

# The Evolution of Digital Cameras – A Patent History

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Just about 40 years ago, a young electrical engineer working at the offices of Eastman Kodak in Rochester, NY, developed a product that would upend the entire world of photography. Since that time, the technology has exploded into consumer markets and has proliferated into our daily lives, from camera components included in smartphones to high-quality megapixel systems which provide professional-grade images. All of this came to be thanks to the development of light-sensitive semiconductor devices capable of storing and transmitting light exposure information to create a digital image.

Here at IPWatchdog, we like to return regularly to our [Evolution of Technology series](#) to detail the development of a popular consumer technology across the years. Today, with our recent focus on patents issued to companies developing digital photography products, we wanted to dive in a little more deeply to look at the history of development in this field of technology.

The chronology of digital photography development comprises the establishment of the JPEG image standard and the development of liquid crystal display screens. It also closely follows the decline of a major American developer of imaging products and the subsequent shift in the entire photography market.



Steve Sasson, inventor of the digital camera, receives National Medal of Science from President Obama on 11/17/2010.

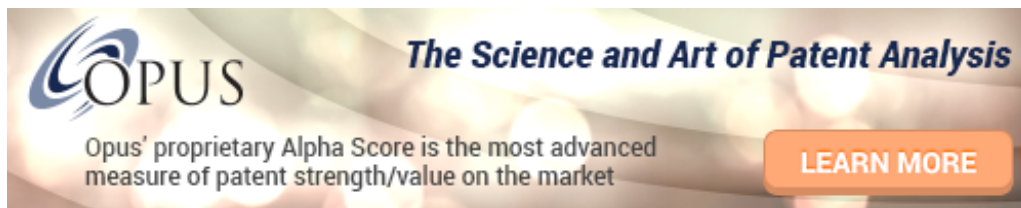
## Early Digital Imaging Technologies

The earliest development which is touted as an early harbinger of digital photography is the invention of the digital image scanner by Russell A. Kirsch, one of the early fathers of computing. [In 1957, he created a rotating drum apparatus and image scanning programming for the Standards Eastern Automatic Computer](#), the world's first internally programmable computer, which he developed with colleagues while working at the National Bureau of Standards. The first scanned image, a five centimeter by five centimeter image of Kirsch's son, only measured 176 pixels along any side.

A little more than one decade later, in 1969, [the charge-coupled device \(CCD\) was created at AT&T Bell Labs by](#)

**joint inventors Willard Boyle and George E. Smith.** The semiconductor device was capable of gathering data from photoelectric sensors and then transferring that charge to a second storage capacitor. As the data was transmitted, the analog data from the light-sensitive chip was converted into a digital grid which could render an image from that data. Interestingly, there are some reports that this invention, which laid the groundwork for digital photography, was conceived over the course of one hour; **the story goes that Boyle and Smith designed the innovation under pressure of having their departmental funding cut by AT&T Bell Labs.**

**U.S. Patent No. 3858232**, issued in December 1974 to Bell Telephone Laboratories Inc. under the title *Information Storage Devices*, protected a charge transfer apparatus designed for the storage and serial transfer of charge carriers, which contain pixel information. This patent lists both Boyle and Smith as inventors. Bell Laboratories was the setting for even more development in early digital imaging technologies. In April 1978, the USPTO issued **U.S. Patent No. 4085456**, entitled *Charge Transfer Imaging Devices*, to Bell Labs. This patent protected a charge transfer area imaging device designed for solid state imaging technologies which is more cost-effective while preventing against smearing aberrations created by similar image capture devices. Invented by Michael Francis Tompsett, this technology received a patent six years after the application was first filed, a span of time which encompasses a major step toward modern digital photography.



### **Steve Sasson and Kodak's Digital Photography**

In 1973, Steve Sasson was a young engineer hired by Eastman Kodak, one of the few electrical engineers employed by a company that was much more renowned for its mechanical and chemical engineering developments at that time. Early on, **Sasson was assigned a project to explore the capabilities of a charge-coupled device created by Fairchild Semiconductor** which could store and transmit image information at a size of 100 pixels by 100 pixels.

By December 1975, Sasson built a prototype for a working camera utilizing the CCD, comprised of a lens from an eight-millimeter film camera, an analog-to-digital converter from a Motorola digital voltmeter, and a digital-data cassette recorder for storing image data. Using this assembly, Sasson and other Kodak researchers could capture an image and record it to a cassette within 23 seconds.

Sasson's innovation can be seen in the technology disclosed within **U.S. Patent No. 4131919**, which is titled *Electronic Still Camera*, issued in December 1978. This patent, which lists a co-inventor, Gareth A. Lloyd, protects an electronic still camera containing a solid state light-responsive device for producing signals indicative of optical images, as well as the means for recording signal data on a non-volatile medium in real time. The stream rate of the image signal is slowed while transmitted, allowing image data to be written on an inexpensive recording medium like audiograde magnetic tape.

Although Kodak was responsible for the early development of digital photography, **it was largely killed by its own creation when the corporation couldn't respond as quickly as other developers of digital photography in the 1990s and early 2000s.** Sasson personally believed that digital cameras would need to achieve a resolution of at least two million pixels before they were truly accepted as a viable option to film photography, and Kodak decided to focus on continuing to sell its popular film products rather than develop digital photography products to compete against its own film versions.

## Early Consumer Models: From Apple to Canon to Nikon

By the very tail end of the 1980s, a few companies began entering the market of digital photography, entering a consumer sector where some saw the opportunity to undermine Kodak's leading market position in consumer cameras. **The first digital camera available in the United States was the Dycam Model 1**; unveiled in 1990, it was capable of recording images at a maximum resolution of 376 pixels by 240 pixels.

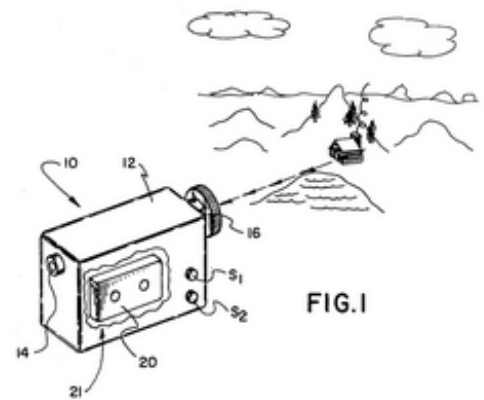
A few developments around this time enabled the further proliferation of digital cameras in consumer markets. First, in 1992, **the Joint Photographic Experts Group developed the first codec for image compression, which we know today as the JPEG image file format**. A solid-state memory card also had to be developed to improve upon the storage capacity of magnetic tape and floppy disks used by prior digital camera systems.

Using Kodak's technology, Apple released the QuickTake 100 digital camera, **considered to be the first widely available digital camera marketed to consumers in the United States**. The QuickTake 100 had a max resolution of 640 pixels by 480 pixels, captured images in 24-bit color and could store up to 24 photos. Kodak had developed some digital camera systems for use in conjunction with Nikon camera bodies a few years prior, but these systems cost around \$20,000 and required a consistent wired connection to a hard-disk system.

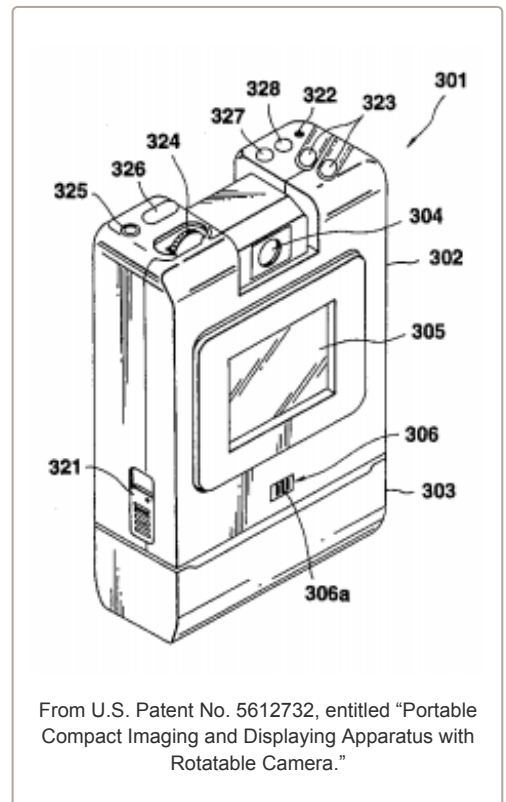
Innovations in digital camera and image display technologies would come about every couple of years after the product became commercially available. The development of liquid crystal display (LCD) screens enabled camera owners to quickly review images which have just been captured. The Casio QV-10, released in 1995, was the first consumer digital camera including one of these LCD screens. In March 1997, the USPTO assigned **U.S. Patent No. 5612732**, entitled *Portable Compact Imaging and Displaying Apparatus with Rotatable Camera*, to Casio Computer Co. It protects a pocketable imaging apparatus with an LCD screen capable of displaying images found on a camera's storage device.

The creation of digital single-lens reflex (SLR) cameras is notable for the quality of digital images created by cameras using lenses meant to replicate the quality of 35-millimeter film. It's also notable for the way which it has set the current market for digital photography, currently dominated by Canon and Nikon. The Nikon D1 was first released in 1999, with a resolution of 2,000 pixels by 1,312 pixels, and Canon followed quickly after with the EOS D30 in 2000, which could capture images measuring 2,160 pixels by 1,440 pixels. One of the earlier digital SLR camera-related patents we could find was **U.S. Patent No. 6731341**, titled *Electronic Still Camera with Casing Containing Image-Capturing*. Issued to the Nikon Corporation in May 2004, it protects a digital SLR camera with an improved configuration to compensate for an improper weight balance created by the electronic components which makes prior versions cumbersome to hold and operate.

Steve Sasson at the White House, 11/17/2010



From U.S. Patent No. 4131919, titled "Electronic Still Camera."



## Current Technologies

Digital cameras and related imaging technologies are still in a period of robust development among a plurality of companies from all over the world. This past week on IPWatchdog, our Companies We Follow series paid attention to digital photography innovations from Canon and Nikon, two of the current leaders in this field. Today, we're looking at the wider world of digital photography development to find even more innovation which may be of great interest to our readers.

We noticed a variety of patents in this field which have recently been awarded to Samsung, a global leader in electronic device development. An intriguing facial recognition technology for the production of sharper facial images by digital cameras is disclosed within [U.S. Patent No. 8786760](#), which is titled *Digital Photographing Apparatus and Method Using Face Recognition Function*. Assigned to Samsung Electronics Co., this patent protects a digital camera comprised of a face recognition unit for identifying a plurality of faces, and an autofocus area setting unit to create autofocus zones for multiple groups of faces.

We also noticed another Samsung technology directed at creating higher quality images, protected by [U.S. Patent No. 8786749](#), entitled *Digital Photographing Apparatus for Displaying an Icon Corresponding to a Subject Feature and Method of Controlling the Same*. This patent protects a digital photographing apparatus capable of detecting facial, dress and other features in a subject and displays an icon which informs a camera user that a subject is adequately posed for a picture.

[As we've seen in our previous coverage on Nikon](#), interchangeable lenses have been a growing field of





