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PART 1.

THE DERMATOSES OF THE PARAFFIN WORKERS

OF THE SCOTTISH SHALE OIL

INDUSTRY.
PART 1.

THE DERMATOSES OF THE PARAFFIN WORKERS OF THE SCOTTISH SHALE OIL INDUSTRY.

INTRODUCTORY.

This paper is based on the experience of over twenty-four years continuous practice in the centre of the Scottish Shale Oil Industry, and on the results obtained during the past four years in carrying out routine examinations at intervals of three months of every workman employed in the Paraffin Departments of the various Works in which the refining of paraffin is carried out.

While the term "Paraffin Workers Cancer" has become a classic one, it is not so generally known outside the shale area of the Lothians that those employed in the Paraffin Departments suffer from various well defined skin lesions, due entirely to their working among and handling oily paraffin in several of the stages of the process of refining. These skin conditions can be truly described as "Occupation Dermatoses", as they occur in approximately fifty percent of the workmen engaged in refining paraffin; the lesions appear in a few weeks or months after beginning work in the Paraffin Departments and persist to a greater or less/
less extent throughout the length of employment as paraffin workers; they disappear (at least the less chronic types) in a short time after ceasing work among paraffin; the types are identically the same in the workmen in the various Oil Works in which the process of refining paraffin is carried out, the only variation being in the extent of the eruptions, due to variations in the methods of working in the different Works. The skin lesions invariably conform to certain well defined types, they are most marked over the parts of the body exposed to contact with the paraffin substances which the workmen have to handle in the course of their employment.

For many years approximately two hundred men have been employed in the Scottish Oil Industry in the Paraffin Departments of the various Works, and the skin lesions incidental to that occupation have been uniformly constant in type and frequency throughout a period of fifty years. Later full details will be given as to the various conditions, their frequency and circumstances which tend to have a modifying influence on their prevalence.

Reference numbers in parenthesis refer to the section on Bibliography, which is arranged chronologically and
in which I have given a short synopsis of the more important articles, and especially those in connection with the Scottish Oil Industry.

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**OCCUPATION DERMATOSES.**

The skin lesions due to contact with cily paraffin in a crude or semi-refined state may be described as conforming to the following types, of which one only or several may be found on the same individual:-

1. **Occupation Coredones.**
2. **Folliculitis and Follicular Dermatitis.**
3. **Dermatitis Pustulare.**
4. **Dermatitis Papulare.** (Erythema Papulare).
5. **Erythema Simplex.**
6. **Dermatitis Erythematosa.**
7. **Epithelion.** (Paraffin Workers Cancer).

These, which include all forms of occupational eruptions met with in the Scottish Shale Oil Industry, will be described under their various heads.
1. Occupation Comedones:

Several dermatologists have noted the fact that workers in paraffin and petroleum may suffer from comedones associated with acne. When occurring in tar workers, this condition has been described as acne picealis (16). The comedones occur in parts exposed to contact with paraffin products, especially over the flexures of elbows, posterior aspects of elbows, upper aspects of shoulder joints, and occasionally over knees. Their origin is purely mechanical, being due to obstruction of the sebaceous ducts with semi-solid paraffin substances, or to thickening of the superficial layers of the epidermis, causing obstruction of ducts. They are larger than comedones met with under ordinary conditions, more closely packed together, and confined to circumscribed areas, being most prevalent on the anterior aspects of the body and limbs. The outer layers are pigmented and hardened. The comedones are easily expressed, but if left unattended are apt to be followed by the development of sebaceous concretions of a cystic nature, which are most commonly found over the flexures of the elbows. There is not the same tendency to acne formation, as under ordinary circumstances, possibly due to the fact that the materials/
materials obstructing the ducts are sterile and practically antiseptic, and it is only after they have persisted for lengthened periods that any tendency towards acne formation is seen. They are not got in the usual situations in which the ordinary type of comedones is met with. On ceasing work among paraffin substances they readily disappear if regularly expressed, and do not develop further, while they are apt to recur on resuming work. Their presence is not associated with any form of systemic disturbance, such as dyspepsia, thus differing from an anomalous type described by Crocker and Wetherill (10), occurring mostly on the forehead. The facts stated all point to this condition being occupational in origin. This condition has been noted in ten instances, or about five percent of the workmen engaged in the Paraffin Departments.

Plate 1 shows comedones over flexure of elbow
Plate 2 shows a later stage where comedones are accompanied by the formation of numerous sebaceous cysts in same situation.

References - (16) Stelwagon, Diseases of the skin, 1907 page 975
2. Folliculitis - Peri-folliculitis - Follicular Dermatitis.

This is one of the most prevalent forms of skin lesion occurring among paraffin workers, and though of little import must be included. The condition was first recorded by Ogston in 1871 (2), and illustrations were given in the Edinburgh Medical Journal of that year.

Folliculitis consists of destruction of the hairs and hair follicles as the result of a mild inflammatory reaction set up by the action of shale oils. The follicles become somewhat dilated and are filled with epithelial debris and dirt, so that they appear as closely grouped clusters of black points over the parts affected. Occasionally a slight peri-folliculitis occurs, in which the inflammatory condition extends to the surrounding skin, which becomes slightly raised above the rest of the skin tissue, and which ultimately becomes somewhat indurated and thickened. The most common sites are the backs of fingers and hands, and to a less degree on the forearms, the legs around the ankles, and the dorsal aspects of toes and feet, especially on the line of the extensor tendons of toes. There is never any tendency towards suppuration or sloughing, the condition persisting as described indefinitely. The usual appearance of dryness of the hands, with clusters of black points/
points on backs of fingers and hands is very characteristic among paraffin workers.

Professor G. G. Page and L. D. Bushnell have investigated the bacteriology of some oils and suggest the name "Oil Folliculitis" for some of the skin lesions. They conclude that "the most serious skin diseases are due to the oil acting as a carrier of infectious material. The addition of germicides has not given satisfactory results, but daily filtration and sterilization of oils reduces the number of metallic particles present and the danger of bacterial infection." (Journal of Industrial Hygiene, June 1921).

Plate 3 shows the condition on dorsal aspect of hand.
Plates 4 and 5 show simple folliculitis in region of ankle.
Plate 6 shows the same of more chronic duration, accompanied by peri-folliculitis.

References - (2) Ogston Alex., Edinburgh Medical Journal 1871/2
Vol. 17, page 544.


3. Dermatitis Pustulare.

While this is not a very prevalent condition, its occurrence as the result of contact with crude or semi-refined paraffin has been noted. Two types have been observed -

(A) One in which the condition is characterised by the appearance of numerous small pustules over the anterior aspect of the body and limbs, and

(B) One in which the pustular eruption is due to the breaking down of the typical papule, which is the most prevalent form of occupational eruption.

(A) Primary Dermatitis Pustulare.

A widely distributed pustular dermatitis has been noted among youths beginning work in the paraffin departments. The pustules are small epidermic elevations, filled with pus, distributed over the body and limbs, on their anterior aspects. Each pustule is surrounded by very slight - in degree and area - inflammatory areola. This condition appears to be due to/
to contact with semi-refined oily paraffin, which sets up an acute irritation of superficial layers of epidermis with pus formation. The channel of entrance appears to be by the hair follicles, as generally a hair is found in the centre of each pustule. This condition corresponds with that described by some writers as Follicular Pustular Dermatitis. It is most probable that, apart from carelessness on the part of the youths affected in allowing their clothing to get saturated with oily material, there is an idiosyncracy towards the action of paraffin in some of its forms, causing one individual to be acutely affected while by far the larger proportion escapes.

Exceptionally, this condition may occur among those handling the final products, such as burning oils. I have seen a general pustular dermatitis over the whole of the anterior aspect of the body in a boy engaged filling barrels with burning oil. Pustular Dermatitis readily disappears on removing the individual from his particular form of work, or on taking precautions as regards cleanliness. The tops of the pustules dry and are shed as crusts, without further return.

(B) Papulo-Pustule.

These occur as small pustular elevations on the sites of papules/
papules, the suppuration taking place at the apical part of the papule. As a rule these are not numerous, and are usually seen in conjunction with a papular eruption. They are not surrounded by an inflammatory areola, and are due to the breaking down of papules, either from a staphylo- or streptococcal infection, or to the separation of a small necrotic area from the centre of the papule, after which the papulo-pustule disappears.

Plate 7 shows papulo-pustules accompanying papules.


This is by far the most common type of skin lesion met with among the paraffin workers of the Scottish Shale Oil Industry, between forty and fifty percent of the workers being affected. The papules are known in the trade as "Paraffin Plukes" and are most typical of an occupation condition both in history and distribution.

The first description of a papular eruption occurring among oilworkers was given by Allen, in American Journal of Medical Science 1862 (1). At later dates, these have been described by various writers, Ogston 1871 (2), Volkmann 1874 (3), Bell, 1876 (4), Kirk, 1903 (12), Prosser White, 1915 (21), and others. For a synopsis of these descriptions, see section on/
on Bibliography, which follows later.

Papular Dermatitis consists of an eruption of small rounded elevations of a reddish colour, varying in size from that of a small peppercorn to that of a small pea. They correspond in every way to the typical primary lesion described as a papule, being solid, superficial, rounded in shape, and containing no fluid. As a rule, the tops are convex, but occasionally there is apparent a minute central depression, from which a tiny thread-like core can be expressed or removed, and which corresponds to anecrosed hair follicle or sweat duct. Several of the plates illustrating papular conditions in the less advanced stages show the umbilicated appearance of tops of papules.

I have seen in a very few instances small, soft papules with tiny, horny excrescences on tops, giving the appearance of diminutive cutaneous horns, such being situated on scrotum. Plate 13 showing a flat papule on the scrotum, also shows a tiny papule of this description, but this, on account of its very small size, is not easily illustrated.

The entrance of irritant to the superficial layers of the skin appears to be most commonly through the sweat ducts, but very frequently the hair follicles are involved, in which case they occupy the central position in a papule. The workmen affected try/
try to pick out or express this central core, after which the papule heals. There is as a rule no inflammatory areola around the typical papule. The papular eruption differs from other lichenoid eruptions, in that there is no itching or irritation, the papules do not tend to coalesce, and as a rule heal spontaneously. Ogston (2) stated that chronic subjects suffered from sleeplessness, loss of weight, foul tongue, and other constitutional disturbances, due to the irritation and pain of the skin, but present day experience differs from this description, as the eruptions cause no inconvenience from irritation and itching, and I have never seen marks of scratching over the affected parts, while there is certainly no systemic disturbance. It has been frequently noted during the routine examinations of the workmen that the sites of papules vary from time to time, and that between the examinations some have healed and others have appeared in different situations. The papules may be present singly or in two's or three's (Plate 7), or in larger numbers until there may be a diffuse eruption of discrete papules (Plate 8). As already stated, between forty and fifty percent of the workmen are affected with this type of eruption, and briefly at this stage it may be said that of those affected approximately fifty percent show/
show not more than three or four papules, forty-five percent have a limited extent of eruption confined to a small area, and five percent have a diffuse eruption (Full details and figures will be given under description of routine examinations). The distribution of the papular eruption is very typical. In the great majority of cases it is confined to forearms, and as a rule is most pronounced over the ulnar aspects, though it is also prevalent over anterior and posterior aspects, around wrists and on backs of hands. Less frequently a few papules are present on the shoulders, legs and dorsal aspects of feet. In old standing cases they are seen over lower thirds of arms and around elbow joints, and occasionally on anterior aspects of body, thighs, and on face and neck. The palms of the hands and soles of the feet are never affected. Approximately seventy-five percent of those affected have eruption on hands and arms only, twenty percent have both arms and legs affected, and about five percent have some eruption on the body, as well as either arms or legs. The most typical position in which the papular eruption is found is over the ulnar aspect of forearms, this being the part most in contact with the paraffin in its semi-refined state. (The method of working is illustrated later).
On two occasions, I have seen papules on the scrotum (Plate 14). The earliest appearance of papules after men begin work in Paraffin Sheds occurs in from ten to twelve days, and they may persist throughout the duration of employment. They disappear a few weeks after ceasing work among the semi-refined paraffin. Plates 8, 9, and 10 show the typical eruption on the ulnar aspects of forearms, Plate 11 shows eruption on ulnar aspect of elbow, and Plates 12 and 13 show papular eruption on legs.

Occasionally in old standing cases the papules instead of healing assume a warty appearance, due to proliferation of superficial layers of epidermis, and to growth of connective tissue cells, forming scaly warts, at first soft, but gradually becoming harder and more indurated, with a covering of dry scales which are readily detached. This warty appearance is of a permanent nature. (Illustrated by plates 15 and 16).

In the most chronic types of this condition of warty papule, there is occasionally a tendency to increase in size, accompanied by the formation of a central necrotic area, which may separate and be followed ultimately by the disappearance of the warty growth, with atrophy of the skin tissue and the formation of a scar. This condition is well/
well illustrated by plates 17 and 18. These more chronic types are as a rule associated with an old standing induration of skin, due to chronic erythematous dermatitis. As a still more advanced stage of the condition described, the warty papule, instead of disappearing, grows until it assumes the characters of an epithelial-neomatosus growth, with the usual clinical and pathological features of that condition. Plates 21 and 22 show large warty growths with central necrotic areas in what might be termed the stage preceding malignancy.

Recently there have been brought to the writer's notice several instances of the occurrence of a papular dermatitis among workers in factories using low grade or unrefined lubricating oils produced from oil shale and used for lubricating purposes. In these instances the arms of the workers come closely into contact with the lubricating oils, the resulting dermatitis being of the papular type as described in the foregoing paragraphs.

4. Erythema Simplex.

This consists of a mild hyperaemia in which the redness is distributed uniformly over the parts affected. The first appearance is a slight blush, followed by a greater degree of redness, which in the early stages disappears on pressing to re-appear when pressure is withdrawn. This hyperaemia is almost always limited to the forearms, which show a generalised redness, there being no "patchiness" in its appearance. In exceptional instances a slight degree has been seen on the feet. Associated with the increase in colour is a marked dryness of the skin (Plate 25). In the later stages there is a tendency for the erythema to become slightly purplish and to remain on pressure, the pigmentation of the skin being permanent. This condition may persist for years without alteration/
alteration. In addition, there is a scaliness of the arms, in which the superficial cells of epidermis are readily rubbed off in fine scales. There is frequently seen a shiny or lustrous condition of skin, giving the arms a polished appearance. There is never at any time any tendency to moistness or exudation, and seldom are there any subjective symptoms, such as itching or irritation along with the erythema. This type of lesion frequently exists alone without the presence of other form of occupation eruption, and is somewhat prevalent among the paraffin workers. In itself it is of little importance, other than that it may gradually, over the course of years, develop into a dermatitis erythematosae. A marked thinning of the subcutaneous layer of adipose tissue, especially over forearms, has been observed after the persistence of erythema for a long period.

The condition has been seen among workers with final products of distillation of shale, such as burning oils, refined wax, petrol, etc., but more commonly these men show dryness of arms, with very little reddening or erythema. A petrol dermatitis has been described, similar to burns of first and second degrees, with vescication, etc. Page, G.B., Surgeon R.N. Practitioner 1918, Vol. 100, page 451. (23).

Plate 22 shows the shiny appearance of skin referred to above. In/
In one instance only, both forearms showed numerous circular patches of hyperaemia, of a purplish red colour, varying in size from a sixpenny piece to that of a shilling. There was no induration or exudation, the patches were quite discrete with no tendency to coalesce. The redness did not fully disappear on pressure, there being slight permanent pigmentation. The condition was unaccompanied by constitutional symptoms, and no history of any condition to which it might be attributed was got. Being the only case of its kind seen, and varying so much from the typical occupational erythema, I do not consider that this can be included as an erythema of occupational character.


This is essentially a dermatitis venenata of a sub-acute or chronic type, due to the irritant action of semi-refined paraffin on the tissues of the skin prolonged over a lengthened period, for years in practically every instance. It represents a further extension of erythema, in which the congestion gradually merges into a chronic inflammation of the various layers of the epidermis and cutis vera, followed by induration, and, in the most advanced stages, by partial or complete destruction of small areas of the skin in the affected parts. The early appearances are first seen on workmen after continuous contact with paraffin substances for seven or eight years. The indurative stages become more pronounced as the periods of employment get longer. In/
In the first stages, the lesion consists of dull red erythematous patches distributed irregularly over the anterior aspects of forearms, either broadly linear or roughly circular in shape, and described by Ogston as a honeycombed appearance of skin (2). They are slightly raised above the surface of the skin, are very dry and somewhat scaly. At first the condition is limited to small areas, but, as it becomes more old standing, involves larger areas, the whole surface of the forearms being frequently affected (Plate 23). Associated with this erythematous condition, there is usually pigmentation occurring in small patches over the parts involved.

This erythematous stage may persist for long periods without further change, or healing may take place, the redness disappearing, being replaced by some induration of the superficial layers of the skin, with a characteristic dry scaliness which is practically permanent.

Frequently the erythematous dermatitis progresses so that the deeper layers of the skin are infiltrated, and as the inflammatory process subsides, small patches of atrophied skin, white in colour, appear, or there may be scar formation, according to the depth of the inflammatory changes. There/
There is frequently a tendency to the formation of small flat scaly warts, usually oval or circular in shape. In advanced cases, the whole surface of the forearm appears indurated, hard and thickened, giving a tanned leathery appearance. (Plate 16).

In some few instances the scaly warts have been observed to show signs of proliferation of the epithelial layers with more rapid growth. This condition has been described by Volkmann (3), Ball (8), Schurdart (9), Heidingsfeldt (15), and others, summaries of descriptions being given under Bibliography Section.

These scaly warty nodules are very typical of old standing dermatitis due to occupation, and must not be confused with ordinary simple callosities and papillomata which are sometimes seen on the hands of workmen, and which are common among ploughmen, bricklayers, etc. When occurring among paraffin shed workmen, these, if injured by abrasion or mechanical damage, are apt to become irritated and undergo excessive epithelial proliferation, with subsequent growth in size.

The advanced condition of dermatitis may persist for many years or for a lifetime, with permanent roughness and wartiness of skin and a chronic desquamative process going on.
A very important feature of chronic paraffin dermatitis, once the "Warty Stage" has been reached in, that the tendency towards the formation of epithelial hyperplasias may continue long after workmen have been removed from contact with paraffin irritants. It would appear that, after the proliferated stage has begun, or after the initial changes have taken place in the superficial tissues, subsequent contact with the irritant is not necessary for the persistence of the tendency towards epithelial proliferation, which may indeed take place to such an extent that ultimately epitheliomata may develop long after workmen have ceased to work in the paraffin departments. I have had many opportunities of verifying this fact in the past, either through (1) permanent incapacity for work through injury or illness, (2) prolonged periods of unemployment, (3) the subsequent progress of workmen affected after their removal from contact with crude or semi-refined paraffin on account of extensive dermatitis or conditions suggestive of future malignancy. A few cases may be given to illustrate the point, which is of considerable importance, both as regards prognosis and the medico-legal aspect.

Case 1. A stillman (oil boiler man) was permanently incapacitated by an injury some fifteen years ago. Prior to his disablement, he had a chronic dermatitis of the face due to paraffin. This has persisted since his injury up to the present time, and on three occasions since ceasing work epitheliomata have been removed from his face, the first occurring several years after his incapacity began, the last about one year ago, several years have elapsed between each occurrence. This man is now about 76 years of age.

Case 2. Paraffin worker, age 69 years, 24 years service in paraffin departments, has had chronic indurated dermatitis with epithelial hyperplasias and wartiness of hands and arms for many years. Nothing suggestive of malignancy was apparent at the date of his ceasing work two years ago. Since then he has developed an epithelioma of the forearm (18 months ago) and an epithelioma of the scrotum within the last few months. (See plates 33 and 38).

Case 3. Paraffin worker, 74 years of age, removed from paraffin departments after excision of epithelioma from face about ten years ago, following a chronic dermatitis. The dermatitis and wartiness of the face have remained since then, an epithelioma was removed from the face about four years ago, and within the last year a similar condition developed on one foot. Recently the clavicular glands on the same side as that from which epithelioma of face was removed, have become infected (See Plates 35, 39 and 41).

In none of these cases were the growths metastatic conditions, each being primary as far as the clinical investigations indicated. The cases are illustrative of the tendency for hyperplasias to persist and for cancer to develop after removal from contact with the irritant. In view of this feature it has been my custom for several years to continue to keep under observation, at regular intervals, men who have been removed from contact with paraffin on account of dermatitis or conditions suggestive of possible future malignancy.

This feature is in conformity with, and has been substantiated by Dr. Leitch, of The Cancer Hospital Research Institute, after a comprehensive set of experiments on mice with tar and paraffin substances (B.M.J. Decr. 9th, 1922, page 1101).
Chronic dermatitis as described above usually co-exists with old standing papular dermatitis, in which the papules are of the indurated type, being hard and scaly, thus in an advanced stage, the forearms show pigmented patches, small white areas of partially atrophied skin, scars, scaly warts and indurated papules. This is well illustrated by plates 26 to 32. The distribution of erythematous dermatitis is confined solely to parts in contact with paraffin substances. The forearms principally are affected, either over the ulnar aspects or generally. In advanced cases the lower thirds or halves of the arms are usually also affected. Occasionally the dorsai of feet show the condition to a slight degree, but there has not been seen the same amount of induration, the feet being better protected. Occasionally chronic dermatitis with warty formation is seen on the face, though this is not nearly so prevalent as in the early days of the industry. Such conditions are now only met with in this situation among the older workmen who have been employed in the paraffin departments for many years. The palms of the hands may show a slight tendency to exfoliation of the epidermis which has become thickened and fissured as a result of the dermatitis. The erythematous dermatitis of paraffin workers differs from other forms of dermatitis venenata, in that there is never any tendency towards moistness of surface. There is never the vesiculation or any formation of bullae, the general tendency being to assume a chronic course and induration is of frequent occurrence. Dryness of the affected parts is a feature of paraffin workers dermatitis, but an occasional slight exocytosis of scar tissue, from injury or climatic conditions, may be seen.

While a considerable proportion of the older workmen show evidence of healed or old standing dermatitis, the condition has become less evident and is practically confined to those who have been paraffin workers for years, the recent employees being more free from this type of skin lesion.

7. Epithelioma (Paraffin Workers Cancer).

Epithelioma, occurring among tar and paraffin workers, was first described by Volkmann (3) and at later dates by others, while cases from Scottish Oil Works were shown as early as 1879, and subsequently. See detailed list in Bibliography Section.
Epitheliomata as seen among the paraffin workers of the Scottish Oil Industry may be defined as an epithelial growth followed by ulceration and necrosis of tissue, having its origin in the epithelial layers of a wart or papule. This condition occurs in workmen abour or over middle life, who have been paraffin workers for long periods, twenty years or more. They usually arise from warts due to chronic dermatitis or indurated papules already described, and therefore usually co-exist with an advanced dermatitis erythematosa in which wartiness is a prominent feature, or with indurated papules of a simple nature. The usual appearance if that of a gradually growing epithelioma in the midst of a chronic indurated dermatitis with numerous simple warts or indurated warty papules, only one of which has become malignant. I have seldom seen more than one epithelioma at one time on the same individual, though it is not uncommon for the same workman to have different growths at various times over a period of years. The warts or papules from which condition arises have as a rule been present for many years in a benign form until the epithelial covering begins to proliferate more rapidly, with increasing growth of the primary lesion, until the characters of malignancy develop. These epitheliomata are only met with on those who have been paraffin workers (or oilworkers) for many years, and indeed those which I have seen have occurred after twenty or more years of work among paraffin materials, the majority being seen after between 25 and 30 years of such service.

In the early stages of the degeneration, the naked eye appearances vary according to the primary condition, so a short outline of the development from a wart and a papule may conveniently be described.

(A) Arising from a scaly wart. In the benign condition the wart is somewhat oval or circular, about the size of a sixpence. It is covered by small scales which are readily removable leaving a somewhat indurated base. The wart does not/
not protrude to any extent above the level of surrounding epidermis. As the epithelium undergoes proliferation, the wart increases in area and also becomes more raised above the level of surrounding skin, until it gradually assumes the size of half a crown in area, raised about quarter of an inch or more above the surface, and covered with thick horny scales. On reaching this size, there is a tendency for the formation of fissures, or abrasions of the surface, from which a serous fluid exudes, causing crusting of the surface. The crusts are readily removed by any slight injury, but re-form. This appearance persists for some months, the area gradually increasing until the inorustation and warty covering of the growth eventually slough and disappear, leaving a superficial ulcer, from which sero-sanguineous fluid exudes. Subsequent growth of ulcer in depth and size takes place slowly.

(B) Arising from a papule. An indurated papule has been already described as occurring in old standing erythematous dermatitis. The papule as a rule persists in this benign form for many years. A central necrotic area may form, accompanied by the gradual growth of the primary lesion. As the papule grows in size, the necrotic area may be separated, followed by the healing of the papule. On the other hand, after separation/
separation of the slough, it may grow until it assumes much larger proportions than formerly, the growth having a central ulcer, surrounded by indurated edges. The growth of the ulcer extends peripherally and also in depth, the edges being indurated and undermined, until all trace of elevation of tissue above the level of the surrounding skin disappears, so that a large open ulcer is formed, with a base of red angry-looking granulation tissue, bleeding profusely on the slightest touch. This condition is illustrated by Plate 29. Plate 29A shows what might be termed clinically the transition stage from a simple to a malignant condition. The plate shows a large central horny slough and the formation of an ulcer tending to spread rapidly, and therefore to all clinical appearances an early malignant condition.

When the growth is situated on the scrotum, there is, as a rule, in the ulcerative stages, an overgrowth of epithelial tissue-forming large masses, protruding above the surrounding surface, giving the appearance of a cauliflower-excorcscence, and being very vascular, they bleed profusely. Ultimately the lymphatic glands are involved in this excrescence, so that in the latest stages the whole inguinal region is invaded by a large ulcerating cauliflower-like mass. Plate 31A shows an epithelioma of scrotum recurring after excision of part of scrotum and right testicle for a similar condition. Case No. 41, page 29.

Clinically, the epitheliomatous growth, as occurring in the Scottish Oil Trade, differs in no respect from that generally described in textbooks, while microscopically it shows the same proliferation of epithelial cells forming cell-nests, with infiltration of the surrounding end deeper structures, as a typical epithelioma.

The/
The malignancy for a long time is not great, a feature which was noted by Longmuir in 1883 (7) in an address describing the occurrence of epitheliomata among oil workers in the pioneer oil work of the Scottish Shale Oil Industry. The lymphatic glands do not become involved till a late stage, but this varies according to the situation, the glands being involved earlier when the lesion is situated on the scrotum than when the site is on the arm or forearm. I have seen occasionally quite advanced tumours and ulcers removed without recurrence, though sometimes amputation of a limb has been necessary, the after effects being satisfactory. In cases terminating fatally, death is as a rule due to extensive ulceration with exhaustion, rather than to metastases. I have known very extensive ulceration of the scrotum and inguinal glands, ending in death, unaccompanied by any gross secondary lesion as far as clinical investigation or symptoms indicated. The most common situations are on the back of the hands or lower third of forearm, and on scrotum, it has been seen on face at outer and inner angles of eyelids, the features of rodent ulcer being sometimes assumed, as illustrated by plates 36.

A point of importance in connection with the occurrence of paraffin workers epithelioma is that, while the various forms of dermatitis and other skin lesions described under headings 1 to 5 are only got among the actual workers in or about the paraffin departments (Crude or Refining Departments) cases of epithelioma have in the past been more prevalent among workmen in other parts of the various oil works, and under conditions in which there is not necessarily prolonged contact with or handling of oil, in any of the stages from the crude to the semi-refined and ultimate products.

It has occurred in retortmen, labourers, and stillmen, none of whom are so intimately in contact with the products of shale in its various stages of distillation and refinement as those who are actually engaged in the paraffin departments. These men form a large group of approximately five thousand in number, quite distinct from the smaller group of paraffin workers.

On/
the semi-refined and ultimate products. It has occurred in retortmen, labourers, and stillwits, none of whom come into such close contact with the products of shale, in the various stages of distillation and refinement. In these men the epithelomatosus growth does not arise from a previously existing condition due to the action of paraffin, such as a papule or wart as already described, but generally begins as a reddish pea-shaped nodule, in which the typical "cell-nests" are present practically from the onset, or on the site of an ordinary simple papillomatosus wart or mole, or small cyst, found frequently on the scrotum under ordinary conditions, apart from any occupational cause, but in the great majority of cases the growth is a primary lesion.

There is the usual epithelial proliferation accompanied later by the degenerative changes associated with an epithelomatosus growth. The primary lesion increases in size, followed by the usual incrustation, fissuring, and ultimate breaking down of the growth, forming an ulcer. This ulcer gradually increases in size, shows indurated and undermined edges, and discharges a sero-sanguineous fluid. Ultimately the lymphatic glands are involved. The subsequent progress differs in no way from that of a typical epithelioma, the clinical and pathological appearances of which are well known. The epithelioma which occur in oil workers and labourers, as distinguished from paraffin workers, without any primary condition or dermatitis, are as a rule found among those men such as retortmen, labourers/
labourers, and stillmen, who come into contact with ash, coke dust or other gritty material. The scrotum is most frequently the site of such lesions, this being due to the difficulty of ensuring cleanliness of this region.

The terms "Paraffin Workers Cancer" and "Paraffin Workers Epithelioma" have for a considerable time been used in a much wider sense than at first, when the condition was described as due to the contact with paraffin substances. At the present time, it is applied to all forms of cancer arising in connection with occupational conditions, and a more applicable description would be "Occupational Cancer".

In examining the records of Edinburgh Royal Infirmary for the past twenty-two years, numerous cases have been recorded as paraffin cancer among railway workers, dock labourers, masons, chimney sweeps, glassmakers, engine men, etc., in none of whom was the condition likely to have been due to paraffin.

The Workmen's Compensation Act of 1906, in which paraffin workers epithelioma was included as a trades disease, was not made applicable to the Scottish Oil Industry till 1920, but since 1914 compensation on the same scale as under that Act has been paid to those affected, ex gratia. There is thus since 1914 a record of cases of this condition.

After/
After a careful search through the records of patients of Edinburgh Royal Infirmary, between January 1st 1900 and December 31st 1921, involving the scrutiny of two hundred and forty thousand admissions to that institution, I have made a complete list of cases that have occurred since 1900, in addition to verifying the lists of cases recorded by the employers. This information, along with my experience over the past twenty-two years, ensures the accuracy of the complete list of cases that have occurred since 1900. I have detailed these under two heads, "Paraffin Workers" and "Oil Workers or Labourers", giving ages, situation of the lesion, and result as far as could be ascertained, with the date of admission to Royal Infirmary.
LIST of CASES of PARAFFIN WORKERS EPITHELIOMA between
JANUARY 1st 1900 and DECEMBER 31st 1921.

In address column:—
A. signifies Addiewell.
B. " Broxburn.
N. " Milnry.
O. " Oakbank.
Ph. " Philpstoun.
Pu. " Pumptherston.
U. " Uphall.
W. " West Calder.

(A) Oil Workers and Labourers:

<table>
<thead>
<tr>
<th>Init-</th>
<th>Add-</th>
<th>Age</th>
<th>Occupation</th>
<th>Admitted to Royal Infirmer</th>
<th>Site of Lesion</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>ials</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>M.R.</td>
<td>A</td>
<td>55</td>
<td>Labourer</td>
<td>24/1/00 Scrotum</td>
<td>Excised.</td>
</tr>
<tr>
<td>2</td>
<td>W.D.</td>
<td>U</td>
<td>47</td>
<td>Labourer</td>
<td>28/11/00 Scrotum</td>
<td>Excised.</td>
</tr>
<tr>
<td>3</td>
<td>M.S.</td>
<td>W</td>
<td>54</td>
<td>Labourer</td>
<td>30/11/01 Nose</td>
<td>Excised.</td>
</tr>
<tr>
<td>4</td>
<td>J.S.</td>
<td>U</td>
<td>52</td>
<td>Stillman</td>
<td>12/10/03 Scrotum</td>
<td>Excised.</td>
</tr>
<tr>
<td>5</td>
<td>P.B.</td>
<td>O</td>
<td>65</td>
<td>Labourer</td>
<td>25/11/03 Nose</td>
<td>Excised.</td>
</tr>
<tr>
<td>6</td>
<td>J.C.</td>
<td>A</td>
<td>39</td>
<td>Labourer</td>
<td>19/11/04 Scrotum</td>
<td>Excised.</td>
</tr>
<tr>
<td>7</td>
<td>J.C.</td>
<td>U</td>
<td>57</td>
<td>Labourer</td>
<td>10/11/04 Aurlie</td>
<td>Cured.</td>
</tr>
<tr>
<td>8</td>
<td>W.P.</td>
<td>A</td>
<td>63</td>
<td>Engineer</td>
<td>11/11/04 Nose</td>
<td>Cured.</td>
</tr>
<tr>
<td>9</td>
<td>P.A.</td>
<td>B</td>
<td>60</td>
<td>Labourer</td>
<td>12/6/05 Scrotum</td>
<td>Relieved.</td>
</tr>
<tr>
<td>10</td>
<td>H.T.</td>
<td>W</td>
<td>70</td>
<td>Labourer</td>
<td>27/6/06 Scrotum</td>
<td>Relieved.</td>
</tr>
<tr>
<td>11</td>
<td>F.G.</td>
<td>A</td>
<td>56</td>
<td>Stillman</td>
<td>17/10/07 Scrotum</td>
<td>Died.</td>
</tr>
<tr>
<td>12</td>
<td>T.M.</td>
<td>Pu.</td>
<td>37</td>
<td>Labourer</td>
<td>15/11/08 Forearm</td>
<td>Scrape</td>
</tr>
<tr>
<td>13</td>
<td>J.F.</td>
<td>O</td>
<td>45</td>
<td>Labourer</td>
<td>10/10/08 Scrotum</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>J.F.</td>
<td>U</td>
<td>70</td>
<td>Labourer</td>
<td>16/11/08 Scrotum, etc.</td>
<td>Excised.</td>
</tr>
<tr>
<td>15</td>
<td>T.P.</td>
<td>A</td>
<td>73</td>
<td>Ammonia Maker</td>
<td>31/5/09 Scrotum</td>
<td>Excised.</td>
</tr>
<tr>
<td>16</td>
<td>A.C.</td>
<td>U</td>
<td>53</td>
<td>Oil Refiner</td>
<td>31/11/10 Arm</td>
<td>Amputated.</td>
</tr>
<tr>
<td>17</td>
<td>J.M.</td>
<td>A</td>
<td>67</td>
<td>Oil Worker</td>
<td>25/11/10 Scrotum</td>
<td>Excised.</td>
</tr>
<tr>
<td>18</td>
<td>P.M.</td>
<td>B</td>
<td>44</td>
<td>Coal Trimmer</td>
<td>31/5/10 Popleiteal{Space.}</td>
<td>Amputated.</td>
</tr>
<tr>
<td>19</td>
<td>P.N.</td>
<td>B</td>
<td>55</td>
<td>Stillman,</td>
<td>1/11/10 Scrotum</td>
<td>Died.</td>
</tr>
<tr>
<td>20</td>
<td>J.F.</td>
<td>N</td>
<td>41</td>
<td>Retortman</td>
<td>9/11/10 Scrotum</td>
<td>Excised.</td>
</tr>
<tr>
<td>21</td>
<td>J.S.</td>
<td>A</td>
<td>58</td>
<td>Labourer</td>
<td>26/11/10 Lip</td>
<td>Removed.</td>
</tr>
<tr>
<td>22</td>
<td>F.O.</td>
<td>N</td>
<td>79</td>
<td>Labourer</td>
<td>13/6/11 Hand</td>
<td>Relieved.</td>
</tr>
<tr>
<td>23</td>
<td>W.D.</td>
<td>U</td>
<td>73</td>
<td>Oil Refiner</td>
<td>27/6/11 Arm</td>
<td>Scrape d.</td>
</tr>
<tr>
<td>24</td>
<td>J.R.</td>
<td>U</td>
<td>76</td>
<td>Labourer</td>
<td>22/8/11 Scrotum</td>
<td>Excised.</td>
</tr>
<tr>
<td>25</td>
<td>W.W.</td>
<td>Pu.</td>
<td>66</td>
<td>Labourer</td>
<td>21/8/11 Scrotum</td>
<td>Excised.</td>
</tr>
<tr>
<td>26</td>
<td>J.C.</td>
<td>U</td>
<td>63</td>
<td>Stillman</td>
<td>13/11/11 Face</td>
<td>Excised.</td>
</tr>
</tbody>
</table>

Note: The results listed are for excision or treatment of the scrotal lesion.
(A) Oil Workers and Labourers (Cont'd):

<table>
<thead>
<tr>
<th>No.</th>
<th>Initials</th>
<th>Add.</th>
<th>Age</th>
<th>yrs. Occupation</th>
<th>Admitted to Royal Inff. or reporte</th>
<th>Site of lesion</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>P. M.</td>
<td>Ph.</td>
<td>53</td>
<td>Labourer</td>
<td>4/5/12</td>
<td>Scrotum</td>
<td>Excised.</td>
</tr>
<tr>
<td>28</td>
<td>A. O.</td>
<td>U.</td>
<td>50</td>
<td>Labourer</td>
<td>22/5/12</td>
<td>Scrotum</td>
<td>Excised.</td>
</tr>
<tr>
<td>29</td>
<td>T. C. W.</td>
<td></td>
<td>60</td>
<td>Platelayer</td>
<td>17/4/13</td>
<td>Hand</td>
<td>Excised.</td>
</tr>
<tr>
<td>30</td>
<td>W. D. U.</td>
<td></td>
<td>49</td>
<td>Labourer</td>
<td>24/1/14</td>
<td>Hand</td>
<td>Excised.</td>
</tr>
<tr>
<td>32</td>
<td>F. H. U.</td>
<td></td>
<td>42</td>
<td>Stillman</td>
<td>14/5/14</td>
<td>Scrotum</td>
<td>Excised.</td>
</tr>
<tr>
<td>33</td>
<td>F. S. Ph.</td>
<td></td>
<td>54</td>
<td>Oilworker</td>
<td>17/8/14</td>
<td>Hand</td>
<td>Amputated.</td>
</tr>
<tr>
<td>35</td>
<td>D. D. W.</td>
<td></td>
<td>50</td>
<td>Labourer</td>
<td>17/7/15</td>
<td>Ear &amp; Glands</td>
<td>Cured.</td>
</tr>
<tr>
<td>38</td>
<td>D. M.</td>
<td>U.</td>
<td>73</td>
<td>Labourer</td>
<td>7/1/18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>J. P.</td>
<td>B.</td>
<td>74</td>
<td>Emptying Oil Tanks</td>
<td>24/1/18</td>
<td>Scrotum, etc.</td>
<td>Died.</td>
</tr>
<tr>
<td>40</td>
<td>J. P.</td>
<td>B.</td>
<td>54</td>
<td>Stillman</td>
<td>26/7/18</td>
<td>Wrist</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>A. D.</td>
<td>U.</td>
<td>53</td>
<td>Retortman</td>
<td>16/3/18</td>
<td>Scrotum, etc.</td>
<td>Recurred.</td>
</tr>
<tr>
<td>43</td>
<td>J. G.</td>
<td>U.</td>
<td>73</td>
<td>Sweating Shed Man</td>
<td>2/3/19</td>
<td>Forearm</td>
<td>Cured.</td>
</tr>
<tr>
<td>44</td>
<td>A. H.</td>
<td>Ph.</td>
<td>52</td>
<td>Oil Worker</td>
<td>24/6/19</td>
<td>Scrotum</td>
<td>Excised.</td>
</tr>
<tr>
<td>46</td>
<td>W. C. A.</td>
<td></td>
<td>54</td>
<td>Labourer</td>
<td>4/7/21</td>
<td>Scrotum</td>
<td>Excised.</td>
</tr>
</tbody>
</table>

(B) Paraffin Pressmen (Green Shed Workers):

<table>
<thead>
<tr>
<th>No.</th>
<th>Initials</th>
<th>yrs.</th>
<th>Occupation</th>
<th>Admitted to Royal Inff. or reporte</th>
<th>Site of lesion</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>47</td>
<td>D. M.</td>
<td>U.</td>
<td>Paraf. Sheds</td>
<td>30/10/02</td>
<td>Arms</td>
<td>Cured.</td>
</tr>
<tr>
<td>49</td>
<td>H. R.</td>
<td>U.</td>
<td>&quot;</td>
<td>7/1/09</td>
<td>Scrotum</td>
<td>Died.</td>
</tr>
<tr>
<td>50</td>
<td>D. S.</td>
<td>U.</td>
<td>&quot;</td>
<td>16/6/10</td>
<td>Hand</td>
<td>Excised.</td>
</tr>
<tr>
<td>51</td>
<td>T. P.</td>
<td>A.</td>
<td>&quot;</td>
<td>20/6/11</td>
<td>Hand</td>
<td>Relieved.</td>
</tr>
<tr>
<td>52</td>
<td>A. H.</td>
<td>U.</td>
<td>&quot;</td>
<td>19/12/13</td>
<td>Hand</td>
<td>Amputated.</td>
</tr>
<tr>
<td>56</td>
<td>J. W.</td>
<td>B.</td>
<td>&quot;</td>
<td>9/6/15</td>
<td>Scrotum</td>
<td>Died.</td>
</tr>
<tr>
<td>57</td>
<td>J. C. A.</td>
<td></td>
<td>&quot;</td>
<td>1/6/15</td>
<td>Groin</td>
<td>Died.</td>
</tr>
</tbody>
</table>


(B) Paraffin Pressmen (Green Shed Workers) /Cont'd/.

<table>
<thead>
<tr>
<th>No.</th>
<th>Init.</th>
<th>Addi.</th>
<th>Age</th>
<th>Sex</th>
<th>Occ.</th>
<th>Inj. or Site of</th>
<th>Lesion</th>
<th>Result.</th>
</tr>
</thead>
<tbody>
<tr>
<td>52</td>
<td>A.M.</td>
<td>U.</td>
<td>45</td>
<td>M.</td>
<td>Paraf. Sheds</td>
<td>27/7/17</td>
<td>Arm</td>
<td>Amputated.</td>
</tr>
<tr>
<td>60</td>
<td>J.J.</td>
<td>A.</td>
<td>77</td>
<td>M.</td>
<td>&quot;</td>
<td>7/1/18</td>
<td>Ear</td>
<td>Cured.</td>
</tr>
<tr>
<td>61</td>
<td>D.A.</td>
<td>A.</td>
<td>64</td>
<td>M.</td>
<td>&quot;</td>
<td>21/3/19</td>
<td>Hand</td>
<td>I.S.O.A.</td>
</tr>
<tr>
<td>62</td>
<td>R.W.</td>
<td>Pu.</td>
<td>68</td>
<td>M.</td>
<td>&quot;</td>
<td>(Engineer)</td>
<td>Oct. 1920</td>
<td>Forearm</td>
</tr>
<tr>
<td>63</td>
<td>H.H.</td>
<td>Pu.</td>
<td>62</td>
<td>M.</td>
<td>Paraf. Sheds</td>
<td>(Engineer)</td>
<td>24/4/16</td>
<td>Scrotum</td>
</tr>
<tr>
<td>64</td>
<td>R.NcL.</td>
<td>A.</td>
<td>61</td>
<td>M.</td>
<td>Paraf. Sheds</td>
<td>(Engineer)</td>
<td>7/6/19</td>
<td>Arm</td>
</tr>
<tr>
<td>65</td>
<td>A.G.</td>
<td>Pu.</td>
<td>48</td>
<td>M.</td>
<td>Paraf. Sheds</td>
<td>20/1/16</td>
<td>Arm</td>
<td></td>
</tr>
</tbody>
</table>

In all, sixty-five cases of paraffin epithelioma have occurred during the twenty-two years prior to 31st Dec., 1921, and as far as possible the differentiation between paraffin pressmen, (Green Shed Workers) has been made, though it may be that some of those designated oilworkers and labourers may actually have been paraffin shed workmen.

In the Oil Works comprised under Scottish Oils, Ltd., there have been employed approximately five thousand workmen annually for many years, this number including oilworkers, labourers, retortmen and all forms of labour necessary in the distillation of shale and the refining of its products. It will thus be apparent that the cancer incidence is not high, being approximately one and a half per cent in twenty-two years, or under 0.15 per annum.

This list includes six stillmen or oil boilermen, a point which/
which will be commented on when considering the aetiology.

One Sweating Shed man only is included, this being the only instance in which a worker in paraffin refining departments has been so affected.

Nineteen cases have occurred in the same period among those definitely known to have been employed in Green Sheds (Paraffin Sheds or Crude Paraffin Departments) and as already stated, there were approximately two hundred men thus employed annually by Scottish Oils, Ltd., during those years. The incidence of this condition among these workers is thus 0.5% per annum approximately.

The ages of the cases recorded vary from 37 to 79 years.

Three were under forty years of age,
Thirteen were between forty-one and fifty years,
Twenty-six were between fifty-one and sixty years,
Sixteen were between sixty-one and seventy years, and
Ten were between seventy-one and seventy-nine years.

The sites of the epitheliomatous lesions were:

<table>
<thead>
<tr>
<th>Site</th>
<th>Cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scrotum</td>
<td>31</td>
<td>47.7%</td>
</tr>
<tr>
<td>Arm, forearm and hands</td>
<td>21</td>
<td>32.3%</td>
</tr>
<tr>
<td>Face</td>
<td>4</td>
<td>6.0%</td>
</tr>
<tr>
<td>Ear</td>
<td>3</td>
<td>4.6%</td>
</tr>
<tr>
<td>Nose</td>
<td>2</td>
<td>3.0%</td>
</tr>
<tr>
<td>Groin</td>
<td>1</td>
<td>1.6%</td>
</tr>
<tr>
<td>Lip</td>
<td>1</td>
<td>1.6%</td>
</tr>
<tr>
<td>Anus</td>
<td>1</td>
<td>1.6%</td>
</tr>
<tr>
<td>Leg</td>
<td>1</td>
<td>1.6%</td>
</tr>
</tbody>
</table>

Of the nineteen cases among paraffin shed men, the lesions were/
were most prevalent on arms, forearms and hands thus:

<table>
<thead>
<tr>
<th>Body Part</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hands, forearms and arms</td>
<td>12</td>
<td>63%</td>
</tr>
<tr>
<td>Face, Neck and Ear</td>
<td>3</td>
<td>16%</td>
</tr>
<tr>
<td>Scrotum</td>
<td>3</td>
<td>16%</td>
</tr>
<tr>
<td>Groin</td>
<td>1</td>
<td>5%</td>
</tr>
</tbody>
</table>

These figures are in accordance with the facts stated that among oil workers, retortmen and labourers the tendency is for the primary lesion to occur on scrotum, being malignant practically from its early stages, while among paraffin shed workmen, as a general rule, the lesion occurs as a degenerative stage of warts or papules, which are most commonly situated on forearms.

Broders (26) Annals of Surgery gives a list of sites of squamous epitheliomata of skin, with percentage frequencies of the points of origin, and a percentage frequency of points of metastasis. These are diagrammatically illustrated. His statistics are based on observation of two hundred and fifty-six cases of epithelioma of skin, and the prevalent sites are described as face, head, neck, and supraclavicular region. Seventy-eight per cent occurred in these regions, and 53.96% of cases occurred in farmers.

The sites of occupational epitheliomata (paraffin cancer) as far as the cases which have occurred in the Scottish Oil Industry during the last twenty-two years are concerned, vary materially from those given for the reasons already stated –

(a)
(a) The anatomical disposition of skin of scrotum, facilitating the lodgment of dirt and deleterious materials between the rugae, and

(b) the prevalence of warts and primary occupational conditions on arms and forearms.

Southam and Wilson have drawn attention to the prevalence of cancer of the scrotum among mule spinners in the cotton industry of Lancashire. This condition is described as being due to the clothing in the lower abdominal and inguinal regions being saturated with lubricating oils of the paraffin series in the course of employment.

(1) Allen, Harrison, American Journal of Medical Science, 1862, Vol. 43 page 92, describes pustular form of skin disease among workers in kerosene factory. This began as reddish papules, with black spots on summits, maturing in about five days into pustules, then desquamating leaving a pock mark. These were most plentiful on anterior aspect of body. Attributed to poisonous effect of kerosene oil, but doubt was thrown on conclusion that rash was due to oil.

(2) Ogston, Alex., Edinburgh Medical Journal 1871-1872, Vol. 17 page 544, describes eruption of nodules and pimples on hands and arms of paraffin workers. Two types described, Acute consisting of bright red nodules on wrists, arms, feet and legs, and occasionally on neck, palms of hands and soles of feet being free. The leading peculiarities were hard nodules, tender to touch, about size of barley seed, consisting of hair follicle enlarged and dilated, filled with epithelial scales.
No tendency to suppuration, being dry and friable. Chronic type consisted in honeycombed appearance of skin, thickened and inelastic, with densely packed groups of hair follicles packed with epithelium, with indurated cutis between. In chronic subjects, sleeplessness, loss of weight, foul tongue, etc., due to irritation and pain of skin. Attributed to "blue oil." Two illustrations accompany article, one showing papular dermatitis, the other follicular and indurated dermatitis.

In the latter he describes paraffin workers dermatitis, exhibiting itself as papules, boils and acneform eruptions, followed by increase of epidermis formation resulting in flattened warts, with white patches of skin. The skin gets dry and fissured, with hyperplasia of epidermic cells, which develop occasionally into multiple flat warts, some of which develop cancer, the prevalent sites of which are arms and scrotum.

(4) /
(4) Bell, Joseph, Edinburgh Medical Journal, 1876-1877. Vol. 22, page 135, described two cases of paraffin epitheliomata of scrotum in labourers in oil works, one with glands involved, the other without. Each worker also has "paraffin acne" over arms, one had an exaggerated degree of comedones over arms, hands and legs.

(5) Cameron, Hector, Glasgow Medical Journal, July to December 1879, page 40, describes case of paraffin epithelioma of scrotum from Oil Work at Bathgate.


(7) Longmuir : Edinburgh Medical Journal, 1883, part 1 page 541. As surgeon to Young's Oil Coy., Bathgate, met with several cases of epithelioma among oil workers and occurring as warty nodules or ulcers. He notes that rapidity of growth is less than scirrhus, encephaloid, melanotic, and colloidal cancers, but resembling these by the same tendency towards infiltration and extension to lymphatic system, inducing death by cachexia. These epitheliomata are described as beginning as irritation causing increase of epithelial cells, forming warts which gradually break down and ulcerate, forming soft crusts, with the ultimate breaking down into open ulcer. He recommends frequent baths (and on his suggestion/)
suggestion these were erected by Young's Oil Co.) applications of vegetable oils, animal fats and lard, with plenty of soap and water. He did approve of local caustics.

(3) Ball. Dublin Medical Journal, 1885. Vol. 30 page 85. Two cases given of cutaneous epithelioma among tar workers, (1) first onset being hard wart, followed by epithelioma on scrotum (2) ulcer on back of hand accompanied by numerous warts of hard and horny character, on wrist and nose, recurrence after amputation. He describes frequency of warts among tar workers, carbolic workers, etc.

(9) Schuchardt: Volkmanns Samml. Klin. Vorträge, 1885, No. 257, page 2212, describes chronic papillary formations as warts and scabs degenerating into carcinoma, forming ulcers, which show characters of epitheliomata, but remain for a long time only as local conditions, and that infection of lymphatic glands does not occur for a long time. He also describes increased activity of epidermis, folliculitis, with formation of clusters of black points, and mentions that skin becomes dry and withered like, with formation of irregularly shaped flat scales and crusts.


(11)

(12) Kirk, Robt., B.M.J. 1903, Vol. 2, page 1526, describes occurrence of eczema in paraffin workers, continuation of irritation causing induration and dermatitis, with formation of paraffin "plukes". These plukes are described as small boils, going on to suppuration and sloughing, some gradually forming epitheliomatous ulcers. Forearms stated to be sites of eruptions, but records case of epithelioma of scrotum involving penis and abdominal wall.

(13). Buchanan, George, Glasgow Patholog. and Clinical Socy., 1893, Vol. V, page 165, showed two specimens of paraffin cancer, one removed from ankle and one from arm, both occurring in Pumphorston workmen.


(15). Heidingsfeld, Dr. Journal of Cutaneous Diseases, 1906 Vol. 24, page 513, in article on paraffin injections mentions irritating nature of paraffin on superficial tissues, causing keratosis and epithelial changes.

(16)
Workers in petroleum and paraffin products subjects of acne 
form furuncular and abscess formations.

(17). Ullman, K. Vienna Dermatological Society, 1909, 
November 3, demonstration of case of multiple carcinoma of 
scrotum.

(18). International Congress of Medicine 1913 illustrations 
of paraffin cancer shown by Drs. Norman Walker and Cranston Low 
in Museum of Dermatology Section.

(19) Walker, W.H.M. Home Office, Factory Department 1913 
Report describes occupational eruptions as papules, due to 
contact with paraffin scale.

(20) Davis: Journal American Medical Association, 1914, 
Vol. 62 No. 22, page 1716, describes paraffin cancer and 
dermatitis occurring among gasworks tar workers. He illustrates 
a case showing cauliflower like excrescence on back of right 
forearm. He states that these also occur among paraffin 
premises, and describes eruptions as "wax boils" gradually 
forming warts and occasionally epithelomata.

(21) White, Prosser, Occupation affections of skin 1915, 
page 32, petroleum acne, hair follicles filled with dirt and 
oil, setting up perifolliculitis with infiltration of skin 
round follicle which may necrose and be separated as slough,
also/
also mentions formation of large indolent boils.

(22). White, Boston Medical and Surgical Journal, 1916, Vol. 175, page 43, states that paraffin workers are subject to skin diseases.


L'intoxication arsenciale dans les industries de la houille et de ses derives (intoxication houillere arsenicale).

(26) Broders. Annals of Surgery, 1921, February, page 141. In article on Squamous celled epithelioma of skin grades epitheliomatous conditions according to cellular activities. He gives statistics of 256 cases, with the percentage frequencies of points of origin, and also percentages of frequency of points of metastasis. Of his 256 cases, 53.96% occurred among farmers. In 78.1% of the total cases, the points of origin were on head, face and neck.


(31) Page. C.G. and Bushnell L.D. "Skin diseases due to contact with oils." (Journal of Industrial Hygiene, June 1921).
(A) PAPULE:

The papular formation in early stage is due to cellular infiltration into rete Malpighii and to proliferation of the cells of that layer, which becomes thickened. The papillae are enlarged and more vascular than normal. In recent cases there is no thickening of corneous layer, though in more chronic types this becomes thickened from cellular proliferation. Occasionally a central depression is found corresponding to the orifice of a sweat duct.

(B) WART:

See microphotographs, plate 32, (1), (2), and (3).

The typical appearance of an occupation wart is best described with reference to these microphotographs, taken from a case sent to Royal Infirmary, Edinburgh, as paraffin cancer, but which proved to be a simple horny wart (W.C., an Addiewell workman aet. 48 years). Plate 1 shows under a low power (x 10 diameters) section of skin through a wart like growth with hornification of the squamous epithelium forming adherent layers on the surface. Along the base of growth the epithelium is thin, with loss of the papillae of skin, at the margin the epithelium is extending below the normal level. There is very little reaction in the deeper/
deeper tissues. This is a fairly benign form of acanthoma. It will be noticed that in no sense is it a papillomatous formation, being mainly a hyperkeratosis.

Plates 2 and 3 show the margins of the growth (x 30 diameters) with the characters of the hornifying layers on the surface, the dipping down of the epithelium of the rete mucosum, the vascular character in the cutis vera, with slight mononuclear cellular infiltration.

(C) SQUAMOUS EPITHELIOMA:

See plates 33 (1) and (2). These microphotographs are taken from section of an epithelioma occurring in a paraffin shed worker (Case No. 55 on list given on page 29, age 73 years).

Plate 1 shows under a low power (x 50 diameters) extensive infiltration by the epithelial cells into the deeper tissues of the cutis vera, forming the characteristic hornified pearls or cell nests.

Plate 2 shows the same (x 100 diameters).

The arrangement of the basal cells to the connective tissue are seen, also the laminated arrangement of the epithelial pearls. Other sections (high and low power) are shown of the more recent epitheliomata, as illustrated.

For the preparation of the sections and microphotographs, I am indebted to the Pathological Department of Edinburgh University.
A short description of the process of distillation of oil shale, and subsequent treatment of the products.

A brief outline of the process of distillation of oil shale and the refining of the products obtained is necessary, so that the prevalence of the occupation dermatoses among the workmen of one department only may be better understood, and also as the various processes will be referred to when discussing the probable cause of these conditions.

Oil shale, which exists in practically unlimited quantities below the lower coal strata in the West and Mid Lothian districts is got by mining in a similar way to that in which coal is obtained. After being broken into small pieces in powerful breaking machines, it is fed into large vertical retorts, which are heated partly by gases obtained from the distillation of shale, the temperature being maintained at approximately 1600 degrees Fahrt. in the lower portion, and 900 degrees Fahrt. in the upper portion of the retort. The oil gases are distilled from the shale in the upper portion, while the nitrogen of the shale is given off at the lower temperature, and in combination with steam passed through the bottom of the retort, part of this nitrogen forms ammonia gas. Another part of the nitrogen combines/
combines to form organic bases known as amines, viz., pyrrol and serics, and pyridin and serics. The gases are drawn into condensers in which they condense into ammonia liquor and liquid oil, which by their different specific gravities separate and are drawn off into different tanks. The ammoniacal bases (amines) condense along with the liquid oil and are contained in it as organic nitrogen compounds known as the pyrrol and pyridin series. The incondensible gases are used for heating the retorts. After the gases have been distilled from the shale, the refuse, known as spent shale, is discharged from the bottom of the retort into a hutch underneath and conveyed to a waste heap. The ammonia solution is distilled and the gases are treated with sulphuric acid, forming sulphate of ammonia, which need not be considered further as far as this paper is concerned.

The condensed oil is known as crude oil. This is delivered into tanks which feed by gravitation into boilers (or stills) where the lightest fractions of oil, ultimately forming naphtha and burning oil are distilled and condensed. The oil now left is distilled to dryness, leaving a solid residue in the still, known as coke, which being rich in carbon forms a valuable fuel. The gases from this heavy oil condense and/
and form "Crude Distillate". The crude distillate is run into tanks, in which it is first mixed with sulphuric acid and then with caustic soda, removing the tarry contents of the crude oil, at this stage also the nitrogenous compounds are eliminated by the sulphuric acid, and pass off with the acid tar, thus removing these substances from the oil. The acid tar goes back and the acid is recovered, after which the acid is used for combining with the ammonia gases to form sulphate of ammonia. The heavy oil left is technically known as "Green Oil", while a residue of coke is left in the stills, the tar, as liquid fuel going to heat the stills. The green oil is re-distilled and the distillate cooled by anhydrous ammonia, forming a pasty mixture of oil and crystals of paraffin, which is then pumped into filter presses. Up to this point the workmen never come into intimate contact with oils, tar, or chemical substances, these being confined to the various vessels in which the processes are carried out. In the filter presses some of the oil is separated, leaving semi-solid cakes known as paraffin scale. The separated oil is known as blue oil.

**FILTER PRESSES.**

These consist of long iron frames about three and a half feet high, with numerous iron plates arranged perpendicularly with/
with filter cloth between, through which the oil is filtered from the scale, the oil running off and the scale being contained in the cloths between the iron plates. The workmen pull the plates apart at intervals, using strong iron hooks for the purpose, and separate the scale from the filter cloths with metal scrapers, the scale dropping into conveyors to be carried to another department for further treatment. (Plate 34 shows the working position of the men, and it will be noticed that the arms are held horizontally so that oil does not trickle over them to a higher level than that at which they are held). The scale is taken to the hydraulic press department, where it is packed in cloths laid on trays, the scale being shovelled into the cloths and levelled with the hands and ulnar aspects of forearms (Plates 35 (1), (2), (3), & (4)). The trays are then placed in hydraulic presses, which are vertical frames about eight feet high, with numerous flat shelves, extending to a height of about seven feet. The trays containing the paraffin scale packed in cloths are placed on the shelves of the presses, and as the higher shelves are being filled, the workmen's arms are raised above their heads, so that they are exposed to drops of oil which run along the forearms and lower parts of arms. Plate 36 illustrates the working attitude, and shows how the arms are exposed to drops of/
of oil falling from the trays. It will also be readily seen that the legs and feet get wet with the expressed oil. In working at the filter presses and hydraulic presses, the men have their arms bare as far as the elbows, thus accounting for the prevalence of eruptions in that region. The departments in which these processes are carried out are known as the Crude Paraffin Departments or "Green Sheds".

As the use of filter and hydraulic presses for the separation of scale is not universal throughout the different Works, and as the incidence of occupation eruptions is less in those in which hydraulic presses are not used, the foregoing description is of some importance, as will be stated later.

After the oil has been expressed by hydraulic power, the trays are emptied by the same workmen, the hardened wax being sent to the refining sheds "Sweating Sheds", where the remaining oil is sweated out. During the whole process in the Green Sheds, therefore, the workmen are daily for long periods in contact with unrefined oily paraffin, the bare forearms being most exposed and the clothing getting wet with drops and splashes of oil.

In the refining sheds the paraffin scale is melted and subjected to steam heat in large flat trays, the remaining oil being/
being sweated out, leaving the wax in a refined condition ready for commercial purposes, after a final filtering. The workmen in the sweating sheds do not come into the same close contact with the paraffin, with the result that they are practically free from occupational eruptions.

The blue oil which is separated in the green sheds is re-treated, and again cooled to extract the last trace of wax, going through the same process, as described, a second time. The subsequent treatment of the oil, dividing it into the various grades of lubricating oil, need not be considered here, as in no other stage of the entire process, from beginning to end, other than that more fully described in connection with the green shed departments, are the workmen affected with any of the typical pustular, pustular, or erythematous eruptions.

A diagram of the entire process of manufacture of sulphate of ammonia, mineral oils, and paraffin wax from oil shale is appended, with a chart and explanatory note referring specially to the processes through which the heavy oil and paraffin passes to be made into refined products.
Diagram illustrating the Method of Manufacture of Mineral Oils, Paraffin Wax and Sulphate of Ammonia from Oil Shale.

The names of Finished Products are underlined.

<table>
<thead>
<tr>
<th>Oil Shale.</th>
<th>Paraffin Wax.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia</td>
<td></td>
</tr>
<tr>
<td>Water.</td>
<td></td>
</tr>
<tr>
<td>Sulphate of Ammonia.</td>
<td></td>
</tr>
<tr>
<td>Crude Naphtha. Oil.</td>
<td></td>
</tr>
<tr>
<td>Distilled.</td>
<td></td>
</tr>
<tr>
<td>Coke.</td>
<td></td>
</tr>
<tr>
<td>Treated &amp; Distilled.</td>
<td></td>
</tr>
<tr>
<td>Cleaners' Solvent Spirit. Naphtha.</td>
<td></td>
</tr>
<tr>
<td>Various Grades of Burning Oil. Crude Blue Solid Oil Paraffin.</td>
<td></td>
</tr>
<tr>
<td>Various Grades of Burning Oil. Crude Blue Solid Oil Paraffin.</td>
<td></td>
</tr>
<tr>
<td>Cool Filter &amp; Pressed.</td>
<td></td>
</tr>
<tr>
<td>Crude Solid Wax Residues.</td>
<td></td>
</tr>
<tr>
<td>Refined.</td>
<td></td>
</tr>
<tr>
<td>Refined.</td>
<td></td>
</tr>
</tbody>
</table>
Chart of Process through which the Heavy Oil and Paraffin fraction from Crude Shale oil passes to be made into Refined Products with special reference to the manufacture and handling of Paraffin Scale.

A
Heavy Oil & Paraffin.

Cooled, filtered & handled.

B
Paraffin Scale.

C
Blue Oil.

Treated with sulphuric acid and caustic soda and distilled.

D
Paraffin Oil

E
Wax. Residue

F
Unfinished Gas Oil.

G
Unfinished Lub. Oil.

Cooled, filtered, & handled.


Oil Scale Scale Oil.

Paraffin Wax.
Explanatory Note of Chart of Process, using the letters shown on Chart to denote the Products.

Fraction A is cooled to a low temperature, which causes the Paraffin Scale B to separate from the oil. After being cooled, it is pumped through filters, which retain the scale, and the oil C drains away to a receiving vessel.

B - From the filters B goes to the hydraulic press room where the workmen pack it in filter cloth ready for the hydraulic presses. It is put into the presses and subjected to a high pressure, when more of the oil C drains away. B is then taken from the hydraulic presses and conveyed to a melting vessel, from which it goes to be refined into paraffin wax D.

Blue Oil O is taken, treated and distilled into the fractions shown on chart, and the two fractions to be noted are F and G, which are taken through exactly the same process as A to extract the remaining scale from them.

This description shows the scale which the men in question handle, and gives the products derived therefrom, and also the oils which the men may come into contact with, when working the scale.
THE EFFECTS on ANIMALS of the APPLICATION of SHALE OILS.

In September 1921, samples of the oils with which the paraffin workers come most into contact were sent to the Cancer Hospital Research Institute, Fulham Road, London, to ascertain the results of their application to the skins of mice. The investigations have been carried out by the Pathologist, Dr. Archibald Leitch, and to him I am indebted for the information which is here given. See also "Paraffin Cancer and its experimental production" by Dr. Archd. Leitch, (B.M.J. Decr. 5th 1922, page 1104).

The experiments have been carried out with green oil (heavy oil and paraffin) and with blue oil. Reference may be made to the chart on page 49 and the explanatory note on page 50.

The Green Oil is called fraction A, the Blue Oil is called fraction C. This latter is the result after the extraction of the greater proportion of the paraffin scale.

A spot of oil was put on the back of each mouse three times a week, and after a few applications the hair fell out, or was pulled out by the animals themselves, so that as the oil spread large bald areas were got, giving the mice the appearance of a French poodle. Generally the skin remained smooth and glossy, but sometimes a scurfy condition resulted. The earliest appearance of a papillomatous condition was seen on the 83rd day, the tumour being about the size of a hemp seed. Others appeared on the 87th day and so on, at later intervals. These are shown on the accompanying photographs, and a short description of the progress on each mouse follows.
(1). Treatment with Green Oil, Fraction A:-

Mouse 2. Box 2.  Oil begun on September 22nd 1921.
First sign of wart......December 29th 1921,  96 days.
4 small discrete warts.January 11th 1922, 111 days.
5 ditto...........January 17th - date of photograph.
6 ditto...........January 27th - Photograph shows one
only distinctly.

Died 20th March, 1922.

Mouse 2. Box 5.  Oil begun September 22nd 1921.
2 minute warts........December 18th 1921,  87 days.
Several warts........January 17th 1922 117 "  photo.
6 or 7 warts........February 9th 1922,  Photograph.
Progress............February 16th 1922, Photo. Feb. 20th,
also same date photo back view.
More warts on other side, March 13th 1922. Photo March 1st.
Spindle celled sarcoma 11th April, 1922.

Mouse 1. Box Va.  Oil begun September 22nd 1921.
A small wart behind
right ear.............December 29th 1921,  96 days.
5 discrete papillomata.January 17th 1922.
Increase, date of photo.February 9th 1922.
Died...................February 10th 1922.

Mouse 2. Box Va.  Oil begun 22nd September, 1921.
Wart appearing........December 29th 1921  96 days.
2 small warts........January 11th 1922.
Several warts........February 9th 1922 Photograph.
More warts...........February 16th 1922
Died...................March 9th, 1922 Photograph on March
1st.

Mouse 3. Box Va.  Oil begun September 22nd, 1921.
Appearance of minute
wart.................January 11th 1922. 111 days.
January 18th 1922 progress. Photograph.
3 warts on dorsal
mid line.............January 27th 1922.
More appearing........February 9th 1922 Photograph.
Progress, 2 anterior
coalescing...........February 16th 1922, Photograph on
March 1st.
Horn breaking off and re-forming March/April.

Mouse 5. Box Va.  Oil begun September 22nd 1921.
Small papilloma. .....January 11th 1922 111 days.
Photograph...........February 9th 1922.
Slow progress........February 16th 1922.
Died...................March 4th 1922.

See plates 37, 38 & 39.
(2) Treatment with Blue Oil. Fraction C.

The first two photographs show side and back views of papilloma 83 days after beginning treatment with blue oil.

**Mouse 1. Box 1.**  
Oil begun September 22nd 1921.

- 3 minute warts noticed...December 29th 1921, 98 days.
- Good progress........ January 17th 1922.
- Stationary............ January 27th 1922.
- Only one good wart.....February 9th 1922.
- Photograph............ February 11th 1922.
- Original wart flattening, and another appearing...February 16th 1922.  
  Photo March 1st.

**Mouse 2. Box 2.**  
Oil begun September 22nd 1921.

- Wart..................December 29th 1921, 98 days.
- 2 warts................ January 11th 1922.
- 2 adjacent horns, much scaliness........January 27th 1922.
- Horns separated by narrow cleft, with small wart, in front of them......February 9th 1922  
  Photograph on March 1st.
- Still separating & growing........February 16th 1922.
- Progress..............March 13th 1922.

**Mouse 3. Box 2.**  
Oil begun September 22nd 1921.

- Minute wart................December 29th 1921, 98 days.
- Wart size of split pea...January 11th 1922.
- Progressing..............January 27th 1922.
- Good flat wart, and another on right flank...February 9th 1922. Photo Feby. 11th.
- Progress..............February 16th 1922.
- Died....................March 5th 1922.

**Mouse 1. Box 2a.**  
Oil begun 22nd September, 1921.

- Wart commencing............January 11th 1922, 111 days.
- Long thin horn......January 27th 1922.
- Still long and thin, progressing................
  also flat wart in front...February 9th 1922.
- Photograph.............. February 12th 1922.
- Died....................February 13th 1922.

See plates 40 & 41
From the foregoing descriptions it will be seen that the papillotomata appeared consistently in about the same periods, the variation being from 83 to 111 days, the greater number being first apparent about the 98th day. At the time of writing, none of the papillotomata showed any signs of becoming malignant, all being simple warts on histological examination. The mortality among the mice was rather high, possibly on account of their licking the oil off and so being poisoned.

These results prove that the conditions described are due to contact with the oils, and that the appearance of the occupation dermatoses among the paraffin shed workmen is due to the oily constituents of the paraffin scale, both as green oil, before its extraction, and as blue oil, after most of the paraffin has been extracted. This is in complete accordance with experience among the different groups of workmen, those handling the refined wax being unaffected, those refining the paraffin scale, which still contains some oil, being affected to a slight extent only, while those handling the oily paraffin scale and the oils from which it is extracted being most affected.

Other compounds got from the disintegration of shale oils are in the course of trial, with a view of determining, if possible, the actual substance responsible for the paraffin workers lesions, but of necessity a very considerable time must elapse before positive or negative results are obtained.
NOTE ON PATHOLOGY of NEOPLASM produced on MOUSE by SHALE OIL "A" (HEAVY OIL & PARAFFIN).

The tumour was first noticed on the 29th Decr., 1921, fourteen weeks after beginning oil treatment on the 22nd Septr. previously, the mouse died on 9th January, 1922, and the tumour therefore was eleven days old.

HISTOLOGICAL EXAMINATION:—

There are two papillomata raised from the surface. The adjacent epithelium is somewhat irregular, showing loss of hair and degeneration (complete) of hair follicles, and here and there irregular hyperplasias. Many of the blood vessels in/
in the corium are dilated, but there are no signs of chronic inflammation.
The papilloma here drawn shows upward prolongations of the rete Malpighii and basal cells appearing as dendritic processes joined together and capped by an excessive corneal proliferation which constitutes the bulk of the tumour. In many of these upward prolongations of epithelium, there is a central core of loose vascular connective tissues: some are solid epithelium: in both cases there are cell nests in the stalks and cell nests are found at the bases of the processes. These do not penetrate deep into the corium, and are all directly connected with the overlying epithelium. The brown coloured layer underneath represents the panniculus carnosus, beneath which again is a layer of connective tissue, and still further down the deep muscles.
The two following projection drawings, kindly supplied to me by Dr. Leitch, are made from microphotographs of tumours on mice.

**Projection Drawing "A", Mouse 1, Box 5A, Shale Oil "A":**

Painted on the back three times a week since 22nd Sept.

29th Dec., a small papilloma seen behind right ear (14 wks.)

11th Jan., slight progress with oedematous condition of skin.

17th Jan., several small papillomata.

27th Jan., five papillomata in all.

9th Feb., seven good warts.

10th Feb., died and partly eaten by other mice in box.

The section shows a papilloma which was pedunculated ¼" wide and a little more in height. Beside it is a smaller wart. The base of the larger wart shows considerable dilatation of the blood vessels, but very little signs of chronic inflammation. The stalks are very vascular, clothed with thickened epithelium, and bound together with excessive keratin formation. The panniculus carnosus (marked with interrupted line) is not encroached upon. There is no epithelial downgrowth. The adjacent skin is somewhat irregular and thickened.

(A papilloma on the verge of malignancy).
Projection Drawing "B", Mouse treated with Shale Oil "A":— Experiments started on 22nd Sept., oil painted on back of mouse three times a week. Beyond the epilation nothing was evident in the skin in the way of lesion until 9th February when a minute examination of the skin revealed a small part where the epithelium seemed to be slightly hypertrophied. The mouse died on 16th February (21 weeks) and sections were taken through the minute plaque.

Histological Examination:—

The drawing is a tracing from the projection and all nuclei shown are faithful in position and numbers. The epithelium is irregular, and at most places considerably thickened. Some cast off keratin is seen on the surface, but the keratin formation is not excessive. There are projections of epithelium, usually showing central keratinisation, below the normal skin level, but these may not be regarded as malignant. In all cases the basal layer is clearly defined. There is an unusual amount of round cell and plasma cell infiltration of the corium, especially about the middle third — evidences of chronic inflammation. The very bottom of the drawing shows a portion of the panniculus carnosus.

The appearances here may be taken as the earliest evident signs of reaction to the irritant, though in most cases signs of chronic inflammation are very sparse.
Summary of Experiments with the various Shale Oils on Mice:-

After the first or second application of the Shale Oils, a considerable area of the mouse becomes epilated and generally remains permanently bald, though re-growth of hair occurs in some after a month or so, but this again falls out and remains permanently epilated. Possibly it is pulled out by the animals as the oil may be irritating. The death rate is high because the animals lick the oil off, and it seems to be toxic. Sections of skin in mice that die early show destruction of hair follicles only. The skin in most mice is smooth and glistening, though in some it takes on a rough eczematous condition for a time. Towards the end of the third month of treatment, minute warts begin to appear, and gradually all the animals show warts, though some may give no signs of them for six or even seven months. The warts increase in size, are upstanding and cornified and easily pulled off. They are frequently multiple, but do not all increase at the same rate. A few disappear spontaneously leaving no evident cicatrix. At first the warts are purely upgrowths from the surface, but in the later stages (six months or so) some show downward growth with the atypical epithelial cells approaching the level of the panniculus carnosus. In one case a sarcoma was produced. So far no other malignant/
malignant tumours (definitely malignant) have yet appeared. There is only one mouse alive now out of one hundred painted with Shale Oil "A", and six out of fifty painted with Shale Oil "C". There is nothing to choose between these two oils (Heavy Oil and Paraffin, and Blue Oil) as far as tumour reactions are concerned. Lately evidences have been got of tumours starting in mice treated with Shale Oil "F" and Shale Oil "G" - see chart on page 49 and explanatory note on page 50.
AETIOLOGY : EXCITING CAUSE.

Having described the eruptions, their sites, the occurrence of the various forms of dermatitis only among those who handle paraffin scale in its moist oily state, and the processes of separation of the scale from the oil, it is certain that the exciting cause is contact with the oily paraffin scale. This has been known for a considerable time, and it has hitherto been believed that the scale itself was the cause of the dermatitis (H.M. Factory Department Reports 1913). Recent experiments with animals, however, have clearly shown that the actual cause is the oil, before and after separation of the scale, and that the scale itself is not the cause of the dermatitis. These experiments have been described in detail, as they are of considerable importance in determining the causative factor. While the exciting cause has been found to be the oils, both green oil (heavy oil and paraffin) and blue oil (after extraction of scale), the actual constituent of these responsible has not yet been determined. Various theories have been advanced, each being a more or less feasible solution of the probable cause, yet, so far, no one has been definitely substantiated with any degree of certainty.

(1) That nitrogenous compounds may be the exciting cause.

In considering the question of chemical or mechanical injury, he points out that the incidence of cancer is most where there is no mechanical injury, and summarises thus:

<table>
<thead>
<tr>
<th>Mechanical Injury</th>
<th>Commodity</th>
<th>Cancer Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greatest</td>
<td>Coal Dust</td>
<td>Nil.</td>
</tr>
<tr>
<td>Considerable</td>
<td>Blast Furnace Pitch</td>
<td>Nil.</td>
</tr>
<tr>
<td>Only little, as it softens</td>
<td>Gas Tar Pitch</td>
<td>Considerable.</td>
</tr>
<tr>
<td>Practically Nil,</td>
<td>Tar</td>
<td>Several cases, but less than pitch.</td>
</tr>
<tr>
<td>Nil,</td>
<td>Soot</td>
<td>Greatest incidence of all.</td>
</tr>
</tbody>
</table>

He further points out that, with the exception of arsenic, all the commodities active in the production of cancer are the result of decomposition in past ages, and draws an analogy in the uses of nitrogenous compounds by gardeners in stimulating cell growth and proliferation, and coming to the conclusion that organic nitrogenous substances may be the chemical substances responsible for the occurrence of occupational cancer. It has been found that watery extracts of dead tissues induce division in lymphocytes and epithelial cells, the active agents in these solutions being nitrogenous substances. To these he gives the name "luxetic" meaning "excitor", and some nitrogenous bodies such as creatin, xanthin and tyrosin have been isolated from these solutions. He found that other substances, to which the term "Kinetic" has been applied, cause cell movement, and that the/
the kinetics augment the action of Auxetics considerably.

Auxetics and kinetics have been found in solutions of soot and gas-works pitch, kinetics only in blast furnace pitch, but no auxetics have been found in paraffin scale or lubricating oils as far as products of the Scottish Oil Industry are concerned. In these latter he found kinetics.

I have given the results of this paper in some detail, as while no definite compound has been named as the cause of occupational cancer, yet a definite working basis has been assumed, as an aid to further investigation.

In criticism of this paper, as far as the paraffin workers of the Scottish Oil Industry are concerned, it is true that mechanical injury is practically nil (other than from handling products at a low temperature), the incidence of dermatoses is high, but the cancer incidence is not high. I have shown in some detail the elimination of the nitrogenous compounds (amines) at stages before the material is handled by the workmen, so that those compounds may practically be dismissed from further consideration as accounting for the production of paraffin dermatoses, and indeed it may be argued further, that, where nitrogenous compounds are present in the most concentrated degree, that is, in the acid which is used for treating the ammonia, in the manufacture of sulphate of ammonia, no dermatoses occur, though the workmen are daily engaged in close contact with the acid and/
and ammonium products in the various processes of refining the unfinished products, though on the basis of Ross's work, they ought to be present, seems to show that this is still in the stage of hypothesis, and that the terms Auxotics and Kinetics can only be looked on at present as abstract terms, and cannot be regarded so far as furnishing definite evidence of any particular chemical compound as the cause of paraffin dermatoses, though further work may throw more light on the question.

(2) Arsenic as a cause of Paraffin Dermatoses.

For a long time arsenic has been recognised as of importance in the production of skin eruptions, which may be classified under the term "dermatitis venenata". These eruptions usually take the form of erythema, papular or vesicular eruptions, with, in the more chronic types, the formation of flat warts and pigmentation, which have been known to undergo proliferation with the subsequent formation of epitheliomata. These eruptions have been stated to follow the prolonged ingestion of arsenic, and occasionally the prolonged outward application of arsenical preparations. In a paper on "Arsenic Intoxication in the Industries of Coal and its derivatives", Dr. Bayet, of Brussels, classifies a group of symptoms called "pitch diseases" among workers in a briquette factory. He states that the symptoms showed a striking analogy to arsenical conditions. The/
The eruptions are described as (1) pigmentation, (2) inflammatory and atrophic changes in skin, (3) thickening of skin, notably on scrotum, and (4) cutaneous cancer. He demonstrates from analytical evidence the presence of arsenic in the pitch, in the dust floating about factory, in the urine of the workers, and in the blood of the majority of them. He concluded that the symptoms were due to arsenical poisoning. He further states that various classes of industry may be considered as in the same category as briquette factories, and enumerates chimney sweeps, tar workers, paraffin workers, railway workers who use tar, and those engaged in making tar paper. He affirms that the eruptions prevalent among these workers are identical with "pitch disease" and that therefore they are due to arsenical poisoning. As far as the paraffin workers of this industry are involved, it may be said that it is quite true that arsenic being one of the most widely distributed of the elements, is found in the raw material, oil shale, but only to an infinitesimal extent. It is also true that the dermatoses have some similarity to arsenic conditions, to some extent in the acute state, but showing more resemblance to arsenical conditions in the chronic types, but nevertheless it can be said with certainty that the paraffin workers dermatoses are not due to arsenical poisoning. On analysis of an average sample of oil shale, it has been found that arsenic is present to the extent of .00056% by/
by weight, or .0392 grains per pound, and that in the blue oil, which the workmen handle, it is present to the extent of .000015%. These are such infinitesimal quantities that the actual influence of the arsenic present may be considered as of no importance. As the process of manufacture of the finished products of shale involves repeated distillations, and frequent treatment with acid and soda, it is certain that any arsenic, if present, is eliminated, either lodging in the retort flues (in which it has never been traced), or by the treatment of the ammonia with sulphuric acid, during which sulphide of arsenic is separated and removed. The subsequent treatment of the crude oil by the same acid again de-arsenicates the oil, so that its presence in subsequent stages is, for all practical purposes impossible. On the other hand no appearance of skin eruptions occurs in the crude oil department, in which they might be expected to appear, if due to arsenic intoxication.

(3). Light in the form of radio-active substances as cause of Paraffin Dermatoses.

The influence of light and actinic rays are well known as the cause of epidermic hyperplasia. In the tropics, conditions known as solar keratoses are found, due to the heat and high actinic power of the sun's rays. These keratoses, as the name implies, consist of thickenings of the epidermis, forming flat warts, which frequently show epithelial proliferation to a considerable extent, and are occasionally followed by the formation of epitheliomata/
Wassermann Reaction. No systematic investigation with reference to this test has been made, but in a few instances it has been tried in cases of paraffin workers suffering from conditions not due to paraffin, in addition to the presence of occupational lesions, and the result in each case was negative.

Organic Sulphur Compounds as a probable cause. The presence of sulphur as organic sulphides is constant in oil-shale, in the crude and semi-refined products, and to some extent in the finished products as well. These exist/
epitheliomata. The well known X-Ray dermatitis, in which there are at first inflammatory changes, followed by induration and destruction of skin tissue, generally to a much more extreme degree than seen in paraffin dermatitis, may also be given as an example of the influence of light rays on the skin tissues. Warts and dermatitis have already been described as occurring among paraffin workers, and it is also true that the clinical and pathological appearances of these conditions are to some extent similar to those due to actinic rays of sun and to X-Rays, but they never occur to such an extreme degree as that produced by X-Rays. There is never vesication or deep seated ulceration, other than that in advanced stages of epitheliomatous degeneration, there is never pain so frequently associated with burns from X-Rays. It is most improbable that a radio-active substance is the determining factor in the causation of the various forms of paraffin dermatoses described, as these would be much more widely distributed, and it might be expected that many of those coming into contact with the various grades of oil, refined wax, burning oils and other final products would also be affected, all these products being hydrocarbons from a common source.

Organic sulphur compounds as a probable cause.

The presence of sulphur, in the form or organic sulphides, is constant in oil shale, in the crude and semi-refined products, and to some extent in the finished products as well. These exist/
exist as Thio-alcohols, or Mercaptans, so called from their affinity for mercury, forming insoluble mercury salts. They are colourless, and have a smell like garlic. They persist throughout the various distillations and treatments with sulphuric acid and soda, and so far their total elimination has not been found possible. Their appearance is most apparent after each distillation, the characteristic odour being got at the worm-ends of the stills (the ends of the coils in which the gases condense, forming the various grades of oil). The formula of Mercaptan is $\text{C}_2\text{H}_6\text{S} = \text{C}_2\text{H}_5\text{SH}$. The hydrogen gets replaced by some metal, usually mercury, when compounds known as Mercaptides are formed, which however are obscure. These, however, have recently been definitely isolated as liquid mercaptides, with the characteristic odour of sulphur compounds.

A point of interest is that among oilworkers generally epitheliomata have been got more frequently after each process of distillation than after the various processes in which the oils are treated with acid and soda. Several cases have occurred among stillmen, without previous dermatitis. These men work about the worm-ends of stills taking dips (samples) of the distillate at frequent intervals, thus being in contact with the oils in progressive stages of the refining processes. At these worm-ends there is always the characteristic odour of the/
the sulphur compounds, showing their presence after distillation. Sulphur compounds are removed during the processes of treating oils with acid and soda, and on re-distillation of oils, these again form from the residual sulphur, which is present to some extent throughout the different processes until the final products are reached.
The heavyoil and paraffin, with which the paraffin shed workers come so much into contact, is also a distillate and therefore containing those compounds.
Similar types of lesions are found among pitch and tar workers, these also being engaged in the distillation of hydrocarbons, with a considerable proportion of sulphur impurities.
I have not been able to find any recorded case of skin eruption attributed to sulphur or its compounds, but nevertheless the possibility of paraffin dermatitis being due to these compounds must not be overlooked. While, so far, there is no direct evidence of this, I am of opinion that the hypothesis of sulphur compounds being the exciting cause is more probable than any theory at present advanced.
Experiments are in process which have a bearing on this subject, but some time must elapse before any result is obtained.
Having given in detail the various theories advanced as probable causes of the dermatoses found in the paraffin workers of the Scottish Oil Industry, no one of which has been accepted as conclusive/
conclusive, the position may be summarised thus:-

The various forms of dermatitis, whether papular, pustular or erythematous, found among paraffin workers are due to direct contact with some chemical substance, which, by the formation of warts and indurated growths, acts as a predisposing cause of epithelioma, and that the determining factor, or exciting cause of epitheliomatous degeneration is, in common with all other forms of cancer, unknown.

AETIOLOGY - PREDISPOSING CAUSES.

Age: -

The influence of age as a predisposing cause of the erythematous, pustular and papular eruptions is slight. While the few cases of primary pustular dermatitis observed have occurred in youths beginning work in the paraffin sheds, the incidence of the papular type is approximately equal in those under and those over forty years of age, and conversely, of those free from eruptions, taking the same age as the dividing line, the numbers are again approximately equal. As a general rule, the early or slight forms of erythematous dermatitis are not seen in men under thirty-five years of age, the more indurated forms being apparent from forty years of age upwards. This, however, only holds good if those affected have been employed continuously in paraffin sheds for some years, so that/
that length of service is really the determining factor in the
causation of this condition.
Age has a distinct influence on the occurrence of epitheliomatous
lesions, these practically never being seen in men under forty
years of age, and generally appearing at more advanced ages than
this, a fact in keeping with cancerous conditions generally. It
will be seen from the list of cases on pages 26, 29 and 30
that these lesions occur only in middle life.

Length of Service in Paraffin Departments.

Length of service is of considerable importance in
determining the nature of the skin lesions. As previously stated,
the primary form of pustular dermatitis appears after a few weeks
work in the paraffin sheds. The papular types likewise appear
after a few weeks service in these departments, though papules
disappear and others form throughout the duration of continuous
employment as paraffin workers. An opportunity of verifying
the early appearance of papules occurred after cessation of
work for a period of six months recently. A few weeks after
the men ceased work in paraffin sheds all recent papules
disappeared, to re-appear a few weeks after resuming work, the
earliest manifestations being got in from twelve to fourteen days.
The presence and degree of erythematous dermatitis are in
proportion to the length of service. The less extensive and
less indurated conditions begin to appear after about seven
or/
or eight years, while the more indurated and more chronic types are only seen on men who have completed many years of service, the worst cases having been continuously thus employed for terms varying from twenty to forty years.

As might be expected, epitheliomatous conditions are only found after long terms of service, these usually arising from chronic warts or papules, which may exist in a benign state for many years before undergoing epitheliomatous changes. Those affected during recent years have been paraffin workers for periods from thirty to forty years.

Idiosyncrasy and Predisposition.

Accumulated evidence tends to show that some workmen have a greater tendency to be affected than others, the working conditions otherwise being the same. It might be expected that most or all of those working among the semi-refined material should show some form of occupation eruption, but this is not the case. It has already been suggested that there may be an idiosyncracy on the parts of a few youths towards the action of semi-refined oils, by their having pustular eruptions soon after beginning work, while the majority escape. Likewise the fact that only approximately half of those working among the same materials and under the same working conditions suffer has never been otherwise explained, and the only reason that can be advanced is that there is greater tolerance on the parts of some than of others. Illustrations of similar idiosyncracies are.
are readily got in connection with plant life, e.g., the well known effects of poison ivy, primula obconica, nettle and others. In addition, with reference to the occasional occurrence of epitheliomata, the actual incidence is low, yet many men are affected with warts due to occupation, which form strong predisposing factors, and, on the other hand, some of those who have suffered from this condition have been affected several different times and in different situations with primary epitheliomatous growths. An instance may be given. One man had an epithelioma removed from scrotum in 1903, without recurrence, another from lower eyelid in 1911, which has since recurred, and a primary growth from right cheek in 1921, followed by secondary infection of cervical glands (Plate 41). In the list of cases given, several names appear more than once, each occasion being some years apart. Plate shows recurrence of growth in eyelid of man referred to. I have had occasionally under observation large warty growths with central necrosis, similar to those illustrated by plates 19 and 20, and suggestive of the stage immediately preceding malignancy, which instead of undergoing epitheliomatous degeneration have healed after separation of necrosed area. Cases such as those might be considered as only lacking in the personal factor, which must have a certain amount of influence in determining the development of a benign into a malignant condition. This is also termed the "Progressive Element".

These facts are suggestive that an idiosyncracy may exist towards the action of paraffin substances, and that the personal/
personal element is a factor of some importance in the further development of warts and papules into epitheliomata.

The following table shows clearly the proportion of those unaffected at four recent examinations since 1919:-

<table>
<thead>
<tr>
<th>Green Shed Mon. (Crude Dept.)</th>
<th>White Shed Mon. (Refining Dept.)</th>
<th>Green &amp; White Shed Men.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feb. 1919, 26.7%</td>
<td>71.2%</td>
<td>42.0%</td>
</tr>
<tr>
<td>Aug. 1919, 29.5%</td>
<td>83.0%</td>
<td>44.5%</td>
</tr>
<tr>
<td>Mar. 1921, 35.4%</td>
<td>94.3%</td>
<td>49.3%</td>
</tr>
<tr>
<td>Aug. 1921, 39.1%</td>
<td>91.4%</td>
<td>47.9%</td>
</tr>
</tbody>
</table>

It will therefore be seen that a considerable proportion of men escape, many of whom have been paraffin workers for long periods. On the other hand, a number of those having eruptions have been paraffin workers for short periods only. An illustration may be given to show how under similar circumstances some are affected and some escape. Following a cessation of work for six months, an examination was made of a group of paraffin workers six weeks after work was resumed. In one work, of those examined, eighteen men had been paraffin workers for less than two years, nine of these were free from eruptions and these were free on former examinations, nine were affected to a greater or less extent, and these, with one exception, had some form of paraffin eruption at previous examinations, which had disappeared with the stoppage of work, and re-appeared soon after beginning work in the green paraffin sheds.

It has been noted that men with fair complexions, or reddish hair, and freckled skins, show more reaction to the irritant than dark complexioned/
More extended experience, after repeated examinations of the same workmen, shows that the susceptibilities of the different workmen vary, and that the extent of such susceptibility may be looked on as practically a constant factor, as far as each individual workman is concerned. Numerous opportunities have in the past arisen for verifying this, such as prolonged absence from illness, unemployment, change of occupation, etc. After a workman affected with papular dermatitis ceases to work among paraffin substances, the papules soon disappear, but on resuming work again in the same department, re-appear in a few weeks, and the extent of the infection is practically always the same as in the previous occasion prior to ceasing work, i.e., each man exhibits a degree of tolerance or otherwise which is for all practical purposes constant.

It has been noted that fair complexioned men show more reaction to the irritant than dark complexioned men, being more extensively affected, and to a greater degree, than the latter. A similar fact has been noted in connection with tropical skin conditions due to solar rays. This, however, in no way explains the differences referred to, so that the most reasonable explanation is that a certain degree of idiosyncrasy may exist, causing a greater tolerance on the part of some than of others.

This feature is of considerable practical importance and it has been the custom of the writer for some time to advise that men extensively affected, or showing marked susceptibility to the irritant effects of paraffin, be removed to some other department in which they do not come into actual contact with the causative agent. It is hoped by this method of selection that ultimately the paraffin departments will be manned by workmen showing a complete tolerance, or very little intolerance to paraffin in any of its more irritating stages. This may reasonably be expected to be followed by amelioration in the extent and degree of the occupation dermatoses.

The presence of other skin diseases.
The presence of several of the more common skin diseases has been occasionally noted. These comprise acne vulgaris, psoriasis, eczema (chronic), and scabies. It may be said generally that, where acne vulgaris is present, the papules have a tendency to assume the papulo-pustular type, possibly from staphylococcus or streptococcus infection. The actual acne condition does not appear to be aggravated by contact with the oily material several cases/
cases kept under observation undergoing gradual improvement. Psoriasis has been seen accompanied by a diffuse non-indurated form of erythematous dermatitis, while eczema of a chronic type has been found to be associated with some induration of the superficial layers of epidermis. Soabies exists without modification by contact with oily paraffin, and responds to the usual method of treatment without after-effects.

Want of Cleanliness.

The importance of cleanliness was emphasized by Longmuir in 1883, and on his suggestion, baths were erected for paraffin workers in Young's Oil Works at Bathgate. These, however, were never used.

In recent years, very considerable attention has been paid to the importance of cleanliness, and facilities have been freely given for this purpose, as will be described later. Notwithstanding strict attention in this respect, it cannot be said that the incidence of early, or papular eruptions has been more than slightly diminished, but on the other hand, there has been a marked diminution in the frequency of the more chronic types, such as erythematous dermatitis, so much so, that recent erythematous dermatitis is now uncommon, while the more chronic and old standing conditions may be said to be more prevalent among those whose habits of cleanliness in the past might have been improved, that is, the influence of greater attention to/
to cleanliness has been followed by a loosening of this form of occupational eruption.

It may be said, in common with the generally accepted opinion, that epitheliomata, especially when occurring on the scrotum, in most instances may be attributed to lack of cleanliness, as the difficulty in this respect, as far as the scrotum is concerned, is well known, on account of its anatomical conformation. This appears to be fully borne out with reference to the incidence of epitheliomata, especially when situated on the scrotum, among the paraffin and oil workers of the Scottish Oil Industry.

With reference to the recent papular eruptions, in the writer's experience, it is impossible to draw any marked distinction as regards cleanliness between those affected and those unaffected. All the workmen concerned make the same use of the facilities provided, but notwithstanding this, a constant percentage of the workmen suffers from this form of occupational eruption, and those are affected shortly after beginning work in the paraffin sheds, while a practically constant percentage escapes. It has been found, however, that of those who have been employed in the paraffin sheds for a short time only, and who are early affected with papular eruptions, a certain proportion recovers quickly. This may be attributed to the fact that at first there is a want of care on/
on the parts of the workmen as regards cleanliness, and in allowing themselves to come unduly into contact with the materials handled, and after they are impressed with the necessity for great cleanliness and for coming as little as possible into contact with drops of oil, recovery takes place to a considerable degree.

**Seasonal Conditions.**

Experience has shown that as a general rule occupational conditions are worse during Winter months. As might be expected, cold, by lowering the vitality of the skin, accentuates old standing eruptions, especially those of the nature of dermatitis erythematosa, and erythema simplex. In the former condition the skin is more roughened and scaly, and the warty excrescences are more numerous during Winter and Spring than in Summer months. While this applies with certainty to erythematous conditions, it does not apply equally forcibly to papular eruptions, for though some individuals have more papules in cold weather, as a general rule seasonal condition have not the same influence on this type of eruption.

**Variation in the Plant used in the Process.**

A full description of the filter and hydraulic presses has already been given on pages 44-45. In some Works hydraulic presses are not used, the green oil and/
and scale being treated several times in filter presses before being sent to sweating sheds. Where hydraulic presses are not used, there is not such a large percentage of men affected as in those works in which both forms of presses are used. This is represented by the following figures:

In two works in which filter presses only are used, at one examination 57% and 63% of the green shed workmen were unaffected; in two works in which hydraulic presses are used, an examination at the same time showed that 37% and 48% of the green shed workmen were unaffected. Apart from the differences in the workingplant, all other conditions, such as the material handled, length of service, cleanliness, and working conditions were the same to all appearance in each instance.

Measures adopted for the Protection of the Workmen.

During recent years a great deal has been done for the protection of the workmen in the paraffin departments in the various works. These consist of the provision of adequate facilities for ensuring absolute cleanliness of bodies and clothing of the workmen, the use of protective applications for the exposed parts, and regular medical inspection every three months. In each of the works in which the refining of oil and manufacture of paraffin wax are carried out, a complete equipment of baths has been provided for the paraffin/
paraffin shed workmen. A description of one such establishment will suffice to show what has been done in this respect.

The bath house is a large well lit, well ventilated building, about fifty-five feet long, fifteen feet broad, and twelve feet high, adjoining the paraffin sheds. It is lined internally by white glazed tiles, and is heated to a comfortable heat by hot air or steam pipes. At one end are several (four) glazed porcelain hand basins, fitted with hot and cold water, and above each is a metal container filled with a neutral liquid soap. At the other end is a deep porcelain basin, with a clothes wringer attached, for washing socks and other articles of clothing. Arranged along the back wall, and at right angles across floor are forty-one iron lockers, fitted with pegs for clothes, shelves for boots, and wires for towels, the lockers being heated by hot air pipes passing along bottoms. The lockers are provided with seats for men while changing boots, etc.

On the front wall along the length of building are five spray baths, lined with glazed tiles, and fitted with hot and cold sprays, each in addition having a deep foot bath with a moveable seat. On both sides of each spray bath are cubicles for undressing, so that one man may get prepared while another is using the bath. Each workman is allowed a weekly quantity of soap and towels to be used by himself only. The baths are kept clean by an attendant. On
ceasing work, the men wash their arms and legs daily, and their bodies frequently, and after washing their socks, place them in the lockers along with boots, and don their outdoor clothes. On returning to work, the outdoor clothing is hung in lockers and working garments are put on, which are then covered with strong backcloth aprons as further protection for clothing, etc. The bath houses of each Company are arranged on similar lines, with differences of detail. See plates 42 & 43.

Protective Applications.

So far as is at present known, the best protective application is castor oil, especially in its semi-crude thick state. This is insoluble in any of the paraffin series, and so forms an impervious covering for the arms, etc. Before beginning work, each workman smears his hands and arms, and occasionally his legs, with castor oil, and occasionally throughout the working day after washing. This has been in use for a long time in the paraffin departments, as nothing better has yet been found. Applications of glycerine and lysol or carbolic acid have been tried, but have been discontinued on account of the tendency towards excoriation of the skin on the parts on which the application has been used.

Protective Clothing.

No practical form of clothing has been found that can withstand/
withstand the extremely searching and solvent action of the paraffin series. Leather, rubber and other waterproof materials are readily acted on, and rapidly become saturated with oils, and are not of any real use, though some of the workmen place layers of brown paper inside their boots before beginning work, this being discarded each day.

Treatmant.

The various methods of treatment, all of which are purely local, are carried out on the ordinary lines of treatment for skin diseases generally. Occupational comedones are readily removed by the usual method of expression, and permanent improvement is got by persistently removing these by the fingers, rather than with any of the implements for the purpose, as these are apt to cause too much mechanical damage to the surrounding tissues.

Papular conditions readily disappear on ceasing work in paraffin sheds, and as a rule require little or no treatment, as in the early stages these tend to heal spontaneously. Mild antiseptic pastes, such as boric ointment suffice to prevent septic infection, though this is uncommon, as the oily materials worked with are themselves both aseptic and germicidal. In the more acute forms of erythematosus conditions sedative applications are of use, the most effective being ichthylol and lead preparations. In the more chronic/
chronic types, these are also useful, or pastes of zinc oxide and salicylic acid, and if wartiness is a prominent feature, stronger preparations of salicylic acid are beneficial. In the more rapidly proliferative warty conditions, salicylic and chronic acids readily remove superficial warts, but when these extend more deeply into the skin tissues, carbon dioxide snow is of greater service. Semen (27) recommends application of radium as the best method of eradicating warts, or a combination of radium and carbonic oxide snow. On any appearance of warts or nodules proliferating too rapidly with excessive growth, removal by excision is a sure method of treatment, and it is exceptional to find recurrence.

The importance of early recognition of the transition stage between benign and malignant conditions cannot be too strongly emphasized, as delay in doubtful cases means unnecessary risks, involving infection of glandular tissues, after which very extensive removal may be necessary.

The periodic examinations of the paraffin shed workmen are of value in this respect, but, as will be seen from the tables of those who have suffered in former years, a great proportion of the cases recorded have occurred among workmen who are not connected with the paraffin shed, so that the early detection of any occupational condition is still a matter of chance as far as these men are concerned.
PART II.

DETAILS AND RESULTS OF EXAMINATIONS OF PARAFFIN SHED WORKMEN.
RESULTS OF EXAMINATIONS OF PARAFFIN SHED WORKMEN IN
SCOTTISH SHALE OIL INDUSTRY.

In February, 1919, an agreement was come to between
H, M. Home Office (Factory Department) and the various
employers in the Scottish Oil Industry engaged in refining
the products of shale, whereby a system of routine examinat-
ions at quarterly intervals of all the workmen in the
various paraffin departments was instituted for the benefit
of the workmen concerned.

I was asked by the parties to the agreement to carry out
the necessary examinations at the various works, these being
Addiewell, Oakbank, Pumpherston, Uphall and Broxburn Oil Works,
involving, in all, the examination of about two hundred
workmen at intervals of three months between each inspection.
Throughout the first examination, it was quite apparent that,
if these were to be of any permanent use for comparative
purposes, both as between the workmen in the different works,
and for future reference, it was necessary that a uniform
standard should be established as a permanent basis. It
was essential that this standard would be equally applicable
to all workmen, one which could be rigidly adhered to, one
which would eliminate the personal factor of the examiner,
and one which would at the same time take into consideration
the various conditions both from a dermatological aspect, and
from/
from the practical standpoint of the extent to which the workmen suffered when considering their suitability or otherwise for the work with which they were engaged. It was found impossible to differentiate the varying degrees of severity of the occupational eruptions on a strictly scientific basis, i.e., according to the type of lesion, as in a large proportion of instances several types co-existed, and on the other hand, the extent of an eruption was the actual determining factor in considering a workman's suitability or otherwise for that particular form of work. The standard fixed on as a permanent basis accordingly took largely into consideration the extents of the various occupational eruptions, and it has not been found necessary to make any further alteration on the original basis, all the requirements considered essential having been met satisfactorily.

The conditions of the workmen were divided into five groups as follows:-

Group 1:- Those having no occupational eruptions.

Group 2:- Those having slight erythema, or folliculitis, or not more than five papules.

Group 3:- Those having a slight degree of any form of eruption, and limited in extent.

Group 4:- Those with an extensive eruption of any type.

Group 5:- Those showing any condition approaching malignancy.

For permanently recording the conditions of the workmen
at each examination, I prepared charts showing front and back views of body, with reference letters for the various parts, and giving details of each man's age, length of service in paraffin departments, and the department in which he works. The condition of each man is noted at each examination in coloured crayon thus:

BLUE is used to represent Papular Dermatitis.
RED is used to represent Erythema and Erythematous Dermatitis.
BLACK represents Comedones, and in a few instances under Group 5, the sites of conditions approaching malignancy.
YELLOW represents scars, callosities, simple warts (papillomata), bruises, and similar non-occupational conditions.
GREEN represents non-occupational skin diseases, such as acne (rosacea or vulgaris) scabies, eczema and psoriasis.

Non-occupational conditions are noted for future reference, a precaution which has been found of service.

(The charts were at first prepared by myself, but latterly these have been supplied by Scottish Oils, Ltd., thus very materially improving the appearance of these permanent records).

A full complement of charts denoting the conditions of the workmen since the first examinations, and also copies of the reports issued on each occasion, are supplied with this paper. These reports give full details of the conditions of the workmen, with alterations from previous examinations, suggestions for improving their conditions, etc.

Reference has already been made in the description of the process/
process of manufacture to the various departments in which the paraffin scale is separated from the heavy oil and paraffin (Green Oil), and subsequently refined.

The crude paraffin departments include those in which the paraffin scale is filtered from the green oil by means of filter and hydraulic presses, as described on page. These departments are technically known as "Green Sheds", and the workmen are known as "Green Shed Workmen" or "Pressmen".

The paraffin refinery is the term applied to the departments in which the remaining oil is "sweated" from the paraffin scale and subsequently refined for commercial use. The workmen in refinery are known as "Sweating Shed Men". These terms are of considerable importance, as throughout the examinations a distinction is drawn between the Green Shed and Sweating Shed Workmen, and statistics are prepared for each of these, as well as for the two classes of workmen combined.

**DETAILS OF EXAMINATIONS OF THE PARAFFIN SHED WORKMEN.**

The details of each examination are based on the uniform standard described, dividing the workmen into five groups according to their freedom from, or the extent of, occupational eruptions/
eruptions.

(A) GREEN SHED and SWEATING SHED WORKMEN COMBINED.  
(Workmen in Crude paraffin departments and in paraffin refineries).

COMPRISING the RESULTS of FIVE EXAMINATIONS as UNDER:-

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 2</th>
<th>Group 3</th>
<th>Group 4</th>
<th>Group 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>March 1919</td>
<td>April 1919</td>
<td>July 1919</td>
<td>Augt. 1919</td>
<td>March 1921</td>
</tr>
<tr>
<td>79 (42.0%)</td>
<td>65 (44.5%)</td>
<td>73 (49.3%)</td>
<td>60 (53.1%)</td>
<td>31 (38.7%)</td>
</tr>
<tr>
<td>29 (15.4%)</td>
<td>46 (31.5%)</td>
<td>24 (16.2%)</td>
<td>31 (27.4%)</td>
<td>15 (18.6%)</td>
</tr>
<tr>
<td>56 (29.8%)</td>
<td>24 (16.4%)</td>
<td>42 (28.4%)</td>
<td>21 (18.6%)</td>
<td>27 (33.7%)</td>
</tr>
<tr>
<td>21 (11.2%)</td>
<td>11 (7.6%)</td>
<td>9 (6.1%)</td>
<td>1 (0.9%)</td>
<td>7 (8.8%)</td>
</tr>
<tr>
<td>3 (1.6%)</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

The average frequency of eruption for the five examinations is:-

Group 1. Those having no occupational eruption...... 45.5%
Group 2. Those having a few papules only.............. 21.4%
Group 3. Those having limited degree of eruption...... 25.1%
Group 4. Those having extensive eruptions............. 7.6%
Group 5. Those showing presence of warty growths...... 0.4%
(B) SWEATING SHED WORKMEN (WORKMEN IN PARAFFIN REFINERIES).

<table>
<thead>
<tr>
<th>Dates of Examinations</th>
<th>March, April, 1919</th>
<th>July-Aug., 1919</th>
<th>March, 1921</th>
<th>Sept., 1921</th>
<th>Feb., 1922</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Men examined,</td>
<td>59</td>
<td>41</td>
<td>35</td>
<td>26</td>
<td>13</td>
</tr>
<tr>
<td>Group 1</td>
<td>42 (71.2%)</td>
<td>34 (83.0%)</td>
<td>33 (94.3%)</td>
<td>26 (100%)</td>
<td>11 (84.6%)</td>
</tr>
<tr>
<td>Group 2</td>
<td>3 (5.1%)</td>
<td>3 (7.3%)</td>
<td>1 (2.9%)</td>
<td>None</td>
<td>1 (7.7%)</td>
</tr>
<tr>
<td>Group 3</td>
<td>10 (16.9%)</td>
<td>2 (4.8%)</td>
<td>1 (2.8%)</td>
<td>None</td>
<td>1 (7.7%)</td>
</tr>
<tr>
<td>Group 4</td>
<td>3 (5.1%)</td>
<td>2 (4.9%)</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Group 5</td>
<td>1 (1.7%)</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

Average frequency of eruptions for five examinations:

- **Group 1.** Those having no occupational conditions... 84.0%
- **Group 2.** Those having a few papules only............ 4.6%
- **Group 3.** Those having a limited degree of eruption. 8.0%
- **Group 4.** Those with extensive eruptions............. 2.8%
- **Group 5.** Those with malignant growths................. 0.6%

These figures show how comparatively free the sweating shed workmen are from occupational lesions; at one examination all were quite free, while there has been a steady improvement since date of first inspection.

During the examination of March, 1919, one man included in above summary was placed in Group 5 on account of a malignant growth on his left arm, after thirty years service in/
in sweating sheds. This is the only instance I have been able to trace of a malignant condition occurring among sweating shed workmen. The growth was excised, with permanent recovery without recurrence.

It will be noted that at first examination the proportion of sweating shed men in Group 3 was rather high. This is entirely due to the greater prevalence of occupational eruptions among the Addiewell workmen, these having been employed in this capacity for many years and under circumstances not so favourable in former years for the prevention or amelioration of the skin conditions. These were only examined on one occasion, the refinery and paraffin sheds being subsequently closed.
(C) GREEN SHED WORKMEN (CRUDE PARAFFIN DEPARTMENTS).

<table>
<thead>
<tr>
<th>Dates of Examination</th>
<th>March 1919</th>
<th>April 1919</th>
<th>July 1919</th>
<th>Aug. 1919</th>
<th>March 1921</th>
<th>Sept. 1921</th>
<th>Feb. 1922</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Men examined,</td>
<td>129</td>
<td>105</td>
<td>113</td>
<td>87</td>
<td>67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 1</td>
<td>37 (28.7%)</td>
<td>31 (29.5%)</td>
<td>40 (35.4%)</td>
<td>34 (39.1%)</td>
<td>20 (29.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 2</td>
<td>26 (20.2%)</td>
<td>43 (41.0%)</td>
<td>23 (20.4%)</td>
<td>31 (35.6%)</td>
<td>14 (20.9%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 3</td>
<td>46 (35.6%)</td>
<td>22 (20.9%)</td>
<td>41 (36.3%)</td>
<td>21 (24.1%)</td>
<td>26 (38.8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 4</td>
<td>18 (13.9%)</td>
<td>9 (8.6%)</td>
<td>9 (7.9%)</td>
<td>1 (1.2%)</td>
<td>7 (10.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 5</td>
<td>3 (2.4%)</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The average frequency for the five examinations is as follows:

Group 1. 32.3% are unaffected.
Group 2. 27.3% have not more than five papules.
Group 3. 31.1% are affected to a limited degree.
Group 4. 8.9% are extensively affected.
Group 5. 0.4% show presence of malignant growths.

These figures show the much greater prevalence of occupational dermatoses among the workmen in the crude paraffin departments, as compared with the workers in sweating sheds (paraffin refineries). This is due to constant close contact with the oily products during the separation of the paraffin scale, as fully described on page

SEASONAL VARIATION.
SEASONAL VARIATION.

In scrutinising the percentages of those affected in each department, as well as those for both sections combined, it will be seen that during the Summer and Autumn examinations, fewer men are included in Groups 3 and 4, and that a larger proportion are included in Groups 1 and 2, than during the Winter and Spring examinations, i.e., during Summer and Autumn there is a decided tendency towards improvement of the occupational conditions, the colder months having an adverse effect. This may be illustrated from table (0) referring to Green Shed Workmen.

<table>
<thead>
<tr>
<th>Groups 1 and 2:</th>
<th>March, 1919</th>
<th>July, 1919</th>
<th>March, 1921</th>
<th>Sept., 1921</th>
</tr>
</thead>
<tbody>
<tr>
<td>N° eruptions of</td>
<td>48.9%</td>
<td>70.5%</td>
<td>55.8%</td>
<td>74.7%</td>
</tr>
<tr>
<td>a few papules only</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GROUPS 3, 4, & 5:—
Limited & extensive eruptions,

<table>
<thead>
<tr>
<th></th>
<th>March, 1921</th>
<th>July, 1921</th>
<th>Sept., 1921</th>
</tr>
</thead>
<tbody>
<tr>
<td>51.1%</td>
<td>29.5%</td>
<td>42.2%</td>
<td>25.3%</td>
</tr>
</tbody>
</table>

The preceding figures refer to the paraffin shed workmen as one complete group of men employed by Scottish Oils, Ltd. On a more detailed analysis of the conditions of the paraffin workers of each oil work, we find differences in the frequency and severity of the occupation lesions, which can to some extent be explained by local circumstances.

In carrying out the examinations, the statistics relating to the workmen of each work are kept separate, and thus comparisons/
comparisons can readily be made. The differences are most readily shown by summarising the results of corresponding examinations at each work, according to the groups into which the men are placed, on the standard already described.

(D) GREEN SHED WORKMEN ONLY — FIGURES FOR EACH WORK.

(a) GROUP 1 — Those free from occupational conditions:

<table>
<thead>
<tr>
<th>Work</th>
<th>Dates of Examinations</th>
<th>Work</th>
<th>Dates of Examinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broxburn</td>
<td>25.7% 25.0% 38.2% 34.4% 40.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uphall</td>
<td>28.0% 28.0% 33.3% 45.5% None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Addiewell</td>
<td>38.9% 47.4% 50.0% None None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oakbank</td>
<td>27.0% None None None None</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) GROUP 2 — Those having not more than five papules:

<table>
<thead>
<tr>
<th>Work</th>
<th>Dates of Examinations</th>
<th>Work</th>
<th>Dates of Examinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pumphorston</td>
<td>22.9% 50.0% 26.5% 37.5% 18.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broxburn</td>
<td>20.0% 48.0% 22.2% 41.0% None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uphall</td>
<td>11.1% 15.0% None None None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oakbank</td>
<td>45.1% 40.0% 20.0% 30.3% 22.8%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(c) GROUP 3 — Those with limited degree of Eruptions:

<table>
<thead>
<tr>
<th>Work</th>
<th>Dates of Examinations</th>
<th>Work</th>
<th>Dates of Examinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pumphorston</td>
<td>45.7% 19.5% 32.3% 28.1% 37.5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broxburn</td>
<td>44.0% 16.0% 33.4% 9.0% None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uphall</td>
<td>16.7% 26.3% 25.0% None None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oakbank</td>
<td>26.9% None None None None</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(d) GROUP 4 — Those with extensive Eruptions:

<table>
<thead>
<tr>
<th>Work</th>
<th>Dates of Examinations</th>
<th>Work</th>
<th>Dates of Examinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pumphorston</td>
<td>5.7% 5.5% 3.0% None None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broxburn</td>
<td>8.0% 8.0% 11.1% 4.5% None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uphall</td>
<td>33.3% 10.5% 25.0% None None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oakbank</td>
<td>19.2% None None None None</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(e) GROUP 5 — Those with any condition approaching malignancy:

<table>
<thead>
<tr>
<th>Work</th>
<th>Dates of Examinations</th>
<th>Work</th>
<th>Dates of Examinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pumphorston</td>
<td>None None None None None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broxburn</td>
<td>None None None None None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uphall</td>
<td>None None None None None</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oakbank</td>
<td>7.7% None None None None</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
LENGTH of SERVICE.

On examining these figures, it will readily be seen that of the workmen employed in Addiewell and Uphall Oil Works a much larger proportion is included in Group 4 than at any of the other Works, i.e., there is a high frequency of the more extensive types of occupation lesions. This is accounted for by the very long terms of service in the paraffin departments. For example, Group 4 of the Addiewell workmen comprises seven workmen, their lengths of service in paraffin sheds being respectively 38, 36, 33, 29, 22, 21, and 15 years. Group 5 of the same workmen includes two men who have been employed in this department for 40 and 32 years respectively. All those in Groups 4 and 5 suffered from extensive indurated dermatitis, with the typical appearances shown on plates. Group 4 of Uphall oil workers comprises seven workmen who have been employed for 39, 34, 28, 27, 18, and 18 years, and one lad who had only been employed for four months and at the end of that period was literally covered with a pustular dermatitis. Group 5 of Uphall workmen consists of one sweating shed workman, having been thus employed for 30 years. This is the only instance of a sweating shed worker having been affected with a malignant condition. All those in Groups 4 and 5 suffered from extensive indurated dermatitis. These/
These facts and figures therefore show the very potent influence which the longer terms of service as paraffin workers have in the production of the extensive indurated types of dermatitis. Some of the plates illustrating this condition were got from Addiewell and Uphall workmen.

Another point of importance is seen from the figures. In scrutinising figures of examination made in September, 1921, it will be noticed that of the Broxburn and Oakbank workmen, a very small proportion were included in Groups 3 and 4, showing a marked contrast to the figures for previous examinations. The explanation is to be found in the fact that the examinations of these two groups of workmen were made after a cessation of work for some six months or so, during which time all the papular eruptions healed, and even the more indurated types had undergone some improvement.

These details therefore show the readiness with which the papular types disappear on removing workmen from the paraffin sheds. This point is of practical importance, as at present it is only by the removal of those most affected and substituting for them others who have not shown the same tendency towards the action of paraffin substances that the prevalence of the eruptions can be diminished.

A further point may be mentioned. At the examination of the Oakbank workmen in February, 1922, the number of men placed in/
in Groups 3 and 4 was larger than at any previous examination, due to the high frequency of papular eruption. These were most prevalent on those with short periods of service in the paraffin sheds, and occurred shortly after beginning this form of work. Throughout the examinations at all the works, there has been noted a tendency for the more recent employees to be affected with papular eruptions, as if the workmen were not sufficiently impressed with the necessity for cleanliness, and the necessity for taking all possible precautions, such as lubricating arms with castor oil, etc., and only after being some time employed were proper protective measures taken by them. During this and the previous examination of the same men, several instances of occupational recoveries were got, described in Part 1 under that head. This condition has been almost solely confined to the Oakbank workmen. There are also considerable differences in the sites of the occupational lesions. During two recent examinations, the sites of the lesions in the workmen of the various works/
works have been as follow:

<table>
<thead>
<tr>
<th></th>
<th>MARCH, 1921</th>
<th></th>
<th>FEBRUARY, 1922</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Arms only.</td>
<td>Arms &amp; legs.</td>
<td>Arms only.</td>
</tr>
<tr>
<td>Pumpherston</td>
<td>62.0%</td>
<td>38.0%</td>
<td>75.0%</td>
</tr>
<tr>
<td>Broxburn</td>
<td>33.3%</td>
<td>66.6%</td>
<td>-</td>
</tr>
<tr>
<td>Uphall</td>
<td>43.0%</td>
<td>57.0%</td>
<td>-</td>
</tr>
<tr>
<td>Oakbank</td>
<td>34.5%</td>
<td>65.5%</td>
<td>20.7%</td>
</tr>
</tbody>
</table>

It will thus be seen that there is a lessened tendency towards eruptions on legs among the Pumpherston workmen than among the others, while among the Oakbank men there is a much greater proportion of men who show some form of lesion on legs.

This can only be due to the fact that in some of the works the lower extremities come more into contact with the oily paraffin than in others.

Accompanying Part 11, giving the results of examinations of the paraffin shed workmen, are 4 charts, showing the distribution of the various types of eruption among the men affected, illustrative of the methods of grouping.

Also I have supplied copies of my reports issued with each examination. Addiewell workmen were only examined on one occasion, the paraffin sheds of that work being subsequently closed.

I have to express my indebtedness to the Management of Scottish Oils, Ltd., for the great facilities given me in completing/
in carrying out the examinations of the workmen, for the information placed at my disposal, and also for the great assistance with the clerical work. I am also indebted to the Chief Chemists for the accuracy of the information regarding the chemical processes which have been given here as of importance in the consideration of the occupation dermatoses of the paraffin workers of the Scottish Shale Oil Industry. My thanks are also due to Dr. Archibald Leitch for the results of experiments on mice with the various oils, and to Mr. T. H. Graham, O.B.E., Librarian of the Royal College of Physicians, Edinburgh, for the facilities placed at my disposal for consulting the literature on the subject.

BROXBURN,
JULY, 1923.