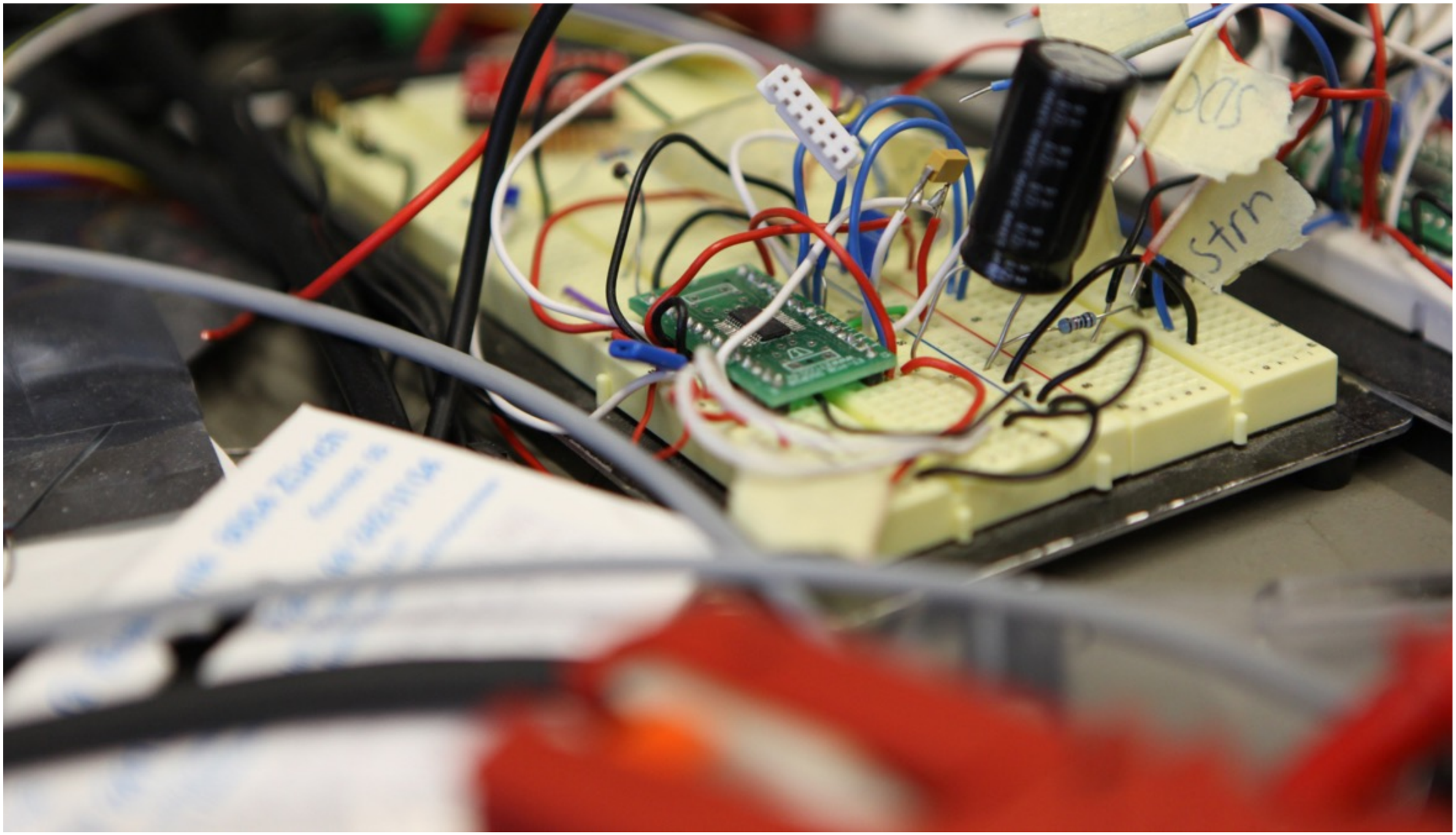
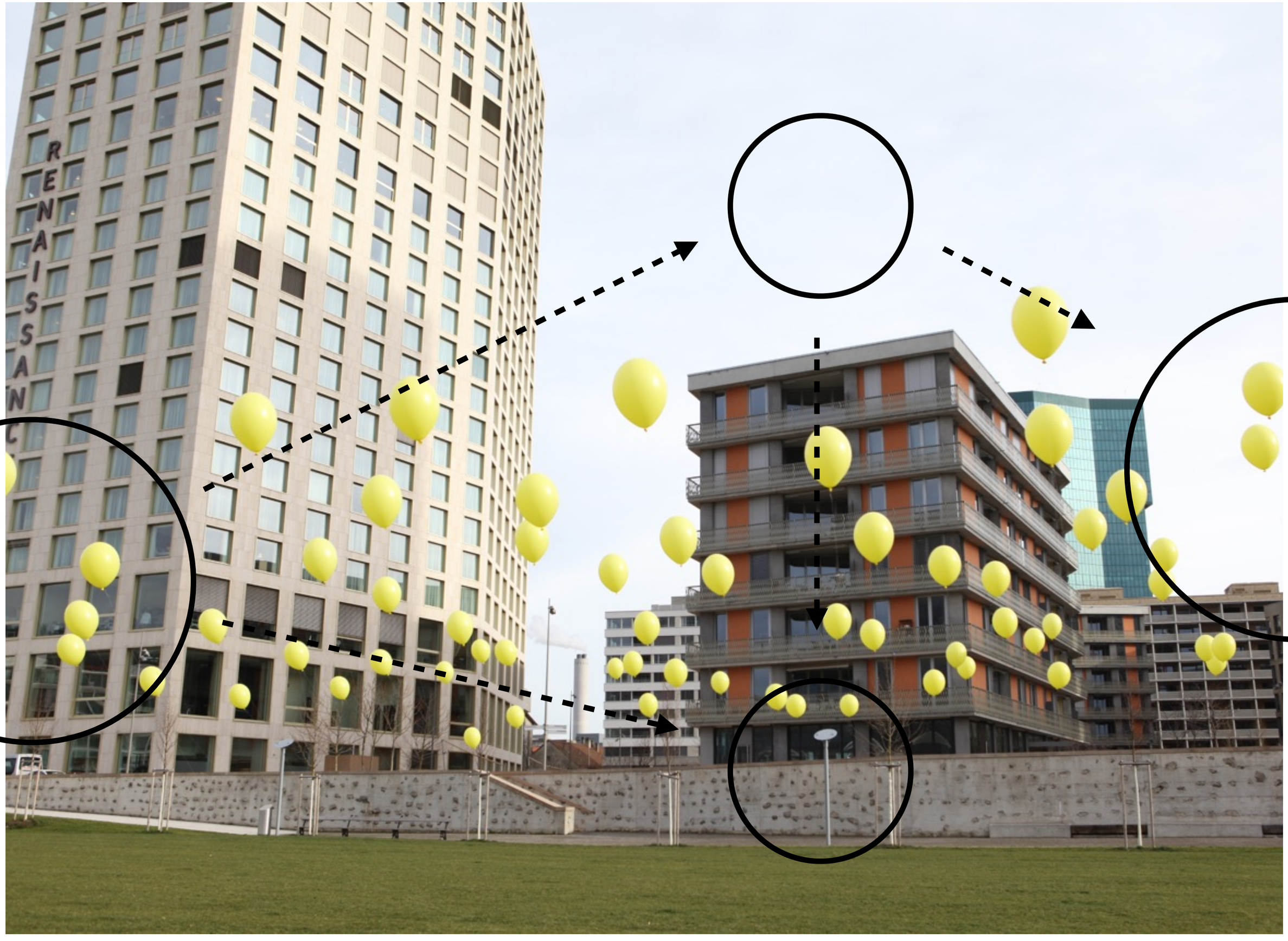
physical computing

2016
moritz kemper
joël gähwiler

interaction
design

physical computing in the broadest sense, means building interactive systems by the use of hardware and software that can sense and respond to the analog world.




RENAISSANCE

the history of technology is the history of the invention of tools and techniques and is similar to other sides of the history of humanity.

wikipedia

one of the major driving forces behind the development of tools and techniques is the curiosity of people and their urge to understand (natural) phenomena.

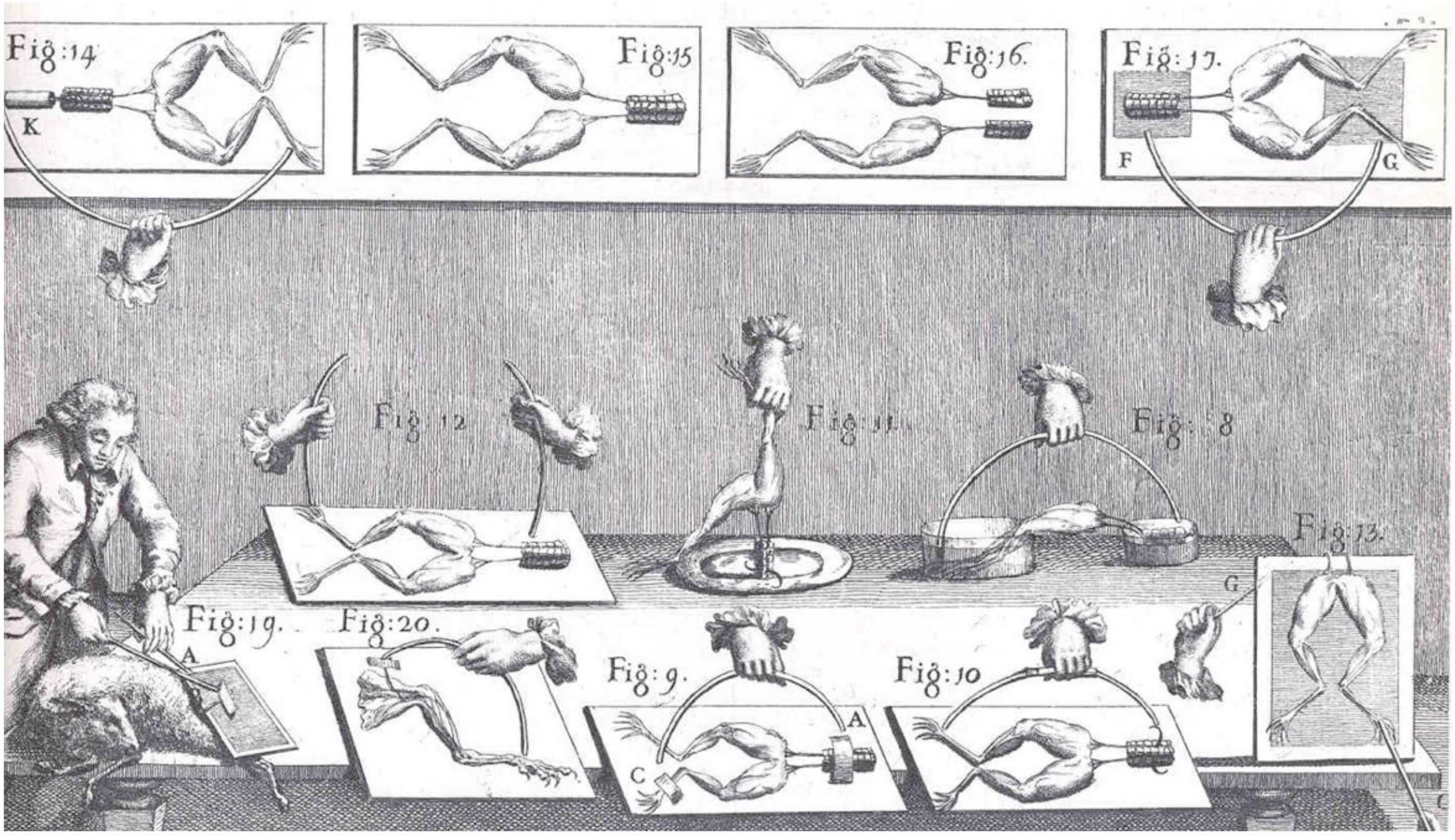
benjamin franklin has been one of the first to engage into thunderstorms and lightning. therefore he prepared experiments with simple kites, trying to trap lightnings.

1752
benjamin franklin

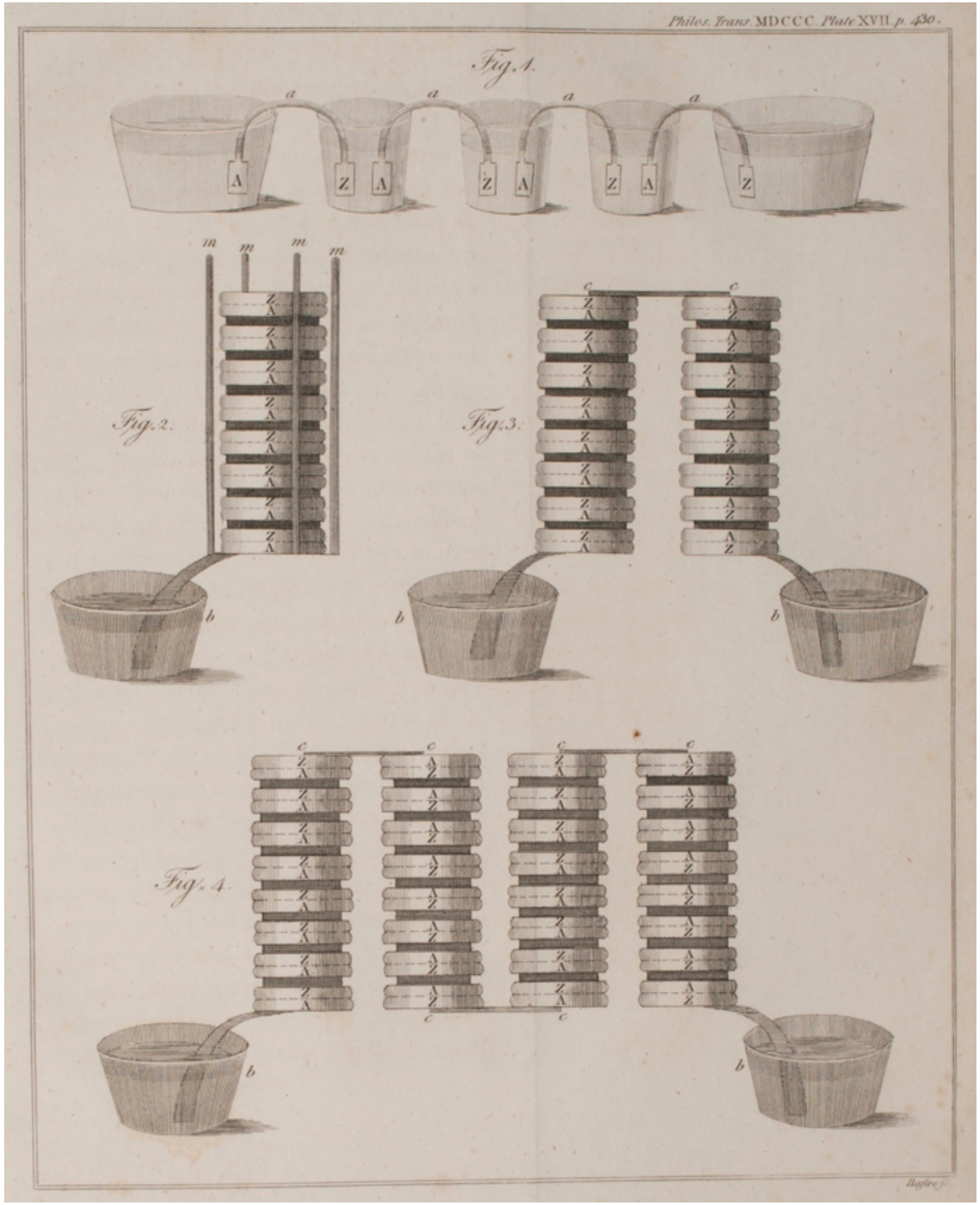
some so called ‘magicians’ used the invisible power of electricity to capture peoples attention. although they weren’t aware of the physical rules and principles they experimented with this invisible force.

some of them even used this force to demonstrate pretty awkward things (e.g. electrifying frog legs). these experiments later revealed the fact that nerve signals in our every bodies are nothing more then small electric impulses.

1770
luigi galvani



italy was the major country for research in the area of electricity – also because the major universities were located there. alessandro volta was the first who introduced a way to store electrical energy and described the concept of VOLTS as the potential of electric energy.



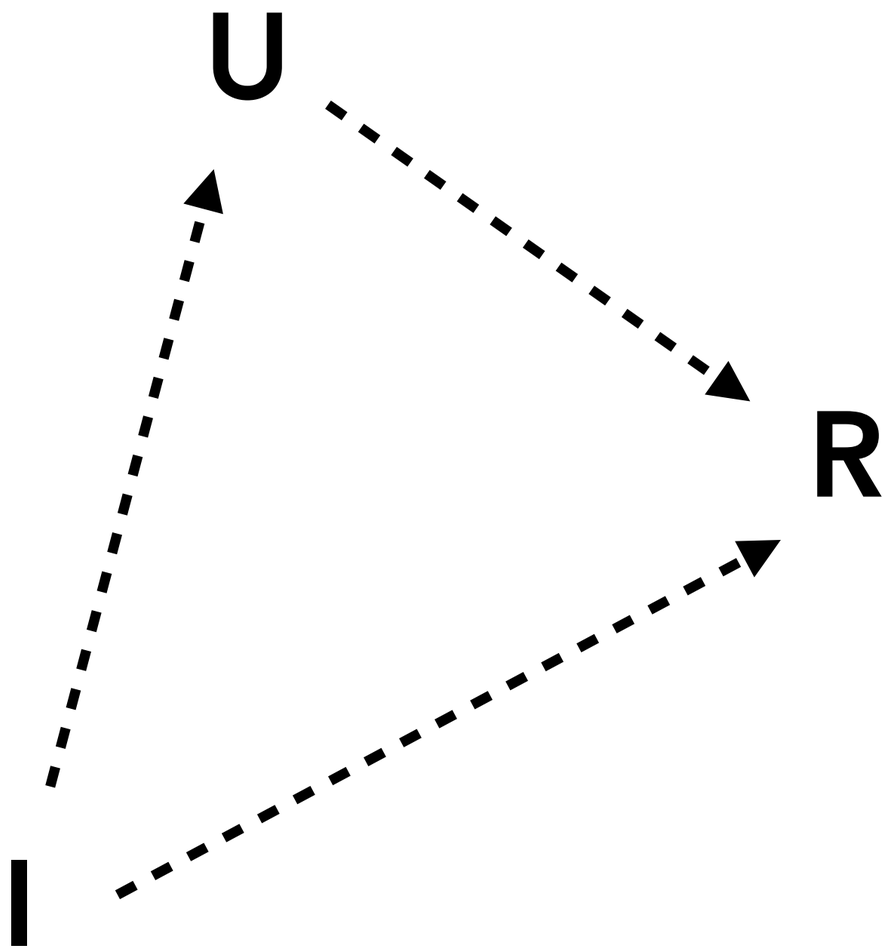
1775
alessandro volta

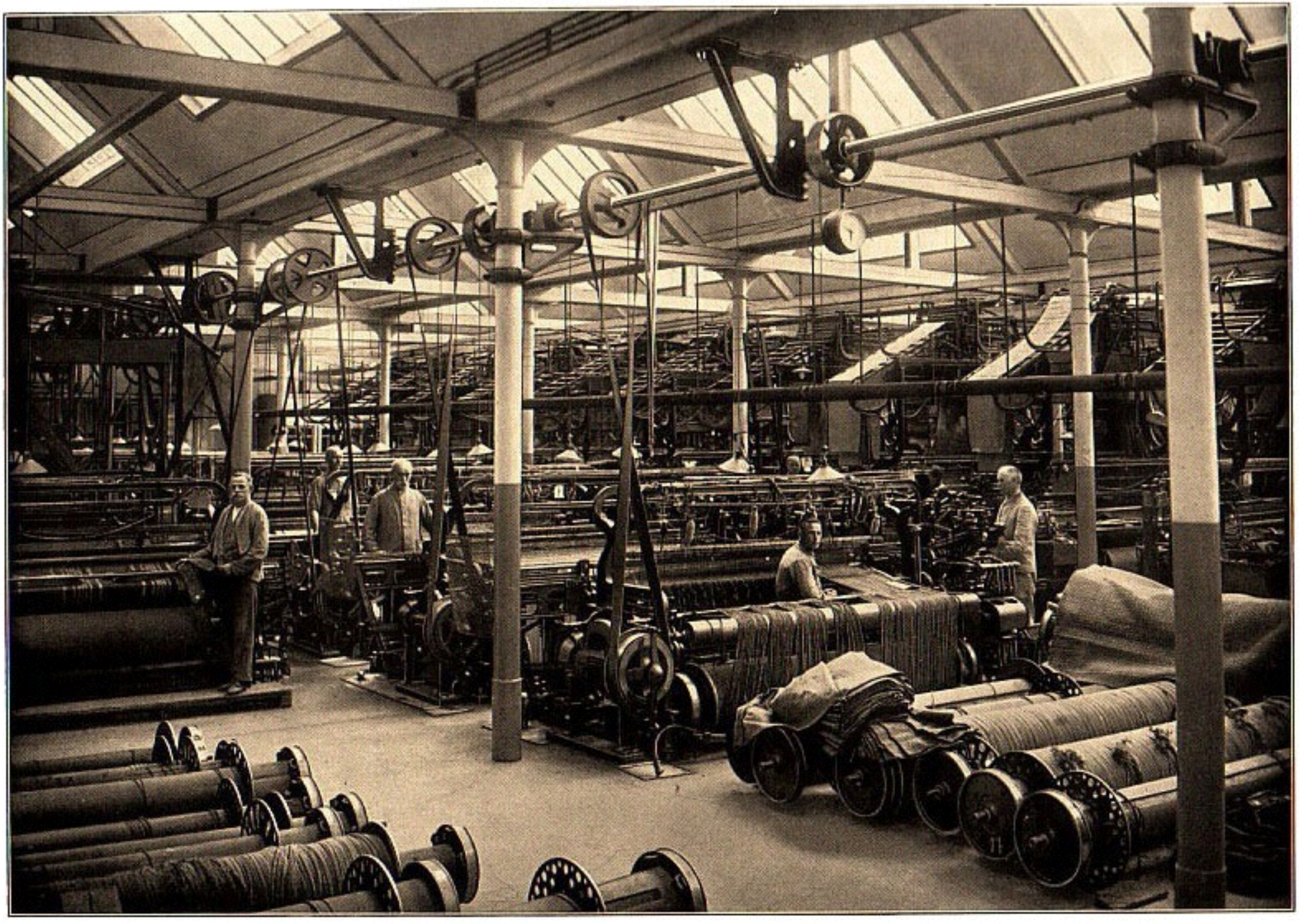
andré marie ampère found out that besides VOLT there is another force which is important when working with electricity. it's the CURRENT which describes the strength of electrical energy.

1820
andré marie ampère

finally a nice german guy introduced the last important size for electricity RESISTANCE. he as well described the relation between VOLTS, CURRENT and RESISTANCE

1825
georg friedrich ohm

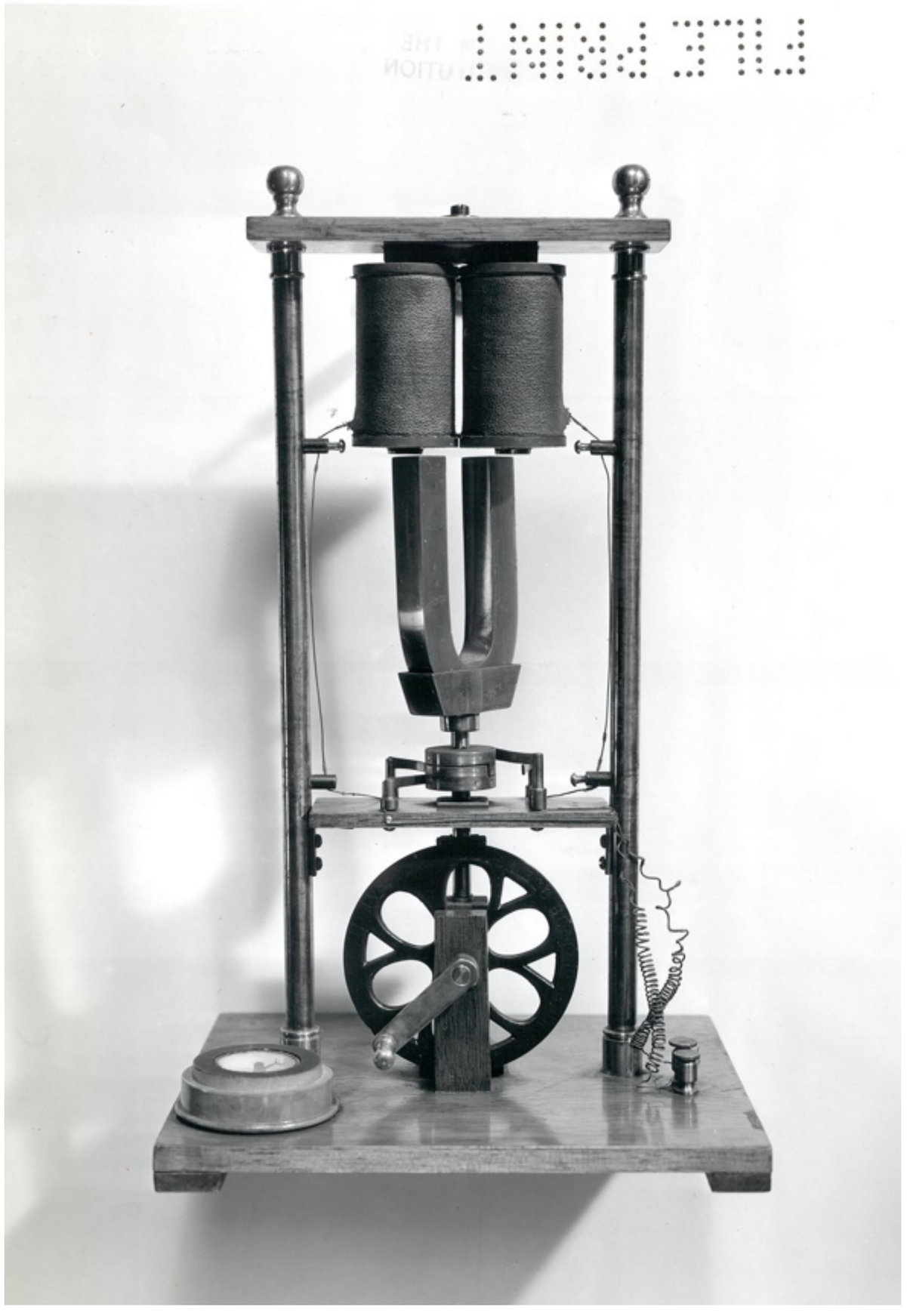




WEBEREI

the first industrialization changed first europe and later the whole world. it started from technology and but had huge impact on economy, the culture of work and especially social live and society.

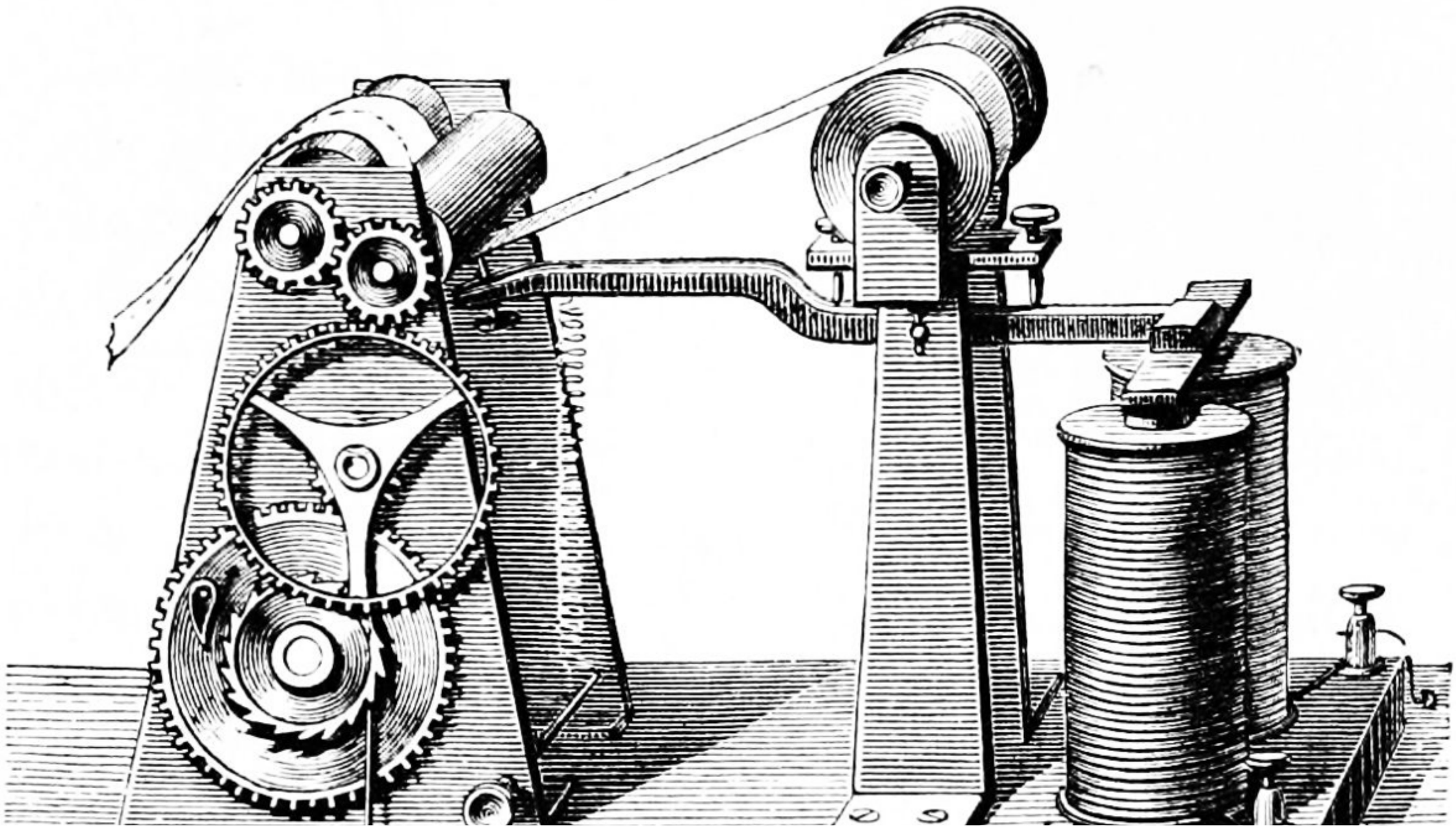
through dedicated tools and machines people were able to finally use the power of electricity wherever and whenever they wanted.



1835
michael farraday
hippolyte pixii

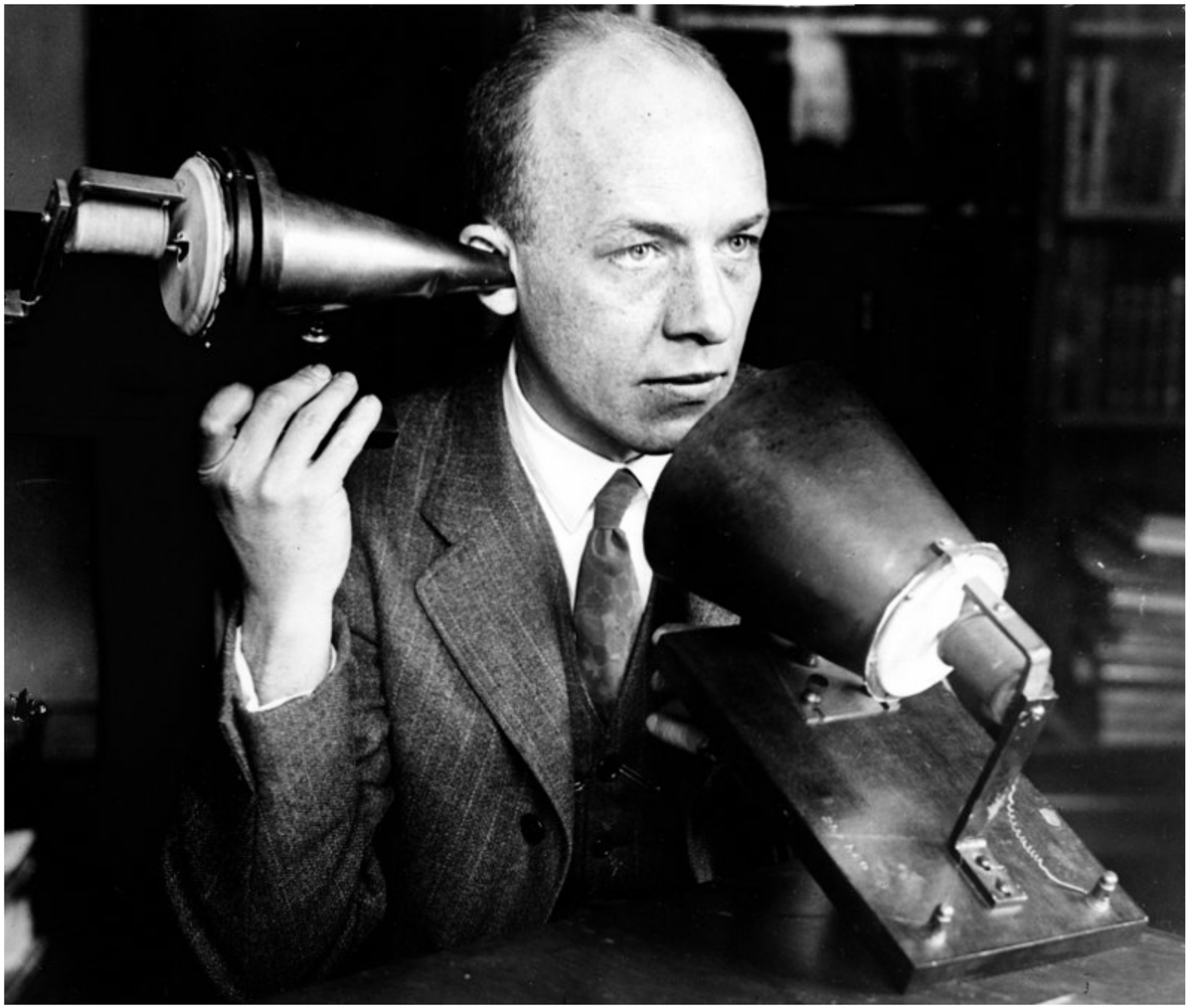
one of the first applications for electrical energy was telecommunications in the way of abstract codes. samuel morse introduced a device which was able to detect finger presses and transmit them through an electrical line.

1833
samuel morse



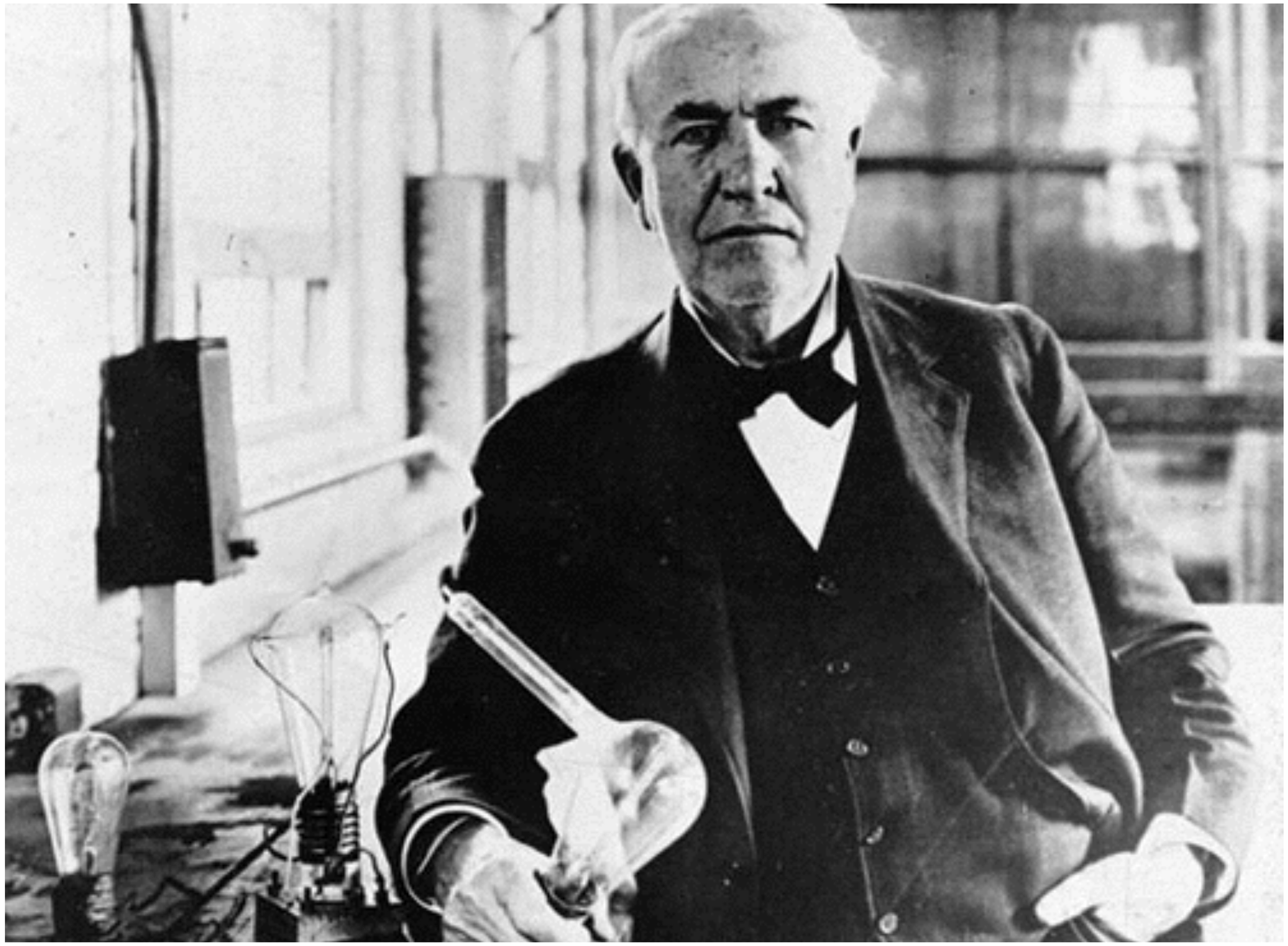
only a few decades later alexander graham bell experimented with telecommunications and introduced a way how human voice could be translated into electrical charge and back to sound waves.

1876
alexander graham bell



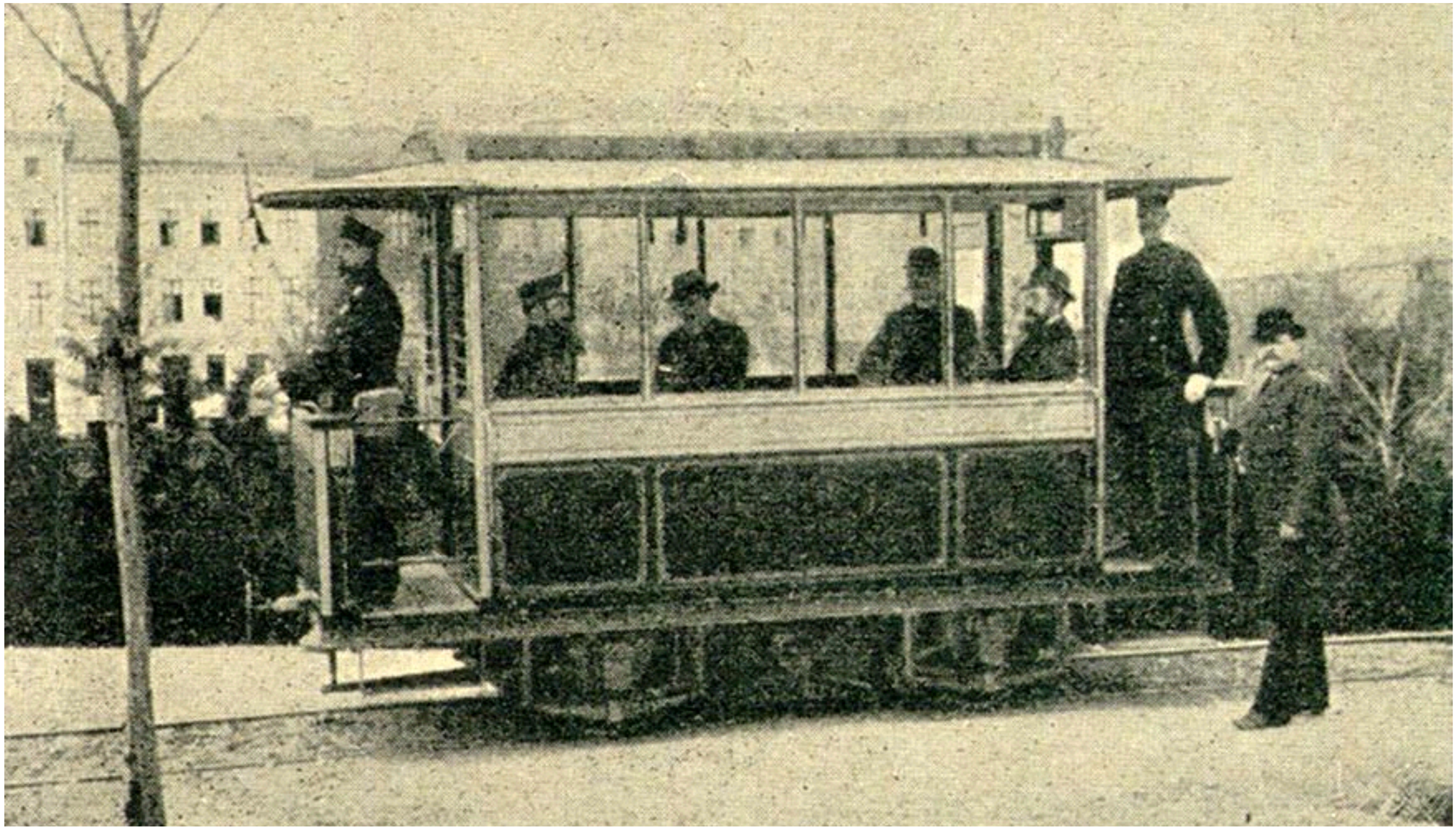
the first ‘consumer product’ was the electrical lightbulb. it was introduced by thomas edison and solved one of the main problems of these days – massive fires because of gas lamps and candles.

1880
thomas alva edison

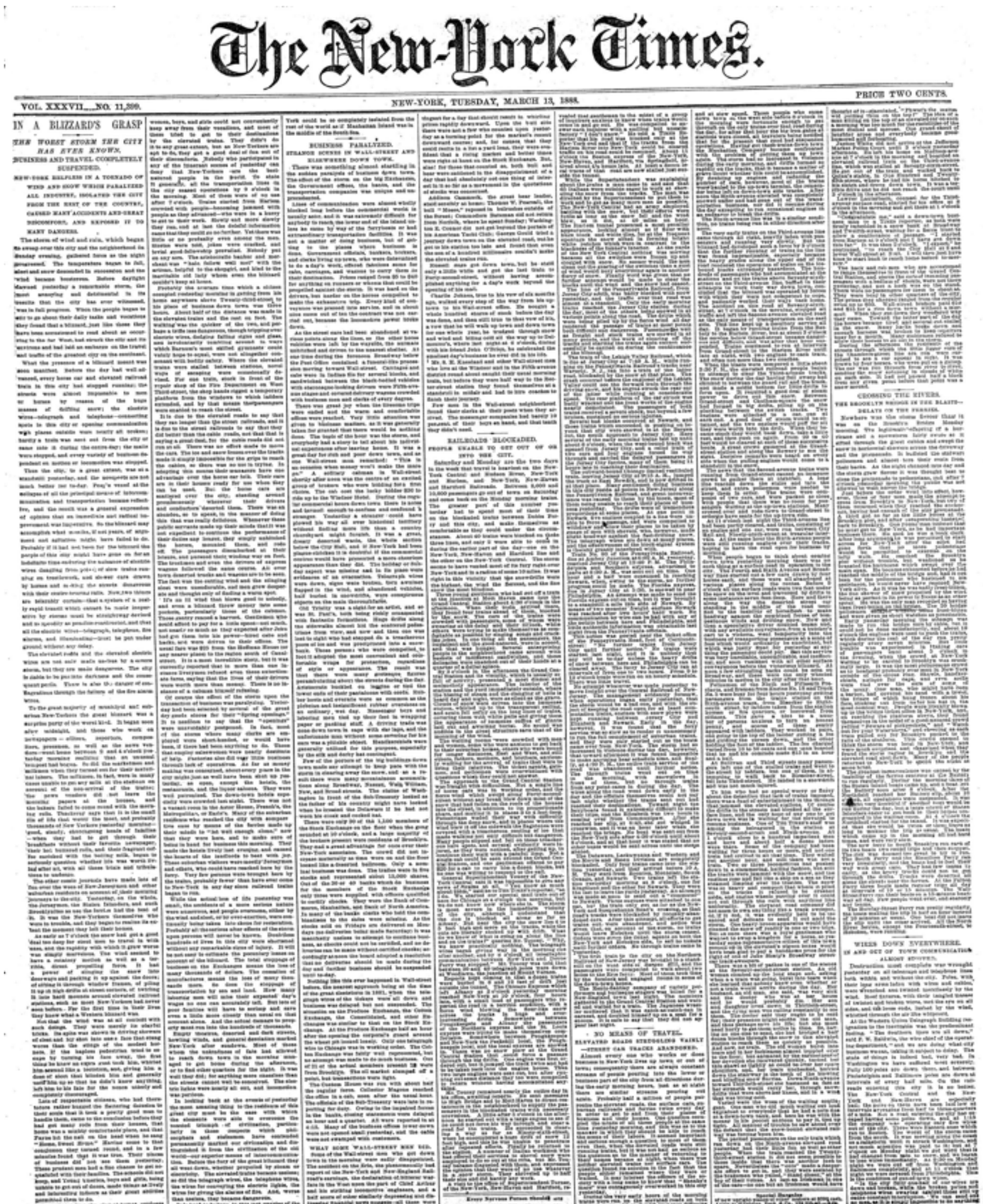


in berlin the first electrified train was introduced to the public. a fact that caused a lot of anxiety in the people of that time. they were afraid that the human body isn’t meant to travel so fast.

1881



in the late 19th century the so called 'war of currents' was carried out between thomas edison and george westinghouse. this could be seen as the first fight for standardization in the history of electricity.



The New-York Times.

VOL. XXXVII....NO. 11,209. NEW-YORK, TUESDAY, MARCH 13, 1888. PRICE TWO CENTS.

IN A BLIZZARD'S GRASP

THE WORST STORM THE CITY HAS EVER KNOWN,

BUSINESS AND TRAVEL COMPLETELY SUSPENDED.

NEW-YORK HELPLESS IN A TORNADO OF WIND AND SNOW WHICH PARALYZES ALL INDUSTRY, ISOLATES THE CITY FROM THE REST OF THE COUNTRY, CAUSES MANY ACCIDENTS AND GREAT DISCOMFORT, AND EXPOSES IT TO MANY DANGERS.

The storm of wind and rain, which began to sweep over this city and the neighborhood on Sunday evening, gathered force as the night progressed. The temperature began to fall, sleet and snow descended in succession and the wind became boisterous. Before daylight dawned yesterday a formidable storm, the most annoying and detrimental in its results that the city has ever witnessed, was in full progress. When the people began to stir to go about their daily tasks and vocations they found that a blizzard, just like those they have been accustomed to read about as occurring in the far West, had struck the city and its environs and had laid an embargo on the travel and traffic of the greatest city on the continent.

What the presence of a blizzard meant was soon manifest. Before the day had well advanced, every horse car and elevated railroad train in this city had stopped running; the streets were almost impassable to men or horses by reason of the huge masses of drifting snow; the electric wires—telegraph and telephone—connecting here in this city or spanning commandeered high places across were nearly all broken; hardly a train was sent out from the city or came into it during the entire day; the mails were stopped, and every variety of business dependent on motion or locomotion was stopped.

Then the ship, in a great street, was as a standstill yesterday, and the newspapers are not much better off to-day. Frog'n vessel at the mouths of all the principal rivers of intercommunication and transportation became reflective, and the result was a general expression of opinion that an incredible and ruthless tyrannical was impressive. No the blizzard may accomplish what months, if not years, of argument and agitation might have failed to do. Probably if it had not been for the blizzard the people of this city might have gone on for an indefinite time enduring the nuisance of electric wires dangling from poles of slow trains running on trackwork, and slower cars drawn by horses and so doing the streets dangerous with their cruise-tearing rails. Now, the whole are blizzardy certain—that a system of a really rapid transit which cannot be made inoperative by storms must be straightway devised and to operate as permanent instrumental, and that all the electric wires—telegraph, telephone, fire alarms, and illuminating—must be put under ground without any delay.

The elevated roads and the elevated electric wires are not only made useless by a severe storm, but they are made dangerous. The city is liable to be put into darkness and the consequent perils. There is also the danger of conflagrations through the failure of the fire alarm wires.

To the great majority of municipal and suburban New-Yorkers the great blizzard was a surprise party of the worst kind. It began soon after midnight, and those who went on to experience—editors, reporters, compositors, pressmen, as well as the nerve wreckers—went home between 2 and 4 o'clock yesterday morning. Others did not succeed in getting that length. So did the watchmen and policemen when they turned out for their next regular tour. The sufferers, in fact, were in many cases unable to get any milk at the station on account of the non-arrival of the latter. The new readers did not learn the morning papers at the houses, and the bankers failed to come round with the morning tea rolls. Therefore say that it is the small fry of life that worst the most, and principally thousands of New Yorkers yesterday morning—good, sturdy, electioneering heads of families—who had to get down their own breakfasts without their favorite newspaper, their hot, buttered rolls, and their fragrant coffee, combined with the morning milk, began to seriously question whether life was worth living after all, with all those trials and tribulations to undergo.

The other comic journals here made lots of fun over the woes of New-Jerseyites and other suburban residents on account of their morning journeys to the city. Yesterday, in fact, when the Jerseyites, the Staten Islanders, and such Brooklynites as use the ferries had the best of it. It was the New-Yorkers themselves who were in trouble, and they began to realize in extent the moment they left their houses.

As early as 7 o'clock the snow had got a good head-way for sleet men to travel in with ease, and the rapidity with which it grew worse was simply marvelous. The wind seemed to have a uniformity motion as well as a terrific, almost prostrating force. It had a power of sinking the snow into downwards and packing it up against the doors of citizens in through window frames, of piling it up in high drifts at street corners, of twisting it into hard masses around elevated railway stations, such as most New-Yorkers had never seen before. For the first time in their lives they knew what a Western blizzard was.

Not that the wind was at all content with such doings. They were especially playful tricks. Its spite was shown in driving showers of sleet and hail shot into one's face that stung worse than the stings of the maddest hornets. If the hapless pedestrian stood to escape by turning his face away, the fiend in the blast knew an expert and took him, whether him aroused like a taxidermist, not, giving him a dose of sleet that blinded him and generally used him up so that he didn't know anything, left him to his fate for the space acutely and completely discouraged.

Lots of preparations sickness, who had theretofore rather boasted on the morning of this great storm that it took a pretty good man to handle them, came to the conclusion before they had got much out of their homes. That home was a mighty comfortable place, and that Fate's hit the nail on the head when he sang "Home, Sweet Home." Those who were in their comfortable they turned round, and in a few minutes found that it was true. Their whose of business did not see them yesterday. Those prudent men had a fine chance to get acquainted with their families. The schools did not keep, and Young America, boys and girls, being unable to get out of doors, made things as lively and interesting indoors as their great ambition permitted them to do.

Nevertheless the stay-at-homes suffered [illegible]. Some thousands of men, women, boys, and girls could not conveniently keep away from their vocations, and those of them tried to get to their destinations by the elevated trains. They didn't do it to any great extent, but as New-Yorkers are apt to do, they got a good deal of fun out of their discomforts. Nobody who participated in any of the blizzard scenes of residential can deny that. New-Yorkers are the best-natured people in the world. To state it generally, all the transportation lines in the city ceased operations by 9 o'clock in the morning. Most of them were of no use after 7 o'clock. Trains started from Harlem covered with people—hanging on and with people on they advanced—but when in a hurry to get to their work. Slowly and more slowly they ran, and at last the foolish travelers became that they could go no further. Yet there was little or no profanity even among the men. Stories were told, jokes were cracked, and a brisk good-fellowship prevailed. Nobody put on any airs. The aristocratic hacker and poor-man's car "hain failure well met" with the artisan, helpful to the sluggish, and kind to the inevitable old lady whom even the blizzard couldn't keep at home.

Probably the avenues time which a citizen occupied yesterday morning in getting from his home anywhere above Twenty-third street, to his place of business down town was three hours. About half of the distance was made in the elevated trains and the rest on foot. The walking was the quickest of the two, for it became a trifle less dangerous, though tripping over electric wires, defiance falling signs and glass, and occasionally the unfortunate accident in very which Barnum's most skilled gymnasts could vainly hope to equal, were not altogether safe.

Persons with bodily safety. Where the elevated trains were stalled between stations, many ways of escaping were successfully devised. For one train, stuck in front of the regular stop of the Fifty-fourth-street station, on Third-street, the shop hands rigged a temporary platform from the windows to which ladders extended, and by that means the passengers were enabled to reach the street.

It is due to the elevated roads to say that they ran longer than the street railroads, and it is due to the street railroads to say that they did better than the cable roads, not that that is saying a great deal, for the cable roads did not run at all. There was no effort made to move the cars. The ice and snow frozen over the tracks made it simply impossible for the grips to reach the cables, so there was no use in trying. In speaking this means their managers have used advantage over the horse car lack. Their cars are in their homes ready for use when they can be used. But the horse cars are scattered over the city, standing around promiscuously wherever their drivers and conductors' deserted them. There was no chance, so to speak, in the manner of doing this that was really delicious. Whenever these public servants made up their minds that it was impossible to continue the performance of their duties any longer, they simply unhitched the horses, mounted them, and rode off. The passengers disembarked at their leisure, and pressed their window way on foot. The horsemen and even the drivers of electric wagons followed the same course. An avenue car deserted tracks and wagons are in a line. The fact was the rushing wind and the stinging sleet were unendurable, and then grew danger-ous and thoughts only of shelter filled the mind.

It's no ill wind that blows good to nobody, and even a blizzard threw money into some pockets, particularly those of the retailers. Those country record a harvest. Gentlemen who could afford to pay for a little spare—and such not nearly so much as they expected after John had got them into his power—hired cabs and hacks, and were driven to their offices. The usual fare was $10 from the Hoffman House or any nearer places to the region south of Canal-street. It is a most incredible story, but it was correctly reported that in more than one instance Irishmen refused even those extortionate fares, saying that the lives of their drivers were worth more than money. There is no instance of a cabman himself refusing.

Of course the effects of the storm upon the transaction of business was paralyzing. Yesterday had been silenced by several of the early days stocks since for their "Spring openings." It is needless to say that the "openings" were unavoidably postponed. In fact, most of the stores where many clerks are employed were closed—locked, or would have been, if there had been anything to do. Those that ongoing subservience were nearly desirous of help. Factories also did vigor from business through lack of operatives. As for an money making was concerned, about every place in the city might just as well have been shut up for-ever, as open, except the hotels, the restaurants, and the liquor saloons. They were well patronized. The down-town hotels especially were crowded last night. There was not a vacant room in the Astor House, Fenwick's, the Metropolitan, or Earle's. Many of the subscribers residence who reached the city from suburban some by means of the ferries made up their minds to "let well enough alone," now that they were here, and to make sure of being in hand for business this morning. They made the hotels lively last evening, and caused the bosses of the landlords to beat with joy. These suburban visitors were mostly Jersey men and others, who could have reached here by the ferry. Very few persons were brought here by the trains, probably fewer than have ever come to New-York in any day since railroad trains began to run.

While the actual loss of life yesterday was small, the accidents of a more serious nature were numerous, and people overcome, either by the wind and cold, or by over-exertion, were unanimously borne taken into shops for restoration. Probably all the serious after effects of the storm upon persons will never be known. Doubtless hundreds of lives in this city were shortened without any remarkable signs of injury. It will be out easy to estimate the pecuniary losses on account of the blizzard. The total stoppage of business on the Exchanges will involve the loss of many thousands of dollars. The cessation of miscellaneous means the loss of many thousands more. So does the stoppage of transportation by sea and land. How many thousands more will arise from expected day's wages no one can accurately tell. But lots of poor families will have to scrimp and save for a little some time to come to make up the amount alone. And the actual damage to property must run into the hundreds of thousands.

Lower avenues, deserted and dark streets, howling winds, and general desolation marked New-York after sundown. Most of those whom the unkindness of fate had allowed to reach down town in the morning were managed to get home during the afternoon, or to find other quarters for the night. It was a night that did; for nowhere was the storm-fiend more furious than in the streets cannot veil to somewhat. The elevated trains were nearly all out, and locomotives were parked.

In looking back at the events of yesterday the most amazing thing is the quickness with which city took the case with which the elements were able to overcome the combined triumph of civilization. Particularly in those respects which pleasure and statesmen have accomplished permanently partial overwhelm and disorganized it from the civilization of the old world—and superior manner of intercommunication. Before the fury of the great blizzard they all went down, whether propelled by steam or electricity. The elevated trains became useless; so did the telegraph wires, the telephone wires, the wires for conveying the electric lights, the wires for giving the alarms of fire. And, worse than useless, they became dangerous.

It is hard to believe in this last quarter of the nineteenth century that for even one day New-York could be so completely isolated from the rest of the world as if Manhattan Island was in the middle of the South Sea.

BUSINESS PARALYZED.

STRANGE SCENES IN WALL-STREET AND ELSEWHERE DOWN TOWN.

There was something almost startling in the sudden paralysis of business down town. The effort of the storm on the big Exchanges, the Government offices, the banks, and the transportation companies was unique and unprecedented.

Lines of communication were almost wholly blocked long before the commercial world in actually gave, and it was extremely difficult for anybody to reach the lower end of the island on less its same by way of the furriness or had extraordinary transportation. It was not a matter of doing business, but of getting to the places where business is done. Government officials, bankers, brokers, and clerks living up-town, who were determined to do a day's work, offered fabulous sums for cabs, carriages, and wagons to carry them to their destination. Prices ranged from $5 to $10 for anything on runners or wheels that could be propelled against the storm. It was hard on the drivers, too, many of whom were compelled to make the exhausting trip. Every kind of conveyance was pressed into service, and in about nine cases out of ten the contract was not carried out, because the locomotive power broke down.

As the street cars had been abandoned at various points along the line, on the other hand the horses and drivers had been left to shift for themselves. Probably all the serious after effects of the storm upon persons will never be known. Doubtless hundreds of lives in this city were shortened without any remarkable signs of injury. It will be out easy to estimate the pecuniary losses on account of the blizzard. The total stoppage of business on the Exchanges will involve the loss of many thousands of dollars. The cessation of miscellaneous means the loss of many thousands more. So does the stoppage of transportation by sea and land. How many thousands more will arise from expected day's wages no one can accurately tell. But lots of poor families will have to scrimp and save for a little some time to come to make up the amount alone. And the actual damage to property must run into the hundreds of thousands.

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It is hard to believe in this last quarter of the nineteenth century that for even one day New-

[illegible] elegant for a day that should result in wholesale prices rapidly downward. Upon the bull side there were not a few who counted upon yester-day as a turning point for the market's recent downward course; and, for reason that they could recite to a fact a year long, they were confident that a rising market and better times were right at hand on the Stock Exchange. But, alas! for those that counted so. Both bull and bear were scattered in the disappointment of a day that had absolutely not one thing of interest in it to so far as a movement in the quotations of stocks was concerned.

Addison Cammack, the street bear leader, sized sensibly at home; Thomas W. Pearsall, the bull "Moses," reposed in Islandian outside of the Academy Church; Gammon did not return from Norfolk, where he spent Sunday; Washington H. Conner did not get beyond the portals of Union Club; Jerome Gould tried a journey down town on the elevated road, but he got on his station too late and found that even as one of a hundred millionaire couldn't make the elevated trains run.

Russell was got down town, but he staid only a little while and got the last train to Forty-second-street, without having accomplished anything for a day's work beyond the exercise of his mail.

Charlie Johnson, true to his vow of six months ago, walked every step of the way from his up-town to his Wall-street office. He bought a whole hundred sheets of sand before the day was done, and then still true to that vow of his, a vow that no wall would ever separate him from his office's main residence. Passengers by all the elevated stock trains were snowed in at various points, and the work of clearing off the tracks and getting the trains again started was a most laborious one during the continuance of the storm.

The train of the Long Island Railroad, which left Hunter's Point at 7:30 A. M., while running at a good speed, was stopped by a snow-drift at Jamaica. The train of the Flushing and North Side Railroad, which left Flushing at 8 A. M., was stopped by a snow-drift at Bowne-street station, Flushing. The train of the Flushing and North Side Railroad, which left Flushing at 9 A. M., was stopped by a snow-drift at Bowne-street station, Flushing. The train of the Flushing and North Side Railroad, which left Flushing at 10 A. M., was stopped by a snow-drift at Bowne-street station, Flushing.

Two men in the Wall-street neighborhood found their clerks at their posts when they arrived. The messenger companies had barely 10 percent. of their boys on hand, and that touch they didn't need.

RAILROADS BLOCKADED.

PEOPLE UNABLE TO GET OUT OF OR INTO OUR CITY.

Saturday and Monday are the two days in the week that travel is heaviest on the New-York Central and Hudson River, New-York and Harlem, and New-York, New-Haven and Hartford Railroads. Between 8,000 and 10,000 passengers go out of town on Saturday, and come back on the Monday morning trains.

Almost every one in the summer resorts under half to spend most of their time on the timbered trains between Jones Point and this city, and make themselves as comfortable as they could under the circumstances. Almost all trains were tracked on Sunday night, and many of them were stalled. During the earlier part of the day—one on the New-York, New-Haven and Hartford line and another on the New-York Central. The snow seems to have vanished most of its fury right over the Sound, and it was not so intense as it was right in this vicinity that the snowdrifts were the highest. The wind, however, was blowing a perfect gale, and the Florida express, which left Philadelphia at 10:30 A. M., reached Jersey City at 4:30 P. M. The train was stalled in the snow-drifts at Elizabeth, and the passengers were transferred with their baggage to the other side of the train, and were carried to Jersey City on a locomotive. The train was then backed to Elizabeth, and the passengers were transferred to the train which had been left there. The train was then backed to Jersey City, and the passengers were transferred to the train which had been left there. The train was then backed to Jersey City, and the passengers were transferred to the train which had been left there. The train was then backed to Jersey City, and the passengers were transferred to the train which had been left there.

NO MEANS OF TRAVEL.

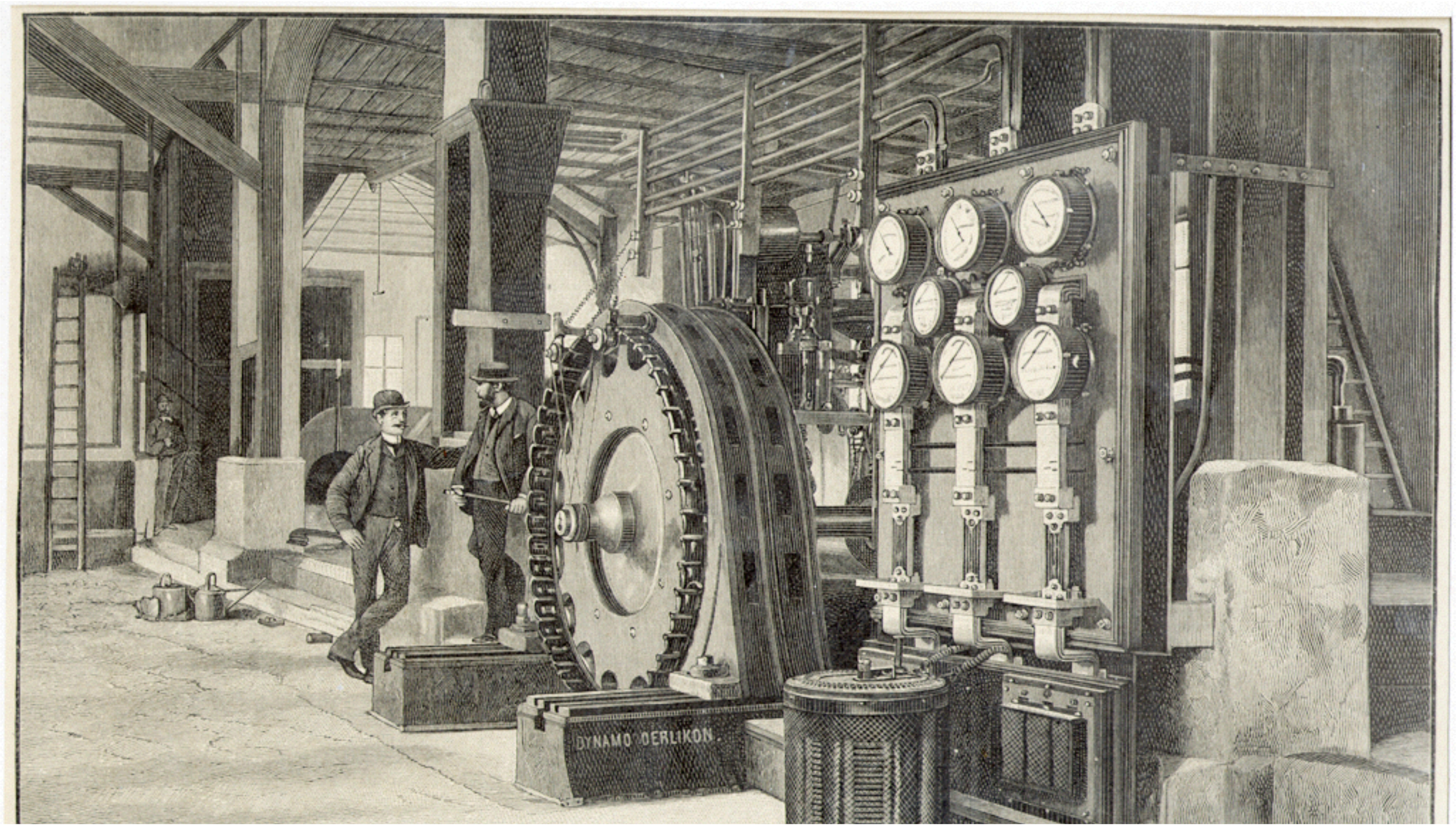
ELEVATED ROADS STRUGGLING VAINLY WITH THE SNOW.

STREET CAR TRACKS ABANDONED.

Almost every one in the city or close by it knows how New-York lives up town or out of town; consequently there are always crowds of people in the railroad depots, either leaving or business part of the city from all directions during the early morning hours, and as a consequence

in oerlikon a company was producing very early power plants and generators which were also used for trains. later the ‘maschinenfabrik oerlikon‘ was transformed into todays still existing abb.

1891

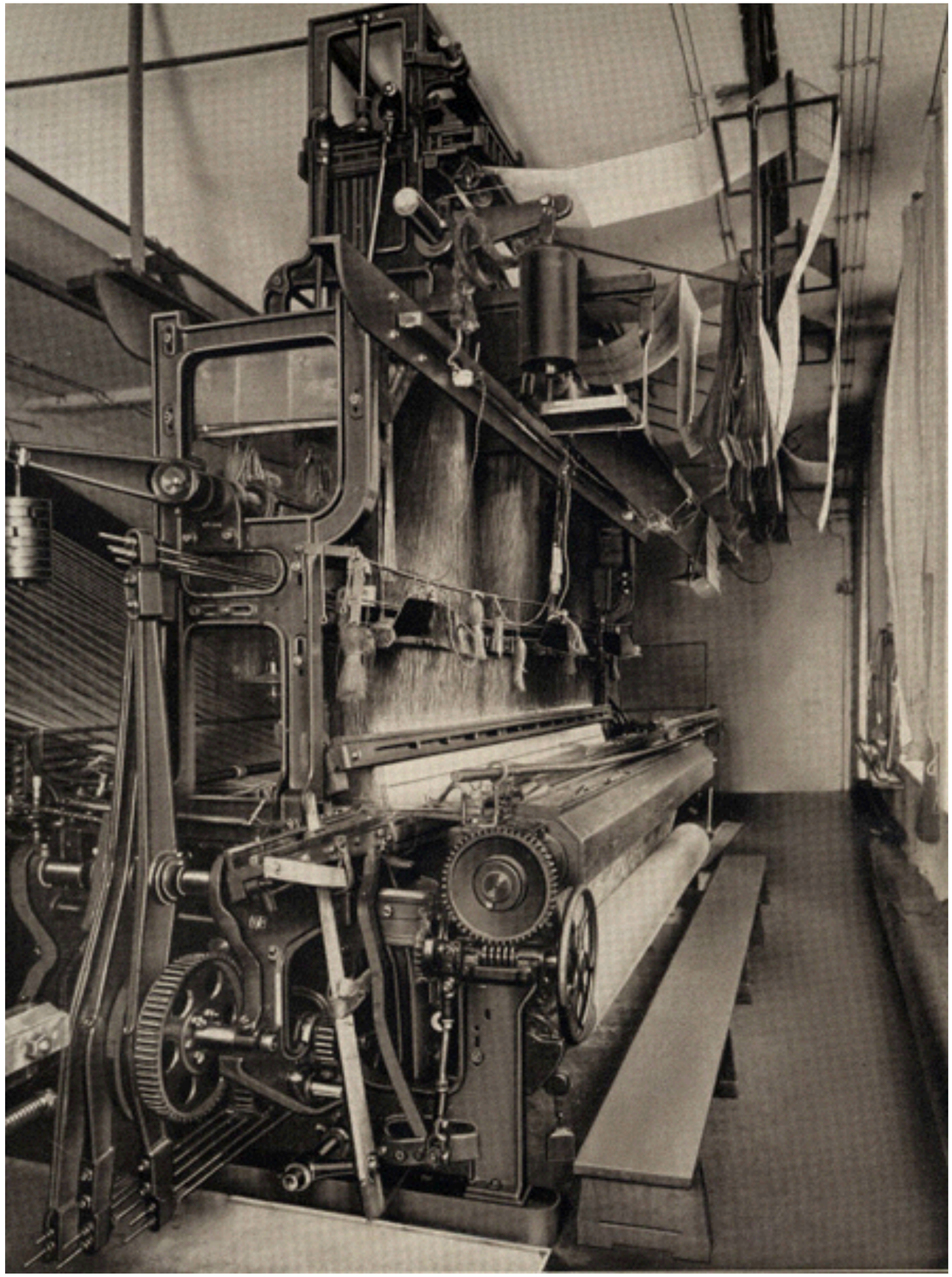


a very smart italian guy was at this time already experimenting with wireless communications. a technology which should later become very useful especially in military applications.

1895
guglielmo marconi

first electrified loom were using cards with punch holes to produce custom patterns. this is maybe one of the first applications for ‘programming’ – although still in the early stages.

1900

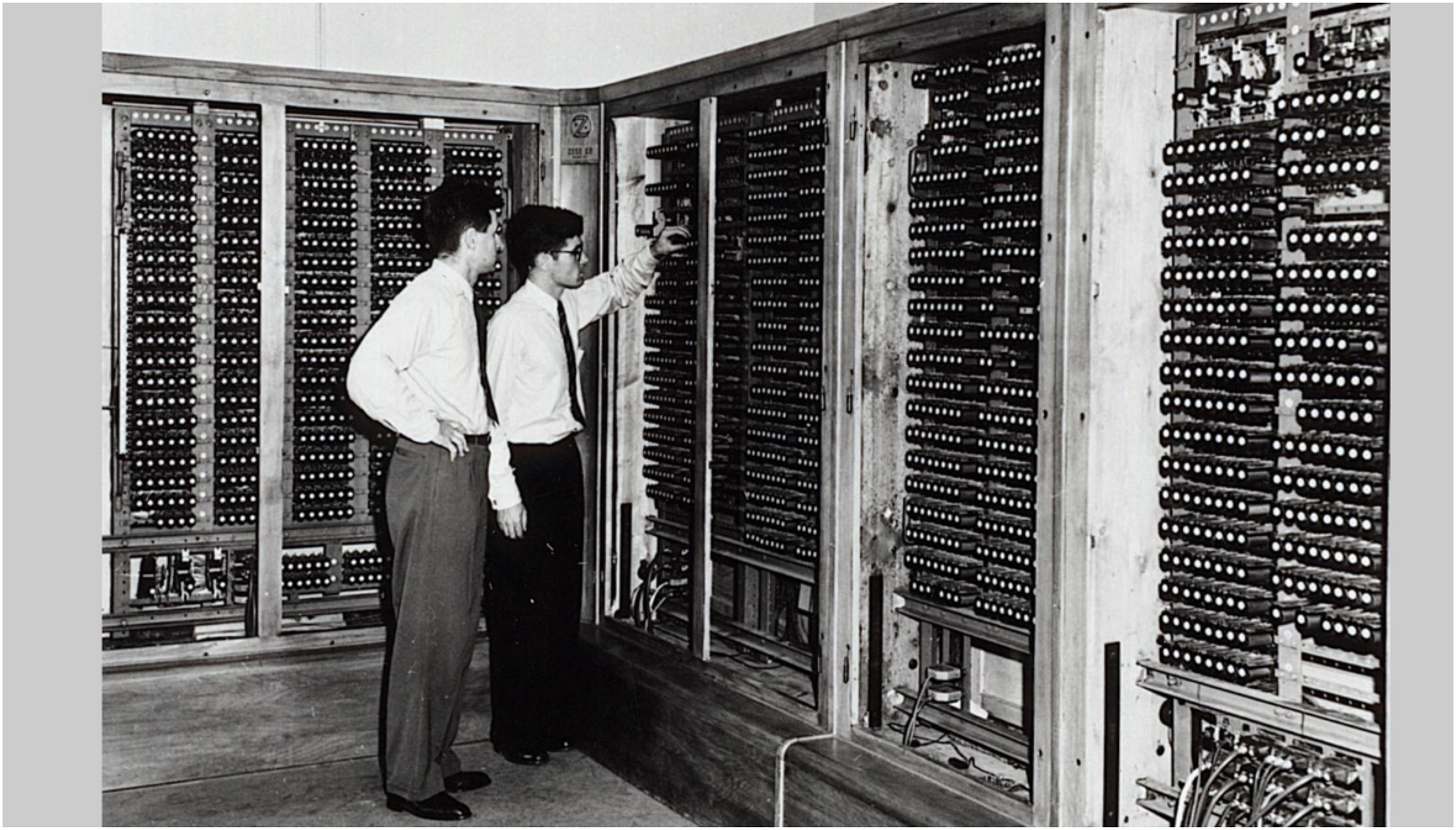


another well-known swiss company introduced the first electrified laundry room with tumbler and washing machine. although still in another style these devices demonstrated how technology was conquering our homes.

1920
vzug

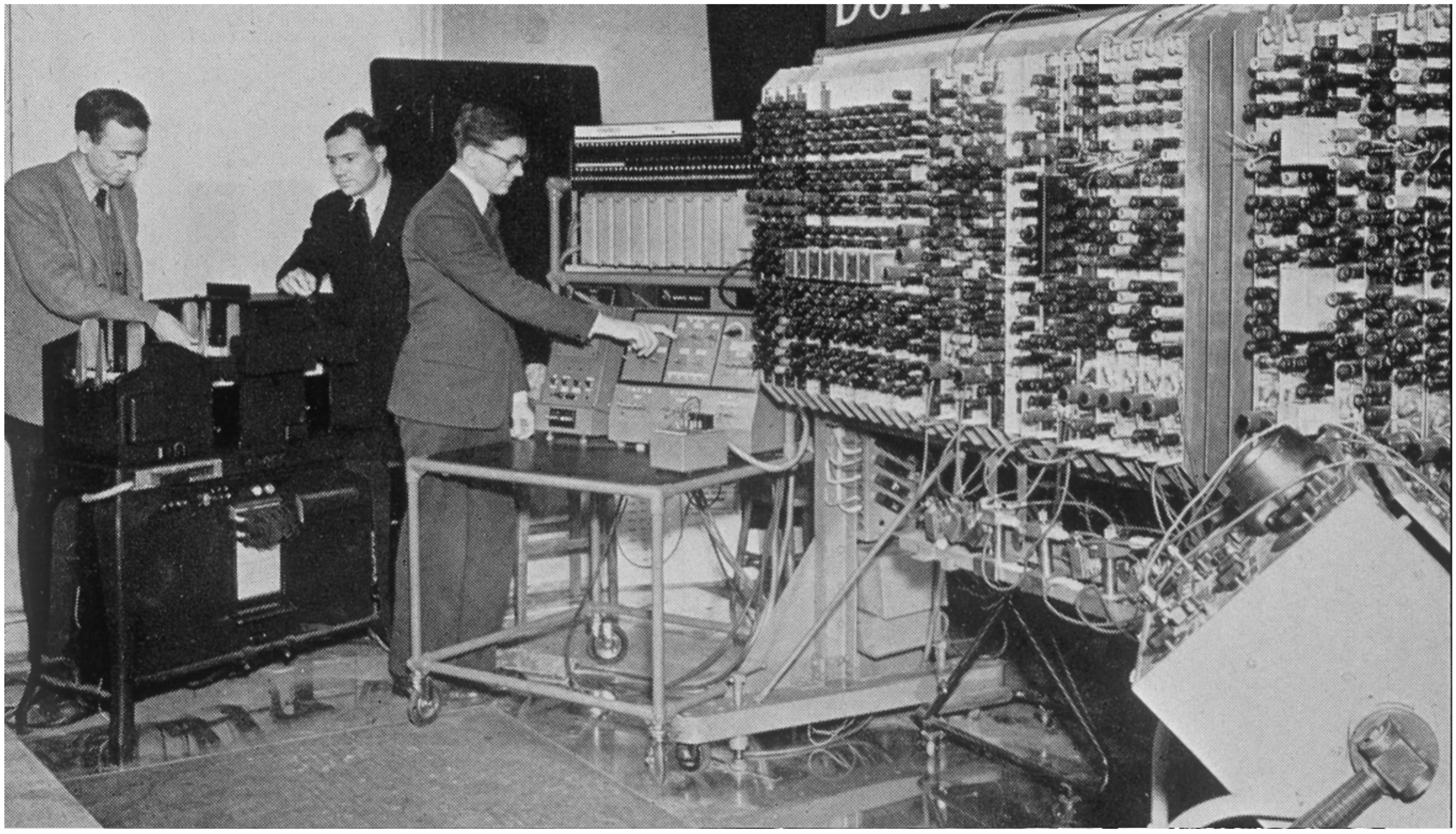
a few years later we had a shift from pure electrified devices towards machines that were more and more intelligent. especially konrad zuse is to be mentioned here.

1938
konrad zuse



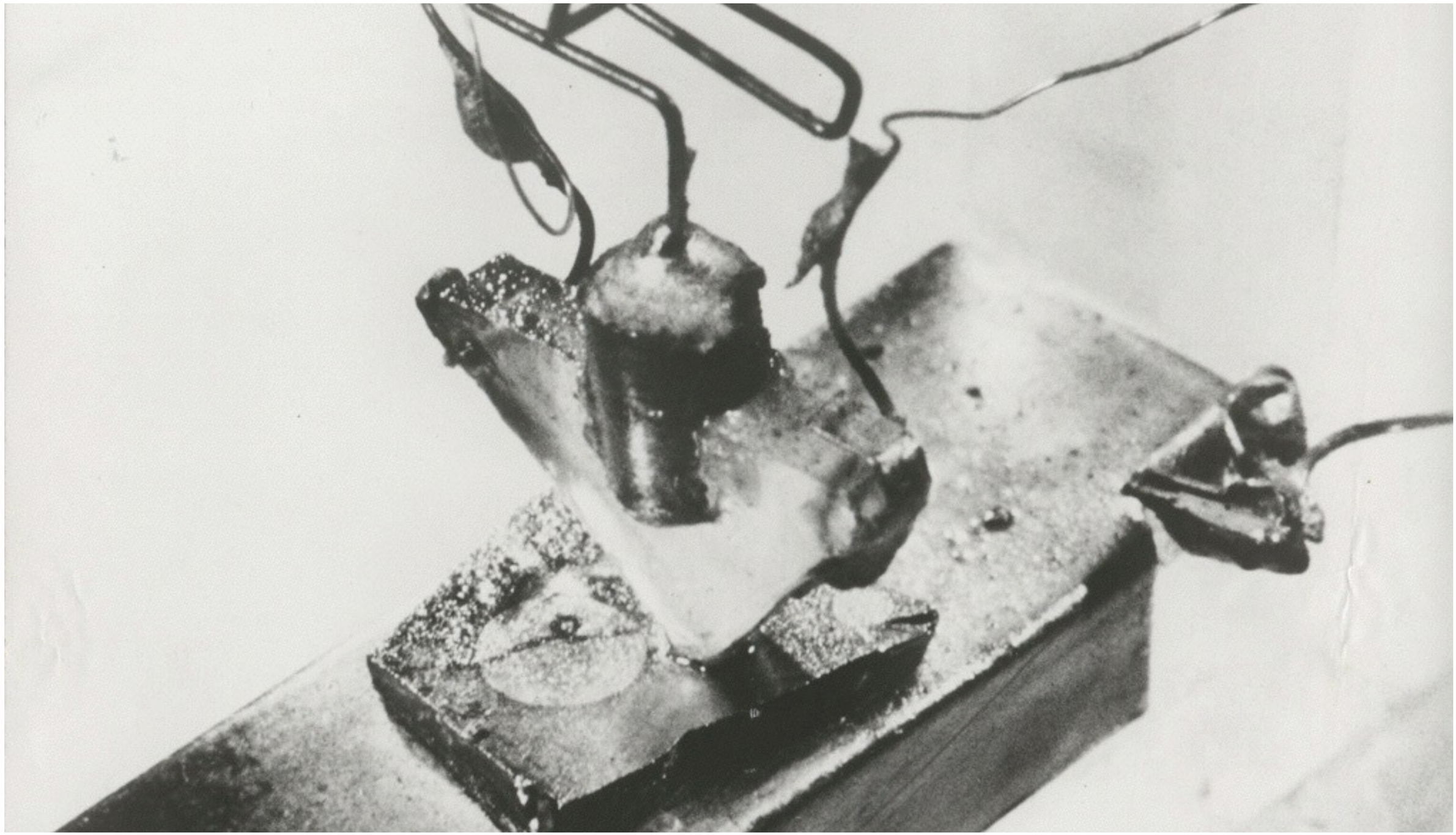
another big name in the game of the early computers is alan turing who was first employed by the military to decode german telegraphy during world war two.

1950
alan turing



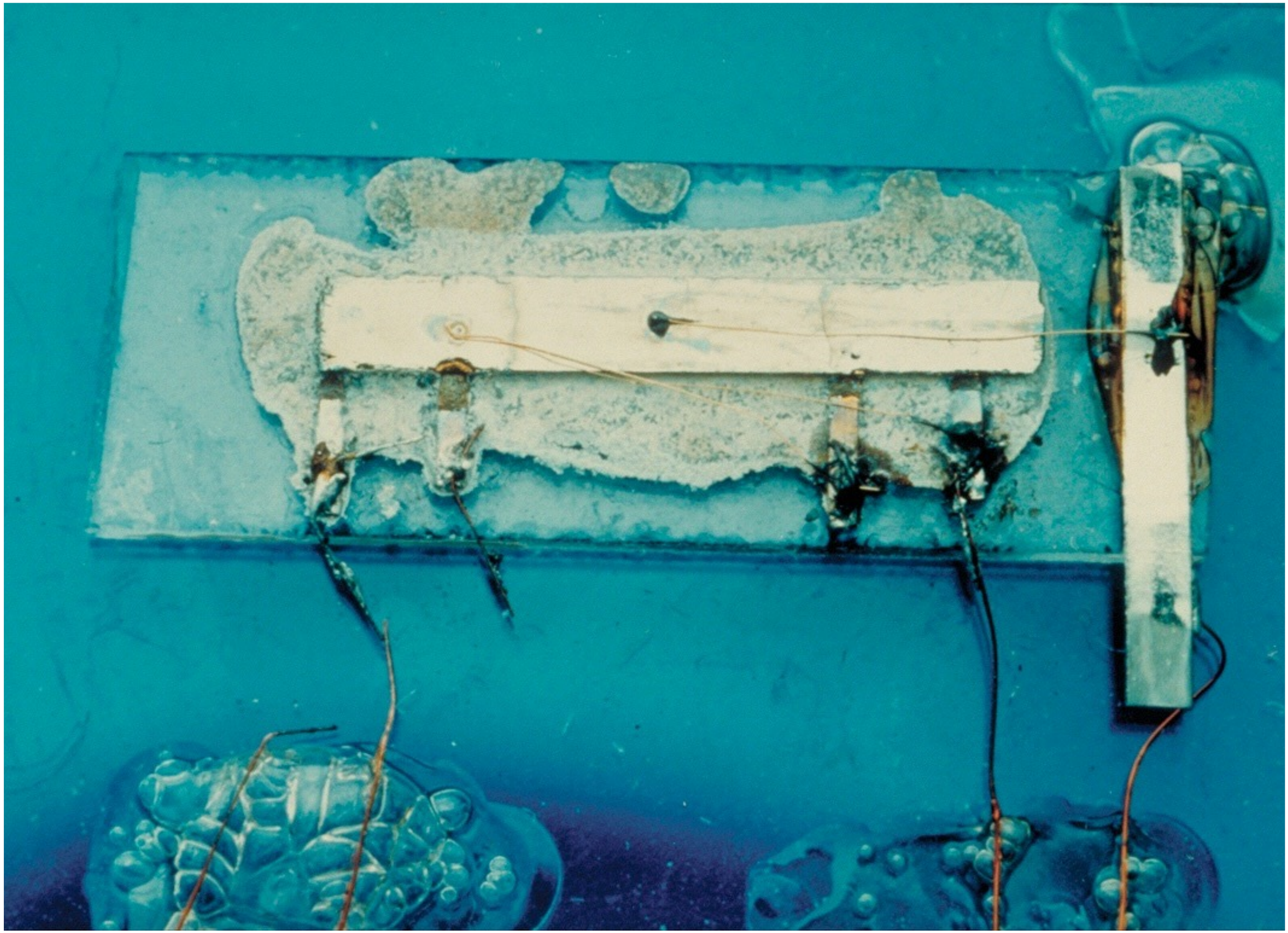
it was in the late 40’ that an invention from the bell labs was introduced which should change the possibilities of the computer industry.

1947
bell labs



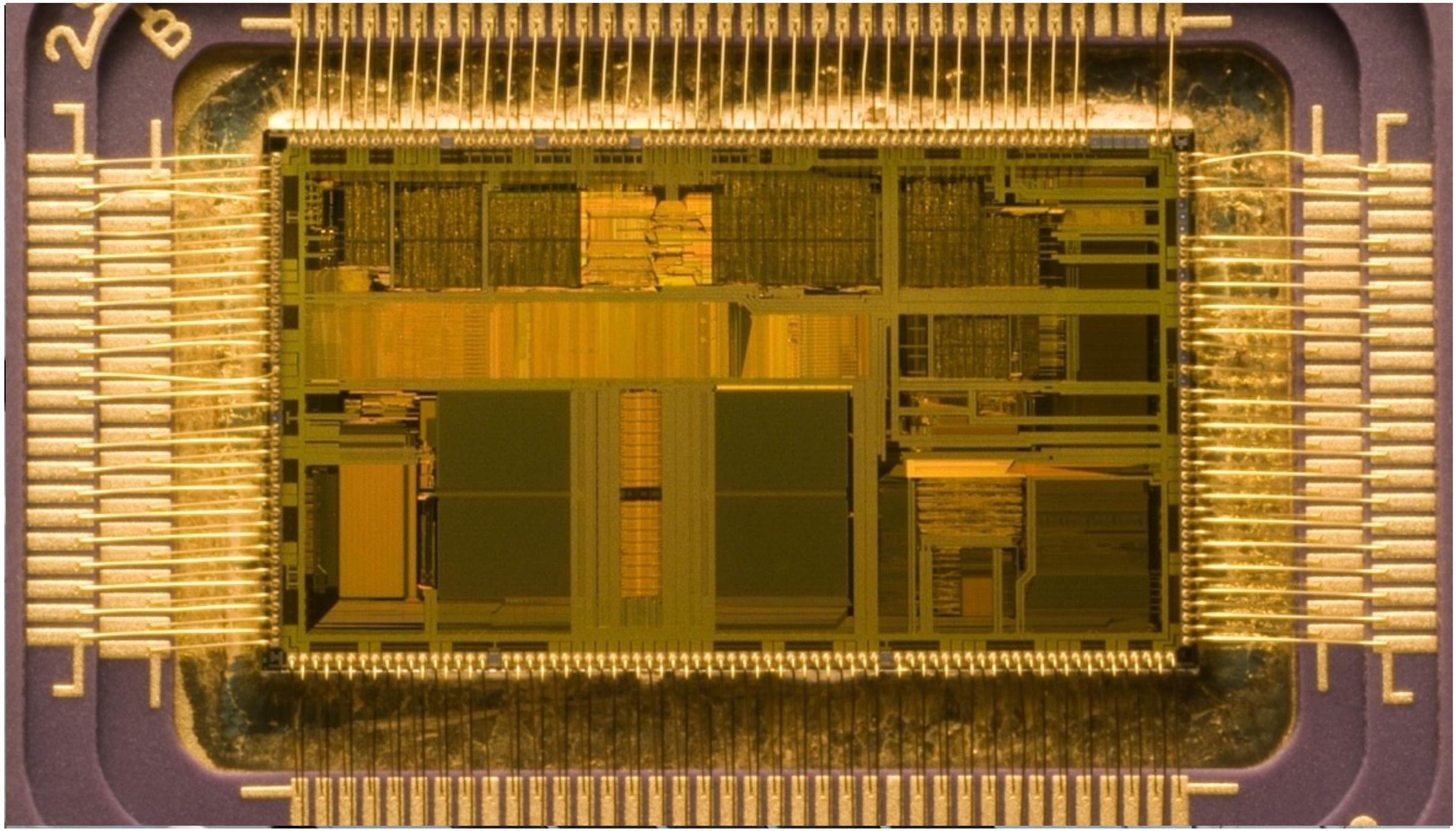
and make housewives happy ;-)
really ! it was the time where more and more products for everyday use were introduced. this caused a new challenge – focussing the users needs and promise an easier life through the use of technology.

1950
vorwerk



the integration of electricity, computers and communication possibilities is the base for all modern technology.

by connecting thousands of transistors on a single integrated chip it was possible to use the associated functionality much more flexible.

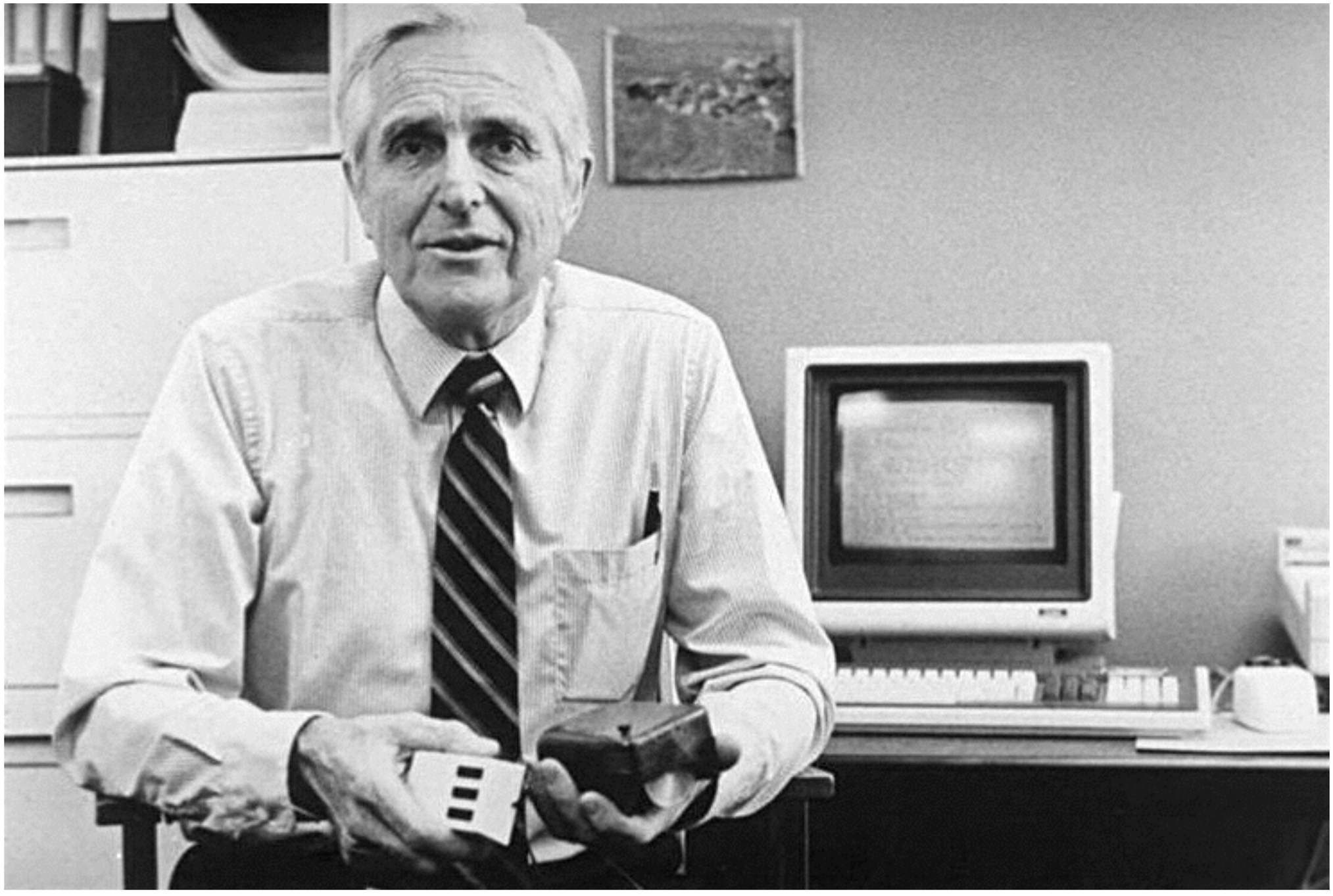


and with more functionality, more possibilities could be realized.

1960
nasa

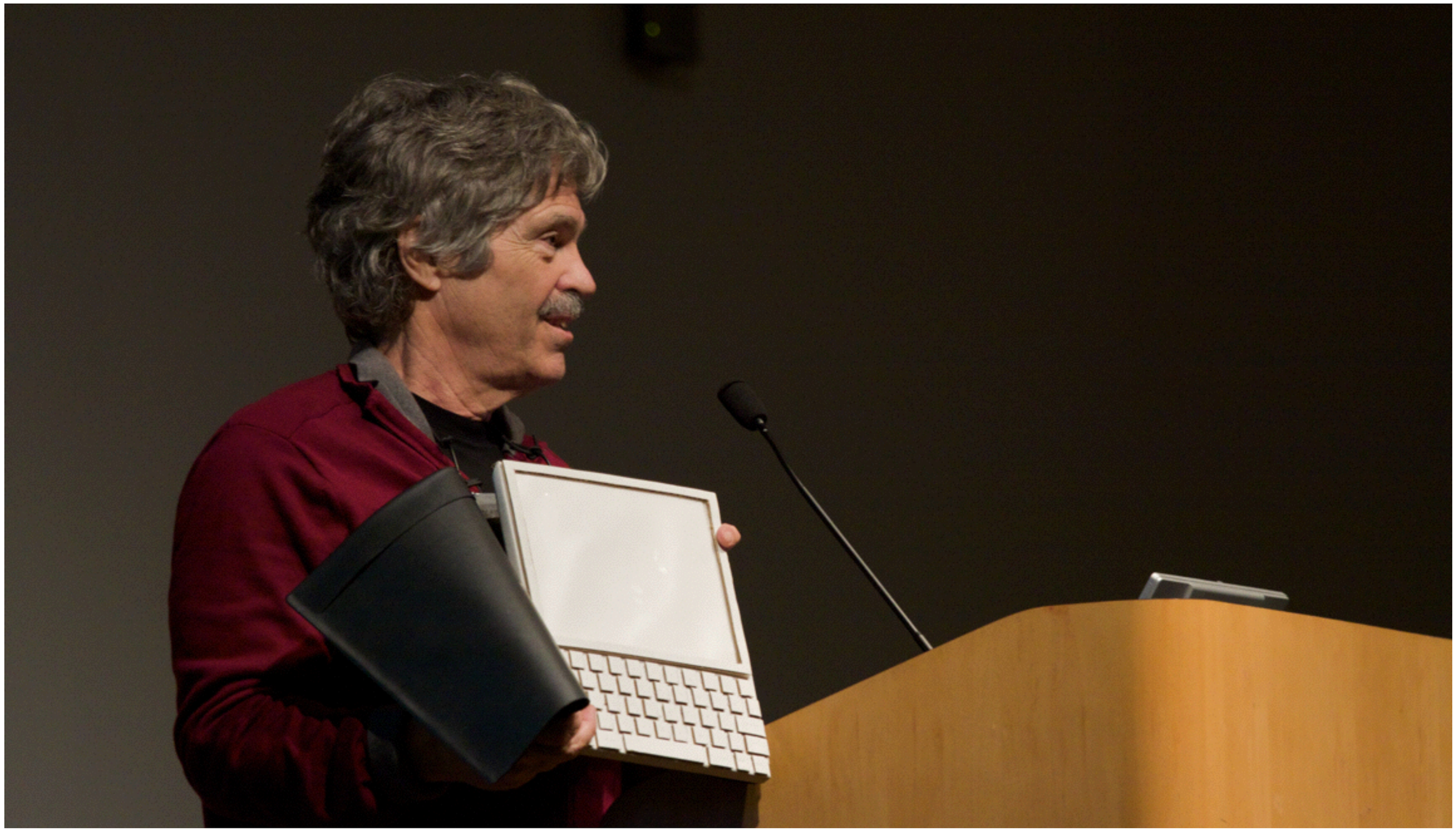
this is also the time where hardware and software engineers were experimenting with new ways to interact with our devices. especially the interaction with the computer became more and more important.

1963
doug engelbart



even concepts of how computers could transform from big machines into small, portable devices (gadgets) were introduced.

1972
alan kay



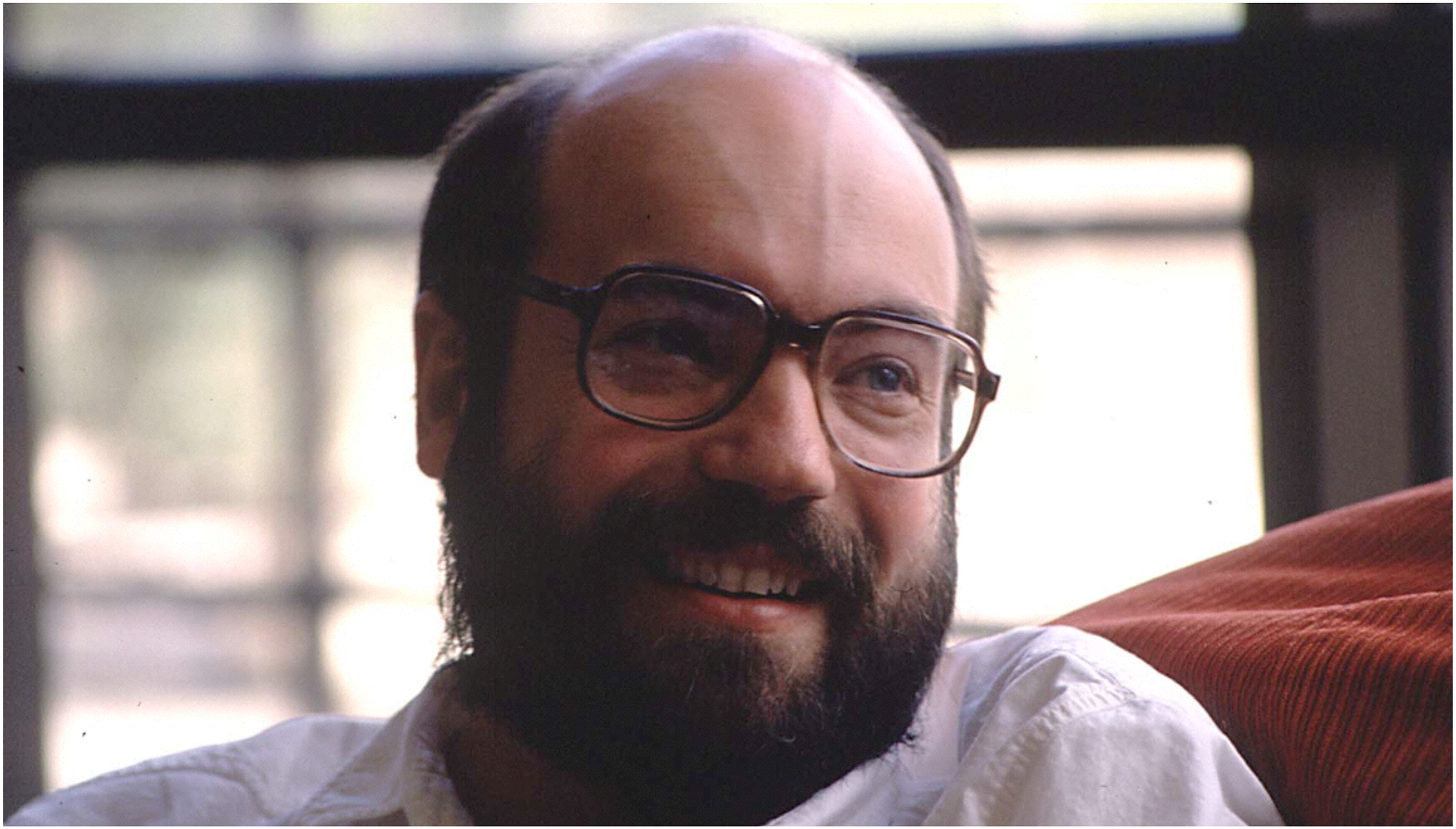
by the way... alan kay is the one who will form the phrase: DOING with IMAGES makes SYMBOLS. this phrase describes the development of computer interfaces and is fundamental for every interaction designer.

www was the basic technology – which already has been developed as a project of military universities in the us – when tim berners-lee introduced the concept of html at cern in geneva.

1990
tim berners-lee

this guy though at the same time how cool it would be to have a fridge that could be integrated in the internet.

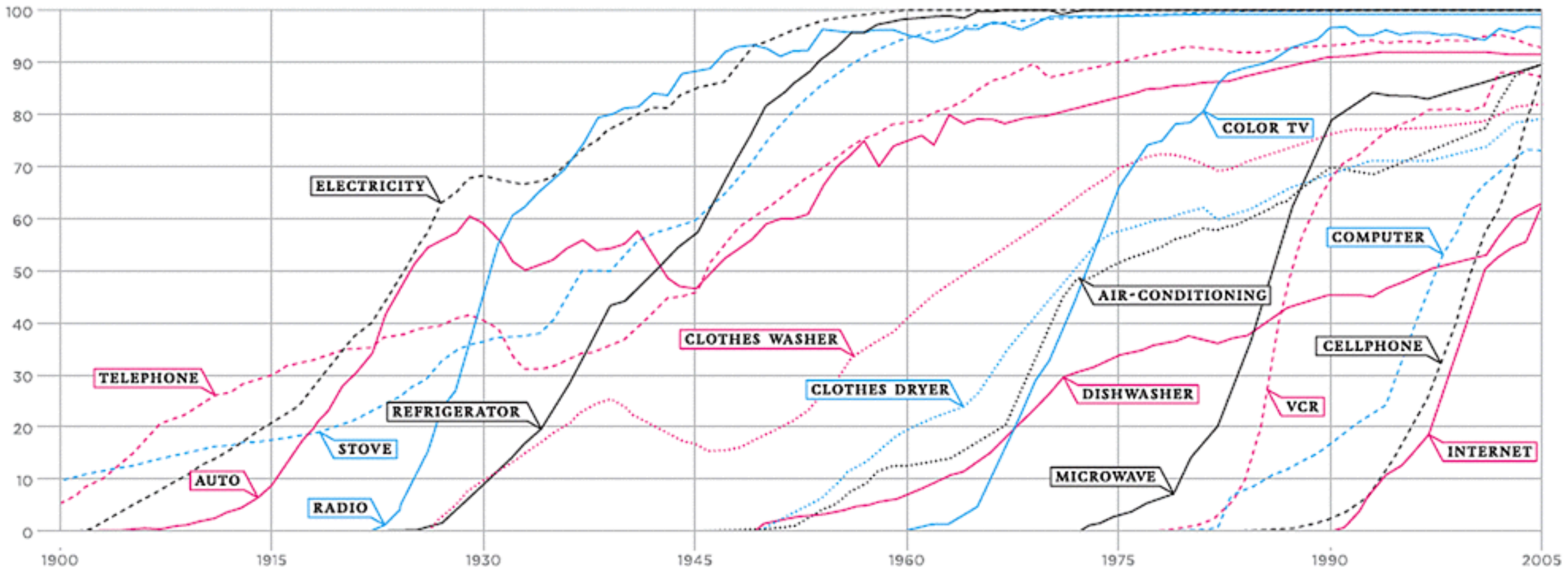
1990
mark weiser



and a company in cupertino thought how cool it might be to do the same stuff that many others did before – but more consequent – and earn a hell lot of money – until today.

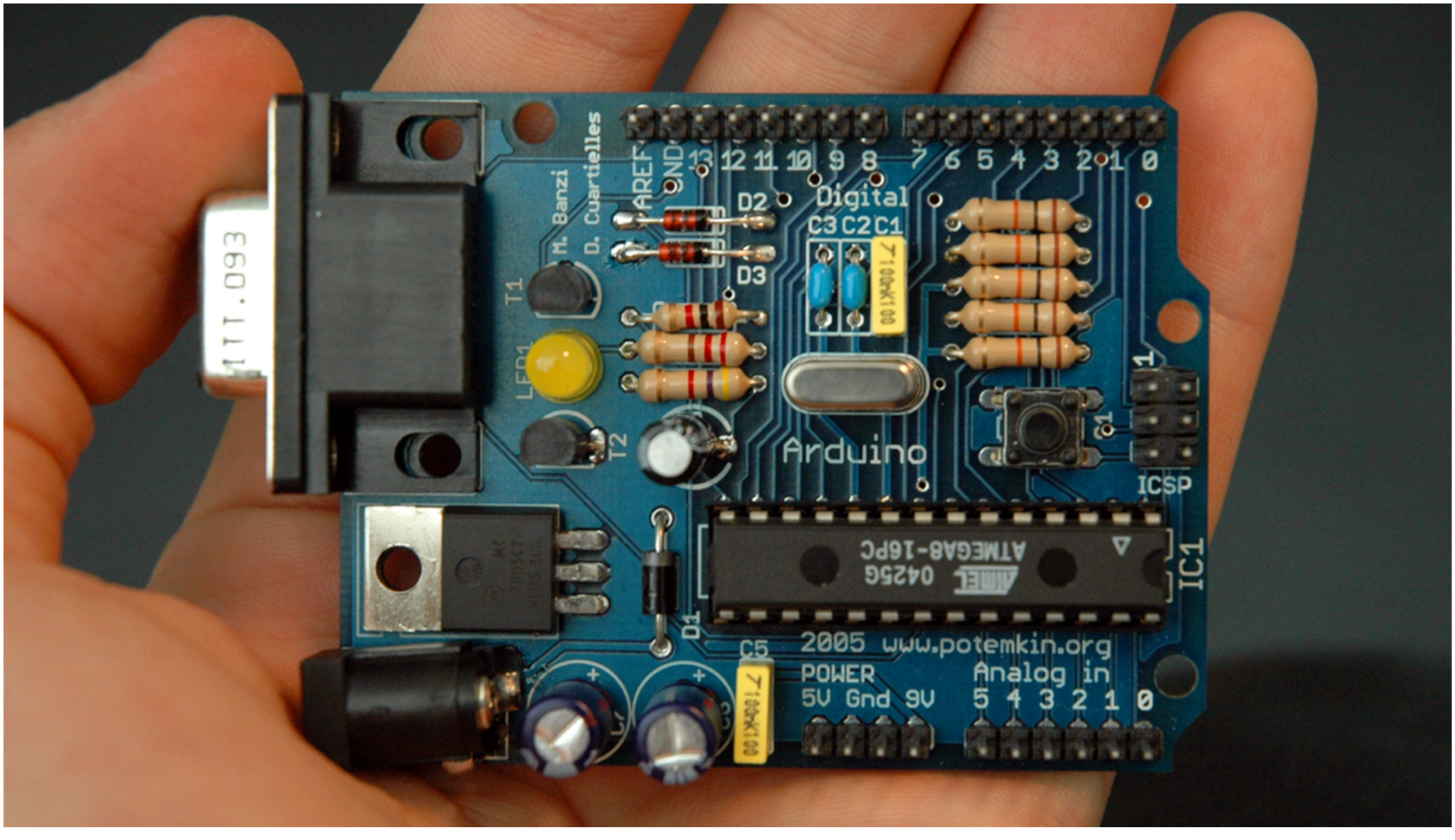
2001
apple

if we look at the rapid growth of technology we have to be aware that we take a big responsibility how technology is perceived and used.

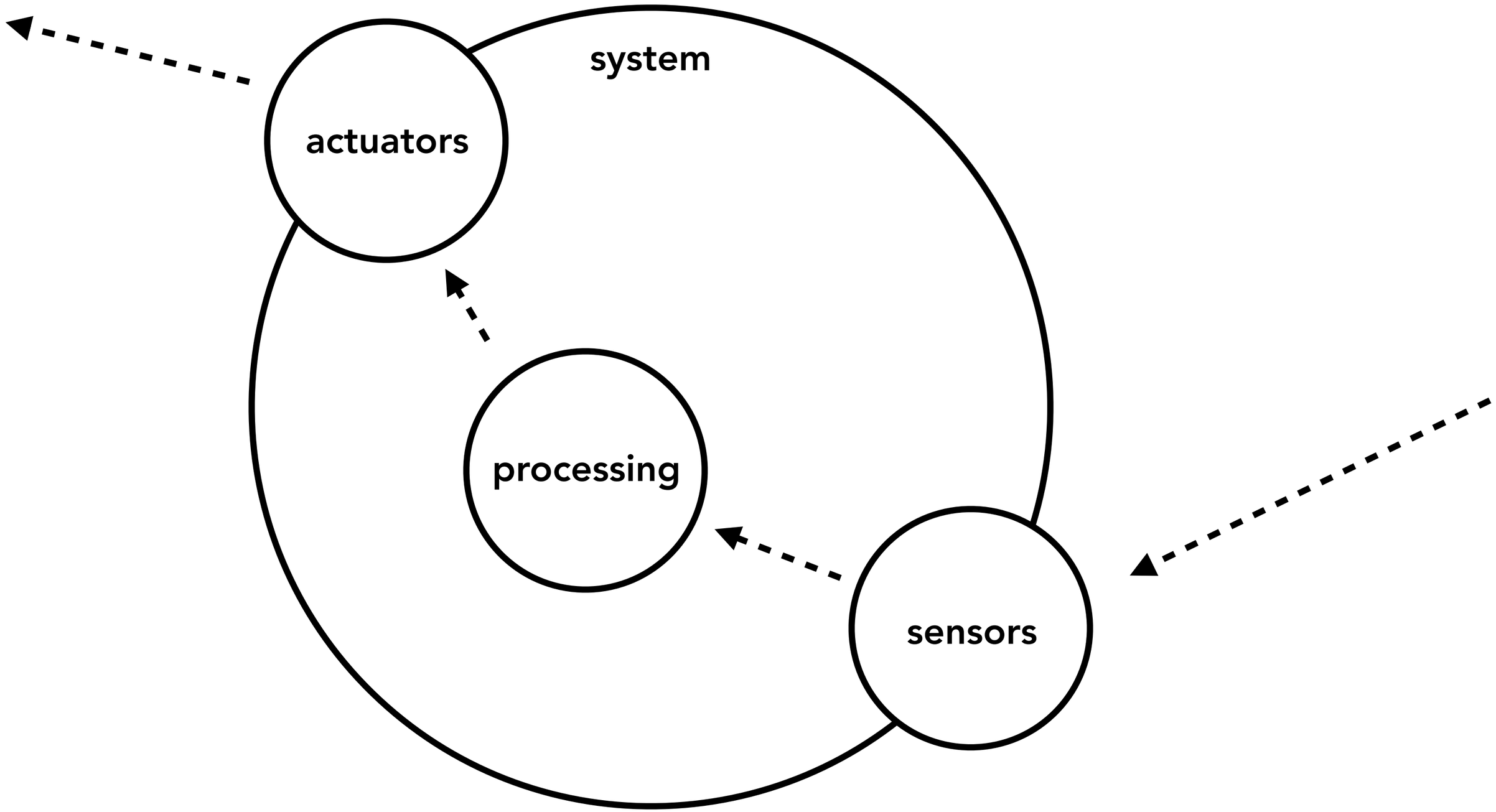


therefore we can learn what technology can do and what technology can’t. the perfect starter is the arduino platform which was build for interaction designers.

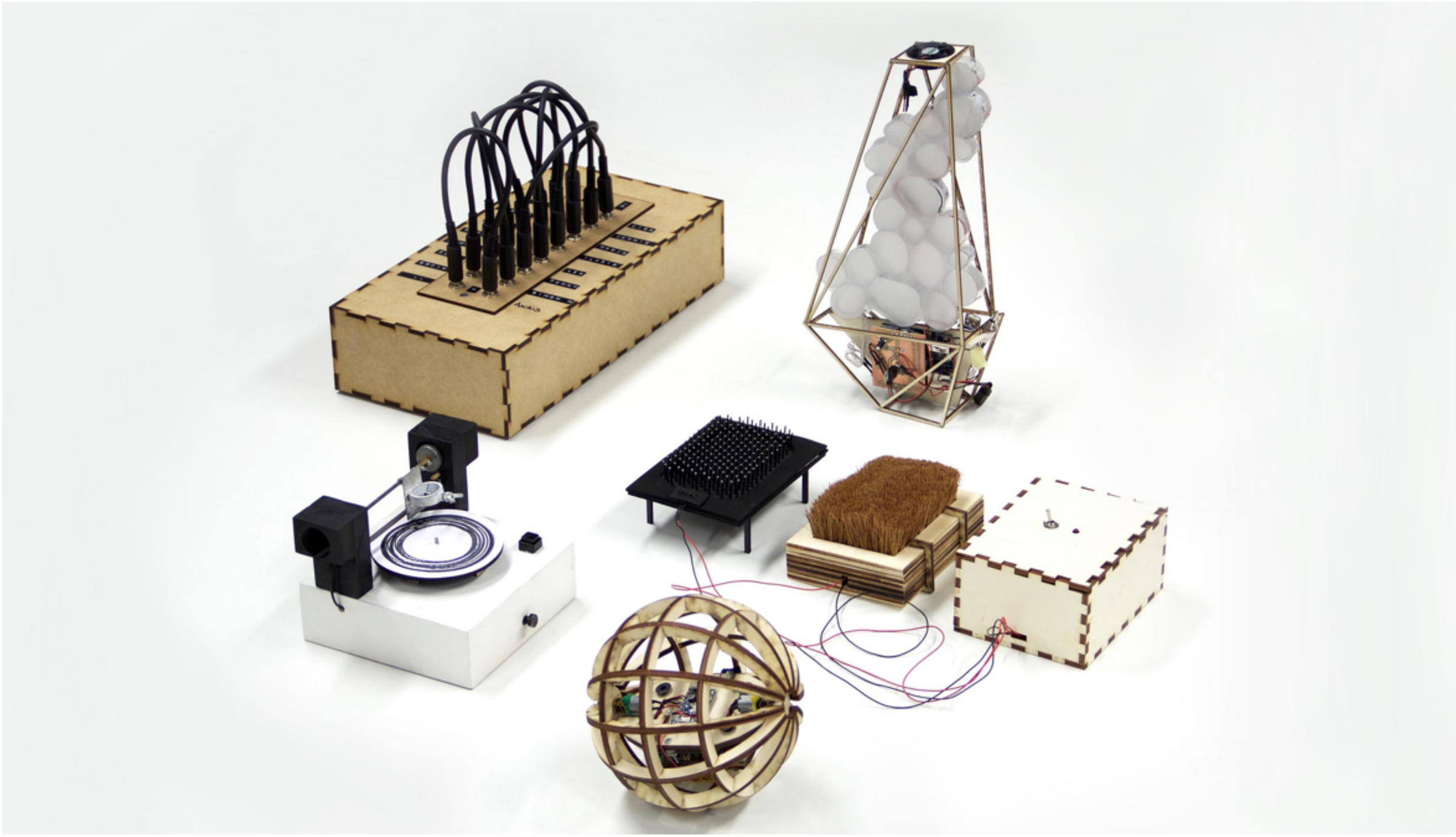
2005
arduino



we use arduino to sense events in the real world through different sensors. we then process this information and react through the use of actuators.



the goal this year is to build an interactive installation where all your objects are interconnected and respond to each other. ready?



resources:

shock and awe, documentary – bbc
doing with images makes symbols – alan kay
arduino documentary – vimeo

physical computing – tom igoe
make: electronics – charles patt
getting started with arduino – massimo banzi
getting started in electronics – forrest m. mims (1983)
arduino cookbook – michael margolis
programming interactivity – joshua noble
making things talk – tom igoe (2011)