

Early Requirements for Mechanical Voting Systems

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Pre 19th Century Reforms

Viva voce voting common

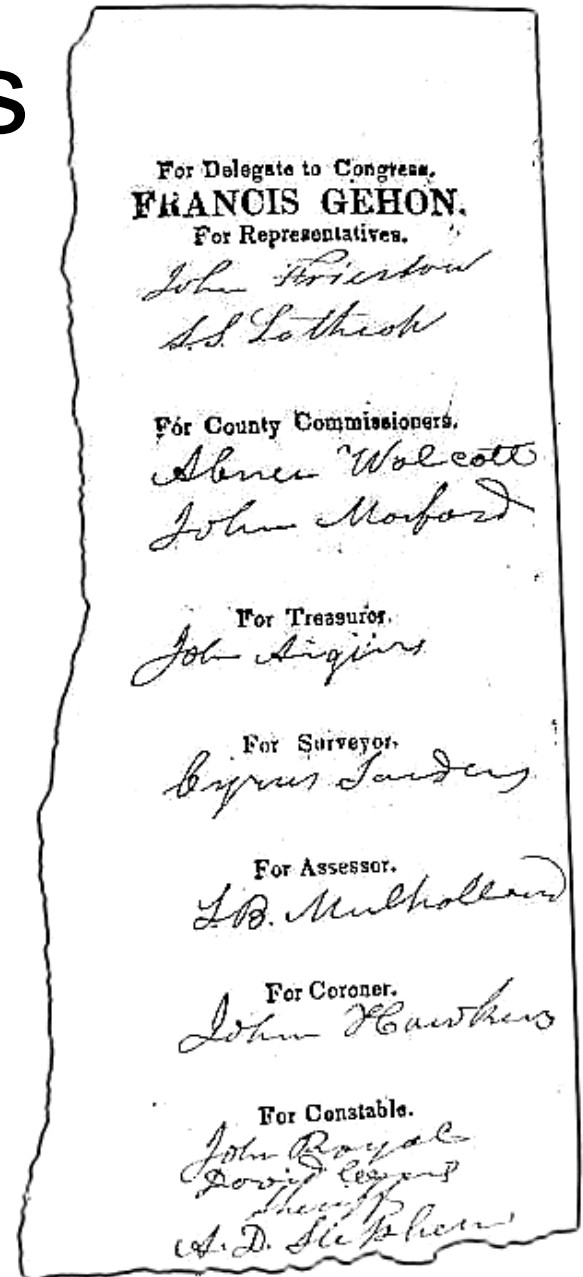
- too much transparency

No secret ballot

- partisan ballot printing
- problems with handwriting

In the US, complex elections

- Example: 1839 ballot from Iowa
- 9 races
- 3 multi-candidate offices

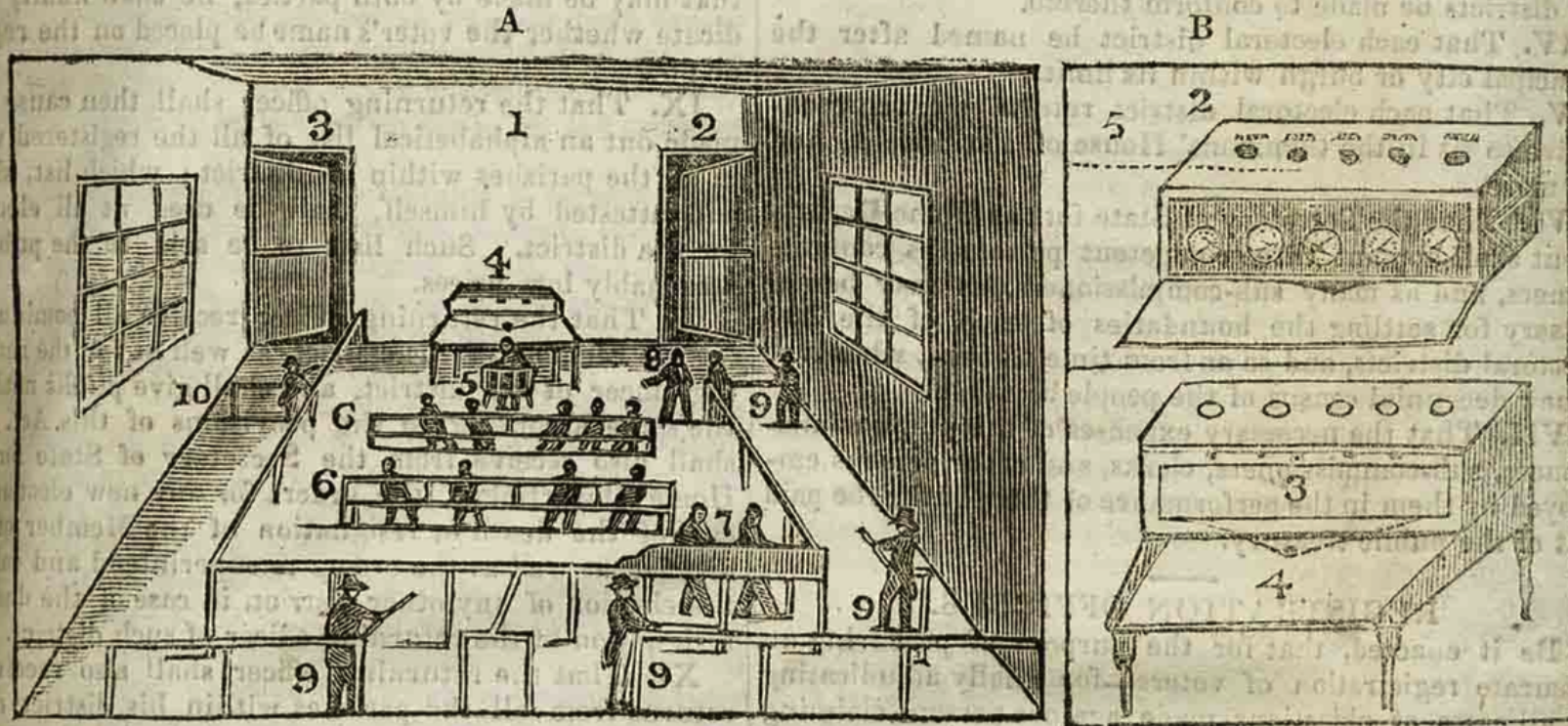


THE PEOPLE'S CHARTER.

2

1839.

THE PEOPLE'S CHARTER; BEING THE OUTLINE OF AN ACT TO PROVIDE FOR THE JUST REPRESENTATION OF THE PEOPLE OF GREAT BRITAIN IN THE COMMONS' HOUSE OF PARLIAMENT; EMBRACING THE PRINCIPLES OF UNIVERSAL SUFFRAGE, NO PROPERTY QUALIFICATION, ANNUAL PARLIAMENTS, EQUAL REPRESENTATION, PAYMENT OF MEMBERS, AND VOTE BY BALLOT, PREPARED BY A COMMITTEE OF TWELVE PERSONS, SIX MEMBERS OF PARLIAMENT AND SIX MEMBERS OF THE LONDON WORKING MEN'S ASSOCIATION, AND ADDRESSED TO THE UNITED KINGDOM.



The Pattern

New requirement discovered

Chartists discovered need for secret ballot.

Insiders rarely pose new election requirements.

Reformers demand adoption of the requirement

Rallies, petitions, lobbying, riot and revolution

Inventors produce mechanisms that meet it

Reformers need proof that requirement can be met.

Inventors frequently part of reform movement.

Secret Ballots

- First practical implementations in Australia
 - Eliminated machines, pure paper ballot
 - Details vary between Australian states
 - State of Victoria model widely exported
- Controversial
 - Where suffrage limited, secret ballot is bad
 - Egalitarian societies don't need it
 - Points made by John Stuart Mill in On Democracy

The Ballot Act, 1872, Britian

2. In the case of a poll at an election the votes shall be given by ballot. The ballot of each voter shall consist of a paper (in this Act called a ballot paper) showing the names and description of the candidates. Each ballot paper shall have a number printed on the back, and shall have attached a counterfoil with the same number printed on the face. At the time of voting, the ballot paper shall be marked on both sides with an official mark, and delivered to the voter within the polling station, and the number of such voter on the register of voters shall be marked on the counterfoil, and the voter having secretly marked his vote on the paper, and folded it up so as to conceal his vote, shall place it in a closed box in the presence of the officer pre-

Types of Ballot Secrecy

- **Conditional secrecy:** Ballot is secret if both
 - Voter does not disclose ballot ID
 - State does not unseal ballot ID data
 - Ballot act of 1872 is a perfect example
- **Absolute secrecy:**

Article I Section 28: ... ballots without any distinguishing mark or symbol ...

 - Virginia constitution of 1902
- Many law codes vague about this

Voting machines – absolute secrecy

One register per candidate,

No ballot stored

Votes stored in registers

Examples:

Spratt, 1875 (shown)

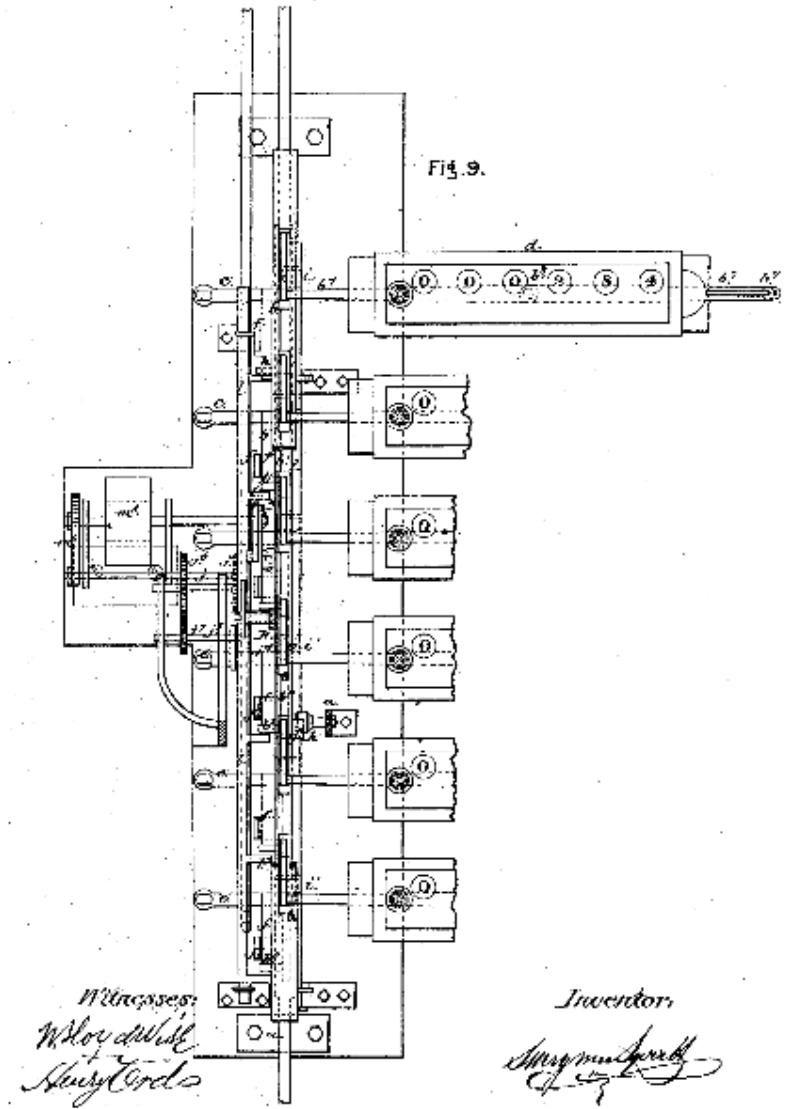
U.S. Patent 158,652

Roney, 1878

U.S. Patent 211,056

Beeranek, 1881

U.S. Patent 248,130



Machines – conditional secrecy

Registering ballot boxes

Serial number the ballots or

Store ballots in sequence voted

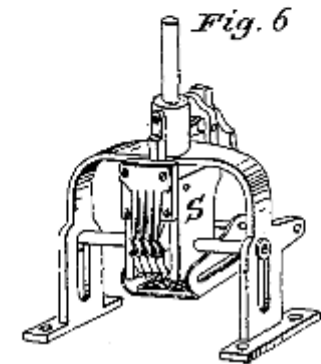
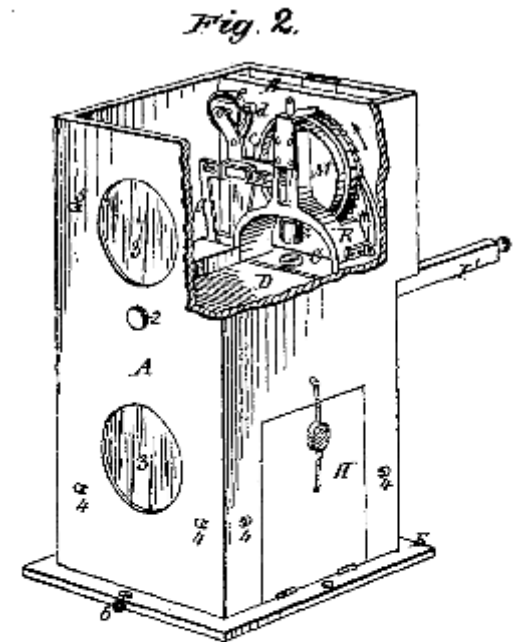
Examples

Bacon, 1878 (shown)

U.S. Patent 203,525

Williams, 1878

U.S. Patent 200,495



Machines – vague intent

Reel-to-reel vote records

Record votes on a paper roll

Examples

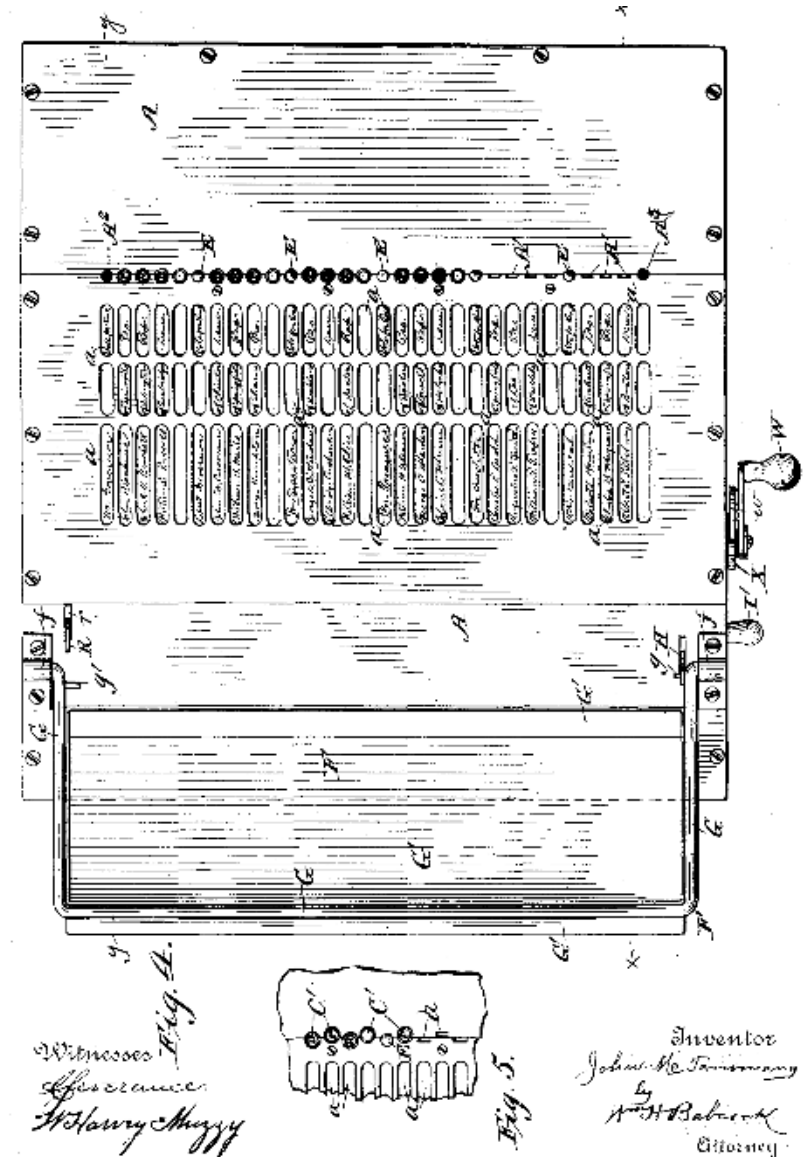
Rhines, 1890

U.S. Patent 422,891

McTammany, 1893

U.S. Patent 502,744 (shown)

"... it is possible to identify a man's vote, by counting voters as they go in and afterward counting the rows of marks on the sheet."



Transparent Ballot Boxes

Examples

Cummings, 1858

U.S. Patent 20,256

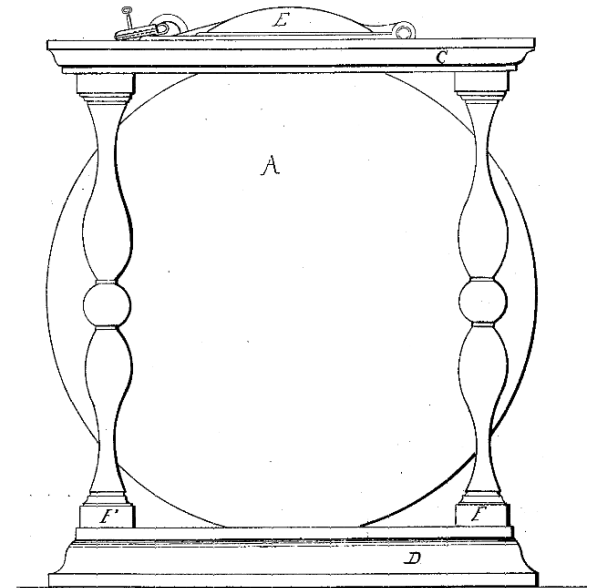
Jollie, 1858,

U.S. Patent 21,684 (shown)

"... the bystanders may

- see every ballot which is put in,
- see all the ballots that are in,
- and see them when taken out."

Jollie



Registering Ballot Boxes

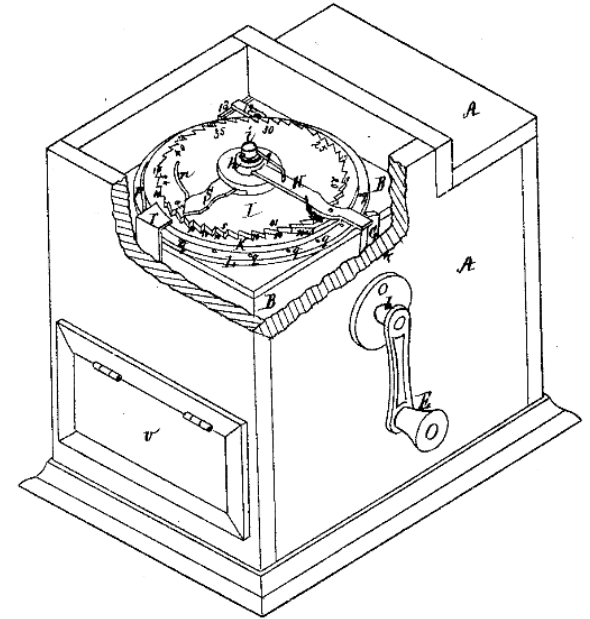
Examples

Savage, 1873

U.S. Patent 142,124 (shown)

Davis, 1874

U.S. Patent 149,202



The bystanders may see that

- the counter is initially zero,
- the counter increments for each ballot voted, and
- the final count matches the count of ballots.

The Public Counter Requirement

Introduced with registering boxes

Included in voting machines

- Spratt, 1875
 - U.S. Patent 158,652
- Myers, 1890
 - U.S. Patent 424,332
- And all subsequent machines

Became a legal requirement

- Still required, 1990 FEC, 2002 EAC
- But visible to "designated officials" not public!

Voter Verification

Recognizing the problem:

"It seems to me that for a person to vote ... he must have some sensible evidence ... that he has performed some effectual act ... to indicate for whom he has voted. ...

But a voter on this voting machine has no knowledge through his senses that he has accomplished a result. The most that can be said, is, if the machine worked as intended, then he has ... voted. It does not seem to me that that is enough."

– Horatio Rogers, In re Voting Machine dissent, 1897

Voter Verification

Indirect recording

Machine emits a "frog"

Voter can verify "frog"

Count "frogs" at ballot box

Punched cards

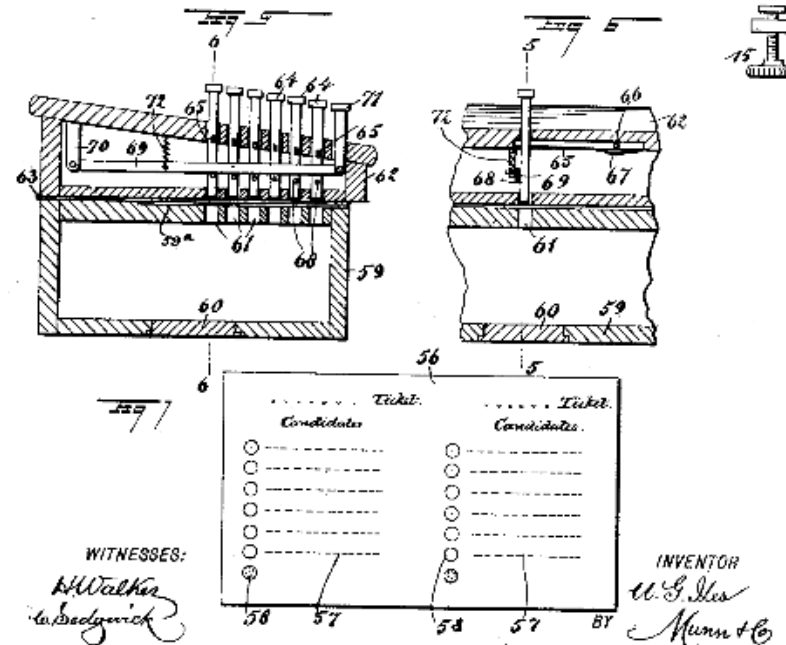
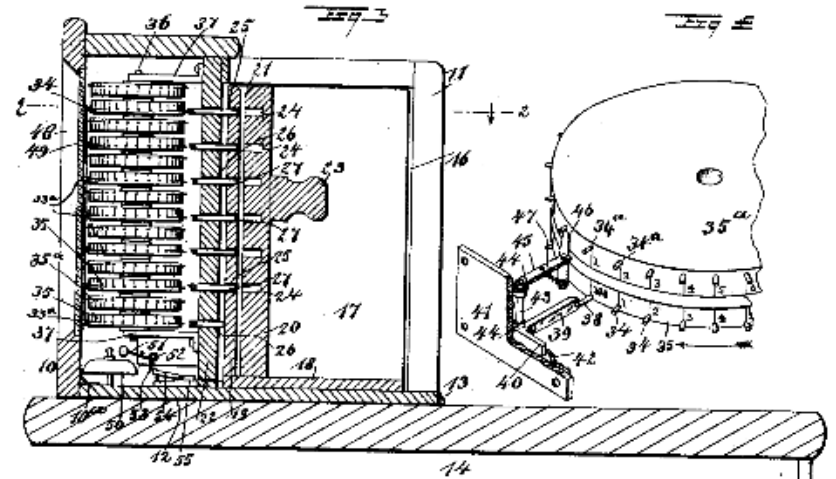
Iles, 1893

U.S. Patent 500,001

No use until rediscovery

Harris (Votomatic), 1960

Bruck, Jefferson, Rivest



Voter Verification

Direct Recording with VVPAT

Machine counts votes and
creates human-readable paper

Paper record is secondary

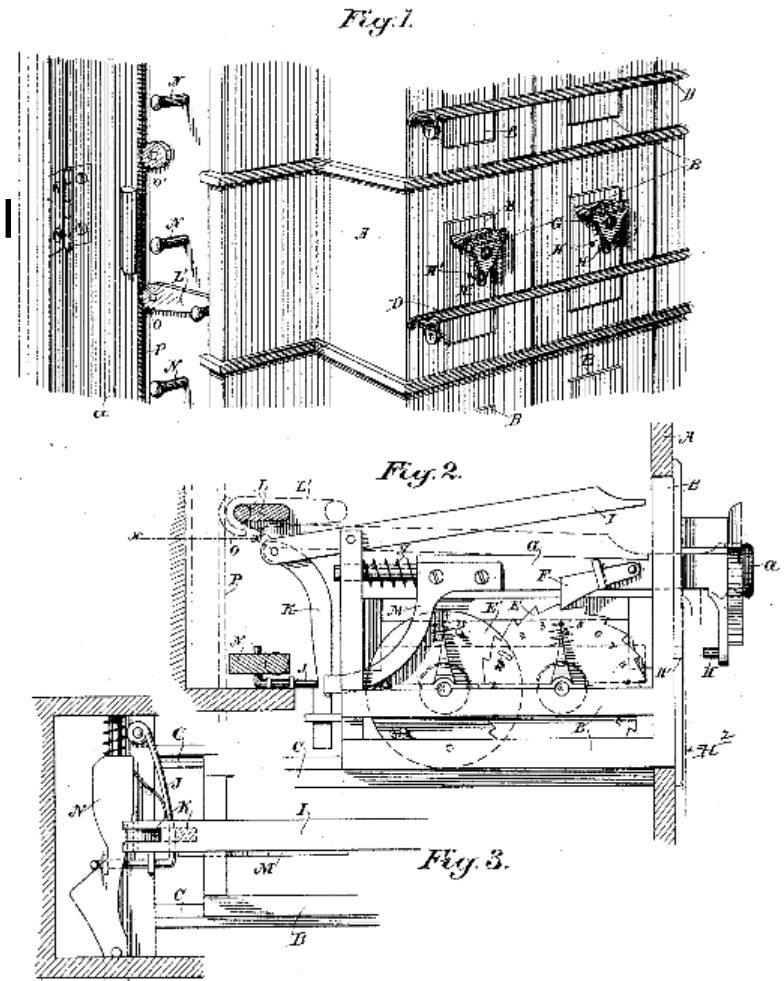
Punched secondary record

Gray, 1899

U.S. Patent 620,767

No use until rediscovery

Mercuri, Chung (Avante)



Recountability/Redundancy

What if you suspect an error

Can recount paper ballots

But direct recording machines?

Possible with redundancy

Rhines, 1890

U.S. Patent 422,891 (shown)

McTammany, 1893

U.S. Patent 502,744

Not voter verifiable!

Reel-to-reel vote recording!

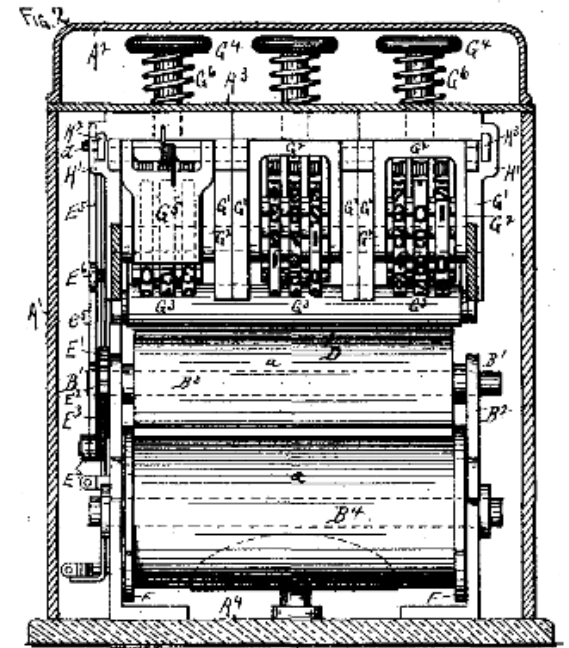


Fig. 6

PRESIDENTIAL ELECTORS.		
REP.	DEM.	PROG.
	1	
		1
	2	
	3	
1		
		2
2		
3		
4		
5		
	4	3

Ballot Validity – Vote for One

Sliding door to expose one knob

Spratt, 1875

U.S. Patent 158,652

Turn knob selects candidate

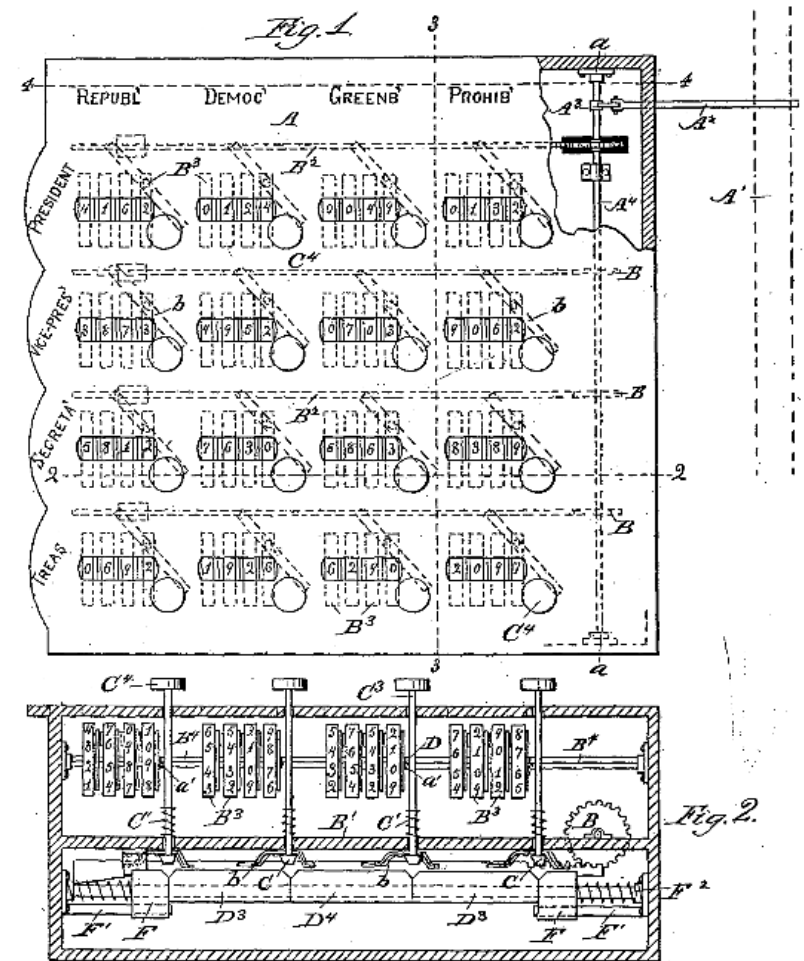
Roney, 1878

U.S. Patent 211,056

Drive wedge between spacers

Beranek, 1881 (shown)

U.S. Patent 248,130



Ballot Validity – Vote for n

Refined wedge and spacer

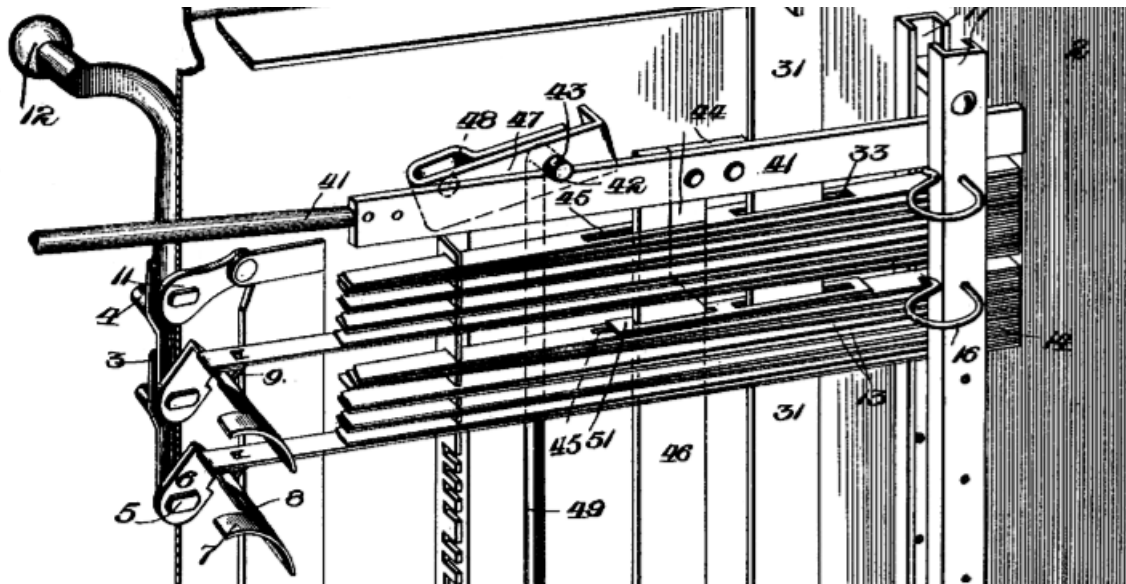
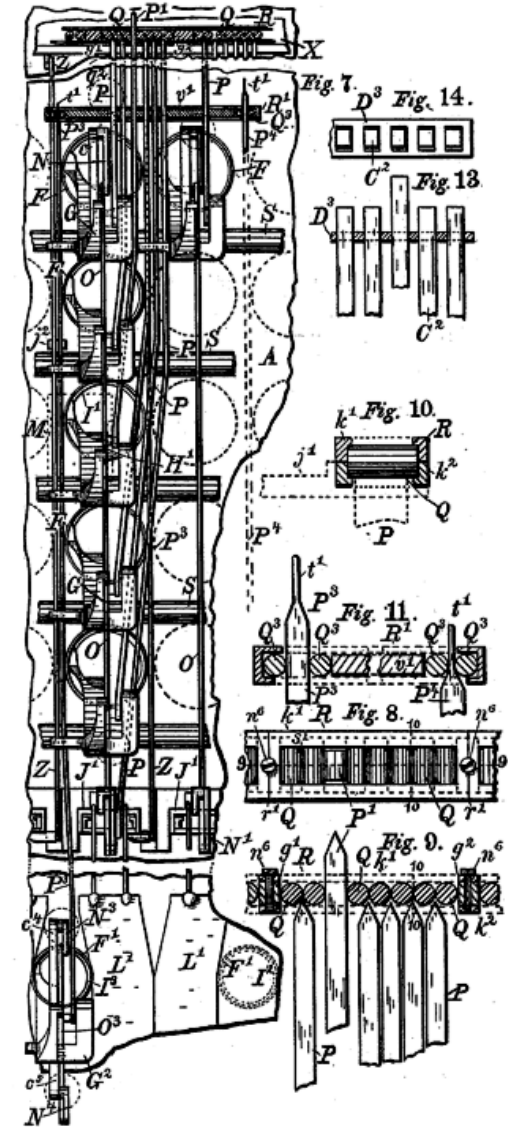
Spratt, 1894

U.S. Patent 526,668 (shown)

Programmable machines

Gillespie, 1899

U.S. Patent 628,905 (below)

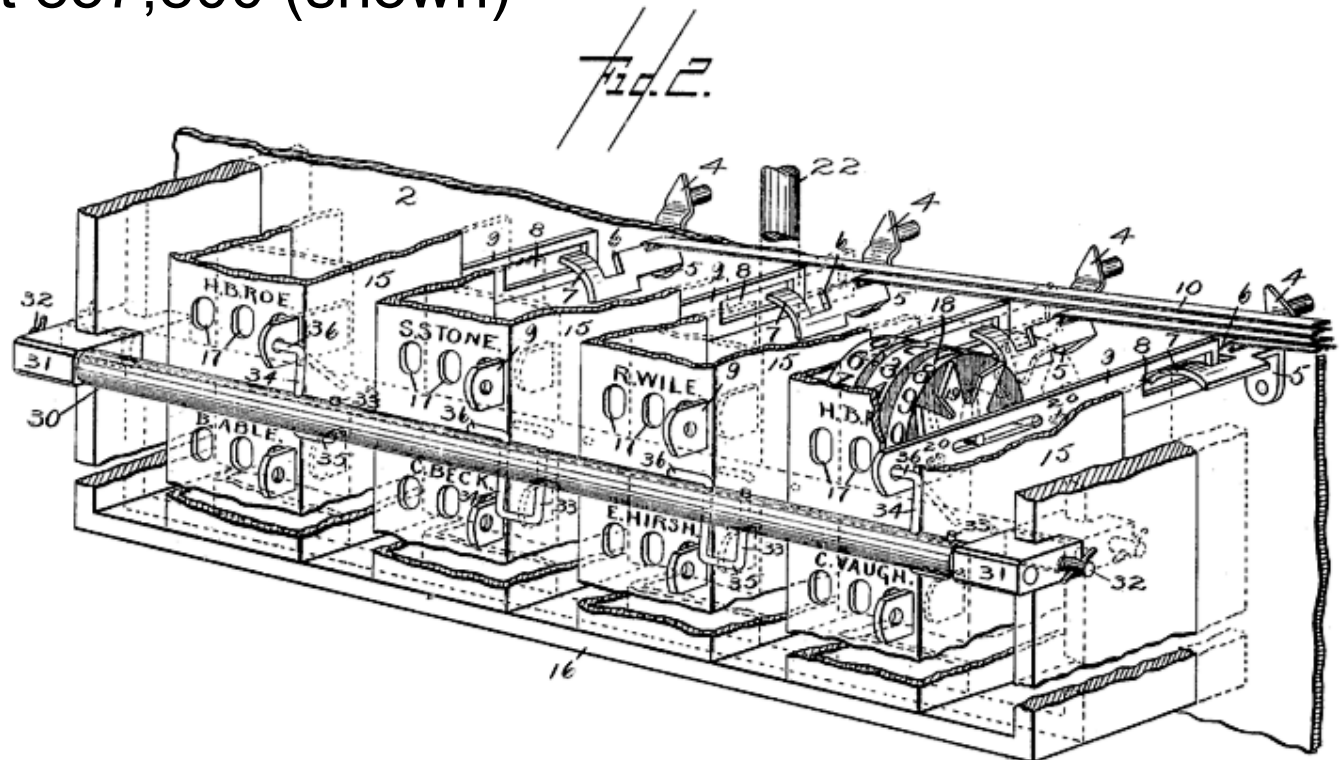


Ballot Validity – Cross Endorsement

Link all registers for cross endorsed candidates

Gillespie, 1907

U.S. Patent 857,800 (shown)



The Law

- 1889 – Myers petition to legalize voting machines
- 1892 – New York legalizes Myers machine
- 1896 – New York legalizes Davis machine etc.
- 1897 – New York Voting Machine Commission
- 1898 – *Report of the Commission for the Purpose of Investigating Voting Machines to the Senate and Assembly 33rd Session of the Legislature of the State of California*

The Public Face of the Industry

1889-1892 – Newspaper reports identify voting machines with political reform movement

1900 – *Appleton's Cyclopaedia* article written by salesman for voting machine vendor

1911 – *Encyclopaedia Britannica* written by salesman for voting machine monopoly

The only stated requirements are those met by the vendor's own products.

The Outcome

1934 – “Laws authorizing the use of voting machines are practically identical in the several states, due, no doubt, to the fact that they were enacted at the instigation of the manufacturers.”

Joseph Harris,

Election Administration in the United States

Conclusion

- Some requirements come from officials
 - Multiple races in one election
 - Straight-party voting
 - Vote for N out of M
- Innovative requirements come from outsiders
 - Secret Ballot
 - Transparency
 - Voter verification
 - Validity enforcement mechanisms
- There is risk when outsiders become vendors