Report to Her Majesty's principal Secretary of State for the Home Department on the conditions of labour in potteries, the injurious effects upon the health of the workpeople, and the proposed remedies / by the.

REPORT

TO

HER MAJESTY'S PRINCIPAL SECRETARY OF STATE FOR THE HOME DEPARTMENT

ON

THE CONDITIONS OF LABOUR IN POTTERIES, THE INJURIOUS EFFECTS UPON THE HEALTH OF THE WORKPEOPLE, AND THE PROPOSED REMEDIES;

BY

THE POTTERIES COMMITTEE OF INQUIRY.

Presented to both Houses of Parliament by Command of Her Majesty.

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Report of Committee appointed to inquire into the Injurious Conditions of the Manufacture of Pottery, and the proposed Remedies.

To the Right Honourable Herbert Henry Asquith, Q.C., M.P., Her Majesty's Principal Secretary of State for the Home Department.

Sir, July 1893.

On the 21st of April last we were honoured with a commission from you "to make "inquiry into the conditions under which the manufacture of pottery is carried on, "with the object of diminishing any proved ill effects in the health of the workpeople "engaged therein."

To most of us the subject of inquiry was familiar, the medical members of the Committee having spent the greater part of their professional life in active practice in the North Staffordshire Potteries District, one of them being also consulting physician and the other honorary surgeon to the North Stafford Infirmary, and the official members of the Committee having served 15, 7, and 1 years respectively, as Her Majesty's inspectors of factories of this district.

About four-fifths of the persons employed in the manufacture of china and earthenware in the United Kingdom are so employed in the part of Staffordshire known as "The Potteries." We therefore fixed on the central town of the Potteries, viz., Stoke-on-Trent, as the centre of our operations. The processes of manufacture are, in our opinion, fully illustrated by those carried on in this district.

The Appendix A. will show the order of our proceedings, but we may here briefly state that previous reports on the subject, the evidence given before the Labour Commission, communications from associations of manufacturers and operatives, letters from individual occupiers of potteries, and from workmen engaged therein, medical reports, and numerous newspaper articles were brought under our notice and duly discussed.

We have examined a large number of workmen, representing nearly all branches of the pottery industry, and taken note of their statements as to the unhealthy nature of the occupation, and their suggestions for remedies.

A large and influential deputation of employers attended one of our sittings, having been deputed to do so by a Joint Committee of the Chamber of Commerce, the China and Earthenware Manufacturers' Association, and the Encaustic Tile Manufacturers' Association, and we have received numerous communications from individual employers. In addition we have received evidence from potters' chemists, managers of potteries, colour makers, factory certifying surgeons, and other gentlemen. To all these we tender our very best thanks for their assistance.

The opinions given by the various witnesses were, as might be expected, somewhat conflicting, and we have done our best to arrive at just conclusions by visiting china and earthenware works and judging for ourselves.

In reply to the question as to how far the manufacture of china and earthenware as at present carried on injuriously affects the health of the workpeople, and how far the injurious effects depend upon the age and sex of the operatives, the medical members of the Committee, Dr. J. T. Arlidge and Mr. W. D. Spanton, have drawn up the subjoined report, representing their views on these subjects, and we would also direct attention to the letter from Mr. W. J. Dawes, Medical Officer of Health, Longton, (Appendix C.), and to the evidence of Mr. J. Alcock (Appendix A.).

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necessary to show how the injury is brought about, and by what measures it may be mitigated and removed.

The ill effects of the trade are referable to two chief causes, viz., dust and the poison of lead. The former is of wider action, as it pervades all the operations or processes wherein potter's clay and flint in powder are in use. The latter prevails in the lesser departments of work concerned in the glazing and colouring of the ware after it leaves the hands of the potter properly so called.

A third but less potent cause exists in the operations necessary to the completion of the ware by firing.

First. Of the Dust of Potter's Clay and of Flint.—This is noxious by inhalation, by finding its way into the lungs, to the tissue of which it operates as an irritant, setting up inflammatory action and ending in gradual consolidation and abolition of the functions of those organs.

The mischief done is manifested by the production of cough and expectoration, with advancing difficulty of breathing, and accompanied by wasting and weakness, a group of symptoms assimilated to those of pulmonary consumption.

Consequently the prevalence of bronchitis and asthma among potters affords a key to the proportion in which they suffer from their occupation.

Analysis of the mortality returns for males above 14 for the year 1890, of the parish of Stoke-on-Trent, including the county borough of Hanley, the boroughs of Longton and Stoke, and the large town of Fenton, shows that, of the total mortality from all causes among potters, bronchitis accounted for 42 per cent., pneumonia and pleurisy 8 per cent., pulmonary consumption 21 per cent.

Grouping bronchitis with lung inflammation, the result thus stands: that in the case of potters 50 per cent. died from chest diseases, as distinguished from pulmonary consumption, which on its part carried off 21 per cent.

Employing the same data, an analysis of the deaths of males above 14 not employed in any form of pottery labour, but living in the same district, the finding is that the diseases of the chest produced 26 per cent. and pulmonary consumption 14 per cent.; showing a very considerably higher ratio of those maladies, to the entire mortality of males in the district, among potters than among non-potters.

The higher mortality of potters is evidenced in another way, viz., that the ratio of deaths ascribed to senile decay among potters is 4·5 per cent., and with non-potters 12·5 per cent.

Another result of the same analysis is, that whilst the average age reached by potters was 48, that attained by non-potters was 53 years.

Extending the inquiry to the divisions of pottery labour it appears that, in the case of *pressers*, bronchitis was the cause of death in 47 per cent., and other lung diseases in 7 per cent., showing that this class of workmen suffers to a greater extent by its form of work than do other potters from like maladies.

The same holds true of pulmonary consumption; for whereas with potters at large the per-centage of the mortality from this cause was 21 per cent., it reached 29 per cent. with pressers.

The business of pressers as a class of artisans is recognised as more dusty than that of other potters, and at the same time statistics prove them to be more frequent victims of lung maladies.

In the same way potters are generally more exposed to dust, and that of unusually irritant character, than other men following other occupations, and show a preponderating prevalence of chest lesions, although among the latter there is a fair proportion of miners who inhale coal dust, besides many workmen whose employment is for other reasons admittedly unhealthy.

The inference is consequently unavoidable, that potters suffer an excessive mortality in following their occupation, and that the mineral dust they inhale is largely accountable for it.

The workpeople exposed to flint dust are, compared to those subjected to the inhalation of clay dust, very few in number. Those most exposed are the china scourers—all females—who brush off the flint powder adherent to china after its removal from the oven. Other sufferers are exemplified by china placers, by men employed in sifting flint, and by the few who "flint" the ware before it is "placed."

All these suffer greatly by flint dust inhalation, and above all the scourers, who break down for the most part within a few years, though some resist the deadly effects for several years.

The number of flint workers is few, and no precise data have been collected for them to furnish the basis for statistical inferences.

In all the employments mentioned where dust is the active agent in inducing disease, the problem is how best to prevent its production, and when produced how to disperse and remove it from the vicinity of the workpeople.

Now its production may be largely obviated by cleanliness in work, by avoiding the scattering of particles of clay, by arrangements for removing waste fragments, by great attention to the cleanliness of working places, by keeping the temperature of shops as low as practicable, so as to avoid the rapid drying of the clay, and by sprinkling the floors with water.

The protection of the workers from the inhalation of dust is best secured by efficient ventilation and ample working space, the former by affixing fans to withdraw dust from the shops and to obtain proper circulation and movement of the air.

Where fans and the necessary motive power are available, the construction of enclosed work-boxes for the use of those employed in "fettling" and "towing," with exhaust draughts of air, to cleanse the ware from dust and to forcibly extract the dust given off, supplies a very efficient plan for saving the workmen from dust inhalation and its evils.

Some means similar in principle are needed for all those using flint in powder.

What shall be the appliances best adapted to each kind of occupation pursued, and most effectual for the purpose, is a problem for engineers, who will avail themselves of the instruction and technical knowledge of the manufacturers.

Still, with or without the intervention of the engineer, the co-operation of the workpeople is essential to effecting any improvements that shall amend their state of health and their longevity. Hitherto such co-operation has been very imperfectly given.

Lead Poisoning.—It is clear from inquiries made by this Committee that a large part of the mortality from lead poisoning is avoidable; although it must always be borne in mind that no arrangements or rules, with regard to the work itself, can entirely obviate the effects of the poison to which the workers are exposed, because so much depends upon the individual and the observance of personal care and cleanliness.

There are several ways in which the poison can be introduced into the system. It is sufficiently proved that dust charged with lead finds its way usually through the stomach, and also, in all probability, through the respiratory passages. When in the form of moist glazes it also enters through the skin.

It undoubtedly gains access into the body by;

(*a.*) Eating food with unwashed hands or partaking of it in the rooms where lead is dealt with;
(*b.*) Neglect of cleanliness of clothing;
(*c.*) Allowing glaze and colours to drop about, become dry, and so form dust that gets inhaled;
(*d.*) Holding the pencil used in painting in the mouth, as is often done by majolica paintresses;
(*e.*) Rubbing the eyes with dirty hands.
(*f.*) Near sightedness, causing the workers to be too close to their work.
(*g.*) Some constitutional idiosyncrasy producing excessive susceptibility to the poison of lead.

At the same time, experience proves that many persons using lead glazes and colours work for a long series of years without manifest injury to their health. These are the careful ones. On the contrary many break down quickly; this is especially the case with young women and lads, with whom the influence of sex and age is a factor to be remembered, apart from that of careless habits. Another of some import is that of being ill fed and debilitated.

It is easy to tell at a glance between those likely to resist the action of the poison or to succumb to it, by noting their personal cleanliness, their clothes, workplaces and other surroundings.

Those employed in mixing glazes and colours, if observant of ordinary precautions, seldom suffer, although much exposed to the poison.

The sole use of "fritted" or fused lead has been advocated on the supposition that it is innocuous, but this belief must at present be considered not proven, as sufficient experiments have not yet been made.

The following statistics, prepared by Mr. Hordley, the secretary of the North Staffordshire Infirmary, show the comparative number of indoor patients treated in that

institution, in a series of years, for lead poisoning, or plumbism, among potters, and also the per-centage of patients admitted.

TABLE I.

NORTH STAFFORDSHIRE INFIRMARY.—TABLE showing NUMBER of LEAD CASES admitted in proportion to other Admissions, with Occupations and Number of Deaths in various Years from 1870 to 1891.

Year.	Total Patients.	Total Lead.	Recovered.	Died.	Dippers.		Placers and Ovenmen.		Dipping House.		Painteresses.		Glost Warehouse.		Ground Layer and Colour Grinder.		Other Trades.	Total Lead Cases	Proportion of Lead Cases per Cent.	Remarks.
					M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.				
1870 } 1871 }	2,538	*39	—	—	5	4	14	—	8	4	—	—	—	3	—	—	1	38 2 years	1·50	These figures show that while lead cases during the first seven years recorded constituted 1·71 per cent. of the whole number of patients admitted, during the last five years they formed only 1·03 per cent. of the whole—a very striking diminution.
1879	1,434	29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2·02	
1880	1,350	22	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1·60	
1881	1,401	23	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1·64	
1883 } 1884 }	3,173	*51	48	3	9	—	8	—	7	13	—	6	—	1	1	1	5	46 2 years	1·44	
1885	1,526	33	32	1	3	—	8	—	1	9	—	7	—	3	—	—	2	33	2·03	
1886	1,717	30	29	1	10	1	1	—	2	7	—	9	—	—	—	—	—	30	1·74	
1887	1,512	15	15	—	1	—	5	—	3	2	—	2	—	1	—	—	1	14	·99	
1888	1,551	15	13	2	4	—	4	—	1	2	—	1	—	—	—	1	2	13	·83	
1889	1,651	21	20	1	1	1	6	—	1	4	—	2	—	2	—	—	4	17	1·02	
1890	1,709	21	21	—	4	1	2	—	1	5	—	3	—	1	2	1	1	29	1·17	
1891	1,728	29	29	—	5	—	2	—	3	8	—	3	—	1	—	—	—	29	1·15	

* Two years.

Compiled by Mr. F. B. HORDLEY, Assistant Secretary.

Another table, prepared by the kindness of Mr. E. J. Hammersley, the secretary, represents the ratio of lead cases among the members of the North Staffordshire Provident Society, who are very numerous and for the most part dwellers in the Potteries.

TABLE II.

NORTH STAFFORDSHIRE PROVIDENT ASSOCIATION RETURNS, showing :—

Year.	Total Paying Members.	Total Sick from Lead.	Total Sickness in Weeks.	Total Lead Sickness in Weeks.	Per-centage of Lead Weeks to to Total Weeks.	Per-centage of Lead Cases to Total No. of Members.	Remarks.
1864	579	9	856	—	—	1·55	This table shows that so far as this society is concerned there has been a steady annual increase in the number of members, a much larger progressive decrease in the number suffering from lead poison, and during the last eight years *no* death ascribed to it.
1865	594	10	907	—	—	1·68	
1866	665	8	883	—	—	1·20	
1878	1,417	14	2,098	—	—	·98	
1881	1,534	23	2,914	—	—	1·49	
1883	1,688	31	2,970	—	—	1·83	
1884	1,753	22	3,093	—	—	1·25	
1885	1,838	13	3,145	—	—	·70	
1886	1,953	3	3,419	34	·99	·15	
1887	2,038	19	3,962	138	3·48	·93	
1888	2,206	25	4,212	154	3·65	1·13	
1889	2,415	35	4,287	188	4·38	1·03	
1890	2,606	22	5,241	50	·95	·84	
1891	2,828	19	5,271	62	1·17	·60	
1892	3,000	17	6,510	93	1·42	·56	

Average per annum for 7 years 1·42.

Average per annum 8 years ·74. No deaths.

The general outcome of these tables is, that there is less prevalence of plumbism among the pottery population than in past times, and this, notwithstanding a growing number of factories and of workers. Inquiries, moreover, made among medical men of

the district indicate it as the general opinion, that there are fewer severe cases, and that these are chiefly confined to dippers; whilst as to slighter ones they occur mainly among young persons. It is, however, fair to note that the diminution of plumbism of late years is partly due to the reduced production of majolica ware during the last five years, and also to the enforcement of order of Secretary of State of December 1882, prohibiting the taking of meals in majolica painting shops.

The higher rate of wages obtainable by dipping house labour acts as an inducement to women and young persons to engage in it, and also to continue to work even when aware of its ill effects upon their health; and it becomes a subject for serious consideration whether a periodical examination should not be insisted upon in the instance of all workers with lead, to be made by the certifying surgeons visiting the factories.

The *third division* of pottery labour chargeable with injurious consequences to the health of the employed, is that concerned with the firing of the ware.

Those engaged in it are placers, ovenmen, and kilnmen, with assistants, the latter mostly youths, who feed the furnaces.

Among these the injurious conditions that obtain are flint dust, the poison of lead, the heat from the furnaces, and the gases and dust thrown off.

Flint dust belongs to china placing only, the articles in china being packed in it, within the saggars.

It likewise falls to the lot of men working in this department to sift the powdered flint. The action of this dust has been already sufficiently noted, and no special remarks are needed concerning the dust and gases proceeding from the oven furnaces.

The leading feature of this division of pottery work is the heat to which men are exposed when occupied in drawing the ovens. The conical shape of the ovens causes the heat to be greater at their upper part, where, as a matter of course the removal of the superimposed series of saggars must be begun. The weight of the saggars, filled as they are with ware, is very considerable; and this coupled with the use of ladders to reach the topmost rows, renders the labour one of great fatigue, whilst the actual heat is aggravated by more or less vapour, charged with some sulphurous gas which accumulates at the upper part of the oven.

The conditions of oven-labour are productive chiefly of rheumatic affections; and now and again men suffer from serious exhaustion from heat and physical exertion. Dust, and much needless exposure to draughts and alternations of temperature, concur, also, in developing bronchial attacks, and the ill effects of the occupation are augmented very frequently by the recklessness and carelessness of the workmen.

Whilst on this subject of heat, some remarks on the temperature of workshops may be permissible.

In former times shops were warmed by circular iron stoves, known as "stove pots," fed through a door and discharging their smoke up a chimney.

In consequence they somewhat improved ventilation.

At the present day these stoves have been replaced in all large potteries by steam pipes. In the absence of proper care an excess of heat is at times produced, and its ill consequences are increased by the want of adequate provision for the introduction of fresh air, and by the folly of the workmen in closing apertures for its admission, and in interfering with the best devised apparatus for securing ventilation. And it appears that on the part of the employed there is a general feeling of dislike to shops heated by pipes, as causing languor and otherwise damaging their health. But whatever be their evil effects, these are augmented materially by the prejudices of the men against admitting the external air into their shops and by carelessness in regard to exposure to the weather outside, often with insufficient clothing, when passing from their heated places of work.

General Remarks and Suggestions.—In what has preceded, attention has been chiefly directed to statistics indicative of the diseases and mortality of potters, and then to those incidental conditions of their labour inimical to health. There is room, however, for some general reflections relative to accidental surroundings and their influence upon their health.

A general review of the facts adduced seems to show that there has not been, in the course of the last 20 years, that degree of improvement in the general health of potters which might have been hoped for, though happily a certain measure is apparent in some directions, as, for instance, in reduction of plumbism.

If the general sanitary state of the Potteries has been ameliorated, the full benefits to the workpeople have been lost by unfavourable circumstances of other kinds. In the

first place, the population of the district has become denser, what were open spaces for the circulation of air have been intruded upon by multiplied habitations, and small plots of ground formerly available for cottage gardens have been built over, depriving the artisans of the benefit of outdoor exercise and of a source of interest outside their calling.

This change has exercised another effect upon them, and led them to seek more largely for diversion in town-made places of entertainment, where the heated and vitiated air of workshops is exchanged for other and no better. A larger proportion reside at remoter distances from the seat of work, and to reach it prefer travelling by rail or tram to and from their homes in place of walking.

Active outdoor exercise is thereby discouraged, and the artisan who travels by public conveyance risks catching cold in passing from his hot workshop and journeying in a more or less cold and windy carriage.

Another incident not salutary is the greater press of labour, fostered by the introduction of machinery, and with it the heating of workplaces by steam pipes; moreover, proper ventilation is too often not provided for, and the air in consequence is stagnant and laden with impurities derivable from the workers and their work.

A few other suggestions originate from statements made by the men, and from sanitary considerations.

The process of ground laying should not be performed in a room where other operations are carried on.

The sifting of flint should be carried on within a covered chest, and the flint diffused in the air be withdrawn by some efficient extracting mechanism, such as a fan.

Shops situated in the basement, more or less below the level of the adjacent ground, are usually damp, ill ventilated, and ill lighted, and altogether unfit for occupation. It seems, therefore, on sanitary grounds, they should be interdicted.

Many old factories are wholly, or in part, unfit in a sanitary point of view for occupation, and there should be some authority to close them, or whatever part of them is condemned, on the same principle as dwellings are declared uninhabitable.

The work of lathe-treading should be disallowed for young females under the age of 16.

The "wedging" of clay should not be done by lads under 13 years of age, nor by girls under 16. It is very unsuitable labour in all respects for females.

It is sufficiently established that lead may provoke miscarriage when a woman is pregnant, and likewise operates prejudicially upon the unborn child, if it survives its birth. It is therefore undesirable for married women to be employed in processes where lead is used.

The collecting of ware on shelves above the heads of the workers in a shop should not be allowed, and in general the retention in the shops of disused moulds or of articles of pottery serving no present purpose should be avoided.

The hot closets in pressers' shops should be closed by a double door, as experience proves may be done with advantage.

The blowing of ware by the mouth of women employed in fettling, in the absence of machinery to effect the same end, is not sufficiently shown to be attended by ill results.

The rule proposed on the part of the workmen that it be forbidden to use boards for carrying ware after their employment in the dipping house, involves a minuteness of supervision beyond attainment by the factory inspectors. The exercise of common sense and observance of cleanliness on the part of the employed should overcome all possible evils arising from such a source.

J. T. Arlidge.
W. D. Spanton.

With reference to the further question referred to the Committee as to "whether "the alleged injury to health caused by the existing processes can be diminished by "an extension of the present regulations or by legislation," we have carefully considered the "special rules" already drafted and submitted to us, and have taken the opinions of employers and employed upon them, and from consideration of this evidence and the reports presented to us, and also as the result of our observations whilst visiting potteries, we beg to submit the special rules in an amended form, and to recommend their adoption.

Reference to the notes of our proceedings (Appendix A.) will show that we have discussed all the points brought before us by masters and workmen, and a comparison

of the rules submitted to us with those we have adopted, will show that we have made no alteration whatever in Rules 1, 9, 11, or 12, verbal alteration only in Rule 4, slight additions to Rules 2, 3, 5, 6, 10, and 13, added a new Rule 8, and have struck out of Rule 7 the part relating to heat of ovens at time of drawing, and recast the rule in as far as it deals with the temperature of potters' shops.

We are of opinion that if these special rules are established and enforced in each pottery in the kingdom, the injurious effects of the various processes will be very greatly diminished.

Special Rules.

Factory and Workshop Act, 1891, *ss.* 8, 9, 10, 11, 12.

The Manufacture of Earthenware and China.

Duties of Occupiers.

1. They shall not allow any child under 14 to be employed in the dipping house or dipper's drying room, or in any processes of ware cleaning after the dipper, glost placing, china scouring, ground laying, or majolica painting, or in any process in which lead is used.

2. They shall provide suitable overalls and head coverings for all workers employed in the places and processes referred to in Rule 1, and shall have the said articles washed on the premises, and shall also provide a place in which the workers can deposit clothing put off during working hours.

3. They shall not allow any persons (either adult males or others) to cook or partake of any food, or to remain during meal times in the dipping house, dipper's drying room, china-scouring room, glost placer's shop, ground-laying shop, or majolica-painting room.

4. They shall adopt efficient measures in the processes of towing of earthenware and of the scouring of china for the removal of all dust and flint by fans or other mechanical means; and in all dusty processes they shall adopt measures for dealing with avoidable dust, and for the prevention of any injurious effects arising therefrom, either by the use of mechanical fans or other efficient means.

5. They shall provide brooms, brushes, and all other necessaries for the daily sweeping of floors of workshops and of such stoves as are entered by the workers, and for the cleansing of work benches and of stairs leading to workshops; and shall arrange that the floors of such workshops and stoves are sprinkled and swept every working day, and the scraps and dirt removed, and that work benches and stairs are cleansed at least once a week. The daily sweeping of floors of potters' shops shall be done after work has ceased for the day, unless there is some sufficient reason to the contrary.

6. They shall provide washing conveniences with a sufficient supply of water, soap, nail brushes, and towels, for all workers employed in the places and processes referred to in Rule 1; and the washing apparatus shall be in convenient proximity to the work places.

7. They shall arrange that the temperature of potters' workshops outside the drying stoves, when people are working there, shall not exceed 80° F. if the outside temperature is below 70° F.; and when the temperature outside is above 70° F., the inside temperature shall not be more than 10° higher.

8. They shall not allow any female under 16 years of age to be employed at treading the lathes used by turners.

Duties of Persons employed.

9. Every person to whom is supplied an overall suit or head covering shall wear the same when at the special work for which such are provided.

10. Every person employed in the places or processes enumerated in Rule 1 shall carefully clean and wash his or her hands and face before meals and before leaving the works.

11. Every person employed in dipping, carrying ware from the dipper, cleaning ware after it has been dipped, glost placing, china scouring, ground laying, majolica painting, or in any process in which lead is used, shall during the meal times leave the shops in which those processes are carried on, and shall not cook or eat any food therein at any time.

12. The measures taken by the employers for the ventilation of the various work rooms and stoves and for the removal of dust, shall not be in any way interfered with by the workpeople without the knowledge and concurrence of the employer or manager of the works.

13. Every male or female worker shall be responsible for the cleansing of that portion of the room in which he or she is employed, and shall see that the floors of shops and of such stoves as are entered by the workers are sprinkled and swept, and the dust, scraps, ashes, and dirt removed every day, and that the work benches and stairs are cleansed at least once a week. The sweeping of floors of potters' shops shall be done after working hours, either by themselves (*i.e.*, the workers) or by an adult male employed and paid by them and approved by the employer.

As to *new legislation*, the Committee deem it desirable that power should be given to some authority, imperial or local, to condemn such factories or parts of factories as are unfit for work. There are potteries which cannot be made fit for use owing to their bad structural arrangements or dilapidated condition.

With reference to the question how far the health of the workers would be improved by the introduction of new manufacturing processes, the Committee have devoted their attention to the problem of modifying the method of glazing earthenware so as to remove or diminish the danger of poisoning by lead.

At present, the raw glaze in which the ware is dipped is a mixture in water of flint, stone, a "fritt" compound of borax and other ingredients, and white lead or red lead. These lead compounds, especially the white lead or carbonate of lead, are known to be very dangerous on account of their easy solubility, and two suggestions have been brought before us with a view to meeting the evil.

One suggestion is, that only leadless glazes should be used on earthenware.

After carefully considering the evidence before us, we do not see any immediate prospect of such glazes becoming universally applicable to pottery manufacture, and we have therefore devoted our attention to the second proposal laid before us, which is as follows:—As already stated, some of the materials used in the glaze are added in the form of a fritt, that is, have been fused together at a high temperature into a coarse glass which is ground before use. It is proposed that all the lead required in the glaze should be first fused with these other ingredients, and only this "fritted lead" used in the glaze. In this way, it is suggested, the lead will be present in an insoluble, and therefore harmless, form, and yet the properties of the glaze will remain unaltered. As this process seemed to involve no very great alteration in the present methods of manufacture, we thought it worthy of our careful examination.

As will be seen in the appendix, the opinions of manufacturers differ considerably on the question.

Some firms are now fritting all their lead, and claim that it is an improvement on the older methods; others do not regard it as practicable.

However, the fact that more than one important firm is using it for all classes of work, shows that it is reasonable to suppose that the fritting of lead might ultimately be found universally practicable. We therefore decided to test for ourselves how far such fritted glazes were really to be regarded as non-poisonous, and with a view to throwing light on this question, requested Mr. Laurie to expose samples of lead fritt supplied by manufacturers to conditions as nearly similar as possible to those existing in the digestive organs.

The following is his report—

Report on the Properties of Lead Fritts.

It is customary in making up the glaze for pottery ware to add a considerable quantity of white lead or red lead.

The white lead is more commonly used, and is recognised as being a very poisonous lead preparation on account of its easy solubility in the juices of the stomach. Now it also is usual to add to the glaze a certain amount of "fritt," that is, of constituents fused at a high temperature into a rough glass, and it has been suggested that if all the lead required was fused up in this fritt it would then exist in a practically harmless form.

Some important evidence was brought before the Committee tending to show that such fritts were harmless, and it therefore seemed of importance to examine how far the lead in these fritts could be regarded as being present in a form insoluble in the stomach. I was therefore requested to apply certain tests with the view of throwing further light on the question.

I therefore obtained samples of fritts in actual use, and submitted them to examination. In applying the tests I have been guided by the experiments published by Dr. Oliver in his work on lead poisoning.

He there describes experiments showing that carbonate of lead is soluble both in the gastric juice and the bile, and he further proves that the active agent in the gastric juice is the free hydrochloric acid it contains, the pepsine exerting no influence.

I decided, therefore, to experiment on these fritts, both with bile and with weak solutions of hydrochloric acid, with a view to testing their solubility.

The first glaze I selected was some supplied to me by a manufacturer out of the dipping tub. It had therefore been very finely ground in water, thus rendering it more liable to be dissolved, and it consisted of a mixture of flint and stone, with two fritts, one containing about 16 per cent. of lead, and the other 30 per cent. of lead. I repeated with this material the experiments made by Professor Bedson for Dr. Oliver on carbonate of lead, treating it with bile in a "diffusion tube" for several hours at a temperature of 100° F. to 110° F., without dissolving out any trace of lead; thus showing that the lead it contained was not soluble in bile.

My next experiment was to treat it with weak hydrochloric acid. I found it necessary, however, to wash it first with water, as the water it was mixed with was strongly alkaline. After washing and drying, I treated 1 gramme with 50 cc. of hydrochloric acid containing ·3 per cent. of acid. I selected this strength of acid partly because it had been used by Dr. Oliver in his experiments, and partly because I thought it advisable to use an acid rather stronger than that present in the stomach, as the conditions for solution are probably much more favourable in the stomach than in a laboratory experiment. I found that on digesting for some time at 100° F. a considerable quantity of lead had been dissolved. Evidently, then, these fritts were not insoluble in weak acid, as I had hoped, and it became necessary to determine to what extent they were soluble as compared with other lead compounds.

I therefore determined to test them under similar conditions against a substance to be taken as a standard of solubility, and I selected for this purpose sulphate of lead. This substance is regarded by the medical profession as practically innocuous because of its insolubility. It is, however, slightly soluble in weak acid, though apparently not to a serious extent.

In each case 1 gramme of the substance was treated for three hours, at 100° F., with 50 cc. of ·3 per cent. hydrochloric acid. There was thus a large excess of free acid present, and the time and temperature corresponded roughly with the digestive process.

The results were as follows :—

Material used.	Per-centage of Raw Lead put in Fritt.	Per-centage of Borax put in Fritt.	Per-centage of Metallic Lead dissolved from 100 Parts of the Material used.	Per-centage of the whole Amount of the Lead present in the Material which was dissolved.	Remarks.
Lead sulphate -	—	—	1·21	1·77	——
Glaze from dippers' tub made up of two fritts.	Not known	Not known	6·67	—	A mixture of Fritts No. 1 and No. 2, with flint and stone.
Fritt No. 1 - -	16·0	28·8	5·41	33·8	——
Fritt No. 2 -	30·0	10·7	1·13	3·7	This fritt analysed, and and found to contain 30·3 per cent. of lead.
Majolica fritt -	60·0	None	7·78	12·9	This fritt is a silicate of lead, free from borax.
Fritt No. 3 -	28·9	Not known	5·61	21·6	Analysed and 26·0 per cent. of lead found.
White lead - -	—	—	41·23	—	That is, the acid dissolved the carbonate until saturated. More acid would have taken up more carbonate.
Seven grammes of a common tea-cup ground up.	—	—	0·21	—	——

On examining this table it is obvious that all these fritts are much better than raw lead, being much less soluble in weak acid, and therefore less dangerous to introduce into the stomach.

On the other hand they differ a good deal in solubility, and are in most cases more soluble than lead sulphate.

The solubility in acid evidently depends on two things, an excess of lead and an excess of borax.

For instance, the majolica fritt, while free from borax and containing nothing but the much more insoluble silicates of lead, but with a large quantity of lead present, dissolves to the extent of nearly 8 per cent.

On the other hand, if No. 1 and No. 2 Fritts are compared, it is evident that, although No. 2 has double the amount of lead, it is less soluble. While No. 1, with half the amount of lead but three times the amount of borax, is more soluble.

It is, therefore, evidently of importance, in order to obtain a perfectly safe fritt, to limit the amount of borax as well as of lead in the fritt.

While, therefore, fritting the lead no doubt diminishes the danger of lead poisoning for the workers, yet we cannot regard all fritts as equally innocuous, nor could we assume any fritt to be as harmless as lead sulphate, without first examining how far it is soluble in weak hydrochloric acid. I think, therefore, that it would be as well for the Home Office to suspend for a time its judgment as to how far a harmless preparation for glaze can be enforced, and in the meantime everything should be done to encourage the manufacturers to continue their experiments in fritted lead, both with a view to obtaining a satisfactory glaze and to having the lead present in as insoluble a state as possible.

Doubtless in this way a quiet revolution in the method of manufacture might be brought about, to the great benefit of the workpeople employed.

A. P. Laurie.

An additional report from Mr. Laurie, giving the results of further experiments on the solubility of fritted lead will be found in Appendix K., page 23.

The Committee recommend that steps be taken, by circular from the Home Office or otherwise, to bring before manufacturers the advisability of experimenting with, and testing the use of, glazes and colours in which all the lead has been fritted, and their effect upon the health of the workpeople. Also that the Committee should be empowered to continue investigations as to the composition of glazes and colours, with a view of finding out how far it is practicable to make a glaze that shall be harmless to those employed in the manufacture, and at the same time shall not injure the ware.

Further information is also required as to the temperature of potters' workshops and of ovens at time of drawing the ware, and the Committee have requested their colleague, Her Majesty's inspector of factories of the district, to make continued observations and records. We have already, in Rule 7, attempted to deal with the temperature of workshops, but do not consider the rule in its present shape as final, as we have fixed the limits of temperature very wide, and do not feel justified in going further at present. The enforcing of the rule in its present shape will throw further light on what is or is not practicable in this direction. The Committee trust that the effect of the rule will be that the moist heat of the drying stoves will be carried to the open air and not allowed to enter the workshops.

As to the ovens or kilns, no evidence of a sufficiently conclusive character was produced as to the temperature of ovens at time of drawing the ware, and looking at the difficulty of enforcing a rule on the subject, and the fact that the persons who draw ware from the ovens are adult males, the Committee decided not to recommend any rule on the subject at present.

Many matters not covered by the special rules were discussed by the Committee, and rules on the subject either decided to be impracticable, or, when proposed, were lost by failure to secure a majority.

Two of these subjects, however, the Committee desire to press on the notice of the authorities and of the employers, viz.:—The desirability of providing mess rooms for the workers, who will be prohibited by Rules 3 and 11 from having meals in the work rooms, and who live at long distances from their places of work; and the desirability of a periodical examination, by the certifying surgeon or other medical man, of all workers in processes in which lead is used or poisonous dust is generated.

The results of our inquiry appear to us, Sir, to justify your action in having declared "processes in the manufacture of earthenware to be dangerous or injurious to health,"

and we trust that they may also assist the Chief Inspector of Factories in suggesting the precautions necessary to remove or mitigate the dangers.

If it should be decided to adopt and enforce the "special rules" we have recommended we hope that manufacturers and workpeople will accept them and cheerfully obey them, with a view of taking away from one of the most beautiful, interesting, and useful of our manufactures, the reproach of being also one of the most unhealthy.

We have the honour to be, Sir,
Your most obedient Servants,

SAM. W. MAY,
H.M. Superintending Inspector of Factories, Chairman of Committee.

JOHN T. ARLIDGE,
M.D. and A.B. (Lond.), F.R.C.P. (Lond.).
J.P. for County of Stafford.

W. DUNNETT SPANTON, F.R.C.S.E.,
J.P. for County of Stafford.

A. P. LAURIE, M.A., B.Sc., F.R.S.E.,
Fellow of King's College, Cambridge,
Gilchrist Lecturer.

J. H. WALMSLEY,
H.M. Inspector of Factories.

WM. DAWKINS CRAMP,
H.M. Superintending Inspector of Factories, Secretary.

APPENDICES TO REPORT OF "POTTERIES" COMMITTEE.

APPENDIX A.

Secretary's Notes of the Proceedings.

By letter dated 21st April 1893, the Secretary of State appointed the following a Committee to make inquiry into the conditions under which the manufacture of pottery is carried on, with the object of diminishing any proved ill effects in the health of the workpeople engaged therein.

Dr. J. T. Arlidge, J.P., Stoke-on-Trent.
Mr. W. D. Spanton, J.P., Surgeon, Hanley.
Mr. A. P. Laurie, Chemist, London.
Capt. S. W. May, R.N., Wakefield.
Mr. J. H. Walmsley, Stoke-on-Trent, and
Mr. W. Dawkins Cramp, Birmingham.
The last-mentioned to act as secretary.

May 29, 1893. First Day.

Meeting at North Stafford Hotel, Stoke-on-Trent.
Present: all members of the Committee.
Capt. S. W. May, R.N., voted to the chair.

It was decided that the meeting should be private, and that the request of the newspaper reporters to be allowed to attend should not be granted; also that the services of a shorthand writer were not necessary.

The secretary read letter of appointment, the scope of inquiry was defined, and order of proceedings arranged.

The Labour Commission Reports, "Daily Chronicle" articles, and Mr. Cramp's report of November 1892 were brought under consideration, and replies from manufacturers' associations, operative potters' associations, and communications from individual operatives and manufacturers were read and discussed. The secretary also read a despatch from Sir E. Malet as to the use of lead in German manufactories, a report of interview of Messrs. Owen, Pickin, and Edwards with Mr. H. J. Gladstone, and letter from Dr. Arlidge.

The questions of automatic and mechanical ventilation and of lead poisoning were then discussed. It was arranged to receive evidence from operatives' associations and other workers the next day, and from manufacturers' association on Wednesday. Arrangements were also made for evidence to be received from M. Arnoux and Mr. G. Leason, of Minton's, Limited. A list of potteries to be visited on Thursday was drawn up, and the secretary requested to make arrangements. The secretary gave a short report of the proceedings of the day to the reporters of three newspapers. Mr. Laurie and Mr. Walmsley visited potteries in Stoke.

May 30, 1893. Second Day.

Meeting at North Stafford Hotel, Stoke-on-Trent.
Present: all members of the Committee.
Capt. S. W. May in the chair.

The following attended to give evidence:—

Mr. W. Owen, secretary of Operative Potters' Committee and National Order of Potters.

Mr. Thomas Pickin, secretary of Hollow-ware Pressers' Society and Sanitary Pressers and Mouldmakers.

Mr. Thomas Edwards, secretary of Ovenmen's and Saggar Makers' Society, representing also the dippers.

Mr. John Goodwin, secretary of Printers' and Transferrers' Society.

Mr. John Foster representing the flatpressers.

There were also present 11 workmen, mostly those who had suffered from lead poisoning, dust inhalation, excessive heat, or defective ventilation.

The examination of the witnesses was conducted on the lines of the proposed special rules, then of subjects not included in the special rules, and lastly of lead poisoning.

Rule 1. *Child under 14 not to work in process where lead is used.*—Workmen agree, except that Mr. Edwards "would like the age to be 21 for those actually engaged "as dippers. The men employed as dippers die off very "rapidly, and the introduction of youths into the "dipping houses produce very bad results. More "youths than men are now employed as dippers, and "if the Committee believe that youths are more susceptible than men to lead poisoning, they should be "prohibited."

Rule 2. *Occupiers to provide overalls and head coverings for workers in processes where lead is used.*—Workmen agree to rule as drafted, but think that the overalls, &c. should be washed on the factory premises.

Rule 3. *Prohibition as to taking meals in certain shops.*—Workmen agree, but think that manufacturers should provide meal rooms, as the workers have nowhere to go for meals. In a factory at Fenton 7 out of 10 live at Tunstall. Suggest the addition of the words, "except in an apartment provided for the purpose." Mr. Edwards does not approve of "glost placers" being included; but all agree that ground layers should be included.

Rule 4. *Mechanical means to be adopted for removal of dust in towing and china scouring, and efficient means to prevent dust inhalation generally.—Mr. Owen* is of opinion "that the word superfluous" before dust is unnecessary, and gives a chance for misinterpretation. In all processes in which dust is generated, mechanical means should be applied to remove the same. He still objects to workers having to blow dust off with their mouths, but would be willing to limit a prohibition as to this to "towing." The fans should be so constructed as to draw away the dust and also to blow it away, as at Mr. Turner's pottery. At a Hanley pottery the women are forced to "blow," and at a Burslem pottery blow pipes were put in, and were taken away because of the expense of the royalty in the patent. The men suggest, therefore, that "blow pipes" should be enforced. As to whether a rule enforcing "efficient means" would not do, there is a good deal in the idea. But in judging what is efficient or not, he would like meetings of manufacturers, operatives, and factory inspectors.

Mr. Edwards said that "in china works, the sifting "of flint and the placing of china are dusty and in-

" jurious processes; and that it is a bad arrangement " to dip, dry, and clean ware in one and the same " place."

Mr. Foster thinks that the "towing" might be done away with. The witnesses generally agree that in such shops as hollow-ware pressers, thorough ventilation is wanted, not fans to each bench. Mechanical fans are necessary in china scouring, but to provide them and the necessary power to drive them would probably cripple small manufacturers, which the operatives have no wish to do. They wish that the local factory inspector should be empowered to select the best fan, and that there should be some authority to judge as to the efficiency of a fan when it is put down. (It was pointed out that such questions will arise, and must, if possible, be arranged by masters, workers, and inspectors, with, if necessary, an appeal to the magistrates.) Workmen complain of inefficient ventilation, especially of the draughts so caused, and think some special rule ought to be provided. If section three of the Factory Act of 1878 provides for ventilation, some words should be inserted in special rules to draw attention to it.

Rule 5. *Provision of brooms, &c. for sweeping, and occupiers to see that is done.*—Workmen agree to rule, but would like the sweeping of floors, &c. to be done after work has ceased. If employers were compelled to employ men to do it at night, the operatives would be willing for the cost to be deducted from their wages. If this would be an infringement of the Truck Act it could not, of course, be enforced, and in that case they would agree to a rule that the workers shall engage and pay an adult male to sweep the shop at night. This could be added to Rule 12 (now 13).

Rule 6. *Provision of washing conveniences.—Agreed to.*

Rule 7. *Temperature of workshops and of kilns at time of drawing.—Mr. Owen* says at one hollow ware presser's shop he went to the heat was 130° Fahr., and in pressers' shops it is often 100°. By the application of a proper system of fan ventilation the evil of excessive heat could be lessened, while the ware would be dried quicker, as a dry atmosphere has been proved to drive the moisture out of the ware quicker than when the air in shop and stove is charged with humidity. Besides, for men, women, and young persons to be constantly employed in shops that are unduly heated, adds an unnatural and unhealthy exhaustion to that which naturally follows from their labour, and as they often have to go out into the cold, the transition means colds and chills, which adds greatly to the potter's liability to diseases of the chest. Since the introduction of steam pipes for heating and drying purposes, potter's shops have become more unhealthy; the workers, therefore, ask for a rule that no workshop shall be heated to a greater degree than 70° Fahr. They especially insist on the fact that the stoves require better ventilation to prevent the heat getting into the shops. With reference to the heat of ovens, the witnesses complain that the ovenmen are compelled to draw the ware when the heat inside the oven is from 150° to 200° Fahr. To prevent this they urge that the rule as to the temperature of ovens not exceeding 115° when ware is drawn be retained. They pin their faith to Rule 7 as proposed, and lay great stress on it.

Rules 8 to 12 (now 9 to 13) generally agreed to. The witnesses stated that some potters' shops are *overcrowded*, and that although each worker may seem to have sufficient cubic space, yet it is not sufficient where the heat is so great. They are further of opinion that "towing," if done at all, should be done in separate shops; and that moulds should be stored in separate shops. They request that a rule should be made, that boards used in dipping houses should not be used in potters' shops until they have been properly cleansed; that neither men nor women should be allowed to work at narrow benches face to face with each other, and that exhaust steam pipes should be so fixed that steam does not enter the shops.

Lead.—On the question of processes in potteries which cause plumbism, *Mr. Edwards* said that the workmen do not wish to injure the employers, but think that there is a substitute that might be used for lead in glazes and colours. We ought to do all we can to lessen the evil effects of lead. There are two gentlemen in the district whose opinions are valuable, M. Arnoux and Mr. John Campbell. These gentlemen use fritted lead, and this is suitable to nearly all bodies of ware. Chemists and practical men say the solubility is much lessened by fritting. If glaze in which all the lead has been fritted answers the purpose, the operatives think manufacturers ought to be made to use it. He produces specimens of ware and tiles, glazed with glaze in which all the lead has been fritted, many of them coloured, and some of them majolica. Produces a testimonial from R. Hammersley and Son, that " fritted glaze is as " consistent with practical potting as using the lead in " a raw state." The workers ask that tests should be made whether fritted lead is injurious or not, and then, that manufacturers should be asked to test whether it is practicable. The fritted glaze is an easier flux than raw lead. They propose that no raw lead shall be used in the composition of any glaze for earthenware or china. They ask that employers and operatives and practical chemists should make an inquiry, and report as to this. *Mr. Owen* added that the conservatism of potters is based on ignorance. The workmen have no proof that fritted lead is non-poisonous, but believe it to be so. Asks for a reply whether the Committee have power to test the fritted lead, as, if not, the operatives' association will memorialise the Home Secretary to give that power.

(For further evidence by these witnesses on this subject, *see* Fifth Day, June 2.)

The 11 workmen who were present—one of them a flat presser who had suffered from excessive heat of shop; another, a man who had suffered from draughts; others from lead poisoning, &c.—were interviewed by members of the Committee separately.

In the afternoon, M. Arnoux, of Minton's, Limited, attended, and gave the Committee the following information as to the use of lead:—

For 30 years he has been managing a department of Minton's works, and has not used *raw* lead. In his opinion fritted lead can be used universally without injury to the trade; it does better for colours, and increases the brilliancy of the ware. For glazing insulators at a Burslem pottery no *raw* lead is used, although there is 60 per cent. of lead in the glaze. In most potteries there is a variety of bodies in the articles made, but the same glaze would do whatever the variety of the biscuit. Fritted glaze has less tendency to craze than glaze to which raw lead has been added; it is possibly a little dearer, as a little is lost in fritting, and there is additional expense at the frit kiln, but the difference in cost would be very little. His opinion is that fritted lead is insoluble; if nitric acid is added it has no effect. He never knew of a single case of lead poisoning in the part of Minton's works, where all the lead is fritted. Ground-laying colours and majolica colours can be fritted, although they contain a higher per-centage of lead than glaze. There would be less danger with red lead than with white, and it suits some colours better. It is not so soluble as white. Thinks sulphate of lead could not be used, it is objectionable in glaze and colours; it may be used in glass, but would not do for earthenware. Instead of adding raw lead to glaze, potters should use, for softening, a flux containing a good deal of lead, but all of it fritted. He insists on it that fritted glaze is better for coloured and printed ware, as well as for white ware. Colours used in a glaze which has been fritted are not altered. Even the turquoise blue over glaze is fritted, and the colour is not affected. Red lead cannot be fritted.

Mr. Laurie and Mr. Walmsley visited potteries in Hanley.

May 31st, 1893. Third Day.

Meeting at North Stafford Hotel, Stoke-on-Trent.
Present: all the members of the Committee.
Capt. May in the chair.

The following manufacturers attended, having been deputed to do so by a Joint Committee of the Chamber of Commerce and Manufacturers' Association.

Mr. R. W. Young,
Mr. F. C. Moore,
Mr. John Ridgway,
} Representing the Staffordshire Potteries' Manufacturers' Association.

Mr. F. Rawdon Smith, representing encaustic tile manufacturers.

Mr. J. B. Shelley, representing china manufacturers.

Mr. S. W. Dean, representing glazed brick manufacturers.

As to the proposed special rules:—

Rule 1. *Child under* 14 *not to work in processes where lead is used.—Agreed to.*

Rule 2. *Occupiers to provide overalls and head coverings for workers in processes where lead is used.*—Manufacturers consider it desirable for the workers in the places and processes specified to wear overalls and head coverings, but consider that the operatives should them-

selves provide these articles. Dippers, for instance, get an extra wage, and have been accustomed to provide their own aprons, &c. Manufacturers would be willing to accept a rule that they should not employ a person who did not wear the overalls and head coverings, but that then it should apply to women and young persons only.

Rule 3. *Prohibition as to taking meals in certain shops.*—Agreed to, but will be difficult to enforce, and witnesses think that a notice affixed prohibiting the taking of meals should absolve the employer from further liability.

Rule 4. *Mechanical means to be adopted for the removal of dust in towing and china scouring, and efficient means to prevent dust inhalation generally.*—Manufacturers do not object to being compelled to provide fans for towing, as steam power is already in use, but it is thoroughly impracticable to ask small manufacturers to put in mechanical fans for china scouring. With reference to future manufactories, or new additions to present factories, they see no objection to a rule requiring fans to be put in to take away the flint dust from china scourers. But in present china works, where there is, as a rule, no power, fans are impracticable. A great deal of power is required to drive a fan. The cost of a gas engine and fan would be at least 30*l*. Mr. Shelley says it cost 300*l*. to put in the engine and fans at his works, but then his works were fitted for it, and he has no doubt it will pay in the end. (*See also* notes of visit to Mr. Shelley's works on June 1.) As to the latter part of the rules, the manufacturers request that the "dusty processes" shall be defined. For instance, a turning shop is not a dusty place, and turning is not a dusty process. The cuttings from the turning lathes are moist, but if allowed to accumulate will soon dry and then cause dust. As a rule, turners are required to take away the dried cuttings at frequent intervals. Fans would do more harm than good in a hollow-ware presser's shop, by causing the dust to be raised from the floor. Potters' shops will never be free from dust. In tile-making the whole process is "dust"; they use dust for making tiles.

Rule 5. *Provision of brooms, &c. and sweeping of shops.*—Agreed to, but suggest that if workmen's ideas as to sweeping at night are adopted, the person selected should be approved by the masters.

Rule 6. *Provision of washing conveniences, &c.*—Approved, but manufacturers object to being compelled to provide the soap, nail brushes, and towels, as experience proves that these articles are stolen as fast as they are provided. Asked whether they could not prosecute the thieves, they replied "You must first catch them."

Rule 7. *Temperature of workshops not more than 75° and of kilns at time of drawing not more than* 115°.—Manufacturers consider this rule most objectionable; it is difficult to gauge whether the temperature in summer is due to artificial means or to natural means. In the case of flat pressers, if they do not have a great heat in the stove they cannot get their work off. Mr. Young spent hundreds of pounds before he could get enough heat. Cannot prevent the heat coming out into the shops. The present stoves are a great improvement over the old stove-pots. Such a rule would very often prevent the workmen from working at all. The maximum proposed, viz., 75° F., cannot be maintained, and the rule could not be enforced.

Ventilation is the only mode of reducing the temperature, but if you over-ventilate the stove you get a chance of reducing the heat of the stove so that the ware would not dry, and of the shop so that the workers could not work.

As to the second part of the proposed rule, Mr. Young states that the temperature of an oven at time of drawing is nothing like 115°. The hottest temperature of 24 ovens, taken specially for this inquiry, was 82° F. These temperatures were taken directly the ovens were ready to draw. But it would not matter to him if such a rule were enforced; he only thinks it unnecessary and absurd. Adult men are able to take care of themselves. If they say an oven is too hot, who is to decide?—To the best of his knowledge, no oven is ever drawn at a higher temperature than 90° F. It is to the interest of the manufacturer not to draw an oven when it is too hot, as to do so would crack the ware. Mr. Moore took the temperatures of various ovens at his works, and found the average to be: biscuit, 77°; glost, 88°; or half-way down, 76°.

Rules 8 to 12 (now 9 to 13).—Generally agreed to.

Lead.—The witnesses stated that in their opinion it was quite premature to state anything about fritted lead; we cannot yet go into the question. Mr. Ridgway's experiments with fritted glaze turned out most unsatisfactory, the colours shifted, and rendered the ware useless. To compel the use of fritted glaze would cause a revolution in trade, and at one fell swoop the whole trade would be paralysed. What suits one man's ware does not suit another's. If, as is likely, crazing of ware should result from its use, our trade would be lost. To follow German examples would bring us down to German levels.

Mr. Young does not use more than 20 per cent. of lead in the glaze, and others not more than 25 per cent. If all of it were fritted, it is probable that when the ware got to America, it would craze, and we should lose all our trade. The adaptation of glaze to colours is a matter of experiment, and many manufacturers are making such experiments. In his own experiments so far, the result was that the glaze did not *cover* the ware.

Mr. Rawdon Smith, a tile manufacturer, uses fritted glaze almost universally, because he believes it to be insoluble; cannot say whether it would do for china and earthenware. It answers very well for tiles. The witnesses generally say it would take at least 12 months to test the matter of crazing. Chemical tests would not do. It would not be reasonable to give a manufacturer a choice of using fritted lead or of being subjected to extra restrictions if he used raw lead. They raised strong objections to a proposal that young persons under 18 or under 16 should be prohibited in "dipping." It is necessary to have a proper proportion of men and apprentices in the dipping house. (On the lead question, see also letters from manufacturers in Appendices E., F., G.)

In the afternoon, Mr. Ask and Mr. Gater, managers at Mr. Alfred Meakin's pottery, Tunstall, attended to give evidence on the heat of ovens at time of drawing. They said that 115° F. is not exceeded on the second or middle stage, but at the top it may be 130°, or in summer 145°, but it would only be the turn of each man once a fortnight to work at the top. This morning (May 31st) the top registered 130°, middle 110°, bottom stage 80°. The temperature of the biscuit ovens after two days' cooling is about 110°, and of glost ovens after 24 hours' cooling 115°. Mr. Meakin draws eight ovens a week, and never had a case of fainting or illness. His ovens cool more rapidly than in general, owing to better arrangements. If the temperature were reduced it would stop the output. There are no sulphur or other fumes inside their ovens. The fires are always drawn out.

Mr. Meakin finds costumes for ware cleaners; the hands wash them themselves, but have not, so far, stolen or illused them.

Mr. George Leason, managing director of Minton's, Limited, attended at request of the Committee, and said that it would be advantageous to the manufacturers to frit all the lead in the glaze before use. When he found that M. Arnoux was using fritted lead for majolica and ornamental ware, and that there had not been a case of lead poisoning in his department, he turned his attention to the matter Lead must be used in some form or other, and the disadvantages of fritted lead are that it takes 5 per cent. more lead, and it wears away the frit kiln. When lead is fritted together with the other constituents of the glaze, and all ground together, the glaze is of the same consistency throughout. He has used a fritted glaze for wall tiles for 12 years, and for the last eight months has used a similar glaze for china and earthenware. The ware is more brilliant. He has tested it at his own house by giving it constant rough usage, and no piece has yet crazed. The use of fritted lead enables them to do with fewer glazes; earthenware glazes reduced from six to two, and eventually to one. Does not think a rule prohibiting the use of raw lead would injure any manufacturer.

June 1st, 1893. Fourth Day.

Meeting at North Stafford Hotel, Stoke.
Present: all members of the Committee.
Capt. S. W. May, R.N., in the chair.

Secretary read letter from Mr. W. Owen, asking that operatives might give further evidence as to glazes. Also one from Messrs. J. Wedgwood and Sons (*see* Appendix G.) and other communications.

At 10.15, the Committee started for Hanley, where they visited a large pottery. In the flat pressers' shops the temperature was found to range from 76° to 80°, and inside the stoves from 91° to 100°. The boys have

to enter a part of some of the steam-heated stoves here, to utilise a part in centre not reached by the revolving shelves. The temperature in the open air on this day was 60°. In the towing shop a Blackman fan was working, and found to be very effective for carrying away the dust. The towing is done in a shop by itself, but there is no more dust than in a potter's shop. It takes a 6 horse-power engine to drive fan for eight towers. In the dipping house, the dippers and their assistants were examined. Boys of 15 were cleaning ware after the dipper, and it appeared to the Committee that this process might be done on a bench provided with a fan for taking away the dust. The dipping house is a lofty, well-ventilated building. The Committee then drove to Tunstall, where they went through all the departments of Mr. W. H. Turner's pottery, and saw his system of fan ventilation in practical application to towing, flatpressing, dipping, ware cleaning, &c. It appeared to be very effective, but on too elaborate a scale for ordinary use. It is applied for ventilation as well as extraction of dust. The plan is to carry away foul air at the point where it originates before allowing it to expand, and to carry away the dust before it rises. For this purpose exhaust fans are provided to carry away the foul air or dust, and also blow pipes or a blast to blow them away. (*See* Appendix H.) At another pottery in Tunstall visited by the Committee, the heat in the flat-pressers' shops was from 70° to 80°. The *stove* in the worst constructed shop is ventilated by a Blackman fan, with the result that the temperature of the shop is reduced 15° or 20°. The fan is hardly large enough for the space it acts upon, but even as it is, if it were not working the manager said the heat in the *shop* would go up from 80° to 95° or 100°. Boys do not enter the stoves here. The "towing" in one of the shops is done in the same room as the pressing, but all the towing tables are connected with exhaust pipes in which a fan is driven. The towing did not appear to be objectionable to the pressers, in fact, it is a question whether owing to the fans being constantly at work, it does not help to ventilate the shop. In another towing shop provided expressly for that process, a number of girls were at work, and all the dust was being carried away by a fan. The girls' hair and clothes were free from dust.

In the afternoon the Committee visited the china factory of Messrs. Wileman & Co. at the Foley, Fenton. The proprietor (Mr. J. B. Shelley) has recently put in a gas engine and fan for china scouring. The same power works a fan for carrying away the flint dust in the sifting process, and is also used for gold grinding and to rotate the brushes used in scouring. The work of china scouring is done by about half the number of women formerly employed, and an economy effected which will recoup the cost of installation. So far as the women employed at scouring are concerned, the benefit appeared very great. The process of ground-laying and also that of casting were examined here.

The Committee then visited a china works at Longton, where the usual system of china scouring is carried on. Three scourers were at work, in front of an open window, and with the ware on a perforated bench. The shop was full of flint dust, although the dust was at the same time going out of the window in clouds. One of the women said, "she had worked—on and off—at china "scouring for nearly 30 years, but few were so tough as "she is, and most of them were done up in one or two "years." All the women appeared to suffer from a dry hacking cough. The Committee were informed by the inspectors that this dusty shop and the very dusty process were fair samples of china scouring as usually carried on. After the return to Stoke, Mr. Laurie visited other works, and received from the chemist specimens of fritted glazes, &c., and information as to the use of lead in glazes and colours generally.

Captain May had to leave Stoke this afternoon for Burnley in his own district.

Friday June 2, 1893. Fifth Day.

Meeting at North Stafford Hotel, Stoke.
Present: all members of the Committee, except Capt. May.
Dr. J. T. Arlidge, in the chair.

At 9 a.m. Mr. W. Owen and Mr. T. Edwards attended, at their own request, to give additional evidence as to glazes. They suggest that Mr. Laurie should have some pieces of ware, and dip some in raw lead glaze, some in fritted glaze, and some in leadless glaze, and see which is most tenacious and covers the best. They maintain that leadless glaze is more "homogenous" to the bodies of the ware than a lead glaze. They admit that they now think that some lead is useful and probably necessary, and they would not now recommend the prohibition of lead, it would not be reasonable to do so without prolonged tests; but they would like the Committee to receive from manufacturers some specimens of glaze *without lead* and test them and report that they find them in actual use, also that members of chambers of commerce should attend some manufactory and see ware dipped in leadless glaze. They state that chemists are now supplying fritted lead (*i.e.*, glaze with a very large proportion of lead in it) for use to add to the frit instead of adding raw lead. They acknowledge that even if it is true that fritted lead is the best, and is non-poisonous, it would take the test of time to prove whether it is practicable.

The Committee then deliberated on the evidence already given; and decided to supplement it by asking Messrs. Alcock and Dawes and Johnson to attend at the adjourned inquiry, and give evidence as to how far the effect of lead shows itself upon women and children, and especially pregnant women and after confinement; how far the effect of dust inhalation has increased or diminished of late years, and whether women should be prohibited from working at dipping or from working at all in potteries for more than one or for two or three months after confinement. They also decided to ask Mr. Harrison, a colour maker, if he would favour them with his views as to the use of fritted lead in glaze and colours, not to ask him the composition of his colours, but his opinion as to how far majolica, ground-laying, and other colours are poisonous.

Dr. Arlidge and Mr. Spanton consented to make a joint report before the next meeting as to the medical part of the question, and Mr. Laurie a report from the chemist's point of view. Mr. Walmsley promised to take temperatures of shops, stoves, and ovens, and report.

The Committee then went through the special rules *seriatim*, and members made the following suggestions:—

1. That the age at which young persons should be engaged in dipping house work should be raised to 16, and it was debated whether women should be prohibited. Query, make a distinction between places where fritted lead is used and those where raw lead.

2. That the following should be added: "and have "the overalls, &c. washed on the premises, and provide "a place for ordinary clothes to be put during working "hours."

3. Query, add glost placing and ground-laying; also "no food to be eaten except in an apartment specially "provided for the purpose."

4. Will require remodelling.

5. Add "sweeping to be done daily after work has ceased."

6. Washing conveniences to be placed near the places of work.

7. Remodel rule to provide for summer temperature. Query, should not boys be prohibited from going into steam heated stoves?

8 to 12. Generally agreed to.

The following further questions were raised: No evidence that oven men do suffer from excessive heat?

Structural arrangements. Whether some one should not have power to condemn a pottery as insanitary or unfit for work?

Whether ground-laying should not be done in a shop by itself? Proposed special rule: "No noxious process "should be carried on in the same shop as any other "process.

Should there be a rule to prevent girls under 16 from working at potters' lathes, query also, wedging clay?

The secretary was requested to get copies of the regulations in force in foreign countries, especially in Germany.

Also to send to each member a summary of proceedings of the Committee up to the present.

The Committee adjourned until Wednesday, June 28th.

During the interval, the secretary received communications from Mr. Alcock and Mr. Harrison offering to give evidence on June 28; from sanitary engineers mentioned in Appendix I., as to ventilating and drying apparatus; from Her Majesty's Chief Inspector of Factories enclosing letter from secretary of Operative Potters' Association, Scotland, asking to be included in the inquiry, and a further letter from the Association to say that as the special rules would apply to Scotland,

they were satisfied; from Mr. Piercy, of Fenton, as to heat of ovens (*see* Appendix D.), from Mr. E. Dunn, suggesting that enamel and hardening-on-kilns in potteries should be closed each day at 1 p.m., and from Mr. J. Gratton, a pamphlet on smoke prevention.

June 28, 1893. Sixth Day.

Meeting at North Stafford Hotel, Stoke-on-Trent.
Present: all the members of the Committee.
Capt. S. W. MAY, R.N., in the chair.

Mr. T. W. Harrison, colour maker, Hanley, and *Mr. Harrison, Jr.*, potter's chemist, Hanley, attended, and the former, in reply to questions, said:—

The proportion in which *raw* white lead enters into glazes varies considerably; in white glaze from 15 per cent. to 30 per cent. Good glaze should not contain more than 15 per cent. of raw lead. In yellow or "cane" wares about 30 per cent. is used, in a soft glaze for common "Rockingham" teapots as much as 40 per cent. For practical purposes nearly all the lead is used *raw*. Vinegar or soda will set free the lead in very soft glazes containing a large proportion of raw lead. These soft glazes are not only injurious to the pottery workers but also to the public. Majolica ware is covered with a coloured glaze, and in this the proportion of raw lead is from 25 per cent. to 40 per cent. by weight. Considers it more injurious to the workers than any other, and has known of more cases of lead poisoning amongst majolica paintresses than amongst any other workers.

In printing, painting, and enamel colours there is little free lead. In ground-laying colours also very little, in some none at all; the injury to the workers in this department is due more to the dust than to the lead. The small proportion of lead in these colours will generally be fused or fritted.

When the glazes are mixed and fritted, they do not usually contain lead, it is added afterwards in a raw state. Produces a piece of good "fritt," containing all the component parts of glaze except lead, this fritt is reduced to a glass. Very clear, almost transparent, but a glaze containing lead in the fritt would be almost as clear. The fritting causes a change in a physical state rather than a chemical, and the benefit of fritting is very largely due to the physical change. White lead or carbonate is flocculent, very fine indeed. Because of this sub-division it readily enters into the system. When mixed with something which makes glaze and then fritted and ground, it is not so fine and not so fully subdivided as raw white lead, and then it is practically harmless. Such glaze is absolutely insoluble in water. If you add nitric or other acid it may be soluble, but it would require a strong solution of acid to dissolve it. It is true that fritts which contain a large proportion of alkali will dissolve in water, but ordinary glazes do not contain sufficient alkali.

As to the practicability of the use of fritted lead, he does not entertain any doubt, and produces specimens of ware dipped in a glaze in which all the lead has been fritted, also a plate half of which has been dipped in a fritted glaze and the other half in a raw lead glaze, and there is no appreciable difference. In his opinion, fritted glaze has no greater liability to craze than raw lead glaze, and it is as durable; it can also be used with any "body" made, and with satisfactory results.

Fritted lead is practicable for majolica and other colours, but it would be more costly, and it wears out the fritt kiln very fast. As a manufacturer of glazes, he would not be afraid of a law prohibiting the sale of glaze containing raw lead.

As to colours, if limited to innocuous articles, the trade could not be carried on; chromate of lead, copper, antimony, tin, and arsenic to a limited extent are used. Red lead or white lead are both so poisonous, that one cannot be recommended in preference to the other. Never used sulphate of lead, and does not believe it would answer, as sulphur in any form is the greatest enemy a potter could have.

As to the substitution of other and innocuous materials, he does not believe that barytes or borax or any other substance will do in place of lead. Has made a leadless glaze, but it is not so good. On the Continent where glaze without lead is used, it is on a hard semi-porcelain body. The temperature required to fire it would be destructive to English ware.

To prohibit the use of lead, would be highly detrimental to the trade, in fact would ruin it. Manufacturers ought not to be called upon at once to use fritted lead, it would take a long time to make experiments. Legislation might be adopted that after a certain date—one or two years—free lead should not be used. Whatever action is adopted should be tentative and gradual. The day is not far distant when raw lead should not be used.

The use of fritted lead would probably cost a little more, but would be of great benefit to the workpeople. It would lessen the risk of lead poisoning but might be more injurious from the point of view of dust, as the particles of dust of fritted glaze are sharp and have a jagged edge. After all, the main difficulty is with the men and women and young persons in handling the glaze. Some years ago he had several cases of lead poisoning, which he found to be due to the carelessness of the men in mixing and using the glaze. He built a mess-room, bath-room, lavatory, and adopted stringent regulations as to cleanliness of person and clothing, and not eating in the workrooms. Since then has had no illness. A great deal depends on the workers, and their use of the appliances supplied.

Mr. J. Alcock, certifying surgeon, Burslem, attended, and informed the Committee that he has had very few patients suffering from lead poisoning. Has made inquiries in manufactories, and examined a large number of persons working in the various processes in which lead is used, and is surprised to find how few persons suffer. He found a few with symptons of lead poisoning, especially amongst ware cleaners. At a majolica works in Burslem they use fritted glaze or colour, and the health of the workers is good. Their ages range from 15 to 31, and they have worked at that pottery from one to 17 years.

Is of opinion that the examination of young persons and children by the certifying surgeon should be periodical and not merely when they first go to work, and that there would be no practical difficulty in carrying out a periodical examination of all the hands working in a pottery, except that of expense.

As to dust inhalation, he finds the women who work in towing shops anæmic, but thinks that the heat is more prejudicial than the dust. He believes that potters' asthma and bronchitis have decreased of late years. Is of opinion that a month is quite long enough for a woman to be absent from work after confinement, and that girls under 16 should be prohibited from working at potters' lathes, although he has not any patients suffering from that cause.

The Committee then deliberated as to future proceedings, and the secretary gave an account of what he had done since the meeting on June 2, and read the letters he had received.

Mr. Laurie visited a pottery, and consulted with the chemist as to the results of various tests of glazes and colours.

June 29, 1893. Seventh Day.

Meeting at North Stafford Hotel, Stoke.
Present: all members of the Committee.
Capt. MAY in the chair.

Letters from Mr. Dawes, Medical Officer of Health, Longton, and from Birmingham and Wolverhampton manufacturers of enamelled sign plates, read. (*See* Appendix D., F.)

Joint report from Dr. Arlidge and Mr. Spanton read, and fully considered clause by clause, ordered to be inserted in report. (*See* pages 3 to 8.)

Mr. Walmsley produced table of the temperature of shops and stoves he had visited, showing that with an outside temperature of 65° to 74°, the shops were from 72° to 82°, and the stoves 80° to 98°, mostly flat pressers and hollow-ware pressers. (*See* Appendix D.)

Mr. Laurie made a report as to the tests of, and experiments with, glazes and colours, which he had made during the interval, and it was ordered to be inserted in the report. (*See* pages 10 to 12.)

The special rules were then considered and amended and left over for final revision as they appear in the report, pages 9 and 10.

June 30, 1893. Eighth Day.

Meeting at North Stafford Hotel, Stoke.
Capt. MAY in the chair.

The Committee considered and debated upon numerous proposals that had been brought before them, amongst others—

"That the certifying surgeon or a medical man "should be empowered to inspect periodically all the "workers in lead and dust processes"; and decided to recommend such a course, but not as a special rule.

"That females under 16 should be prohibited from "working at the treading of lathes for turners"; and

a special rule to this effect was carried by three to two, Mr. Walmsley not voting.

A very long discussion ensued on a proposal "that a "special rule should be made requiring occupiers to "arrange for a weekly or monthly visit by a doctor "who shall examine every worker employed in the "processes referred to in Rule 1." The Committee were divided in opinion, the non-official members being in favour, the official members against. The proposal was therefore lost, but is included in the recommendation given above.

"That the process of ground-laying shall not be carried on in the same shop as any other process." Agreed to as a recommendation, but not as a rule.

Rule 7 was again under consideration, and it was suggested whether it would not be better to do away with it, and wait until further tests of temperature could be made, when the rule could be made more definite and precise, and it was decided to retain the rule, to introduce the principle, and to try its effect as it stands before making it more stringent.

July 1, 1893. Ninth and Last Day.

Meeting at North Stafford Hotel, Stoke.

Present: all members of the Committee.
Capt. MAY in the chair.

Draft report considered and adopted. Special rules finally revised and adopted. Medical report and Mr. Lauries' report discussed again and adopted, and the secretary instructed to write out the report and appendices and send to each member for signature.

WM. DAWKINS CRAMP,
Secretary to the Committee.

APPENDIX B.

NOTES by Dr. J. T. ARLIDGE, J.P., re Manufacture of Pottery.

Conditions of manufacture divisible into two groups—

1. Those found in external surroundings.
2. Those found in the processes pursued.

§ Concurrent and subordinate conditions are found in the age, sex, habits, and modes of work of workpeople.

I. *External surroundings.*—These are for the most part accidental and remediable. They are found in—

(*a.*) The construction and position of the workshops, and in their fittings.
(*b.*) In their cubic capacity and ventilation.
(*c.*) In the modes of heating and lighting.
(*d.*) In the observance of general cleanliness and in provisions made for the same.
(*e.*) In the drainage and cleanliness of yards, water-closets, &c.
(*f.*) In arrangements for taking meals.

II. *Processes pursued.* — These vary somewhat in earthenware and china making, nevertheless are reducible to three groups, according as they are concerned with—

(*a.*) The construction of ware from clay and flint.
(*b.*) The firing of ware and proceedings coupled with it, as glazing and placing.
(*c.*) The finishing of ware by decorating with colours, gold and otherwise.

To whichever group they belong these processes are injurious to health and life by—

1. The dust of clay;
2. ,, flint;
3. ,, plaster;
4. ,, glazes and colours; or by heat, and by gases evolved in firing; and
5. By mixed dust arising from kilns and ovens.

They are further chargeable with danger accompanying the filling and drawing of ovens, and where machinery is employed.

1. The dust of clay is especially evolved in the fettling and towing of ware, in the work of pressers and turners, and, in lesser degree, in throwing and handlemaking.
2. The dust of flint is especially raised in china scouring and placing.
3. The dust of plaster occurs in the work of modellers and mould makers.
4. The dust of glazes and colours owes its evils to the presence of lead, and affects dippers and their assistants, the mixers and grinders of glazes and colours, ground layers, glost placers, and those engaged in majolica painting.
5. Heat and mixed gases and vapours attend the business of firing and oven work.
6. Mixed dust arises in connexion with the work of drawing ovens, and consists chiefly of coal and flint dust.

§ Concurrent conditions influencing the results of work in potteries are found in the age, sex, habits, and modes of working of artisans.

In general, the ill consequences of the manufacture of pottery are more pronounced in women and children, in workpeople who are intemperate and dissipated, who neglect cleanliness in person and work, and wear unsuitable or insufficient clothing, or who recklessly expose themselves to the cold and wet, and to the baneful circumstances of their calling.

Again, injurious factors obtain in the position maintained when at work, and in the movements necessary to the carrying on of work.

In regard to the presence of lead and its consequences it is desirable to ascertain—

a. The proportion in which it enters into the composition of glazes and colours.
b. The chemical and physical state in which it exists in those compounds, and the possible changes in its physiological properties it undergoes in fritted glaze.
c. The question of solubility of fritted glaze, and of the reactions upon it by agents with which it is mixed.
d. The use of fritted glaze in colours for ground laying.
e. The relatively poisonous property of red and of white lead.
f. The substitution of other and innocuous materials in place of lead.

Sex, age, and constitutional peculiarities exert manifest influence upon the liability to suffer from lead.

Children are more subject to the effects of *lead* than are adults. The same is true of women; and apart from the influence of sex, women are less fitted for employment in dipping houses, and where lead dust is thrown off, by reason of their loose dresses, the materials employed for them, and their long hair.

APPENDIX C.

DEAR SIR, Longton, June 28th, 1893.

IN reply to yours of the 5th ultimo, which I regret not having answered earlier, I beg to say I have been compelled to defer the reply, in the first place because I have no statistics, and, for a considerable number of years, no personal acquaintance with the class of workpeople about which you wish information, consequently I can only speak from remarks on the subject gathered from others from time to time; in the second place I had hoped to be able to attend your meeting and yet I could not possible decide whether I could do so until close on the day. I now find myself unable to attend it.

I have already said I have no statistics, so must answer your various important questions by quoting the experience of men, young in practice, but coming more in contact with such cases, and comparing their experiences of this day with my own of years ago.

Children 11 to 13 years are occasionally victims to lead and colour poisoning; they should not be allowed to work at either, they are too young and thoughtless to avail themselves of precautions.

Young persons, females chiefly, 13 to 18, are often poisoned, especially those working in oil and dust.

Women are very frequently afflicted from the same cause.

I think it must be highly objectionable, both on the mothers' and infants' account, for pregnant women to work in lead or some colours, the bad results are too frequent. Women, after confinement, cannot resume such work without injury to themselves and their offspring. As all who are thus employed suffer more or less, and in the case of females the bad consequences being more directly conveyed to their offspring, I am of opinion that females should *not* be allowed to engage in such employments. I believe that the ill-effects of dust inhalation have diminished of late years.

Women should be prohibited from working in potteries for a longer period than one month after confinement, six weeks should be the minimum; a great many require at the least two months.

Girls under 16 should not be allowed to work at potters' lathes. I believe that lead colic and potters' paralysis are not nearly as common as they were some years ago.

Abortion and premature births are not uncommon in women poisoned by lead or dust colours.

I am sorry not to be able to assist more amply in this very important inquiry. It is a question pregnant with important consequences to the people of this district. The vigour or decline of a great portion of the present rising and future generations depend upon the inquiry leading to satisfactory legislation on the subject.

I remain, &c.
(Signed) W. J. DAWES,
Wm. Dawkins Cramp, Esq., M. O. H.
Her Majesty's Superintending Inspector of Factories.

APPENDIX D.

TEMPERATURE of POTTERS' WORKSHOPS and STOVES, taken by Mr. J. H. WALMSLEY, June 1893.

Out of Doors.	Shop.	Stove.	Heated by.	—
Degrees. 70	Degrees. 72	Degrees. 98	Steam	Flat pressers.
—	75	92	„	„
70	78	84	„	Hollow pressers.
74	80	90	Fire	Flat pressers.
74	78 and 82	84	„	„
65	70	—	Steam	Hollow pressers.
70	80	88	„	„
70	80	—	„	Flat pressers.
—	72	80	„	Hollow pressers.
—	80	—	„	Flat pressers.
—	80	96	Fire	Hollow pressers.
— (dull.)	70	—	Steam	„
— (dull.)	72	—	„	„
68	74	—	„	„
68	76	—	„	„
—	75	—	Fire	Flat pressers.
—	72	—	„	Hollow pressers.
70	80	94	Steam	Flat pressers.

OVENS.

One oven apparently over 150, fire drawn at 5 a.m., half emptied at 1 o'clock.

	Degrees.
1 biscuit oven nearly empty	- 90
1 „ half „	- 100
1 „ nearly „	- 88

From Mr. W. E. PIERCY, Fenton Potteries, June 2, 1893.

In accordance with my promise to you I have carefully registered with thermometer the ovens we have drawn since Monday last. You can take the register herewith sent as a fair average of both our biscuit and glost ovens. Of course they would vary slightly according to the atmospheric temperature, but as we always give the same time to each oven to cool, they could vary very little. Our ovens are so arranged that we can get two or three currents of air to play on the ovens, and can cool them down in as short space of time as would be safe to the contents.

Biscuit oven drawn 30th May, registered at 10 a.m., centre 96 degrees, back 101 degrees. This oven was fired up on Friday, 26th May, and was cooling three nights and two days with clammings down.

Glost oven (large) drawn 31st May, registered at 10 a.m., centre 110 degrees, back 124 degrees. This oven was fired up at 2 p.m. on Monday 30th, and was cooling two nights and 1½ days with clammings down.

APPENDIX E.

Extracts from Letters from Two German Manufacturers of Pottery as to the Law in Germany.

1. In reality there is no special law in Germany (known by us) about glazes on earthenware and about dust, but there is a general prescription in the *general-ordnung*, which is like a law, prescribing that everything injurious for the health of the workman must be avoided.

In reality I have for the last two years made all mechanical installations necessary for taking dust out of our rooms, and I am very satisfied with the result.

With regard to raw lead, I have reduced the proportion as much as possible by using more borax or boracic acid.

The lead is added to the frit in the frit kiln, and in some few cases the white lead is put into the mill in a per-centage which will not exceed 10 per cent.

2. There is no law in this country that compels manufacturers not to use more than a limited p rcentage of raw white lead in glaze.

There are laws that compel manufacturers to ventilate the rooms in a sufficient manner, and that compel them to build the workshops a certain height.

All men or women that work in the lead have to take their meals in rooms away from the workshops, and we have to provide extra washing stands and clothing and soap for them.

But the worst of all is that we have a law in our country that makes you responsible for any damage done in that way to a workman, whether it is the direct fault of the manufacturer or not, this law goes a long way. I had to pay a dipper that was affected by the lead and lost the use of his eyes.

We used to use our raw white lead in the glaze, but after the experience we had, we now frit it all.

APPENDIX F.

Extracts from Letters from Two English Manufacturers of Enamelled Iron Plates as to the "Fritting" of Lead.

1. You are perfectly right in stating that in enamel works like ours the lead is vitrified, and that no raw lead is added after the fusing with the exception of one colour, for which there is very little demand.

There is not the slightest doubt that the lead is far less dangerous to the workpeople when vitrified. Nevertheless it is then dangerous, and all enamel makers have to contend with illness through lead poisoning, although no free lead is used. The fact is the acids of the stomach do dissolve glass made from lead.

2. We beg to state that we incline to the opinion of the workpeople you mention, that if the oxide of lead contained in the glaze is fritted before being ground for use, that the danger of lead poisoning is greatly minimised, if not entirely avoided.

We always use oxide of lead vitrified (fused into a glass), and do not add any raw lead when grinding.

If I may venture upon a suggestion regarding the grave subject you are inquiring into, it is that a chemical expert of the highest standing should decide this question of "fritted" lead by actual experiments, say, for instance, he takes flint glass and decides if lead poisoning can be communicated from it, and if, as we believe, it cannot be, add larger proportions of lead to the glass until a point of danger is reached.

A restrictive rule regarding the proportion of lead that may be safely used, would not injure any interest, and would clear up the present uncertainties on the part of both employers and employed.

APPENDIX G.

Extracts from Letters from Manufacturers of China and Earthenware.

From Messrs. J. Wedgwood & Co., Etruria, May 27, 1893.

Factory Act Inquiry.

We shall be much obliged, should the question of restriction of lead in glazes be raised at the above inquiry, if this letter could be brought to the notice of the Commissioners.

Any interference with the amount of free lead in glazes would mean the absolute closing of one branch of our manufacture, in which we have again and again tried to use fritted lead without success, and it would seriously cripple other branches.

From the Worcester Royal Porcelain Co., May 17, 1893.

Earthenware is not made in Worcester, only china and semi-porcelain and a vitreous stone ware, and the glazes for these bodies would not, we think, be suitable for earthenware.

The glaze used at our "Grainger works" in St. Martin's Place is especially prepared to suit the china and semi-porcelain made there, and is known in the trade as a "Barytes" glaze, we have not felt justified in introducing it for general use, as the results cannot be relied upon. We have experimented for years with glazes, but have not succeeded in dispensing with lead in its raw state; when fritted the character is so altered that we have failed to successfully work it.

From Messrs. T. C. Brown-Westhead, Moore & Co., Cauldon Place.

The use of Red and White Lead.

Our practical opinion in this matter is, that in the first place, the general use of lead should be somewhat modified, in that it should be used only in proper quantities to arrive at the real purposes for which it is required. We think that undue excess of lead, in many cases, in the common glazes, such as "Rockingham," raw majolica glazes, and the cheaper sanitary glazes, has done much to add to the troubles arising from lead disease.

To fix any exact per-centage of lead to be used would be to practically paralyse the pottery manufacturer's trade.

We would earnestly call your attention to the impossibility of any such action as has been suggested, viz., that a leadless glaze (*so-called*, as it is admitted a per-centage of lead in some cases has to be added) can be supplied to us by outsiders.

We have in use, perhaps, 20 different glazes, each one the result of great care and experience, and, of course, only suitable to our individual requirements; in proof of this, we may add that some of our colours and bodies date back over a century.

Our long experience of the district proves to us that to make pottery satisfactory requires a very close, personal, and daily acquaintance with its almost endless technicalities. We have, however, made many experiments of fritted lead, &c., which are certainly encouraging, and invite further effort. We are makers of tiles ourselves, but we do not see that a tile glaze, said to be innocuous, and giving satisfaction, is a criterion for glazes suitable to general pottery.

In conclusion, we would add, whilst some manufacturers appear with the best intentions prepared to carry out new systems, we think, in our candid opinion, that alterations in this important matter should not at first be widely made, but, as we have said, first modified and then by patient experiment carefully followed up, for time is the only true test; or, very probably, the best endeavours of the most charitably minded may result in an unforeseen change as to the enduring quality of the pottery, which would be almost unsurmountable, and give into the hands of foreign competitors the very thing which they could most desire.

From Mr. Cecil Wedgwood, Etruria.

Towing of flat is not carried on at our works, so of this process we cannot speak. China scouring is carried on, and here we have adopted a fan, which carries off the flint dust.

It would be impossible on our works and on many old works to apply the fan system to all shops where flat pressers, hollow-ware pressers, turners, ware cleaners, &c. are employed. Neither, in our opinion, is it necessary.

We have plenty of motive power, but it would be impossible to carry the requisite shafting through the different disconnected shops, and if it was insisted on would mean the closing or rebuilding of our works.

The dust in flat pressers, hollow-ware pressers, and turners' shops is not occasioned by the work itself, but is due to clay dried and trodden into dust; and proper care in sweeping the shop and sprinkling the floor with water, would seem to us more effective than a fan, which must draw all the dust off the floor past the mouths and nostrils of the workpeople.

Potters work in plastic clay, so with due precautions as to cleaning the shops, no injurious amount of dust ought to be created.

Lead poisoning.—We should be delighted if we could in any way minimise the danger connected with work in which lead compounds are used. We have tried the plan of "fritting" the entire glaze, but without success so far. We are now working at this question, but it is one of extreme difficulty. The glaze must suit the body of the ware, the colours of the pattern printed under the glaze, the colours and gold applied on the surface of the glaze. It is extraordinary what a slight change in composition will entail a large loss in defective ware.

One of the most damaging faults to a potter's credit, *i.e.*, "crazing," does often not appear until a year or so after the goods have left him, so that any experiments would have to be tried on a large scale over some years, and we are always very loathe to change our mixings on which our reputation of 130 years is built. Hence this question is one of extreme difficulty.

It is extremely difficult to enforce care on the dippers and others employed in the glaze. When asked for the nail brushes, soap, and towels provided by the masters for their use, they generally reply, "They are in the cupboard." It does not seem to occur to them to use them. Some constitutions are far more liable to suffer from lead than others. No dipper should go on after he has had the first signs that he is suffering from the lead.

He should then take to "placing" or some other branch to which he is fitted. But the good pay and short hours, which are intended to make up in a certain degree for the danger attending a "dipper's" work, act as an inducement for a man to go on at this trade when it is wiser he should stop.

Care in cleaning the hands and nails before eating, not eating in the workshops, properly dusting the smocks and taking them off before meals, are all necessary points to be attended to.

APPENDIX H.

From Mr. W. H. Turner, Alexandra Works, Tunstall, on his Ventilating Apparatus.

A long series of experiments with air and dust, commencing in 1877, has led to the discovery of an evenly balanced current of air which can be kept under control and regulated at any given point.

Taking the case of towers, whose duty it is to produce a highly polished surface on the plate in the clay state when it is perfectly dry.

This operation is usually performed by women, and consists in applying sand-paper to the plate whilst revolving, thus creating an amount of fine dust which impregnates the atmosphere, and has such disastrous effects on their health.

To lessen the evils attending the inhalation of this impure air, extracting currents of air are caused by exhaust fans, which are placed to the best advantage.

The greatest portion of dust is conveyed into the lungs when the tower blows off with her mouth the finest particles of dust that the extracting current fails to lay hold of, as the average number of plates which the tower has to blow dust off with her mouth (in order to make good work) is about 600 (hundred) daily, it is easily conceived how this dust when at liberty settles on their dress, also the walls and ceiling of the workshop.

The introduction of an injected current of air in connexion with the extraction current so as to create an evenly balanced volume at any given point, is practically found most efficient.

This injected current is always assisting the "tower" in her work without the effects of draught; it keeps the clothing free from dust; all dust is immediately carried away from sand-papered or dusty ware or moulds before it can impregnate the air breathed by the operatives.

The room in which this evenly balanced volume of air is continually circulating can be rapidly released from dust caused by cleaning and sweeping or passing and repassing of the workpeople.

With the evenly balanced volume of air grasping and carrying off the dust at the point where it is created before it is permitted to expand, it is impossible for it to enter the eyes, ears, nose, or mouth of the operative.

China scouring, an operation usually performed by women, requires the dust collecting by means of evenly balanced current of air at the point where it is made without allowing it to expand, so that there is no necessity for any further protection, inasmuch as the head of the worker is always surrounded by pure air. The cost of perfecting this system, so that the saving would amply repay the manufacturer for his outlay in three years, has not yet been ascertained; there is no doubt that it can easily be accomplished.

Ware cleaning, usually performed by girls, is the levelling of the glaze when perfectly dried on the ware, by rubbing with the hands in a warm atmosphere;

thus all the fine particles of lead are kept in suspension, and readily have access to the body, through the nose, eyes, and ears. Here, under the new conditions of ventilation in the form of an air curtain, it is practically proved that the poisonous dust cannot be inhaled, and the head is surrounded by pure air, without danger to children and young persons.

The process can be easily adapted to existing works, and without a large outlay, and will easily repay itself in the increased facility of manufacture.

There are no conditions under which poisonous gases cannot be controlled in all staple trades, so that the wearing of goggles and respirators can be dispensed with.

APPENDIX I.

CATALOGUES, PRICE LISTS, &C., HAVE BEEN RECEIVED FROM THE FOLLOWING VENTILATING AND SANITARY ENGINEERS.

Blackman Ventilating Co., Limited, 63, Fore Street, London.

Sturtevant Blower Co., 73, Queen Victoria Street, London.

Robert Boyle and Sons, 64, Holborn Viaduct, London.

Baird, Thompson, & Co., 159, Queen Victoria Street, London.

APPENDIX K.

EXPERIMENTS ON THE SOLUBILITY OF FRITTS.

In my first report on fritts (page 10), I pointed out that the solubility of the lead in weak hydrochloric acid, depended both on the amount of lead present and on the amount of borax present in the fritt.

With a view to determining with such exactness as was possible, what were the limits within which borax and raw lead might be added to a fritt, I asked Mr. G G. Leason, of Minton's, Limited, to prepare a set of experimental fritts containing varying quantities of borax and white lead, along with Cornish stone, sodium carbonate, flint, and whitening. These fritts, after being made, were ground in the usual fashion, and sent to me by Mr. Leason, ready for the dipping tub.

The following table shows the per-centage of borax and white lead contained in these fritts.

No. 1.

PER-CENTAGE OF BORAX AND WHITE LEAD IN FRITTS.

Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Borax - -	10	20	30	10	20	30	10	20	30	10	20	30	10	20	30
White lead - -	10	10	10	20	20	20	30	30	30	40	40	40	50	50	50

A gramme of each of these fritts was treated with ·38 per cent. hydrochloric acid for three hours at from 100°–110° F. At the same time some sulphate of lead was treated in the same way as a check experiment. The amount of sulphate of lead dissolved was ·9 per cent., being practically the same as the amount dissolved in the former experiments.

On estimating the amount of lead dissolved from each of these fritts, the conclusions of my previous report were confirmed in a remarkable manner, the amount of lead dissolved varying both with the amount of lead present in the fritt and the amount of borax present in the fritt.

These results are clearly shown in Table 2. Along the top of the table are placed the per-centages of raw lead in the fritt, and down the side of the table the per-centages of borax in the fritt. Consequently, in order to find any fritt mentioned in Table 1, it is only necessary to draw a line down Table 2, starting from the per-centage of raw lead it contains, and along Table 2, starting from the per-centage of borax it contains, to find the square corresponding to that fritt.

On looking at Table 2 it will be obvious at once that the amount of lead dissolved increases horizontally with the increase of the amount of lead present, and increases vertically with the amount of borax present. We may probably assume for the present, until further light is thrown upon this question by the medical authorities, that fritts in which less than 3 per cent. of the lead is dissolved are practically harmless. All such fritts have been printed in heavy type in Table 2.

No. 2.

Per-centages of Borax in Fritt.	Per-centages of Raw Lead in Fritt.				
	10	20	30	40	50
	Per-centages of Lead dissolved.				
10	**·3**	**·5**	**2·8**	5·0	12·0
20	**·6**	**2·4**	5·0	13·0	15·0
30	**1·3**	6·0	14·0	20·0	36·0

NOTE.—In the use of fritts in which the per-centage of lead and borax added together amount to 60 and upwards, some of the lead chloride formed separates slowly in working, and in the fritt containing 30 of lead and 30 of borax the acid is saturated.

On comparing these fritts one with another we find that we can sum up the results of the inquiry in a very simple rule, viz. :—

If the per-centage of raw lead and the per-centage of borax in a fritt do not amount, when added together, to more than 40, the fritt may be regarded as practically harmless; but if the per-centage of lead and the per-centage of borax, when added together, amount to more than 40, the fritt is probably too soluble to be safely used.

It would be interesting to know whether manufacturers of fritts consider this limit practicable for ordinary glazes. It will be noticed at once that this rule would not include majolica fritts, and that therefore, while doubtless majolica fritts are far less dangerous to use than raw lead, it would be a great mistake to regard them as non-poisonous.

It would be a matter of some interest to know how far the fritts used in the enamel plate making, and which have proved dangerous to health, agree with the standard here laid down.

I need hardly say that I regard this standard merely in the light of a temporary working hypothesis, the ultimate justification of which must depend upon medical evidence.

It must further be understood that these results might possibly be modified in the case of any particular fritt by an alteration in the proportions of some of the other ingredients.

A. P. Laurie.