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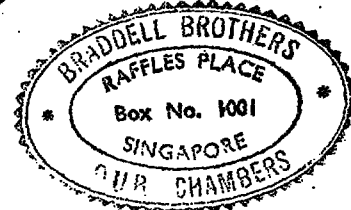
COMPLETE SPECIFICATION

"Improvements in or relating
to safes"

I, CHIU TSUEN MU, a citizen of the Republic of China of No. 304, Wu Fong N. Road, Chia-ih, Taiwan, Republic of China, do hereby declare the invention for which I pray that a patent may be granted to me and the method by which it is to be performed to be particularly described in and by the following statement:-

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Braddell Brothers



5 This invention concerns improvements in or relating to safes. As criminal techniques improve and the number of cases of theft increases, it is becoming increasingly difficult to protect valuable property securely by known guarding and protection means, hence the object of this invention is to provide an improved safe of greater security than heretofore.

10 Jewellery shops for example generally collect their jewellery from display at the end of the day and store them overnight for protection against theft. The following day the jewellery is taken out of store and redisplayed. This procedure besides being complex and inconvenient also relies on the doubtful security of known safe storing means. This situation may be improved by one embodiment
15 of the present invention.

According to the invention there is provided a safe comprising an outer protective casing, an inner storage case adapted to be received within the outer casing, hydraulic lifting means adapted to elevate said case from
20 within the casing to an outer position wherein access to the interior of the case is available, the case being retractable into the casing where such access is prevented, and lockable hydraulic switching means adapted to control a hydraulic fluid path to said lifting means whereby to
25 allow or prevent said elevation of the case.

Said lockable hydraulic switching means preferably comprises two combination locks each having a plurality of hydraulic fluid passages adapted to register with other passages to complete said fluid path for elevating said case. Said locks preferably each comprise a rotatable core member and a rotatable tubular member engaged around the core member and located in a body portion, each member and the body portion having fluid passages formed therein, the passages being adapted to register to complete said fluid path.

One of said locks is preferably provided with one or more further fluid passages adapted to return hydraulic fluid to a reservoir whereby the inner case is retracted into the casing under gravitational action.

The safe preferably includes a lock arranged to actuate a motor to pressurize hydraulic fluid in said fluid path.

The casing may be formed of layers of steel plate, asbestos and cast iron, and an alarm valve may be mounted up-stream of the lock means in said hydraulic path, to sound an alarm when unauthorized opening of the safe is attempted.

The outer casing may have one of a number of shapes, such as a long body, a round body or be L-shaped.

When the combination locks are properly set and the hydraulic fluid motor is running, the inner case will be elevated to an uppermost position to allow the deposition and removal of valuables in and from the safe. After such

depositing or removal, one of the locks can be reset to allow the release of hydraulic fluid pressure when the inner case descends into the outer casing under its gravity. The combination locks are then adjusted to
5 cancel the combination to prevent re-opening of the safe.

With the outer casing constructed of steel plate, asbestos and cast iron, it is difficult for potential thieves to damage it by means of a drill, chisel or gas cutting. Furthermore the inner case of the safe may
10 itself serve as display cabinet for use in a shop. Thus the outer casing may comprise a floor mounted sturdy frame structure or it could be mounted beneath the ground with the result that the inner case is raised above the ground during the day and retracted underground at night
15 for safer protection.

Once the apparatus has been installed and used it will generally not be dismantled thereafter and it may be put into a room without influencing the decor.

The hydraulic fluid pressure will generally be
20 around 70 kg/cm^2 and can raise an 100 inner case having a weight of 300 kg. The pressure is not so high that it would normally be prone to leakage or damage, but if any leakage does occur it can be arranged to overflow into the reservoir. The fluid passages preferably comprise
25 tubes which are difficult to damage.

The combination locks may have a scale of 25 positions per member, so that, with four members, the probability of selecting the correct combination $(1/25)^4$ —i.e. 390,625 combinations are possible.

In order that the invention may be more readily understood, an embodiment thereof will now be described by way of example with reference to the accompanying drawings in which:-

5 Fig. 1 is a front elevation and side elevation of a preferred embodiment of a safe in the retracted position.

 Fig. 2 is a front elevation and side elevation of said embodiment in the elevated position.

10 Fig. 3 is a cross-section through the combination locks of the safe.

 Fig. 4 shows longitudinal cross-sections through the rotatable members of one of the combination locks.

 Fig. 5 shows side and end elevations of the rotatable members of the other combination lock, and

15 Fig. 6 shows the hydraulic circuit to the safe.

 Referring firstly to figs. 1 and 2, the safe comprises an outer protective casing 1 which is hollow but open to the top, and an inner case 2 received within the casing 1. The outer casing 1 comprises a layer of steel plate 11, a
20 layer of fire retarding asbestos 12, and an inner layer of white cast iron 13.

 Disposed between the case and casing is a lifting gear 3, hydraulic oil pump 14 and oil reservoir 15. On the front of the casing are mounted a combination lock
25 assembly 4, a power switch lock 16, and an alarm 17.

 The inner case which is provided for storing precious materials, jewellery and the like has a top plate 21 made of similar materials to the outer casing, and a glass window enabling display of the contents.

The lifting gear comprises an outer pair of struts 31, each of which is pivotally connected to an inner strut 32 by a link pin 34. The lower ends of the outer struts 31 are fixed on brackets 19 by pins 35 which serve as centres of rotation of the outer struts. The upper ends of the outer struts 31 are provided with rollers 36 which can roll along brackets 2. In a similar manner the upper ends of the inner struts 32 are fixed in upper brackets 23 by means of pins 37, the lower ends being mounted on rollers 38 in brackets 18 for rolling therealong.

A connecting link 33 connects the two inner struts 32 and is itself connected to a hydraulic cylinder 5 which is actuated by hydraulic oil delivered by a motor driven pump 14. In this way it may be seen that actuation of the cylinder 5 causes elevation of the inner case.

The combination lock assembly comprises a body portion 40 in which are mounted a first combination lock 6 and a second combination lock 7 (see figure 3). The body portion 40 itself contains hydraulic oil passages 411, 412 and 413, vent passages 44, oil return passage 42, and an oil return passage 43 (not visible in figure 3).

As shown in fig. 4 the first lock 6 itself comprises a core member 61 and a tubular member 62 disposed around the core. A hydraulic oil passage 611 is provided inside the core member 61, an oil passage 621 and overflow passage 622 are provided in the tubular member 62.

The members are mounted in the bracket by means of a fixing screw 63 (which engages in a threaded bore 612 in the core member 61) and washer 64. The two members 61, 62 can each be freely rotated within the bracket, graduations 65, being formed on the forward surface of the core member 61, and similar graduations (not shown) on the tubular member 62, to enable the combination to be made.

As shown in fig. 5, the second combination lock comprises a core member 71 and tubular member 72. Hydraulic oil passages 711 and 721 and overflow passages 722 are provided therein. Furthermore oil drainage passages 712 and 723 are provided in the core member 71 and tubular member 72 respectively. The oil drainage passages should not be arranged in series with the oil passages 711 and 721. The lock 7 is similarly mounted by screw 73 and washer 74 and the core member 71 is provided with graduation marks 75. The tubular member 72 also has graduation marks (not shown).

Figure 6 shows the hydraulic circuit of the safe. The pump 14, driven by a motor 141 draws oil from the reservoir 15. To the pump output is connected a pressure sensitive alarm valve 171 of the alarm system 17, and also a pressure relief regulator 52. Oil from the pump is fed, via a one-way check valve 51 to the inlet passage 411 of the combination lock assembly, and thence (from output passage 413) to the hydraulic cylinder 5.

The first combination lock 6 and second lock 7 are operated as follows. When the precise combination for opening the safe is selected, hydraulic oil passes through passage 411 then leading into the oil passages 621, 611 of the core and annular member of the first lock which meet with passages 411, 412 of the bracket. Thus oil from the passages may lead into passages 721, 711 of the core and tubular member of the second lock 7 with the correct combination selected such that a flow path via passage 413 to the hydraulic cylinder is completed to cause elevation of the inner case 2. When it is desired to lower the inner case, the core member 71 and tubular member 72 of the second lock are adjusted to a specific mark where oil passages 42, 712, 723 and 43 meet with one another. The hydraulic oil in the hydraulic cylinder 5 will immediately be released from passage 42 through passages 723, 712 and 43 to return to the oil reservoir 15 whereby the inner case is lowered. Any leaking oil or overflow oil in the locks will overflow through passages 42, 622 and 722 and return to the reservoir.

Thus it will be seen that operation of the safe is relatively simple. The settings of the combination locks 6 and 7 are first adjusted to the correct combination such that the various oil passages meet with one another to complete a flow path for the hydraulic oil. A key is then inserted into the power switch lock 16 and turned to start operation of the hydraulic oil pump. The oil is driven into the hydraulic cylinder 5 and elevates the inner case.

The power is automatically switched off when the case reaches its uppermost position at which time one can take or deposit valuables from or into the risen case which can also serve as a display cabinet. The inner case will remain in its uppermost position until lock 7 is actuated as hereinbefore described to release the oil pressure and cause it to be lowered.

If one has forgotten the correct combination it is practically impossible to correctly meet the oil passages.

If one then tries to start the hydraulic pump 14 even though a little deviation from mesh still existed, the oil pressure will rapidly build up and cause an alarm to sound by means of an oil alarm valve 171. This is because a pressure, for example 75 kg/cm^2 , has been set for the alarm valve whereas the normal pressure of the oil is 70 kg/cm^2 . If the combination is incorrect the oil pressure increases and actuates an electric circuit to sound the alarm.

Without the power switch being on the hydraulic oil cannot elevate the casing to its upper position.

(38)

WHAT I CLAIM IS: —

1. A safe comprising an outer protective casing,
an inner storage case adapted to be received within the
outer casing, hydraulic lifting means adapted to elevate
5 said case from within the casing to an outer position
wherein access to the interior of the case is available,
the case being retractable into the casing where such
access is prevented, and lockable hydraulic switching
means adapted to control a hydraulic fluid path to said
10 lifting means whereby to allow or prevent said elevation
of the case.

2. A safe according to claim 1 wherein said lockable
hydraulic switching means comprises two combination locks
each having a plurality of hydraulic fluid passages adapted
15 to register with other passages to complete said fluid path
for elevating said case.

3. A safe according to claim 2 in which each of said
locks comprises a rotatable core member and a rotatable
tubular member engaged around the core member and located
20 in a body portion, each member and the body portion having
fluid passages formed therein, the passages being adapted
to register to complete said fluid path through the lock.

4. A safe according to claim 2 or 3 wherein one of
said locks is provided with one or more further fluid
25 passages adapted to return hydraulic fluid to a reservoir
whereby the inner case is retracted into the casing under
gravitational action.

5. A safe according to any one of the preceding
claims including a lock arranged to actuate a motor to
30 pressurize hydraulic fluid in said fluid path.

6. A safe according to any one of the preceding claims wherein an alarm valve is mounted upstream of the lock means in said hydraulic fluid path.

5 7. A safe according to any one of the preceding claims wherein said casing is formed from layers of steel plate, asbestos and cast iron.

8. A safe substantially as hereinbefore described with reference to the accompanying drawings.