
RHINOCERON
1515

2022-2023 DHMSA:

Hospitals, Medicine and Laboratory Science:

The history of humour in hospital medicine.

Adrian Thomas

Visiting Professor

Canterbury Christ Church University

1st April 2023

2022-2023 DHMSA: Radiology and Imaging: Part 1

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Visiting Professor

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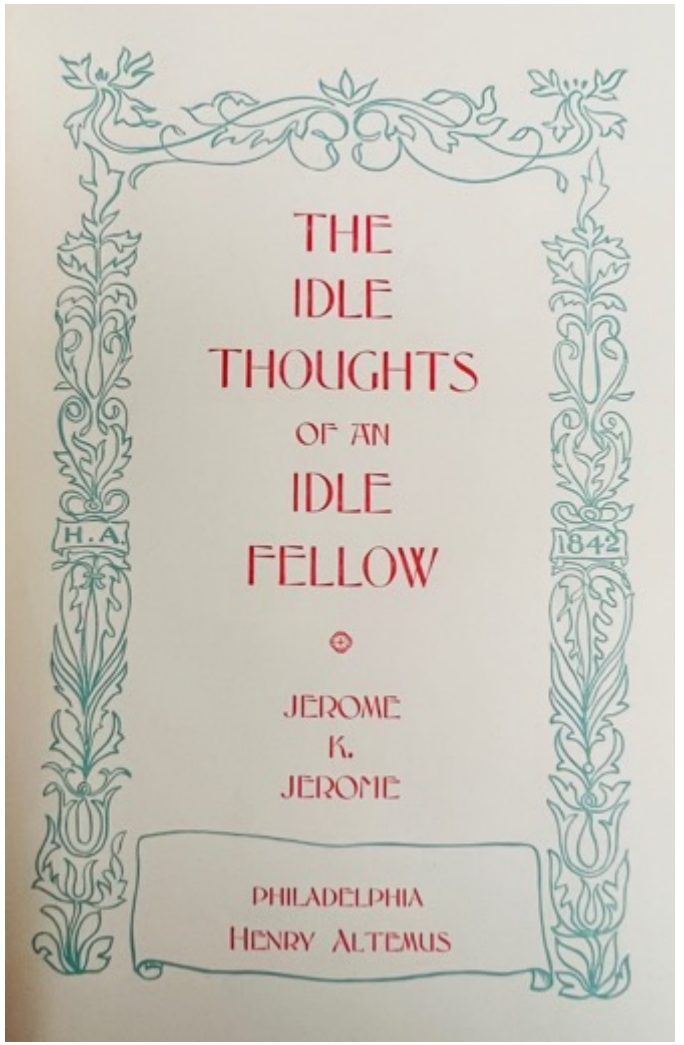
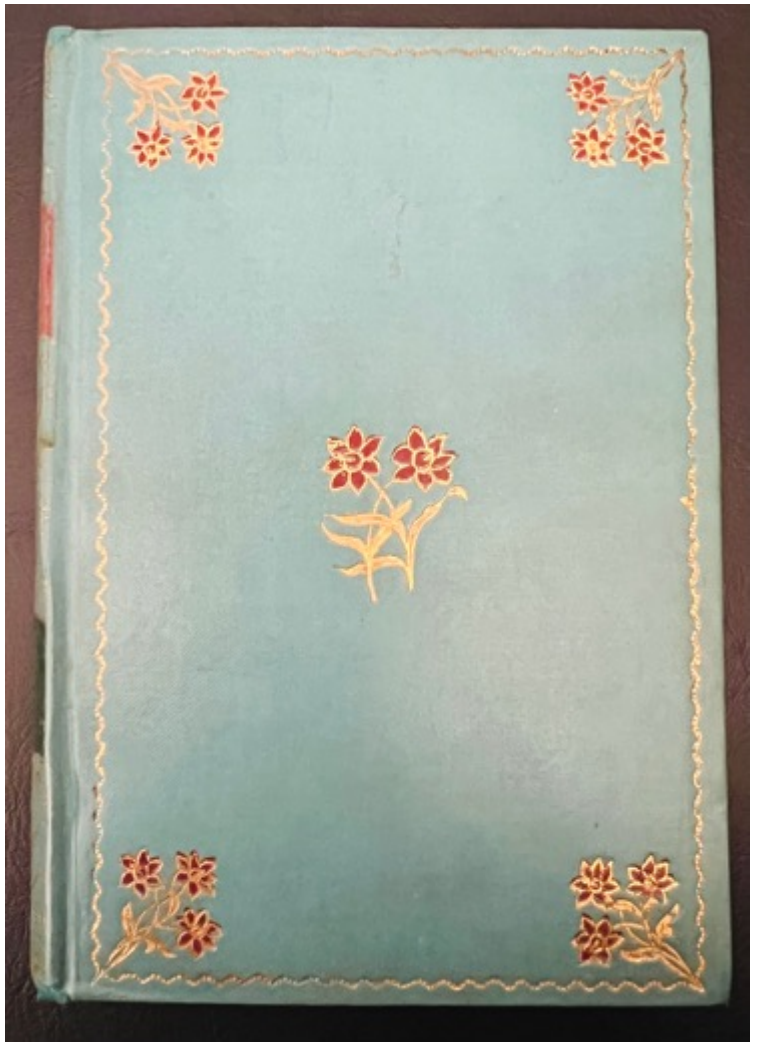
1st April 2023

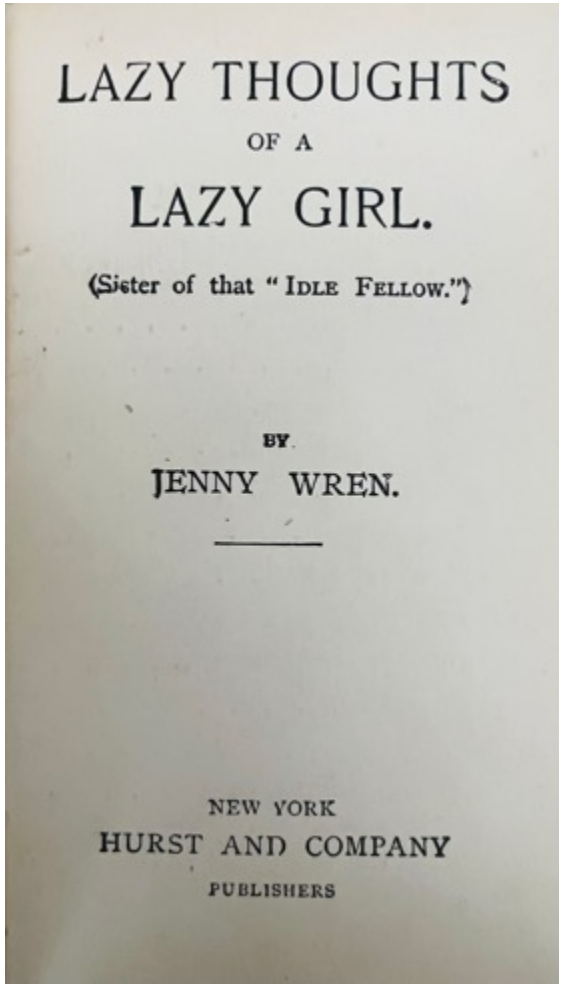
April 1: World Idleness Day.

Idle Thoughts of an Idle Fellow, published in 1886.





Lazy Thoughts of a Lazy Girl, by Jenny Wren
Sister of that "Idle Fellow" First published January 1, 1891


LAZY THOUGHTS
OF A
LAZY GIRL.
(Sister of that "IDLE FELLOW.")
BY
JENNY WREN.
NEW YORK
HURST AND COMPANY
PUBLISHERS

One thing leads to another:

- One development facilitates another.
- Key developments:

1. Focus tube.
2. Coolidge tube.
3. Bucky grid.
4. Shockproof apparatus.
5. X-ray television.
6. Automatic Processing.
7. Digital imaging: CT, PACS, AI &c.

Various Elements of Radiology:

- Photographic: Recording media (plate, paper, film, digital/virtual/PACS).
- Electrical Engineering: X-ray tubes & generators.
- Mechanical Engineering: X-ray tables.
- Anatomical: Normal and developmental.
- Medical: Transformation of diagnosis and investigation.
- Chemical: Contrast media, plastics, metallurgy.
- Civil Engineering: Hospital and departmental design.
- Cultural: Art, novels, & films.

Morgan, Davy and Faraday.

- In the 19th Century there was increasing interest in passing electrical discharges across evacuated glass bulbs.
- **Humphry Davy** in 1822 and **William Faraday** looked at what happened when two metal electrodes were sealed at the ends of a glass bulb and a current was passed as the pressure inside was reduced.
- Some of these tubes were made in interesting shapes and would light up with a pretty colour. These were called Geissler tubes.

ON RADIATION.

THE "REDE" LECTURE

DELIVERED IN THE SENATE-HOUSE

BEFORE THE UNIVERSITY OF CAMBRIDGE

ON TUESDAY, MAY 16, 1865.

BY

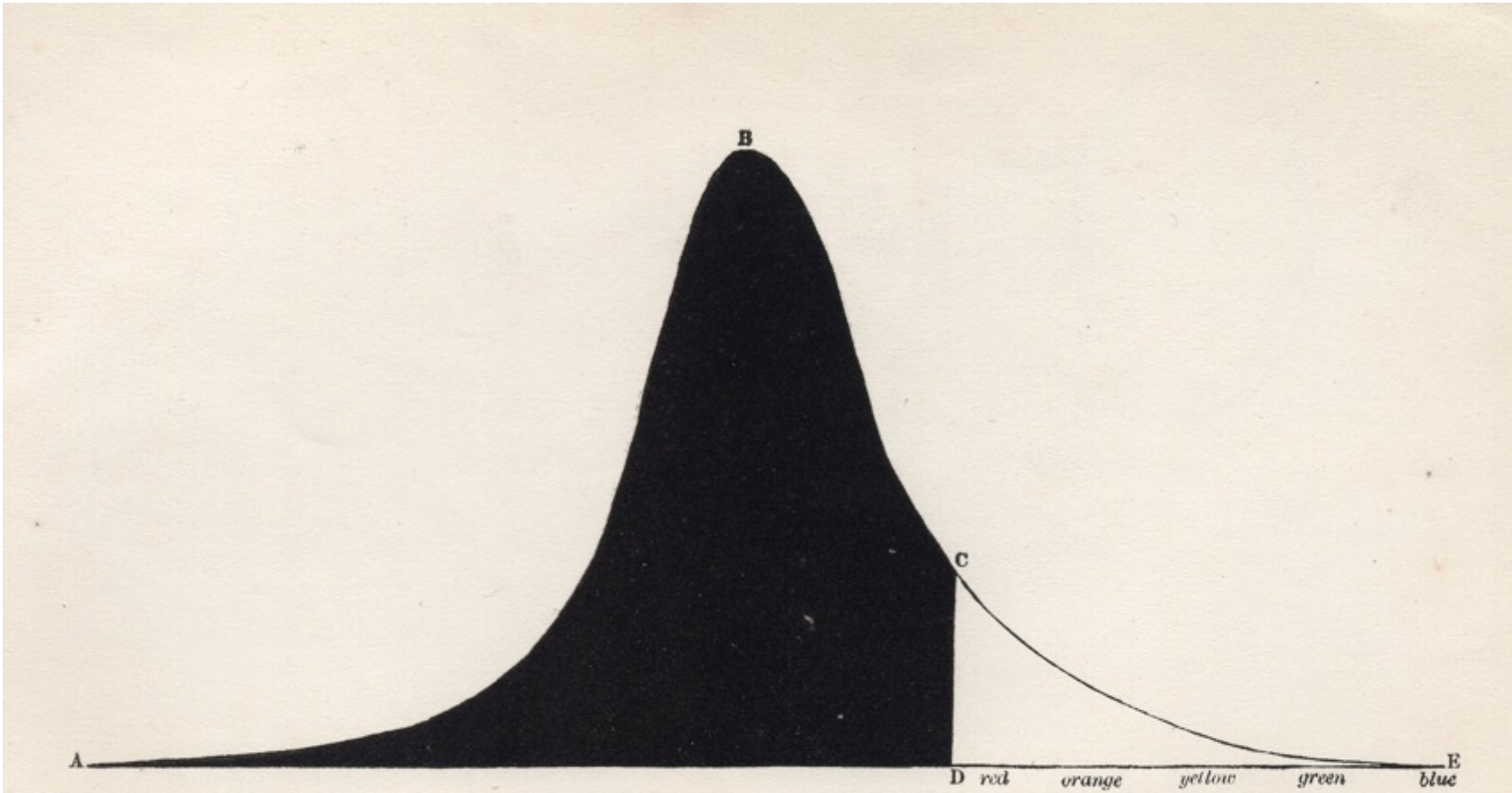
JOHN TYNDALL, F.R.S.

PROFESSOR OF NATURAL PHILOSOPHY IN THE ROYAL INSTITUTION
AND IN THE ROYAL SCHOOL OF MINES.

LONDON:

LONGMAN, GREEN, LONGMAN, ROBERTS & GREEN.

1865.



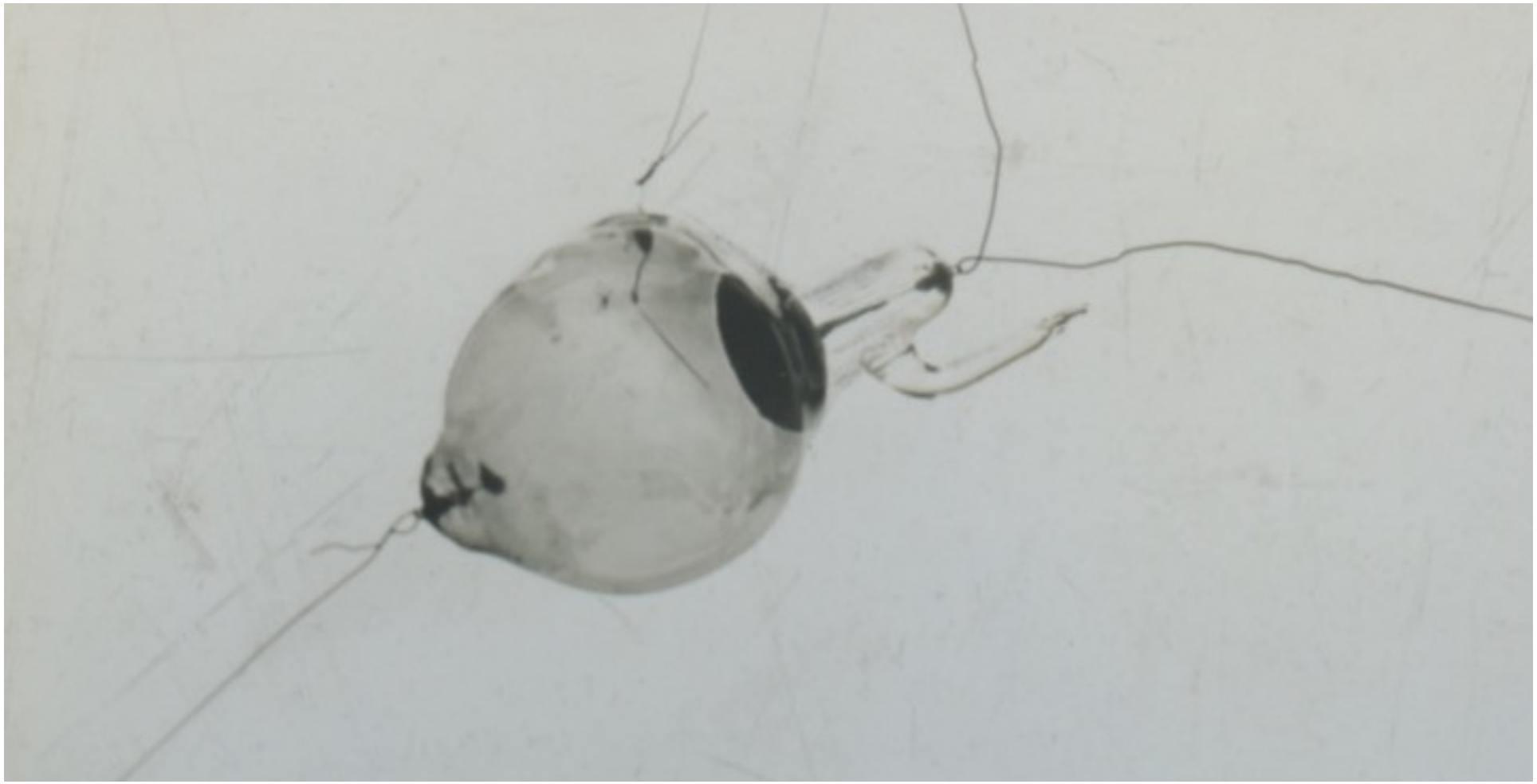
Spectrum of Electric Light.

Sir William Crookes

- **Sir William Crookes** (1832-1919) made a series of experiments in 1879.
- In these early tubes (Crookes-Hittorf tubes) the anode and cathode were simple electrodes projecting into the bulb and it was using one of these tubes that **Wilhelm Röntgen** made his discovery.

No. 1. Original tube with concave electrode to focus the cathode rays on a platinum target, used by Sir William Crookes in his experiments on radiant matter. Made 11th March, 1879; described and illustrated in Phil. Trans. 1879, Fig. 22, p. 163 (with stand). (Broken and repaired 1925.)

Presented by Sir William Crookes.



G W C Kaye (1919) X-Rays: An Introduction to the Study of Röntgen Rays.

IN the early nineties, it was not infrequently maintained that the science of physics had put its house in complete order, and that any future advances could only be along the lines of precision measurement. Such pessimism has been utterly confounded by a sequence of discoveries since 1895, unparalleled in their fundamental nature and promise.

Even many not specially concerned have had their attention directed to the recent attempts at solving the riddle which has excited interest and taxed ingenuity since the beginning of civilisation—the problem of the ultimate structure of matter. The chemist and physicist have long built upon a theory of atoms and molecules; though information as to the existence and behaviour of individual atoms was only based on speculation, however justifiable.

But within the last decade we have not only isolated the atom, but we have learnt a great deal about its internal structure. Radioactivity has, for example, introduced us to an electrically charged atom of helium (the α ray) with characteristics such that it can, in spite of its extreme smallness,[1] make individual appeal to our senses. The speed of α rays is so abnormally high,[2] that if, for instance, they are allowed to strike a fluorescent screen, as in the Spinthariscope of Sir Wm. Crookes, each atom possesses enough energy to record its arrival by a visible flash of light. This provided what was probably the first instance of the registering of a single individual atom. Rutherford and Geiger similarly turned to account the electric charge, and have

[1] Mass about 7×10^{-24} gramme; diameter about 2×10^{-8} cm.

[2] About 12,000 miles or 2×10^{9} cm. per sec.

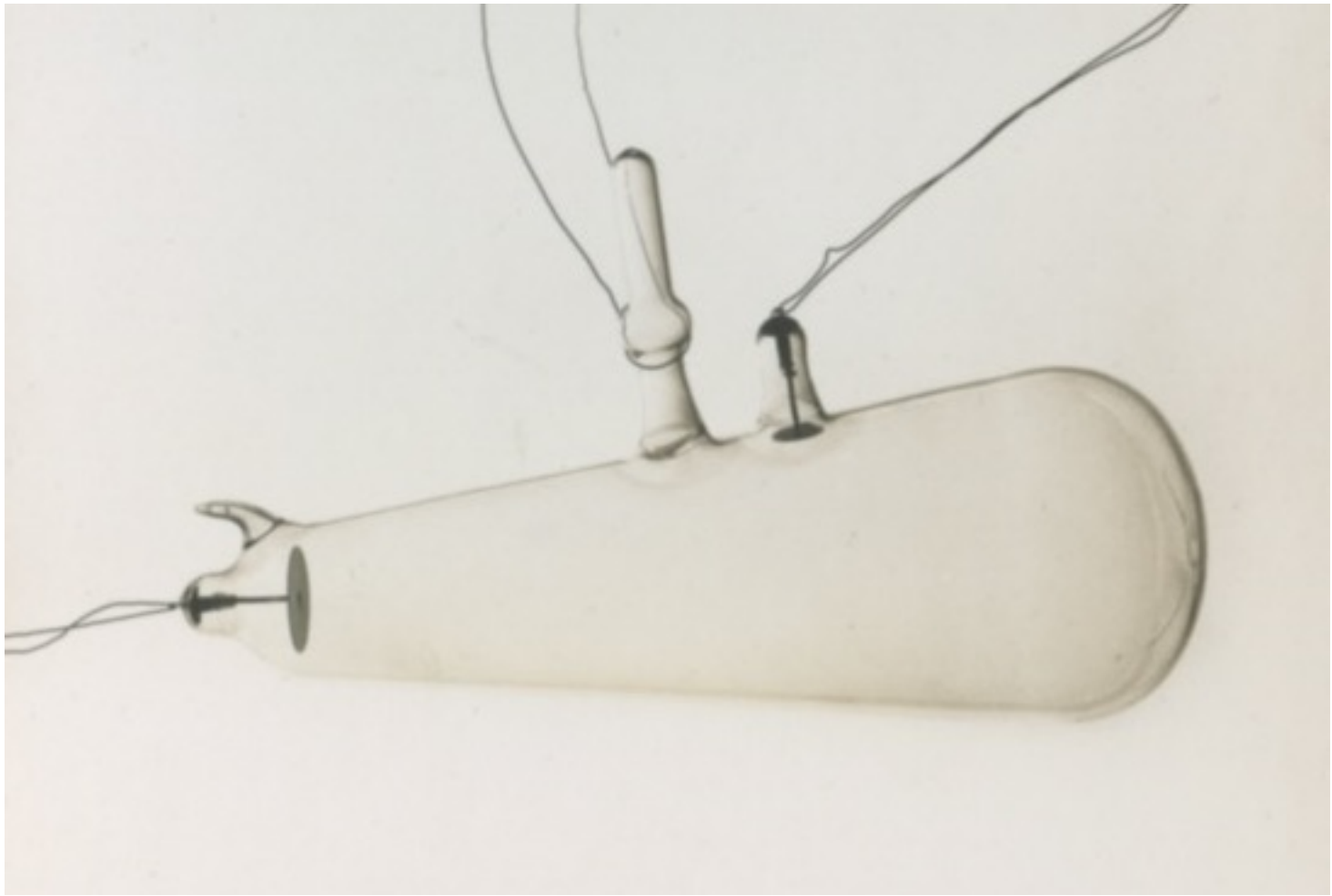
Wilhelm Conrad Röntgen (1845-1923)

- Discovered “A New Kind of Radiation” on November 8th 1895 in Würzburg, Germany.
- He called them “X-rays”.

- 2023 is the centenary of his death.

No. 5. Large pear-shaped tube, the form originally used by Prof. Röntgen for producing X rays. Manufactured in Germany. The glass has been pierced by bringing the cathode rays to a focus with a magnet. Cracked at one end.

Presented by Mr. A. A. Campbell Swinton.

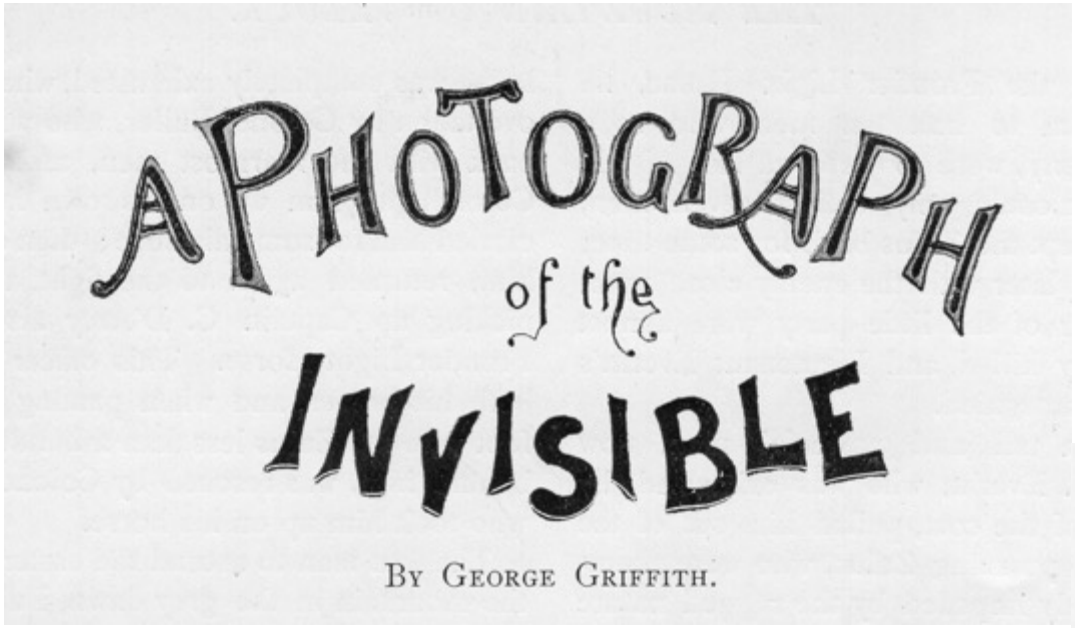


Hand of Frau Bertha Röntgen.

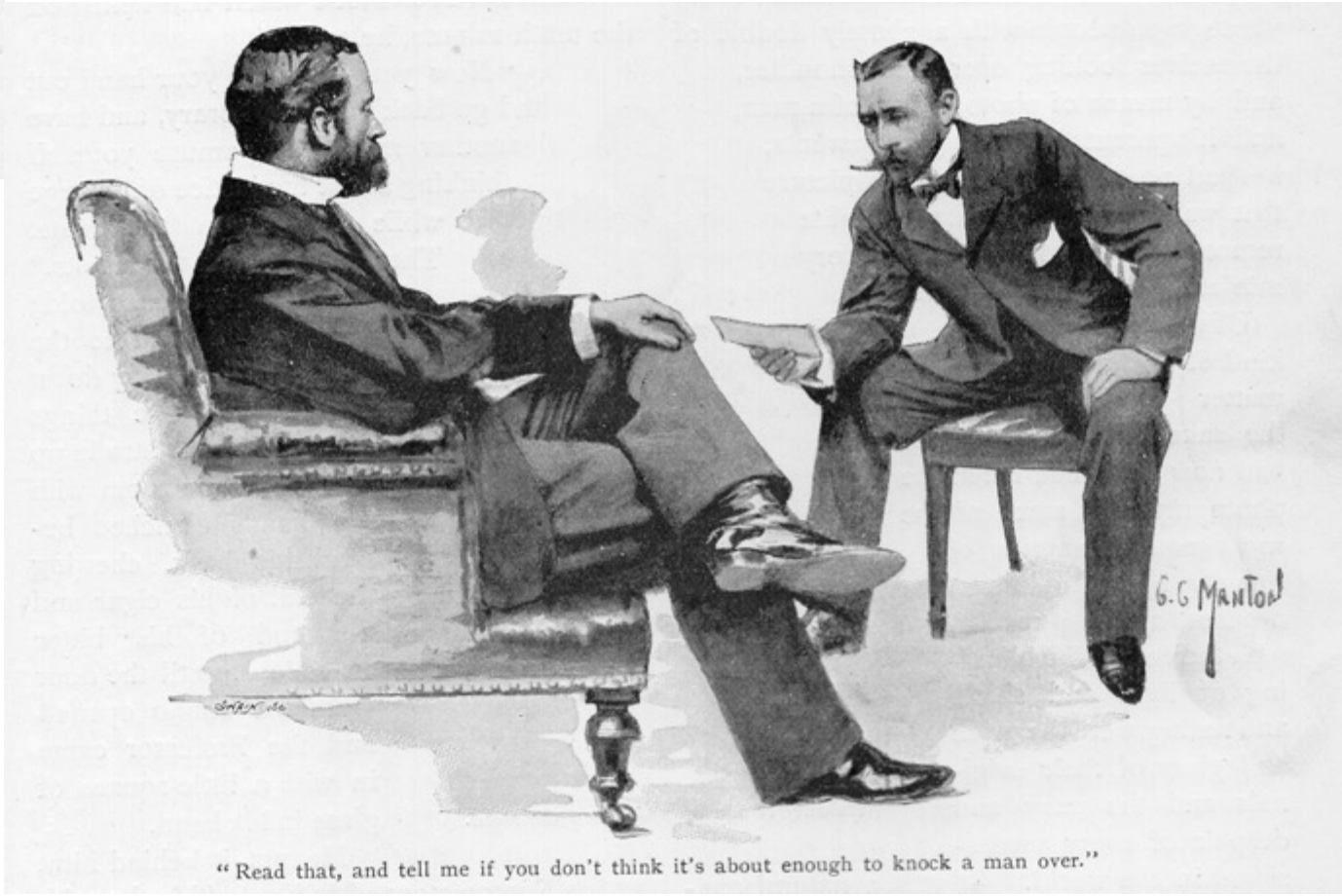
BMJ 22nd February 1896

"What we see depends mainly on what we look for"

Sir John Lubbock

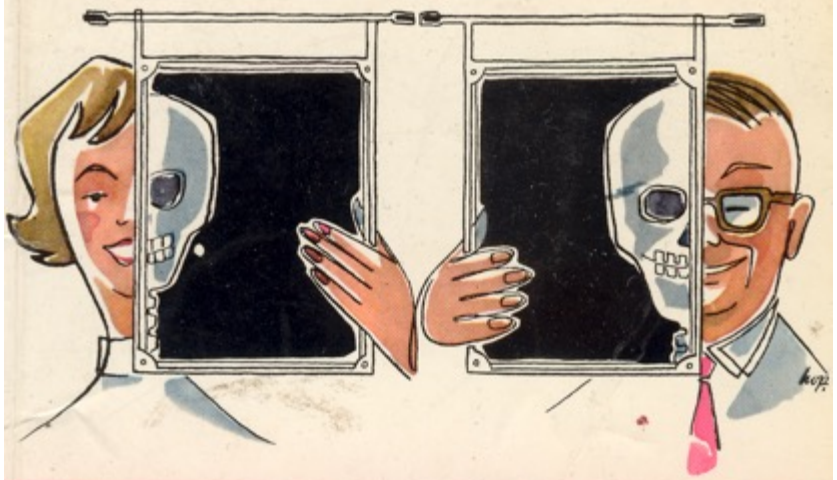


Griffiths, G. 1896.
A Photograph of the Invisible.
Pearson's Magazine, Vol 1. (April 1896) 376-380.



- The couple are horrified by the likeness for above the dress “were the face and hair not of a living woman, but of a ghost, and, beneath all, sharp in outline and perfect in every hideous detail, a fleshless skull – her own skull ….. grinned at her through the transparent veil of flesh, and seemed to stare at her out of the sockets in which two ghostly eyes seemed to float.”
- Denton had his revenge and the lady was admitted to a private lunatic asylum. She imagined that she was now a skeleton, and that her clothing and skin and flesh were nothing more than transparent shadows which everyone could see through. She was forced to live in a dark room lest she saw her flesh.

The blood died out of her face till it was grey and white and ghastly.

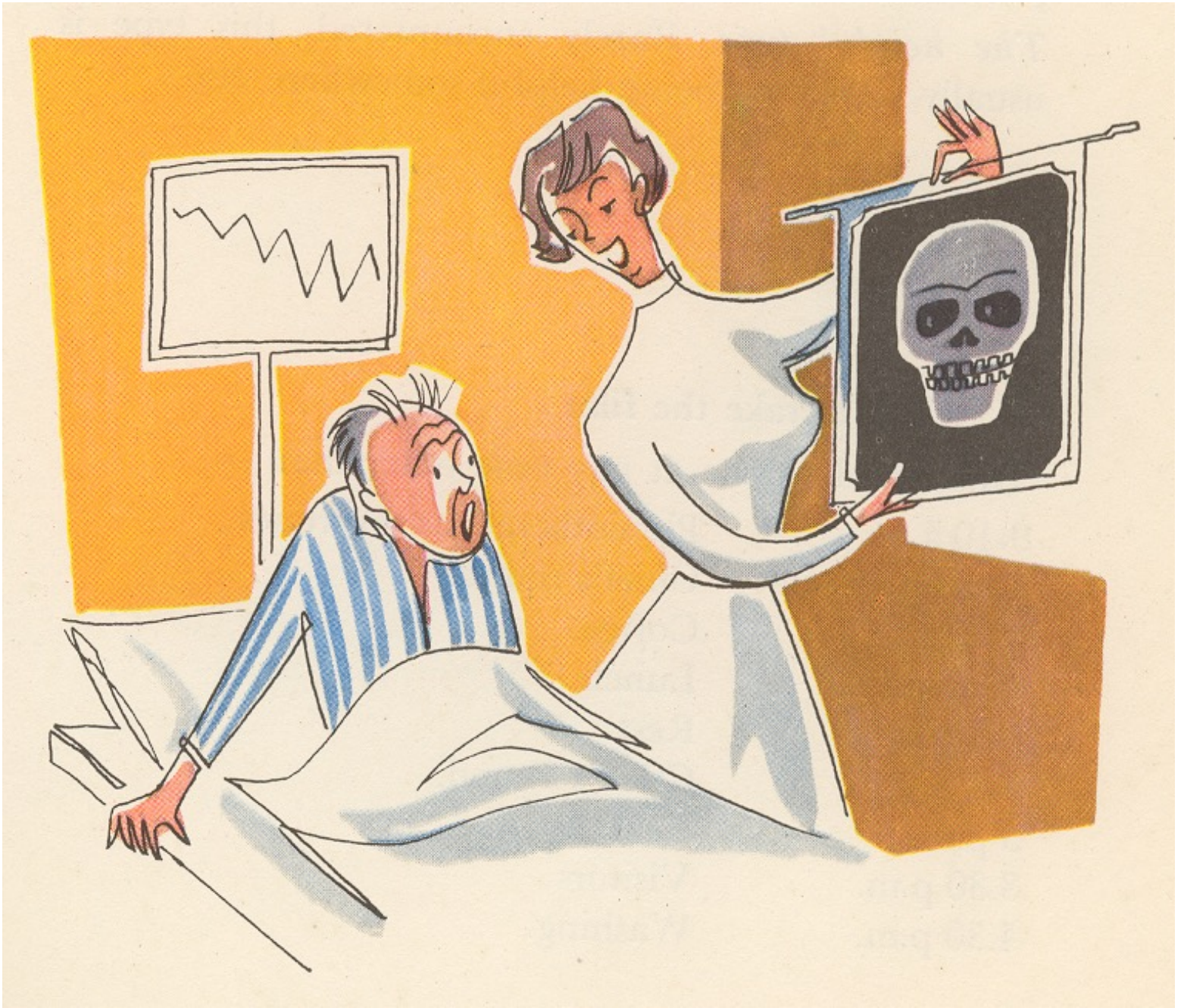


HOW TO SUCCEED AS A RADIOGRAPHER

BY MISS M. V. REYNOLDS M.S.R.

GEVAERT

GEVAERT LIMITED,
GREAT WEST ROAD, BRENTFORD MIDDX.



THE NEW PHOTOGRAPHIC DISCOVERY.

THANKS TO THE DISCOVERY OF PROFESSOR RÖNTGEN, THE GERMAN EMPEROR WILL NOW BE ABLE TO OBTAIN AN EXACT PHOTOGRAPH OF A "BACKBONE" OF UNSUSPECTED SIZE AND STRENGTH!

THE NEW PHOTOGRAPHY.

[Professor RÖNTGEN, of Würzburg, has discovered how to photograph through a person's body, giving a picture only of the bones.]

O, RÖNTGEN, then the news is true,
And not a trick of idle rumour,
That bids us each beware of you,
And of your grim and graveyard humour.

We do not want, like Dr. SWIFT,
To take our flesh off and to pose in
Our bones, or show each little rift
And joint for you to poke your nose in.

We only crave to contemplate
Each other's usual full-dress photo;
Your worse than "altogether" state
Of portraiture we bar *in toto!*

The fondest swain would scarcely prize
A picture of his lady's framework;
To gaze on this with yearning eyes
Would probably be voted tame work!

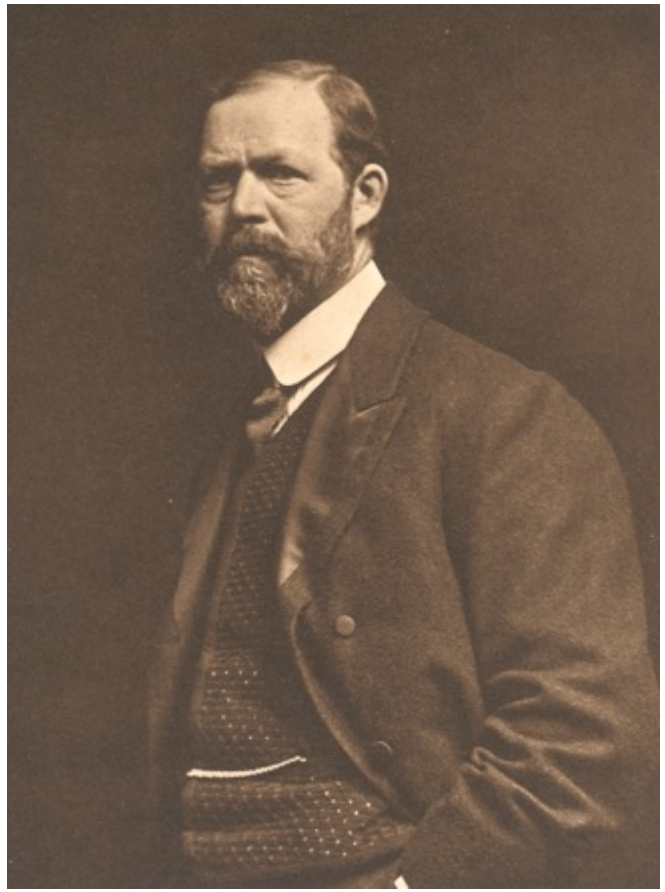
No, keep them for your epitaph,
These tombstone-souvenirs unpleasant;
Or go away and photograph
Mahatmas, spooks, and Mrs. B-s-NT!

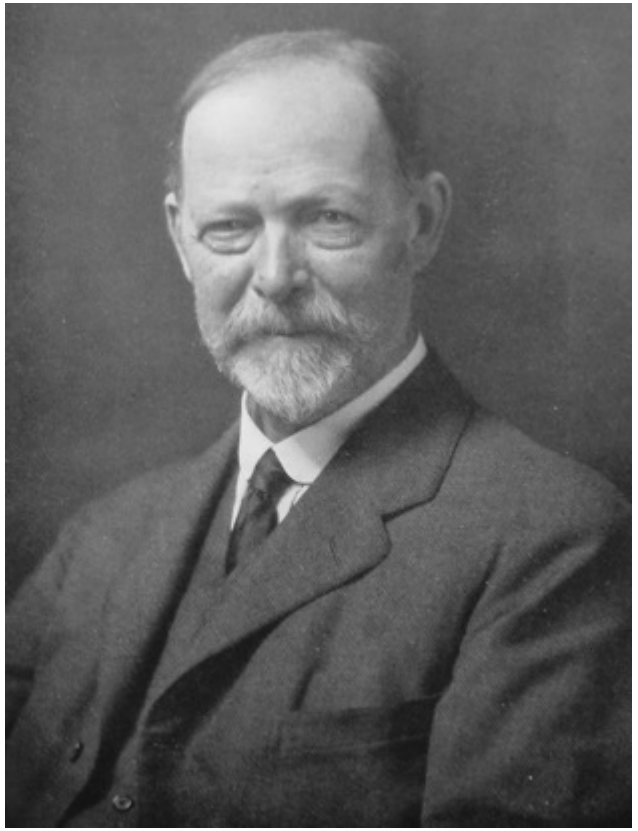
The Cry of a Hungry Biped.

["On New Year's Day a number of ladies and gentlemen went to Acton, where the horses and donkeys at the Home of Rest where regaled with a dinner of carrots, bread, apples, and sugar."]

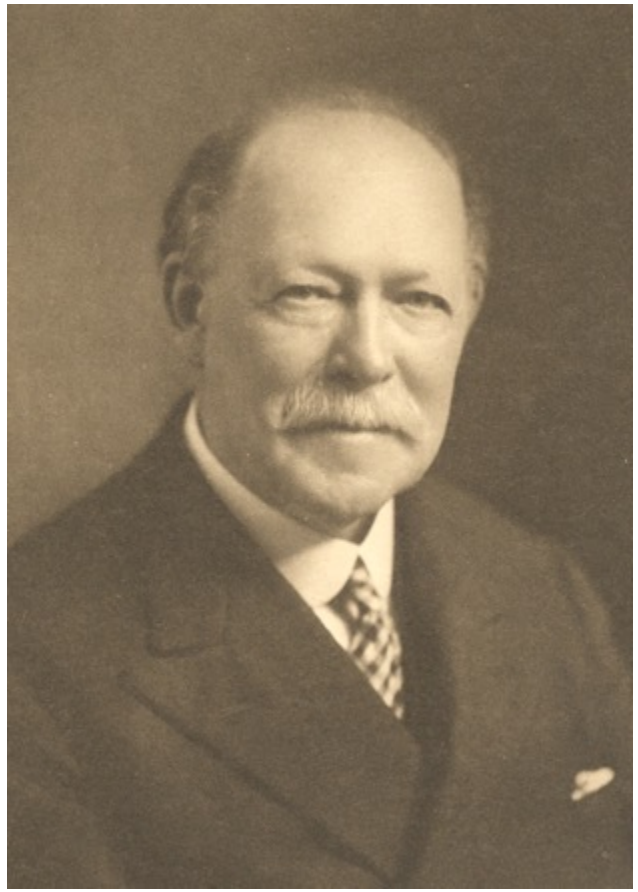
FOR four-legg'd beasts there 's lots of stuff,
But not for this barbarian.
Oh! would that I were ass enough,
To be a Vegetarian.

"INQUIRER" wishes to know if the war-song of the troops under the command of Dr. JAMESON is "*Jimmy on the 'shoot,' Boys!*"?



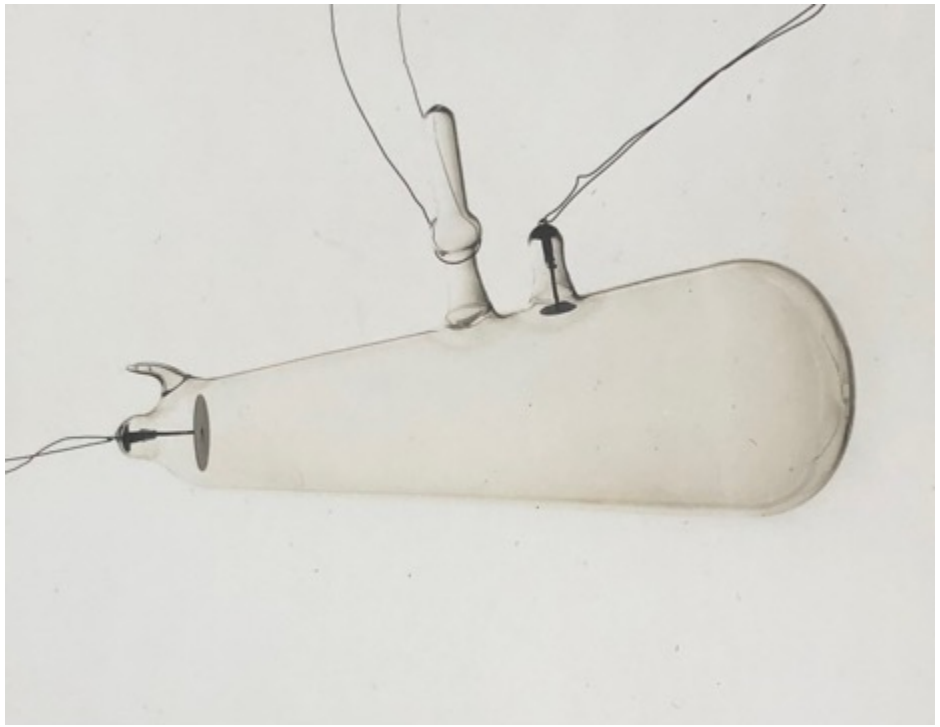


Kind regards
Yours sincerely
C. Thurston Howard

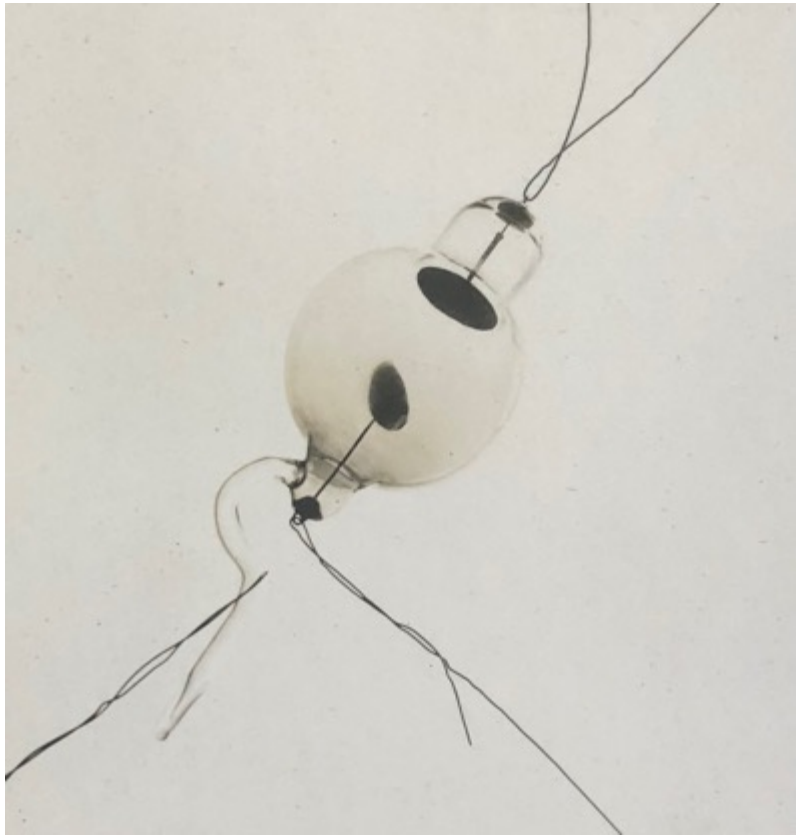


Apparatus: tubes.

- “pear-shaped vacuum tube”
  - Crookes tube



- …one of Herbert Jackson’s
  - ‘focus tubes’…



September 17th 1896

Hand of a child at the age of one year.

2 min. exposure,

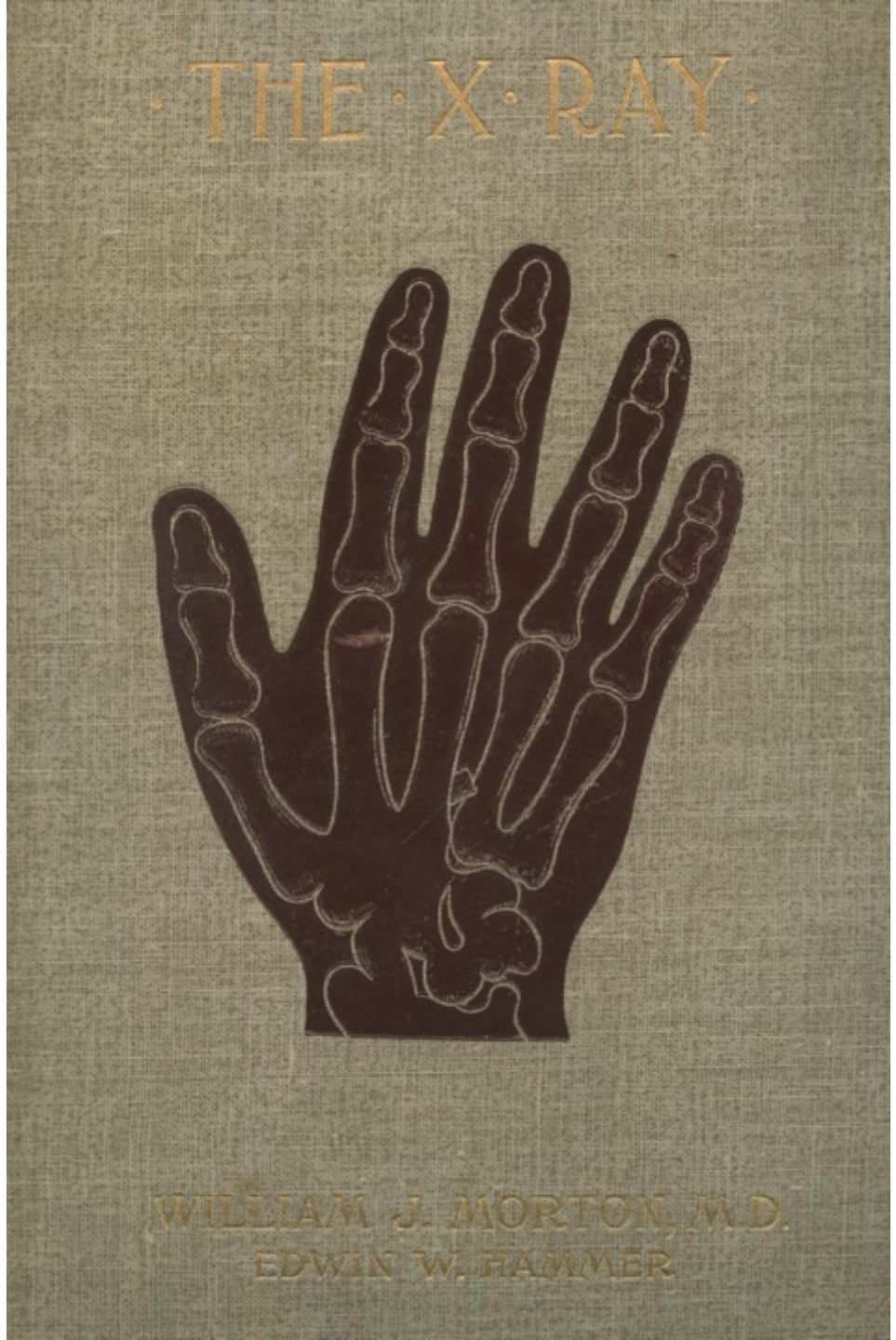
6 in. coil.

“There were no X-ray departments in any of the the hospitals. There were no experts. There was no literature. No one new anything about radiographs of the normal, to say nothing of the abnormal.”

Charles Thurstan Holland

William J Morton: *The X-Ray or Photography of the Invisible,* 1896

- *"In teaching the anatomy of the blood vessels the X Ray opens out a new and feasible method.*
- *The arteries and veins of dead bodies may be injected with a substance opaque to the X Ray, and thus their distributions may be more accurately followed than by any possible dissection.*
- *The feasibility of this method applies equally well to the study of other structures and organs of the dead body."*



John Poland

- The early work on bone age was developed by John Poland, a surgeon from the Miller Hospital in Greenwich.
- In his bone age atlas that was published in 1898, Poland pointed out that the actual development of the ossification centers differed quite considerably from that which had been previously described.

John Poland

- Boy aged 17 years.
- 1 second exposure.
- John Poland commented that ‘In this instance the epiphyses of the metacarpal bones and phalanges of finger and thumb, though fully developed, have not, as in the two preceding skiagrams (radiographs), joined their respective shafts.’

TRAUMATIC SEPARATION

OF

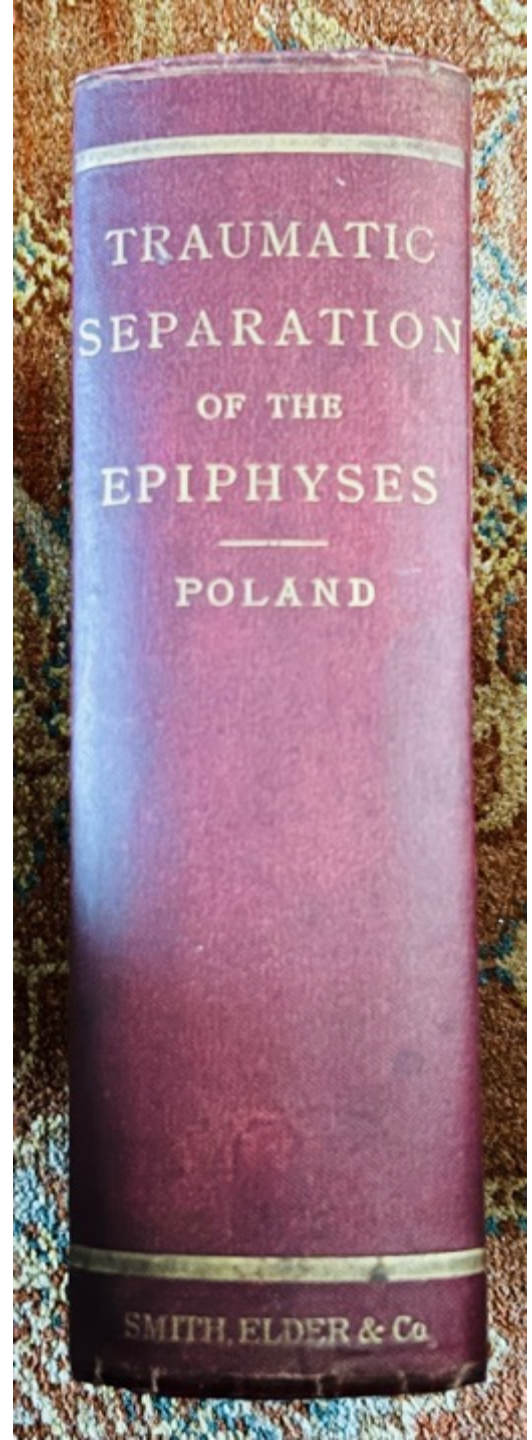
THE EPIPHYSES

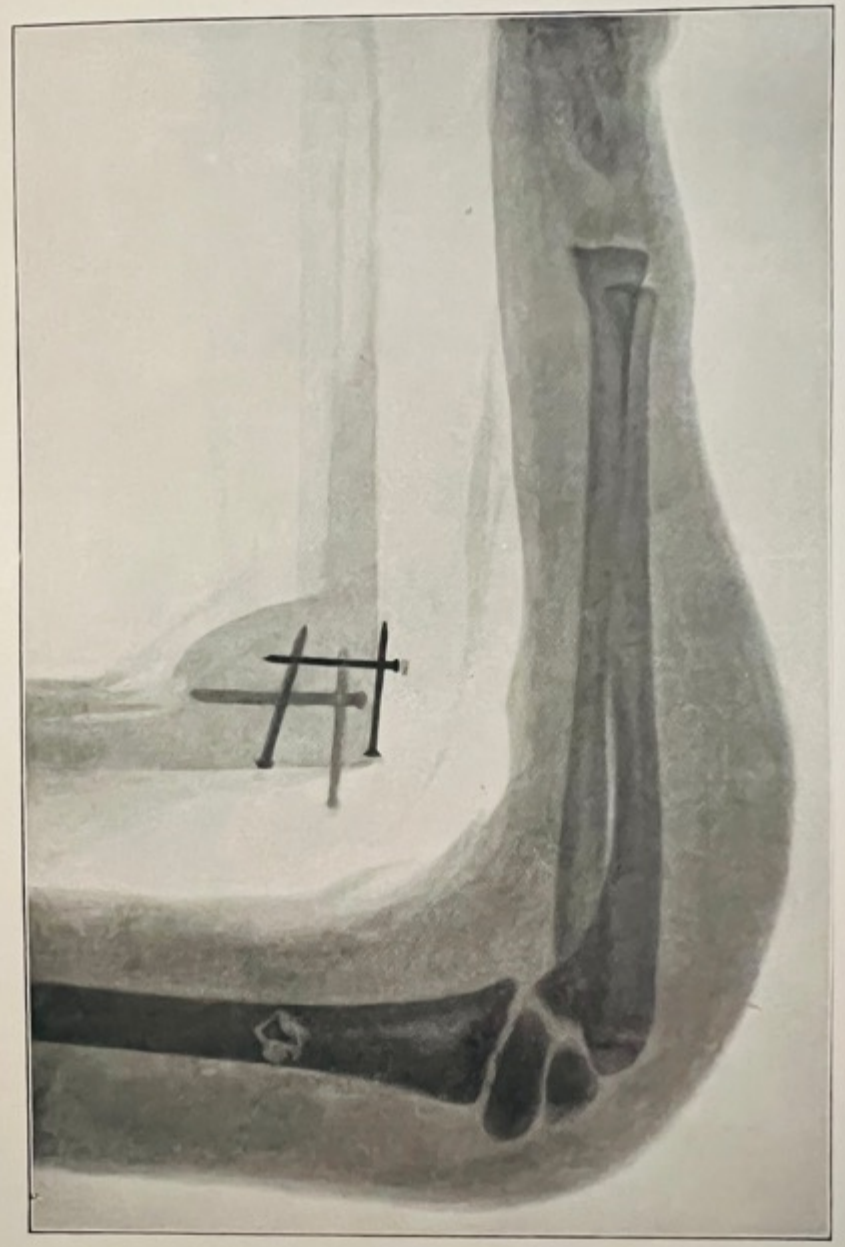
BY

JOHN POLAND, F.R.C.S.

WITH THREE HUNDRED AND THIRTY-SEVEN ILLUSTRATIONS AND SKIAGRAMS

LONDON
SMITH, ELDER, & CO., 15 WATERLOO PLACE
1898





SEPARATION OF LOWER EPIPHYSIS OF HUMERUS.

Shadows of the splint and padding are seen. Prof. W. B. VAN LENNEP's case.

experience must exist during life. If this knowledge be obtained by Röntgen's method, it will materially assist the surgeon in giving a decision as to immediate operative measures in elbow-joint injuries of children, and in removing some of the many instances of subsequent severe deformity and loss of function of the joint and limb now so little creditable to surgery.

Eugene Corson

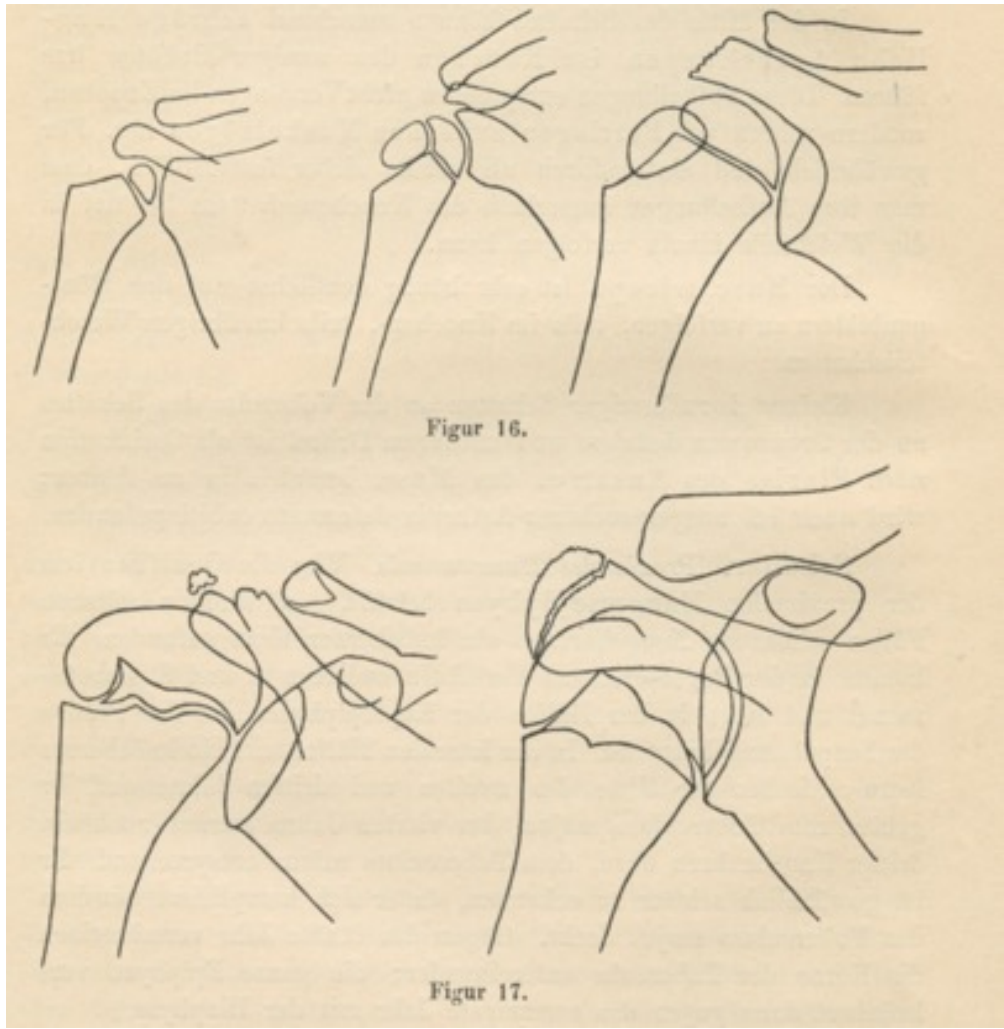
- “The X-ray will prove to be a valuable aid in the study of many points of normal anatomy.”
- References Alban Köhler.
- Annals of Surgery, November 1900

Eugene R Corson (1900)

- “The bone relationships in joints, the various joint movements, and the different steps in bone development can all be studied in a striking way by the X-ray.”
- “…….the discovery of Röntgen, a discovery which makes possible and easy and an absolutely correct diagnosis where previously uncertainty and error outweighed definite knowledge.”

Alban Köhler of Wiesbaden

- *Lexikon der Grenzen der Normalen und der Anfänge des Pathologischen im Röntgenbilde.*
- Published by Köhler in 1910.



H C Orrin

- The X-ray Atlas of the Systemic Arteries of the Body (1920)

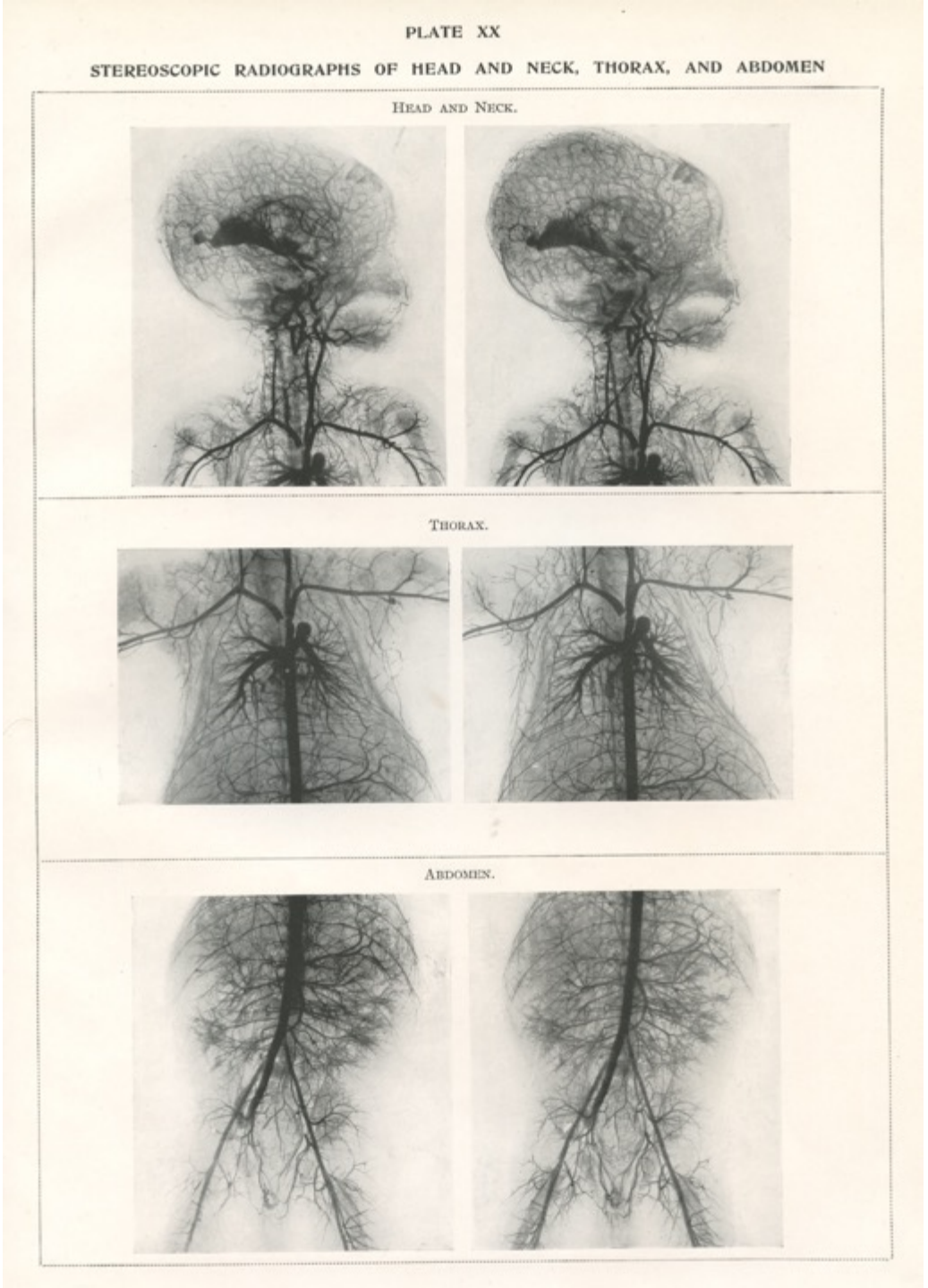


PLATE XX

STEREOSCOPIC RADIOGRAPHS OF HEAD AND NECK, THORAX, AND ABDOMEN

HEAD AND NECK.

THORAX.

ABDOMEN.

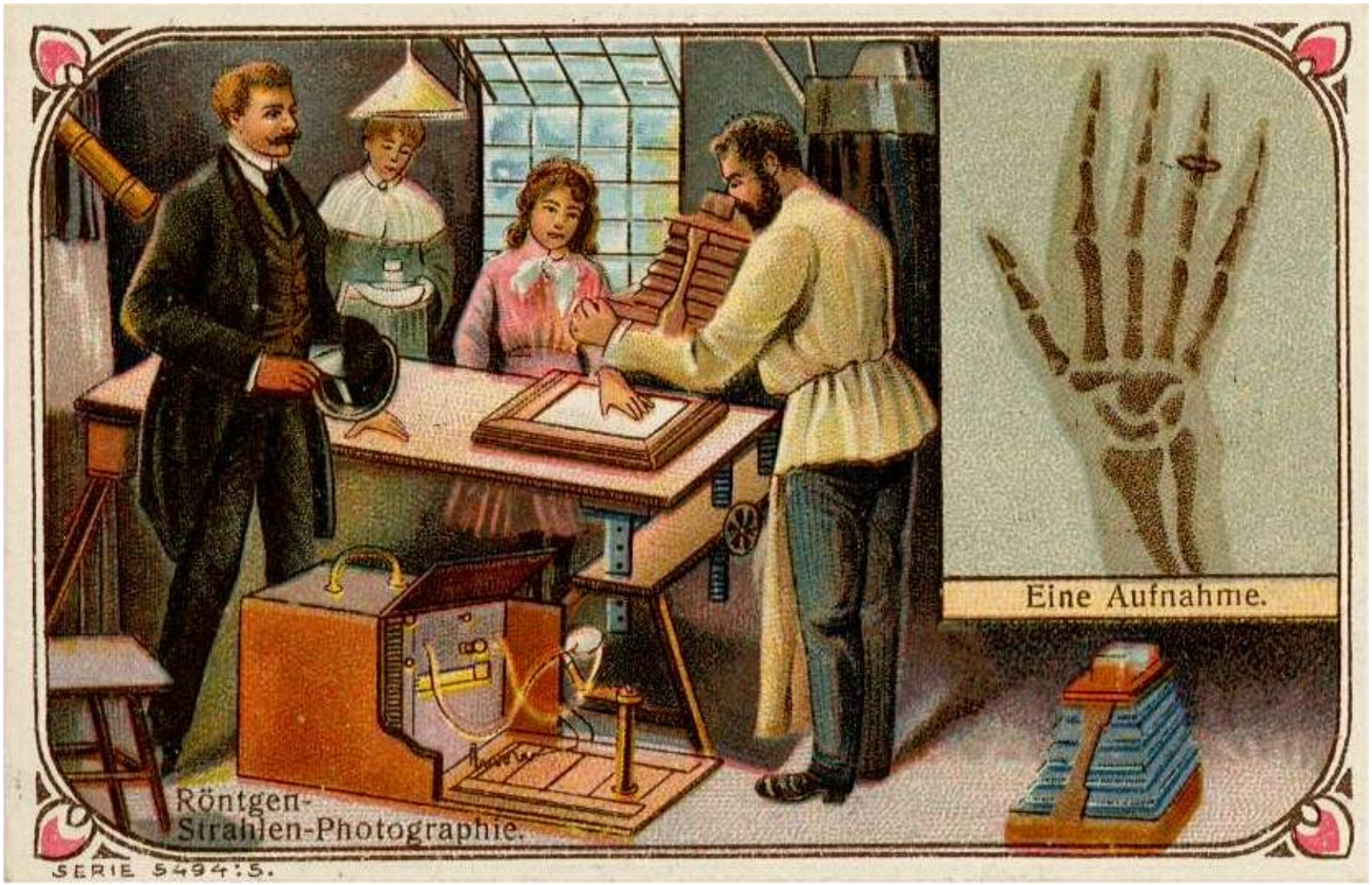
H C Orrin (1920)

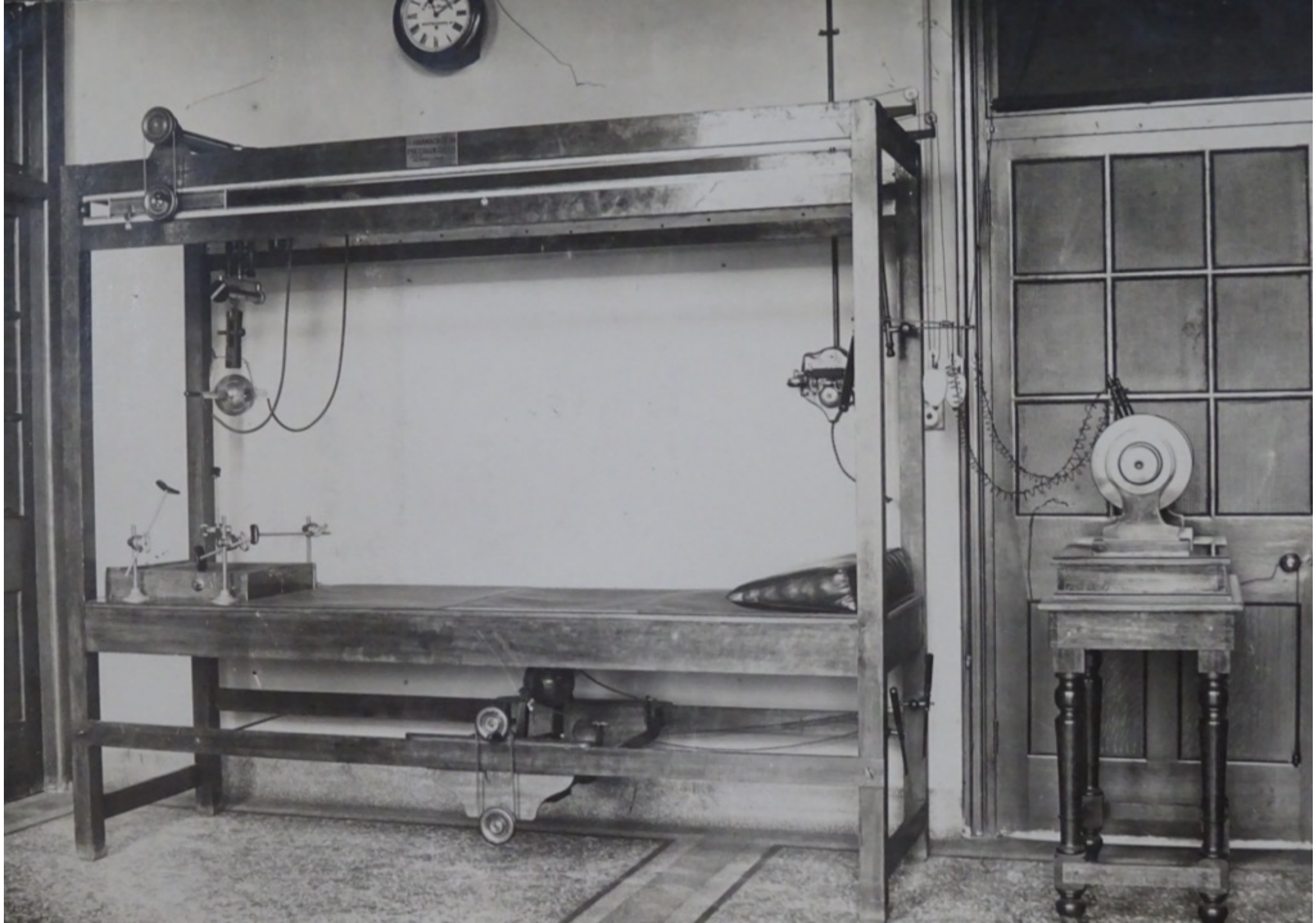
- *"No matter how well dissection is performed, complete continuity of the vessels; their exact relationship to bones; their finest terminal branches; the series of anastomosis into which they enter are seldom if ever accurately displayed or intelligently appreciated by dissection alone."*
- The atlas contained stereoscopic radiographs: "*which provide the only possible means of accurately rendering visible the points and details specified.*"

Dawson Turner (1857-1928) and the development of Radiotherapy

- He was the Medical Officer in Charge of the Electrical Department at the Royal Infirmary in Edinburgh.
- In the early days before deep X-ray therapy many of the lesions treated were superficial, and were often conditions that would not be treated using radiation today, including lupus vulgaris and tubercular neck glands.
- In 1913 he is one of the earliest recorded persons using radiation to successfully treat lymphosarcoma (small cell sarcoma). The tumour was treated using surface application of radium, and insertion of radium into the mass (brachytherapy).
- *Turner, Dawson F. D. (April 1913). A Case of Lymphosarcoma Treated by Radium. Arch Roentgen Ray, 17 (11): 418–419.*

Early Apparatus

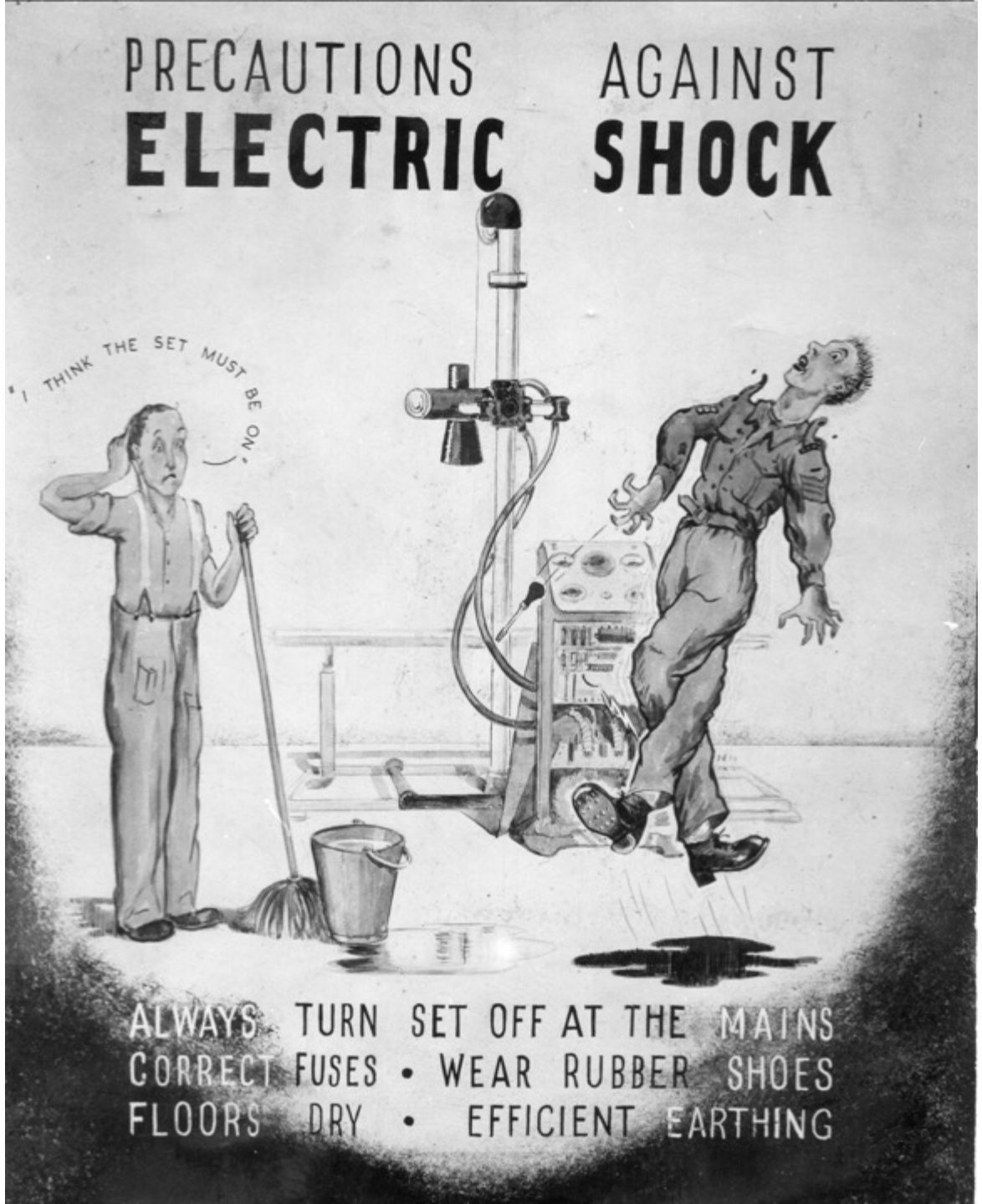


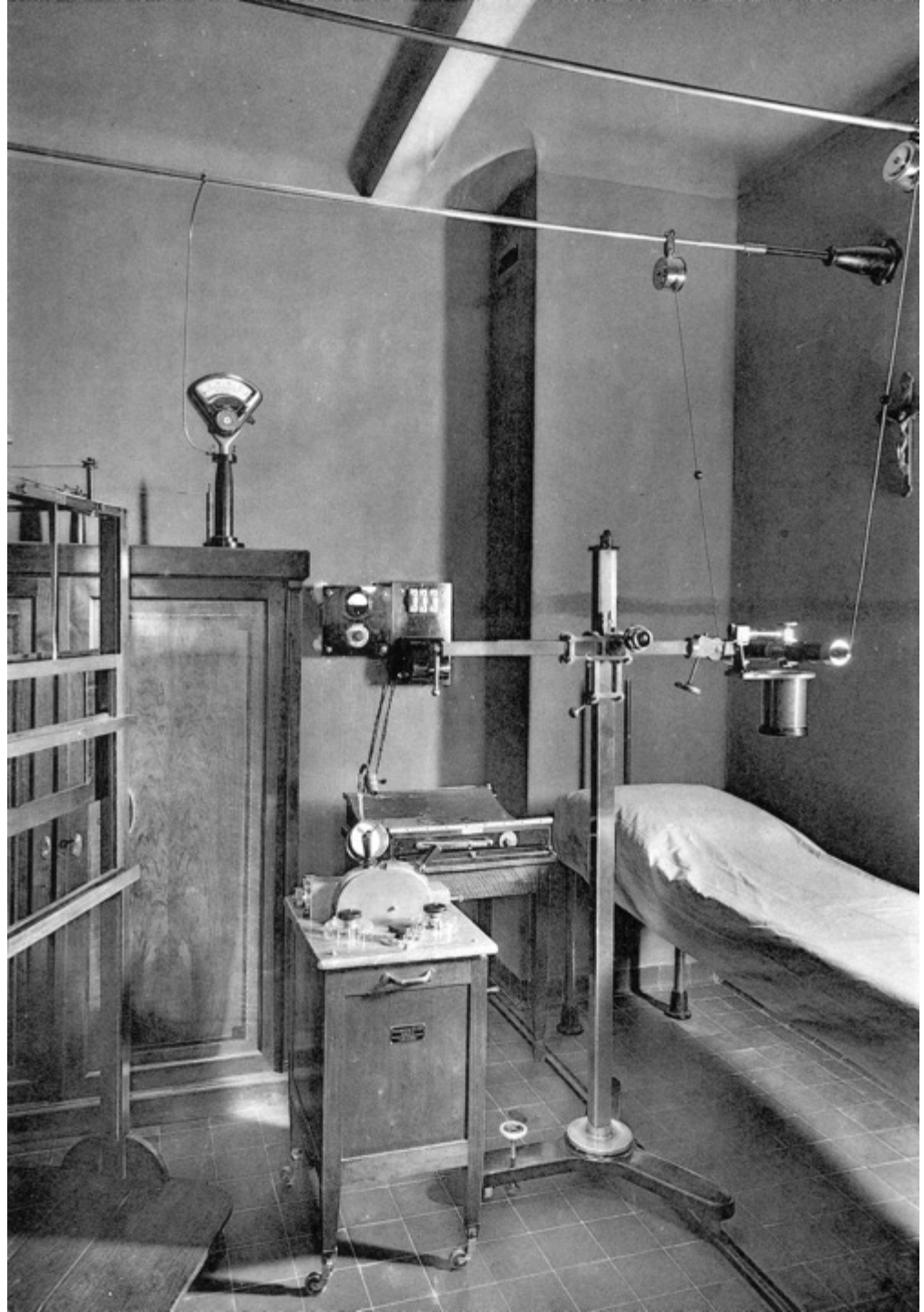


Dangers in the X-ray Department.

- Electrical.
- Radiation.
- Darkroom disease.

- Image of the radiography martyr at the (Royal) London Hospital.


PRECAUTIONS AGAINST
ELECTRIC SHOCK
"I THINK THE SET MUST BE ON."
ALWAYS TURN SET OFF AT THE MAINS
CORRECT FUSES • WEAR RUBBER SHOES
FLOORS DRY • EFFICIENT EARTHING

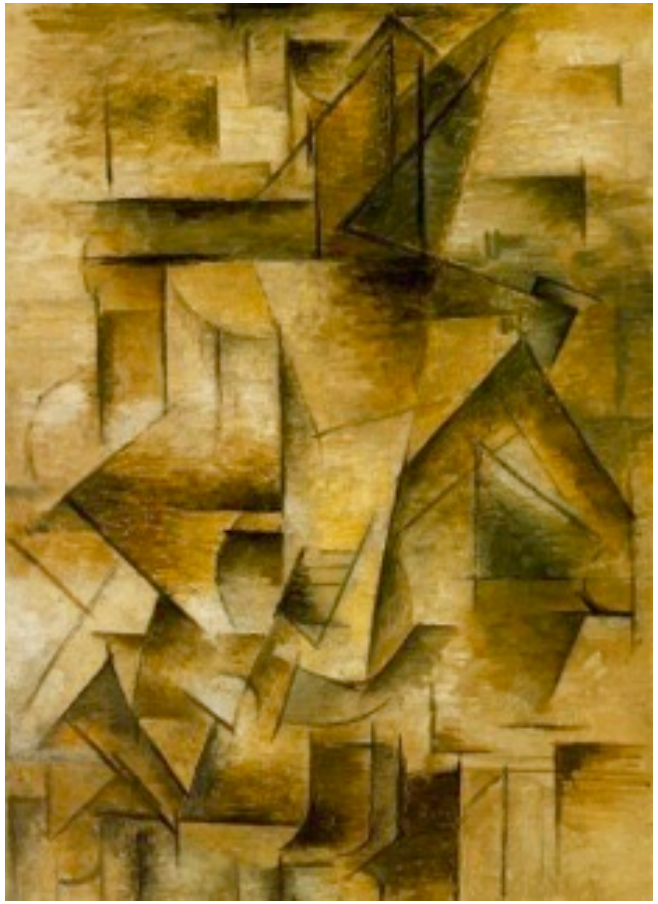


Hands of Ernest Wilson.

Art.

- Lawrence Alma-Tadema
- Unconscious Rivals 1893

- Henri Matisse Woman with a Hat, 1905.



Pablo Picasso
The Guitarist 1910

Walsham and Orton (1906).

- "In the diagnosis of thoracic aneurysm the x-rays reach one of their most successful practical applications. The diagnosis by the ordinary methods is in many cases extremely difficult and in some absolutely impossible; with the aid of the Röntgen rays, however, a satisfactory conclusion can as a rule be arrived at."

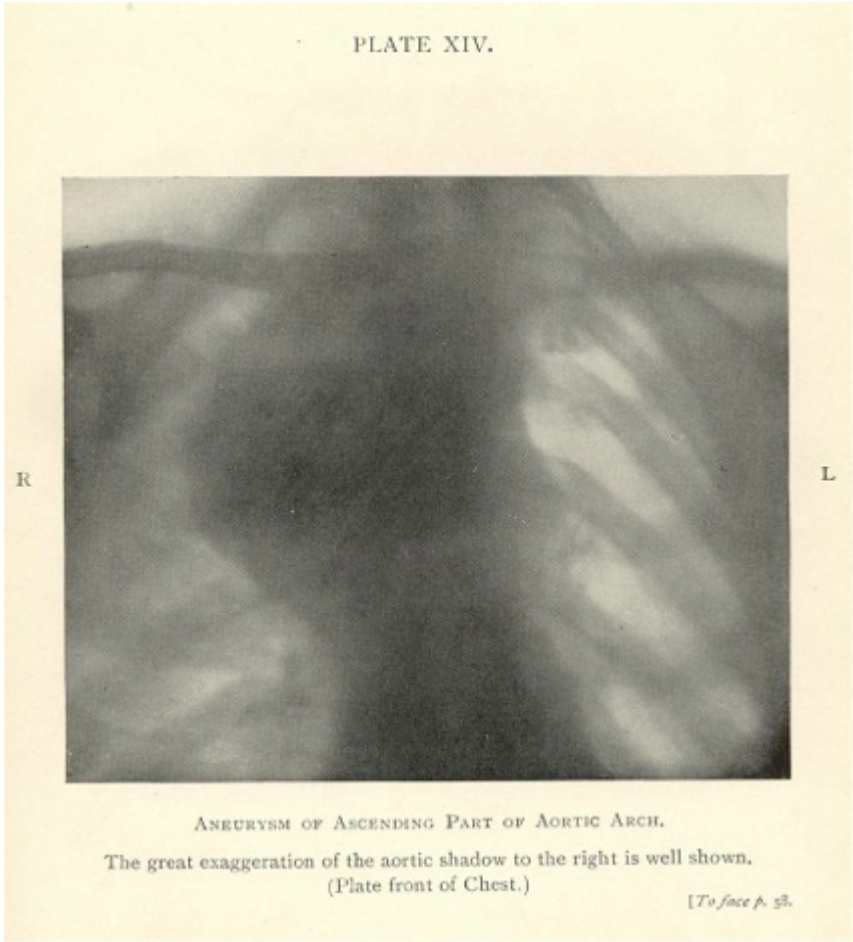


PLATE XIV.

R L

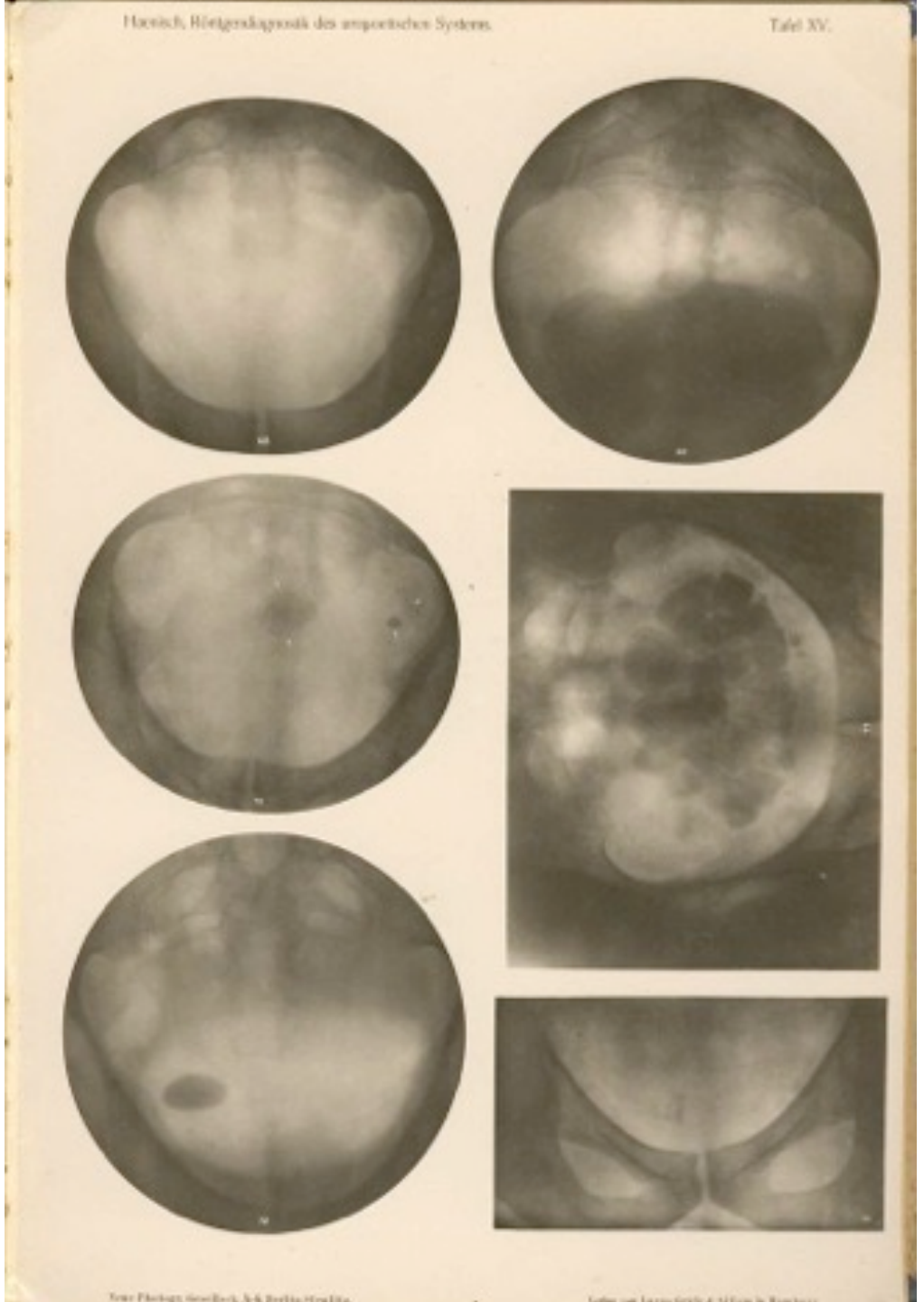
ANEURYSM OF ASCENDING PART OF AORTIC ARCH.

The great exaggeration of the aortic shadow to the right is well shown.
(Plate front of Chest.)

[To face p. 58.

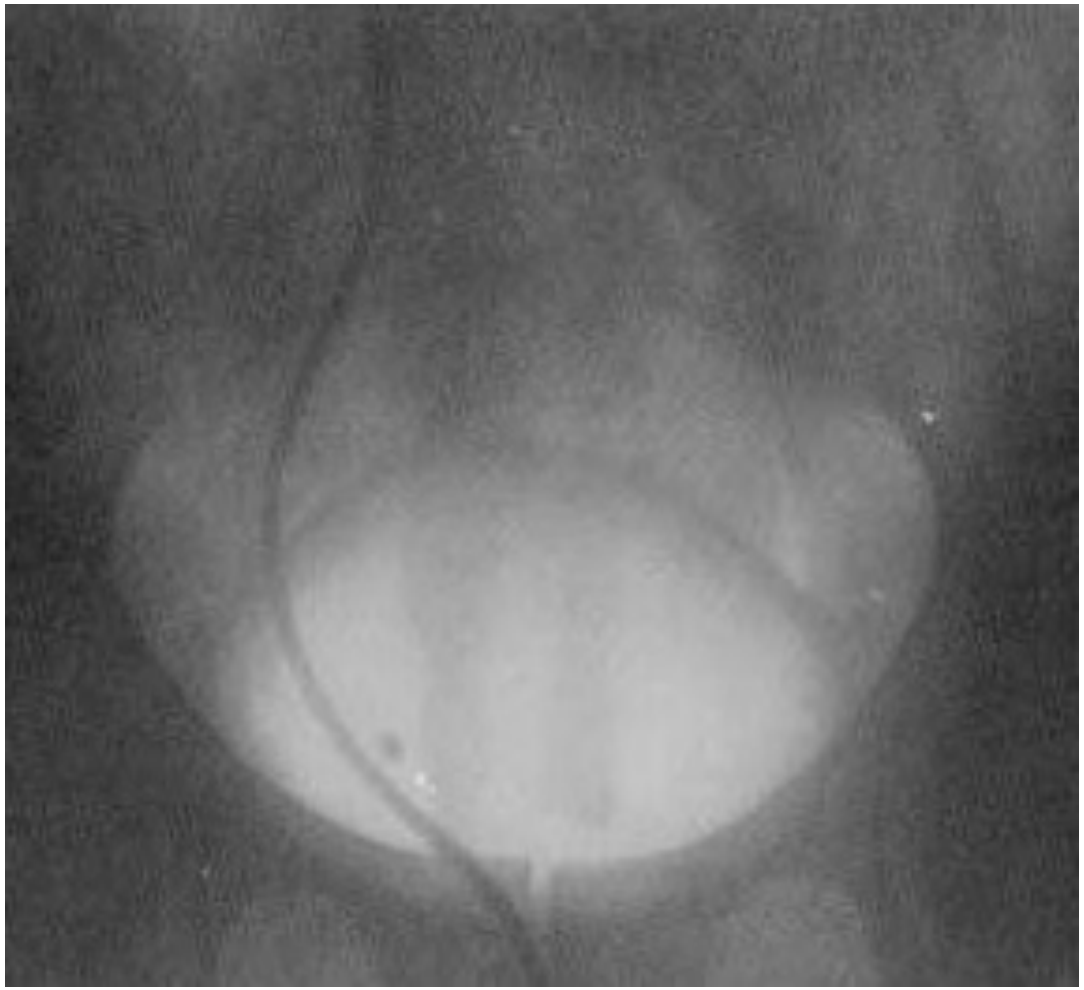
Dr Fedor Haenish, Hamburg 1908

- He looked at the origin of abdominal shadows (skiagram)
- The appearances were confusing.
- What is normal?



Hurry Fenwick.

- “The value of Radiography in the Diagnosis and Treatment of Urinary stone” 1908
- Schmidt and Kolischer had introduced and radiographed ureteric catheters in 1901.
- *Ureteric X-ray bougie. Air inflation of bladder. Fenwick 1908*



Opaque Ureteric catheters:

- Lewis Schmidt & Gustav Kolischer (Chicago)(1901): Used fuse wire in a ureteric catheter.
- F Löwenhardt (1901): catheter with a lead mandrin.
- Von Illeyes (Hungary)(1901): lumen of catheter filled with bismuth.
- E Hurry Fenwick (UK)(1905): “radiographic bougie” with iron oxide impregnated walls.

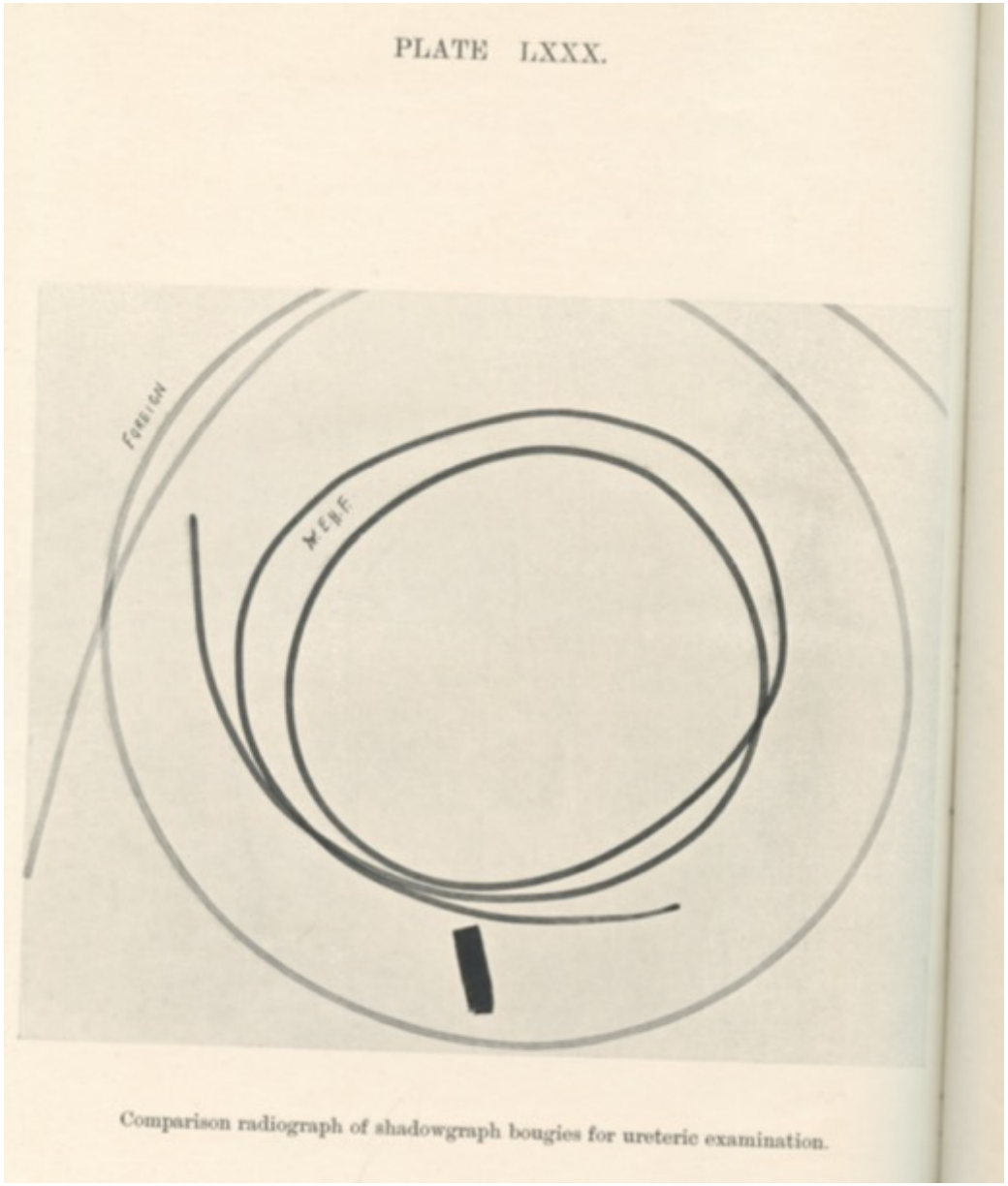
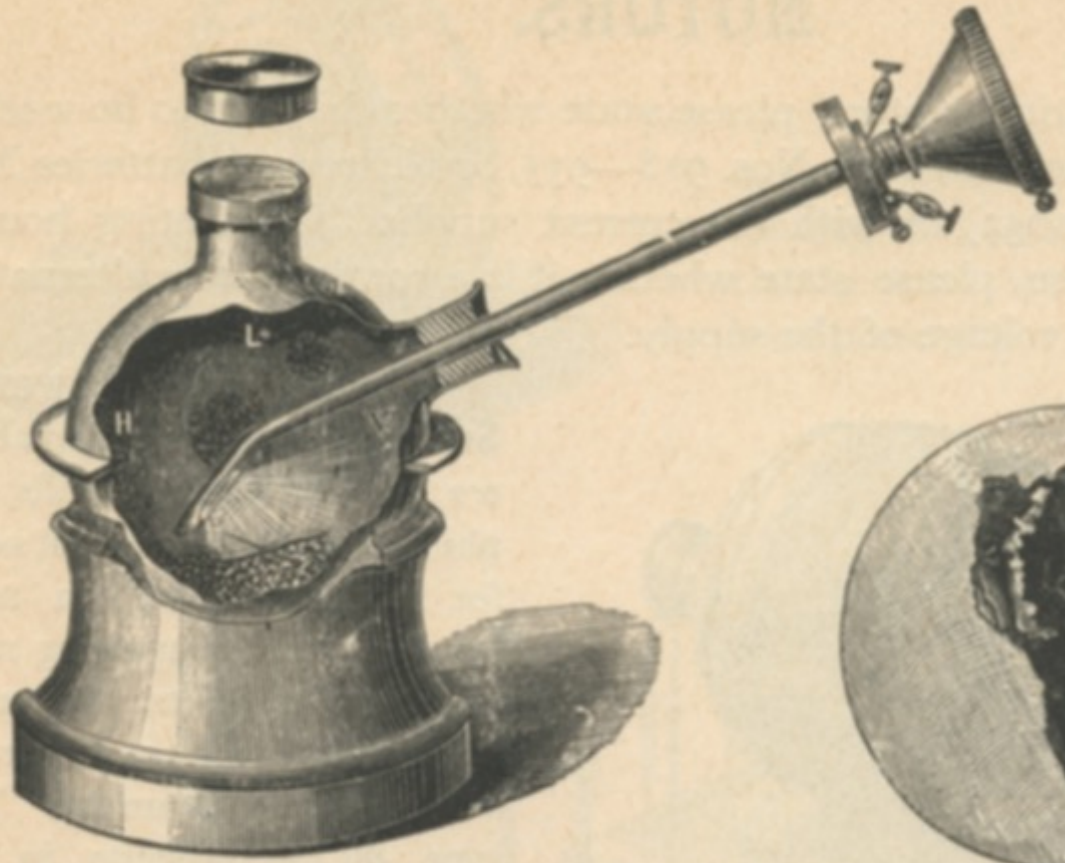


PLATE LXXX.

Comparison radiograph of shadowgraph bougies for ureteric examination.



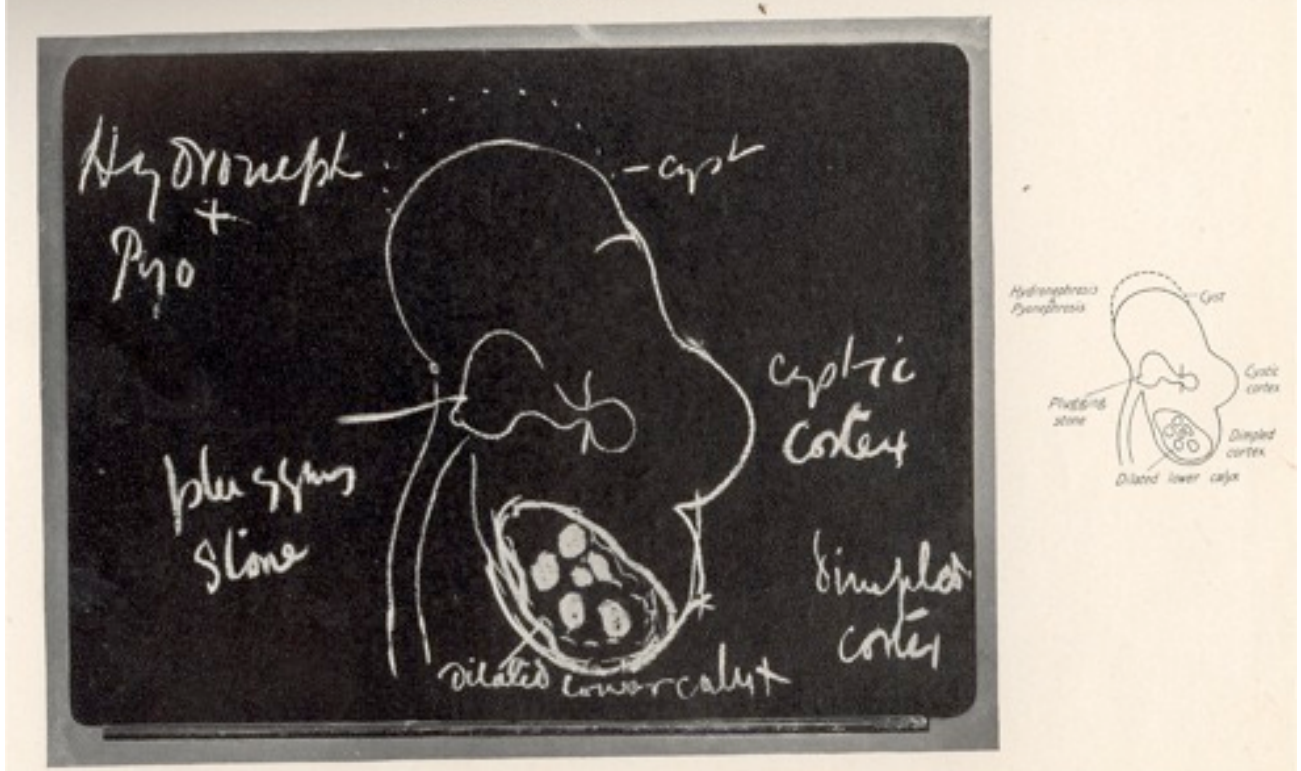
No. 1342.

No. 1343.

No. 1329. For practising with Cystoscopes and for demonstrations, a Phantom as shown (No. 1342), exhibiting artificial tumours, stones, and foreign bodies, &c., is very convenient **£0 18 0**

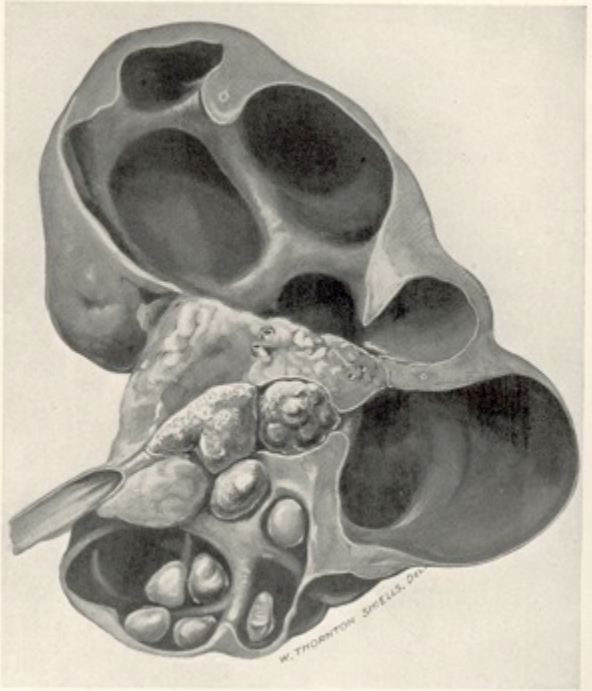
E Hurry Fenwick: clinico-radiologico-surgical correlation.

PLATE XXVIII.



Blackboard diagram, drawn before operation, of condition of left kidney as revealed by preceding radiograph (Plate XXVII).

PLATE XXIX.



Drawing of half left kidney removed from case of which Plate XXVII is the radiograph.

William Coolidge (1873-1975)

- He replaced the cathode with a heated spiral tungsten filament and molybdenum-focussing bowl.
- The filament could be heated and a current would pass through the tube even with a very low vacuum.
- The anode of the standard Coolidge tube was set at 45º.

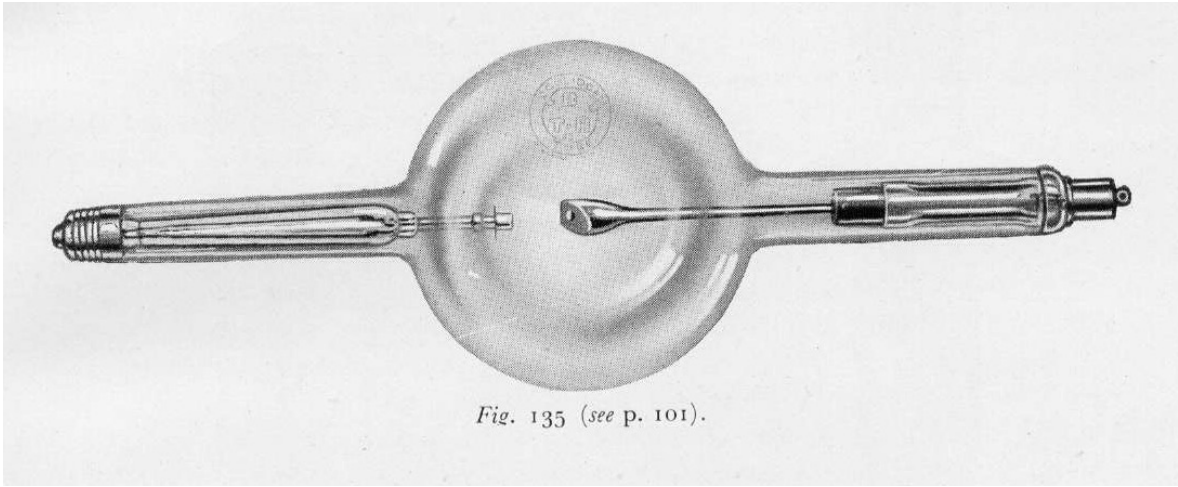


Fig. 135 (*see* p. 101).

Gustav Bucky.

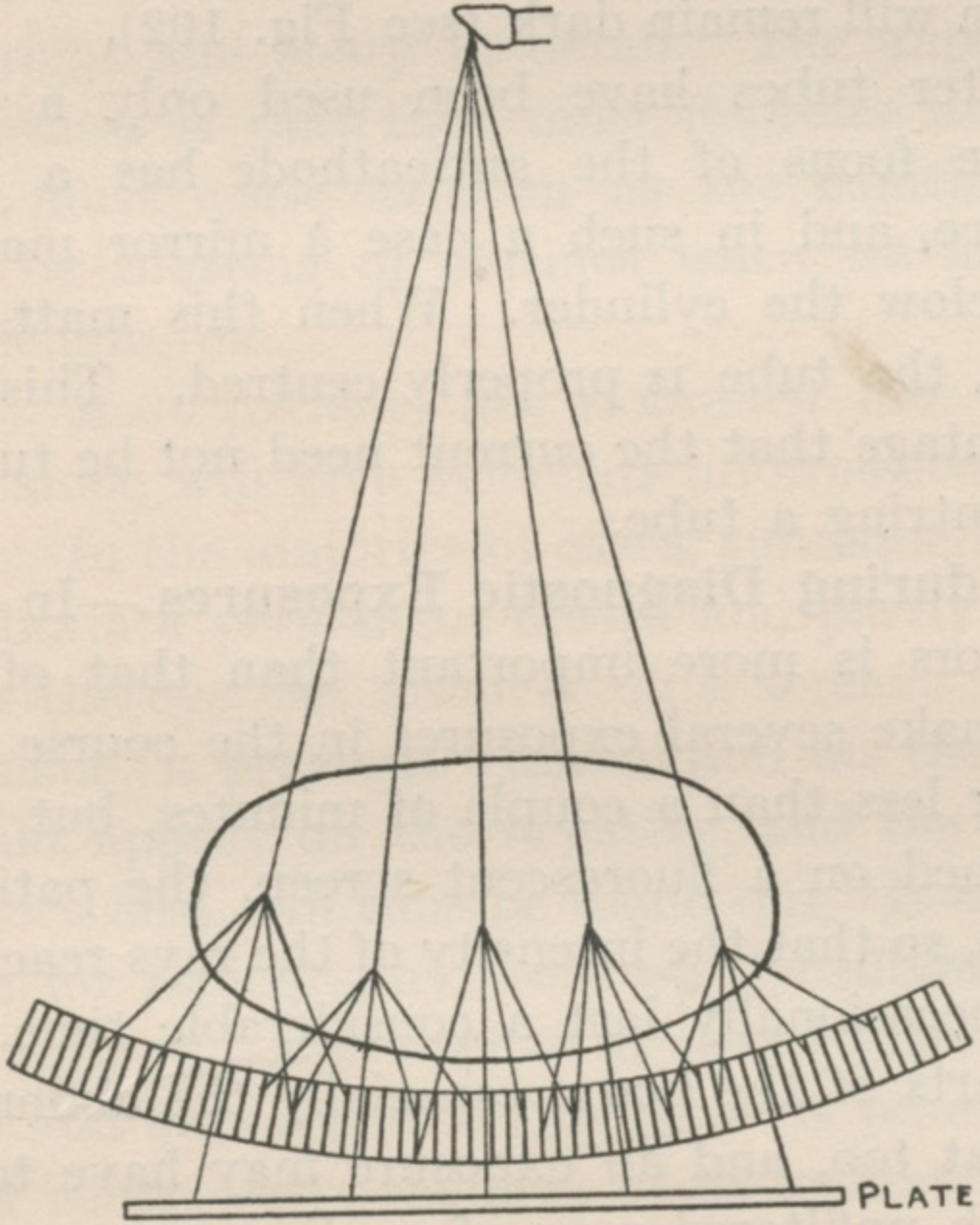
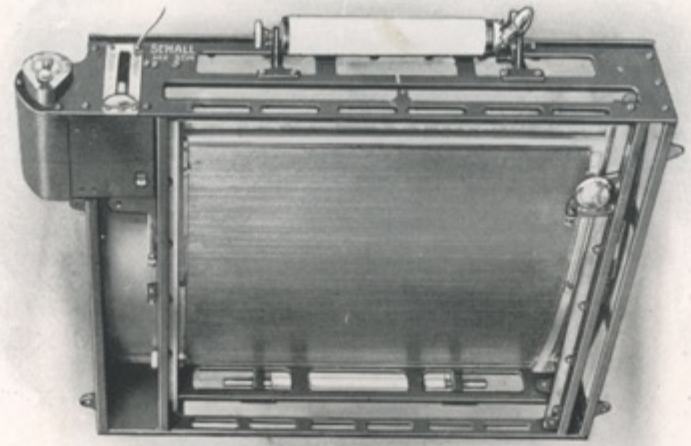
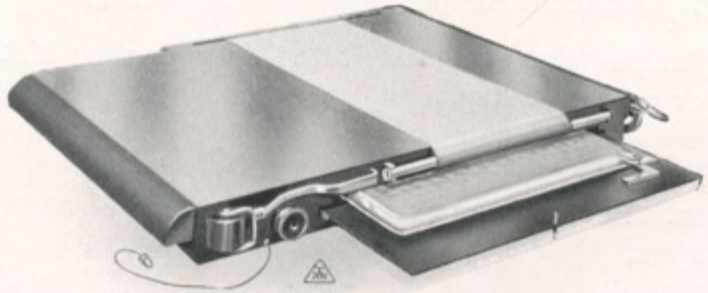


Fig. 100.



No. 26195 (Curved).



No. 26196 (Flat).

Without grid

70 kV d.c.

1/4 sec
10 mWs

10 kW

With grid

100 kV d.c.

1/4 sec
20 mWs

10 kW

With grid

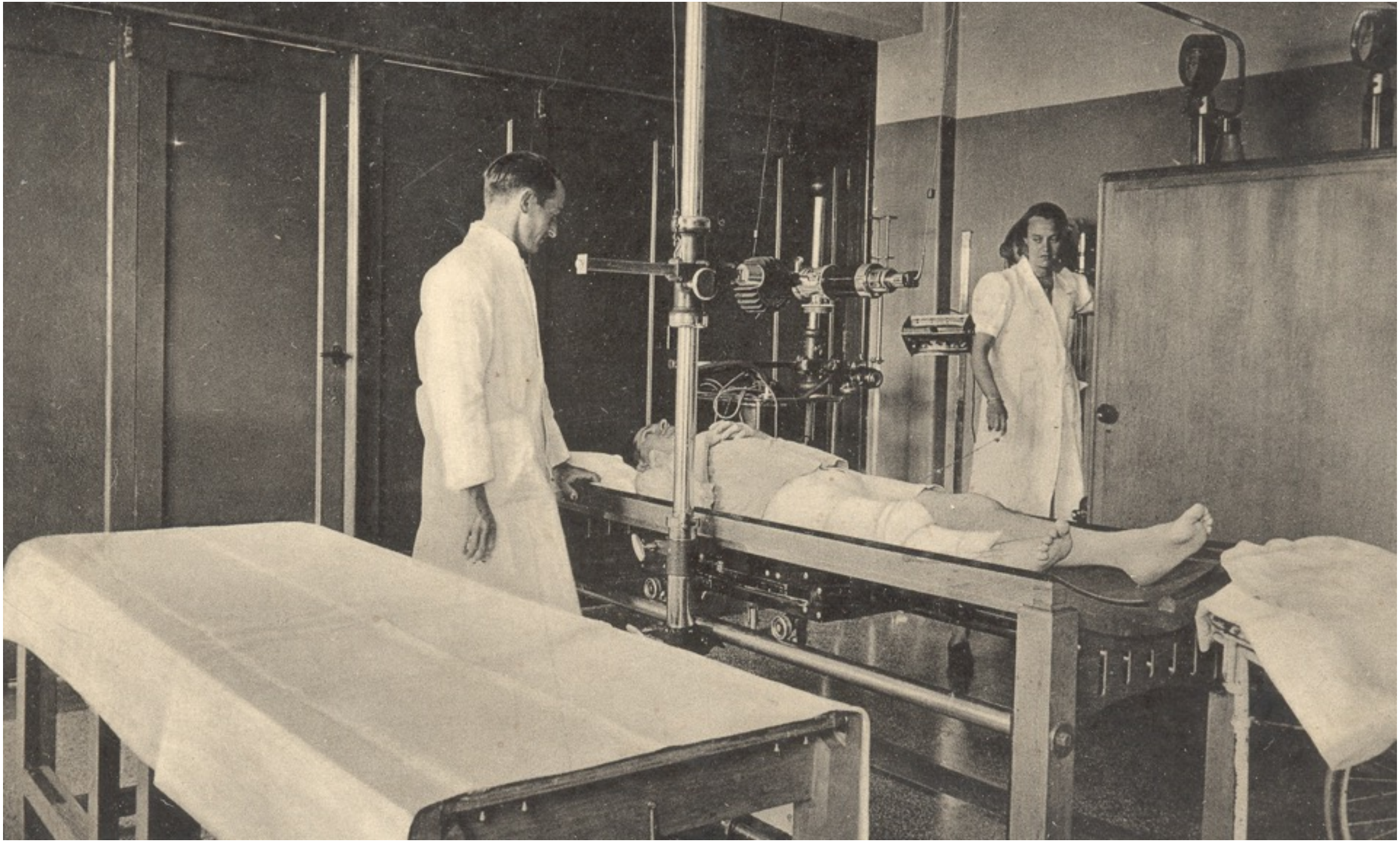
70 kV d.c.

1 sec
40 mWs

10 kW

The Metalix Tube.

- **A Bouwers** of Philips designed the Metalix tube in 1924.
- The tube was made of chrome iron with a lead jacket.
- This self-protecting tube was a considerable improvement on the larger gas tubes and enabled truly shockproof and portable apparatus to be produced.



Shockproof Metalix.

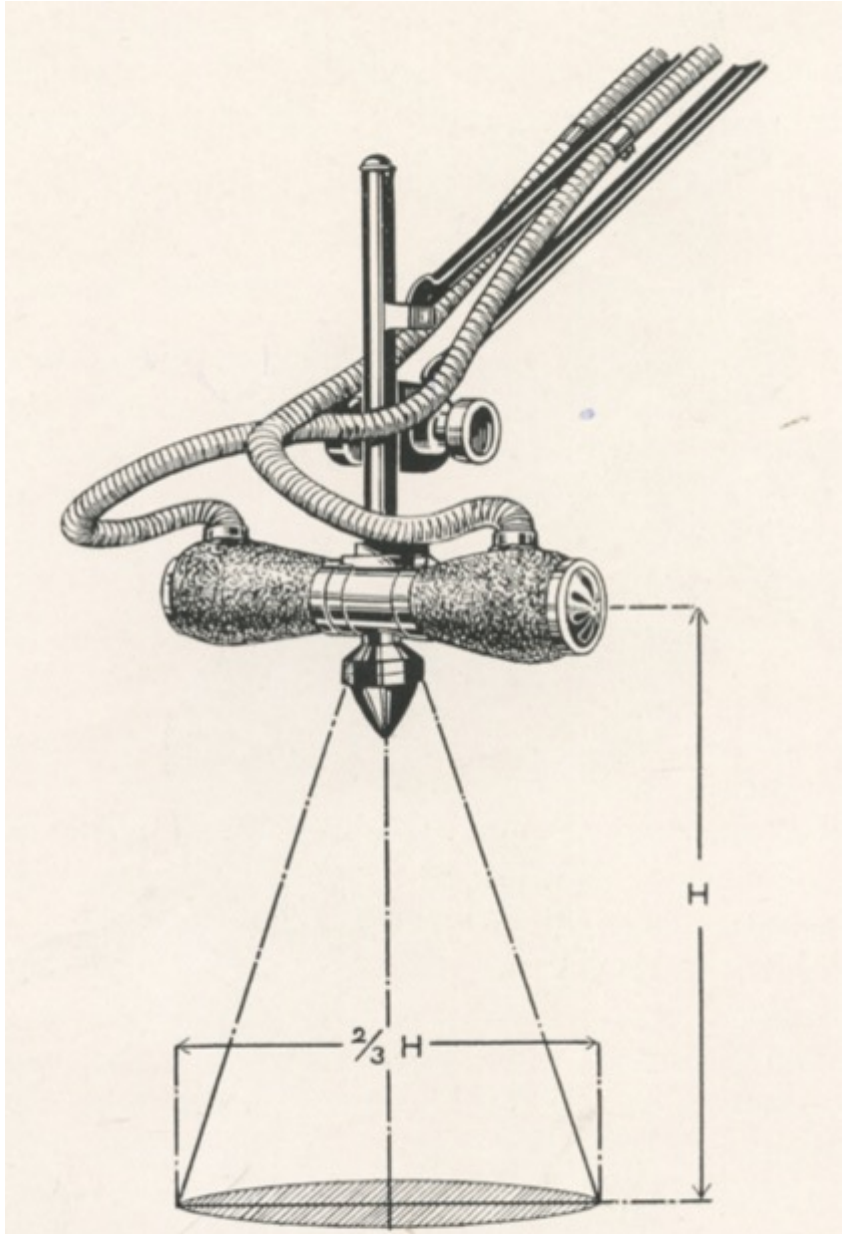


FIGURE 13.

SHOWING AREA COVERED BY THE TUBE AT VARIOUS FOCUS/FILM DISTANCES.

Shockproof Rotalix

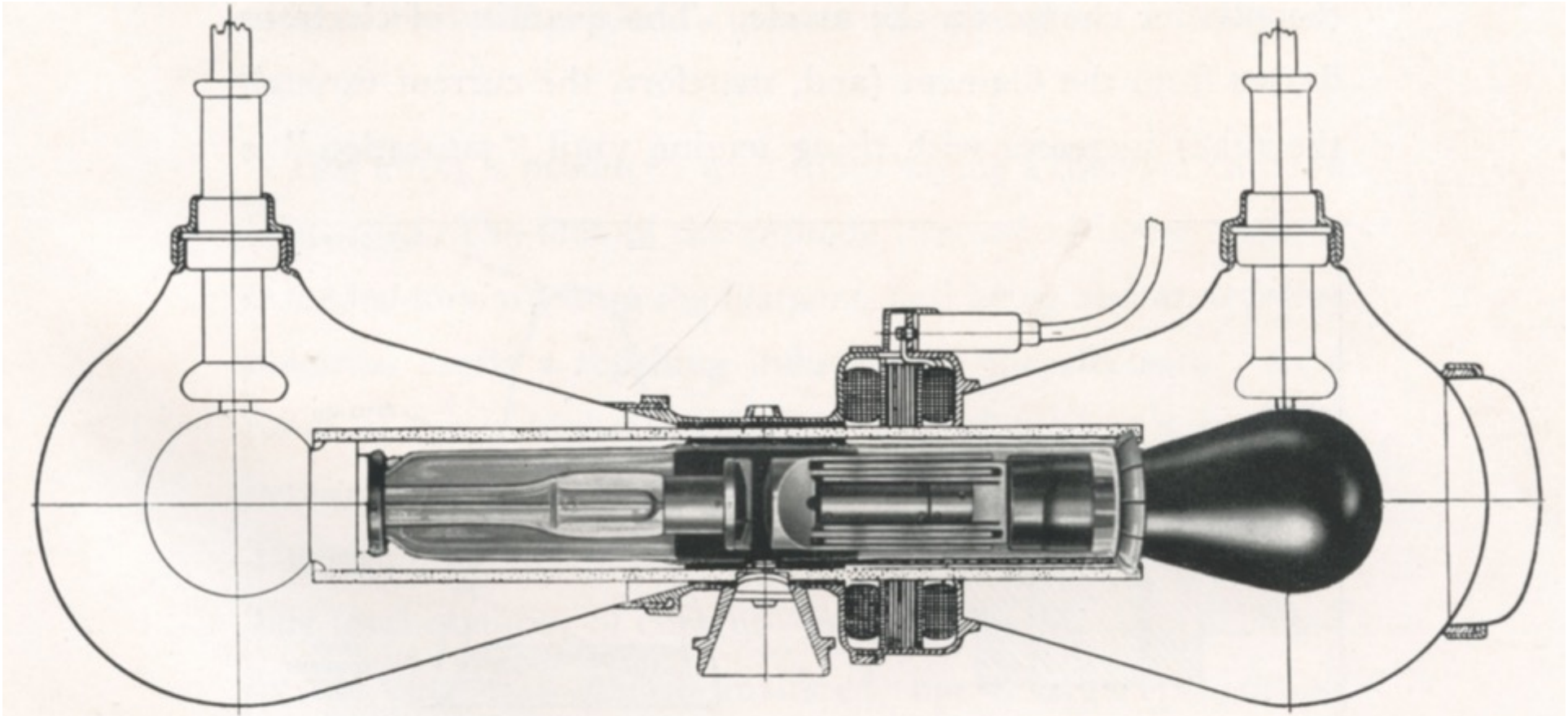


FIG. 13.—*Sectional Diagram of Shockproof "Rotalix" Tube.*

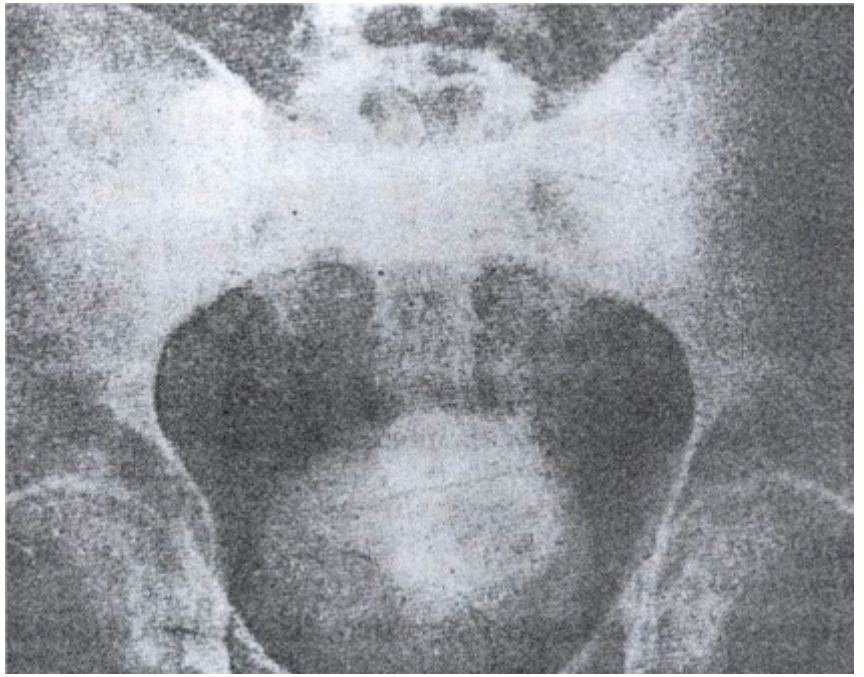
Retrograde Pyelography: Collargol.

- Introduced by Voelcker & Von Lichtenberg in 1906.
- A 2% solution of colloidal silver.
- Many complications.

Pyelograph. Collargol in Renal Tubules 15.2.1917

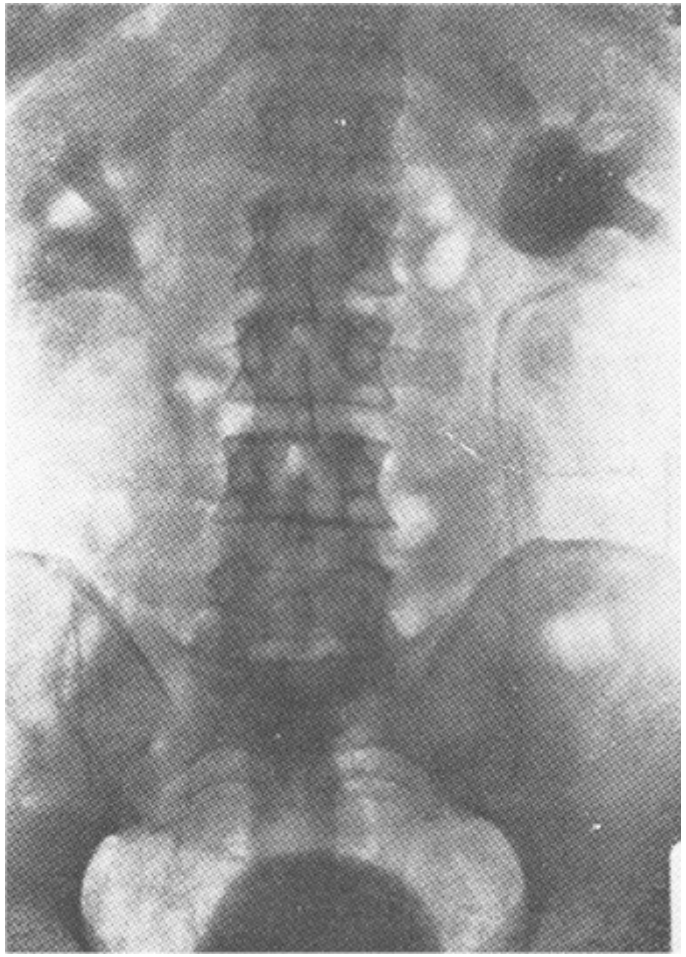
Development of the Intravenous Pyelogram (IVP).

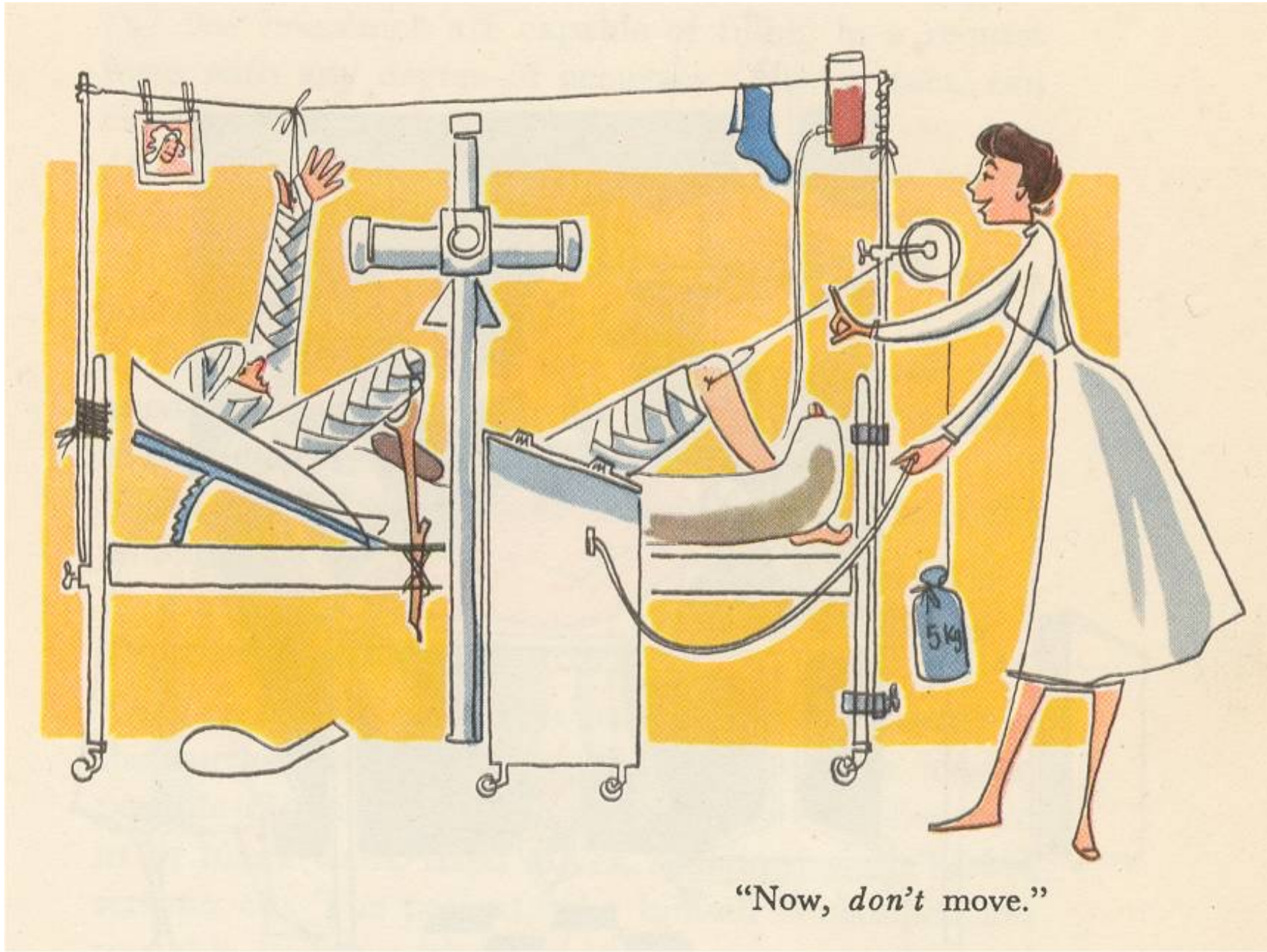
- 1923: a team of workers at the Mayo Clinic described the use of intravenous and oral sodium iodide (for treatment of syphilis) to visualise the urinary tract



The IVU / IVP.

- Swick and von Lichtenberg presented the work to the Ninth Congress of the German Urological Society in September 1929.
- Von Lichtenberg and Swick together presented the second paper on the human clinical uses with the paper read by von Lichtenberg.
- The two papers were published in November 1929 in Klinische Wochenschrift.





"Now, *don't* move."

Wet Processing 1956.

$$3AgBr + 4Na_2SO_3 = 3NaBr + Na_5Ag_3(SO_3)_4$$

silver bromide + hypo = sodium bromide + sodium silver thiosulphate

. . . or in other words, a large proportion of the metallic silver which the manufacturers put in your plates and films is dissolved out in the fixing bath. Don't throw away your exhausted fixing solution : reclaim the silver—regenerate your fixer —ensure perfect fixation :

INSTALL

PURHYPO

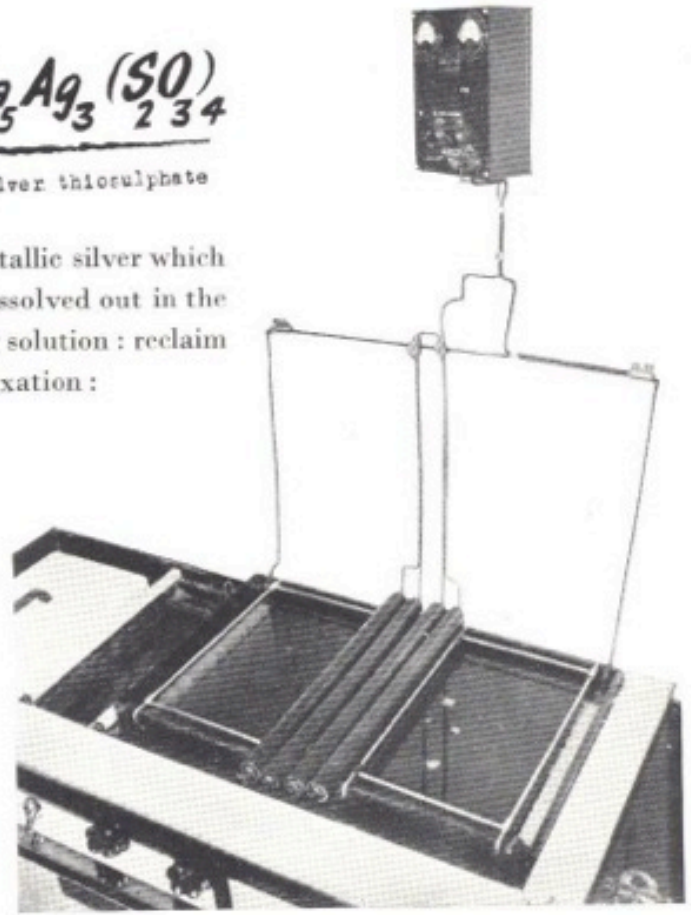
(British Patent No. 476985)

Supplied (with fixing tank), installed and maintained free of charge by

D. PENNELLIER & COMPANY LIMITED

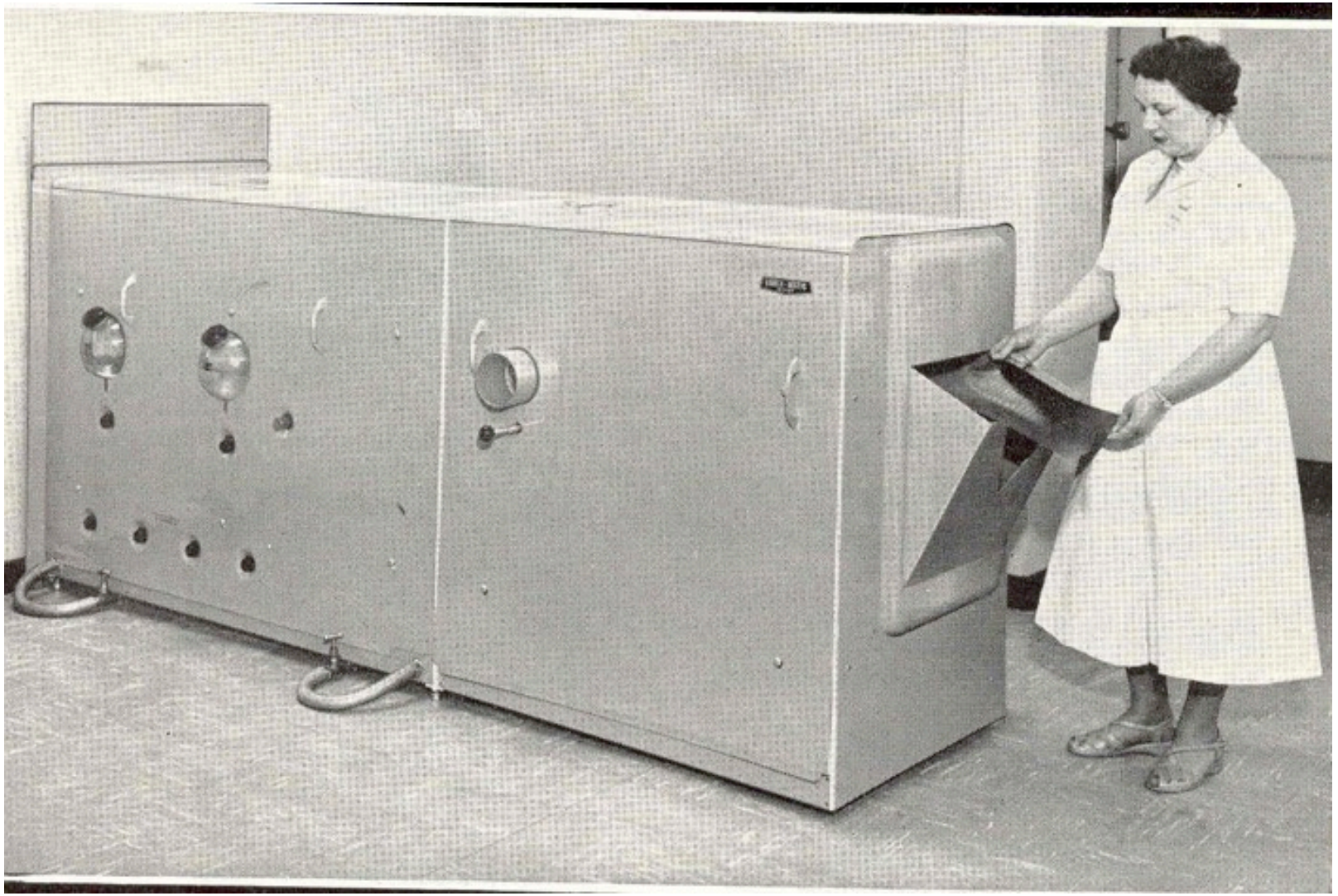
28 HATTON GARDEN, LONDON, E.C.1.

Telephone: HOLborn 4064 CHAncery 4681/2

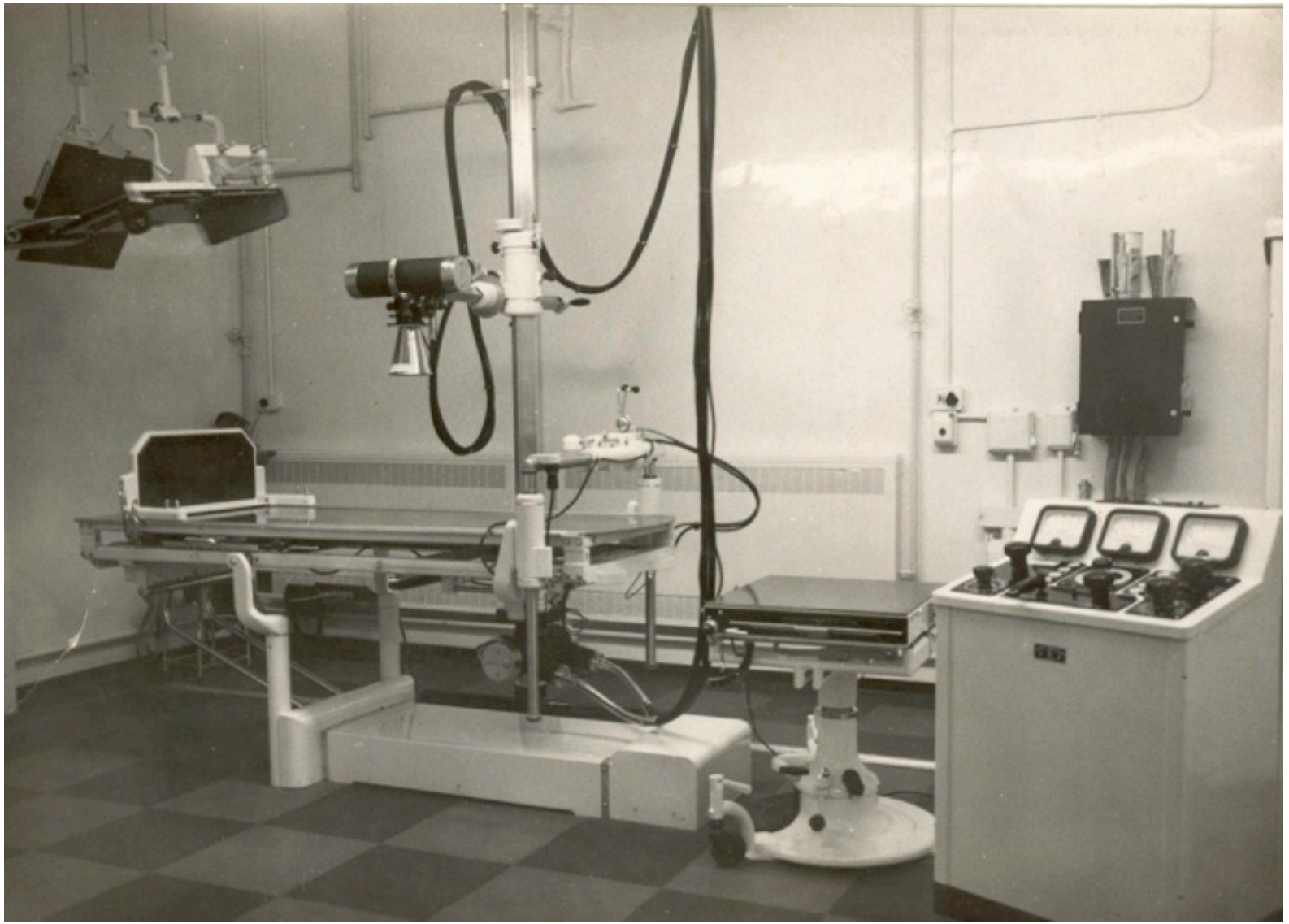


A typical X-ray Processing Unit fitted with two 17-gallon ebonite fixing tanks containing the PURHYPO equipment

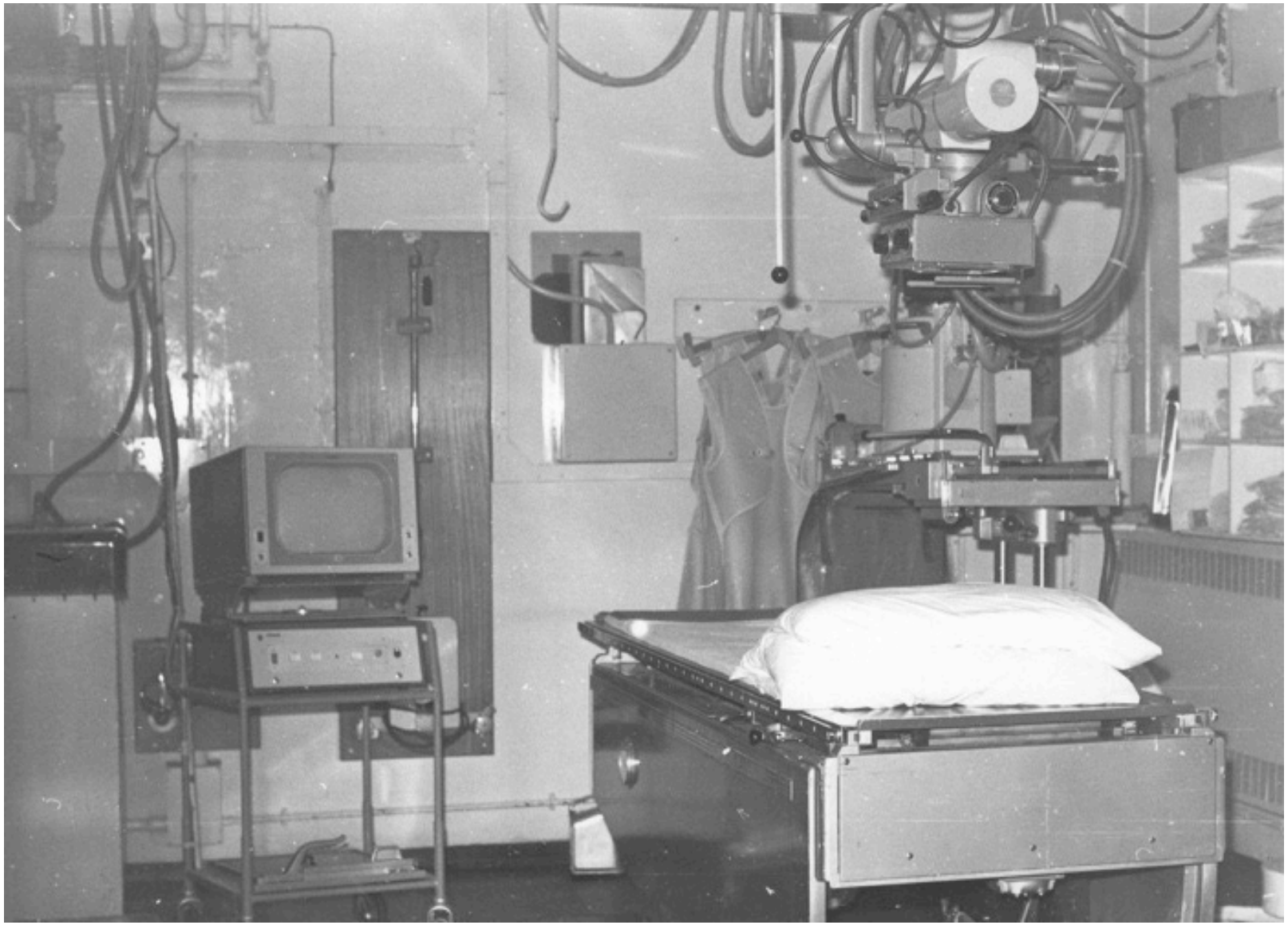
Agfa 1964.



Farnborough Hospital 1953.

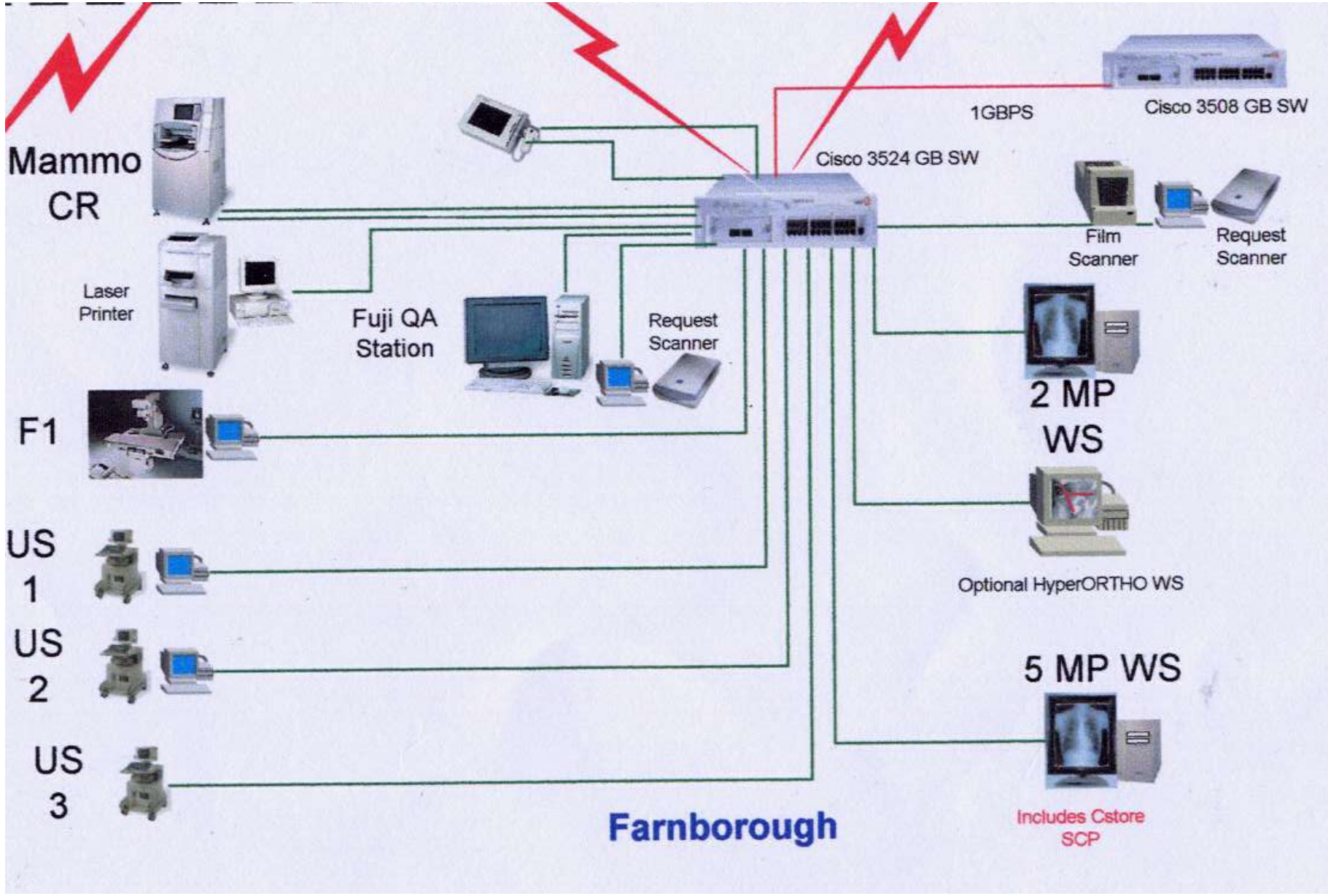


Farnborough Hospital 1970.




WATSON
BEAVER 2
Publication 420
Second Edition

Farnborough Hospital LAN/PACS

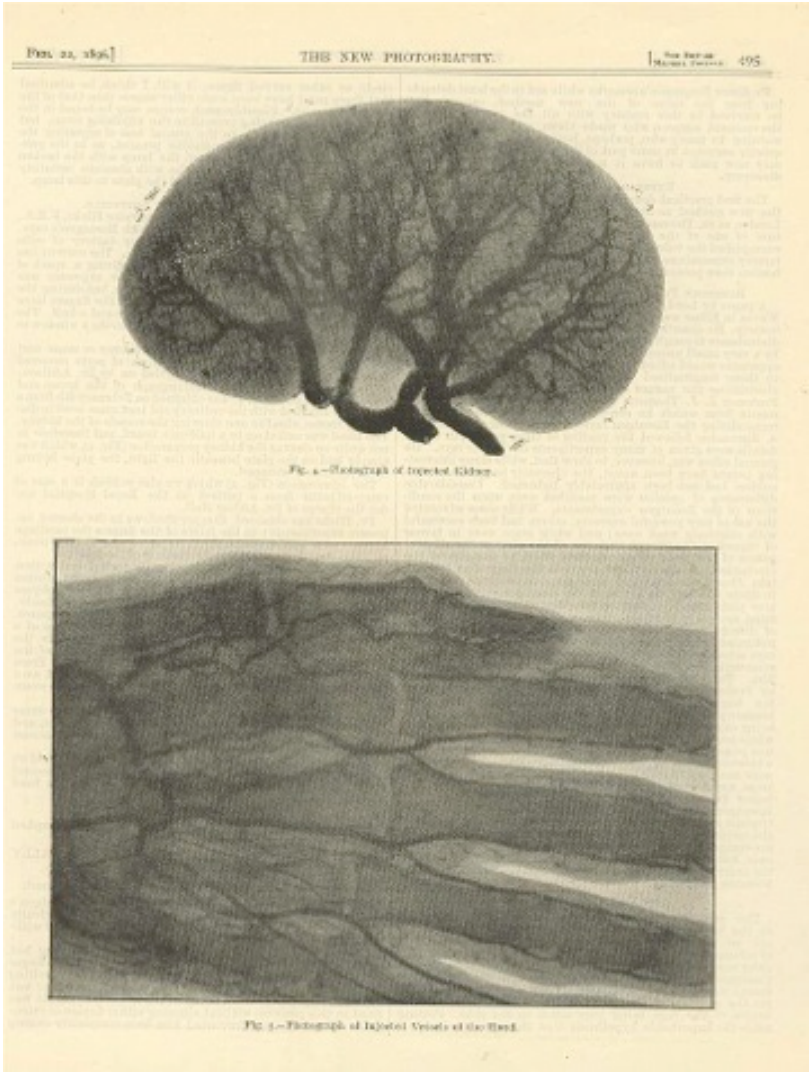


Torsten Almén: salt and sugar

- Torsten Almén studied the pharmacology of contrast agents.
- Almén's ideas were rejected by several pharmaceutical manufacturers but Hugo Holterman, the research director of Nyegaard, encouraged his team to attempt synthesis of some of Almén's theoretical molecules.

The Development of Diagnostic Radiology

- January 1896 Haschek and Lidenthal injected calcium carbonate emulsion into a severed arm of a cadaver. Arteriogram exposure of 57 minutes.
- February 1896 Hicks (physicist in Sheffield) achieved a renal arteriogram.



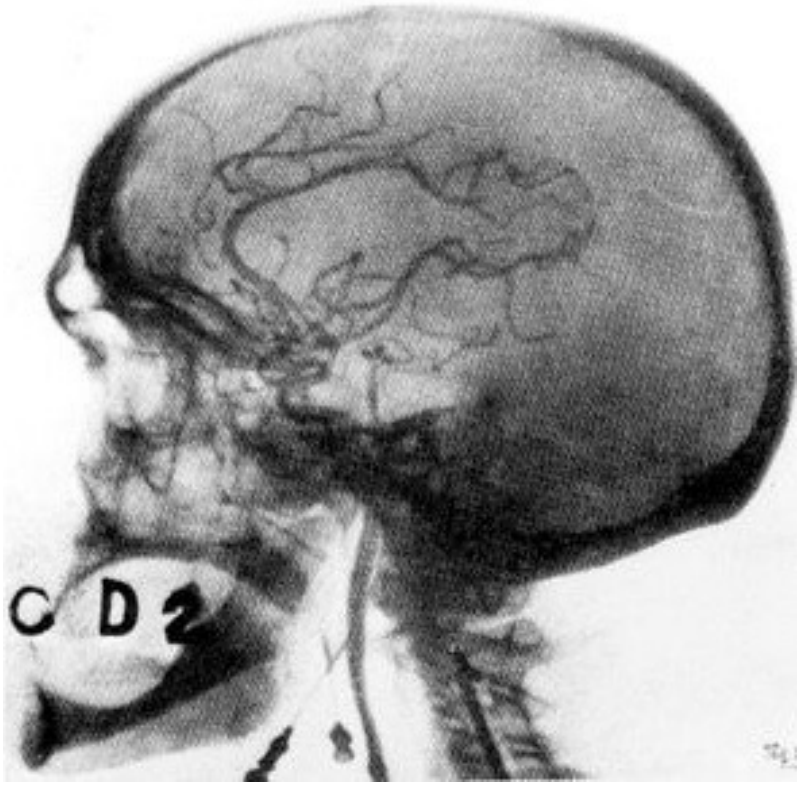
The Development of Diagnostic Radiology.

Interventional radiology

- Angiography developed in Portugal in late 1920s
  - Cerebral angiography 1927 (Egas Moniz)
  - Trans lumbar aortography 1929 (dos Santos)
  - Human right heart catheterisation 1929 (Werner Forssmann, Berlin)
- The Seldinger technique was published in1952

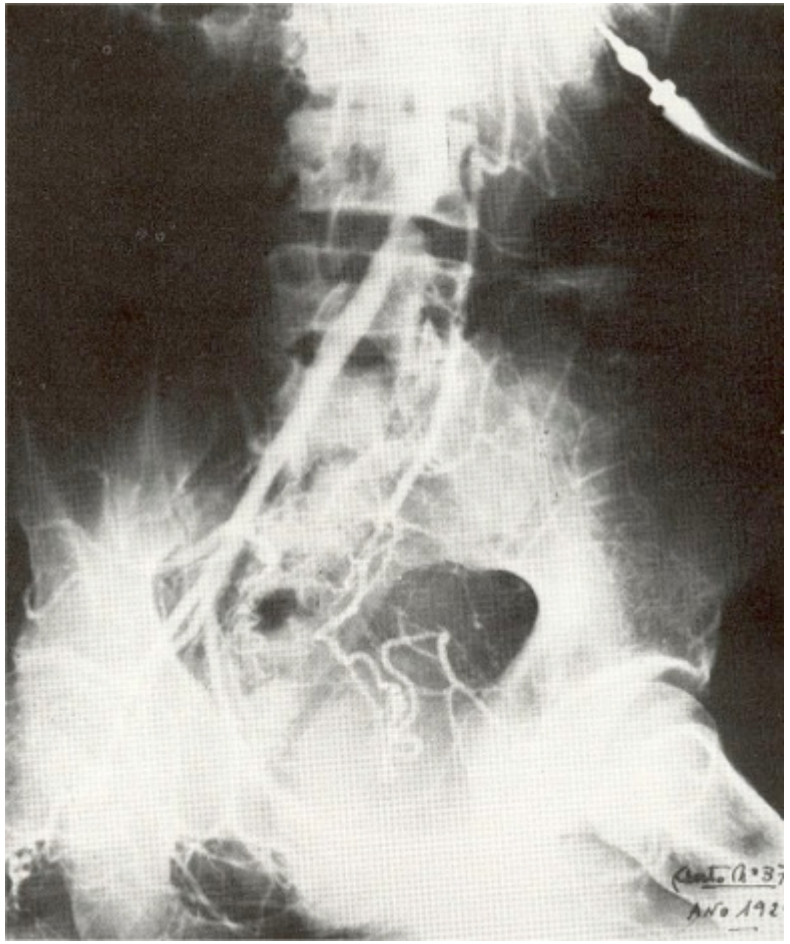
Egas Moniz.

- Aware of the work of Jean Sicard & Jaques Forestier.
- He initially tried to opacify the brain itself and then performed arterial injections.



Injection of 30% NaI into a preserved head (1927)

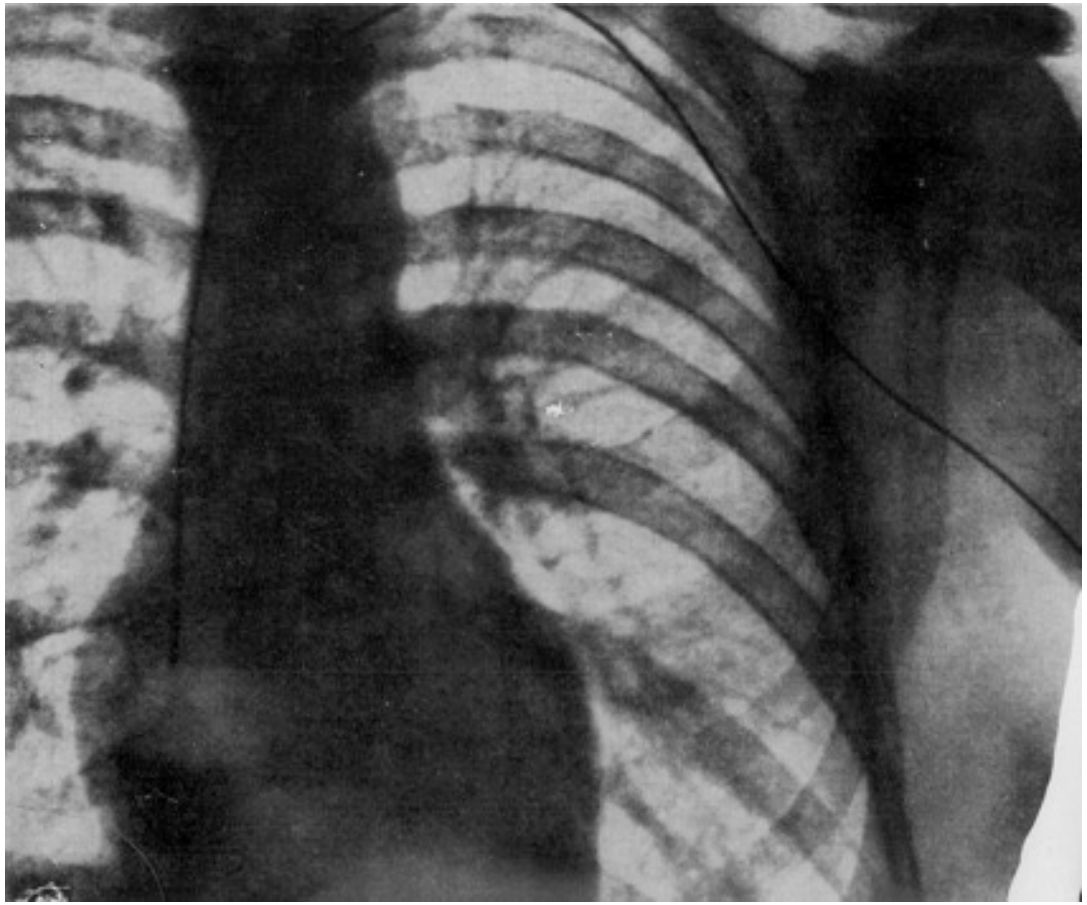
Reynaldo Dos Santos (1880-1970)



Werner Forssmann (1929)

- "You idiot, what the hell are you doing?"

- Forssmann, W. 1972. *Experiments on Myself. Memoirs of a Surgeon in Germany*. Saint Martin's Press, New York.



Sven Ivar Seldinger: Catheter Replacement of the Needle in Percutaneous Angiography (1952)

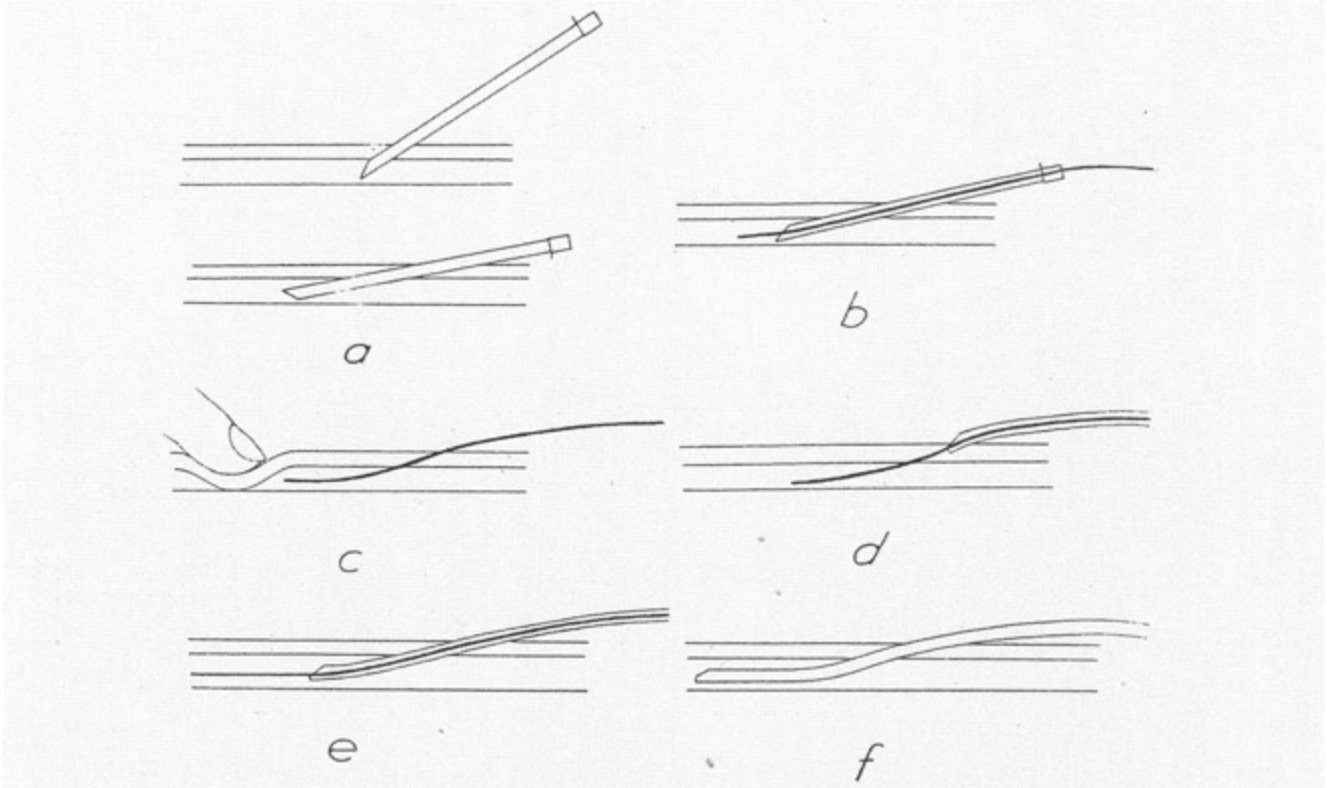


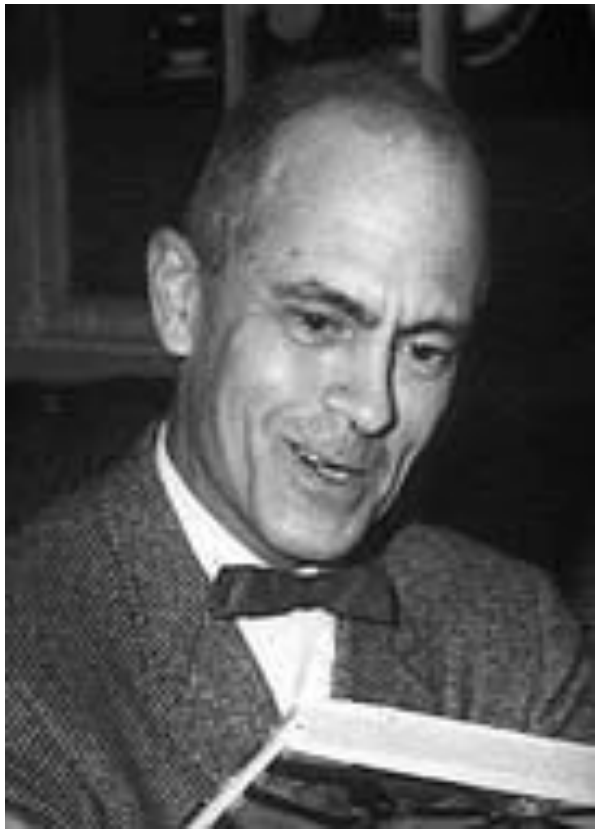
Fig. 2. Diagram of the technique used. a) The artery punctured. The needle pushed upwards. b) The leader inserted. c) The needle withdrawn and the artery compressed, d) The catheter threaded on to the leader. e) The catheter inserted into the artery. f) The leader withdrawn.

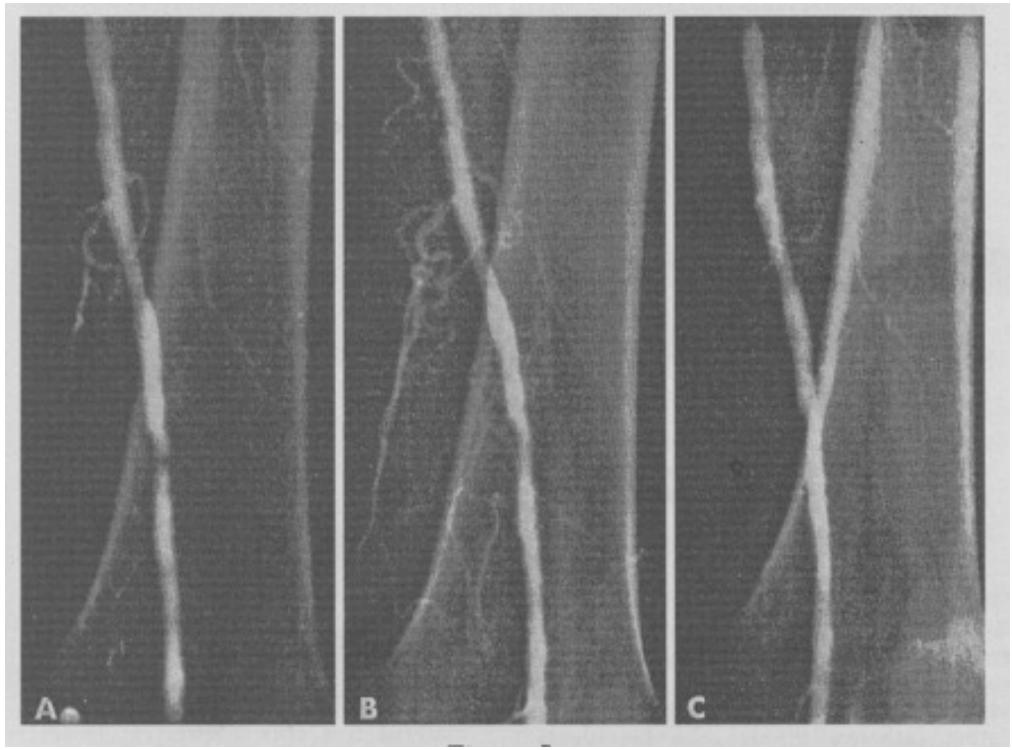
The Development of Interventional Radiology

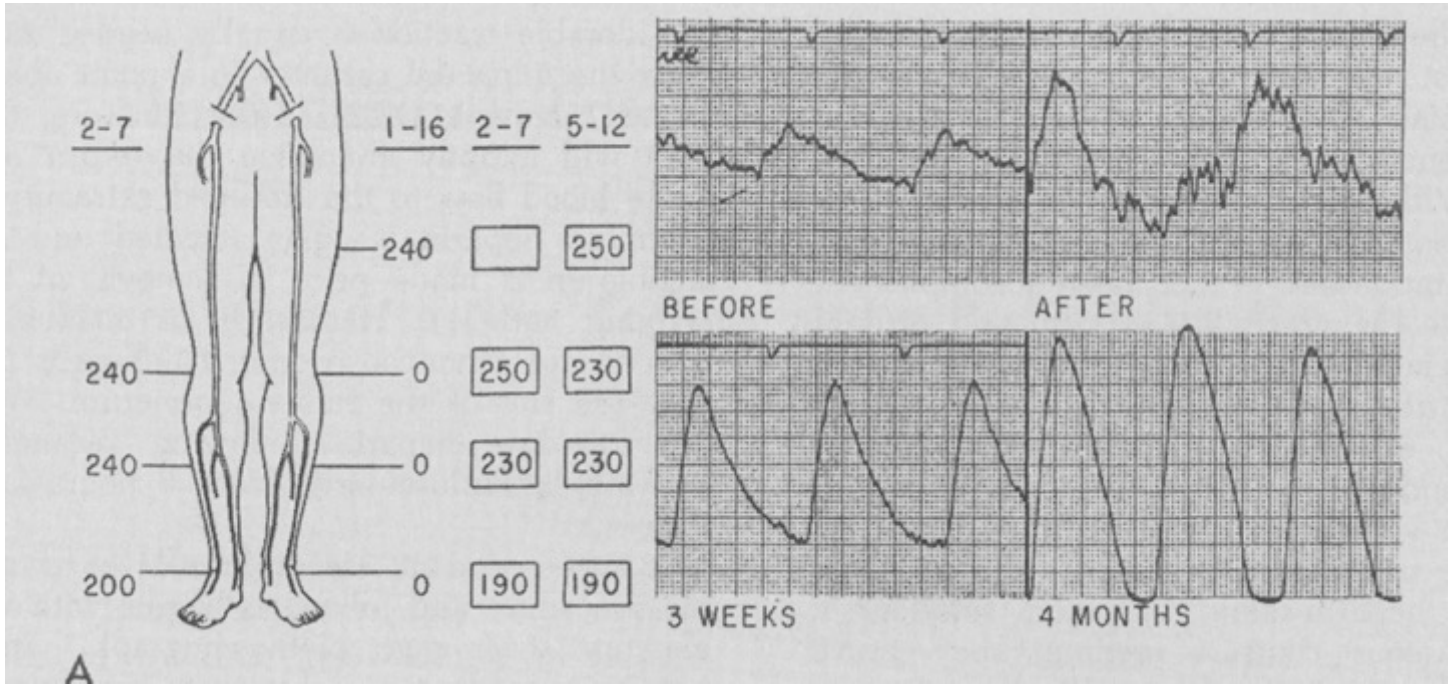
- 1963 Charles Dotter passed a catheter percutaneously through an occluded iliac artery
- Developed co-axial system for dilating arterial lesions in leg but angioplasty gained widespread acceptance following development of noncompliant balloons in 1974 by Andreas Greuntzig
- Therapeutic embolization developed in 1970s
- Clinical application of metallic stents in 1980s

Charles Dotter (1920-1985)

- 16 January 1964, which is now over 50 years ago.
- First angioplasty (PTA).




A
B
C


2-7
1-16
2-7
5-12
240
250
240
0
250
230
240
0
230
230
200
0
190
190
BEFORE
AFTER
3 WEEKS
4 MONTHS
A

Oesophageal Intervention

- 1845: Leroy d'Etiolles (France): intubation using decalcified ivory.
- 1887: Sir Charles Symons: first successful insertion of oesophageal tube.
- "Dilatation using an angioplasty balloon was first proposed by London et al. 1981" W. Cwiukiel & A Stridbeck (1994).
- 1981: Owman and Lunderquist reported the use of a new oesophageal dilatation balloon.
- Grundy, A., Belli, A. 1988. *Balloon Dilatation of Upper Gastrointestinal Strictures*. Clinical Radiology, 39, 299-235.

A E Jordan 1923 on cardiospasm (Achalasia of the Cardia).

- Diagnosed by swallowing a bismuth carbonate emulsion.
- Can be dilated with an oesophageal bougie.
- Use of metallic “acorn”.
- A spindle-shaped dilating bag can be attached to the lower catheter above the metallic acorn.
- The passage of the catheter with an empty bag, and the descent of the metallic acorn can be observed fluoroscopically.

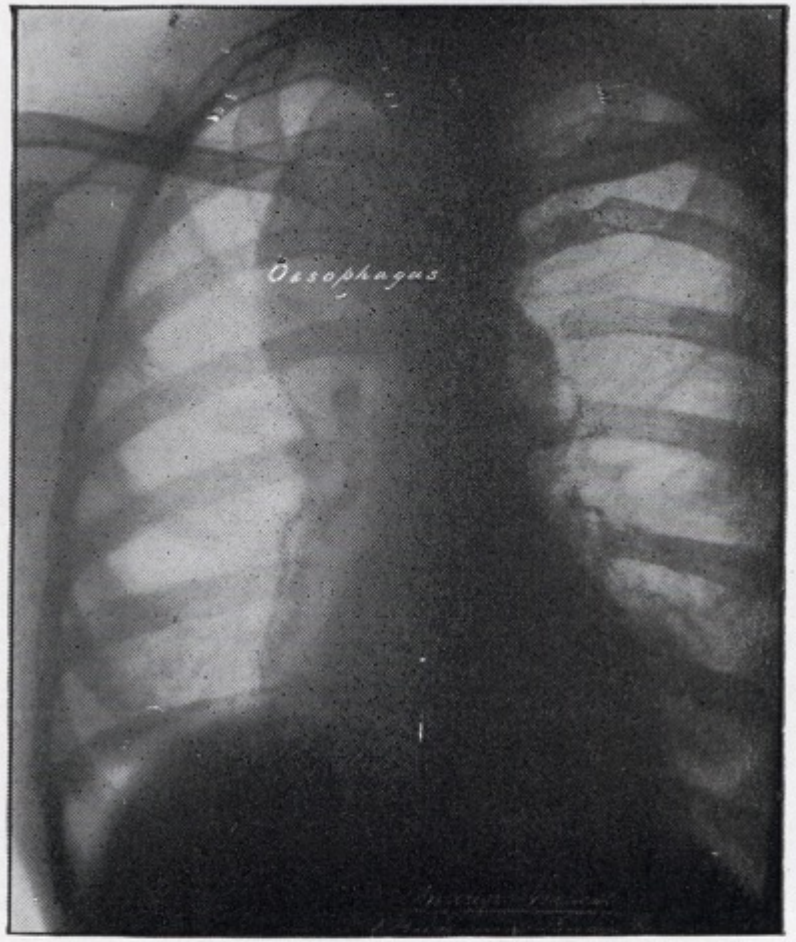


FIG. 233.—Chest of a woman, aged 39, taken from the front with the patient vertical. Shows the œsophagus, greatly dilated and full of mucus and food, forming a large shadow in the upper part of the right side. (Her œsophagus and stomach are also shown in Figs. 250 and 251, p. 167.)

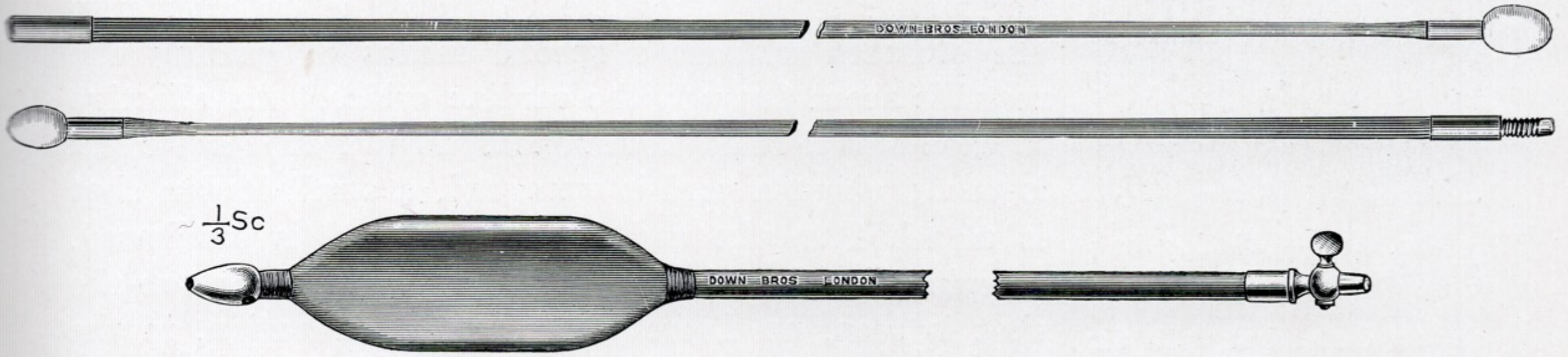


FIG. 235.—Bougie with metallic "acorn," the descent of which through the œsophagus into the stomach is observed with the fluorescent screen. Catheter with rubber dilating bag and perforated metallic "acorn" used in the treatment of cardiospasm.

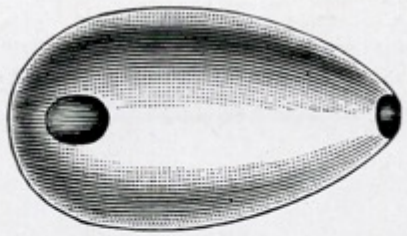


FIG. 236.—Metallic "acorn," showing perforation for the silk thread which is used as a guide (see text).

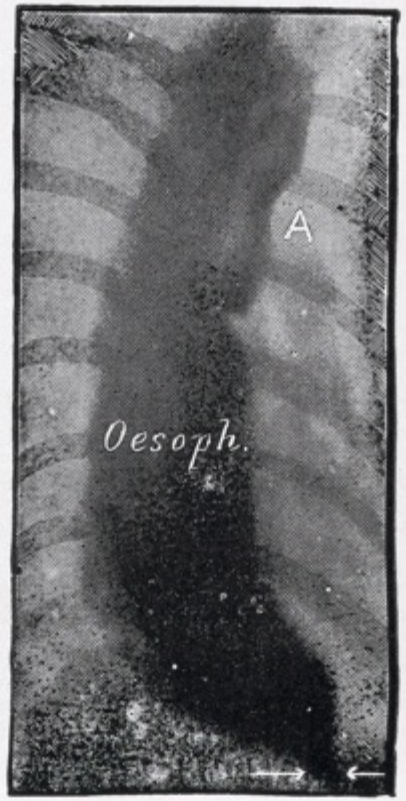


FIG. 234.—Œsophagus, containing bismuth, greatly dilated, taken vertically in the right anterior oblique view in a typical case of cardiospasm in a woman aged 39.

A.=Aortic arch. The arrows indicate the spasmodic constriction of the lower end of the œsophagus. (See also Figs. 237, 247, 248 and 249.)

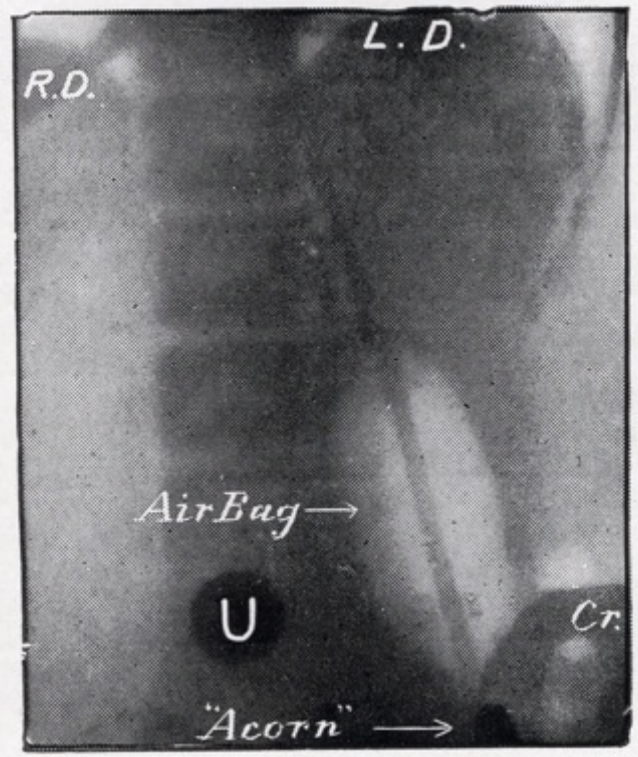
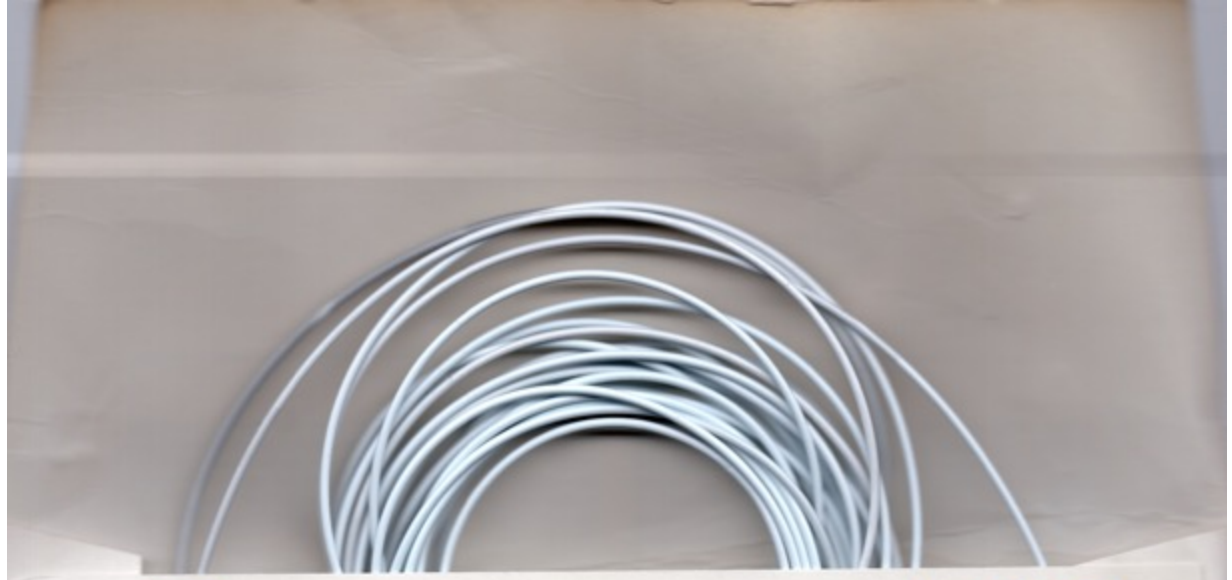


FIG. 237.—Dilating bag (Fig. 235) shown *in situ* in the stomach; the bag is shown distended with air prior to its withdrawal.

R.D., L.D. = right and left diaphragm. Cr. = crest of left ilium. U. = umbilicus. (In the subject of Figs. 234, 247, 248, and 249.)

Image Guided Intervention: Why flourishing?

- Seldinger technique: ease of access.
- Image intensification/X-ray television: no longer working in the dark.
- Non-ionic contrast agents: no pain for patients.
- Development of plastics: catheters &c.
- Digital imaging: no longer waiting for film processor for angiographic series.
- Last image hold on screen: to help guidance of technique.



20 FEET

NO. **7636**

THIS TUBING IS IN A TAMPER EVIDENT PLASTIC BAG.
TEAR ALONG IMPRESSION APPROXIMATELY ¼" FROM TOP OF BAG TO OPEN.

PLASTIC BAG IS RECLOSABLE

TO OPEN:	TO CLOSE:
PULL FLAPS APART	PRESS ALONG GRIPPER

FORMOCATH™

B-D MEDICAL GRADE RADIOPAQUE

POLYETHYLENE TUBING

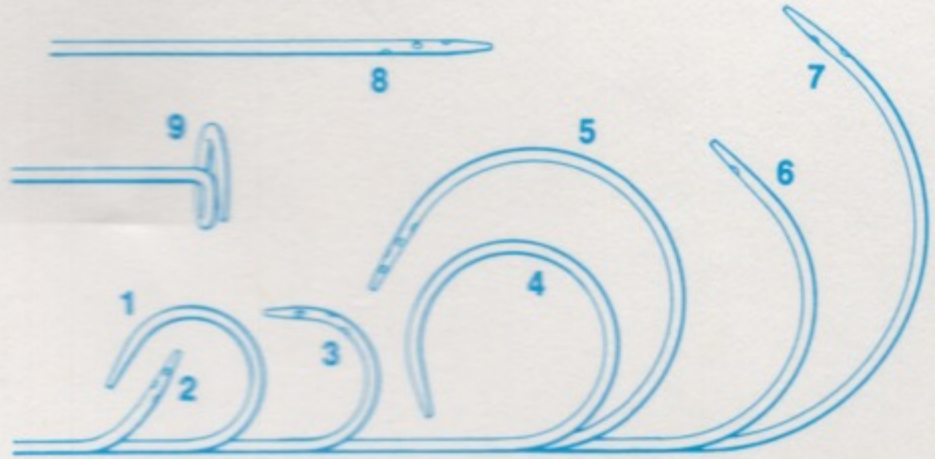
NON-STERILE • NON-TOXIC • NON-REACTIVE TO TISSUE
MAY BE STERILIZED BY GAS OR COLD STERILIZATION SOLUTION

DO NOT STORE IN STRONG LIGHT

IF EXPOSED TO STRONG LIGHT, TUBING MAY DISCOLOR.
OTHER PROPERTIES OF THE TUBING WILL NOT BE AFFECTED.

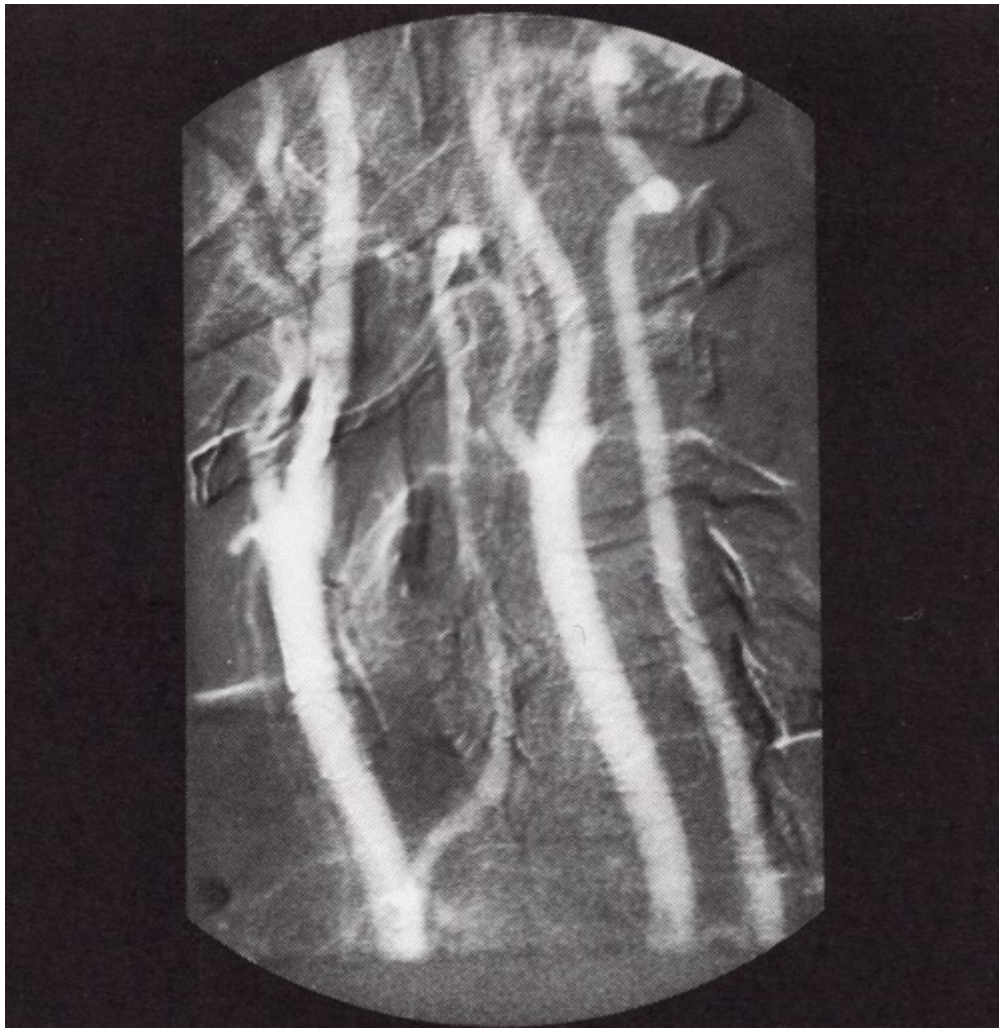
COLOR	I. D.		O.D.
BLUE	.045	X	.062
	WILL RECEIVE 18G NEEDLE SNUGLY.		WILL PASS THRU 13G REGULAR AND 14G THIN WALL NEEDLE.

SEE INSTRUCTIONS ON OTHER SIDE



TYPICAL CATHETER TIP SHAPES FOR ROENTGENOGRAPHY

1. Internal mammary and axillary artery branches. 2. Percutaneous arteriography; cerebral arteriography via femoral. 3. Selective renal arteriography and celiac arteriography. 4. Hepatic venography. 5. Transseptal left-heart catheterization via femoral vein. 6. Abdominal aortography via brachial artery. 7. Thoracic aortography via femoral artery. 8. Lumbar aortography via femoral artery. 9. Coronary arteriography, loop end catheter.



Two Paradigms.

Traditional.

- Minimally Invasive / Invasive Diagnosis.
- Invasive Therapy.

Contemporary.

- Non-invasive diagnosis.
- Minimally invasive Therapy.

Hand with ring .....

Thank you