FOREWORD

This information circular is Part II of a Bibliography on Rock Bolting Methods in Mining Practice and contains abstracts from world literature for the decade 1958 to 1967 inclusive. Part I was published by the Mines Branch in 1968 as Information Circular IC 207 and covered the period dating back from 1957.

As before, this work is the result of an extensive search of the published literature describing rock bolting practice in various countries. The bibliography includes abstracts which are intended to make this a useful and convenient reference work for both mining and operational staffs.

The bibliography was produced by the Mining Information Centre of the Mines Branch as a Canadian contribution to scientific knowledge.

John Convey,
Director,
Mines Branch.

Ottawa, March 2, 1970.

AVANT-PROPOS

La présente circulaire d'information constitue la 2[e] partie de la Bibliographie sur les méthodes de boulonnage dans les exploitations minières, et contient des résumés d'études publiées dans le monde entier entre 1958 et 1967 inclusivement. La 1[ère] partie a été publiée par la Direction des mines en 1968 dans la Circulaire d'information IC 207 et couvrait la période antérieure à 1957.

Comme précédemment, cet ouvrage est le résultat d'une recherche importante sur les publications qui décrivent les méthodes de boulonnage employées dans divers pays. La bibliographie comprend des résumés destinés à en faire un ouvrage de référence utile et pratique pour les travailleurs des mines et les agents d'exploitation.

La bibliographie a été établie par le Centre d'information minière de la Direction des mines en tant que contribution canadienne à la science universelle.

John Convey,
Directeur,
Direction des mines.

Ottawa, le 2 mars 1970.

Mines Branch Information Circular IC 241

BIBLIOGRAPHY ON ROCK BOLTING METHODS IN MINING PRACTICE

PART II: ABSTRACTS FROM WORLD LITERATURE, 1958 TO END OF 1967

by

A. E. Gardner*

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SYNOPSIS

Issued as Part II of a series, this information comprises a further installment to assemble all published information on rock bolting methods in mining practice. Both publications now cover to the end of 1967.

In this information circular are 256 additional abstracts grouped as before and numbered from 281 to 536. The Authors Index includes abstracts 1 - 280 in brackets as well as references by number from 281 to 536 to the current volume. Chronology is from late to earlier.

Three appendices list Conferences, Suppliers of Equipment, and Sources of Information. Indexes are included of Authors, of Companies and Other Public Bodies, and of Subjects.

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Direction des mines

Circulaire d'information IC 241

BIBLIOGRAPHIE SUR LES MÉTHODES DE BOULONNAGE DANS LES EXPLOITATIONS MINIÈRES
PARTIE II: RÉSUMÉS D'ÉTUDES PUBLIÉES DANS LE MONDE ENTIER DE 1958 JUSQU'À LA FIN DE 1967

par

A. E. Gardner*

RÉSUMÉ

Ce recueil, qui constitue la 2e partie d'une série, forme une nouvelle étape dans la compilation de tous les ouvrages de référence sur les méthodes de boulonnage employées dans les exploitations minières. Les deux publications donnent la bibliographie jusqu'à la fin de 1967.

La présente circulaire d'information contient 256 résumés nouveaux, classés dans le même ordre que dans l'ouvrage précédent et numérotés de 281 à 536. L'index des auteurs comprend les références des résumés 1 à 280 (entre parenthèses) et des résumés 281 à 536 contenus dans le présent volume. L'index chronologique va des plus récents aux plus anciens ouvrages.

La liste des conférences, des fournisseurs de matériel et des sources d'information est donnée dans trois appendices. Les index indiquent les noms des auteurs, des sociétés et autres corps publics, et les sujets.

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*Agent technique, Centre de recherches minières, détaché en août 1969 auprès du Centre d'information minière, Direction des mines, ministère de l'Énergie, des Mines et des Ressources, Ottawa, Canada.

AUTHOR'S PREFACE

Historically, the ten-year period which followed 1957 seemed marked by difficulty in maintaining bolt tension. As before, concrete grouting continued to be used to minimize bolt movement, but also, new quick-setting resins were introduced to fix the bolt in place.

When grouting is applied to part of the bolt or bar length it is often referred to as "distributed anchorage", in distinction to the normal slotted-wedge or expanding-shell types, whose anchorage is essentially at a point.

Hydraulic apparatus has been reported from South Africa, where it is said to be in use to install stud-bolts quickly and accurately, even with unskilled labour.

The literature contains many articles which discuss distributed anchorage bolts, ways of installing bolts at the correct tension, and the need for a reliable indicator of bolt tension after installation.

References have been arranged chronologically, either according to subject matter or to country of origin, the most recent being placed first. Whenever the original article was in a language other than English, the title, transliterated where necessary, has been included in the original language. The translated title in English follows foreign titles in brackets. When the original article was not seen, the reference has been marked by an asterisk (*).

The following abstracting sources were used to compile this bibliography:

1. Applied Science and Technology Index,
   H. W. Wilson Co.,
   New York, USA.

2. Centre d'Etudes et de Recherches des
   Carbonnages de France,
   Service Documentation,
   35 rue Saint-Dominique,
   Paris.

3. The Engineering Index Inc.,
   Sheridan Printing Co.,
   345 East 47th St.,
   New York 10017, USA.

4. Fuel Abstracts, Department of
   Scientific & Industrial Research,
   HMSO Stationery Office,
   York House,
   London W. C. 2.

5. IMM Abstracts,
   44 Portland Place,
   London W 1, England.

6. Safety in Mines Research Establishment Abstracts,
   Ministry of Power,
   Red Hill,
   Sheffield 3, England.

7. US Government R & D Index,
   Clearinghouse,
   Springfield, Va. 22151, USA.

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A.E. Gardner

Ottawa, March 1970

CONTENTS

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A. THEORY

281. PASHKOV, A.D. and ROGIZNYI, V.F.
Raschet parametrov shtangovoi krepi v vertikal'nykh vyrabotkakh (Calculating the parameters of support bolts in vertical openings).
Gornyi Zhur. 1967 (12) 24-27.
A theoretical evaluation of the triaxial stresses involved.

282. KNILL, J.L., FRANKLIN, J.A. and RAYBOULD, D.R.
A study of the stress distribution around rock bolt anchors.
Proc. C.I.S. Rock Mech. 1966 2 341-345.
An attempt was made to measure the stresses imposed on rock masses by rock bolts. The implications of this study are discussed in the light of current rock bolting practice.

283. STEFANKO, R.
Stabilizing underground excavations.
Mineral Ind. 1965 35 Dec 1-6.
An application of rock mechanics principles can lead to optimization of support systems. The importance of rock mechanics research must be recognized and supported by mining companies.

284. PANEK, L.A.
Design for bolting stratified roof.
Trans. A.I.M.E. 1964 229 113-119.
Consolidates results pertinent to rock bolt design for horizontal stratified mine roof; explains how roof bolts are installed and their anchorage capacity is measured. Excludes objectives other than for horizontal strata.

285. COATES, D.F.
Rock mechanics principles.
Cdn. Mines Br. M. 874, 1965 3-28/31 and 7-15/26.
A brief exposition of the considerations whereby adequate anchorage capacity for rock bolts and rock anchors is obtained.

286. RICHTER, R.
Grundlegende Betrachtungen zum Ankerausbau (Fundamental considerations of roof bolting).
Bergb.-Wiss. 1964 11 393-402.
The analysis of conditions in which roof bolting can be used determines the practicality of using this method of roof support. The different theories of roof bolting are discussed and general conclusions are presented.

287. LANG, T. A.
Theory and practice of rock bolting.
Trans. A. I. M. E. 1961 220 333-348.
An illustrated and detailed study of the types of rock bolt and anchorage tests which were used for the Snowy Mountains project in Australia.

*288. GOCMAN, R.
Die Berechnung von Ankerausbau (Calculation of roof bolting).
Przeglad G'orniczy 1961 17 (9) Sept 468-472.
The theory underlying the calculation and the use of Panek's nomogram to determine the coefficient of roof reinforcement is explained. A typical example for a roadway is given. 2 refs.; 4 figs.

289. EVANS, W.H.
Roof bolting and the stabilization of natural arches on roadways.
Colliery Eng. 1960 38 (437) 293-296.
The theory of roof bolting is reviewed and it is suggested that the stratified and fractured bed is bolted into blocks, which perform the arch function in the same way as the wedge-shaped or Voussoir stones in a builder's arch.

290. HUGON, A. and COSTES, A.
Le boulonnage des roches en souterrain (Underground roof bolting).
Paris: Eyrolles: 1959: 179.
The theory of rock bolting; calculations; a description is given of the types of bolt available in France; hydraulic and mechanical pull tests; torque tests, and concrete anchorage.

291. CORLETT, A. V.
The why of rock bolting.
Can. Mining J. 1958 79 (9) 99-102.
The author discusses the classification of rocks, the stresses around a mine opening, how ground may be supported, and why the likelihood of failure can sometimes be reduced by good rock bolts properly placed.

See also abstracts

(366) STRYGIN: Choice of rockbolt diameter.
(382) KRIPPNER: Positioning of bolts.

B. TESTING

292. NESTERENKO, G.T., SKOZOBTSOV, B.S. and AFANAS'EV, Yu S.
Issledovanie napryazhsnnogo sostoyaniya armatury zhelezobetonnykh shtang ustana virvaenya v krovle ochistnyakh kamer (Investigation of the stressed state of the reinforcement in concrete roof bolts driven into the roofs of rooms).
Gornyi Zhur. 1967 (3) Mar 32-34.
Results of tests using up to twenty strain gauges at one time indicated that the stresses are unevenly distributed over the roof bolt. Maximum stresses seem to be related to the bedding plane separations.

293. UNDERWOOD, L.B. and DISTEFANO, C.J.
Development of a rock bolt system for permanent support at NORAD.
Trans. A.I.M.E. 1967 238 30-55.
The results of extensive tests showed a loss of anchorage unless rock bolts were installed and grouted soon after excavation. This was to be for permanent support, in granite, of up to 45-foot span.

294. HABENICHT, H. and SCOTT, J.J.
The influence of shock waves on the stability of rock-bolt anchorage.
Trans. A.I.M.E. 1967 238 113-117.
Strain gauges were used to measure both static and dynamic strains. A decay of bolt anchorage was found after shock waves were caused by explosives.

295. OSEN, L. and PARSONS, E.W.
Yield and ultimate strengths of rock bolts under combined loading.
U.S. Bur. Mines Rep. Inv. 6842 (1966) 22 p.
Testing indicates that bolt assemblies of C 1040, high-strength steel bolts, lubricated and installed within their yield point with combined loading, will retain their tensile strength as the shear stress will nullify itself as the tensile load is cycled up and down in the mining process.

296. STEARS, J.H.
Evaluation of a penetrometer for estimating roof-bolt anchorage.
U.S. Bur. Mines Rep. Inv. 6646 (1965) 23 p.
Extensive testing showed that a portable hydraulic penetrometer could be used to find the optimum anchorage horizon in a series of strata, but did not give a good estimate of the anchorage capacity.

297. OSEN, L., HABBERSTAD, J.L., PARSONS, E.W. and RODRIGUEZ, E.R.
Load relations in preloaded rockbolt testing.
U.S. Bur. Mines Rep. Inv. 6613 (1965) 24 p.
Steel bolts were anchored in steel, aluminum and granite blocks with steel sleeves and flat, dished or embossed bearing plates. The effects on bolt load of both a theoretical solution and actual pull tests led to similar results.

298. STEHLIK, C.H.
Mine roof rock and roof bolt behaviour resulting from nearby blasts.
U.S. Bur. Mines Rep. Inv. 6372 (1964) 33 p.
Roof-bolt tension changes and deterioration of roof quality were found to be coincident with blasting; possibly due to seismic shock generated by the blasts.

299. STRYGIN, B.I.
Opredelenie nesgshchei sposobnosti klinoshchelevogo zamka ankernoi krepi (Determination of the carrying capacity of the wedge lock or roof bolts).
Ugol' 1963 (4) Apr 20-23.
Reports tests carried out to assess the anchorage of a rock bolt having a slotted wedge lock as a function of lock shape, and the limits of either compressive creep for plastic or compressive strength for brittle rocks.

300. PARSONS, E.W.
Design and development of a rock bolt anchored by explosive forming: a progress report.
U.S. Bur. Mines Rep. Inv. 6250 (1963) 29 p.
This report describes the laboratory and preliminary anchorage tests for 3 types of explosive-anchored bolts in soft ground. More tests are required.

301. KONSTANTINOVA, A.G. and PETROSYANTS, E.V.
Primenenie seismoakusticheskо metoda dl-ya izvcheniya deistviya vzry-va na zaankerovannuyu krovlyu (Application of the seismo-acoustic method for investigating the effect of blasting on bolted roofs).
Ugol' 1962 (5) May 15-17.
The seismo-acoustic transducer, which was used to study the effects of blasting on bolted roofs, is described. The frequencies and propagation rates of the elastic waves were measured.

302. SHETH, P.G.
Use of models for study of mine roof rock.
J. Mines M.F. 1962 10 (6) June 11-15, 25.
Models to represent roof rocks were subjected to stresses with the use of a centrifuge. The beam theory seems to hold for thin beds, but not where the ratio of the roof span to its thickness exceeds a critical value.

303. PANEK, L.A.
The effect of suspension in bolting bedded mine roof.
U.S. Bur. Mines Rep. Inv. 6138 (1962) 59 p.
Tests of mine roof models in a centrifuge indicate that the maximum suspension effect, which results from bolting a horizontally bedded mine roof, which has frictionless surfaces of contact between the beds, depends principally on the number of bolted beds and their relative flexural rigidities, provided sufficient bolt tension is exerted to prevent strata separations at the bolt locations.

304. BELIN, R.E.
The suppression of movement of a rock face by the application of rock bolts.
Aust. J. Appl. Sci. 1960 11 (2) 261-271.
Study of load-deformation curves indicates that rock bolt loads, in an exploratory tunnel, were sufficient to suppress movement of the rock face into the opening.

305. BARRY, A.J. and McCORMICK, J.A.
Evaluating anchorage testing methods for expansion-type, mine roof bolts.
U.S. Bur. Mines Rep. Inv. 5649 (1960) 19 p.

A hydraulic jack set between the plate or roof and the head of a special load-sensitive bolt, after its installation, applied the loads for these tests.

306. KOZINA, A.M.
Issledovanie povedeniya krovli pri ankernom kreplenie na model yakh iz ekvivalentnyth materialov (Investigation of roof behaviour on anchor-type roof supports in models made of equivalent materials).
Ugol' 1959 (4) 25-29.
Reports the results of model tests, simulating practical conditions, to evaluate the effect of roof bolting. Roof displacements under various conditions of support are tabulated.

307. SEN, G.C.
Protection of sides in a roof-bolted roadway.
Iron and Coal Trades Rev. 1958 177 (4710) 487-490.
Describes the unfavourable reaction of overhead roof-bolting on the sides of underground roadways, and the steps taken to protect the sides.

308. GARDNER, R.A.
How visual tension indicators improve roof support with bolts.
Coal Age J. 1958 63 (9) Sept 80-82.
The indication given by a concave, spring-steel washer placed under the roof bolt nut was effective in visually showing whether the tension was correct, or either above or below normal.

309. SEN, G.C.
Testing of roof-bolting systems.
Iron and Coal Trades Rev. 1958 177 (4710) 631-633.
The author describes a few tests carried out underground, with satisfactory results, in which a "Goodyear" rubber compression pad was checked by a torque meter wrench.

310. KRAVCHENKO, G.I.
Puti uvelicheniya nadezhnosti i ekonomichnosti shtangovogo krepleniya (Means of improving the reliability and economy of roof bolting).
Gornyi Zhur. 1958 (6) 31-35.
Tests carried out showed a smaller-diameter bolt could be used. A rubber pad was used to measure bolt tension, and a ball bearing to reduce friction.

C. EQUIPMENT

(1) GENERAL
(2) TYPES OF BOLT OR STUD-BOLT
(3) NEW TYPES

(1) GENERAL

311. TECQUIPMENT, LTD.
Direct reading strain gauge.
Mining M. 1967 116 Jan 57.
Designed by Cambridge University, this instrument allows 11 pairs of strain gauges to be monitored. Accuracy is within 3 micro-inches per inch.

312. NORDIN, PER-OLAF
In situ anchoring.
Rock Mech. Eng. Geo. 1966 (4) 25-36.
This new method of anchoring was developed by Hagconsultant A. B., Stockholm, Sweden, in consultation with Sandvikans, Jernvict and Atlas Copco, primarily for reliable control of high walls of excavated pits.

313. DOMAAS, F. B.
How to combat fall of rock, mining's greatest killer.
Eng. Mining J. 1962 163 (12) 67-77.
Recent products and techniques to combat roof fall.

*314. ROJEK, W.
Tensometric dynamometer for the measurement of the load on roof bolts.
Przelglad Gorniczy 1961 17 (6) 9-12. (In Polish).
Results of tests of a device to measure the load of roof bolts and calculations of sensitivity of the device.

*315. BORAK, L. and JUROSKA, E.
Measuring instruments for checking the anchoring of bolt supports.
Uhli 1961 (12) 426-427.

316. KELLY, L. W.
Roof bolt recovery in the middle-west.
U.S. Bur. Mines Inf. Cir. 7828 (1958).
A bolt recovery machine is described and the savings by recovery of roof bolts are discussed.

(2) TYPES OF BOLT OR STUD-BOLT

317. TORQUE-TENSION BOLT CO. (PTY) LTD.
Improved roof bolting techniques for hard rock and collieries.
Coal GBM of SA 1965 Jan 41-49 and 1967 Oct 31.
A roof bolting system is described in which one man drills and tensions stud bolts quickly.

318. BATEMAN, E. L. LTD.
Rock bolting, roasting, and filtration.
S. African Mining Eng. J. 1967 Sept 2347-2348.
Since 1954, rock stud tensioners have been used instead of torque wrenches to install bolts. A dished washer gives visual indication of tension after installation.

319. ROOFBOLTS S. A. (PTY)
Threadless roof bolt developed locally.
S. African Mining Eng. J. 1967 Oct 2577.
A dished slit washer is wedged between the rock and the end of the bolt to eliminate bolt threading.

*320. LUBENESCU, D. and CURPAN, C.
Roof bolts made of pressed wood for the support.
Revta Min. 1965 16 (11) 453-457. (In Russian).
Various types of wooden bolts are reported, those of pressed thin veneer of beech or birch being comparable with those of iron in concrete-filled holes.

321. PARSONS, E.W. and OSEN, L.
Field testing of the explosive-anchored rockbolt.
U.S. Bur. Mines Rep. Inv. 6595 (1965) 40 p.
Anchorage superior to that obtained with expansion-shell and wedge bolts was obtained. Details of the explosive charge are given.

322. HUNTER, J.K.
Rockbolting practice at Rhokana Corporation Limited.
S. African Mining Eng. J. 1964 Feb 293-301.
Studs instead of bolts are quickly installed with hydraulic tensioners. Grouted bolts are also used.

323. PAZAVIN, V.I. and GUBENIN, Yu B.
Kreplenie vyrabotok zhelezobetonnymi shtangami i nabryzg-betonom (Wall supporting and cementing with concrete).
Gornyi Zhur. 1964 5 May 34-36.
A brief article on support of underground workings by means of reinforced-concrete roof bolts.

324. CUMMING, J.D.
Rock bolting devices.
Mining J. 1963 31 May 534-535.
Various designs of plate are discussed and reasons for variation between bolt tension and torque wrench readings. "Roc-washer" and "Roc-plate" are described.

325. ROOS, J.
Rope roof bolts.
Steel and Coal 1962 185 Sept 454-456.
Sewing or the suspension of roof by double anchorage of both ends of a steel wire rope by expansion wedges is described.

326. REPUBLIC, STEEL
New rock bolting method.
Mining J. 1958 251 Aug 134.
One bolt end is forged into a conical wedge, which expands a two-part shield when the nut is tightened against the plate. Sometimes there is no deformation and the assembly may be removed and re-used without damage.

327. FORRESTER, G.N.
Rock bolts. (Stelco).
Can. Mining J. 1958 79 Sept 102-105.
In strong rock, it may be better to drill holes for 5/8-in.-diameter bolts of high-strength steel than for 3/4-in.-diameter bolts of regular steel. Rolled threads were found to be 5% stronger in tension than cut threads.

(3) NEW TYPES OF ANCHORAGE

328. PNEUMATISK
New grouted roof bolt.
Mining Mag. 1967 117 (3) Sept 189.
A reinforcing rod, slotted one end and threaded the other end, is installed with a wedge into a hole filled either with mortar or with resin.

329. BETHLEHEM STEEL CORP.
New roof bolt improves safety.
Coal Age 1967 Jan 109.
Designed to obtain anchorage in relatively soft rock by Bergwerksverband G.m.b.H. of Essen-Kroy, West Germany. This is a resin capsule used with a steel bolt.

330. SELFIX
Roof bolt anchored in synthetic resin.
Colliery Guardian 1966 212 Apr 519 and 213 Nov 594-595.
Consists of a high-tensile steel bolt with a capsule containing a resin and a hardening agent which may be used to anchor either a part or the whole bolt length.

331. McCORMICK, J.A.
Experience with roof bolts anchored with a resin cartridge.
Proc. Coal Mining Inst. of America. Annual report 1965, 120-126.
Resin anchorages probably would be of help in support of weak roof of shale or coal.

332. OITTO, R.H.
Use of polyester-type resin to stabilize fractured rock: a progress report.
U.S. Bur. Mines Rep. Inv. 6626 (1965) 16 p.
A reinforcing rod was bonded to fractured rock with polyester resin. Test results from a 3-year study are reported.

333. McLEAN, D.C. and McKAY, S.A.
Use of resins in mine roof support.
C. Mining J. 1964 85 Nov 65-70.
The use of Roc-Loc mining kits to bond reinforcing bars (some threaded, some not) into holes, where tensioning of strata is not required.

334. ROC-LOC
Resin bonding, roof bolts.
Colliery Guardian 1964 209 Nov 627.
Briefly describes a polyester composition, developed by the Cyanamid Company for bonding pins and bolts, which has the trade name "Roc-Loc".

*335. SCHUERMANN, F.
Der Klebanker (Cemented anchor).
Zeit fuer Erzberbau u Metallhuettenwesen 1962 15 (2) 97-98.
Describes a plastic-bonded roof bolt for coal mines. A glass container is broken by the bolt on insertion and cements the bolt into position.

D. SPECIFICATIONS AND STANDARDS

(1) U.S.A.
(2) OTHER

(1) U.S.A.

336. GADDY, F.L.
Standards for roof bolt plates and drill bits.
Mining Congr. J. 1965 Oct 39-41.
This article describes how deflections of various types of embossed plates were recorded and recommends tolerance limits of deflection. Also reviews previous work of the American Standards Committee.

337. GADDY, F.L.

Recent developments in drilling and bolting mine roof.
Mining Congr. J. 1963 Aug 60-61.

The author reports that the Mining Roof Action Committee agreed that all expansion-type roof anchors which are for holes other than 1 3/8 inches (35 mm.) diameter should be marked to show the required diameter.

338. AMERICAN MINING CONGRESS, COAL

Standard roof bolt anchorage testing procedure.
Mining Congr. J. 1959 Dec 59-60.

A tentative procedure for testing roof bolts by using a hydraulic extension.

339. SALL, G.W.

Standards help support mine roof.
Mag. Stds. 1958 Aug 239.

Basic dimensions of 5/8-, 3/4-, and 1-inch-diameter roof bolts are depicted on the American Standards Specification for roofbolting materials for coal mines, M30.1 - 1957.

(2) OTHER

340. ERSHOV, N.N.

Russian - English - German - French Dictionary.
5th International Mining Congress, Moscow 1967.

Gives the simultaneous translation into four languages of words and phrases used at the 5th Mining Congress in Moscow. English, German and French words are indexed to the Russian equivalent, which is not transliterated.

*341. BERBIG, O.

Die Anwendung des Ankerausbaus im Bergbau der DDR unter besonderer Berücksichtigung der Standardisierung (Roofbolting in the mining industry of the German democratic republic, with particular reference to standardization).
Bergbautechnik 1963 13 (1) 30-32.

The technical reasons for the inclusion of three types of bolt for standardization are explained.

See also abstracts

(66) MAHOOD: Specifications for roof bolting material.
(67) INTERNATIONAL LABOR OFFICE: Safety in coal mines.
(69) COMMITTEE: Specifications for roof bolting material.
(401) STRAKA: Standards for wedge-type bolts.

342. NAT. COAL BD., LONDON
Glossary of strata control terms in English, French and German, published in London in 1958, with supplement published in Liege in 1963.
This glossary gives the approved equivalents of strata control terms alphabetically from each language into the other two.

E. DRILLING AND DUST CONTROL

343. MacFADGEN, D.
Roof bolting practices, Dominion Coal Company, Sydney, N.S.
Can. Mining Met. Bull. 1963 Dec 885-886.
Holman dryductor stopers are used for drilling. An eductor exhausts cuttings through the hollow drill rod to a filter to reduce dust.

344. MECHANIZATION, U.S.A.
Roof control experience.
Mechanization 1962 Apr 53-55.
A description of typical practices to drill and to control dust in the Pennsylvania coal mines.

345. McGREGOR, K.
Roof bolting.
J. Mines M.F. Spec. Issue 1962, 391-393 and 424.
A review of current Canadian drilling methods for roof bolting, together with a description of disposal of cuttings by auger, flushing, or by suction.

346. HINDS, C.G.
The use of rock-bolts and steel wire lacing for the support of underground workings.
Assoc. Mine Managers S. Africa 1960-1961 325-338.
A description of typical South African practices to drill and control side walls by wire lacing (in gold mines).

347. JONES, D.C.
Roof control.
Mechanization 1961 Jan 35-37, Feb 52-54 and Mar 47-50.
A three-part review of roof control in which the last covers drilling and dust control.

F. SAFETY PRECAUTIONS

348. SIGMA COLLIERY
Sigma's roof bolting programme.
Colliery Eng. 1964 41 June 249-250.
Roof bolting machines are stated to reduce costs and increase safety. Hydraulic unit eliminates torsion on bolt during installation and enables unskilled labour to tension bolts accurately, within approximately 90 seconds.

*349. SHTUMPF, A.G. and SHTABEL, V.G.
The efficient use of roof supports.
BZTPAM 1964 8 (3) 3-6. (In Russian).
Important improvement in safety seems to be obtained through the use of slotted-wedge roof bolts.

350. STAHL, R.W.
Needed: better roof support at mine intersections.
Coal Age 1962 67 (5) May 106-110 and 113.
The figures for fatalities show twice as many occur under roofs at intersections as at other places. Longer bolts at intersections are suggested as a temporary expedient.

351. PYNNONEN, R.O. and BERNARD, R.L.
Supervision in roof bolting.
Skillings' Min. Rev. 1961 50 Feb 1, 4-5.
Explains how adequate supervision might eliminate unsafe practices.

352. GADDY, F.L.
Strength of steel roof bolts after repeated bending.
U.S. Bur. Mines Rep. Inv. 5408 (1958).
Reclaiming bent rods may jeopardize the safety of the men working in mines where they are re-used too often.

353. McCAA, G.W.
Safety features in the design and development of Ireland Mine.
Coal Age 1958 63 (9) Sept 92-93 and 96-97.
Describes how safety was achieved when using boring and ripper types of continuous miners in the Hanna Coal Co. mine.

354. COAL AGE
45th National Safety Congress.
Coal Age 1957 62 (12) Dec 82, 83 and 164.
Roof control by bolts anchored with injected epoxy resin and the electrolysis of steel roof bolts are briefly mentioned.

355. U.S. BUREAU OF MINES
Research and technologic work on coal and related investigations 1956.
U.S. Bur. Mines Inf. Cir. 7904 (1959) 112 p.
Fatalities occurred under roof bolted roof but less frequently than under timber.

G. COSTS

356. WOODRUFF, S.D.
Methods of working coal and metal mines, Vol. 2. Ground Support Methods.
Pergamon Press Ltd. Chapt. 7, 168-218.
Comparative costs of timber and bolts are given.

357. HOWES, M.H.
Methods and costs of constructing the underground facility of the NAADC at Cheyenne Mountain, El Paso County, Colorado.
U.S. Bur. Mines Inf. Cir. 8294 (1966) 33-45.
Costs of a permanent installation in hard rock are outlined.

*358. TOTROV, G.V., SEMENOV, I.S. and MAR'ENKOV, V.V.
Opytnye vidy shtangovoi krepi na Sadonskom rudnike (Experimental types of roof bolt in the Sadon Mine).
Izves. V.U.Z. 1964 (1) 12-19.
Roof bolts seem to prevent floor heaving in the Sadon Mine.

359. ZURABISHVILI, I.I. and KHVICHIA, S.A.
Primenenie shtangovoi krepi na Chiaturskikh rudnikakh (Use of roof bolts in Chiatura Mines).
Gornyi Zhur. 1962 (5) 27-28.
Sleeve-type rock bolts installed by hydraulic jack, which have small diameter studs, are reported to achieve savings up to 50%.

360. ACKERMAN, M.J. and WALLACE, J.J.
Costs of mining under bolted roof and timbered roof in bituminous coal mines.
U.S. Bur. Mines Inf. Cir. 8024 (1961).
A study of costs conducted in Pennsylvania, East Ohio, and North and South of West Virginia in the United States.

361. KRAVIG, C.N.
Rock bolting practices at Homestake.
Mining Congr. J. 1960 Aug 32-34.
The wedge-type is used almost exclusively but "Perfo" bonded bolts are used where good anchorage is difficult to obtain. A cost saving method is described for installing these bolts which are set in cement grouting.

362. PLOESSER, A.P.
Benguet now recovers rock bolt shells.
Eng. Mining J. 1959 160 (3) Mar 110.
Shells were used again and their cost of recovery was 60% of new cost (45 cts); few plugs were recovered.

*363. PELAN, G.
Support of cross-cuts by bolting and cement blasting.
Chambre syndicale des mines de fer de France .
Bul. Technique 1957 2nd quarter 1-4. (In French).
The cost of support was for bolting 9.1, cementing 5.9, total 15 francs per meter. It appeared that bolting would be sufficient if the marls were kept dry by means of a cement coating.

See also abstracts

(365) COATES: Roof bolting effectiveness.
(391) CHIFF: Costs of roadways (France).
(400) SINCLAIR: Asbestos mine uses wood bolts.
(404) LEGMAN: Costs of resin bolts.
(411) VIDAL: Costs, various types, France.
(419) HANSAGI: Expense of roof bolting.
(495) SCHMUCK: Bolting cost for dam construction.
(510) ROGOJIN: Experimental bolts set in concrete.

H. PRACTICE - GENERAL

364. WILKS, B.E.
Roof bolting in British collieries and its possible use in the coal mines of India.
J. Mines M.F. 1967 July 209-212 and 224.
A review of British practice and opinion of the author why the use of rock bolts in Britain is decreasing.

365. COATES, D.F. and DWARKIN, L.M.
Roof bolting effectiveness at Michel.
Can. Mining Met. Bull. 1967 659 Mar 32-37.
The results of instrumentation of test entries are presented together with a discussion as to how such data may be utilized to improve mining practice.

366. STRYGIN, B.I.
Stress in metal rock bolts and choice of their diameter.
Soviet Mining Science 1965 326-331.
It is calculated that, under the conditions of combined torsion-tension stress loading, a smaller diameter bolt of higher working strength, about 85,000 psi, would effect economy. An alloy steel is recommended to replace the existing steel.

367. THIEL, P.S.
Recent developments in roof bolting and roof bolt installation procedure.
Can. Mining Met. Bull. 1964 57 (630) 1050-1062.
The author examines the torque and the impact wrench methods of obtaining tension in bolts, compares South African and U.S. test data, and recommends that stud bolts be installed by a hydraulic puller.

368. PANEK, L.A.
Design rationale for bolting stratified roof.
3rd Int. Mining Con. 1963.
The functions performed by roof bolts in horizontally stratified deposits are analysed.

369. COCHRANE, T.S. and GRANT, F.
Pull tests as a measure of roof bolt efficiency and of roof bolt design.
C.I.M.M. Trans. 1963 620 Dec 877-879.
Some details of pull tests with a hydraulic jack are given. These tests were carried in coal mines on various types of rock.

370. DWARKIN, L.M.
Roof bolt anchorage at Michel colliery.
C.I.M.M. Trans. 1963 620 Dec 880-884.
Six types of expansion shell were tested in two kinds of rock and bolt load-displacement curves were plotted. Significant differences were found in the anchorage capabilities.

371. TINCELIN, E. and SINOU, P.
Tirs et soutènement dans des galeries à toits délicats d'une mine de fer de Lorraine (Blasting and support in galleries with delicate roof in an ore mine of Lorraine).
Int. Mining Congr. Salzberg 1963 15-21 Sept (Pergamon Press) Vol. III - Safety in Mining.
Vertical roof bolts were replaced by longer bolts angled outward in mine roof, with grouting, for permanent anchorage.

372. HALL, J.C.
The holding strength of rock-bolts and eye-bolts.
Assoc. Mine Mgrs. S. Africa 1960-1961 379-391.
Tests were carried out on bolts having various types of anchor and installed with various amounts of torque. The values of bolt tensions were reported to be about double those found by U.S.B.M. for the same torque.

373. BARNES, E.L.S.
Roof bolting practice in collieries of Australian Iron and Steel Pty. Ltd.
Aust. Inst. Mining M.P. 1961 200 Dec 21-36.
Anchorage and tightening with "Atlas Falcon" and "Fletcher" roof bolters have presented problems; good panel supervision is required.

374. ANDERS, G.
Rockbolting at Algom Nordic Mine.
Can. Mining Met. Bull. 1961 591 July 522-529.
In spite of increased care, 5/8-in. H.S. bolts soon lost tension after installation. In special trials, a spread of from 5 to 12 tons tension was recorded by hydraulic load cell. The installing torque was 165 foot-pounds.

*375. SEMEVSKII, Y.N., BAKHLIN, F.S. and VOLZHSKII, V.M.
Checking the safety of roof bolts.
BZTPAM 1960 (4) Dec 4-5. (In Russian).
Spring washers placed between the support plate and the nut indicate the bolt tension. Mass production is recommended.

*376. UCHMAST, J. and GOCMAN, R.
Ring dynamometer for the measurement of roof bolt tension.
Przeglad Gorniczy 1960 16 (7/8) 4-5. (In Polish).
A simple roof-bolt tension indicating device has been produced, which is essentially a rubber ring with a steel tape around its circumference.

377. MAKHAN'KO, Yu A. and SEVER'YANOV, A.N.
Vliyanie sootnosheniya diametrov shtang i skvazhin na povedenie zakreplennoi shtangami krovli (Influence of ratio of bolt and bore-hole diameters on behaviour of bolted roof).
Gornyi Zhur. 1960 136 (10) 31-33.
It is indicated that roof stability depends upon the clearance between bolt and hole; roof bolting combined with grouting is recommended.

378. TOKAREV, V.A.
Primenenie shtangovoi krepi na rudnikakh Kirovgradskogo kombinata (The application of roof bolts to the mines and concentrator of Kirograd).
Gornyi Zhur. 1959 11 30-35.
A hydraulic jack imparts direct tension to a stud bolt and a hemispherical washer gives even loading to the plate when the bolt is not normal to the face.

379. CRANDALL, W.E.
How Hecla used yieldable steel sets.
Mining World 1959 21 (4) Apr 20-24.
When timbering and rock bolting in combination failed to hold in heavy ground, yieldable steel archs were found to be satisfactory.

380. ADAMSON, A.A.
Rock bolting at McIntyre Porcupine Mines.
Can. Mining J. 1958 79 Sept 105-107.
When a switch from normal 1-inch slotted, to 5/8-in. high-strength bolts was made they were found difficult to install. Studs were used in preference to headed bolts.

381. POCOCK, J.
Roof bolting in South Wales.
Iron and Coal Trades Rev. 1958 176 Feb 381-387.
One-inch slotted bolts were considered easier to install than 3/4-inch sleeve-type for which the drill hole was 1 11/16-inches. Roof bolting was not only cheaper but reduced roadway accidents.

382. KRIPPNER, D. E.
Ankerausbau in Abbau- und Gesteinsstrecken (Roof bolting in gate roads and stone drifts).
Glückauf 1958 94 267-279.
The various types of rock bolt and a new hydraulic pull jack to install bolts at correct tension, are described. This apparatus is said to be an improvement on impact or torque wrenches, which require great care in their use.

I. PRACTICE - REGIONAL

(1) AUSTRALIA
(2) AUSTRIA
(3) BELGIUM
(4) BRAZIL
(5) CANADA
(6) CZECHOSLOVAKIA
(7) FRANCE
(8) GERMANY
(9) GREAT BRITAIN
(10) HUNGARY
(11) INDIA
(12) NETHERLANDS
(13) POLAND
(14) ROUMANIA
(15) SOUTH AFRICA
(16) SWEDEN
(17) UNITED STATES
(18) U.S.S.R.
(19) YUGOSLAVIA

(1) AUSTRALIA

383. MOYE, D. G.
Unstable rock and its treatment in underground works in the Snowy Mountains Scheme.
Proc. 8th Comm. Met. & Min. Congr. (Melbourne), 1965 6 429-441.
Rock bolts were not installed by hydraulic jack but are now checked for tension.

384. LEECH, T. D. N. and PENDER, E. B.
Experience in grouting rock bolts.
Proc. 5th Int. Conf. S.M. & F.E. 1961 445-452.
A description of the method of injecting.

385. ROC-LOC

Polyester resin used in Cyanamid's method for rock wall stabilization.

Mining C.E.R. 1964 56 Dec 10-11.

For grouting rock bolts or reinforcing bars, all or part of their length, to obtain anchorage.

386. GKN - LYSAGHT PTY. LTD.

Groutable rock bolts.

Mining C.E.R. 1960 52 Apr 49.

"Williams" rock anchor is an expanding-shell type manufactured at Alexandria NSW, Australia.

387. GILMOUR, L.W.

Some aspects of underground work - Snowy Mountains Scheme - Australia.

Sym. Shaft Sink. Tunnelling 1959 London: 90-92.

The methods of anchorage testing and the patterns and statistics of the rock bolts used, are described.

388. LANG, T.A.

Rock bolting speeds Snowy Mountains project.

Civil Eng. 1958 28 90-92.

Spans up to 77 feet in granite and granite gneiss roof were rock-bolted for generator and transformer halls. Bolts up to 15 feet long were permanently anchored.

See also abstracts

(287) LANG: Theory and practice.
(304) BELIN: Suppression of ground movement.
(373) BARNES: Practice in coal mines.

(2) AUSTRIA

389. LAUFFER, H.

Die neuere Entwicklung der Stollenbautechnik (New developments in tunnel construction techniques).

Oes. Ing. Zeit. 1960 3 (1) 13-24.

The effects of static pressures on tunnels are discussed in relation to the placement of rock bolts. Both slotted bolts and reinforcement rods set into concrete are considered.

(3) BELGIUM

390. LABASSE, H.
Les pressions de terrains dans les mines de houille (Rock pressures in coal mines).
Ann. Mines Belg: 1967 61.
Rock bolting is rarely used as the only means of support because the bolts slip in their anchorage.

391. CHIFF, E. and DUYSE, H. VAN.
Applications du boulonnage au charbonnage de Zwartberg (Rock bolting in the Zwartberg coal mines).
Inichar B.T. Mines: 1966 106 2376-2392.
Describes tests in two roads with retreat working using roof bolts. Also discusses techniques and costs, which were favourable.

(4) BRAZIL

392. COSTA NUNES, A. J. da
Slope stabilization—improvements in the techniques of pre-stressed anchorages in rocks and soils.
Proc. I.C.I.S. Rock Mech. 1966 Vol. II 141-146.
After drilling and reaming holes, the reinforcing-bar end is anchored by injecting concrete or other grouting. The bar is pulled by a hydraulic jack, and the remainder of the empty space in the hole is filled with concrete, which sets while the tension is held.

(5) CANADA

393. SIFTO SALT
Roof-bolting speeded up at Sifto Salt.
Can. Mining J. 1967 88 Aug 52-54.
A diesel-powered crane was equipped with a combination auger and bolt-tightening machine from an operator controlled basket. Up to 14-ft. long roof bolts are installed in a 10-foot high roof.

394. McGREGOR, K.
The drilling of rock.
C R Books Ltd. London 1967 271-276.
A section devoted to roofbolting describes horizontal strata bolting and bolting suited to mine conditions. Both cemented and resin-bonded bolts are mentioned.

395. BRAY, R.C.E.
Control of ground movement at the Geco Mine.
Proc. 4 R.M.S. Ottawa: 1967 35-36.
Noranda Mines used conventional 5/8-in.-diameter bolts tightened by stoper to between 125 and 160 ft lb of torque; except when positive tension was required a hydraulic ram was used.

396. MARSHALL, D.
Hanging-wall control at Wilroy.
Can. Mining Met. Bull. 1963 56 (612) Apr 327-331.
Bars of "stress steel" were anchored by grouting one end, then grouting the remainder of the bar while the bolt was held under tension.

397. LEGGET, R.F.
Geology and engineering.
McGraw-Hill Book Co. New York USA 1962 884 p.
A few references to various applications in which rock bolts have been used.

398. WILSON, E.B.
Rockbolting in Elliot Lake Area.
Can. Mining J. 1959 80 (9) Sept 89-95.
A survey of 10 mines in the Elliot Lake area, which are reported currently to use 70,000 bolts monthly. Most are tightened by stoper and checked by torque wrench.

399. MAMEN, C.
Mining in Canada.
Can. Mining J. 1958 79 (2) Feb 162-178.
A description of the employment of rockbolting in Canada based on reports from 15 mines. It was concluded that high-strength rather than regular-strength bolts are preferred.

400. SINCLAIR, W.E.
Roof bolting in asbestos mines.
S. African Mining Eng. J. 1958 69 (2) 12 Dec 1197, 1199, 1201, 1203.
Wooden bolts are reported to lower costs and reduce maintenance in Canadian asbestos mines.

See also abstracts

(285) COATES: Theory of rock bolting.
(291) CORLETT: The why of rock bolting.
(324) CUMMING: Bolting devices.
(327) FORRESTER: Higher strength bolts (Stelco).
(333) McLEAN: Resin anchorage.

(343) MacFADGEN: Practices, Dominion Coal Co.
(345) McGREGOR: Drilling methods.
(365) COATES: Effectiveness of roof bolting.
(369) COCHRANE: Pull tests to measure efficiency.
(370) DWARKIN: Anchorage at Michel colliery.
(374) ANDERS: Bolt load variation.
(380) ADAMSON: McIntyre Porcupine mines.

(6) CZECHOSLOVAKIA

401. STRAKA, J.
Statické reseni únosnosti Klinového svorniku (Statistical treatment of the bearing capacity of wedge-type bolts).
Rudy 1965 13 318-326.
This is a description of tests of anchorage capacity performed on various slotted-wedge-type bolts to evaluate the effect of hole size, contact surface, dryness, and hardness of strata.

402. VAVRO, M. and URBANEC, J.
Výsledky zkoušek svornikové rýztůze v přirodnich podminkach Dolu Cinovec (The results of tests on roof bolts in the natural conditions of the Cinovec Mine).
Rudy 1965 13 152-157.

*403. CHARBULA, K.
Streckenausbau (Roadway support).
Mining M. L. 1962 140 94.
A review of the various methods of supporting roadways underground.

(7) FRANCE

*404. LEGMAN, L.
Boulonnage à la résine (Rock bolting by resin).
Trav. Maîtrise (V. e. H.) 1967 Dec 4, 5
The use of rock bolts set into resin, their position, length, strength, frequency, and the method of anchoring.

405. ELLIE, G.
Consolidation des toits en tailles et en galeries (Strengthening rock in cuttings and in drifts).
Charbonnages France 1967 9 467-494.
A general survey of the two types of rock support by bolting, either anchoring by synthetic resin or by the conventional expansion-shell point anchorage.

406. CHAMBON, C. and RAFFOUX, J.F.
Méthode de mesure pour étudier les déformations des terrains aux alentours d'une voie de taille et pour contrôler l'efficacité d'un boulonnage à la résine (Method of measurement for study of deformations of ground around a gate road and to control the effectiveness of resin bolting).
Rev. Ind. Minérale 1967 Apr 268-282.
The authors discuss the measurement of vertical movements consequent upon the installation of rock bolts. Converging and diverging bolts are considered as well as bolts set in resin or distributed anchorage.

*407. MINES DE FER (NANCY)
Boulonnage à la résine (Rock bolting using resin).
BCTS Mines (Nancy) 1967 66 6 p.
A summary of local experience in the use of resin to secure rock bolts. Polyester resins are used and the methodsof proportioning the ingredients are described.

408. TINCELIN, E., SINOU, P. and LEONET, O.
Soutènement suspendu par tiges d'acier scellées au ciment ou à la résine polyester dans les mines de fer de Lorraine (Suspended roof support with steel shafts fastened in cement or polyester resin in the iron ore mines of Lorraine).
Rev. Ind. Minérale 1965 47 (7) 477-489.
Roof bolts set in polymerized resin were considered superior to those set into concrete.

409. COEUILLET, R.J.
National report: France.
Proc. I.C. Strata Conf. 1964.
Roof bolting is used to a very limited extent as the roofs fissure quickly beyond the bolts.

410. MELLET, M. and LeJAN, G.
Le soutènement mécanisé en Provence 1957-1963 (Mechanized roof support in Provence from 1957 to 1963).
Rev. Ind. Minérale 1964 Apr 289-324.
It seems there was spalling, even with bolted roof, hence the room-and-pillar system was abandoned.

411. VIDAL, V.
Exploitation des mines (Working of mines).
Dunot 1961 1 491-509.
The theory of roof suspension by bolting is explained; the types of bolts, testing for both iron and coal mines, costs, and the limitations to the usefulness of bolts are discussed.

412. CARDON, R. and BUISSON, R.
Boulonnage du toit en voie (Roof bolting in gate roads).
Rev. Ind. Minérale 1961 43 (10) 693-703.
The authors discuss the factors to be considered when the decision whether or not to bolt gate roads is made.

413. TINCELIN, E., SINOU, P. and LEONET, O.
Le soutènement suspendu ou boulonnage (Suspended roof support or strata bolting).
Rev. Ind. Minérale 1961 (special issue) 372-470.
A review of bolting practice in France which includes types of bolts and the conditions for their proper use. Discusses methods of installation not restricted to horizontal strata.

*414. ZIEMCZAK, J.
Roof bolting in roadways.
AAAEEM Douai Bulletin Mensuel 1960 Apr. 625-630 May 640-644. (In French).
A general study of roof bolting in roadways with stress on safety and inspection.

415. TINCELIN, E. and SINOU, P.
Summary of the results obtained from eight years research in strata control.
Int. Strata Con. Congress 1958.
A summary of French experience in the measurement of forces and stresses to which roof bolts are subjected.

416. HUGON, A.
Soutènement par des étançons (roof bolting).
Monde Soutèrrain 1958 24 (109) 175-183.
The author reviews the results of tests carried out underground with a view to predicting the effect of support by calculation.

See also abstracts

(290) HUGON: Rock bolting generally.
(363) PELAN: Costs of support.
(371) TINCELIN: Permanent support.

(8) GERMANY

417. MULLER, O.
Der einfluss von erschütterungswellen auf die spannung von ankern im gebirge (The effect of vibration waves on the tension of rock bolts).
Glückauf: 1967 Oct 1142.
A brief note on the reduction of bolt tension consequent on the effect of vibration waves.

418. KUHN, O.
National report: West Germany.
Proc. 1C Strata Con. 1964.
Roof bolting has only slightly increased (1.53%) as sole support, except in the Saar where it has increased to 12.38% on gate roads.

419. HANSAGI, I.
Die Rolle der Unterlegplatte beim Ankerausbau (The part played by the base plate in roof bolting).
Bergb.-Wiss. 1963 10 (8) 186-188.
The role of the base plate is important, it should be suitable for the load it is to carry, elastic, and be correctly oriented to the face. The seat is also important to proper bolt installation.

*420. KEIENBURG, F.
Stahlverbolzungen und Sicherheitsklammern bei modernem Streckenausbau (Steel bolting and safety clamps in modern roadway supports).
Schlägel u. Eisen 1962 9 615-617.
A brief survey of modern roof bolting techniques with a description of the various clamps and bolts in use.

421. SCHUERMANN, F.
Richtlinien für den Ankerausbau (Manual for rock bolting).
Glückauf 1960 96 183-186.
An instruction manual, which was assembled by D.E. Krippner for use in the Essen coal mines, is outlined with diagrams showing how bolts are properly placed.

*422. MOELLER, H.J.
Die Mechanisierung der Vorfändung im Streckenvortrieb (Bolting of roadway support frames).
Schlägel u. Eisen 1959 7 371-374.
The author describes wooden bolts and steel bolts in relation to support frames, and analyses the advantages and disadvantages of steel bolts.

*423. GIMM, W.
Ankerausbau im Tiefbau (Roof bolting in deep mining).
Bergbautechnik 1958 8 (9) 451-460.
A description of roof bolts is given, the advantages and disadvantages are discussed, and the possible applications in the German Democratic Republic are indicated.

See also abstracts

(286) RICHTER: Fundamental considerations.
(335) SCHUERMANN: Cemented anchors.
(341) BERBIG: 3 standard types.
(382) KRIPPNER: Hydraulic installation of bolts.

(9) GREAT BRITAIN

424. PEARSON, G.M. and SMITH, R.J.
Some investigations into the tensional behaviour and influence of bolting reinforcements in mine roadways.
Mining Engineer 1964 (48) 688-702.
Bolt anchorage and initial tension are discussed in relation to various strata conditions, which include whether the hole is wet or dry.

425. ADCOCK, W.J.
National report - Great Britain.
Proc.IC Strata Con.1964.
Roof bolting is reported to be below expectations; in 1958, 250,000 bolts were set and in 1962, 282,000.

426. PEQUIGNOT, C.A.
Tunnels and tunnelling.
Hutchinson, London 1963.
Rock bolting practices for permanent installations are discussed on six pages in this book.

*427. SMITH, R.J. and PEARSON, G.M.
Tensional behaviour of floor bolts in advancing longwall coal mining.
King's Coll.Mining Bull. 1963 9 (4) series strata control 19.
Describes the introduction of floor bolting in an attempt to overcome the problem of "floor heave".

428. LANSDOWN, R. and McCLUNIE, W.A.
Tunnelling in British coal mines.
Sym.Shaft Sink Tunnelling 1959 183-197.
Roof bolting is cheaper than most other forms of support, and the clearance is greater than if arch supports were used.

429. PEARSE, G.E.
Investigations concerning rock-bolting at Billingham mine, County Durham.
Bull.IMM 1960 69 (642) 459-465.
Attempts to correlate the torques registered by a torquemeter spanner and the axial loads were abandoned. Test loads approaching 40 tons were withstood by special rockbolts 30 ft long grouted in 2 feet of mortar.

430. SEN, G.C.
Strata bolting in South Wales.
Colliery Eng. 1959 36 (6/7) 247-250 and 291-298.
A general description of roof, wall and floor bolting as applied to roadways in horizontal strata.

431. SEN, G.C.
Strata bolting in mines.
Iron & Coal Trades Rev. 1959 178 (4750) 1297-1299.
Anchorage of slotted-wedge bolts in horizontal strata is doubtful for wall bolting due to the uncertain insertion of the wedge.

432. SEN, G.C.
Historical development of strata bolting.
Mining Mag. 1959 100 (1) 9-11.
A short history of strata bolting.

433. SISKOL MACHINES LTD.
Recoverable roof support.
Iron & Coal Trades Rev. 1958 177 282.
A bolt having two separate rubber expanding sleeves is reported to be in use for temporary control of side rippings at roadheads in collieries.

434. SEN, G.C.
Floor bolting in roadways.
Colliery Guardian 1958 197 (7) 61-64.
A regular pattern of floor bolting may be used to minimize floor heaving.

435. POCOCK, J.
Roof bolting at Cwmtillery colliery.
Iron & Coal Trades Rev. 1958 176 381-387.
"Bayliss" sleeve bolts were compared with slotted-wedge bolts and a "Goodyear" rubber pad was used to give visual indication of bolt tension.

436. McKILLUP, R.G.
Roof bolting in weak strata.
Iron & Coal Trades Rev. 1957 175 (8) 305-308.

This paper describes a successful use of steel bolts in addition to the standard timbering system to hold a weak shale roof.

(See also abstracts)

(289) EVANS: Roof bolting on roadways.
(307) SEN: Side protection of roadways.
(309) SEN: Rubber compression pad.
(311) TEQUIPMENT: Strain gauging.
(325) ROOS: Rope roof bolts.
(326) REPUBLIC STEEL: New methods of anchoring.
(330) SELFIX: Synthetic resin anchorage.
(334) ROC-LOC: Resin bonding for anchorage.
(324) NAT COAL BD: English-French-German glossary.
(356) WOODRUFF: Roof bolting costs.
(357) HOWES: Costs of permanent installation.
(364) WILKS: Reasons for decreased importance.
(381) POCOCK: Wales preference for slotted bolts.

(10) HUNGARY

437. RICHTER, R. and SIMON, K.
Probleme und richtlinien des modernen ausbaus für grubenbaue bei ungünstigem nebengebirge (Problems and trends in support design for coal faces and development workings in unreliable strata).
5 Int. Mining Congress 1967 Moscow.

A general review of the requirement for support and the employment of roof bolts.

438. SZECHY, K.
The art of tunnelling.
Akademiae, Budapest 1966 601 p.

This book has a section which deals with roof bolting. It is stressed that the correct load should be installed on rock bolts or the tension will not likely be maintained.

439. NEMETH, A.
Laboruntersuchung der Firstenverankerung (Support by bolting, laboratory trials).
Bany. Lap. 1964 Sept 597-600.

The author reviews the various theories concerning roof bolting, both Hungarian and foreign, and describes experiments designed to test the theory.

(See also abstract)

(286) RICHTER: Fundamental considerations.

(11) INDIA

*440. RAJU, N.M. and SINGH, B.
Roof bolting - anchorage efficiency of 22-mm-diameter wedge and slot type roof bolts in a group of collieries.
Cen.Mining RS (Dhanbad) 1967 No 37 July 20 p.
Bolt extensions and loads were measured as 22-mm-diameter wedge and slot types of roof bolt were pulled from their anchorages.

441. RAJU, N.M. and SINGH, B.
Roof bolting investigations in Indian mines.
J.Mines MF 1967 15 (5) May 129-138.
Describes the activities of the Dhanbad research station and rock bolting practices in India.

*442. GHOSH, S.K.
Roof bolting - instrumentation.
Cen.Mining RS (Dhanbad) 1967 No 33 Apr 20 p.
A description of the instruments used and their method of use at Dhanbad is presented.

443. SINHA, K.N. and SINGH, B.
Instrumentation for the measurement of load on underground supports.
Proc.ICIS Rock Mech. 1966.
Various load cells are described for use with and without strain gauges.

*444. DHANBAD, CMRS
Preliminary investigation on roof bolting in an Indian colliery.
Cen.Mining RS (Dhanbad) 1965 No 18
Results of preliminary studies are presented.

445. GHOSE, A.K., MAJUMDAR, S. and BAGCHI, S.
Experiments and investigations on roof bolting at a colliery in India.
J.Mines MF 1964 12 (4) 109-118.
An account of roof bolting at a colliery in the Karanpura coalfield in Bihar.

446. SCHRODTER, E.
Recent findings in the field of mine supports.
J. Mines MF 1962 10 Special Issue 359-363 & 424.
Resin-bonded roof bolts are described.

(See also abstract)

(302) SHETH: Models for study.

(12) NETHERLANDS

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National report: Netherlands.
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Influence of bolting on the load-carrying capacity of rock and on decrease of settlement; effects of radial placement of bolts.

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Brief theoretical discussion and practical observations are given in relation to performance under different conditions.

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Suitable conditions for bolting mine roof are stated and the control measures necessary to the maintenance of the bolted roof are discussed.

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(See also abstracts)

(288) GOCMAN: Calculations.
(314) ROJEK: Load measurement dynometer.
(376) UCHMAST: Ring dynometer.

(14) ROUMANIA

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Roof bolting in Roumanian mines.
Revta Min. 1957 8 (10) 485-488. (In Roumanian).
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(See also abstract)

(320) LUBANESCU: Russian and Roumanian trials.

(15) SOUTH AFRICA

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New rock stud tensioning device.
Can. Mining J. 1967 88 (6) 53.
Two hydraulic units are used to install bolts by a straight pull instead of by combined torque and tension. One operates off mine air at 60-80 psi.

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J. S. Afr. I. Mining M. 1965 65 (7) 374-397.
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New roof bolting device shows when bolt has become overloaded.
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A "rock control" plate shows initial deflection when the bolt load exceeds 5,000 pounds, and collapses above 11,000 pounds.

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Prestressed support at Bancroft Mine.
S. African Mining Eng. J. 1963 74 145.
A special method has been used to pre-stress high-tensile steel cables up to 44 tons' load by hydraulic jack.

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Steel cables are stretched across the mine roof and anchored at both ends.

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A description of the Roofmaster Gabs equipment.

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Roof bolting in South Africa.
Iron & Coal Trades Rev. 1960 180 (4776) 254.
A brief note describes the use of cement-grouted bolts at the Thabazimbi mine. Permanent anchorage was obtained by using corrugated bolts.

(See also abstracts)

(317) TORQUE TENSION: Techniques for hard rock and collieries.
(318) BATEMAN: Stud belt tensioning.
(319) ROOFBOLTS S. A.: Threadless bolts.
(322) HUNTER: Hydraulic tensioning of stud bolts.
(346) HINDS: Steel wire lacing support.
(348) SIGMA COLLIERY: Tensioning machine.
(367) THIEL: Hydraulic tensioning.
(372) HALL: Torque-tension relationship.

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Modern application of cut-and-fill in Swedish mining.
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Developments and trends in roof control methods and techniques in Swedish mines.
Proc. IC Strata Con. 1964 557-558.
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The "Injekto" method is used as the standard one at the Kiruna Fe ore mines, Sweden. Cement grout is sprayed into the borehole.

(See also abstracts)

(312) NORDIN: Insitu anchoring.
(328) PNEUMATISK: Grouted roof bolts.

(17) UNITED STATES

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Strata control by powered supports and roof bolts: Part 2: Roof bolting.
Aust. Mining 1967 59 (3) 46-51.
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Rock anchor design.
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A report of U. S. Army experience is given. Permanent anchorage for tunnels is considered.

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Resin-anchored rock reinforcing members.
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Research develops angle roof bolt at White Pine copper mines.
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A specially designed bolt head with a "ball and socket" is reported to account for the success of a new, plate and roof bolt assembly.

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Annotated bibliography on selected mining subjects.
Col. Sch. Mines 1966 61 (2) 128-139.
This publication contains a full bibliography on the subject of "grouting" as applied to underground mining.

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Resin-bonding roof bolts.
Colliery Guard. 1964 209 (5403) 627.
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The Bureau reports studies to develop an economical device that will indicate the bolt tension because the torque tension relationships are extremely erratic. Polyester-grouted bolts are reported advantageous to support broken ground.

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Development of a rock bolt system for permanent support at NORAD.
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Roof bolting has made available more headroom, and number of roof falls is much less.

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Hydraulic roof-bolting machines.
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Safety practices in shaft sinking and tunnelling: West Delaware aqueduct.
US Bur. Mines Inf. Cir. 8114 (1962).
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A survey of existing methods and practice in US mines, including the use of sonar to study structural discontinuities.

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Ground support and mine bolts - Study of usage.
Eng. Mining J. 1962 163 (8) 95-99.
Applications and limitations of rock-bolting practices in mines.

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Geol. Soc. Am. Rev. Eng. Geology 1962 1 257-280.
Classification of rock bolts from standpoint of utilization and criteria for designing and testing installations.

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Mathematical formulae are obtained for the change in maximum roof bending stress and for the change in roof deflection due to the combined friction and suspension effects.

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Determining the in-place support of mine roof with rock bolts, White Pine copper mine, Michigan.
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A procedure is developed for determining the number of bolts required, based upon the roof sag consequent upon removal and the load before removal which was measured.

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A practical look at progress in roof control.
Mining Congr. J. 1960 46 (12) 51-55.
A review of the latest equipment and techniques for roof bolting, including visual tension indicators.

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Recovery of roof bolts.
Mining Congr. J. 1960 46 (9) 63.
The use of recovery machines is recommended to recover roof bolts safely.

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Bolts stabilize high rock slopes.
Civil Eng. 1960 30 98-99.
Rock bolting is reported to be suited to prevention of rock slides.

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Rock bolts - applications in construction.
Western Const. 1960 35 1-A 52-55 & (2) 40-42.
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Roof bolts increase safety of aqueduct tunnel.
Safety Maint. 1959 118 (5) 15-16.
Installation of roof bolts in New York City's new West Delaware water tunnel is described.

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Advances in roof control.
Mining Congr. J. 1959 45 (10) 89-93.
Machine has bolting equipment mounted for rapid bolt installation in mine roof.

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Standard roof bolt anchorage testing procedure.
Ill. Mining Inst. 1959 (10) 79-82.

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Roof control in thin seams.
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Helical spring washers, which close to a dead-pressed condition on reaching a bolt load of 6500 lb, are recommended to maintain bolt tension.

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The author describes the use of rock bolts at the Mountain Con mine at Butte, Montana, USA.

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An American roof bolt.

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This 3/4-in.-dia "stud" bolt is claimed to resist a pull of 40,000 lb and to be less weakened by twisting during tightening.

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Turn-of-nut method for tensioning bolts.

Civil Eng. 1958 28 31-32.

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Roof bolting in Kentucky coal mines.

Ken. U. Eng. Exp. Stn. 1958 Bull. No. 47 12 (3) 60 p.

A history of roof bolting from Jan. 1949 through Dec. 1954 together with failures of bolted roof is given.

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Anchorage efficiency of roof bolt installations.

Mechanization 1958 22 (1) 59-61.

Using 3/4-in.-dia bolts, anchorage efficiency of regular expansion shells was found satisfactory at Westvaco mine near Green River.

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Pro. Ill. Mining Inst. 1957 29-33.

60 per cent recovery of roof bolts is reported without accident. Both 3/4-in.- and 5/8-in.-dia expansion shell bolts were recovered.

(See also abstracts)

(282) KNILL: Stress distribution around anchors.
(283) STEFANKO: Stabilizing underground excavations.
(284) PANEK: Design for stratified roof.
(287) LANG: Theory and practice.
(293) UNDERWOOD: Permanent rock bolts at NORAD.
(294) HABENICHT: Influence of shock waves.
(295) OSEN: Combined loading bolt strength.
(296) STEARS: Penetrometer for anchorage estimation.
(297) OSEN: Load relations in preloaded tests.

(298) STEHLIK: Effect of blasting.
(300) PARSONS: Explosive formed anchorage.
(303) PANEK: Effect of suspension in bolted roof.
(305) BARRY: Anchorage test methods.
(308) GARDNER: Visual tension indicators.
(313) DOMAAS: Products for roof bolting.
(316) KELLY: Recovery of bolts.
(321) PARSONS: Explosive anchored bolts.
(329) BETHLEHEM STEEL: Resin bolting.
(331) McCORMICK: Experience with resin anchored bolts.
(332) OITTO: Polyester bonding of reinforcing rod.
(336) GADDY: Standards for plates.
(337) GADDY: Markings on bolts.
(338) AMC COAL: Anchorage test procedure.
(339) SALL: ASA Specification M30. 1-1957.
(344) MECHANIZATION: Experience in dust control.
(347) JONES: Roof control.
(350) STAHL: Better support needed at intersections.
(351) PYNNONEN: Supervision in roof bolting.
(352) GADDY: Strength of bolts after bending.
(353) McCAA: Safety in Ireland Mine.
(354) COAL AGE: 45 National Safety Conference.
(355) USBM: Less fatalities with bolted roof.
(360) ACKERMAN: Savings from roof bolting.
(361) KRAVIG: Practices at Homestake.
(362) PLOESSER: Benguet recovers shells.
(368) PANEK: Design rationale for stratified roof.
(379) CRANDALL: When rockbolting fails.

<u>(18) U. S. S. R.</u>

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Metal arches and anchor bolts for roads of great width.
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From 12 to 18-m wide roadways were satisfactorily supported by anchor bolts and metal arches. Examples of new types of experimental bolts are given.

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Experimental uses of bolts anchored in concrete reinforcement.
Shakht. Stroit. 1967 (7) 26-27. (In Russian).
A description of the installation of bolts in reinforced concrete and an outline of where they should be used from the point of view of economy and cost.

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The bearing capacity of wooden anchor bolts.
Soviet Mining Science 1967 (6) 625-630. Orig. Fiziko Tekh. pro. 1967 (6) 99-104.
Wooden bolts are being used in the Kuzbass collieries. Their characteristics, spacing, and strength are described according to the type of wood used. Agreement was found between experimental and calculated data.

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Selection of a way of securing anchor bolts.
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Difficulties in anchoring bolts, functions, and mathematical considerations are discussed to permit calculation of expansion of the shell required in relation to the type of rock.

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The use of mild-steel anchor bolts in "Norilsk" coal mines has become general; 53 km of roadways have been bolted since 1964.

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Air powered removal of difficult anchor bolts.
Shakht. Stroit. 1967 (4) 22. (In Russian).
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Satisfactory anchoring of bolts which are embedded into concrete.
Gornyi Zhur. (IZUV) 1966 (1) 45-48. (In Russian).
The behaviour of rock bolts embedded in concrete-grouted holes was studied and found to depend upon length, diameter, shape, and expansion of shell.

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Results of measurements of the degree of support given by bolting in shafts "Ciesd KPSS".
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The effect of humidity on support by bolts type "ESI" is discussed in relation to the tension on the bolt. The advantages of dry holes are indicated.

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Use of anchor bolts as temporary support.
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Gornyi Zhur. (IVUZ) 1965 (7) 52-56, 4 fig.
An account of laboratory and mine tests to evaluate the optimum conditions for the preparation and grouting of roof bolts into position, using a manual injector for the cement slurry with both ascending and descending methods of hole filling.

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The load capacity of roof bolts made of compressed wood.
Ugol' Ukrainy 1965 (5) 20-22. (In Russian).
A comparative study of the properties of metal bolts and of compressed wood bolts.

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Vliyanie natyazheniya ankerov i tipa podkhvatov na ustoichivost Zaankerovannoi krovli (Effect of stressing roof bolts and types of supporting boards on the stability of bolted roof).
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The use of metal strips instead of pine boards improved the effect of roof bolting.

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Comparison of wooden supports, roof bolting, sprayed concrete, and combined wood-concrete supports in fringe drifts.

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Roofbolting in the Kuznetsk coalfield.
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Roof-bolting and supports in combination.
Ugol' Ukrainy Kiev 1964 8 (2) 48. (In Russian).

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Ankernaya krep iz plastifitsirobannoi drevesiny (Plasticized wood roof bolt).
Ugol' 1963 (9) 20-22.
Drawings of slotted wooden bolts and their components are shown.

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Vliyanie natyazheniya shtang na rassloenie porod Krovli ochistnykh kamer slantsevykh shakht (Effect of bolt tension on lamination of roof in rooms of bituminous shale mines).
Gornyi Zhur. 1962 (5) 28-29.
Increased bolt tension reduces sagging of roof and appears to increase safety.

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Zhelezobetonnaya shtangovaya krep (Reinforced concrete roof bolts).
Gornyi Zhur. 1962 (3) 33-35.
Costs of reinforced concrete bolts is less than that of bolts with ribbed inserts.

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Opyt primeneniya kamernoi sistemy razrabotki na shakhtakhtresta Estonslanets (Experience with application of room-and-pillar system of mining in mines of Estonslanets trust).
Ugol' 1962 (1) 13-18.
The application of the room-and-pillar method with roof bolting and the extraction of roof bolts are described.

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Vliyanie vzryvou na shtangovuyu krep (Effects of blasts on roof bolts).
Gornyi Zhur. 1961 (12) 27-30.
An experimental study of the changes in roof bolt tension caused by the blast wave.

530. VOLZHSKII, V.M.
Opyt primeneniya shtangovoi krepi na Yaregskikh nefteshakhtakh (Experience with application of rock bolting in petroleum mines of Yareg).
Gornyi Zhur. 1961 137 (4) 37-39.
Method of preventing spalling of argillites using 0.9- and 1.4-m long bolts.

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Ispytaniya Konstruktsii zamkov shtangovoi krepi (Testing construction of roof bolt locks).
Gornyi Zhur. 1961 137 (3) 39-40.
A description of the arrangements for tests and the results for study of rock pressure and roof support at Unipromed Institute.

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Kontrol'no-izmeritel'nye pribory dlya ispytanii shtangovoi krepi (Control devices for testing roof bolts).
Gornyi Zhur. 1960 136 (10) 24-28.
Calipers for measuring borehole diameters, 4 types of hydraulic pullers to screw onto the end of bolts, and dial indicator gauges to measure bolt travel are all described with drawings.

533. ZHARKOV, S.N. and LUSHIKHIN, P.
Novyi pribor dlya ispytanii shtangovoi krepi (New device for testing roof bolts).
Gornyi Zhur. 1960 136 (10) 28-30.
Design and performance of hydraulic puller VSHG-15 which is capable of imposing a bolt load of up to 15 tons.

534. LINDENAU, N.I. and MEL'NIKOV, N.I.
Opyt primeneniya ankernoi krepi v podgotovitel'nykhvyrabetkakh na shakhte "Kapital'naya-1" Kuzbassa (Experience with use of roof bolts in Kapital'naya-1 coal mine in Kuznetsk basin).
Ugol' 1960 35 (5) 32-33.
Bolting is used for roof control in drifts and galleries, where coal bed is 1.6 m thick and dip of bedding is 23°. A loose wedge is used to expand the shell.

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Kreplenie shtangami pri stroitel'stve kapital'nykh gornykh vyra'otok (The application of roof bolting in the construction of main mine workings).
Gornyi Zhur. 1959 (11) 35-41.
The "Perfo" system of roof bolting is described and the practical and economic advantages of roof bolting are discussed.

(See also abstracts)

(281) PASHKOV: Calculations for roof bolting.
(292) NESTERENKO: Stresses in concrete roof bolts.
(299) STRYGIN: Slotted wedge anchorage capacity.
(301) KONSTANTINOVA: Effects from blasting shocks.
(306) KOZINA: Model testing.
(310) KRAVCHENKO: Rubber pad compression tests.
(323) PAZAVIN: Reinforced concrete bolts.
(340) ERSHOV: Dictionary, Russian, English, German, French.
(349) SHTUMPF: Safety by roof bolting.
(358) TOTROV: Prevention of floor heave.
(359) ZURABISHVILI: Savings up to 50% in manganese mines.
(366) STRYGIN: Selection of hole diameter.
(375) SEMEVSKII: Spring washers to maintain tension.
(377) MAKHAN'KO: Relation of bolt and hole diameters.
(378) TOKAREV: Hydraulic tension apparatus.

<u>(19) YUGOSLAVIA</u>

536. DZVONIK, J.
Srornikova vystuz pri dobyvani magnezitu (Roof bolting for the mining of magnesite).
Rudy 1964 (9) 349-354.
Seven different types of roof bolt have been tested at Dumbrava. The greatest strength has been shown by distributed anchorage bolts.

APPENDIX I

LIST OF CONFERENCES INVOLVED

(Note: The numbers following the titles refer to papers from the conference that are listed in this or the previous bibliography.)

1967.

Fifth International Mining Congress, Moscow, USSR.
See Nos. 340, 447 & 463.

Fourth Rock Mechanics Symposium, Ottawa, Canada.
See No. 395.

1966.

First Congress of the International Society of Rock Mechanics, Lisbon, Portugal. (3 volumes of proceedings).
See Nos. 282, 392, 443, 471 & 472.

79th Annual Report, Coal Mining Institute of America, USA.
See No. 331.

1965.

Eighth Commonwealth Mining and Metallurgical Congress, Melbourne, Australia.
See No. 383.

1964.

Sixth Symposium on Rock Mechanics, Rolla, Missouri, USA.
See Nos. 478 & 479.

Fourth International Conference on Strata Control, New York, USA.
See Nos. 409, 418, 425, 447 & 477.

1963.

Third International Mining Congress, Salzberg (published by Pergamon Press London, England).
See No. 368.

International Conference on the Rapid Advance of Workings in Coal Mines, Liège, Belgium.
See No. 480.

1961.

Fifth International Conference on Soil Mechanics and Foundation Engineering, Paris 2, France.
See No. 384.

1959.

Symposium on Shaft Sinking and Tunnelling, Institute of Mining Engineers, London, England.

See Nos. 387 & 428.

1958.

International Strata Control Congress, Leipzig, Germany.

See No. 415.

APPENDIX II

SUPPLIERS OF EQUIPMENT

(Note: This is not a comprehensive list, but provides the names of a few suppliers in some countries where rock bolts are used.)

AUSTRALIA

Atlas Copco (Australia) Pty. Ltd.,
199-205 Parramatta Rd.,
Auburn, N.S.W. 2144
(Bolts and drills)

Cyanamid (Australia) Pty. Ltd.,
95 Collins St.,
Melbourne, VIC.
(Roc-Loc, etc.)

GKN-Lysaght Pty. Ltd.,
Alexandria, N.S.W.
(Williams anchor)

Titan Manufacturing Pty. Ltd.,
476 St. Kilda Rd.,
Melbourne, VIC.
(Bolts)

CANADA

A-1 Steel & Foundry,
1775 Clark Dr.,
Vancouver 12, B.C.
(Bolts)

C & R Metal Products Ltd.,
1141 Kelly Lake Rd.,
Sudbury, Ont.
(Bolts)

Canadian Ohio Brass Co. Ltd.,
Box 267,
Niagara Falls, Ont.
(Bolts)

CANADA (cont'd)

Industrial Screw & Machine Works Ltd.,
5445 Paré St.,
Montreal, Que.
(Bolts)

Lister Bolt & Chain Works Ltd.,
301 West 5th Ave.,
Vancouver 10, B.C.
(Bolts)

Manitoba Bridge & Engineering Works,
845 Logan Ave.,
Winnipeg 3, Man.
(Bolts)

Western Canada Steel Ltd.,
450 S.E. Marine Dr.,
Vancouver 15, B.C.
(Bolts)

FRANCE

Hermant Hicguet,
Usine d'Ars-sur-Moselle,
Moselle
(Boltex bolts)

Goldenberg et Cie,
Saverne,
Bas-Rhin
(Armex bolts)

Lenoir et Mernier,
Levrezy,
Ardennes
(Pattin bolts)

Meco
15 Place de la Madelaine,
Paris 8e
(Bayliss bolts)

Sika
164 Faubourg St. Honoré,
Paris 8e
(Perfo bolts)

GERMANY

Clever & Goebel,
5891 Gloerfeld Post,
Gruener Baun
(Bolts)

Eisenwerk Stahle GmbH,
43 Essen-Stahle,
Dahlhauser Str 106
(Bolts)

Gutehoffnungshuette Sterkrade Aktiengesellschaft,
4200 Oberhausen-Sterkrade,
Bahnhof Str 66
(Bolts)

Mannesmann - Export GmbH,
Düsseldorf,
Bergerallee - Hochhaus
(Bolts)

Maschinenfabrik Julius Schroeder,
46 Dortmund - Brackel,
Holland Str 17
(Bolts)

Nilos GmbH,
Foederband-Ausreustung, Achenbachstr 26,
4 Düsseldorf
(All types bolts)

Wedag,
Westfalia, Dinnendahl Groeppel A. G.,
Herner Strasse 299,
463 Bochum
(Resin bolts)

GREAT BRITAIN

Bayliss, Jones & Bayliss Ltd.,
GKN House, 22 Kingsway,
London W. C. 2
(Bayliss bolts)

GREAT BRITAIN (cont'd)

Ewart Chainbelt Co. Ltd.,
Colombo St.,
Derby
(Resin bolts)

Explosives & Chemical Products Ltd.,
120 Moorgate Rd.,
London E.C. 2
(Selfix bolts)

Rawlplug Co. Ltd.,
147 London Rd.,
Kingston-on-Thames
(Bolts)

Verrard Europe Ltd.,
40 Pall Mall,
London S.W. 1
(Expansion bolts)

Victor Products,
P.O. Box 10, Wallsend-on-Tyne,
Northumberland
(Bolts)

JAPAN

Nippon Oils & Fats Co. Ltd.,
No. 5, 1-Chome Yuraku-Cho, Chiyoda-Ku,
Tokyo
(Explosive bolts)

POLAND

Centrozap,
Ligonia St.,
7 Katowice
(Bolts)

ROUMANIA

Industrial Export,
2 Gabriel Peri St.,
Bucharest
(All bolts)

SOUTH AFRICA

Ed. L. Bateman Ltd.,
P.O. 1671 Braamfontein,
Johannesburg
(Pullers & stud bolts)

Roofbolts S.A. Pty. Ltd.,
Johannesburg
(Pullers & threadless bolts)

Torque-Tension Bolts Pty. Ltd.,
P.O. Box 62,
Heidelberg
(Pullers & stud bolts)

SWEDEN

Alimak-Verken AB,
Box 654,
Skelleftea 3 (Bolts)

Atlas Copco AB,
S-10523,
Stockholm
(Bolts)

Pneumatisk Transport AB,
Ankdammsgatan 42,
Solna
(ATEW bolts)

Sala Maskinfabriks AB,
Sala
(Steel bolts)

U.S.A.

American Cyanamid Co.,
859 Berdan Ave.,
Wayne, N.J. 07470
(Resin bolts)

Bethlehem Steel Export Co.,
25 Broadway,
New York 10004
(All types bolts)

U.S.A. (cont'd)

Colorado Fuel & Iron Corp.,
P.O. Box 1920,
Denver, Colo. 80201
(Steel bolts)

Ohio Brass Ltd.,
380 North Main St.,
Mansfield, Ohio 44902
(Bolts & access.)

Rawlplug Co. Inc.,
200 Petersville Rd.,
New Rochelle, N.Y. 10802
(Expansion bolts)

Republic Steel Corp.,
405 Lexington Ave.,
New York, N.Y. 10017
(All types bolts)

APPENDIX III

SOURCES OF INFORMATION

1. SERIAL PUBLICATIONS (includes translations)

(Note: The abbreviated titles used in this bibliography are listed alphabetically. The full title and place of publication are given in each case.)

AAAEEM Douai:- Association Amicale des Anciens Elèves de l'Ecole des Mines de Douai, France, 414.

A. I. M. E. Trans:- See Mining Eng.

Ann. Mines Belg:- Annales des mines de Belgique, Brussels 5, 390.

Archiwum Gornictwa:- Archiwum Gornictwa, Krakow, 452.

Ass. Mine Mgrs. S. A. :- Papers and Discussions of the Association of Mine Managers of South Africa, Johannesburg, S. A., 346-372.

Aust. Inst. Mining MP:- Australian Institute of Mining and Metallurgy, Proceedings, Melbourne, 373.

Ast. J. App. Sci. :- Australian Journal of Applied Science, Melbourne, Australia, 304.

Aust. Mining:- Australian Mining, Melbourne (formerly 1960-1966 Mining and Chemical Engineering - 1917-1960 Chemical Engineering and Mining), 385, 386, 469.

Bany Lap:- Banyaszati Lapok, Budapest, 439.

BCTS Nancy:- Bulletin Technique de la Chambre Syndicale de Mines de Fer, Nancy, 407.

Bergbautechnik:- Leipzig, 341-423.

Bergb. Wiss.:- Bergbauwissenschaften Goslar W. G., 286, 419.

Bull. IMM:- Bulletin of the Institution of Mining and Metallurgy, London S. W. 1, Eng., 429.

Bull. Technique Mines Inichar:- See Inichar BT Mines.

Bureau of Mines:- See US Bur. Mines.

BZTPAM:- Bezopasnost Truda v promyshlennosti (Safety in Industry), Moscow USSR, 349, 375.

Can. Mining J. :- Canadian Mining Journal, Gardenvale, Quebec, 291, 327, 333, 380, 393, 394, 398, 399, 456.

Can. Mining Met. Bull:- Canadian Mining and Metallurgical Bulletin, Montreal, 343, 365, 367, 374, 396.

Carbonnages France:- Carbonnages de France, Paris, Documents Techniques, 405.

Cen. Mining RS Dhanbad:- Central Mining Research Station, Dhanbad, India, 440, 442-444.

Chambre Syndicale des Mines de Fer de France, Bulletin Technique, Paris, 363.

Civil Eng. :- Civil Engineering, Concord N. H., USA, 388, 494, 504.

CIMM Trans.:- Canadian Institute of Mining and Metallurgy (Transactions), Montreal, Canada, 369, 370.
Coal Age:- Coal Age, New York, USA, 308, 329, 350, 468, 473, 481.
Coal GBM of SA:- Coal, Gold and Base Metals of South Africa, Johannesburg, SA, 317, 461.
Colliery Eng.:- Colliery Engineering, London, Eng., 289, 347, 367, 430.
Colliery Guardian:- Colliery Guardian, London, Eng., 330, 334, 432, 470, 476, 482.
Col. Sch. Mines:- Colorado School of Mines, Denver, Colorado, USA, 475.
Eng. Mining J.:- Engineering and Mining Journal, New York, USA, 313, 362, 474, 487.
Fiziko Tech. Prob.:- Fiziko Tekhnicheskie Problemy, Novosibirsk, USSR, 511.
Glückauf:- Glückauf Bergmannische Zeitschrift, Essen, W. Germ., 382, 417, 421.
Gornyi Zhur:- Gornyi Zhurnal (1825) Moscow, USSR, 281, 292, 310, 359, 377, 378, 522, 526, 527, 529, 533, 535.
Gornyi Zh IZUV:- Gornyi Zhurnal, Izvestiya Vysshikh vozdukha, Zavedenii, Moscow, USSR, 519.
IGD Moscow:- Communication of the Institute, Gornogo Dela, Moscow, USSR, 512, 513.
Ill. Mining Ins.:- Illinois Mining Institute, Proceedings, USA, 498.
Inichar BT Mines:- Inichar Bulletin Technique Mines, Inichar, Belgium, 393.
Iron & Coal Trade Rev.:- Iron and Coal Trades Review, London, England, 307, 309, 381, 431, 433, 436, 462, 503.
Izves.VUZ: Izvestiya Vysshikh Uchebnykh Zavedenii Tsvetnaya Metallurgiya, Moscow, USSR, 358.
J. Mines MF:- Journal of Mines, Metals and Fuels, Calcutta, India, 302, 345, 364, 441, 445, 446, 486.
J.S. Afr. I. Mining M:- Journal of South African Institute of Mining and Metallurgy, Johannesburg, SA, 322, 457.
King's Coll. Min. Bull.:- King's College Mining Bulletins, Durham University, England, 427.
Mag. Stds:- The Magazine of Standards, New York, N.Y., USA, 339, 507.
Mechanization:- Mechanization, Alexandria, Va., USA, 344, 347, 506.
Mineral Ind.:- Mineral Industries, Pennsylvania State University, Pennsylvania, USA since 1966 continued as Earth and Mineral Sciences, 283.
Mining CER:- See Aust. Mining, 385, 386.
Mining Congr. J.:- Mining Congress Journal, Washington, USA, 336, 337, 492, 493, 497, 499, 502.
Mining Eng.:- Mining Engineering of AIME, New York 10017, USA, 483.
Mining Engineer:- The Mining Engineer, Transactions of the Institute of Mining Engineers, London SW 1, England, 424.
Mining J.:- The Mining Journal, London, England, 324, 326.
Mining Mag.:- The Mining Magazine, London, England, 311, 328, 431.

Mining ML:- Mining and Metallurgical Library, Prague, Czechoslovakia, 403.

Mining World:- Mining World, Chicago, USA, 379, 465.

Monde Souterrain:- Le Monde Souterrain, Paris, France, 416 (since 1967 Revue des Techniques).

Oes. Ing. Zeit.:- Oesterreichische Ingenieur Zeitschrift, Vienna, Austria, 389.

Penn. State Univ. MIES:-Pennsylvania State University, Mining Industries Experimental Station, Pennsylvania, USA, 490.

Pro. Ill. Mining Inst.:- Proceedings of the Illinois Mining Institute, USA, 501, 508.

Przeglad Gorniczy:- Przegląd Górniczy, Katowice, Mariaka 17, Poland, 288, 314, 376, 448, 449, 453.

Rev. Ind. Minérale:- Revue de l'Industrie Minérale, St. Etienne, Loire, France, 406, 408, 410, 412, 413.

Revta Min.:- Revista Minelor, Bucarest, Roumania, 320, 454, 455.

Rock M. Eng. Geo.:- Rock Mechanics and Engineering Geology, New York, USA, 312 (formerly "Geologie und Bauwesen").

Rudy:- Rudy, Prague, Czechoslovakia, 401, 402, 536.

Safety Maint.:- Safety Maintenance, Morristown, N.J., USA, 496.

S. African Mining Eng. J.:- South African Mining Engineering Journal, Johannesburg, SA, 318, 319, 400, 458, 459, 460, 465.

Schlagel u Eisen:- Schlagel und Eisen, Dusseldorf, W. Germany, 420, 422.

Shakh Stroit:- Shakhtnoie Stroitelstvo, Moscow, USSR, 509, 510, 514, 518.

Skillings Min. Rev.:- Skillings Mining Revue, Duluth, Ma., USA, 351.

Soviet Mining Science:- Soviet Mining Science, New York, USA, Translation of Fiziko Tech. Prob., 366, 511.

Steel and Coal:- Steel and Coal, London, England, 325.

Trans. A.I.M.E.:- Transactions of the Society of Mining Engineers of A.I.M.E., New York, 10017, USA, 284, 287, 293, 368.

Trav. Maîtrise (VeH):- Travail et Maîtrise, Verneuil-en-Halatte, France, 404.

Ugol:- Ugol, Moscow, USSR, 299, 301, 306, 521, 525, 528, 534.

Ugol' Ukrainy:- Ugol' Ukrainy, Kiev, USSR, 516, 517, 520, 523, 524.

Uhli:- Uhli, Prague, Czechoslovakia, 315.

U.S. Bur. Mines Inf. Cir.:- United States Bureau of Mines, Information Circulars, Washington, DC, USA, 316, 355, 357, 360, 484, 485.

U.S. Bur. Mines Rep. Inv.:- United States Bureau of Mines, Report of Investigation, 295, 297, 298, 300, 303, 305, 321, 332, 352, 466, 488, 491.

Western Const.:- Western Construction, San Francisco, Calif., USA, 495.

Wiadomosci Gorni:- Wiadomosci Gornicze, Warsaw, Poland, 450.

Zeit fuer Erzberbau u Metallhuettenwesen, Berlin, 335.

2. BOOKS, REPORTS AND STANDARDS

1967

The drilling of rock.
McGregor, K. 394
CR Books Ltd., London

Rock mechanics and the design of structures in rock.
Obert, L. and Duval, W. 467
John Wiley & Sons, New York

1966

The art of tunnelling.
Czechy, K. 438
Akademiae Budapest.

Methods of working coal and metal mines.
Woodruff, S.S. 356
Pergamon Press, London (3 vols.)

Annotated bibliography on selected mining subjects: grouting.
Colorado School of Mines 475
Denver, Colorado, U.S.A.

1965

Rock mechanics principles.
Coates, D.F. 285
Queen's Printer, Ottawa, Canada.

1963

Tunnels and tunnelling.
Pequignot, C.A. 426
Hutchinson & Co., London.

1962

Geology and Engineering.
Legget, R.F. 397
McGraw-Hill, New York.

1961

Exploitation des Mines, Vols. 1 & 2.
Vidal, V. 411
Dunot, Paris.

1959

Le boulonnage des roches en souterrain.
Hugon, A. and Costes, A. 290
Paris Eyrolles.

Richtlinien für den Ankerausbau.
Krippner, D. E. 421
Essen, W. Germany.

1958

Handbook on rock blasting.
Thomas, E. M. and Smedberg, M. 500
Atlas Copco, Stockholm.

Glossary of strata control terms in English, French & German.
National Coal Board. 342
London, Great Britain.

1957

Roofbolting materials in coal mines.
Mining Committee. 339
American Standards Specification M30. 1.

3. TRANSLATIONS

Soviet Mining Science,
New York, USA 366, 511

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United States Bureau of Mines (USA)

Information Circulars

Year	Report No.	Biblio. No.	
1966	8294	357	Howes: NORAD costs and methods
1962	8114	485	Rachunis: Safety practices West Delaware aqueduct
	8113	484	Stahl: Intersections
1961	8024	360	Ackerman: Costs in 14 mines
1959	7904	355	Staff: Statistics
1958	7826	316	Kelly: Recovery for re-use
1954	7678	213	Young: Practice in Alabama
1952	7653	230	Kelly: Savings for coal mines
	7652	246	Platt: Bolting Delaware aqueduct
	7637	63	Kelly: Wooden bolts
	7633	224	Kelly: Costs in coal mines
1951	7621	37	Thomas: Guide for inspection
	7615	75	Westfield: Dust control in bolting
1950	7583	209	Thomas: Survey of bolting
1949	7533	238	Thomas: Practices for lead mines
1948	7471	239	Thomas: St. Joseph's lead mine

Reports of Investigations

1967	6890	466	Oudenhoven: Stress distribution
1966	6842	295	Osen: Yield and ultimate strength
1965	6613	297	Osen: Load relations in tests
	6626	332	Oitto: Polyester anchorage
	6595	321	Parsons: Explosive anchorage in mines
1964	6372	298	Stehlik: Effect of blasting
1963	6250	300	Parsons: Explosive anchoring

Reports of Investigations (cont'd)

Year	Report No.	Biblio. No.	
1962	6139	488	Panek: Combined effects of friction and suspension
	6138	303	Panek: Theory and practice
1961	5746	491	Merrill: Support in place
1960	5649	305	Barry: Anchorage test methods
1958	5408	352	Gaddy: Strength after bending
1957	5310	30	Barry: Anchorage 5/8-in. expansion
1956	5304	64	Maize: Permeability for bonding
	5228	34	Barry: Torque tests 5/8-in.
	5194	30	Barry: Anchorage 3/4-in. expansion
	5156	5	Panek: Theory
	5155	7	Panek: Design
	5154	6	Panek: Model tests
1954	5080	34	Barry: 3/4-in. torque tests
	5040	30	Barry; 1-in. slotted anchorage tests
1953	4967	34	Barry: 1-in. torque tests

INDEX OF SUBJECTS

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