose elements such as spheres or balls of relatively hard material, the intervening spaces between these balls being filled with a relatively loose material, of abrasive character, such as sand, cement, or other hard and vitreous substances.

Figs. 11, 12 and 13 are referred to for a comparison of the relative strengths of the forms of the doors mentioned above. Fig. 11 shows a section of the conventional form of door which usually is of a circular shape. Fig. 12 shows a section taken on the same horizontal plane as that of Fig. 11 of an oval or elliptical form of door wherein the same thickness of material is utilized. It is obvious that a door of oval or elliptical form is narrower than that of the circular form and that with the same thickness of material used in the frame thereof, the oval or elliptical form of door would be considerably stronger than the circular door. Fig. 13 shows a section similar to that of Fig. 12 of the oval or elliptical form of door with the exception that the material used is thinner. With this form of door having a reduced thickness of the material, the same strength, as that possessed by the circular form of door shown in Fig. 11 is obtained.

Fig. 14 is a diagrammatic view showing the comparison of the two forms of doors and also showing the saving in space and material obtained by the use of an oval or elliptical form of door over the circular form. It is evident that with the use of the oval or elliptical form of door, that the space represented by the crescent shaped area on the opposite sides of said door, shown in Fig. 14 is economized in door material and that the vault space on each side of the oval or elliptical door of the vault is economized similarly. This feature has been described hereinbefore.

Figs. 15 and 16 are more or less diagrammatic views showing the section of the triangular bolt and the socket in which the bolt is adapted to move as well as the conventional form of cylindrical bolt used in the socket of the conventional door. These figures clearly show that when the triangular form of bolt is used and the same has been moved into locking position, the contacting surfaces upon two sides of this bolt are in complete contact throughout the surfaces with the two corresponding faces of the socket. Therefore, the line *a*—*b* represents a projected line or surface of strength, said line being equal to substantially the length of the base of the triangle representing a section of this bolt. This line, it will be seen, is considerably longer than the diameter of a circle having the same area of cross section as the triangular bolt. Fig. 16 shows the relative position of the cylindrical bolt in the socket walls within which the same operates. In this case, when the bolt is presented in the socket, on theory, but one line of contact occurs between said bolt and said socket wall, but in practice the line *a*—*b* is shown to indicate the projected length of the surface of contact between said rod and socket. The bolt of cylindrical form cannot contact the walls of the cylindrical socket with equal stress throughout one-half of its surface and the contact between the surfaces of the bolt and socket could not be represented by the projected line equal to the length of the diameter of the bolt. Consequently, Figs. 15 and 16 show a comparison of the strength of the two forms of locking means.

It will also be noted that, aside from the gain in strength in the bolts in the use of

the triangular form, there is also a similar gain in the strength of the bolt ring by reason of the amount and the form of the material in the portion thereof resisting the lateral action of the bolt. Figs. 15 and 16, therefore, also serve the purpose to comparatively represent by the lined areas shown therein, the relative strengths of the portions of the ring referred to.

While the foregoing discloses one specific form of embodiment for carrying out my invention, it is not my intention to limit myself in any way thereto and my invention contemplates the use of the improvements referred to and to particularly include all equivalent devices which may be comprehended thereby. Therefore, the specific language used is not to be taken as limiting my invention to the particular form of device shown and described.

Having thus described my invention, what I desire to secure by Letters Patent and claim as my invention, is:

1. In a safe, vault and the like, provided with a door, the combination of a locking means comprising a locking bolt mounted on said door, a bolt socket member in which said bolt is adapted to move, a locking ring provided with a beveled surface mounted on said safe or vault adjacent said bolt socket member, and across which the end of said bolt moves, said bolt provided at its end with a beveled surface corresponding to and adapted to contact with the beveled surface on said locking ring, said bolt socket member provided with a beveled surface, said bolt also provided with a second beveled surface adapted to contact the beveled surface on said bolt socket member whereby the bolt in its movement to locking position may be wedged into locking position in said socket and against said locking ring.

2. In a vault, safe and the like provided with an opening and a door therefor, the combination of a locking bolt, a socket member therefor, in which said bolt is adapted to freely move, a locking ring having a beveled surface, said bolt provided with a beveled surface corresponding to the beveled surface upon the locking ring and adapted to contact therewith, said socket member provided with a beveled surface, said locking bolt also provided with a second beveled surface corresponding to and adapted to contact with the beveled surface on said socket member, and means to move said locking bolt through said socket member and across said locking ring whereby said beveled surfaces contact and said bolt is wedged within said socket member and against said locking ring.

3. In a vault, safe and the like provided with an opening and a door therefor, the combination of a locking bolt mounted on said door, a socket member in which said bolt moves also mounted on said door, a locking ring over which said locking bolt moves mounted on said vault or safe, co-acting inclined surfaces upon said ring and said bolt, co-acting inclined surfaces of different inclination upon said socket member and said bolt, a roller in said socket member upon which said bolt may rest upon separation of the second mentioned co-acting surfaces, a rod adjustably connected to said bolt, and means connected to said rod adapted to impart movement to said rod and said bolt.

4. In a safe, vault and the like provided with an opening and a door therefor, the combination of compressing, locking and unlocking systems comprising a hand wheel, a shaft moved thereby, power transmitting means thereon, power transmitting connections for operating said compressing system, power transmitting means for operating said locking and unlocking system and means by which said hand wheel may be disconnected from one system and connected with the other.

5. In a safe, vault and the like provided with an opening and a door therefor, the combination of compressing, locking and unlocking systems comprising a hand wheel, a shaft moved thereby, power transmitting means thereon, power transmitting connections for operating said compressing system, power transmitting means for operating said locking and unlocking system, and means for holding said wheel in an intermediate inoperative position.

6. In a safe, vault and the like, provided with an opening and a door therefor, the combination of a locking bolt of polygonal section mounted on said door, a socket member with a socket, in which said bolt may move, of like section and of larger dimension whereby a clearance may be provided between the walls of the socket and the faces of the bolt, and means for moving said bolt longitudinally in said socket, said socket members and said bolts provided with co-acting inclined surfaces for effecting a transverse movement to said bolt in said socket through said clearance when said bolts are moved longitudinally.

7. In safes, vaults and the like provided with an oval opening, the combination of an oval form of door adapted to close said opening, and locking means on said door for holding said door in closed position comprising rotatable control shafts disposed longitudinally and centrally thereof, gears on said shaft, a plurality of operating rods disposed in positions normal to the tangents to the margin of the door at the locking point thereof, gears on said rods operatively engaging the gears on said shafts, a plurality

of locking bolts adapted to operate at the locking points along the margin of said door, said bolts being threaded to said rods whereby rotation of said rods causes a longitudinal movement of said bolts, and a hand wheel on said door provided with clutch and gear means for operating said shafts.

8. In safes, vaults and the like provided with an elliptical opening, the combination of an elliptical door adapted to close said opening, control shafts rotatably mounted on one side of said door and disposed along the major axis thereof, rotatably mounted operating rods extending laterally in different directions from said shafts along lines normal to the tangents to the locking points at the margin of said door, gears connecting said rods to said shafts, longitudinally movable locking bolts at said locking points connected to said rods, rollers for supporting the locking bolts, a hand wheel on the other side of said door, and means including gears connected to said hand wheel and said shafts whereby an operation of the former causes a rotation of the latter.

In witness whereof, I have hereunto set my hand this 13th day of May, 1918.

EDWARD H. PHIPPS.