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Guns are widely distributed throughout the United States. Sixty-five million handguns are possessed nationwide, and in California 100,000 handguns were purchased in the first six months of 1999.[1] Gun control advocates contend that over the years there has been an alarming increase in deaths and injuries from firearms, whether purposeful or accidental, and that firearms are inherently dangerous. As a result, a very vocal portion of the population has demanded significant limitations in the distribution of firearms to the general public, and/or modification of guns to include mechanisms that prevent inadvertent discharge or use by someone other than the authorized or licensed owner.

States have responded to this demand in various ways. Recent court decisions in both California and New York have found gun manufacturers liable for criminal use of the products they sell. The State of New Jersey has included in its Fiscal Year 2000 budget a grant to the New Jersey Institute of Technology ("NJIT") to analyze personalized weapons technologies. The Center for Manufacturing Systems at NJIT, under the direction of Professor Donald Sebastian, will advise the New Jersey legislature of the technical feasibility of smart gun technology as a precursor to possible legislation. In addition, it established a comprehensive web site with an extensive listing of relevant information on personalized weapon technology.[2] Several other states are also considering restrictions on the use and/or sale of guns.

The resulting legislation will likely focus on the gun user. For the public at large, legislation will focus on a combination of restrictions limiting access to guns,

requiring locking mechanisms, and implementing technology that restricts gun use to the authorized owner. For those requiring ready access to guns, such as police officers and military personnel, legislation likely will not restrict ease of use, but will instead limit use to the authorized users or group of users.

The demand for safer guns has resulted in innovations in the area of guns and gun storage technology, as reflected in patents issued by the United States Patent and Trademark Office ("USPTO"). This article addresses aspects of patent law, including inventor rights, infringement, and assignment issues, which affect commercial implementation of gun safety devices. This article also provides an overview of existing patented gun technologies, specifically focusing on the concepts of safe guns and smart guns.

Background Regarding United States Patent Law and Gun Safety Property

Anyone who invents or discovers a new and useful process, machine, manufacture, composition of matter, or improvement may obtain a patent covering that invention.[3] Generally speaking, an invention is "new" if it was not known or used by others, patented or published by others prior to the date of invention by the patent applicant,[4] or if it would not have been obvious to one skilled in the art at the time of invention.[5]

A patent includes a detailed description of the invention. It often includes a description of related prior inventions disclosed in published articles, product literature and patents (prior art), and sets forth an explanation of how the current and prior inventions differ. Also included is a set of claims that specifically provide a statement of the invention. An issued patent grants the inventor the right to prevent others from making, using, selling, or offering the invention for sale for the life of the patent.[6] A U.S. patent, depending on its

date of issuance, has a life of 17 years from the date of issuance, or 20 years from the date of filing the application. It is common for a patent to cover an improvement to a prior patented device. Thus, in order to use the patented improvement, one may have to use the invention claimed in an earlier patent. The owner of a patent has the right to practice the claimed invention only if claims of earlier expired patents will not be infringed upon. Therefore, if the earlier patent has not expired, using its claimed invention in a subsequent invention would constitute infringement, and the owner of the earlier issued patent may take legal action to enjoin the infringing use. Unfortunately, this can result in gun manufacturers being less likely to incorporate firearm improvements for fear of patent infringement.

The grant of a patent also includes the right to transfer some or all of patent rights to another.[7] This transfer is by assignment or an exclusive or non-exclusive license. Since many gun safety device patents have been issued to individuals and do not appear to be assigned to manufacturers of firearms, the right to assign or license the claimed invention may be extremely important in implementing the new safety devices. If the patent is an improvement on an earlier patented technology, it may be necessary for a gun manufacturer to purchase or license several overlapping patents in order to commercialize a particular gun safety concept. The result is a myriad of assignments, licenses, and ownership rights questions.

Preparation of this article included a review of over 140 U.S. patents related to gun technology issued over the last 20 years, along with the some of the disclosed prior art.[8] While comprehensive, this review was not exhaustive. Other relevant patents exist, and there are many relevant earlier issued patents that have since expired and have entered the public domain. In addition, there are many patents issued by foreign patent offices covering similar or related technologies. Finally,

there are patents for security systems and identification systems that are not specifically directed to weapons, but may be applied to weapons. For example, many museums use secured storage systems and devices that limit access through building and vehicle doors, such as key locks, electronic combination locks, and personal identification systems. Clearly, there exist countless options for gun safety devices.

Existing safety modifications to firearms divide guns into two groups: safe and smart guns, often referred to as personalized weapons technology. Safe gun legislation focuses primarily on weapons sold to the public at large. These guns include locks or alarms, such as key locks, trigger locks, locked storage containers, timing mechanisms, and function-interrupting mechanisms such as user-operated components that block movement of the bolt or firing pin. Smart gun legislation, on the other hand, focuses primarily on weapons for users requiring immediate access, such as police officers. These guns include mechanisms that recognize and function only for an authorized user, and may also include means to prevent firing the weapon at certain people.

Relevant Intellectual Property of Safe Guns

Guns have for many years included integral safety devices intended to prevent inadvertent or accidental firing. However, patents to such devices are not included in this discussion. Safe guns generally include storage container locks, trigger locks, and other locking and alarm devices. The safe gun patents, listed in Attachment I, are all intended to prevent access to weapons or use of weapons by unintended individuals, such as children, by limiting use of the weapon to persons having an access code or key.

A review of patents for trigger locks or other locking mechanisms applicable to guns reveals that there

are many different mechanical devices intended to have the same result. The list of Locked Storage Containers presents an overview of locked boxes, access alarm systems, and methods of restricting transportation of guns from the storage site. Several of these techniques are so restrictive that they render the weapon completely nonfunctional. The list of trigger locks and other locking systems is extensive, as there are many different ways to structure a trigger lock. However, the problem from a safety perspective is that the lock can be by-passed by a variety of mechanical keys, combination locks, and electronic access devices.

Other alarms, locking systems, and access devices are installed directly into the weapon. They utilize a wide variety of methods for restricting functioning of the gun by blocking various moving parts (hammer, trigger, magazine, ammunition loading functions), or by blocking the bore. In many instances the safety device also includes alarms triggered by movement of the weapon, tampering with the device, or attempts to enter an erroneous access code.

Relevant Intellectual Property of Smart Guns

Smart guns include mechanisms that will only fire when grasped by an authorized user, and/or cannot be fired at certain persons or in restricted environments. For example, they may be programmed to recognize the finger print or palm print of the weapon owner, may be able to function only in close proximity to a signal transmitter worn by the owner, or may not be able to be fired if pointed at a person carrying a recognizable signal transmitter. While these mechanisms may apply to weapons distributed to the general public, primarily application would be to weapons distributed to law enforcement personnel. Using this technology, it is possible for officers to carry an activating transmitter that would send a signal to prevent the weapon from being

fired at anyone carrying such a transmitter. This would not only prevent an assailant from taking an officer's weapon and using it on the officer, but would also prevent one officer from accidentally shooting another officer. Unfortunately, the result would be that a black market would exist among criminals for such blocking devices so that they too would be protected from such guns.

An extensive review of smart gun technology and feasibility can be found in the *Final Report on the Smart Gun Technology Project* prepared by Sandia National Labs.[9] The Project's objective was to eliminate the capability of an unauthorized user from firing a law enforcement officer's firearm, and to identify technologies that are "highly reliable, very safe, very secure and meet stringent law enforcement requirements."[10] The incidents of officers injured by use of their weapon by others are detailed in this report.

Various modalities were evaluated, and all had at least one negative rating. The highest rated technologies were receiver/transmitter systems with a discrete RF signal transmitter, preferably with a short distance of operation such as with a ring or wristband transmitter, that avoids interference signals. Touch memory systems, which require that the officer wear a ring contacting the weapon surface in order to operate the weapon, were ranked next. Third ranked were finger print recognition systems. However, prototypes tested were bulky, making installation in a weapon difficult. Also, the print recognition time was too long for practical use. Magnetic rings ranked fourth. Voice recognition ranked lower because of unreliability as the voice changed due to fatigue, stress, colds and age. Mechanical systems such as key locks, combination locks, and bar coding were all considered to be unacceptable, primarily because they were too clumsy and time consuming.

Response by gun manufacturers to the concept of a "smart gun" is mixed. Based on the Sandia Report, Colt

has developed the Colt EP-1 and EP-2 which incorporate a weapon mounted receiver and an owner-worn RF transmitter, such as in a bracelet. The EP-2 incorporates a much smaller transponder, an integrated power supply, a RF module in the handgrip, a laser-aiming device, an improved trigger blocking mechanism, and an onboard diagnostic display. Colt indicates there is a patent pending covering this product. On September 29, 1999, Colt announced that it was spinning off its smart gun technology into a new company named iColt. This spin-off is seen as an attempt by Colt to distance itself from controversy surrounding the smart gun technology, as gun advocates see the guns as a concession to firearm opponents and anti-gun lobbyists.

Fulton Arms Inc. has also developed and patented smart gun technology. An early version of its SSR-6 revolver was introduced in 1993. The revolver uses a magnetic interlock activated by a ring worn by the user. Not all gun manufacturers are eager to enter the smart gun market. Beretta U.S.A Corporation has taken the position that smart gun technology is "undeveloped and unproven" and "could actually increase the number of fatal accidents involving handguns."[11] Their position is that locks and other security devices are effective and available.

Other particularly notable smart gun patents also exist. Patents have been developed for techniques that lock or unlock weapons using an external signal unique to a user or group of users. U.S. patent number 5,937,557 lists several patents to finger print sensors and other individual physical characteristics (such as iris prints) for weapon enablement and security access. In addition, U.S. patent number 5,675,925 describes the use of a satellite relay system that would allow a large number of weapons to be rendered non-functional. A typical scenario would be in the contest of a military action where lost, stolen or captured weapons could be reprogrammed and rendered inoperative.

Conclusion

As a result of increasing public demand, it is inevitable that legislation will be enacted restricting access to guns. Legislation will likely involve the placement of safety requirements on legally available handguns that will make access and/or use by unlicensed, and unintended individuals more difficult. A broad range of technologies is available to accomplish this task, primarily falling under the umbrellas of safe guns and smart guns. However, many issues affect the implementation of these gun safety devices including: aspects of patent law and general issues of feasibility and effectiveness. Thus, a review of currently patented and future innovations provides insight into the feasibility of such legislation.

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SAFE GUNS

PATENT NO.	ISSUE DATE	INVENTORS	ASSIGNEE	COMMENTS
Storage Container Lock				
5,901,589	5/11/99	Cordero, Carlos		Spring biased latching mechanism with hidden unlatching trigger
5,701,770	12/30/97	Cook et al		Finger print recognition
5,598,151	1/28/97	Torii, Dennis		Push button lock
5,525,966	6/11/96	Parish, Lane	Eagle Electr. Inc	Holster retainer with alarm
5,416,826	5/16/95	Butler, Gerald		Storage box with telephone connection to external site, activated by opening box without disabling using key word recognition system
5,416,472	5/16/95	Torii, Dennis		Box with remote alarm and key pad access code
5,379,179	1/3/95	Graves, David		Weapon enclosure which also attaches to the users wrist so the gun cannot be taken
5,068,989	12/3/91	Martin, John		Heavy storage box with gun tethered to box. Limits transport and concealment.
4,768,021	8/30/88	Ferraro, Michael		Box with alpha-numeric key pad for access or fingerprint recognition; also pressure sensitive pad and alarm
4,688,023	9/18/87	McGill et al	Stephen Highsmith	Alarm attached to box lid; shut off inside box with timing circuit
4,624,372	11/25/86	Brolin, Charles		key lock and audible alarm on cabinet
Trigger Lock				
5,829,179	11/3/98	Carter et al		Two interlocking combination locks
5,828,301	10/27/98	Sanchez, Luis	Micro ID, Inc	Electronic holster lock
5,720,193	2/24/98	Dick, Daniel		Programmable multiple button lock
5,713,149	2/3/98	Cady et al.	Trigger Block, Inc	Electronic trigger lock
5,704,151	1/6/98	West etal	James Paul West	Battery powered microprocessor
5,680,723	10/28/97	Ruiz, Michael		Key lock
5,640,860	6/24/97	Carter et al		Tamper resistant combination lock
5,638,627	6/17/97	Klein, Helmut	Franzen Int., Inc	Lock with multiple number wheels

5,561,935	10/8/96	McCarthy et al.	Coastal Trading Co.	Key pad access code
5,544,440	8/13/96	Stockman, Greg.		Quick-release mechanical lock
5,535,605	7/16/96	Werner, Ted	U.S. Marketing Corp.	Rotating cylinder combination lock
5,535,537	7/16/96	Aviganim, Meir		Key lock
5,515,634	5/14/96	Kong, Yu		Screw-treaded lock destroyed by improper opening
5,515,633	5/14/96	Harris, Jon		Trigger shield; hidden quick release
5,487,234	1/30/96	Dragon, Paul		Audible alarm, motion sensor with timer; requires unlocking in a fixed time period.
5,433,028	7/18/95	Novak et al		Pin movable by a magnetic to free trigger in trigger guard
5,419,068	5/30/068	Pages et al.		User settable electron lock
5,392,552	2/28/95	McCarthy et al.		Key pad unlocking code entry
5,367,811	11/29/94	Sansom, Kenneth		Mechanical lock construction
5,283,971	2/8/94	Fuller et al.		Battery powered,electronic lock
4,509,281	4/9/85	Dreiling et al		Rotatable trigger lock
4,499,681	2/19/85	Bako et al.	Presto Lock, Inc.	Mechanical combination lock
4,299,045	11/10/81	Cervantes, Ramon		Keyless lock operational in the dark
4,213,263	7/22/80	Brouthers, Paul	DWA Assoc.	Trigger guard assembly
4,182,453	1/8/80	Worswick, Alan		
4,136,475	1/30/79	Centille, Edward		Locking pin shiftable to block trigger movement
4,084,341	4/18/78	Cervantes, Ramon		
3,978,604	9/7/76	Smith, Joseph		Unlocked by a magnetic ring
3,964,366	6/22/76	Atchisson, Maxwell		Trigger guard safety
3,956,842	5/18/76	Ballenger, Robert	Central Specialties Co.	Trigger lock
3,624,945	12/71	Foote		Key lock
3,616,559				Trigger lock
2,667,274	1/54	Diebold		

1,063,921		Hempstead		Trigger guard lock and rifle butt interlock
Other Locking & Alarm Devices				
5,930,930	8/3/99	Howell, Duane		Cylinder combination lock in gun body
5,913,666	6/22/99	Perkins, Richard		Key lock
5,903,994	5/18/99	Tange, Mark		Mechanical safety
5,860,241	1/19/99	Waters, Michael		Electronic combination code
5,782,029	7/21/98	Brooks, Frank	Saf T Lok Corp	Cylinder lock in base of handle
5,758,524	6/2/98	Yu, Sandy		Magnet on ring finger unlocks blocking mechanism in the handle
5,743,039	4/28/98	Garrett		Combination lock in Handle
5,732,497	3/31/98	Brooks, Frank	Saf T Lok Corp	Combination lock in gun body
5,715,623	2/10/98	Mackey, Earl		Movement of firearm produces an audible alarm at a remote location
5,671,560	9/30/97	Meller, Yehuda	Binyamin & Mordechai Yirmiyahu	Key activated moveable control member in hand grip
5,669,252	9/23/97	Bentley, James		Key lock in an injection port insert for a shot gun; locks action slide assembly
5,621,996	4/22/97	Mowl, George	Pride Cast Metals, Inc.	Clam shell encasing device opened by key or external electronic signal
5,619,817	4/15/97	Jones, David		Magnetic internal piston which interrupts function or trigger lock with timer circuit and access code entry means
5,581,927	12/10/96	Meller, Yehuda	Binyamin & Mordechai Yirmiyahu	Key activated moveable control member in hand grip
5,517,780	5/21/96	Haber, Terry	Habley Medical Tech. Corp.	Unlocking switches in handle grip
5,508,683	5/16/96	Hall, James		Alarm sounds when handle is gripped or gun is moved
5,488,794	2/6/96	Arrequin, Phillip		Barrel bore blocker padlocked to trigger guard
5,465,519	11/14/95	Blanck, Edward	Blue Sky Productions	Bolt lock, key release
5,437,117	8/1/95	Mackey, Earl		Motion sensor and audible alarm placed in chamber; prevents firing
5,423,143	6/13/95	Martin, John		Timer activated disabling device , signal recognition disablement
5,419,069	5/30/95	Mumbleau et al.		Breech block
5,392,552	2/95	McCarthy et al		Electronic locking device

5,361,525	11/8/94	Bowes, Kenneth		Key attached to a lanyard worn by user
5,335,521	8/94	Brooks, Frank	Saf T Lok Corp	Grip lock assembly
5,235,763	8/93	Nosler et al		Key operated hammer block
5,229,532	7/93	Brooks, Frank	Saf T Lok Corp	Grip lock assembly
5,223,649	6/29/93	Claridge, Joseph	Claridge Hi-Tech, Inc	Bolt hold-down and firing pin safety
5,196,827	3/23/93	Allen et al		Platform with weight detector and alarm to indicate removal of gun from surface
5,192,818	3/9/93	Martin, John		Accelerometer switch activator and timing circuit; 24 hour battery limits functionality following activation when time expires.
5,171,924	12/15/92	Honey et al	Kiss Lock Enterp.	Barrel bore blocking device
5,140,766	8/25/92	Brooks, Frank	Saf T Lok Corp	Push button lock
5,108,019	4/28/92	Woodward et al.		Audible alarm on holster
5,090,148	2/25/92	Brooks, Frank	Saf T Lok Corp	
5, 081,779	1/21/92	Pack, Harold		Hammer locking pin
5,022,175	6/11/91	Oncke et al		Hammer unlocking system electronically activated from a remote key pad
4,987,693	1/29/91	Brooks, Frank		Combination push button lock
4,833,811	5/30/89	Wilkinson, Earl		Release pin in handle tied to holster; moving weapon to far from holster pulls pin and disables the weapon
4,777,753	11/18/88	Stancato, Albert		Projectile catcher locked in barrel
4,763,431	8/16/88	Allan, et al		Electronic or mechanical lock
4,658,529	4/21/87	Bertolini, William		Mechanical firing pin interrupting device
4,512,099	4/23/85	Mathew, Ronald		Mechanical key
4,302,898	12/12/81	LaRue, Earl		Safety firing button
4,457,091	7/3/84	Wallerstein, Rbt.		4 button sequence switch in handle
4,398,366	8/16/83	Wernicki		Dummy round preventing operation
4,162,586	7/31/79	Pachmayr, Frank		Soft handle that must be squeezed to operate
4,090,316	5/23/98	Volkmar, Will	Carl Walther, Sportwaffen-Fabrik	Mechanical firing pin interrupting device
4,105,885	8/8/79	Orenstein, Henry		Ring inserted into recess in weapon

3,882,622	5/75	Perlotto	Factory installed lock on safety latch mechanism
3,768,189	10/30/73	Goodrich	Combination barrel lock
3,735,519	5/73	Fox	Combination tumbler lock on weapon's safety
3,673,725	7/72	Cravener	Mechanical key blocker hammer movement
3,553,877	1/71	Welsh et al.	Key lock on integral safety on gun
3,462,869	8/69	Wallace	Key lock in hammer
3,419,728	12/31/68	Wilson	Push button switch on holster
2,945,316	7/60	Mulno	Key to unlock firing mechanism
2,553,995		Young	Finger operated safety
2,237,334	8/43	Parker	Locking mechanism in barrel
2,041,661		Lepp	Rifle butt safety
1,484,671	2/24	Pomeroy	Combined magazine and trigger safety interlock
1,210,459		Gile	Rifle butt safety
834,722		Tambour	Hand grip safety
633,939	9/1899	Ackerman	Shot gun lever lock

SMART GUNS

PATENT NO.	ISSUE DATE	INVENTORS	ASSIGNEE	COMMENTS
Finger Print				
5,937,557	8/17/99	Bowker et al.	Arete Associates	Fiber optic finger print detection
5,915,936	6/29/99	Brentzel		Palm print sensor
5,603,179	2/18/97	Adams, Heiko		Trigger finger print reader
4,467,545	8/28/84	Shaw, Frederick		Activated by finger print or palm print of several authorized users
Voice Print				
5,636,464	6/10/97	Ciluffo, Gary		Audio recognition unit, memory also stores owner information
5,570,528	11/5/96	Teetzel, James		Voice recognition activated lock in hand grip
5,560,135	10/1/96	Ciluffo, Gary		Word recognition activated lock

5,546,690	8/20/96	Ciluffo, Gary		Word recognition activated lock
5,459,957	10/24/95	Wilner,Guy		Voice comparison activated solenoid
4,003,152	1/18/77	Barker, et al	Precision Thin Film Corp.	Voice prints or brain waves
Direction Disabling				
5,564,211	10/15/96	Mossenberg, et al	O.F. Mossberg & Sons	Gun deactivated if pointed at owner carrying transmitter
5,448,847	9/12/95	Teetzel, James		Remote IR or electromag netic signal transmitter for friend recognition and disablement; internal trigger lock
3,400,395		Ash		Electromagnetic wave transmitter and receiver
2,472,136		Whitlock		Electromagnetic wave transmitter and receiver
Signal Receiver				
5,953,844	9/21/99	Harling et al	Quantum Leap Research Inc.	Transmitter attached to trigger seeks authorizing signal
5,924,232	7/20/99	Rhoden et al.	Programmable Safety Systems	Voice recognition, or key pad or signal transmitter in a watch, bracelet or other worn item
5,896,691	4/27/99	Kaminski et al	Colt's Manuf. Co., Inc.	Transceiver with transponder carried by user
5,675,925	10/14/97	Wurger,Franz	Mauser-Werke Oberndorf Waffensysteme	Transmitter/receiver possibly with a satellite relay
5,651,206	7/29/97	Matarazzo, Fred		Magnetic locking piston in handle withdrawn by a ferromagnetic disk in palm of glove worn by owner
5,603,180	2/18/97	Houze, Wade		Handle encloses high voltage source, external electrodes and a receiver; an external signal activates the high voltage source to give a shock to anyone holding the handle
5,416,812	10/31/95	Bennett, Emeric		Transmitter in gun, transponder in owners ring
5,168,114	12/1/92	Enget, Jerome		Transmitter/receiver unlocking mechanism
5,062,232	11/5/91	Eppler, Larry		Signal transmitter on finger or palm; matching detector on weapon to enable
5,016,376	5/21/91	Pugh, Kenneth	Fulton Arms? (not assigned on the face of the patent)	Deactivation of lock by

				magnetized ring or microchip carried by owner
4,682,435	7/28/87	Heltzel, James		Operation prevented by removal of external transmitter carried by owner
4,563,827	1/14/86	Heltzel, James		External signal required to operate
4,488,370	12/18/84	Lemelson, Jerome		External activation signal
4,354,189	10/12/82	Lemelson, Jerome		External activation signal
4,205,589	6/3/80	Engler et al		External activation signal
4,189,712	2/19/90	Lemelson,Jerome		Finger ring transmitter
4,154,014 key	5/15/97	Smith, Joseph		Magnetically activated
4,110,928 key	9/78	Smith, Joseph		Magnetically activated
4,105,885	8/8/78	Orenstein, Henry	Consumer Concepts, Inc.	Ring on owners finger is insertable in recess in handle of gun to unlock
4,003,152	1/18/77	Barker et al	Precision Thin Film Corp	External signal required to activate
3,939,679	2/24/76	Barker et al	Precision Thin Film Corp.	External Transmitter to activate
Other				
4,970819	11/20/90	Mayhak		Grip pattern recognition

Endnotes

1. James K. Hahn, *Stop Gun Violence: We Must Change the Way Firearms are Designed and Distributed in the U.S.*, L.A. DAILY NEWS, October 10, 1999.

2. Personalized Weapons Technologies Project (visited February 21, 2000) <http://www.njit.edu/smartgun/resources>.

3. *See* 35 U.S.C. § 101.

4. *See* 35 U.S.C. § 102 and § 103 for an explanation of what is meant by the term "new."

5. *See* 35 U.S.C. § 103(a). For other restrictions on what is patentable, *see* 35 U.S.C. §§ 103 (b)-(c).

6. *See* 35 U.S.C. § 271.

7. *See* 35 U.S.C. § 261.

8. *See* Attachments I and II.

9. NTIS, U.S. DEP'T OF COMMERCE, No. DE96013854 (May 1996).

10. *Id.* at 12.

11. Company Press Release (visited January 4, 1999) <http//:www/berettausa.com/smartfun.htm>.